EVALUATION OF HIGHEST PRIORITY RETROFIT SITES

HOOD CANAL REGIONAL STORMWATER RETROFIT PROJECT

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

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Introduction

The Hood Canal Coordinating Council (HCCC) is leading a study of stormwater management facility retrofits in the Hood Canal Action Area that can cost-effectively improve upon existing water quality problems in Hood Canal and its tributary streams. A secondary consideration in this effort is reducing high flows that erode stream channels and contribute to degraded water quality. The study began with analysis of priority areas within the Action Area in which to focus subsequent analysis of specific retrofit site opportunities. The results of the geographic prioritization process are documented in a memorandum entitled *Evaluation of Priority Areas for Retrofit, Hood Canal Regional Stormwater Retrofit Project* (Herrera 2013).

Sixteen priority areas of concern for stormwater runoff impacts were identified in the Hood Canal Action Area, spread throughout the Action Area from Port Ludlow to Hoodsport to Belfair to northern Kitsap County. A "windshield" assessment was conducted in May 2013 to identify stormwater retrofit opportunities within these 16 priority areas. This assessment was informed by input from each of Jefferson, Mason, and Kitsap counties, including utility and zoning mapping, perceived vehicular use, locations of community gathering spaces, and specific locations where drainage problems/complaints have been documented in the past. Concurrent with the information gathering from the three counties, stormwater infiltration characteristics were assessed in the priority areas (Aspect 2013). Draft information from the infiltration assessment was used to guide identification of areas where infiltrative stormwater facilities, such as rain gardens, could be successful. The windshield assessment yielded 60 sites that were subsequently evaluated for relative benefits.

The 60 potential retrofit sites were screened based on the following criteria, which were developed in coordination with the Hood Canal Stormwater and Land Use Practices Workgroup (the Workgroup):

- Probable retrofit feasibility based on infiltration potential, topography, available space, visible conflicts (or lack thereof) with utilities or other features, and loss of site use (e.g., parking spots)
- Site use intensity as measured by perceived vehicle turnover rate in parking lots and daily traffic load of roads in the retrofit site drainage area
- Educational opportunity based on proximity to a park, school, or other intensively visited location by the public

The top 24 prioritized retrofit sites were carried forward for further analysis and prioritization. During subsequent analysis of those 24 sites, it was determined in coordination with the Workgroup that additional residential neighborhood-scale sites should be reconsidered. Based upon additional site reconnaissance thereafter in the Alderbrook and Union areas of Mason County and Brinnon and Port Ludlow areas of Jefferson County, six more sites were added into the detailed analysis work. Most of the sites are a specific property, such as a post office, a business, or a community center. Some of them are a residential neighborhood in which several common retrofits could be implemented.

During the course of more thorough analysis of these 30 sites, two of them in Mason County were dropped from further consideration because proposed site improvements for a separate project render the stormwater retrofit concepts moot. These two sites are Belfair Elementary School and North Mason High School. The locations of the 28 sites evaluated in detail are presented in Figure 1. The remainder of this report documents analysis of those 28 sites and ranks them in order of priority for pre-design development based on a wide range of technical considerations.

Drainage Area Characterization and BMP Selection for Candidate Retrofit Sites

A focused reconnaissance site visit was performed for each of the 28 prioritized retrofit sites to further develop retrofit concepts, confirm retrofit feasibility, and evaluate potential retrofit benefits and cost considerations in more detail. For each candidate retrofit site the following information was documented in the field and refined thereafter:

- Description of retrofit concept (facility type(s) most suitable for the site-specific circumstances and specific location(s) on the site)
- Drainage area tributary to the retrofit facility location(s), and associated slope and ground cover characteristics
- Anticipated challenges for construction and long-term performance success
- Impact of retrofit facility on property use
- Existing stormwater treatment or flow control (onsite or downstream)
- Layout of the retrofit facility concept and associated drainage conveyance features needed to route runoff into the facility (existing and proposed conveyance)

All information that could be obtained via visual observations onsite was documented in field forms and a photo log. An example of a completed field assessment form and photo log is included in Attachment 1.

For some of the sites, there are several discrete drainage areas within it, each of which could have a retrofit BMP. These sub-areas were previously identified with a letter following the site number for earlier analyses on this project (e.g., sites 7a, 7b, and 7c for the Belfair Community Center). For site comparison purposes described in this report, it was assumed that all BMP retrofit opportunities identified for these sites would be implemented, and thus the evaluation described for those sites addresses the aggregated total drainage area managed (e.g., the sub-areas at site 7 are “rolled up” and considered to be a single site as described hereafter).

Analyses were performed following site reconnaissance to quantify potential stormwater management performance that could be accomplished at each site and other attributes of the retrofit concepts to inform comparative screening. Those analyses are described in the following section.

Legend

- Potential Retrofit Sites
- County boundary

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Figure 1. Map of 28 Prioritized Retrofit Sites

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Evaluation Criteria for Comparing Candidate Retrofit Sites

Overview

Retrofit site evaluation criteria were developed through a series of meetings with the Workgroup in 2013. The criteria capture costs and environmental benefits, as well as many other attributes considered important to the Workgroup members, such as educational value, social value, and likelihood of effective operations and maintenance. The resultant eight criteria include:

- Water quality benefits
- Project cost efficiency (relative cost to achieve the water quality benefits)
- Anticipated ease (or difficulty) of funding for design, permitting and construction
- Educational opportunity
- Flow control benefit (for those sites that drain to a stream)
- Likelihood of attentive operations and maintenance over the long term following construction
- Social benefits
- Other environmental benefits

Each of these criteria are described below.

Water Quality Benefits

Water quality benefits were evaluated by estimating mass pollutant removal that could be accomplished on an annual basis by the retrofit facility(ies) at a given site. Pollutant removal was calculated based upon the facility drainage area characteristics, assumed pollutant concentrations in the associated runoff, and pollutant removal capability of the facility.

Indicator Pollutants

Five indicator pollutants were included in the analysis, reflecting different concerns for water quality conditions in Hood Canal and tributary streams. The five pollutants and rationale for using them are:

- **Total suspended solids** – most of the pollutant content in stormwater runoff attaches to suspended sediment particles, and thus this parameter captures the overall threat of pollutant delivery to receiving waters
- **Total nitrogen** – the Hood Canal exhibits low dissolved oxygen content in many locations at certain times of year, due in part to decay of algal biomass that is fed by nitrogen in the water
- **Total copper** – fish and other aquatic organisms in the Hood Canal and tributary streams are vulnerable to toxic effects of copper, which is prevalent in runoff from developed areas

- **Total zinc** - fish and other aquatic organisms in the Hood Canal and tributary streams are vulnerable to toxic effects of zinc, which comes from some different sources than copper in developed areas
- **Fecal coliform bacteria** – many areas of the Hood Canal are prone to high fecal coliform bacteria counts that can result in swimming beach closures and closures of shellfish growing areas for human health protection

While these pollutants are all important in the context of this study, they are not necessarily present in relatively high concentrations in stormwater runoff in the drainage areas associated with the 28 sites evaluated in detail, nor in stormwater runoff in many other parts of the Action Area. For example, nitrogen is typically present in low concentrations in stormwater runoff from roadways. As described below, it is a challenge to remove pollutants from runoff when they are present at low concentrations. However, if a retrofit BMP could remove nitrogen, for example, under these conditions, then it should score higher in the water quality benefits criterion compared to other sites. For that reason, all five indicator pollutants were retained for pollutant loading and pollutant removal calculations as described below.

Pollutant Concentration Data

Stormwater runoff pollutant concentration data are generally lacking in the Hood Canal Action Area. Therefore, representative data from regional sources must necessarily be used for this project. Pollutant concentrations measured in untreated runoff by municipalities in western Washington were considered to be the best source of information for this purpose. Specifically, NPDES Phase II municipal permittee monitoring data submitted to the Washington State Department of Ecology (Ecology) were reviewed to obtain mean concentrations of the five indicator pollutants for the following land uses: low density residential, high density residential, commercial, industrial, and open space. Table 1 lists the pollutant concentrations used in this analysis.

Table 1. Typical Pollutant Concentrations in Runoff from Different Types of Land Use.

Indicator Pollutant	Low Density Residential Land Use	High Density Residential Land Use	Commercial Land Use	Industrial Land Use	Open Space
Total suspended solids	19.0 mg/L	51.0 mg/L	75.4 mg/L	64.9 mg/L	-
Total nitrogen	2.9 mg/L	1.38 mg/L	2.1 mg/L	1.15 mg/L	-
Total copper	3.08 ug/L	10.1 ug/L	28.4 ug/L	19.0 ug/L	-
Total zinc	23.1 ug/L	61.5 ug/L	124.5 ug/L	136.7 ug/L	-
Fecal coliform bacteria [a]	15.3 CFU/mL	-	49.9 CFU/mL	-	90.9 CFU/mL

mg/L – milligrams per liter

ug/L – micrograms per liter

CFU/mL – colony forming units per milliliter

[a] For fecal coliform bacteria, there are no data specific to "open space" land use. The value here is associated with "undeveloped" land use.

The fecal coliform bacteria concentrations applied to this analysis may not be reflective of stormwater runoff characteristics in the Action Area, particularly given the prevalence of

older septic systems in many residential areas that could cause higher concentrations if and where stormwater mingles with septic leachate in a drainage ditch. The concentrations used for the other four indicator pollutants could also be misrepresentative of conditions in the drainage areas under consideration. However, lacking any local data on pollutant concentrations linked to specific land uses, the available NPDES Phase II municipal permittee data were not manipulated. Following calculation of potential pollutant removal and resultant water quality benefit scoring, judgment can be applied to any of the sites to elevate or lower its retrofit priority based on awareness of potentially worse stormwater quality than assumed, or for other reasons. This step in the analysis procedure is described later in this memorandum.

Annual Runoff Volume

To estimate the annual mass of pollutants carried in runoff from the drainage area tributary to a retrofit facility location the annual runoff volume was multiplied by the typical pollutant concentration assigned for the associated land use type(s). The annual runoff volume was modeled using MGS Flood 4.31 software using a 158-year continuous hydrologic simulation for a range of annual precipitation depths bracketing precipitation characteristics in the Action Area, yielding unit runoff amounts (per acre) for impervious surfaces and for grass cover on either till or outwash soils. For the retrofit sites under consideration the non-impervious areas are generally mostly grass or other landscaping with few if any trees. Annual runoff volume to potential retrofit facilities was therefore approximated using the tributary area determined during site reconnaissance and annual runoff calculated by MGS Flood based on the retrofit site location. Table 2 indicates runoff volumes per acre used for different precipitation zones and land covers.

Table 2. Estimated Annual Runoff Volume by Land Cover (acre-ft/acre).

Mean Annual Precipitation (inches)	Annual Runoff from Impervious Land Cover	Annual Runoff from Grass Land Cover on Till Soils	Annual Runoff from Grass Land Cover on Outwash Soils
32	2.20	0.85	0.003
40	2.86	1.36	0.007
44	3.21	1.64	0.011
48	3.53	1.91	0.019
52	3.87	2.21	0.028
56	4.21	2.50	0.039
60	4.54	2.79	0.050

Values from MGS Flood v. 4.31 for mean annual precipitation zones in Western Washington.

A fraction was applied to the total drainage area for retrofit "sites" that are actually residential neighborhoods in order to estimate the drainage area that can feasibly be routed to a series of retrofit facilities (such as bioretention in roadside ditches throughout a neighborhood) based on existing drainage patterns and slopes, and available space for facilities. For example, the Poulsbo Edgewater neighborhood has relatively steep grades in roadside ditches and thus it may not be feasible to route all runoff to identified retrofit ditches. The neighborhood drainage fractions are shown in Table 3.

Table 3. Fraction of Neighborhood Drainage Area Feasible to Manage with Stormwater Retrofit Facilities.		
Site ID	**Neighborhood Name**	**Fraction Assumed**
50	Lake Symington Neighborhood	0.25
55	Poulsbo Edgewater Neighborhood	0.25
61	Alderbrook Neighborhood	0.1
62	Union Neighborhood	0 [a]
63	Appaloosa Neighborhood	0.5
64	Brinnon Ln Neighborhood	0.5
65	Canal View Neighborhood	0.25
66	Port Ludlow Neighborhood	0.25

[a] Union neighborhood is assigned a fraction of 0 as there is no feasible location for stormwater retrofit facilities without first installing a formal drainage system to direct runoff away from steep private parcels to the public right-of-way.

Pollutant Removal Capability

Seven types of stormwater management facilities were considered as potential retrofit options across the 28 sites. The ability of a particular type of stormwater management facility to remove each of the indicator pollutants was estimated based on published information sources. Sources of information included the International Stormwater Best Management Practices (BMP) Database (ISBMPD 2012) and performance data submitted to Ecology for Filterra units (Americast 2009) and media filter drains.

Due to the lack of data for total nitrogen and fecal coliform removal for Filterra systems and media filter drains, the pollutant removal rates observed for bioretention systems were assigned to these BMPs. Ditch and pond retrofit pollutant removal performance was taken as the difference between a “good” and an “average” pond or ditch in order to account for existing pollutant removal performance. A good pond or ditch retrofit BMP was assigned the removal rate of the 75th percentile of ponds or ditches from the ISBMPD, whereas an average pond was assigned the removal rate of the median pond and an average ditch was assigned the removal rate of the 25th percentile of ditches in the ISBMPD for each indicator pollutant. The median value for pond performance was used since only one pond retrofit is being considered and field evaluation at that site (the Camp Union Grocery) indicated the pond infiltrates runoff adequately, does not “short circuit” the path of flow passing through it, and had not flooded recently. The 25th percentile of performance from the ISBMPD was used for ditch retrofits because field evaluations indicated many ditches under consideration are not infiltrating runoff, have limited plant growth, and show evidence of erosion. Table 4 shows the pollutant removal performance by each BMP type used in this analysis.

Pollutant concentrations used to represent runoff from low density residential land use are below irreducible levels for total copper and total zinc (Washington Stormwater Center and Herrera 2011). Therefore, retrofit BMPs in low density residential drainage areas are assumed to have a zero removal percentage for copper and zinc.

Table 4. Pollutant Load Removal Percentage by BMP Type.					
	Copper, Total	Zinc, Total	Total Nitrogen	Total Suspended Solids	Fecal Coliform Bacteria
Bioretention	55%	79%	21%	79%	93%
Ditch Retrofit	43%	57%	5%	80%	18%
Drywell Retrofit	58%	73%	21%	88%	93%
Filterra	58%	73%	21%	88%	93%
Media Filter Drain	86%	85%	21%	94%	93%
Oil/Water Separator	0%	0%	0%	0%	0%
Pond Retrofit	21%	21%	23%	9%	35%

Results

The pollutant concentrations applied to each retrofit site, the results of the site runoff volume calculations, the assumed pollutant removal performance, and the resultant calculations of annual mass removal that could be accomplished for the five indicator pollutants at each of the 28 retrofit sites are provided in summary sheets found in Attachment 2. These results should be considered approximate, and for purposes of comparing the candidate retrofit sites only. Actual pollutant removal performance at any of these sites could vary considerably based on many factors that this analysis cannot account for.

The pollutant removal that could be achieved relative to all other sites was then ranked, by pollutant, and the average rank for all five indicator pollutants calculated to yield an overall water quality benefits rank on a scale of 1 to 10. Water quality benefits are assigned a higher possible score compared to the other evaluation criteria reflecting the primary goal of the study being to identify stormwater retrofits that can improve upon degraded water quality conditions in Hood Canal.

Cost Efficiency

An approximate, planning-level construction cost was estimated for each retrofit site based upon similar past projects Herrera has been involved in, unit price construction cost data tracked by the Washington State Department of Transportation, and product vendor quotes for those sites that would entail a proprietary stormwater treatment facility installation. With a resultant cost estimate specific to each site, a cost efficiency index value was calculated as the estimated construction cost divided by the water quality benefits score. These index values were then sorted into low, medium and high categories, with corresponding scores of 1, 2, and 3, respectively. Table 5 presents a summary of the cost information used for this criterion.

Table 5. Typical Facility Cost Estimate Values.				
Facility Type	**Construction**	**Allied Cost**	**Likely Cost**	**Units**
Bioretention	$50	$20	$70	per SF Facility
Filterra	$21,000	$8,400	$29,400	each
Pond New	$23	$9.20	$32.20	per SF Facility
Oil/Water Separator	$15,400	$6,160	$21,560	each
Media Filter Drain	$24	$9.60	$34.00	per SF Facility
Ditch Retrofit	$9	$3.77	$13.19	per SF Facility
Pond Retrofit	$4	$1.61	$5.65	per SF Facility

SF – square feet

Ease of Funding

An important consideration in comparing the candidate retrofit sites is the relative likelihood of funding availability for design, permitting and construction. The logical entities to provide funding for the retrofits under consideration are either the HCCC or one of the three counties in the Hood Canal Action Area. Neither HCCC, Jefferson County, or Mason County has a reliable source of funding for stormwater retrofits, and thus would need to seek grant funds from other sources (such as the Ecology grant programs for watershed improvements, stormwater retrofits, and low impact development implementation). The public agency grant programs that are currently in place do not allow funding for stormwater facilities constructed on private sites. Kitsap County has a larger pool of utility-funded and leveraged resources to draw upon, and thus has better ability to potentially fund a retrofit site located on private property. As a result, the following scores were assigned for ease of funding:

- Site on private land in Mason or Jefferson counties = 1
- Site on private land in Kitsap County = 2
- Site on public land = 3

Education Opportunity

No single stormwater retrofit site under consideration can possibly have a measurable impact on Hood Canal water quality and tributary stream habitat improvements due to the scale of the Action Area and the problems affecting receiving water. Thus, the opportunity for public education regarding the importance of Hood Canal water quality, stream health, and stormwater pollution reduction is an important consideration. The potential education value of any retrofit site is directly associated with visibility to the public. Accordingly, the following education opportunity scores were assigned to the candidate retrofit sites:

- Site on private land in relatively obscure location = 1
- Site on public or private land in a moderately visible location (e.g., a shopping center) = 2
- Site at a park or other relatively busy community gathering place = 3

Flow Control

If a candidate retrofit site drains to a stream, it has potential for additional environmental benefits (i.e., stream water quality and habitat improvements) that a site draining directly to the Hood Canal cannot achieve. Potential for stormwater runoff flow control at these sites was thus used as a surrogate for stream benefits. Mean annual precipitation, infiltration characteristics, and the available space at each site were taken into account in order to assess the feasibility of a flow control facility. The following scores were assigned for flow control benefits, for those sites that drain to a stream:

- Confined site with limited space for runoff storage = 1
- Site with suitable space for flow control of a portion of the runoff = 2
- Site with available space for a "full sized" flow control facility = 3

Operations and Maintenance

As is the case with all stormwater treatment and flow control facilities, the long-term effectiveness of any retrofit facility in the Hood Canal Action Area in achieving intended objectives is directly related to whether or not inspection and maintenance activities will be performed on a routine basis. It is presumed that if such inspections and maintenance are performed in accordance with applicable guidance then the pollutant removal and flow control capability of the facility can be relied upon for the long term, and thus the facility should be ranked higher than another with less certain operations and maintenance attention.

Likelihood of maintenance is a function of property ownership and the funding in place in each of the three counties to support stormwater BMP inspections and maintenance. If a site is on public land, it is reasonable for purposes of this study to assume that operations and maintenance attention would be reliably provided for a retrofit facility. Kitsap County takes responsibility for inspections and maintenance of stormwater BMPs on private properties in addition to those on County-owned land. Neither Jefferson County nor Mason County has the financial resources to perform or otherwise assure inspection and maintenance of BMPs at privately owned sites. The operations and maintenance scores that were assigned to the retrofit sites are as follows:

- Site on private land in Jefferson County or Mason County = 1
- Site on private land in Kitsap County = 2
- Site on public land with applicable State, City or County oversight = 3

Social Benefits

Social benefits of stormwater retrofits in the Action Area were assumed to be applicable if nearby residents and visitors would gain an aesthetic amenity, and if multiple retrofits in combination could be viewed as a resource for a neighborhood. Social benefits were assigned the following score for each candidate retrofit site:

- No apparent social benefit = 1
- Aesthetic improvement at site (such as a highly visible rain garden) = 2

- Ability to "bundle" with other retrofits nearby = 2
- Aesthetic improvement and potential to bundle with other retrofits nearby = 3

Additional Environmental Benefits

In addition to general water quality and stream habitat benefits captured in other evaluation criteria, the potential for a retrofit project to improve upon habitat conditions for prized aquatic resources was considered in this criterion. This criterion addresses the presence or absence of the following eight fish and shellfish species/categories in close proximity to, or downstream of, the retrofit site: Chinook, chum, and coho salmon; bull, steelhead and cutthroat trout; hardshell clams; and oysters. If a candidate retrofit site drains to a stream rather than directly to the Hood Canal, there is opportunity to benefit fish species, if present in that stream, to a greater extent, and thus the retrofit site should score higher on overall environmental benefits. Similarly, if a retrofit site drains to the Hood Canal in an area where clams and/or oysters are harvested, that site should score higher on overall environmental benefits. The scores assigned to the candidate retrofit sites for these additional environmental benefits are as follows:

- Site drains to stream and/or Hood Canal shoreline area with none or one of eight fish and shellfish species of interest: score = 1
- Site drains to stream and/or Hood Canal shoreline area with two of eight fish and shellfish species of interest: score = 2
- Site drains to stream and/or Hood Canal shoreline area with three or more of eight fish and shellfish species of interest: score = 3

Results

Four projects were eliminated prior to prioritization due to their existing water quality and flow control performance identified during field reconnaissance. Post Office Port Hadlock (site #41) and Chimacum Creek Primary School (site #45) have existing stormwater ponds that would not perform better via retrofit as they already appear to infiltrate the majority of site runoff. This agrees with the infiltration analysis performed earlier in this project (Aspect 2013). Hoodsport IGA (site #29) was also removed from the potential retrofit site list due to the finding that an existing Stormceptor® stormwater pollutant removal system and detention vault are located onsite that treat and detain runoff from the entire site. True Value Hadlock (site #43) was eliminated due to the finding that there is an existing infiltration system under the parking lot.

A total of 24 sites are prioritized here according to their total score for each evaluation criteria. Water quality benefits scores range between 1 and 10 while the other evaluation criteria scores range between 1 and 3. Thus water quality benefits carry the greatest weight when scores are aggregated. Table 6 presents the results of scoring across all criteria.

Discussion

As indicated in the results presented in Table 6, aside from four sites that have relatively strong water quality benefits scores and overall higher scoring on the other criteria as well

(yielding sum total scores of 23 or higher), most of the sites score in a similar mid range. Thus, the subjective evaluation criteria scores are quite important for the total scored results. While those criteria could be reconsidered and weighted differently, the higher-scoring sites in Table 6 make sense from a big picture perspective of striving to meet the primary goal of improving Hood Canal water quality because they are mostly in commercial land use, where pollutant content in the runoff is greatest, and in residential neighborhoods that have greater potential to retrofit more facilities than some other neighborhoods evaluated. A few exceptions are site #49 (Chimacum High School), which scores very low on water quality benefit but relatively high on the other criteria.

The results presented in Table 6 are useful for defining retrofit priorities, but other considerations are important in deciding upon which sites should be carried into predesign development. As the process for analyzing and prioritizing the 28 sites was conducted, input received from several Workgroup members indicates that public education value and eligibility for state grant funding are quite important, and both should be factors influencing which sites in the "middle of the pack" in Table 6 should be moved higher or lower in priority given how inexact the prioritization criteria are.

Based on the results of the prioritization analysis presented in Table 6 and other local information, local jurisdictions will determine the sites in their jurisdiction to advance to pre-design. Issues for consideration by jurisdictions in selecting sites for pre-design work include:

- Likelihood of receiving future grant funding (State funds cannot be used to improve private properties unless an overriding public benefit can be demonstrated)
- Likelihood that a stormwater management retrofit will be required in the near future as a permit condition (for site redevelopment), or as part of another planned program (e.g., WSDOT and State Parks)
- Whether other, lower cost stormwater management tools should be implemented first
- Where retrofits may have multiple benefits such as educational and community value

Additionally, if the goals and objectives of this study could be achieved through alternative tools or approaches, then different study products should be identified that would yield greater benefits for Hood Canal.

Table 6. Summary of Potential Retrofit Site Projects

Site Id	Location Name	Community	BMP	Land Use Designation[1]	Total Score[2]	Water Quality Score[3]	Cost Efficiency Score[4]	Ease of Funding Score[5]	Education Opp. Score[6]	Flow Control Score[7]	O&M Cost Score[8]	Social Factors Score[9]	Environmental Factors Score[10]
						1-10	1-3	1-3	1-3	1-3	1-3	1-3	1-3
36	Brinnon Community Center	Brinnon	Bioretention, Drywell Retrofit	COMM	25	8	3	3	3	x	3	2	3
54	Twelve Trees Business Park	Breidablick	Bioretention	COMM	23	6	3	2	2	3	2	2	3
27	N. Finch Creek Road	Hoodsport	Ditch Retrofit	COMM	23	7	3	3	1	1	3	2	3
25	Hood Canal Church	Hoodsport	Media Filter Drain, Bioretention	COMM	23	8	3	1	3	2	1	2	3
49	Chimacum High School	Port Hadlock	Bioretention	COMM	21	3	3	3	3	3	3	1	2
34	Dosewallips State Park	Brinnon	Bioretention	COMM	21	4	3	3	3	x	3	2	3
9	Habitat for Humanity	Belfair	Bioretention, Media Filter Drain	COMM	21	10	3	1	2	2	1	1	1
63	Appaloosa Neighborhood	Brinnon	Ditch Retrofit, Bioretention	LDR	20	5	1	3	2	1	3	2	3
52	Camp Union Grocery Pond	Lake Symington	Pond Retrofit	COMM	20	7	3	2	1	1	2	1	3
50	Lake Symington Neighborhood	Lake Symington	Ditch Retrofit	LDR	20	5	1	3	2	1	3	2	3
47	Carl's Building Supply	Port Hadlock	Filterra, Bioretention	COMM	19	5	3	1	2	3	1	2	2
28	Hoodsport Hatchery	Hoodsport	Filterra	COMM	19	5	3	3	1	x	3	1	3
7	Belfair Community Center	Belfair	Bioretention	COMM	19	6	3	1	3	2	1	2	1
55	Edgewater Neighborhood	Breidablick	Ditch Retrofit	LDR	18	3	1	3	2	1	3	2	3
53	Four Corners Tavern	Breidablick	Bioretention	COMM	18	2	3	2	2	2	2	2	3
23	Hoodsport Visitor Center	Hoodsport	Bioretention	COMM	18	2	3	1	3	2	1	3	3
22	Hoodsport Post Office	Hoodsport	Filterra	COMM	18	4	3	1	2	1	1	3	3
66	Port Ludlow Neighborhood	Port Ludlow	Ditch Retrofit, Bioretention	LDR	17	5	1	3	2	x	3	2	1
64	Brinnon Ln Neighborhood	Brinnon	Ditch Retrofit	LDR	16	1	1	3	2	1	3	2	3
40	QFC Port Hadlock	Port Hadlock	Bioretention, Filterra	COMM	16	3	3	1	2	2	1	2	2
65	Canal View Neighborhood	Brinnon	Ditch Retrofit	LDR	15	2	1	3	2	x	3	2	2
61	Alderbrook Neighborhood	Union	Ditch Retrofit	LDR	14	5	1	1	2	1	1	2	1
18	Happy Hollow Restaurant	Belfair	Bioretention	COMM	12	5	1	1	2	x	1	1	1
62	Union Neighborhood	Union	Ditch Retrofit	LDR	11	1	1	1	2	x	3	2	1

Notes:

1. Land use designation utilized in water quality analysis. LDR = low density residential. COMM = commercial.
2. Total score is the sum of all criteria with water quality weighted more heavily since it ranges between 1-10.
3. Water quality score determined using average annual pollutant concentration by land use type (see table A-1), annual runoff volume for each site modeled in MGSFlood, and average annual pollutant removal by BMP type (see table A-2).
4. Project cost score determined using estimated project cost relative to expected water quality benefit.
5. Ease of funding based on if project site is on public land or on Kitsap private land.
6. Education opportunity score based on if project location is at a school, park, meeting location, or a high turn-over highly visible location.
7. Flow control score based on maximum feasible impervious area managed with proposed BMP in available space. No points (x) assigned to sites that do not require flow control, i.e. drain directly to Hood Canal rather than a stream.
   Note that project costs do not reflect the additional cost to provide flow control.
8. O&M cost score based on expected ease of funding long-term operations and maintenance.
9. Social factors score based on expected aestetic contribution and opportunity to join neighboring projects together.
10. Environmental factors score based on fish and shellfish habitat downstream of project.

HERRERA

References

Americast. 2009. Filterra® Long Term Field Performance Evaluation Report. Americast, Inc. April 2009.

Aspect. 2013. Hood Canal Stormwater Retrofit Infiltration Feasibility Assessment. Hood Canal, Washington. Prepared for Herrera Environmental Consultants, Inc., Seattle, Washington, by Aspect Consulting. August 8, 2013. Draft.

ATR Associates. 2009. Technical Report Addendum, Additional Field Testing and Statistical Analysis of the Filterra Stormwater Bioretention Filtration System. Prepared for The Filterra Division of Americast, Inc. Ashland, Virginia, by ATR Associates, Inc., Stasburg, Virginia. January 26, 2009.

Herrera. 2006. Technology Evaluation and Engineering Report: WSDOT Ecology Embankment. Prepared for the Washington State Department of Transportation by Herrera Environmental Consultants, Inc., Seattle, Washington. July 14, 2006.

Herrera. 2009. Technical Evaluation Report: Filterra Bioretention Filtration System Performance Monitoring. Prepared for Americast, Inc., by Herrera Environmental Consultants, Inc., Seattle, Washington. December 3, 2009.

Herrera. 2013. Draft Technical Evaluation Report: Filterra System Phosphorus Treatment and Supplemental Basic Treatment Performance Monitoring. Prepared for Americast, Inc., by Herrera Environmental Consultants, Inc., Seattle, Washington. October 4, 2013.

ISBMPD. 2012. International Stormwater Best Management Practices (BMP) Database, Pollutant Category Summary Statistical Annendume: TSS, Bacteria, Nutrients, and Metals. Prepared by Wright Water Engineers, Inc., and Geosyntec Consultants, Inc. July 2012.

ISBMPD. 2012. International Stormwater Best Management Practices (BMP) Database, Pollutant Category Summary Statistical Annendume: TSS, Bacteria, Nutrients, and Metals. Prepared by Wright Water Engineers, Inc., and Geosyntec Consultants, Inc. July 2012.

Washington Stormwater Center and Herrera. 2011. Evaluating influent ranges of dissolved metals for the Technology Assessment Protocol – Ecology (TAPE). Prepared by the Washington Stormwater Center, Tacoma, Washington, and Herrera Environmental Consultants, Inc., Seattle, Washington. June 28, 2011.

Yu, S.L. and R.L. Stanford. 2006. Field Evaluation of the Filterra® Stormwater Bioretention Filtration System. A Final Technical Report. Prepared for Americast, Inc., by Dr. Shaw L. Yu and Richard L. Stanford, Department of Civil Engineering, University of Virginia. May 24, 2006.

ATTACHMENT 1

Sample Field Assessment Form and Photo Log

Hood Canal Retrofit Plan
Field Assessment Form

Date: 9.17.13
Initials: MMF

Basic Site Info

Project Name: **Belfair Community Center - Swale retrofit**

Site #: 7

Priority Area: M1

Source of Runoff:	[x] Private	[ ] WSDOT	[ ] Public - Other
BMP Location:	[x] Private	[ ] WSDOT	[ ] Public - Other
Shallow Infiltration:	[ ] Good	[x] Fair	[ ] Underdrain
Deep Infiltration:	[ ] Possible	[x] Unlikely	

Contributing Pervious and Impervious Surface

[ ] Drainage Area 1

	Roof	Parking	Road	Lawn	Other:
Size (SF):					
Level of Use:	-	H M L	H M L	-	H M L

[ ] Drainage Area 2

	Roof	Parking	Road	Lawn	Other:
Size (SF):					
Level of Use:	-	H M L	H M L	-	H M L

[ ] Drainage Area 3

	Roof	Parking	Road	Lawn	Other:
Size (SF):					
Level of Use:	-	H M L	H M L	-	H M L

Description of Drainage Area (Existing FC/WQ Problems, Drains to Stream before Hood Canal) & Any Follow up:
- All water drains to South CB - walls up from structure in lawn to west, sheet flows west through wetlands to Canal.
- Talked to Anne (see back for contact) ~~[illegible]~~, no major flooding issues on site, though during heavy events some flooding in parking lot (likely be only one CB servicing entire lot)

No history of basement flooding, etc.

Facility Field Design

Description of Proposed Facility:
Rain Garden / swale retrofit at outlet of South CB.
potentially a second small RG North of site but really minimal drainage area (Anne requested that we take a look & will keep us updated w/ WSDOT project)

Anticipated Site Challenges / Potential High Cost Items / Risks:
ground slope | existing storm system | (utilities) | groundwater | safety hazard | structures/trees | buffer zone

utilities: water line with history of leakage near proposed rain garden location.
groundwater: none observed.

Impact of Facility on Property Use or Amenity (If Any) (e.g., loss of parking, smaller parking stalls, trees):
None

How Impacts Have Been Minimized and Other Alternatives for Reducing Impacts:
—

Existing Stormwater Treamtne or Flow Control (onsite or downstream):
Dispersion, flow to wetland

Other Project Benefits

Public Visibility	Education	Aesthetics	County Goals	Other:
(H) / M / L	(H) / M / L	(H) / M / L	H / M / L	H / M / L

Q.A.

[ ] Photo [ ] Sketch [ ] Field Form Initials: _____

Hood Canal Retrofit Plan
Field Assessment Form

Date: _____
Initials: _____

☐ Drainage Area 4

	Roof	Parking	Road	Lawn	Other:
Size (SF):					
Level of Use:	-	H M L	H M L	-	H M L

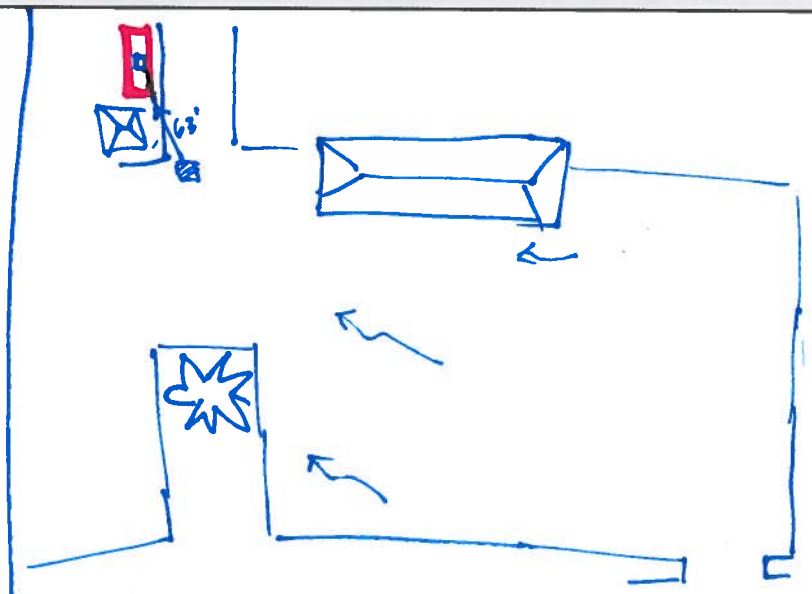
☐ Drainage Area 5

	Roof	Parking	Road	Lawn	Other:
Size (SF):					
Level of Use:	-	H M L	H M L	-	H M L

☐ Drainage Area 6

	Roof	Parking	Road	Lawn	Other:
Size (SF):					
Level of Use:	-	H M L	H M L	-	H M L

Facility Design Sketch and Notes



IF DRAINAGE CHANGES WITH SR-3 WIDENING
FLOODS IN SMALL STORMS
6'
14' FENCE TO WATER LINE
BIOSWALE
NE STATE ROUTE 3
40
45
50
55
55
55
60
65
7
bing
N
0
40
80
160
ft
WGS 1984 Web Mercator Auxiliary Sphere
K:\Projects\11-05408-000\Project\Field Maps\Mason County Template.mxd (7/26/2013)

07 Belfair Community Center

Photo Number	Photo Description
1	Parking lot from north end of lot
2	Edge of parking along north end of lot
3	Parking lot showing SR-3 entrance
4	Parking lot facing north
5	Parking lot facing north
6	Catch basin along trial head
7	Landscape near trail head
8	Parking lot from north end of lot
9	Edge of parking along north end of lot

09/17/2013 13:58
1

09/17/2013 13:58
2

09/17/2013 13:59
3

09/17/2013 14:01
4

5

6

7

8

9

ATTACHMENT 2

Project Summary Sheets and Site Maps

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Belfair Community Center **Site ID:** 7

SUMMARY

City:	Belfair
County:	Mason
Facility Type(s):	Bioretention
Property Type:	Private
Site Priority Rank:	13

Estimated Cost Range	
Low End:	$16,300
Likely:	$23,300
High End:	$35,000

PROJECT DESCRIPTION

Narrative:

This project would convert approximately 330 sf of existing landscaped area into bioretention. The facility would provide enhanced water quality treatment to runoff from approximately 0.7 acres of low use commercial parking area. Runoff from this area is currently untreated and flows directly to wetlands along the shoreline of Hood Canal.

Site Challenges:

Potential conflicts with utilities (e.g., water line). Water line has a history of leakage near proposed facility location.

Land Cover	Drainage Area (sf)
Impervious:	28,760
Parking::	28,760
Roof:	0
Road:	0
Pervious:	0
Total:	28,760

Design Considerations	
Facility Size:	330 sf BR
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Unlikely
Mean Annual Precipitation (in):	55
Land Use Type:	COMM
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

Enhanced water quality treatment for stormwater from low-use commercial parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.12
Total Suspended Solids:	441
Fecal Coliform (CFU/yr):	156
Total Nitrogen:	3
Total Phosphorus:	0.3
Total Zinc:	0.73

Criterion	Score (1 to 3)
Water Quality:	6
Cost:	3
Ease of Funding:	1
Education Opportunity:	3
Flow Control:	2
OM:	1
Social:	2
Environmental:	1
Total Score:	19

Other Benefits:

High public visibility, educational opportunity, and aesthetics.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Belfair Community Center

Site Number: 7

0 70 140
Feet

N

Legend

Bioretention
Parcel
Drainage Area
5-foot contour

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Habitat for Humanity **Site ID:** 9

SUMMARY

City:	Belfair
County:	Mason
Facility Type(s):	Bioretention, Media Filter Drain
Property Type:	Private
Site Priority Rank:	7

Estimated Cost Range	
Low End:	$34,500
Likely:	$49,300
High End:	$73,900

PROJECT DESCRIPTION

Narrative:

This project would convert approximately 620 sf of existing landscaped area into bioretention. The facility would provide enhanced water quality treatment to runoff from approximately 1.2 acres of medium use commercial parking area. Runoff from this area is currently untreated and flows to Hood Canal via Sweetwater Creek.

Site Challenges:

Potential conflicts with utilities (e.g., overhead power lines).

Land Cover	Drainage Area (sf)
Impervious:	68,560
Parking::	47,240
Roof:	9,040
Road:	12,280
Pervious:	0
Total:	68,560

Design Considerations	
Facility Size:	620 sf BR
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Unlikely
Mean Annual Precipitation (in):	55
Land Use Type:	COMM
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

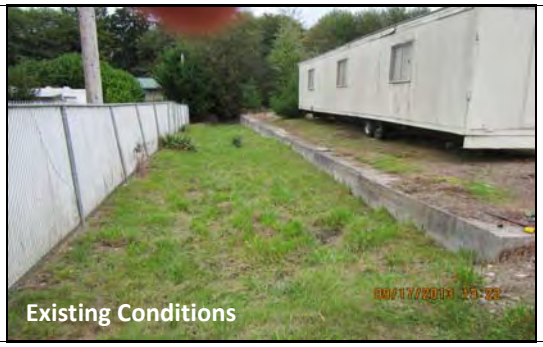
Enhanced water quality treatment for stormwater from medium-use commercial parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.31
Total Suspended Solids:	1,097
Fecal Coliform (CFU/yr):	372
Total Nitrogen:	8
Total Phosphorus:	1.1
Total Zinc:	1.77

Criterion	Score (1 to 3)
Water Quality:	10
Cost:	3
Ease of Funding:	1
Education Opportunity:	2
Flow Control:	2
OM:	1
Social:	1
Environmental:	1
Total Score:	21

Other Benefits:

--



Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Habitat for Humanity

Site Number: 9

0 65 130
Feet

N

Legend

- Bioretention
- Media Filter Drain
- Drainage Area
- 5-foot contour
- Parcel

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Happy Hollow Restaurant **Site ID:** 18

SUMMARY

City:	Belfair
County:	Mason
Facility Type(s):	Bioretention
Property Type:	WSDOT
Site Priority Rank:	23

Estimated Cost Range	
Low End:	$15,400
Likely:	$22,100
High End:	$33,100

PROJECT DESCRIPTION

Narrative:

This project convert existing vegetated area to bioretention. The facility would provide enhanced water quality treatment for approximately 0.4 acres of high use commercial parking area.

Site Challenges:

Potential conflicts with utilities (e.g., overhead power lines).

Land Cover	Drainage Area (sf)
Impervious:	18,000
Parking::	14,360
Roof:	2,760
Road:	880
Pervious:	8,610
Total:	26,610

Design Considerations	
Facility Size:	320 sf BR
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Unlikely
Mean Annual Precipitation (in):	57
Land Use Type:	COMM
Source(s) of Runoff:	WSDOT

BENEFITS

Benefits Description:

Enhanced water quality treatment for stormwater from low-use commercial parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.10
Total Suspended Solids:	368
Fecal Coliform (CFU/yr):	101
Total Nitrogen:	3
Total Phosphorus:	0.2
Total Zinc:	0.61

Criterion	Score (1 to 3)
Water Quality:	5
Cost:	1
Ease of Funding:	1
Education Opportunity:	2
Flow Control:	x
OM:	1
Social:	1
Environmental:	1
Total Score:	12

Other Benefits:

High public visibility.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Happy Hollow Restaurant

Site Number: 18

0 37.5 75
Feet

N

Legend

- Bioretention
- Parcel
- Drainage Area
- 5-foot contour

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Hoodsport Post Office **Site ID:** 22

SUMMARY

City:	Hoodsport
County:	Mason
Facility Type(s):	Filterra
Property Type:	Private
Site Priority Rank:	17

Estimated Cost Range	
Low End:	$20,600
Likely:	$29,400
High End:	$44,100

PROJECT DESCRIPTION

Narrative:

This project would retrofit approximately 40 square feet of existing parking area with a planter box filtration system between rows of parking. The planter box would provide enhanced water quality treatment and oil control for 0.3 acres of medium use commercial parking area. Runoff from this area is currently untreated and flows directly to Finch Creek.

Site Challenges:

Potential conflicts with utilities (e.g., power pole, overhead power lines). Care should be taken to avoid blocking business and City access to garbage facilities. The proposed facility would receive drainage from the WSDOT ROW.

Land Cover	Drainage Area (sf)
Impervious:	11,350
Parking::	7,300
Roof:	4,050
Road:	0
Pervious:	0
Total:	11,350

Design Considerations	
Facility Size:	1 Filterra unit
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Unlikely
Mean Annual Precipitation (in):	73
Land Use Type:	COMM
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

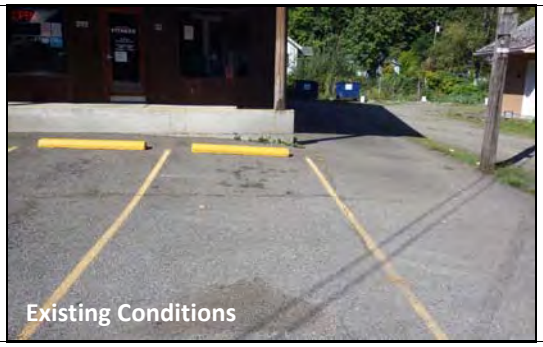
Enhanced water quality treatment for stormwater from low-use commercial parking area that discharges directly to a fish-bearing creek.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.07
Total Suspended Solids:	266
Fecal Coliform (CFU/yr):	84
Total Nitrogen:	2
Total Phosphorus:	0.5
Total Zinc:	0.36

Criterion	Score (1 to 3)
Water Quality:	4
Cost:	3
Ease of Funding:	1
Education Opportunity:	2
Flow Control:	1
OM:	1
Social:	3
Environmental:	3
Total Score:	18

Other Benefits:

--



Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Hoodsport Post Office

Site Number: 22

0 25 50
Feet

N

Legend

- Filterra
- Parcel
- Drainage Area
- 5-foot contour

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Hoodsport Visitor Center **Site ID:** 23

SUMMARY

City:	Hoodsport
County:	Mason
Facility Type(s):	Bioretention
Property Type:	Private
Site Priority Rank:	16

Estimated Cost Range	
Low End:	$4,800
Likely:	$6,800
High End:	$10,300

PROJECT DESCRIPTION

Narrative:

This project would convert approximately 100 sf of existing landscaped area into bioretention. The facility would provide enhanced water quality treatment to runoff from approximately 0.2 acres of low use commercial parking area. Runoff from this area is currently untreated and flows directly to Finch Creek and Hood Canal.

Site Challenges:

Potential conflicts with utilities (e.g., power pole). Location of proposed facility is near important building signage. Potential issues with traffic control along the ROW.

Land Cover	Drainage Area (sf)
Impervious:	6,800
Parking::	0
Roof:	0
Road:	6,800
Pervious:	0
Total:	6,800

Design Considerations	
Facility Size:	100 sf BR
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Unlikely
Mean Annual Precipitation (in):	74
Land Use Type:	COMM
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

Enhanced water quality treatment for stormwater from low-use parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.04
Total Suspended Solids:	143
Fecal Coliform (CFU/yr):	51
Total Nitrogen:	1
Total Phosphorus:	0.1
Total Zinc:	0.24

Criterion	Score (1 to 3)
Water Quality:	2
Cost:	3
Ease of Funding:	1
Education Opportunity:	3
Flow Control:	2
OM:	1
Social:	3
Environmental:	3
Total Score:	18

Other Benefits:

High public visibility, educational opportunity, and aesthetics. Consistent with County Goals.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Hoodsport Visitor Center

Site Number: 23

0 50 100
Feet

N

Legend

Bioretention
Parcel
Drainage Area
5-foot contour

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Hood Canal Church **Site ID:** 25

SUMMARY

City:	Hoodsport
County:	Mason
Facility Type(s):	Media Filter Drain, Bioretention
Property Type:	Private
Site Priority Rank:	4

Estimated Cost Range

Low End:	$12,300
Likely:	$17,600
High End:	$26,400

PROJECT DESCRIPTION

Narrative:

This project would convert approximately 200 sf of existing landscaped area with a media filter drain and 160 sf of existing landscaped area to bioretention. The facility would provide enhanced water quality treatment to runoff from approximately 0.6 acres of low use commercial parking area. Runoff from this area is currently untreated and flows directly to Finch Creek and Hood Canal.

Site Challenges:

Facility footprints must be located in existing developed footprint due to proximity to stream buffer.

Land Cover	Drainage Area (sf)
Impervious:	24,520
Parking::	19,740
Roof:	0
Road:	4,780
Pervious:	0
Total:	24,520

Design Considerations	
Facility Size:	200 sf Filter Drain + 160 sf BR
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Unlikely
Mean Annual Precipitation (in):	73
Land Use Type:	COMM
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

Enhanced water quality treatment for stormwater from low-use parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.18
Total Suspended Solids:	570
Fecal Coliform (CFU/yr):	182
Total Nitrogen:	4
Total Phosphorus:	0.9
Total Zinc:	0.89

Criterion	Score (1 to 3)
Water Quality:	8
Cost:	3
Ease of Funding:	1
Education Opportunity:	3
Flow Control:	2
OM:	1
Social:	2
Environmental:	3
Total Score:	23

Other Benefits:

High aesthetic potential.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Hood Canal Church

Site Number: 25 A & B

0 40 80
Feet

N

Legend

- Filterra
- Bioretention
- Media Filter Drain
- Drainage Area

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: N. Finch Creek Road **Site ID:** 27

SUMMARY

City:	Hoodsport
County:	Mason
Facility Type(s):	Ditch Retrofit
Property Type:	Private
Site Priority Rank:	3

Estimated Cost Range	
Low End:	$57,200
Likely:	$81,700
High End:	$122,600

PROJECT DESCRIPTION

Narrative:

This project would retrofit approximately 1,990 sf of existing drainage ditch area. The retrofit would include installation of a bypass pipe to divert flow around the improved ditch. The retrofit ditch would manage 1 acres of low use commercial parking area. Runoff from this area is currently untreated and flows directly to Finch Creek and Hood Canal.

Site Challenges:

Potential conflicts with existing stormwater culvert and high groundwater levels.

Land Cover	Drainage Area (sf)
Impervious:	44,440
Parking::	0
Roof:	0
Road:	44,440
Pervious:	0
Total:	44,440

Design Considerations	
Facility Size:	1,990 sf Ditch
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Unlikely
Mean Annual Precipitation (in):	71
Land Use Type:	COMM
Source(s) of Runoff:	Private, Public

BENEFITS

Benefits Description:

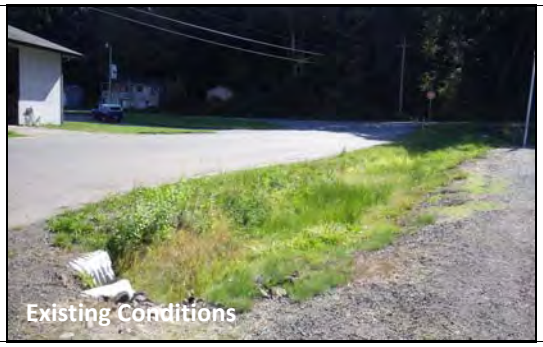
Enhanced water quality treatment for stormwater from low-use parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.18
Total Suspended Solids:	910
Fecal Coliform (CFU/yr):	61
Total Nitrogen:	2
Total Phosphorus:	0.8
Total Zinc:	1.07

Criterion	Score (1 to 3)
Water Quality:	7
Cost:	3
Ease of Funding:	3
Education Opportunity:	1
Flow Control:	1
OM:	3
Social:	2
Environmental:	3
Total Score:	23

Other Benefits:

High aesthetic potential.



Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

N. Finch Creek Road

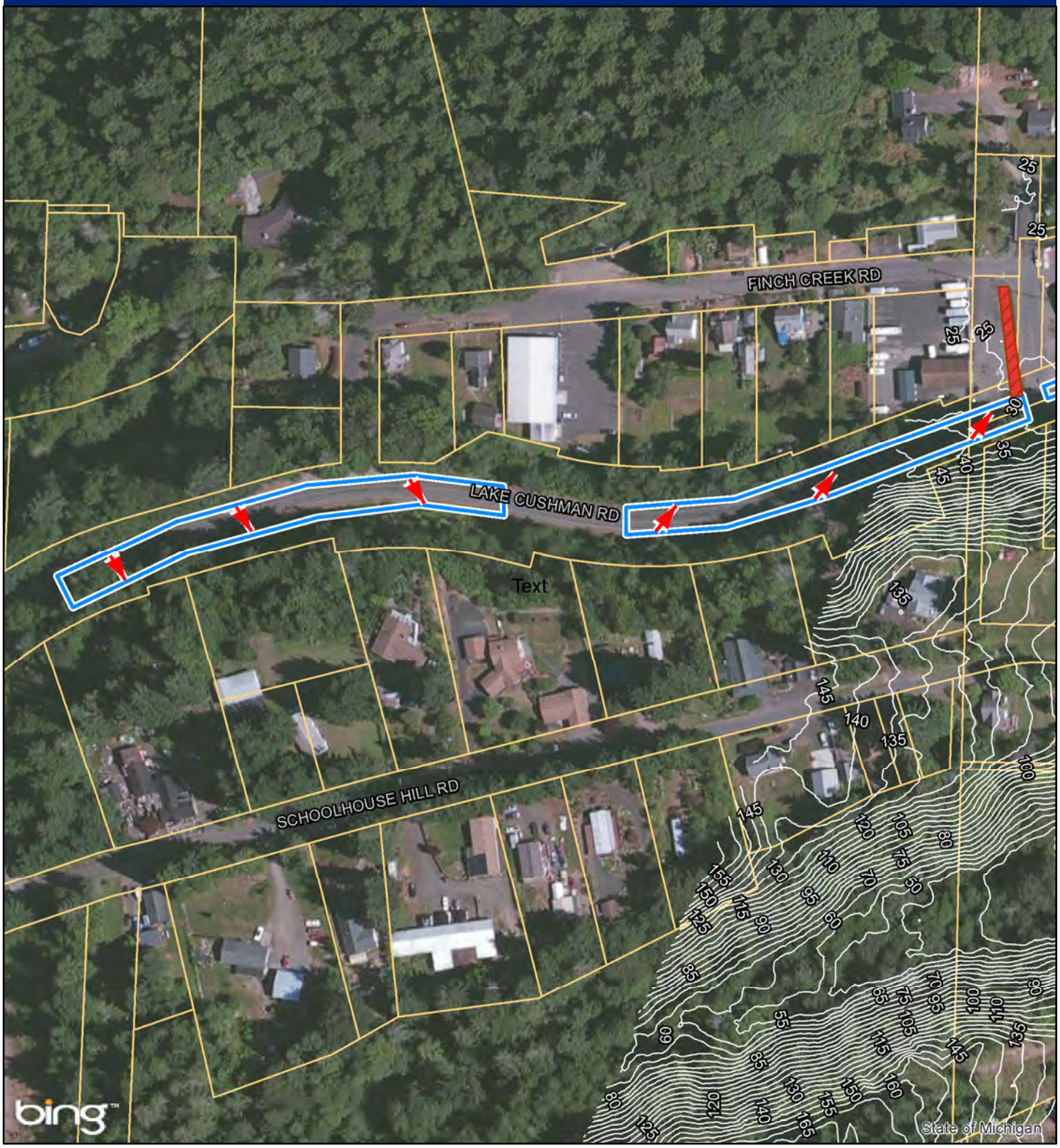
Site Number: 27

0 170 340
Feet

N

Legend

Ditch Retrofit
Parcel
Drainage Area
5-foot contour



Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Hoodsport Hatchery **Site ID:** 28

SUMMARY

City:	Hoodsport
County:	Mason
Facility Type(s):	Filterra
Property Type:	Public
Site Priority Rank:	12

Estimated Cost Range	
Low End:	$41,200
Likely:	$58,800
High End:	$88,200

PROJECT DESCRIPTION

Narrative:

This project would retrofit approximately 80 square feet of existing parking area with two planter box filtration system between rows of parking or at the edge of the right-of-way. The planter boxes would provide enhanced water quality treatment and oil control for 0.3 acres of medium use commercial parking area.

Site Challenges:

Potential conflicts with existing stormwater system. Proposed location is near the edge of the building, so care would be taken to avoid impacts to building footing.

Land Cover	Drainage Area (sf)
Impervious:	14,720
Parking::	8,580
Roof:	820
Road:	5,320
Pervious:	0
Total:	14,720

Design Considerations	
Facility Size:	2 Filterra units
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Unlikely
Mean Annual Precipitation (in):	73
Land Use Type:	COMM
Source(s) of Runoff:	Public

BENEFITS

Benefits Description:

Enhanced water quality treatment for stormwater from medium-use commercial parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.09
Total Suspended Solids:	344
Fecal Coliform (CFU/yr):	109
Total Nitrogen:	2
Total Phosphorus:	0.6
Total Zinc:	0.47

Criterion	Score (1 to 3)
Water Quality:	5
Cost:	3
Ease of Funding:	3
Education Opportunity:	1
Flow Control:	x
OM:	3
Social:	1
Environmental:	3
Total Score:	19

Other Benefits:

High public visibility.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Hoodsport Hatchery

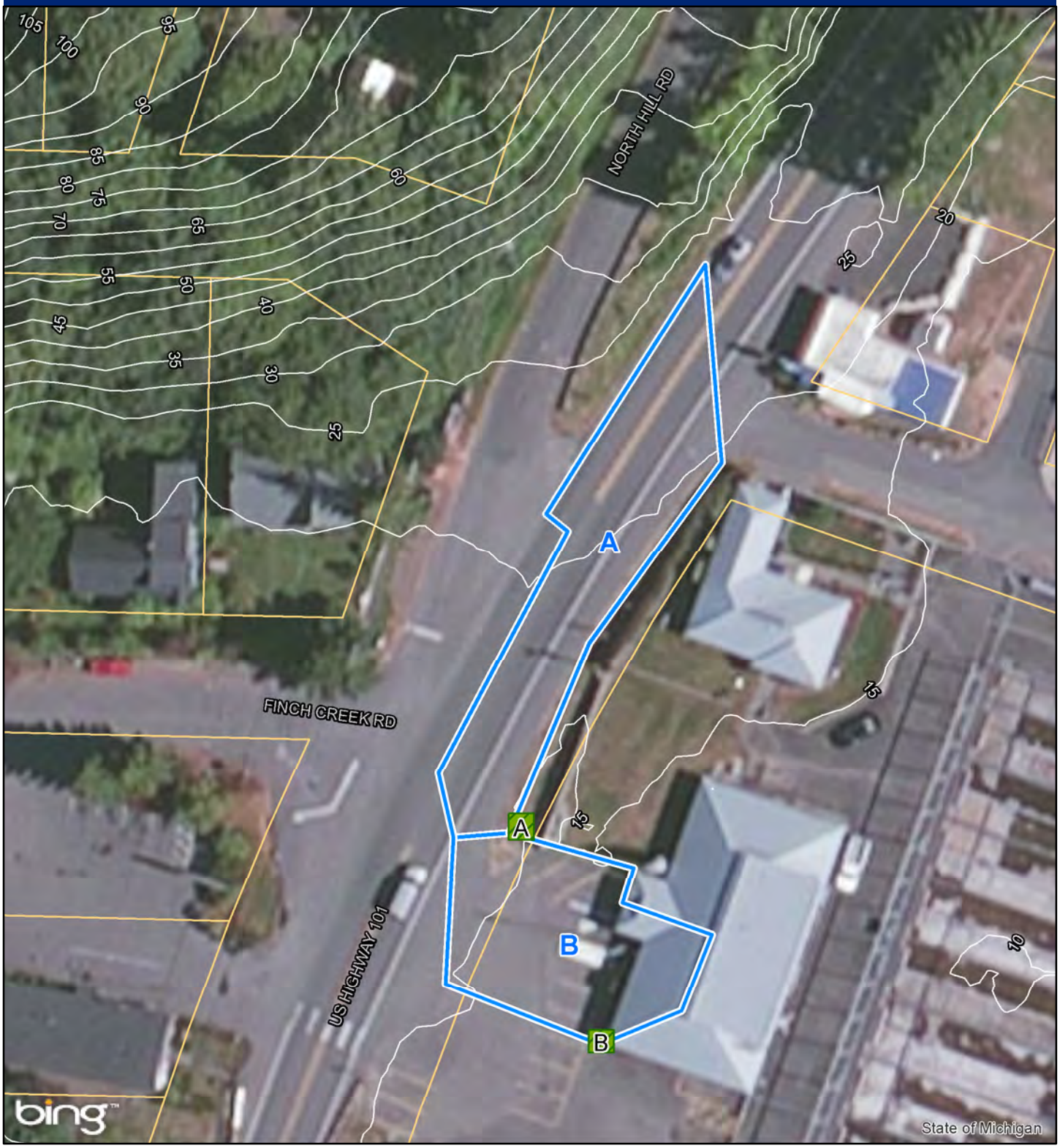
Site Number: 28 A & B

0 40 80
Feet

N

Legend

- Filterra
- Parcel
- Drainage Area
- 5-foot contour



Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Dosewallips State Park **Site ID:** 34

SUMMARY

City:	Brinnon
County:	Jefferson
Facility Type(s):	Bioretention
Property Type:	Public
Site Priority Rank:	6

Estimated Cost Range	
Low End:	$7,300
Likely:	$10,400
High End:	$15,600

PROJECT DESCRIPTION

Narrative:

This project would convert approximately 160 sf of existing landscaped area into bioretention. The facilities would provide enhanced water quality treatment to runoff from approximately 0.4 acres of low use commercial parking area. Runoff from this area is currently untreated and flows directly to Hood Canal.

Site Challenges:

Potentially high groundwater levels due to proximity to Hood Canal. Proposed location of one bioretention facility would require careful excavation around existing tree driplines. Use of odd-shaped parking stalls.

Land Cover	Drainage Area (sf)
Impervious:	19,590
Parking::	19,590
Roof:	0
Road:	0
Pervious:	0
Total:	19,590

Design Considerations	
Facility Size:	160 sf BR
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Unlikely
Mean Annual Precipitation (in):	50
Land Use Type:	COMM
Source(s) of Runoff:	Public

BENEFITS

Benefits Description:

Enhanced water quality treatment for stormwater from low-use parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.07
Total Suspended Solids:	272
Fecal Coliform (CFU/yr):	96
Total Nitrogen:	2
Total Phosphorus:	0.2
Total Zinc:	0.45

Criterion	Score (1 to 3)
Water Quality:	4
Cost:	3
Ease of Funding:	3
Education Opportunity:	3
Flow Control:	x
OM:	3
Social:	2
Environmental:	3
Total Score:	21

Other Benefits:

High educational opportunity (proximity to Hood Canal helps tie purpose of project to source). Consistent with County Goals.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Dosewallips State Park

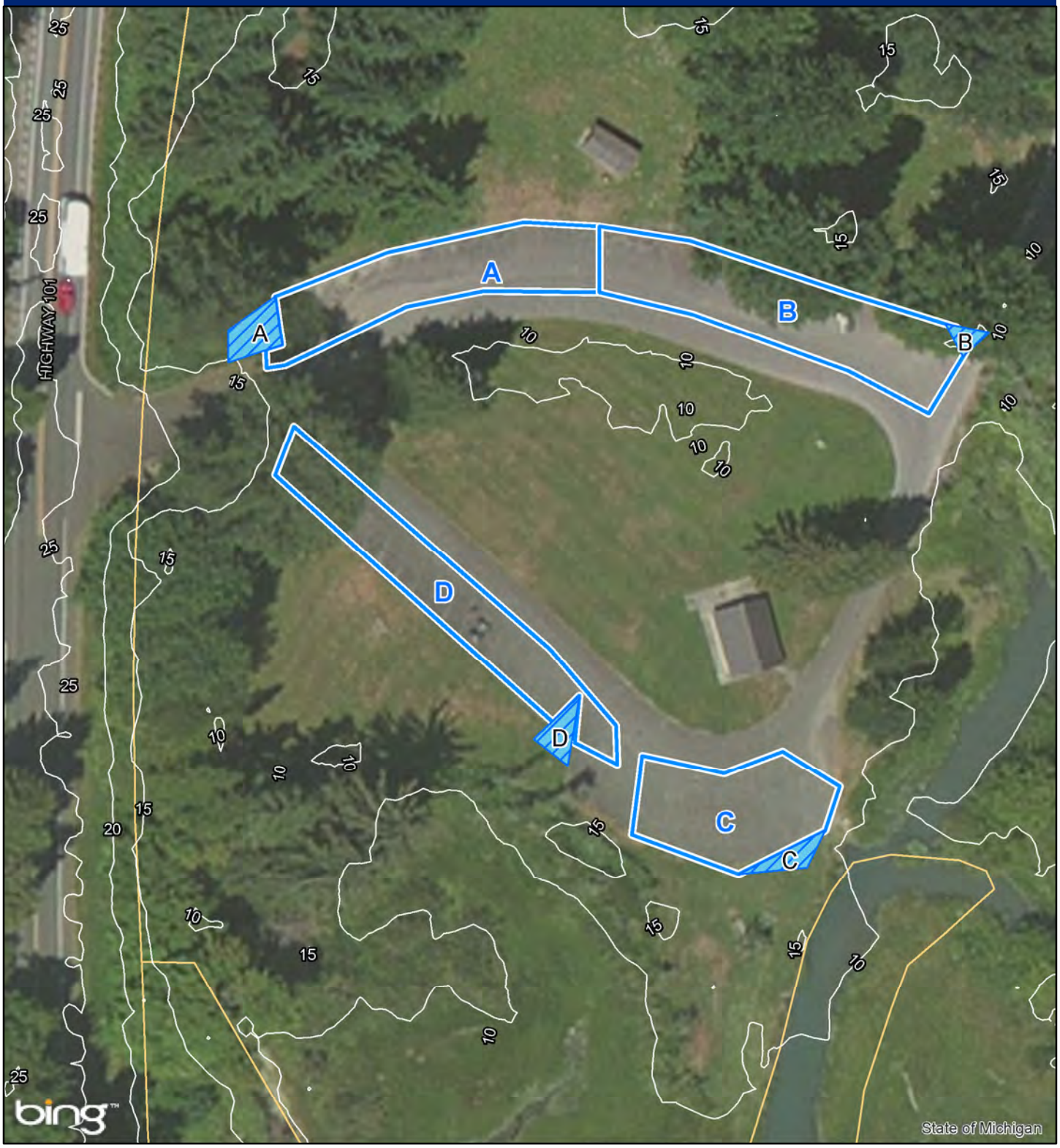
Site Number: 34 A - D

0 62.5 125
Feet

N

Legend

- Bioretention
- Parcel
- Drainage Area
- 5-foot contour



Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Brinnon Community Center **Site ID:** 36

SUMMARY

City:	Brinnon
County:	Jefferson
Facility Type(s):	Bioretention, Drywell Retrofit
Property Type:	Private
Site Priority Rank:	1

Estimated Cost Range	
Low End:	$35,900
Likely:	$51,300
High End:	$77,000

PROJECT DESCRIPTION

Narrative:

This project would convert approximately 310 sf of existing landscaped area into bioretention and retrofit an existing drywell. The facilities would provide enhanced water quality treatment to runoff from approximately 1 acre of low use commercial parking area. Runoff from this area is currently untreated and flows directly to Hood Canal.

Site Challenges:

Potentially high groundwater levels due to proximity to Hood Canal. Proposed location of one of the bioretention facilities would require clearing/ working around existing vegetation.

Land Cover	Drainage Area (sf)
Impervious:	43,830
Parking::	21,890
Roof:	0
Road:	21,940
Pervious:	9,680
Total:	53,510

Design Considerations	
Facility Size:	310 sf BR + 1 Drywell
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Unlikely
Mean Annual Precipitation (in):	51
Land Use Type:	COMM
Source(s) of Runoff:	Private, WSDOT

BENEFITS

Benefits Description:

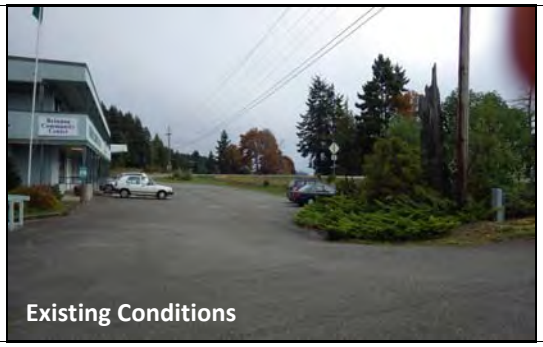
Enhanced water quality treatment for stormwater from low-use parking area. Retrofit of existing stormwater drywell to improve conditio

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.17
Total Suspended Solids:	640
Fecal Coliform (CFU/yr):	218
Total Nitrogen:	5
Total Phosphorus:	0.6
Total Zinc:	1.00

Criterion	Score (1 to 3)
Water Quality:	8
Cost:	3
Ease of Funding:	3
Education Opportunity:	3
Flow Control:	x
OM:	3
Social:	2
Environmental:	3
Total Score:	25

Other Benefits:

High public visibility, educational opportunity, and aesthetics. Consistent with County Goals.



Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Brinnon Community Center

Site Number: 36 A - E

0 70 140
Feet

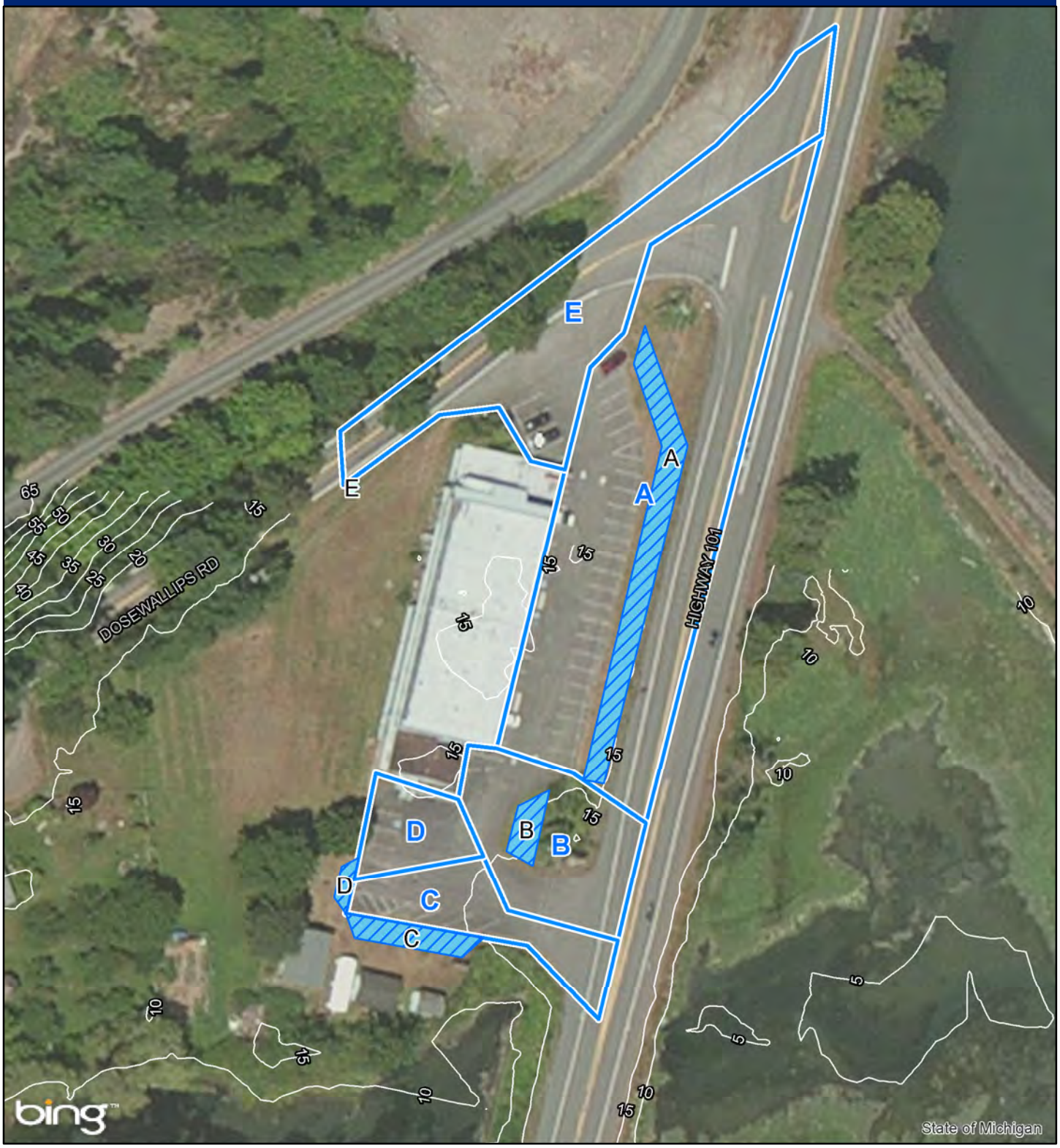
N

Legend

Bioretention

Drainage Area

5-foot contour



Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: QFC Port Hadlock **Site ID:** 40

SUMMARY

City:	Port Hadlock
County:	Jefferson
Facility Type(s):	Bioretention, Filterra
Property Type:	Private
Site Priority Rank:	20

Estimated Cost Range	
Low End:	$22,300
Likely:	$31,900
High End:	$47,900

PROJECT DESCRIPTION

Narrative:

This project would convert approximately 40 sf of existing landscaped area into bioretention and retrofit 40 sf of existing parking with a planter box. The facilities would provide enhanced water quality treatment to runoff from approximately 0.6 acres of low use commcerial parking area. Runoff from this area is currently untreated and flows directly to Chimacum Creek and Hood Canal.

Site Challenges:

Potential conflicts with utilities (e.g., overhead power lines, water meter). Safety concerns due to location near intersection.

Land Cover	Drainage Area (sf)
Impervious:	28,490
Parking::	28,490
Roof:	0
Road:	0
Pervious:	1,220
Total:	29,710

Design Considerations	
Facility Size:	40 sf BR + 1 Filterra unit
Shallow Infiltration Potential:	Good
Deep Infiltration Potential:	Possible
Mean Annual Precipitation (in):	26
Land Use Type:	COMM
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

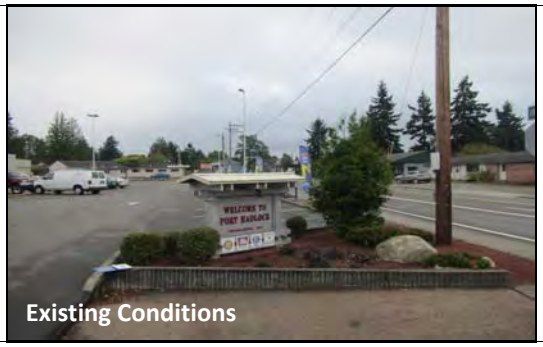
Enhanced water quality treatment for stormwater from medium-use parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.05
Total Suspended Solids:	190
Fecal Coliform (CFU/yr):	62
Total Nitrogen:	1
Total Phosphorus:	0.3
Total Zinc:	0.28

Criterion	Score (1 to 3)
Water Quality:	3
Cost:	3
Ease of Funding:	1
Education Opportunity:	2
Flow Control:	2
OM:	1
Social:	2
Environmental:	2
Total Score:	16

Other Benefits:

High public visibility, educational opportunity, and aesthetics. Consistent with County Goals.



Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

QFC Port Hadlock

Site Number: 40 A & B

0 70 140
Feet

N

Legend

- Filterra
- Bioretention
- Drainage Area
- 5-foot contour
- Parcel

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Carl's Building Supply **Site ID:** 47

SUMMARY

City:	Port Hadlock
County:	Jefferson
Facility Type(s):	Filterra, Bioretention
Property Type:	Private
Site Priority Rank:	11

Estimated Cost Range	
Low End:	$23,900
Likely:	$34,100
High End:	$51,100

PROJECT DESCRIPTION

Narrative:

This project would retrofit approximately 70 sf of existing landscaped area into bioretention and 40 square feet of existing parking area with a planter box filtration system between rows of parking. The facilities would provide enhanced water quality treatment and oil control for 1.1 acres of medium use commercial parking area. Runoff from this area currently infiltrates or flows untreated to Chimacum Creek and Hood Canal.

Site Challenges:

Potential conflicts with existing stormwater system, utilities (e.g. power lines), and existing signage on site. Safety concerns due to traffic in the area.

Land Cover	Drainage Area (sf)
Impervious:	49,320
Parking::	27,920
Roof:	5,670
Road:	15,730
Pervious:	3,580
Total:	52,900

Design Considerations	
Facility Size:	70 sf BR + 1 Filterra unit
Shallow Infiltration Potential:	Good
Deep Infiltration Potential:	Possible
Mean Annual Precipitation (in):	26
Land Use Type:	COMM
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

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Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.09
Total Suspended Solids:	336
Fecal Coliform (CFU/yr):	111
Total Nitrogen:	2
Total Phosphorus:	0.4
Total Zinc:	0.50

Criterion	Score (1 to 3)
Water Quality:	5
Cost:	3
Ease of Funding:	1
Education Opportunity:	2
Flow Control:	3
OM:	1
Social:	2
Environmental:	2
Total Score:	19

Other Benefits:

High public visibility, educational opportunity, and aesthetics. Consistent with County Goals.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Carl's Building Supply

Site Number: 47 A & B

0 70 140
Feet

N

Legend

- Filterra
- Bioretention
- Drainage Area
- 5-foot contour
- Parcel

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Chimacum High School **Site ID:** 49

SUMMARY

City:	Port Hadlock
County:	Jefferson
Facility Type(s):	Bioretention
Property Type:	Public
Site Priority Rank:	5

Estimated Cost Range	
Low End:	$7,900
Likely:	$11,300
High End:	$17,000

PROJECT DESCRIPTION

Narrative:

This project would convert approximately 160 sf of existing landscaped area into bioretention. The facility would provide enhanced water quality treatment to runoff from approximately 0.6 acres of low use commercial parking area. Runoff from this area is currently untreated and flows directly to Chimacum Creek and Hood Canal.

Site Challenges:

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Land Cover	Drainage Area (sf)
Impervious:	27,630
Parking::	22,460
Roof:	0
Road:	5,170
Pervious:	20,190
Total:	47,820

Design Considerations	
Facility Size:	160 sf BR
Shallow Infiltration Potential:	Good
Deep Infiltration Potential:	Possible
Mean Annual Precipitation (in):	27
Land Use Type:	COMM
Source(s) of Runoff:	Public

BENEFITS

Benefits Description:

Enhanced water quality treatment for stormwater from low-use parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.05
Total Suspended Solids:	181
Fecal Coliform (CFU/yr):	64
Total Nitrogen:	1
Total Phosphorus:	0.1
Total Zinc:	0.30

Criterion	Score (1 to 3)
Water Quality:	3
Cost:	3
Ease of Funding:	3
Education Opportunity:	3
Flow Control:	3
OM:	3
Social:	1
Environmental:	2
Total Score:	21

Other Benefits:

High public visibility, educational opportunity, and aesthetics. Consistent with County Goals.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Chimacum High School

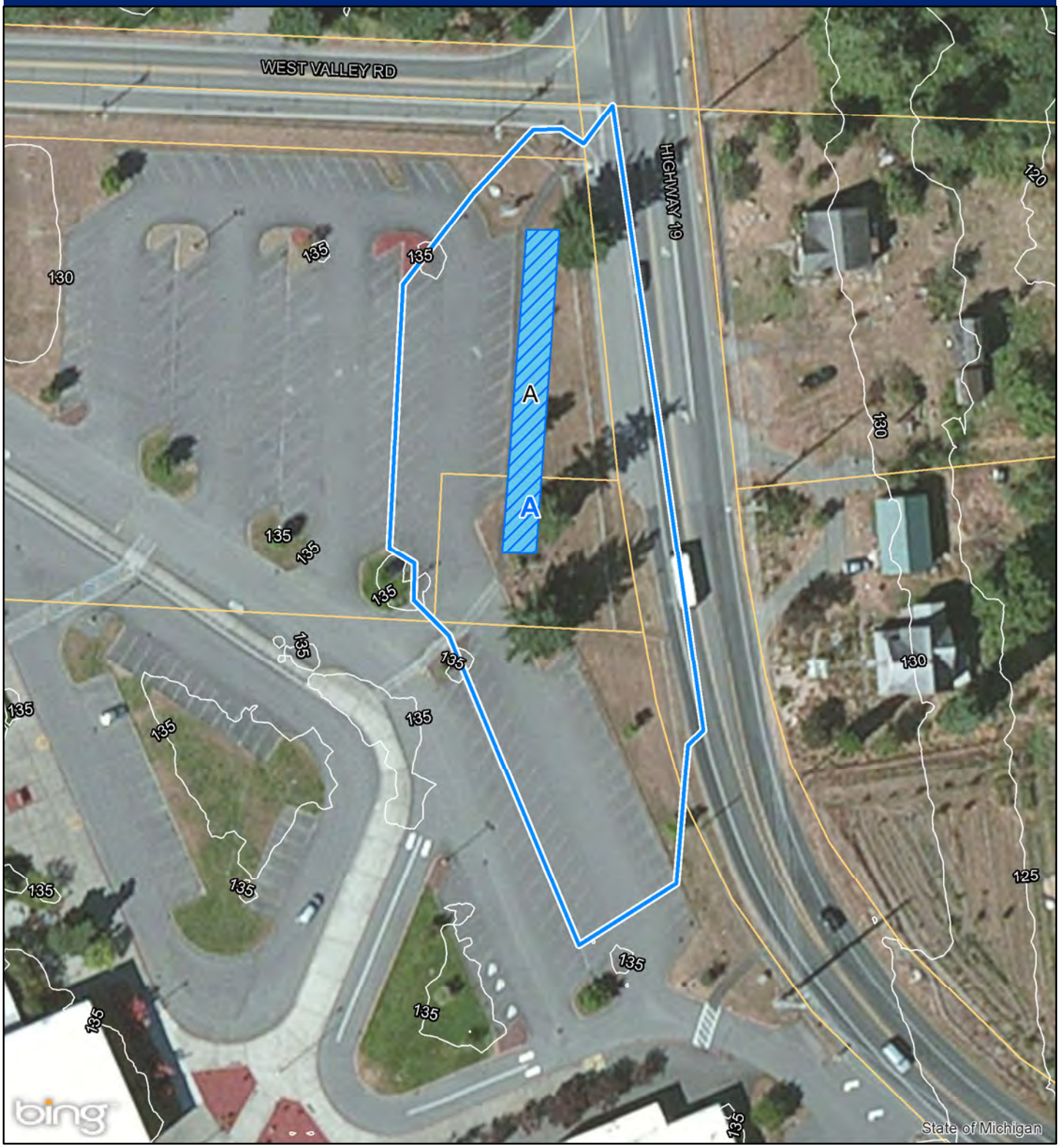
Site Number: 49

0 70 140
Feet

N

Legend

- Bioretention
- Parcel
- Drainage Area
- 5-foot contour



Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Lake Symington Neighborhood **Site ID:** 50

SUMMARY

City:	Lake Symington
County:	Kitsap
Facility Type(s):	Ditch Retrofit
Property Type:	Public
Site Priority Rank:	10

Estimated Cost Range	
Low End:	$1,288,600
Likely:	$1,840,800
High End:	$2,761,200

PROJECT DESCRIPTION

Narrative:

This project would retrofit approximately 10,350 sf of existing drainage ditch area. The improved facility would provide water quality treatment to runoff from approximately 14.5 acres of low density residential land. Runoff from this area is currently untreated and flows to Lake Symington prior to flowing to Big Beef Creek and Hood Canal.

Site Challenges:

Potential conflicts with steep slopes, existing utilities (e.g., overhead power lines), and existing structures (e.g., mature trees). Safety concerns due to tight intersections in neighborhoods.

Land Cover	Drainage Area (sf)
Impervious:	165,540
Parking::	47,020
Roof:	81,250
Road:	37,270
Pervious:	315,960
Total:	481,500

Design Considerations	
Facility Size:	~14,000 sf Ditch
Shallow Infiltration Potential:	Difficult/Slope Hazard
Deep Infiltration Potential:	Possible
Mean Annual Precipitation (in):	55
Land Use Type:	LDR
Source(s) of Runoff:	Public

BENEFITS

Benefits Description:

Treatment for stormwater from low density residential area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.00
Total Suspended Solids:	1,381
Fecal Coliform (CFU/yr):	53
Total Nitrogen:	13
Total Phosphorus:	2.5
Total Zinc:	0.00

Criterion	Score (1 to 3)
Water Quality:	5
Cost:	1
Ease of Funding:	3
Education Opportunity:	2
Flow Control:	1
OM:	3
Social:	2
Environmental:	3
Total Score:	20

Other Benefits:

--

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Lake Symington Neighborhood

Site Number: 50

0 255 510
Feet

N

Legend

- Ditch Retrofit
- Drainage Area
- 5-foot contour
- Parcel

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Camp Union Grocery Pond **Site ID:** 52

SUMMARY

City:	Lake Symington
County:	Kitsap
Facility Type(s):	Pond Retrofit
Property Type:	Private
Site Priority Rank:	9

Estimated Cost Range	
Low End:	$37,400
Likely:	$53,500
High End:	$80,200

PROJECT DESCRIPTION

Narrative:

This project would retrofit an existing 9,470 sf stormwater pond located between a grocery store and church parking lot. The pond would be replanted with native species, and retrofit with an additional berm to improve flow through the facility from the inlet to the outlet of the second cell.

Site Challenges:

Potential conflicts with utilities (e.g., overhead power lines), safety concerns with entrance to gas station and existing propane tank adjacent to the pond.

Land Cover	Drainage Area (sf)
Impervious:	82,710
Parking::	71,180
Roof:	11,530
Road:	0
Pervious:	0
Total:	82,710

Design Considerations	
Facility Size:	9,470 sf Pond
Shallow Infiltration Potential:	Good
Deep Infiltration Potential:	Possible
Mean Annual Precipitation (in):	58
Land Use Type:	COMM
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

Retrofit existing pond to improve function and water quality treatment.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.13
Total Suspended Solids:	152
Fecal Coliform (CFU/yr):	173
Total Nitrogen:	11
Total Phosphorus:	1.0
Total Zinc:	0.59

Criterion	Score (1 to 3)
Water Quality:	7
Cost:	3
Ease of Funding:	2
Education Opportunity:	1
Flow Control:	1
OM:	2
Social:	1
Environmental:	3
Total Score:	20

Other Benefits:

--

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Camp Union Grocery Pond

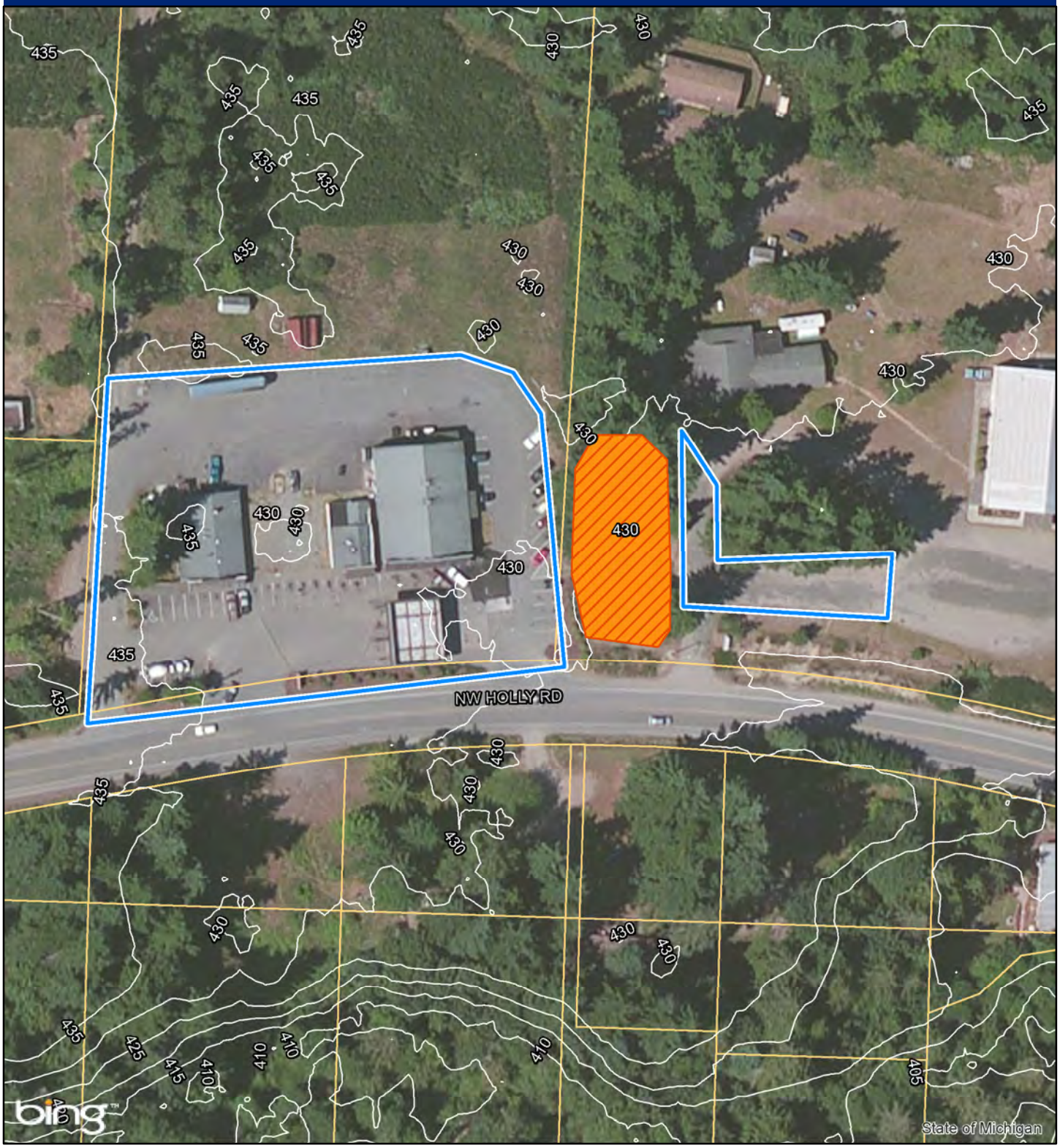
Site Number: 52

0 90 180
Feet

N

Legend

- Pond Retrofit
- Drainage Area
- 5-foot contour
- Parcel



Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Four Corners Tavern **Site ID:** 53

SUMMARY

City:	Breidablick
County:	Kitsap
Facility Type(s):	Bioretention
Property Type:	Private
Site Priority Rank:	15

Estimated Cost Range	
Low End:	$3,100
Likely:	$4,400
High End:	$6,600

PROJECT DESCRIPTION

Narrative:

This project would convert approximately 70 sf of existing landscaped area into bioretention. The facilities would provide enhanced water quality treatment to runoff from approximately 0.3 acres of low use commercial parking area. Runoff from this area is currently untreated and flows directly to Kinman Creek and Hood Canal.

Site Challenges:

Potential conflicts with utilities (e.g., overhead power lines). Would require some regrading of the parking area to route runoff to one of the proposed locations.

Land Cover	Drainage Area (sf)
Impervious:	12,590
Parking::	4,600
Roof:	930
Road:	7,060
Pervious:	0
Total:	12,590

Design Considerations	
Facility Size:	70 sf BR
Shallow Infiltration Potential:	Good
Deep Infiltration Potential:	Possible
Mean Annual Precipitation (in):	36
Land Use Type:	COMM
Source(s) of Runoff:	Private, WSDOT

BENEFITS

Benefits Description:

Enhanced water quality treatment for stormwater from low-use parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.03
Total Suspended Solids:	117
Fecal Coliform (CFU/yr):	41
Total Nitrogen:	1
Total Phosphorus:	0.1
Total Zinc:	0.19

Criterion	Score (1 to 3)
Water Quality:	2
Cost:	3
Ease of Funding:	2
Education Opportunity:	2
Flow Control:	2
OM:	2
Social:	2
Environmental:	3
Total Score:	18

Other Benefits:

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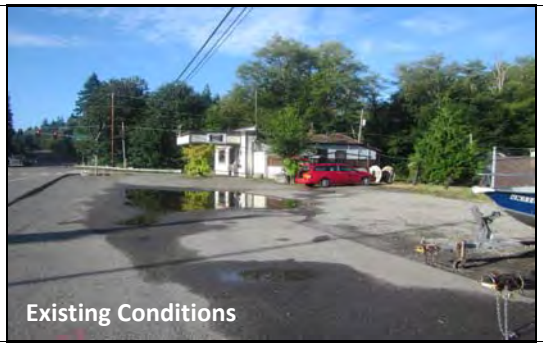


Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Four Corners Tavern

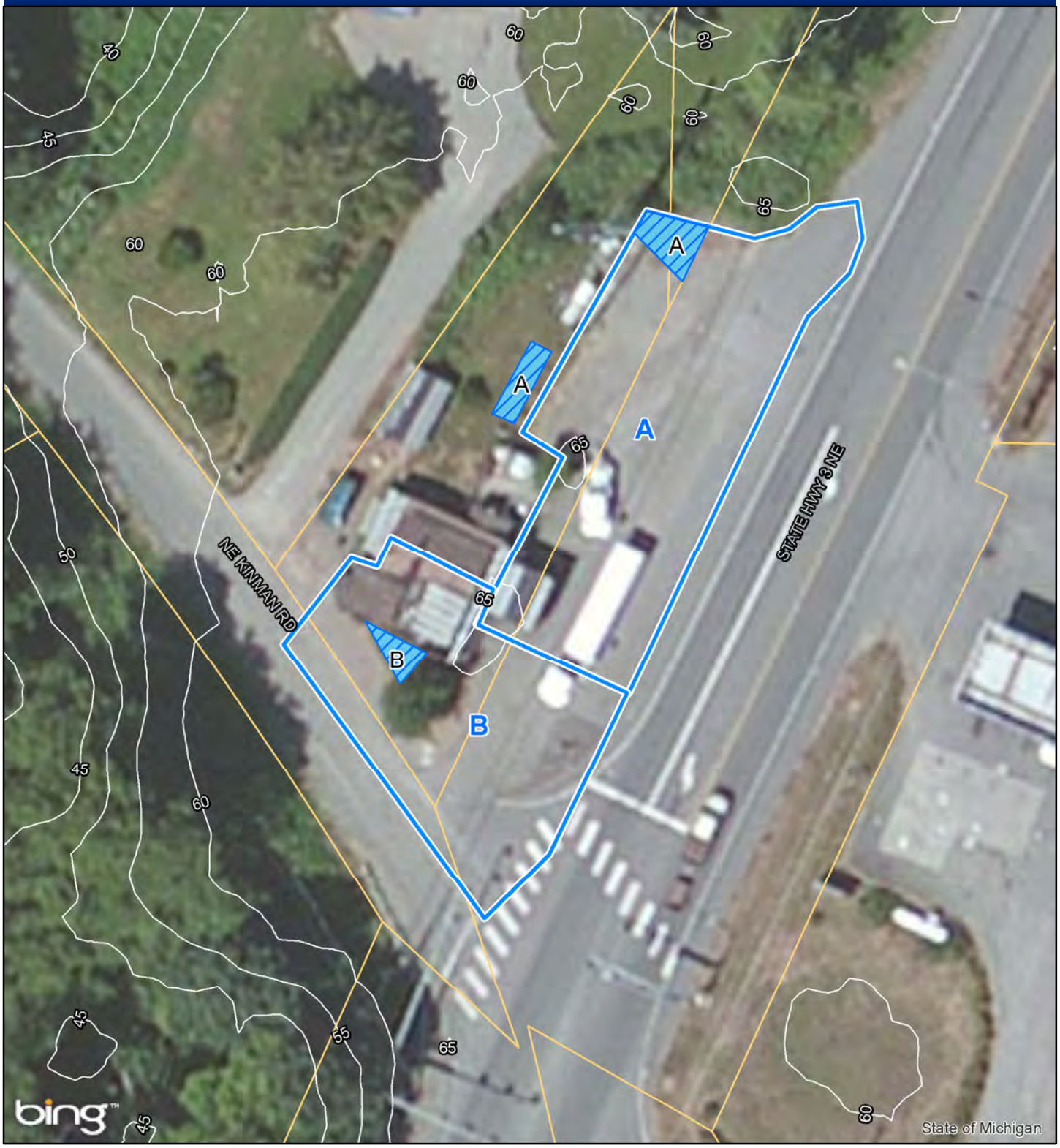
Site Number: 53 A & B

0 37.5 75
Feet

N

Legend

- Bioretention
- Drainage Area
- 5-foot contour
- Parcel



Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Twelve Trees Business Park **Site ID:** 54

SUMMARY

City:	Breidablick
County:	Kitsap
Facility Type(s):	Bioretention
Property Type:	Private
Site Priority Rank:	2

Estimated Cost Range	
Low End:	$10,500
Likely:	$15,000
High End:	$22,400

PROJECT DESCRIPTION

Narrative:

This project would convert approximately 220 sf of existing landscaped area into bioretention. The facilities would provide enhanced water quality treatment to runoff from approximately 0.9 acres of low use commercial parking area. Runoff from this area is currently untreated and flows directly to Jumpoff Joe Creek and Hood Canal.

Site Challenges:

Some moderately steep sloped driveways. Bioretention facilities may have a minor impact on parking.

Land Cover	Drainage Area (sf)
Impervious:	39,930
Parking::	39,930
Roof:	0
Road:	0
Pervious:	0
Total:	39,930

Design Considerations	
Facility Size:	220 sf BR
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Possible
Mean Annual Precipitation (in):	37
Land Use Type:	COMM
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

Enhanced water quality treatment for stormwater from low-use parking area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.10
Total Suspended Solids:	392
Fecal Coliform (CFU/yr):	138
Total Nitrogen:	3
Total Phosphorus:	0.2
Total Zinc:	0.65

Criterion	Score (1 to 3)
Water Quality:	6
Cost:	3
Ease of Funding:	2
Education Opportunity:	2
Flow Control:	3
OM:	2
Social:	2
Environmental:	3
Total Score:	23

Other Benefits:

--

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Twelve Trees Business Park

Site Number: 54 A - F

0 140 280
Feet

N

Legend

- Bioretention
- Drainage Area
- 5-foot contour
- Parcel

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Edgewater Neighborhood **Site ID:** 55

SUMMARY

City:	Breidablick
County:	Kitsap
Facility Type(s):	Ditch Retrofit
Property Type:	Public
Site Priority Rank:	14

Estimated Cost Range	
Low End:	$281,100
Likely:	$401,500
High End:	$602,300

PROJECT DESCRIPTION

Narrative:

This project would retrofit approximately 18,970 sf of existing drainage ditch area. The improved facility would provide water quality treatment to runoff from approximately 30.6 acres of low density residential land. Runoff from this area is currently untreated and flows directly to Jumpoff Joe Creek and Hood Canal.

Site Challenges:

Potential conflicts with utilities (e.g., overhead power lines, utility poles), steep slopes. Saftey concerns due to tight intersections within neighborhood, some mature trees that may require careful excavation around driplines.

Land Cover	Drainage Area (sf)
Impervious:	258,380
Parking::	95,050
Roof:	99,950
Road:	63,380
Pervious:	314,800
Total:	573,180

Design Considerations	
Facility Size:	~3,000 sf Ditch
Shallow Infiltration Potential:	Good
Deep Infiltration Potential:	Possible
Mean Annual Precipitation (in):	37
Land Use Type:	LDR
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

Water quality treatment for stormwater from low density residential area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.00
Total Suspended Solids:	646
Fecal Coliform (CFU/yr):	53
Total Nitrogen:	6
Total Phosphorus:	1.1
Total Zinc:	0.00

Criterion	Score (1 to 3)
Water Quality:	3
Cost:	1
Ease of Funding:	3
Education Opportunity:	2
Flow Control:	1
OM:	3
Social:	2
Environmental:	3
Total Score:	18

Other Benefits:

Public visibility, educational opportunity, and aesthetics. Consistent with County Goals.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Edgewater Neighborhood

Site Number: 55

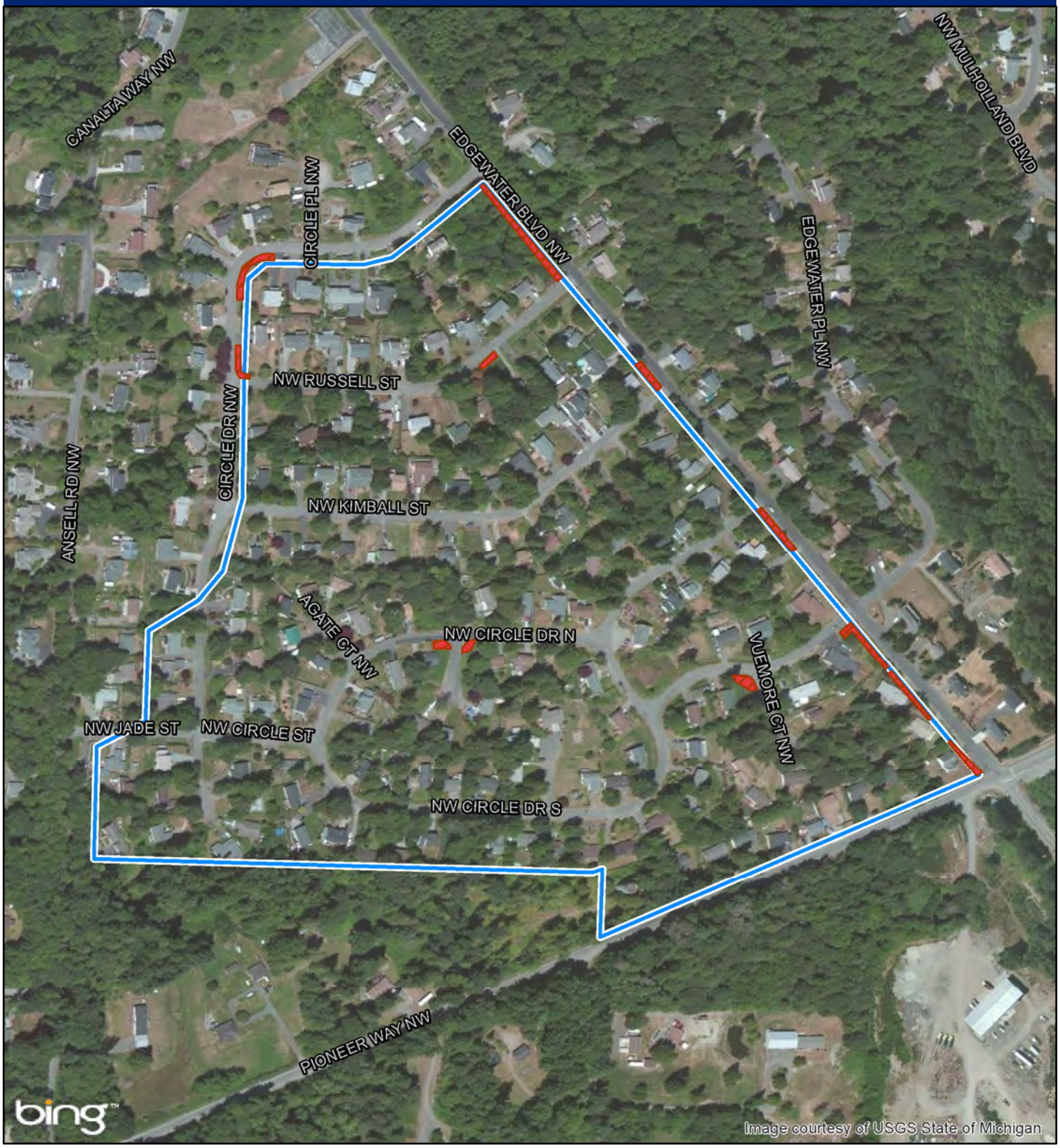
0 325 650
Feet

N

Legend

Ditch Retrofit

Drainage Area



Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Alderbrook Neighborhood **Site ID:** 61

SUMMARY

City:	Union
County:	Mason
Facility Type(s):	Ditch Retrofit
Property Type:	Private
Site Priority Rank:	22

Estimated Cost Range	
Low End:	$2,139,200
Likely:	$3,055,900
High End:	$4,583,900

PROJECT DESCRIPTION

Narrative:

This project would retrofit existing drainage ditch area. The improved facility would provide water quality treatment to runoff from low density residential land. Runoff from this area is currently untreated and flows to Hood Canal.

Site Challenges:

Land Cover	Drainage Area (sf)
Impervious:	178,400
Parking::	54,680
Roof:	66,480
Road:	57,240
Pervious:	494,550
Total:	672,950

Design Considerations	
Facility Size:	23,170 sf Ditch
Shallow Infiltration Potential:	NA
Deep Infiltration Potential:	NA
Mean Annual Precipitation (in):	67
Land Use Type:	LDR
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

Water quality treatment for stormwater from low density residential area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.00
Total Suspended Solids:	2,376
Fecal Coliform (CFU/yr):	71
Total Nitrogen:	23
Total Phosphorus:	4.2
Total Zinc:	0.00

Criterion	Score (1 to 3)
Water Quality:	5
Cost:	1
Ease of Funding:	1
Education Opportunity:	2
Flow Control:	1
OM:	1
Social:	2
Environmental:	1
Total Score:	14

Other Benefits:

Public visibility, educational opportunity, and aesthetics. Consistent with County Goals.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Alderbrook Neighborhood

Site Number: 61

0 625 1,250
Feet

N

Legend

- Ditch Retrofit
- Parcel
- Drainage Area
- 5-foot contour

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Union Neighborhood **Site ID:** 62

SUMMARY

City:	Union
County:	Mason
Facility Type(s):	
Property Type:	Private
Site Priority Rank:	24

Estimated Cost Range	
Low End:	$0
Likely:	$0
High End:	$0

PROJECT DESCRIPTION

Narrative:

A formal drainage system would collect and convey stormwater runoff to the major North-South streets and alleviate existing erosion problems throughout the steep neighborhood. Ditches would provide water quality treatment for some runoff and convey stormwater to Hood Canal.

Site Challenges:

Constrained and steep East-West oriented streets provide little space for collection and convayance.

Land Cover	Drainage Area (sf)
Impervious:	0
Parking::	0
Roof:	0
Road:	0
Pervious:	0
Total:	0

Design Considerations	
Facility Size:	-
Shallow Infiltration Potential:	Underdrain
Deep Infiltration Potential:	Possible
Mean Annual Precipitation (in):	63
Land Use Type:	LDR
Source(s) of Runoff:	Private

BENEFITS

Benefits Description:

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.00
Total Suspended Solids:	0
Fecal Coliform (CFU/yr):	0
Total Nitrogen:	0
Total Phosphorus:	0.0
Total Zinc:	0.00

Criterion	Score (1 to 3)
Water Quality:	1
Cost:	1
Ease of Funding:	1
Education Opportunity:	2
Flow Control:	x
OM:	3
Social:	2
Environmental:	1
Total Score:	11

Other Benefits:

--

NO IMAGE AVAILABLE

Notes:

ROW - right-of-way, sf - square feet

Union Neighborhood

Legend

Drainage Area

Site Number: 62

0 325 650

Feet

N

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Appaloosa Neighborhood **Site ID:** 63

SUMMARY

City:	Brinnon
County:	Jefferson
Facility Type(s):	Ditch Retrofit, Bioretention
Property Type:	Public
Site Priority Rank:	8

Estimated Cost Range	
Low End:	$573,400
Likely:	$819,100
High End:	$1,228,700

PROJECT DESCRIPTION

Narrative:

This project would retrofit existing drainage ditch area and convert existing landscaped area into bioretention. The improved facility would provide water quality treatment to runoff from approximately 17 acres of low density residential land. Runoff from this area is currently untreated and flows to the Dosewallips River and Hood Canal.

Site Challenges:

Potential conflict with utilities. Facility footrpint may be in flood plain of Dosewallips River.

Land Cover	Drainage Area (sf)
Impervious:	260,390
Parking::	99,200
Roof:	105,780
Road:	55,410
Pervious:	512,300
Total:	772,690

Design Considerations	
Facility Size:	6,210 sf Ditch
Shallow Infiltration Potential:	NA
Deep Infiltration Potential:	NA
Mean Annual Precipitation (in):	55
Land Use Type:	LDR
Source(s) of Runoff:	Private, Public - Other

BENEFITS

Benefits Description:

Water quality treatment for stormwater from low density residential area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.00
Total Suspended Solids:	1,043
Fecal Coliform (CFU/yr):	84
Total Nitrogen:	10
Total Phosphorus:	1.9
Total Zinc:	0.00

Criterion	Score (1 to 3)
Water Quality:	5
Cost:	1
Ease of Funding:	3
Education Opportunity:	2
Flow Control:	1
OM:	3
Social:	2
Environmental:	3
Total Score:	20

Other Benefits:

Public visibility, educational opportunity, and aesthetics. Consistent with County Goals.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Appaloosa Neighborhood

Site Number: 63

0 200 400
Feet

N

Legend

- Bioretention
- Ditch Retrofit
- Drainage Area

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Brinnon Ln Neighborhood **Site ID:** 64

SUMMARY

City:	Brinnon
County:	Jefferson
Facility Type(s):	Ditch Retrofit, Bioretention, Pond Retrofit
Property Type:	Public
Site Priority Rank:	19

Estimated Cost Range	
Low End:	$36,100
Likely:	$51,600
High End:	$77,400

PROJECT DESCRIPTION

Narrative:

This project would retrofit existing drainage ditch area and convert existing landscaped area into bioretention. The improved facility would provide enhanced water quality treatment to runoff from approximately 1.2 acres of low density residential and commercial land. Runoff from this area is currently untreated and flows to Hood Canal.

Site Challenges:

Difficult access to existing ditch overgrown with blackberries.

Land Cover	Drainage Area (sf)
Impervious:	8,910
Parking::	0
Roof:	8,910
Road:	0
Pervious:	42,460
Total:	51,370

Design Considerations	
Facility Size:	390 sf Ditch
Shallow Infiltration Potential:	Fair
Deep Infiltration Potential:	Unlikely
Mean Annual Precipitation (in):	51
Land Use Type:	LDR
Source(s) of Runoff:	Private, Public - Other

BENEFITS

Benefits Description:

Water quality treatment for stormwater from low density residential area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.00
Total Suspended Solids:	33
Fecal Coliform (CFU/yr):	3
Total Nitrogen:	0
Total Phosphorus:	0.1
Total Zinc:	0.00

Criterion	Score (1 to 3)
Water Quality:	1
Cost:	1
Ease of Funding:	3
Education Opportunity:	2
Flow Control:	1
OM:	3
Social:	2
Environmental:	3
Total Score:	16

Other Benefits:

Public visibility, educational opportunity, and aesthetics. Consistent with County Goals.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Brinnon Ln Neighborhood

Site Number: 64

0 155 310
Feet

N

Legend

- Bioretention
- Ditch Retrofit
- Pond Retrofit
- Drainage Area

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Canal View Neighborhood **Site ID:** 65

SUMMARY

City:	Brinnon
County:	Jefferson
Facility Type(s):	Ditch Retrofit
Property Type:	Public
Site Priority Rank:	21

Estimated Cost Range	
Low End:	$306,000
Likely:	$437,100
High End:	$655,700

PROJECT DESCRIPTION

Narrative:

This project would retrofit existing drainage ditch area. The improved facility would provide basic water quality treatment to runoff from approximately 10 acres of low density residential land. Runoff from this area is currently untreated and flows to Hood Canal.

Site Challenges:

Potential difficulty due to steep slope. Right of way used for parking. Existing swale in confined space between parcels.

Land Cover	Drainage Area (sf)
Impervious:	91,940
Parking::	8,410
Roof:	28,620
Road:	54,910
Pervious:	341,880
Total:	433,820

Design Considerations	
Facility Size:	3,310 sf Ditch
Shallow Infiltration Potential:	NA
Deep Infiltration Potential:	NA
Mean Annual Precipitation (in):	51
Land Use Type:	LDR
Source(s) of Runoff:	Private, Public - Other

BENEFITS

Benefits Description:

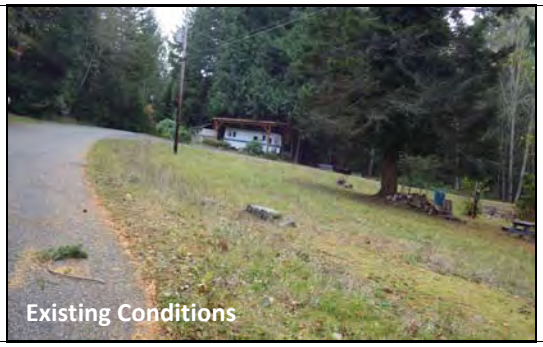
Water quality treatment for stormwater from low density residential area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.00
Total Suspended Solids:	340
Fecal Coliform (CFU/yr):	27
Total Nitrogen:	3
Total Phosphorus:	0.6
Total Zinc:	0.00

Criterion	Score (1 to 3)
Water Quality:	2
Cost:	1
Ease of Funding:	3
Education Opportunity:	2
Flow Control:	x
OM:	3
Social:	2
Environmental:	2
Total Score:	15

Other Benefits:

Public visibility, educational opportunity, and aesthetics. Consistent with County Goals.



Existing Conditions

Proposed Stormwater Facility Example

Notes:

ROW - right-of-way, sf - square feet

Canal View Neighborhood

Site Number: 65

0 250 500
Feet

N

Legend

- Bioretention
- Ditch Retrofit
- Drainage Area

Hood Canal Regional Stormwater Retrofit Plan Project Summary Sheet

Site Name: Port Ludlow Neighborhood **Site ID:** 66

SUMMARY

City:	Port Ludlow
County:	Jefferson
Facility Type(s):	Ditch Retrofit, Bioretention
Property Type:	Public
Site Priority Rank:	18

Estimated Cost Range	
Low End:	$493,400
Likely:	$704,900
High End:	$1,057,300

PROJECT DESCRIPTION

Narrative:

This project would retrofit existing drainage ditch area and convert existing landscaped area into bioretention. The improved facility would provide basic water quality treatment to runoff from approximately 15 acres of low density residential and commercial land. Runoff from this area is currently untreated and flows to Hood Canal.

Site Challenges:

Steep slopes and poor infiltration. Potential conflicts with utilities. Existing armored ditches and private landscaping in ditches.

Land Cover	Drainage Area (sf)
Impervious:	242,940
Parking::	70,780
Roof:	128,320
Road:	43,840
Pervious:	386,500
Total:	629,440

Design Considerations	
Facility Size:	10,070 sf BR
Shallow Infiltration Potential:	Underdrain
Deep Infiltration Potential:	Possible
Mean Annual Precipitation (in):	28
Land Use Type:	LDR
Source(s) of Runoff:	Private, Public - Other

BENEFITS

Benefits Description:

Water quality treatment for stormwater from low density residential area.

Pollutant	Average Load Reduction (lbs/yr)
Total Copper:	0.00
Total Suspended Solids:	421
Fecal Coliform (CFU/yr):	182
Total Nitrogen:	17
Total Phosphorus:	0.5
Total Zinc:	0.00

Criterion	Score (1 to 3)
Water Quality:	5
Cost:	1
Ease of Funding:	3
Education Opportunity:	2
Flow Control:	x
OM:	3
Social:	2
Environmental:	1
Total Score:	17

Other Benefits:

Public visibility, educational opportunity, and aesthetics. Consistent with County Goals.

Existing Conditions

Proposed Stormwater Facility Example

Notes:

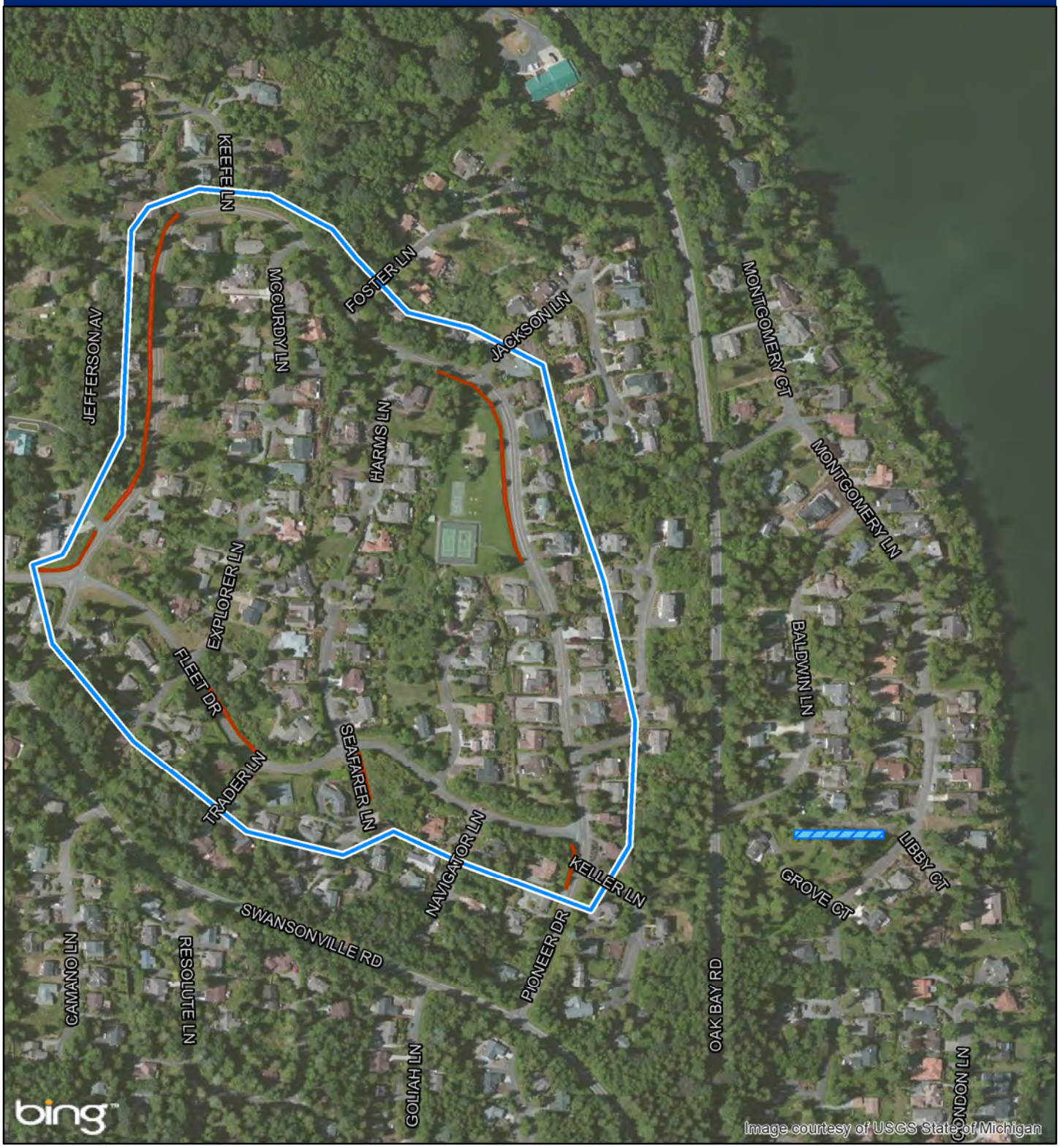
ROW - right-of-way, sf - square feet

Port Ludlow Neighborhood

Site Number: 66

0 387.5 775
Feet

N

Legend

- Bioretention
- Ditch Retrofit
- Drainage Area