Taylor Aquatic
Science and Policy

Technical Memo

To:	Bill Reilly, City of Bellingham Brandy Lubliner, WDOE
From:	William J. Taylor, Taylor Aquatic Science and Policy Douglas Beyerlein, Clear Creek Solutions, Inc.
Date:	October 23, 2015
Re:	Bioretention Hydrologic Performance (BHP) Study Site Selection Process and List of Selected Sites Technical Memo – Deliverables 2.2 and 2.3 Combined

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This memo provides a summary of the site selection process and results of the site evaluations combined into one memo. As the selection process and recommended sites for selection are closely intertwined, it make sense to combine these into one product.

Background

Phase I of the BHP study involved contacting Puget Sound Basin jurisdictions to identify "candidate" bioretention facilities to be recommended for an overall list of facilities for evaluation and possible selection of a set of ten facilities for performance monitoring. The selected sites would then be monitored for inflow and outlflowing stormwater flows during Phase II. Additional site data would also be collected for groundwater and ponding levels, bioretention soil mix composition and infiltration rate, subsurface soil conditions, and vegetation composition and density as supporting information to evaluate the site performances.

Outreach to Jurisdictions, and Candidate Sites Identified and Evaluated in the Field

Jurisdictions selected for contact for nomination of potential sites came from three different sources:

1. Jurisdictions indicating interest in the BHP study during the proposal phase of the Regional Stormwater Monitoring Program (RSMP)

2. Jurisdictions identified through the Ecology Water Quality Grant program as having funded construction of a bioretention facility as part of their grant funded project, and

3. Jurisdictions that contacted the consultant team as a result of group emails from the Stormwater Work Group, the APWA Stormwater Managers Committee, and from the NPDES Stormwater Permit Coordinators forum.

Approximately twenty jurisdictions were contacted through direct telephone contact with stormwater managers or related engineers and water quality specialists to discuss the BHP study, and their thoughts on possible candidate sites within their jurisdiction.

From these twenty jurisdictions, twenty-eight facilities were recommended for possible site evaluation. Site design plans (including planting plans), technical information reports (TIRs) and modeling information was gathered for most of these facilities. Twenty-four facilities were then visited in the field for final evaluation.

Because most of the sites contained multiple cells, each with their own conditions, the site visits for these twenty-three facilities resulted in evaluation of approximately seventy individual cells.

Attachment 1 provides a list of the final bioretention facilities assessed in the field, their location, and the jurisdiction contact for the project. Figure 1 provides a map of the distribution of these sites throughout the Puget Sound Basin.

Site Field Evaluation

After receipt of design drawings, TIRs, and hydrologic modeling results, each consultant discipline leader evaluated their background material before assessing each site in the field. Information then assessed in the field related to each of the main disciplines for selection of the sites:

- Accessibility of inflow and outflow locations for flow monitoring feasibility
- Contributing drainage area
- Qualitative soil media composition and soil probe depths
- Plant community composition, relative density, and apparent maintenance activity

Site Selection Criteria

A long list of site selection criteria was prepared to help evaluate candidate sites. These criteria identified factors that could affect the feasibility of monitoring, site logistics, or later assessment of the results of Phase II. This site selection criteria checklist was previously prepared and delivered to the City and Ecology.

While the criteria checklist provides an almost exhaustive list of items that could be considered in the site selection, the final realistic considerations were limited to those items identified as “fatal flaws” for selection. Once these factors were addressed, understandably, the accessibility of flow monitoring to attain accurate hydrologic results was almost exclusively the deciding factor. The remaining criteria checklist items were nonetheless useful as a checklist reminder of factors affecting site performance and additional data collection needs.

Separate from the criteria checklist, there was a need in both the selection of candidate sites, and sites finally recommended for monitoring, to be geographically well distributed in the Puget Sound Basin to provide a wide surficial geological, meteorological, and jurisdictional representation.

Compilation of Site Information and Recommended Sites for Monitoring

Attachment 2 provides spreadsheets of information on each site used to evaluate the site conditions and existing information for selection. The spreadsheet provides additional information to that listed in the Criteria Checklist compiled by each of the consultant team discipline leads. The spreadsheets cover the disciplines of monitoring access, geotechnical conditions, hydrologic modeling background and vegetation conditions.

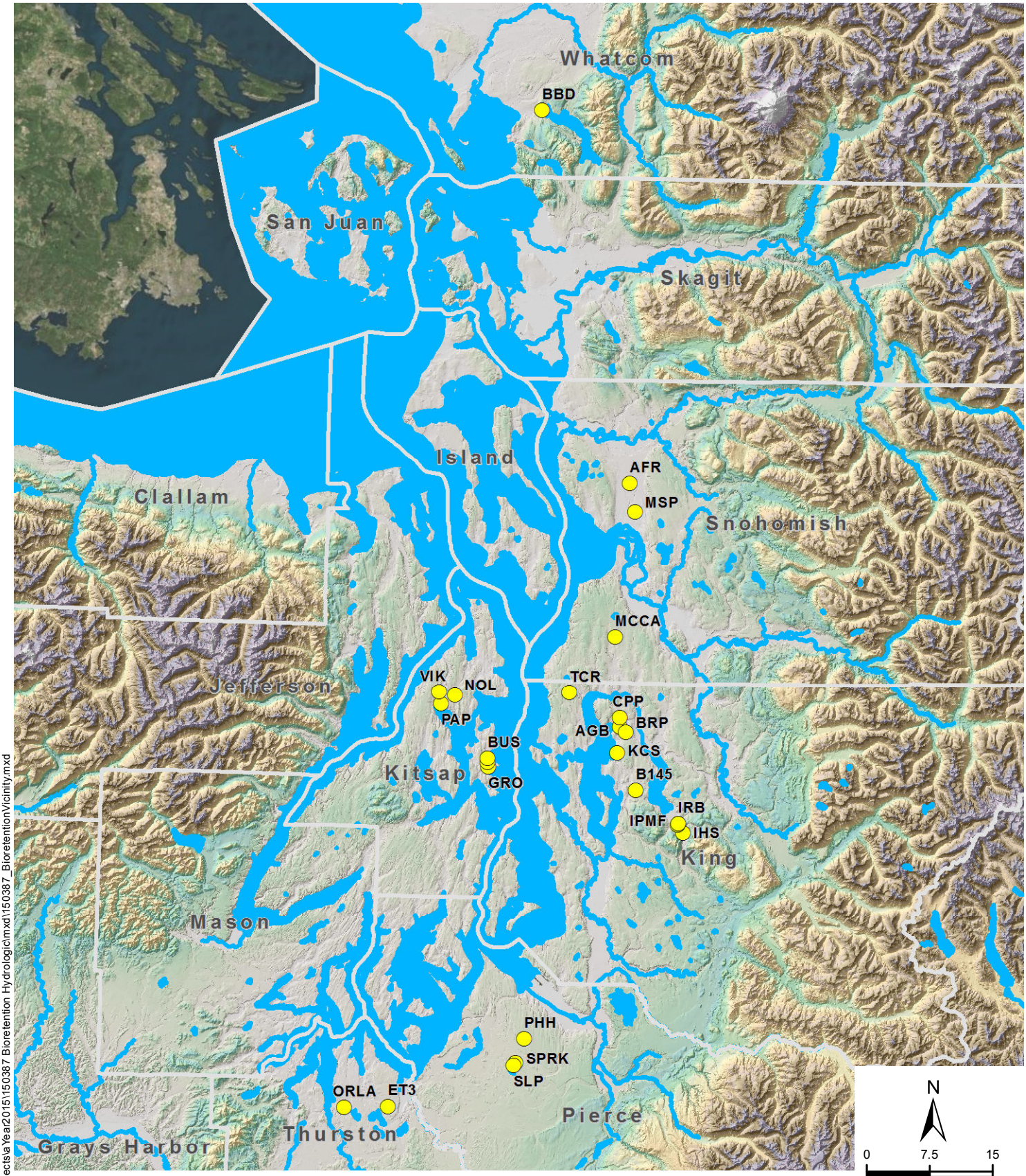
With this spreadsheet, the sites highlighted in yellow are recommended for monitoring, with a total of 10 sites highlighted.

Figure 2 provides a map of these ten sites recommended for monitoring.

Seasonal Schedule for Monitoring

Phase II of the project is intended for conducting the flow monitoring, and ground water and surface water pooling level data collection. While the flow data collection can be storm event targeted data, the ground water and pooling water levels are best collected on a continuous basis during the course of a substantial portion of the wet season to help use the continuity of these data to help reveal the infiltration patterns of the facilities, and to reflect those patterns in the model calibration process. As a result, initiation of these data collection early enough in the wet season is important for the overall quality of the model results. The storm event data collection also needs to be started early enough in the wet season to attain collection of at least storm events of a range of sizes. Of course the uncertainty of the wet weather conditions will affect the data collection, but starting data collection by some time in January would be the latest effective time to start.

If you have any questions, please call Bill Taylor or Doug Beyerlein.



REFERENCE:

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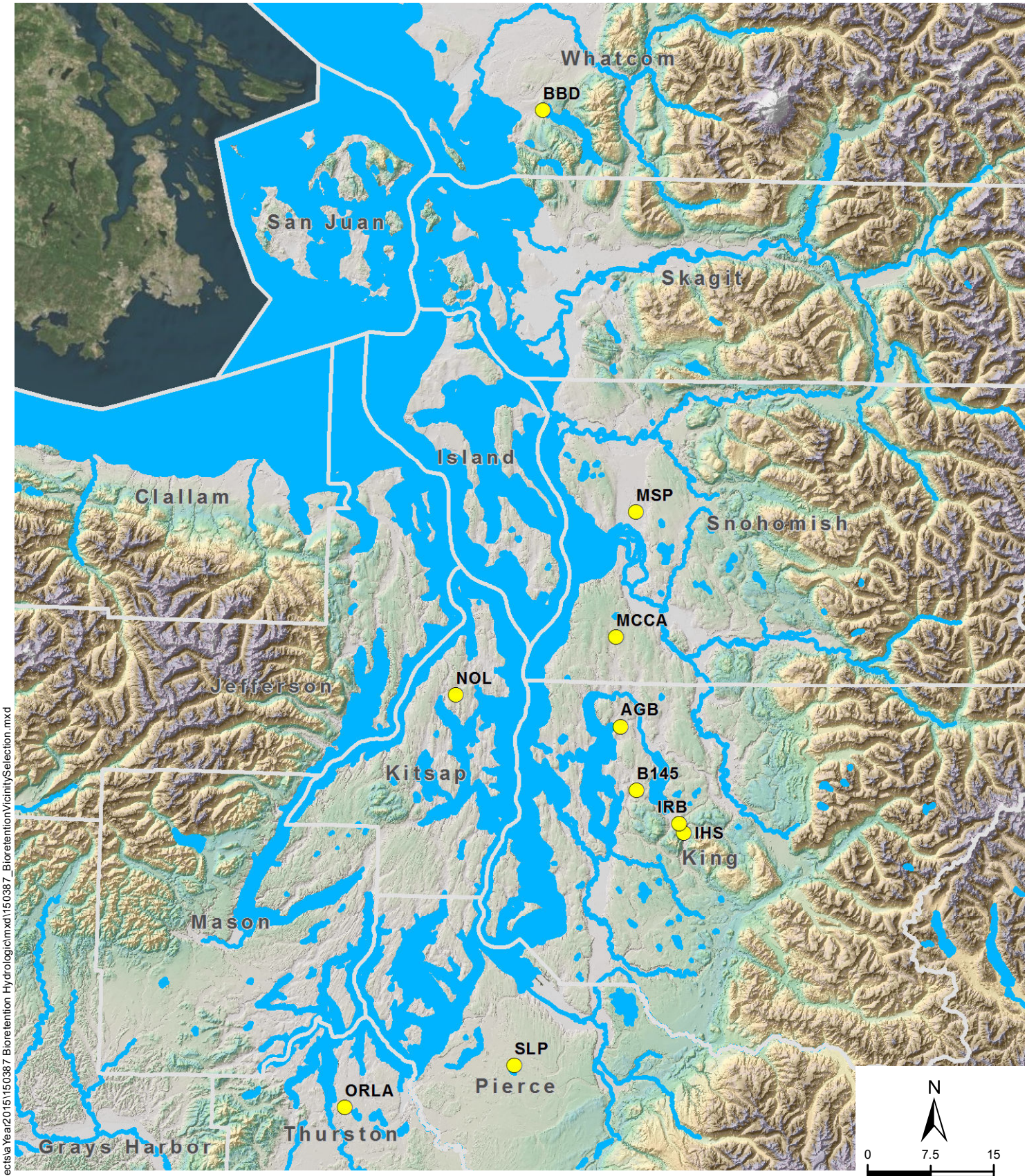
BIORETENTION SITES ASSESSED

BIORETENTION HYDROLOGIC PERFORMANCE MONITORING STUDY
PUGET LOWLAND, WASHINGTON

FIGURE 1

DATE 10/15

PROJ. NO. KH150387A



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associated earth sciences incorporated

BIORETENTION SITES SELECTED

BIORETENTION HYDROLOGIC PERFORMANCE MONITORING STUDY
PUGET LOWLAND, WASHINGTON

FIGURE 2

DATE 10/15

PROJ. NO. KH150387A

Attachment 1. List of candidate bioretention monitoring sites visited and assessed for selection as a site to be monitored during Phase II of the BHP study. Sites highlighted in yellow are selected for monitoring in Phase II.

Jurisdiction	Project Name	Location	Contact Name	Contact Phone
Bainbridge Island	Bainbridge Isl. High School	Bus Barn NE1/4 SE1/4 S22, T25N R2E	Melva Hill	206-780-3724
Bainbridge Island	Bainbridge Isl. High School	200 Building 9330 NE High School Rd.	Melva Hill	206-780-3724
Bainbridge Island	Grow Community	280 Madison Avenue N.	Melva Hill	206-780-3724
Bellevue	145th Place SE	145th Place SE & SE 22nd Street	Rick Watson	425-452-4896
Bellingham	Bloedell Donovan Park	2214 Electric Avenue	Bill Reilly	360-778-7955
Kirkland	AG Bell	11212 NE 112th St	Kelli Jones	425-587-3855
Kirkland	Benjamin Ryan Short Plat-Lot 1	10220 124th Avenue NE	Kelli Jones	425-587-3855
Kirkland	Cedar Park	112th Avenue NE	Kelli Jones	425-587-3855
Kirkland	Kirkland Children's School	5311 108th Avenue NE	Kelli Jones	425-587-3855
Issaquah	Rainier Blvd. LID Phase II	Rainier Boulevard and NW Holly Street	Kerry Ritland	425-837-3410
Issaquah	Park Maintenance Facility	525 1st Avenue NW	Kerry Ritland	425-837-3410
Issaquah	Issaquah High School	700 2nd Avenue SE	Kerry Ritland	425-837-3410
Marysville	Art Investments Res. Devel.	51st Ave NE & 83rd Street NE	Brooke Ensor	360-363-8288
Marysville	Armed Forces Reserve Center	13613 40th Avenue NE	Brooke Ensor	360-363-8288
Mill Creek	MC Community Association Bldg	15524 Country Club Dr.	Mary Ann Heine	425-316-3344
Olympia	ORLA School	12th Avenue SE & Boulevard Rd SE	Jake Lund	360-753-8152
Pierce County	Spanaway Lake Park	14905 Bresemann Blvd S.	Dawn Anderson	253-798-4671
Pierce County	Woods at Golden gibbon	104th and Golden Gibbon	Dawn Anderson	253-798-4671
Poulsbo	Anderson Parkway	Anderson Pkwy & NE Lincoln Rd	Anja Hart	360-394-9753
Poulsbo	Noll Roundabout	Lincoln Rd & Noll Rd	Anja Hart	360-394-9753
Poulsbo	Viking Ave	between SR 305 & New Finn Hill Rd	Anja Hart	360-394-9753
Shoreline	N Fork Thornton Creek	multiple sites	Uki Dele	206-801-2451
Thurston County	Evergreen Terrace III	9th Ave & Torrey	Steve Johnson	360-867-2332

Site Information for Monitoring Assessment

BHP Phase I
Site Selection

Yellow = 1st Choice

					Monitoring																			
					Ability to monitor Inflow				Location of nearby rain gauge		Number of inlets and outlets (fewer better)			Type of inlets and outlets (piped or weir preferred)		Underdrain	Hydraulic head available	Near other sites		Availability of current or previous monitoring data at site? Y/N	Stability of inlet and outlet control	Site security for installation of monitoring equipment?		
	AESI KMZ Label	**Jurisdiction**	**Site**	**Arbitrary Site numbering (in order visited)**	**Can inflow be easily monitored; 1 = Yes; 0 = No or Not applicable**	**Can inflow be monitored with simple modifications; 1 = Yes; 0 = No or Not applicable**	**Accessibility (especially for outflow to monitor (see above) Y/N**	**Owner staff available to initiate monitoring equipment? Y/N**	**Rain gauge location very representative of site rainfall? Y/N**	**Owner staff available to conduct good maintenance/data? Y/N**	**One primary inlet? Y/N**	**Multiple inlets? 1-10**	**Can temp. retrofit for calibration monitoring then remove? Y/N**	**Piped, weir, or sheet flow?**	**Can be temporarily retrofitted for calibration monitoring**	**is underdrain accessible for monitoring**	**Range is head space for access - can counter sink? 1-10**	**Inproved efficiency by nearness to other sites? 1-10**	**Owner staff available for multiple site support? Y/N**	**Quality of data? 1-10**	**Hard structures better than soft (grass channel). 1-10**	**Good/poor site security? 1-10**	**Monitoring Comments**	**Comments**
1	BRP	Kirkland	Ben Ryan Short Plat (3 cells)	1	1	0	Y	?	?	?	Y	1	Y	Piped in and out	Y	NA	limited, inlet is right at cell bottom, likely submerges	?	?	NA	1	1	4" inlet would need 6" stub for thelmar. Inlet is right on cell floor so likely inundates, good in that one thelmar for inlet, 1 for outlet	underconstruction; upper RG in till, middle in wx till, lower filled with BSM
2	AGB	Kirkland	Alex.Graham Bell Elem. School (2 cells)	2	1	0	Y	?	N	NA	N	5 in #3, 4 in #4	Y	piped in and out	Y	Y	Y	2 cells on same property	?	NA	1	1	6" roof inlets, 6" underdrain, 8" outlets, no sheet flow, would need to use roof runoff for inflow or else monitor multiple inlets	good access, need geotech
3	CPP	Kirkland	Cedar Park Short Plat (several cells)	3	0	1	No outflow	N	?	?	Y	1	Y	curb cut	Y	NA	good head space, edge of curb cut is 3" above cell bottom and 3" below street level	?	N	NA	1	exposed but quiet cul de sac	Only curb cuts, small drainage areas, would need separate transducer to know if cell was full and bypassing	good access, heavily maintained; compacted by foot traffic
4	KCS	Kirkland	Kirkland Children's School (1 cell)	4	1	0	Y	?	?	?	N	2 inlets 4" roof and 8" pipe	Y	piped	Y	NA	OK, inlets are above cell floor	?	?	NA	1	good, behind fence and hidden in brush	4" roof drain need 6" stub, two 8 " thelmars, access only during school hours	poor access
5	B145	Bellevue	145th Bellevue (3 cells)	5	1	0	Y	N	?	?	Y-for RG1 and RG2	1	Y	piped	Y	NA	Y inlet pipes high enough above cell botttom	N	?	need to look	1	pretty exposed, could hide some but would need to harden installation	RG1 and RG2 good with single inlet and single outlet, RG3 has multiple inlets, exisitng float switch installed in RG2 and 3 to record overflows?	good access, check for mon data; need AMEC geotech report
6	GRO	Bainbridge	Grow Community (several cells)	6	0	0	Y	?	?	?	N	11 curb cuts	N	sheet	Y	Y	Y	?	?	NA	riprap cuts	exposed out of the way	too many curb cuts, erosion on inlets, missing outlet control structure at time of visit	Unk geotech
7	BHS	Bainbridge	High School (several cells)	7	?	1-need to clear brush	Y	?	?	?	Y	1-2 area, footing or roof drains	Y	piped	Y	Y	? Couldn't fin inlet pipes	N	N	?	1	exposed on school property	couldn't find inlets, need sheet C-302 to more thoroughly review upper cells.	Geotech report not provided
8	BUS	Bainbridge	Bus Barn (2 cells)	8	0	0	Y	?	?	?	N	yes very convoluted		both and	maybe	Y	Y	?	?	NA	mix of grass and pipe	1	very complicated, couldn't find some pipes. Not a good site unless last resort	Unk geotech
9	NOL	Poulsbo	Noll Roundabout (1 cell)	9	1	0	Y	?	?	?	Y	1	Y	Piped	Y	Y	Y	N	?	?	1	5-exposed but could hide somewhat	inlet and outlet both 12" and close enough to share single datalogger.	Unk geotech
10	VIK	Poulsbo	Viking Ave (several linked cells)	10	0	0	Y	?	?	?	N	1 pipe, long sheet flow stretch	N	pipe and sheet	sheet=no	Y	Y	?	?	?	1	poor but could maybe hide stuff in brush	long sheet flow stretch, single outlet pipe. 1 inlet pipe too. Too much sheet flow and multiple cells chained together by single underdrain pipe	Non-standard BSM; geotech rpt did not address infiltration;
11	PAP	Poulsbo	Anderson Pkwy (Lined)	11	NOT APPLICABLE																			Shallow gw at 6-8' bgs, tidally influenced; geotech rpt did not address infiltration;
12	TCR	Shoreline	Thornton Creek Retrofit (several cells)	12	0	0-would require interception pipe and spreader	Y	N	?	?	N	sheet	N	sheet through gravel	N	Y	Y	Y	?	?	N	poor	only sheet flow through gravel shoulders, would require installation of interception and spreader pipes=look elsewhere	17 bioretention cells; used Ecology '05 manual grain size to est infiltration rate
13	SLP	Pierce County	Spanaway Lake Park (9 cells)	13	0	1	Y for Cell J, NA for cell I	Y	Y	?	2 for J, 1 for I	2 for J, 1 for I	Y	curb cuts	Y	NA	Y	Y if doing both sites	?	NA	3-some spall could rerode	poor	puplic park-could only temporarily install equipment for targeted events. Use tarp to funnel water to 6 or 8 inche thelmar	Spanaway Lake level expression of water table
14	PHH	Pierce County	Habitat for Humanity (several cells)	14	0	1	Y	N	?	?	Y	1	Y	piped roof drain	Y	NA	Y	?	?	NA	1	poor	no outlet, small roof drains only, would need to retrofit drain from4" to 6" for thelmar. No cover but in neighborhood	Standing water present in nearby excvation; looks like glacial till exposed
15	ORLA	Olympia	ORLA (several cells)	15	1	0	Y-could hide it well	?	?	?	N	4 roof drains	Y	Piped	Y	Y	Y	N	?	?	1	outlet very secure, inlet less so	could monitor each inlet a few times to dial in roof drainage/rainfall, outlet is easy, underdrain is lower to promote infiltration	bioretention -> gravel trenches-> infiltration trenches -> pond
16	ET3	Olympia	Evergreen Terrace Phase 3 (several cells)	16	0	0	no outflow just lots of curb cuts and not a good site																	no drainage or geotech report
17	IRB	Issaquah	Ranier Blvd LID Phase II (4 cells)	17	0	1	Y	?	?	?	N	2 curb cuts	Y	curb cut in piped out	Y	NA	Y	?	?	NA	1	poor	would need to tarp and pipe both curb cuts, could secure monitoring box ot sidewall and put themlar in outlet, NE facitlity only	based on MW's; proximity to Issaquah Ck; field rates lower than average for some
18	IPMF	Issaquah	Parks Maintenance FacilityRetrofit (1 cell)	18	0	0	Y	?	?	?	N	4 pipes and many curb cuts	N	pipe and sheet	N	NA	Y	?	?	?	loose sheet flow areas with erosion	good	too many inlets	expect shallow gw; likely lateral flow issues
19	IHS	Issaquah	Issaquah High School Cell #24 (24 cells)	19	1	0	Y	N	?	N	N	2	Y	piped	Y	Y	Y	?	N	NA	Y	good	easy to hide in dense brush	AESI currently monitors surface water level and shallow ground water level
20	AFR	Marysville	AFRC	20	1	0	Y	?	?	?	N	3	Y	piped in, ditch out	Maybe	NA	Y	?	?	?	inlet yes, outlet no	poor	would need to install weir or flume in outlet ditch or tarp and pipe	
21	MSP	Marysville	Residential	21	1	0	Y	?	?	?	Y	1	Y	pipe	Y	No overflow	Y	?	?	?	1	ok, could hide behind fence	1 inlet pipe, overflow sturcture goes into 3 underdrain pipes.	
22	MCCA	Mill Creek	Mill Creek Community Association (MCCA)	22	0	1	NA	?	?	?	N	2-maybe 1 inlet and one out	Y	piped	Y	NA	Y	N	?	NA	1	marginal, quiet area	1 4 in roof drain, another pipe tied to parking lot, not sure if it is inlet or outlet	
23	BBD	Bellingham	Bloedel Donovan Park	23	0	1	Y	Y	Y	Y	N	2	Y	curb cut, pipe out	Y	NA	Y	N	Y	some data exists, not sure how much	Y	OK, could hide most in brush or in CB	2 curb cuts in, overflows to 8" pipe out, outlet may have slight backwater issues, City notes that isde overflow also occurs, may need to sandbag	
24	SPRK	Pierce Cty (Park/ Span)	Sprinker Parking Lot LID Retrofit	Did not visit per Dawn at Pierce County																				no drainage or geotech report; MGS mdl 30 iph, dtw of 15 ft

Site Information for Geotechnical Assessment

BHP Phase I
Site Selection
Yellow = 1st
Choice

Geotech

	AESI KMZ Label	Jurisdiction	Site	Geotech	CF	Geology	Explorations	Inf Test Type	Hydrogeo	BSM rate < Native iph	Estimated Construction	Site Visit Date	Comments
1	BRP	Kirkland	Ben Ryan Short Plat (3 cells)	Geo-resources	4.76 or 0.21	Till	TP/HA	EPA FH	B1	NO	Aug-15	8/27/15	underconstruction; upper RG in till, middle in wx till, lower filled with BSM
2	AGB	Kirkland	Alex.Graham Bell Elem. School (2 cells)	Unk	NA	Till	Unk	None	B2	NO	2013	8/27/15	good access, need geotech
3	CPP	Kirkland	Cedar Park Short Plat (several cells)	Earth Consultg	Yes	Rec. OW	TP/HA	Unk	AX	YES	2010	8/27/15	good access, heavily maintained; compacted by foot traffic
4	KCS	Kirkland	Kirkland Children's School (1 cell)	Terra		Adv. OW	TP/HA	EPA FH	CX	YES	Sep-13	8/27/15	poor access
5	B145	Bellevue	145th Bellevue (3 cells)	Herrera and AMEC	None	unk (likely thin Till over Qva)	TP	PIT (3'x3')	CX	NO	2012?	8/27/15	good access, check for mon data; need AMEC geotech report
6	GRO	Bainbridge	Grow Community (several cells)	Unk		Likely Till	Unk	Unk	B2 like	Unk		9/1/15	Unk geotech
7	BHS	Bainbridge	High School (several cells)	Krazan (rpt missing)	NA	Till	Unk	None	B2	NO		9/1/15	Geotech report not provided
8	BUS	Bainbridge	Bus Barn (2 cells)	Unk		unk - Till likely	Unk	Unk	B2 like	Unk		9/1/15	Unk geotech
9	NOL	Poulsbo	Noll Roundabout (1 cell)	Unk	None	unk - Till likely	Unk	None (D10 est)	B2	NO		9/1/15	Unk geotech
10	VIK	Poulsbo	Viking Ave (several linked cells)	Krazan (foundations only)	None	unk - Till likely	B	None (D10 est)	B2	NO		9/1/15	Non-standard BSM; geotech rpt did not address infiltration;
11	PAP	Poulsbo	Anderson Pkwy (Lined)	Landau (for seawall)	Unk	Unk - Fill likely	B	None (D10 est)	E	NO		9/1/15	Shallow gw at 6-8' bgs, tidally influenced; geotech rpt did not address infiltration;
12	TCR	Shoreline	Thornton Creek Retrofit (several cells)	HWA	yes, varies	Sandy Till to Qva	B	None (D10 est)	BX/CX	NO		(BT and BB only)	17 bioretention cells; used Ecology '05 manual grain size to est infiltration rate
13	SLP	Pierce County	Spanaway Lake Park (9 cells)	None	2 to 4	Rec. OW Steilacoom	Unk	None	AX	NO		9/9/2015	Spanaway Lake level expression of water table
14	PHH	Pierce County	Habitat for Humanity (several cells)	Unk	Unk	unk - Till likely	Unk	Unk	B2 like	Unk		9/9/2015	Standing water present in nearby excvation; looks like glacial till exposed
15	ORLA	Olympia	ORLA (several cells)	ICI	Yes	Rec. OW Sand	TP/B	None (D10 est)	A2	YES	2014?	9/9/2015	bioretention -> gravel trenches-> infiltration trenches -> pond
16	ET3	Olympia	Evergreen Terrace Phase 3 (several cells)	Unk		Rec. OW Sand	Unk	Unk	AX	Unk	Approved June 2010	9/9/2015	no drainage or geotech report
17	IRB	Issaquah	Ranier Blvd LID Phase II (4 cells)	GeoDesign	0.18	Recent Alluvium	B/HA	EPA FH	D1	NO	Est. Sum 2014	9/16/2015	based on MW's; proximity to Issaquah Ck; field rates lower than average for some
18	IPMF	Issaquah	Parks Maintenance FacilityRetrofit (1 cell)	South Fork Geosciences	0.25	Recent Alluvium	TP	Small Scale PIT	D1	NO	Est. Sum 2014	9/16/2015	expect shallow gw; likely lateral flow issues
19	IHS	Issaquah	Issaquah High School Cell #24 (24 cells)	AESI		Outwash	TP	PIT	A1	NO	Summer 2010	9/16/2015	AESI currently monitors surface water level and shallow ground water level
20	AFR	Marysville	AFRC	AESI		Rec. OW Sand	TP/B	PIT	A1			BT, BK, CW 9/18/2015	
21	MSP	Marysville	Residential									BT, BK, CW 9/18/2015	
22	MCCA	Mill Creek	Mill Creek Community Association (MCCA)										
23	BBD	Bellingham	Bloedel Donovan Park										
24	SPRK	Pierce Cty (Park/ Span)	Sprinker Parking Lot LID Retrofit	Unk		Rec. OW Steilacoom	Unk	Unk	A2	YES	Stamped Oct'10	Did not visit	no drainage or geotech report; MGS mdl 30 iph, dtw of 15 ft

Site Information for Modeling Assessment

BHP Phase I
Site Selection
Yellow = 1st
Choice

Modeling

	AESI KMZ Label	Jurisdiction	Site	Design Manual	Model	Underdrains	Liner	Overflow	BSM Rate	BSM b	BSM n	Subgrade Design Rate	TIR Civil	Comments
1	BRP	Kirkland	Ben Ryan Short Plat (3 cells)	KC'09	MGS Fld v.4.12	No	No	Yes	2	1	40	RG#1, 0.21 and RG#2-#3, 0.42	Larson and Assoc.	underconstruction; upper RG in till, middle in wx till, lower filled with BSM
2	AGB	Kirkland	Alex.Graham Bell Elem. School (2 cells)	KC'09	MGS Fld v.4.12	Yes	No	Yes	1	1.5	30	0	CPL	good access, need geotech
3	CPP	Kirkland	Cedar Park Short Plat (several cells)	KC'98	KCRTS	No	No	No	1	1	?	1 iph	Blueline Group	good access, heavily maintained; compacted by foot traffic
4	KCS	Kirkland	Kirkland Children's School (1 cell)	KC'09	MGS Fld	No	No	Yes	1	1.5	40	2	CPH	poor access
5	B145	Bellevue	145th Bellevue (3 cells)	COB'10 (Ecology'05)	WWHM3 Pro	No	No	Yes	2.5	2	40	RG#3 1.3 iph; rate used for RGs, no CF	Herrera (RK)	good access, check for mon data; need AMEC geotech report
6	GRO	Bainbridge	Grow Community (several cells)			Yes	No	Yes	1	1.5 to 2		unk?	Browne Wheeler	Unk geotech
7	BHS	Bainbridge	High School (several cells)	Ecology '05	MGS Fld 3.1	Yes	No	Yes	1	1.5		Nil	CPL	Geotech report not provided
8	BUS	Bainbridge	Bus Barn (2 cells)			Yes	No	Yes						Unk geotech
9	NOL	Poulsbo	Noll Roundabout (1 cell)	WSDOT '08; Ecology '05	WWHM3 Pro	Yes	No	Yes	2	1.5	40	0.5	Parametrix	Unk geotech
10	VIK	Poulsbo	Viking Ave (several linked cells)	WSDOT '08; Ecology '05	WWHM3 Pro	Yes	No	Yes	2	2	40	0.5	Parametrix	Non-standard BSM; geotech rpt did not address infiltration;
11	PAP	Poulsbo	Anderson Pkwy (Lined)	Ecology '05, '12	WWHM	Yes	YES	Yes				initial 2 iph in '09; 2012 plan set shows pvc liner	Parametrix	Shallow gw at 6-8' bgs, tidally influenced; geotech rpt did not address infiltration;
12	TCR	Shoreline	Thornton Creek Retrofit (several cells)	Ecology '05	MGS Fld v.4.29								Perteet	17 bioretention cells; used Ecology '05 manual grain size to est infiltration rate
13	SLP	Pierce County	Spanaway Lake Park (9 cells)		WWHM	No	No		1.5 to 3	2		set equal to BSM;	Pierce County	Spanaway Lake level expression of water table
14	PHH	Pierce County	Habitat for Humanity (several cells)	Unk	Unk	Not seen in field	Unk	Unk	Unk	Unk	Unk	Unk	Unk	Standing water present in nearby excvation; looks like glacial till exposed
15	ORLA	Olympia	ORLA (several cells)	City of Olympia '09	WWHM v4	No	No	Yes	1.5	1.5		varies	LPD	bioretention -> gravel trenches-> infiltration trenches -> pond
16	ET3	Olympia	Evergreen Terrace Phase 3 (several cells)		Unk	No	No	No	Unk	1.5	Unk	Unk	Unk	no drainage or geotech report
17	IRB	Issaquah	Ranier Blvd LID Phase II (4 cells)	City of Issaquah '11 (KC'09)	WWHM v4 and KCRTS Flow Control	No but geotech rec'd	No	Unk - check	Unk	1.5	Unk	field rate of 2.8 iph x 0.18 = 0.5 iph	KPG	based on MW's; proximity to Issaquah Ck; field rates lower than average for some
18	IPMF	Issaquah	Parks Maintenance FacilityRetrofit (1 cell)	City of Issaquah '11 (KC'09)	WWHM v3	No	No	Yes	Unk	1.5	Unk	average rate of 5.7 iph x 0.25 = 1.425 iph	City of Issaquah	expect shallow gw; likely lateral flow issues
19	IHS	Issaquah	Issaquah High School Cell #24 (24 cells)	City of Issaquah '11 (KC'09)		No	No	No	1.5	1.5	40	greater than BSM	CPL	AESI currently monitors surface water level and shallow ground water level
20	AFR	Marysville	AFRC	Ecology '05		No	No							
21	MSP	Marysville	Residential											
22	MCCA	Mill Creek	Mill Creek Community Association (MCCA)		WWHM3	No	No	???		1	40		Harmsen & Associates	
23	BBD	Bellingham	Bloedel Donovan Park											
24	SPRK	Pierce Cty (Park/ Span)	Sprinker Parking Lot LID Retrofit		MGS Fld	No	No	No	Unk	2.5	Unk	30	Unk	no drainage or geotech report; MGS mdl 30 iph, dtw of 15 ft

Site Information for Vegetation Assessment

BHP Phase I
Site Selection
Yellow = 1st Choice

Vegetation

	AESI KMZ Label	Jurisdiction	Site	Planting Plan	Herbaceous (H) or Woody (W) Vegetation or Both	Percent Cover	Comments
1	BRP	Kirkland	Ben Ryan Short Plat (3 cells)	No	Zone 1- H		underconstruction; upper RG in till, middle in wx till, lower filled with BSM
2	AGB	Kirkland	Alex.Graham Bell Elem. School (2 cells)	Yes	Back Cell -W Front cell W, H	Back Cell -90-95% Front cell 75%	good access, need geotech
3	CPP	Kirkland	Cedar Park Short Plat (several cells)	Yes	1st Cell in Series-W	50%	good access, heavily maintained; compacted by foot traffic
4	KCS	Kirkland	Kirkland Children's School (1 cell)	No	Zone 1- H Zone 2- W	90%	poor access
5	B145	Bellevue	145th Bellevue (3 cells)	Yes	Cell #1 -H (Zone 1) Cell #2- H (Zone 1) Cell #3- H (Zone 1)	Cell #1 -70% Cell #2-65% Cell #3- 90%	good access, check for mon data; need AMEC geotech report
6	GRO	Bainbridge	Grow Community (several cells)	Yes	W	50%	Unk geotech
7	BHS	Bainbridge	High School (several cells)	No	Circular Cell-W, H Entry Cell- W Lower & Upper Cells Courtyard- Zone 1-H Front Cell- W, H	Circular Cell- 70 % Entry Cell- 80 % Lower & Lower Cells Courtyard- 80% Front Cell- 90%	Geotech report not provided
8	BUS	Bainbridge	Bus Barn (2 cells)	No	Cell Adj to Road- H Cell # 2- W, H	Cell Adj to Road- 80% Cell #2- 60%	Unk geotech
9	NOL	Poulsbo	Noll Roundabout (1 cell)	No	W, H	70%	Unk geotech
10	VIK	Poulsbo	Viking Ave (several linked cells)	Yes	W	80%	Non-standard BSM; geotech rpt did not address infiltration;
11	PAP	Poulsbo	Anderson Pkwy (Lined)		NA (lined)		Shallow gw at 6-8' bgs, tidally influenced; geotech rpt did not address infiltration;
12	TCR	Shoreline	Thornton Creek Retrofit (several cells)		Did not Visit		17 bioretention cells; used Ecology '05 manual grain size to est infiltration rate
13	SLP	Pierce County	Spanaway Lake Park (9 cells)	Yes	Cell J- W Cell I- W, H	Cell J- 60% Cell I- 90 %	Spanaway Lake level expression of water table
14	PHH	Pierce County	Habitat for Humanity (several cells)	No	H	50-70%	Standing water present in nearby excvation; looks like glacial till exposed
15	ORLA	Olympia	ORLA (several cells)	No	Basin 1B- H Basin 2B- H Side yard Cells- H	Basin 1B- 60 % Basin 2B- 70 % Side yard Cells- 100%	bioretention -> gravel trenches-> infiltration trenches -> pond
16	ET3	Olympia	Evergreen Terrace Phase 3 (several cells)	No	H	(mowed lawn g	no drainage or geotech report
17	IRB	Issaquah	Ranier Blvd LID Phase II (4 cells)	Yes	SW Corner Cell- H SE Corner Cell-H	SW Corner Cell- 50% SE Corner Cell- 70%	based on MW's; proximity to Issaquah Ck; field rates lower than average for some
18	IPMF	Issaquah	Parks Maintenance FacilityRetrofit (1 cell)	Yes	H	50%	expect shallow gw; likely lateral flow issues
19	IHS	Issaquah	Issaquah High School Cell #24 (24 cells)	No	Maint. Area Cell- W	int. Area Cell- 9	AESI currently monitors surface water level and shallow ground water level
20	AFR	Marysville	AFRC	No	H	80%	
21	MSP	Marysville	Residential	No	H	90%	
22	MCCA	Mill Creek	Mill Creek Community Association (MCCA)	No	East Cell- H West Cell- H	East Cell- 70% West Cell- 80%	
23	BBD	Bellingham	Bloedel Donovan Park	No	Boat Launch Cell- W Entry Cell-W	Boat Launch Cell- 75% Entry Cell-85%	
24	SPRK	Pierce Cty (Park/ Span)	Sprinker Parking Lot LID Retrofit				no drainage or geotech report; MGS mdl 30 iph, dtw of 15 ft

Acronyms Used in Attachment Spreadsheets

KC: King County
TIR: Techical Information Report
COB: City of Bellevue
b: soil thickness in feet
n: soil porosity in percent
CF: correction factor, when applied to field infiltration rate
Rec. OW: recessional outwash
Adv. OW: advance outwash
EPA FH: Environmental Protection Agency Falling Head
TP/HA: test pits/hand augers
B: exploration boring

Hydrogeo Category

AX: recessional outwash, no underdrain, ground water depth unknown
A1: recessional outwash, no underdrain, ground water within 10 feet
A2: recessional outwash, no underdrain, ground water greater than10 feet
BX: glacial till, unknown underdrain configuration
B1: glacial till, no underdrain
B2: glacial till, underdrained
CX: advance outwash, no underdrain, ground water depth unknown
C1: advance outwash, no underdrain, ground water within 10 feet
C2: advance outwash, no underdrain, ground water greater than10 feet
DX: recent alluvium, no underdrain, ground water depth unknown
D1: recent alluvium, no underdrain, ground water within 10 feet
D2: recent alluvium, no underdrain, ground water greater than10 feet
E: other