Habitat

The purpose of the Habitat Analysis study was to assess fish habitat in lower Vasa Creek (downstream of I-90) and to evaluate the capacity of the stream to support kokanee salmon spawning.

Kokanee salmon were once numerous in Lake Sammamish but today spawn only in a few streams. Kokanee do not go out to the ocean but spend their entire lifecycle in fresh water. While kokanee have been observed in Vasa Creek, their presence has been periodic and in low numbers.

Key Findings

Lower Vasa Creek has channel dimensions and sediment composition very similar to other major kokanee creeks draining Lake Sammamish, so should be considered potential habitat for kokanee. If kokanee can access the stream, it is likely they can spawn successfully.



There is potential for habitat improvement:

- **Shade the Stream:** Shading from trees and shrubs helps keep water cold and stabilizes stream banks. Excellent shade (greater than 90% coverage) was found in 9 of the 12 reaches. Stream areas with lawns to the stream edge could be improved by planting trees and shrubs.
- **Reduce impact of barriers:** Several potential fish passage barriers were discovered within the lower reaches.

Habitat

One private and two city-owned culverts were identified as potentially slowing migration unless there is adequate rain to increase the stream depth, thereby giving fish more space to jump.

Five grade control weirs (small waterfalls, see photo) need deeper pools to allow fish to jump over logs or rocks installed to stabilize the stream bed. The barriers are located on private property between 137th Ave SE and 164th PLSE.



- Increase Wood: Lower Vasa Creek needs more large pieces of wood in the stream to create complex habitat,
 - especially deep pools. Lack of pools limits the ability for kokanee to rest, find cover from predators, and jump over barriers.
- Sammamish, could benefit the most from improvements. There is development close to the stream, limited shade, rock armoring (riprap), lack of wood in the channel, and few pools. Because all kokanee and other salmon need to pass through this section to spawn, the whole system would benefit from improvements in this area.

Fish Studies

• Lack of pool habitat may be limiting fish diversity and the number of older trout residing in Vasa Creek. Only cutthroat trout were observed in a 151 foot survey area of lower Vasa Creek. Most (95%) of the 86 trout captured were less than 3 inches long, indicating they were less than one year old. Only two fish were more than one year old.



Habitat

What will Bellevue Utilities do with this information?

- Fix fish passage at public culverts through the Bellevue Utilities Fish Passage Improvement Capital Program, D-81.
- Provide or coordinate technical assistance to property owners wanting to improve habitat.

What can you do to help?

- Plant native trees and shrubs near the stream to provide shade and habitat.
- Place wood to create pools. Construct better fish passage over grade control weirs. This will require local and state permits.
 - Contact Angie Peace, Washington Department of Fish and Wildlife, Regional Habitat Biologist *Angie.Peace@dfw.wa.gov*, 425-427-0570 for technical assistance.
 - Contact Mark Taylor, Trout Unlimited, for volunteer help and assistance. Personal Cell (206) 200-2840. Email emtbckt@msn.com. Trout unlimited web information www.tu-bi.org/kokaneeproject.htm
- If you see kokanee, call or email Bellevue Stream Team at 425-452-5200 or *streamteam@bellevuewa.gov*.



For Additional Information

Questions? Kit Paulsen, Bellevue Utilities, 425-452-4861

Technical reports are available at: http://bellevuewa.gov/pdf/Utilities/Vasa_Creek_Final_Habitat_Memo.pdf

Kokanee Workgroup Information: www.kingcounty.gov/environment/animalsAndPlants/salmon-and-trout/kokanee.aspx

Vasa Creek Fish Habitat Assessment



Prepared for:



Prepared by:



Vasa Creek Fish Habitat Assessment

Prepared for:



City of Bellevue 450 110th Ave. NE Bellevue, WA 98009

Prepared by:



August 2014

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Attachments

ATTACHMENT A – Maps

ATTACHMENT B – Habitat Assessment Field Forms

ATTACHMENT C – Lower Vasa Outfall Reconnaissance Inventory/Sample Collection Field Forms

ATTACHMENT D – Digital Deliverables

ATTACHMENT E – 2014 Vasa Creek Electro-fishing Summary Report

ATTACHMENT F – 2011 Vasa Creek Macroinvertebrate Summary Report

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1. Introduction

1.1 Background Information

Vasa Creek is a 1,085-acre basin located in the Puget Lowland that drains into the southwestern end of Lake Sammamish. The watershed is highly developed with a mixture of predominately residential, commercial and institutional development. Forty percent of the land cover is classified as impervious surface. The basin elevation ranges from 31 to 1,195 feet (City of Bellevue 2009).

The portion of Vasa Creek (lower Vasa Creek) downstream of Interstate 90 (I-90) is migratory fish bearing, with occasional rainbow trout, cutthroat trout, coho salmon, and late-run kokanee salmon present. The presence of I-90 is a complete fish passage barrier, preventing upstream access beyond this point. Furthermore, kokanee spawning habitat within the tributary creeks to Lake Sammamish is relatively limited. Suitable spawning habitat in most Lake Sammamish tributaries occurs in short reaches due to migration barriers or poor channel conditions upstream (Connor et al. 2000).

Recent results from the Lake Sammamish Kokanee Technical Work Group (LSKTWG) highlight the importance of the Lake Sammamish tributaries for kokanee salmon. The LSKTWG (2013) report results have shown a major spike in escapement estimates from 2013 demonstrating the success of the supplementation program that began in 2010-2011 and underscoring the need for evaluating kokanee habitat and restoration potential in Lake Sammamish tributaries.

1.2 Project Overview

Tetra Tech was contracted by the City to assist with ongoing efforts to study fish habitat and slope stability in the Vasa Creek (State Stream #08-0156) and the East Tributary to Vasa Creek stream corridors. The objective of this project is to evaluate kokanee salmon habitat in the accessible portions of lower reach of Vasa Creek (downstream of I-90) and slope stability concerns upstream that may negatively impact habitat quality and/or restoration potential. This work builds on the technical report (master's thesis) by Britton (2013) that examined Vasa Creek channel conditions and slope stability in a stream segment upstream of the I-90 crossing, which is a complete barrier to fish passage.

This project has two discrete components; a landslide assessment, and a fish habitat assessment. The landslide assessment component of the field work occurred in May of 2014. The results from that effort are available in the *Vasa Creek Landslide Inventory and Slope Stability Reconnaissance* technical memo (Tetra Tech 2014). The fish habitat assessment field work was completed in June of 2014. During the habitat assessment survey, Tetra Tech staff surveyed

lower Vasa Creek assessing habitat conditions using the assessment protocols of the Washington Department of Ecology for Status and Trends Monitoring (WADOE 1999). In addition to the habitat data collected, Outfall Reconnaissance Inventory/Sample Collection forms were completed for observed discharges.

The habitat assessment surveys were conducted on the extent of lower Vasa Creek between the outlet of the I-90 crossing and the mouth of Vasa Creek at Lake Sammamish (approximately 1,270 meters). Within this reach, a series of relatively evenly spaced representational stream transects were identified starting at Transect A (near the mouth) and ending at Transect K (at the fish passage barrier). Section 2 describes the layout of transects and data collection methods in greater detail. Figure 1 contains the habitat assessment area surveyed and the habitat survey transect locations. The gaps in the survey area downstream of Transect A and between Transect B and West Lake Sammamish Parkway were not surveyed due to access being denied by landowners for those parcels (Figure 1). Data were also collected to characterize a left bank (facing downstream) tributary to Vasa Creek following the same methods described in Section 2.

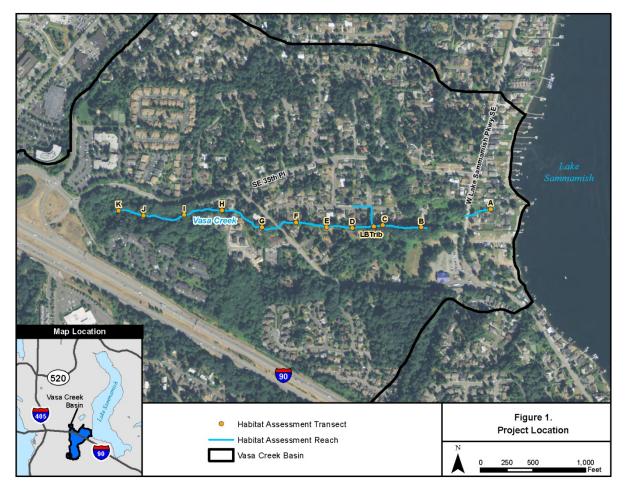


Figure 1. Location Map of Lower Vasa Creek Basin and Fish Habitat Assessment Transects

The remainder of this document will describe the results of the fish habitat assessment as follows:

- Section 2 contains a description of the field data collection and reporting methods, and a summary of methodology limitations;
- Section 3 contains a summary of the fish habitat assessment findings;
- Section 4 contains a summary of results from macroinvertabrate sampling from Rithron (2011);
- Section 5 contains a summary of recent electrofishing results from City of Bellevue (2014);
- Section 6 contains a discussion of results and a list of recommendations based on the fish habitat assessment work that was conducted; and
- Section 7 lists references cited in the document.

2. Methods

2.1 Data Collection

Tetra Tech's field crew conducted a fish habitat assessment of lower Vasa Creek, downstream of the I-90 crossing, using the Status and Trends Monitoring for Watershed Health & Salmon Recovery: Field Data Collection Protocol (WADOE 1999). Only lower Vasa Creek was surveyed due to the complete fish passage barrier at I-90.

As described in Section 1, survey transects were set up to characterize the fish habitat in lower Vasa Creek from I-90 downstream to the mouth. This is a variation on the WADOE (1999) protocol in that it recommends the site length should be 20 times the average bankfull width. This is because typically these surveys are meant to be used as samples that represent much larger areas. Due to the relatively short distance of the accessible fish habitat in lower Vasa Creek, Tetra Tech modified the protocol to cover the entire reach extent instead of just sample reaches, except where landowner access was denied.

Field data were collected at major and minor transects as well along the entire channel survey length. Figure 2 contains a conceptual diagram describing the layout of major and minor transects. Minor transects (dashed line) were located midway between major transects (solid line). Continuous data collected between major transects (blue line) are described by stream segments (i.e., Segment A-B). Data collected at the various locations are described below.

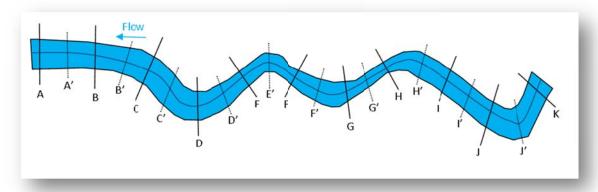


Figure 2. Field survey sampling layout of major and minor transects. Adapted from WADOE (2006).

At major transects (solid line):

- Slope and bearing
- Wetted and bankfull width
- Wetted and bankfull height
- Substrate size and embeddedness
- Water depth, bankfull depth
- Bar width
- Bank instability
- Canopy shade
- Fish cover
- Near bank human disturbance
- Riparian vegetation structure
- GPS coordinates of transects
- Photographs

At minor transects (dashed line):

- Wetted and bankfull width
- Substrate size and embeddedness
- Water depth and bankfull depth
- GPS coordinates of transects
- Photographs

Along the entire survey length:

- Habitat units
- Thalweg depth
- Presence of side channels
- Presence of bars
- Tally of Large woody Debris (LWD)
- GPS coordinates of transects
- Photographs

In total, 12 major survey transects were established: 11 on Vasa Creek (A to K), and 1 on a left bank tributary (LBTrib) located 420 meters (1,378 feet) upstream of the mouth (Figure 1). Minor transects, where less detailed data collection took place (described below), were located midway between each major transect. The downstream extent of the survey (Transect A) was located 90 meters (295 feet) upstream of the mouth of Vasa Creek and the upstream extent (Transect K) was near the I-90 crossing outlet (Figure 1). The distribution of habitat units and amount of LWD was collected throughout the length of the segments between major transects. Two sections, totaling 230 meters (754 feet), were not surveyed due to access to those parcels being denied. In total, 1,020 meters (3,346 feet) were surveyed on Vasa Creek as part of the fish habitat assessment. A length of 50 meters (164 feet) was surveyed on the left bank tributary before it reached the residential road network.

Habitat Units

Habitat unit type, length, and characteristics were identified throughout the length of the survey reach. Habitat units were classified into the following habitat unit types:

- Fast non-turbulent habitat unit with flow that has a smooth surface and is less deep than in pools.
- Fast turbulent habitat unit with supercritical flow, with hydraulic jumps sufficient to have a water surface that is rippled or contains whitewater.
- Pools habitat units with a maximum depth at least 1.5 times the pool tail crest depth (WADOE 1999).

The locations of all habitat unit breaks were identified in the field. Where there were consecutive pools in a series, all were included as a single habitat unit with the downstream pool dimensions being measured and the others tallied.

Channel Dimensions

Physical channel dimensions were measured at each major and minor transect using standard field methods. At major transects, these dimensions included wetted width, bankfull width, bar

width, wetted depth, slope, and bearing. The same data were collected at minor transects, except for bankfull depth.

Shading and Riparian Vegetation

Densitometer readings were taken at each major transect to evaluate the percent shade. Readings were taken from the center of the channel facing upstream, downstream, right bank, left bank, and at the channel banks.

A categorical assessment of the riparian vegetation structure was also conducted at each major transect. Vegetation type and abundance was evaluated for the canopy, under-canopy, and ground cover.

Fish Cover and LWD

The amount of available fish cover including woody debris, brush, over-hanging vegetation, undercut banks, boulders, ledges, and artificial structures was evaluated at each major transect. The presence of algae and macrophytes/bryophytes was also recorded.

Pieces of LWD with a diameter greater than 0.1 meter and length greater than 2 meters were tallied between each major transect. Only pieces of LWD located within the bankfull channel were counted.

Substrate Size and Embeddedness

Substrate size and fine sediment embeddedness were evaluated at major and minor transects. The dominate and sub-dominate substrate size classes and percent relative abundance were visually estimated at sample points across each transect. Substrate sizes classes included boulder, cobble, coarse gravel, fine gravel, sand, fines and hardpan.

Habitat Assessment Field Forms were used to document habitat characteristics according to field protocols. The entire set of completed field forms is included in Attachment B (Habitat Assessment Field Forms).

Additionally, the City Outfall Reconnaissance Inventory/Sample Collection Field Forms were completed to document characteristics of all outfalls observed during the habitat field surveys downstream of 163rd Avenue SE. Outfalls upstream of 163rd Avenue SE were inventoried during the landslide inventory and included in Tetra Tech (2014). There may have been additional outfalls within the project area that were not detected due to vegetation cover and therefore not surveyed. The field data collected included the following items regarding detected outfalls:

- Location data (GPS Point, Photo)
- Outfall type (Material, Shape, Size)

- Flow dependent indicators (Odor, Color, Turbidity, Floatables)
- Site indicators (Outfall Damage, Deposits/Stains, Abnormal Vegetation, Poor Pool Quality, Pipe Benthic Growth)

The entire set of completed field forms is included in Attachment C (Lower Vasa Outfall Reconnaissance Inventory/Sample Collection Field Forms).

2.2 Methodology Limitations

Since this assessment occurred in June, only low flow habitat conditions within lower Vasa Creek were assessed. While historically the Lake Sammamish kokanee had three distinct run timings that spanned August through December, the current opinion is that only the late-run kokanee (late October through early January) spawn in any great numbers (LSKWG 2013).

The field protocols used for this assessment did not include a fish passage barrier assessment; therefore, one was not completed. During the habitat survey, the location of potential barriers was documented and photographs were taken. Although these observations provide for an estimate of fish passage conditions during low flows, more detailed observations in winter months, during higher flow conditions, would be needed to evaluate fish passage potential during the period when late-run kokanee are thought to be present. In addition, the Washington Department of Fish and Wildlife (WDFW) Fish Passage and Diversion Screening Inventory (FPDSI) database was reviewed for existing fish passage evaluations (see Section 6.0). Figure A-1 to Figure A-3 in Attachment A contain the location of culverts with existing fish passage evaluations.

3. Summary of Findings

3.1 Habitat Assessment

All survey transects were located in lower Vasa Creek, between the mouth of Vasa Creek and the I-90 crossing. The Left Bank Tributary (LBTrib) is represented by a single transect just upstream of the Vasa Creek confluence.

Two areas were not surveyed due to restricted landowner access: 1) the 90 meters (295 feet) downstream of Transect A and 2) the area between stations A.4 and B.0, due to restricted landowner access just upstream of West Lake Sammamish Parkway (140 meters (460 feet)). The following subsections summarize the results of the data collected during the assessment. The completed field data forms can be found in Attachment B.

3.1.1 Habitat Units

Habitat units were delineated for the entire length of the survey. Individual habitat units were identified with an alphanumeric code beginning with downstream transect letter followed by a number incrementing in the upstream direction (e.g., A-1, A-2, A-3). The majority (83 percent) of the habitat in the survey area was classified as fast, turbulent habitat, commonly referred to as riffles. A smaller proportion (4 percent) was classified as fast, non-turbulent habitat, commonly referred to as glides or runs. Pools represented 12 percent of the total length. Table 1 summarizes the length of the habitats found in Vasa Creek. The field data can be found in the forms included in Attachment B. There were no side-channels detected during the habitat assessment of lower Vasa Creek.

Table 1. Habitat Unit Length

Habitat Type	Length Present (m)	Percent of Reach Length (%)
Turbulent	849.5	83
Non-Turbulent	44.2	4
Fast Water Subtotal	893.7	88
Scour Pool (10)	17.9	2
Plunge Pool (55)	108.4	11
Slow Water Subtotal	126.3	12
Total	1,020	100

A total of 65 pools were identified along lower Vasa Creek (0.06 pools per meter surveyed). Table 2 summarizes the dimensions for each pool identified. Pool habitat was found in each of the segments surveyed; however, the number of pools per segment was variable (Table 2). The pools identified were scour pools and plunge pools formed by boulder or woody debris steps (Figure 3). Some of the structures creating plunge pools (D2, D4, D6, E4, and G6) may be potential barriers to upstream passage by adult kokanee due to the shallow pool depths compared to the height of the structures.



Figure 3. Plunge Pool A4

Table 2. Pool Habitat Units

Habitat Unit	Habitat Type ^{1/}	Pool Code	Pool Width (m)	Pool Length (m)	Max Pool Depth (m)	Pool Crest Depth (m)	Notes
A2	PS	В	1.3	0.5	0.16	0.08	
A4	PS	В	1.9	0.8	0.35	0.03	
B4	PP	SWD	2.2	1.0	0.12	0.04	
В8	PS	В	0.5	1.1	0.13	0.08	
B10	PS	В	0.8	3.0	0.2	0.1	
B12	PS	В	1.1	3.5	0.19	0.08	
C2	PS	SWD	1.0	3.0	0.16	0.08	
C4	PP	LWD	1.7	1.2	0.27	0.01	
C6	PP	В	1.9	1.1	0.28	0.06	2 pools
C8	PP	SWD	1.3	1.4	0.23	0.06	
D2	PP	В	1.9	1.2	0.27	0.04	Potential Barrier
D4	PP	В	1.0	0.8	0.17	0.06	Potential Barrier
D6	PP	LWD	2.2	1.5	0.17	0.04	2 pools, Potential Barrier
D8	PP	В	1.8	6.3	0.2	0.04	2 Consecutive pools
E2	PS	LWD	0.7	1.5	0.17	0.05	2 pools
E4	PP	LWD	1.3	1.2	0.3	0.06	2 pools, Potential Barrier
E6	PP	В	1.7	1.1	0.2	0.09	2 pools
E8	PP	В	2.0	1.3	0.21	0.06	
E10	PP	В	0.8	0.8	0.13	0.09	
E12	PP	В	1.8	1.0	0.25	0.08	
E14	PP	В	1.3	1.0	0.15	0.05	
F2	PP	В	1.4	1.1	0.19	0.04	
F4	PP	В	1.1	6.0	0.15	0.07	3 Consecutive pools
F6	PP	В	0.9	7.5	0.26	0.07	2 Consecutive pools
F8	PP	Concret e	1.9	27	0.24	0.07	9 Consecutive micro pools
F10	PP	В	2.0	1.1	0.26	0.06	
G2	PS	R	0.8	2.6	0.16	0.07	
G4	PP	B/SWD	1.2	0.8	0.18	0.09	
G6	PP	В	1.2	7.3	0.26	0.08	3 Consecutive pools, Potential Barrier

Table 2. Pool Habitat Units (continued)

Habitat Unit	Habitat Type ^{1/}	Pool Code	Pool Width (m)	Pool Length (m)	Max Pool Depth (m)	Pool Crest Depth (m)	Notes
G8	PP	В	0.6	1.4	0.22	0.09	
H2	PP	SWD	0.9	0.9	0.14	0.02	
H4	PP	SWD	1.0	1.1	0.16	0.06	
H6	PP	SWD	1.1	1.2	0.19	0.03	
H8	PP	SWD	1.0	0.6	0.13	0.03	
12	PS	В	1.6	0.9	0.13	0.01	
J2	PS	LWD	0.8	1.0	0.15	0.06	
J4	PP	B/SWD	1.1	1.3	0.16	0.08	
J6	PP	SWD	1.1	18	0.16	0.05	4 Consecutive pools
J8	PP	В	1.0	5.5	0.20	0.04	
J10	PP	В	2.1	1.7	0.28	0.04	
Trib2	PP	LWD	2.4	2.0	0.37	0.04	Installed LWD
Trib4	PP	LWD	2.3	1.5	0.31	0.06	Installed LWD
Trib6	PP	LWD	2.0	1.5	0.35	0.04	Installed LWD
Mean			1.4	2.9	0.21	0.06	
SD			0.5	4.8	0.07	0.02	

^{1/} PP- Plunge Pool, PS- Scour Pool, B-Boulder, SWD-Small Woody Debris, LWD-Large Woody Debris

3.1.2 Channel Dimensions

Channel dimensions, slope, and bearing were measured at major and minor transects. Table 3 contains channel dimensions collected at each transect and summary statistics. Wetted channel widths at the time of survey ranged from 0.7 meter to 2.0 meters, with a mean of 1.4 meters. Wetted channel depths ranged from 0.04 meters (4 cm) to 0.10 meters (10 cm), with a mean of 0.06 meter (6 cm). Mean bankfull width and depth are 2.2 meters and 0.33 meter, respectively. Channel gradient ranged from 1.3 percent in downstream extent to 8 percent, excluding the steep (>20 percent) gradient barrier at the upstream extent. Additional water depths were taken as part of the habitat survey and can be found on the field forms in Attachment B.

Table 3. Channel Dimensions at Habitat Assessment Transects

Transect	Wetted Width (m)	Wetted Depth (m)	Bankfull Width (m)	Bankfull Depth (m)	Bar Width (m)	Percent Slope (ft/ft)	Bearing (degrees)
А	1.5	0.10	2.9	0.4	0	1	270
A'	1.7	0.04	3.0		0	1	270
В	1.7	0.09	2.5	0.3	0	2	240
B'	1.1	0.07	1.4		0	2	270
С	1.1	0.05	2.0	0.3	0	3	260
C'	1.1	0.05	1.6		0	3	270
D	1.1	0.09	2.9	0.35	0	5	280
D′	1.0	0.06	2.2		0.5	5	270
E	1.6	0.06	1.8	0.3	0	5	305
Ε'	1.1	0.08	1.7		0	5	210
F	0.7	0.04	1.1	0.5	0	5	290
F'	1.8	0.06	1.6		0	5	240
G	2.0	0.04	2.8	0.2	0	5	270
G'	0.7	0.05	1.2		0	5	300
Н	1.0	0.10	1.5	0.4	0	8	270
H'	1.7	0.08	2.3		0	8	280
I	1.6	0.08	2.5	0.3	0	8	220
<u>l</u> ′	2.0	0.04	3.1		0.5	8	270
J	1.8	0.07	2.5	0.3	0	4	300
J'	1.1	0.07	4.0		0.6	4	280
K	0.9	0.04	1.4	0.3	0	20	330
Mean	1.4	0.06	2.2	0.33	0.08	4.7	271.2
SD	0.4	0.02	0.8	0.08	0.19	2.1	NA
LBTrib	0.9	0.03	1.7	0.3	0	4.7	320

3.1.3 Shading and Riparian Vegetation

The results of the densitometer measurements are representative of overall streamside shading present along lower Vasa Creek, showing fairly high percentages of shading along the survey area, with a few exceptions (Table 4).

The section downstream of West Lake Sammamish Parkway (Transect A) flows through a residential area and is mostly backyard lawns with some patchy overhanging vegetation (Figure 4). This is reflected in the result of 23 percent shading (Table 4). Transect E occurred at a bend where the right bank consisted of an open lawn that ran up to the bank edge, resulting in 49 percent shading.

Figure 5 and Figure 6 show the dense riparian vegetation at Transects K and B, respectively, resulting in 100 percent shading.



Figure 4. Vegetation at Transect A

Table 4. Summary of Densitometer Readings

Transect	Center Upstream	Center Left Bank	Center Downstream	Center Right Bank	Left Bank	Right Bank	Percent Shading
Α	2	1	0	4	6	10	23
В	17	17	17	17	17	17	100
C	17	17	17	17	17	17	100
D	11	17	15	14	17	14	88
E	12	14	3	1	15	4	49
F	17	17	17	16	17	15	99
G	17	17	17	17	17	17	100
H	15	15	14	15	17	16	92
<u> </u>	17	17	17	17	17	17	100
J	15	16	13	15	17	17	93
K	17	17	17	17	16	17	100
LBTrib	17	17	17	17	17	17	100





Figure 5. View Upstream of Transect K

Figure 6. Vegetation at Transect B

A summary of vegetation type and abundance for the canopy, under-canopy, and ground cover is contained in Table 5. The riparian canopy varied by type and abundance throughout the survey area. At Transects A, E, and F, riparian canopy was either absent or minimal (Table 5), which directly correlates with the low percentage of shading in those areas. Alternatively, at transects with greater shading, such as Transect B, all three layers of riparian vegetation were present and the canopy was dominated by large trees (Table 5).

Table 5. Summary of Riparian Vegetation Assessment

	Canopy			Ur	nder-canopy	1	Ground		
Transect- Bank	Type ^{1/}	Big Trees ^{2/}	Small Trees	Type ^{1/}	Woody	Non- woody	Woody	Non- woody	Bare
A-LB	N	0	0	D	1	1	0	3	1
A-RB	N	0	0	M	2	0	0	3	1
B-LB	D	3	2	D	1	2	1	2	2
B-RB	D	3	1	D	0	2	1	2	2
C-LB	М	2	1	D	2	3	2	1	2
C-RB	М	2	0	D	3	3	2	1	1
D-LB	С	2	0	D	0	0	0	3	0
D-RB	D	1	0	D	1	2	0	3	0
E-LB	D	2	1	D	2	1	0	3	1

Table 5. Summary of Riparian Vegetation Assessment (continued)

	Canopy			Uı	nder-canopy	1		Ground	
Transect- Bank	Type ^{1/}	Big Trees ^{2/}	Small Trees	Type ^{1/}	Woody	Non- woody	Woody	Non- woody	Bare
E-RB	N	0	0	N	0	0	0	3	2
F-LB	N	0	1	D	2	3	3	0	0
F-RB	N	0	0	N	0	2	0	3	0
G-LB	М	3	2	D	2	3	2	1	2
G-RB	N	0	0	D	2	1	1	1	2
H-LB	М	2	1	D	1	1	1	2	2
H-RB	М	2	1	D	1	1	2	3	1
I-LB	М	3	1	D	3	2	1	2	2
I-RB	М	3	2	D	3	2	2	2	2
J-LB	М	2	0	D	3	1	2	1	2
J-RB	D	2	1	D	3	1	2	1	2
K-LB	D	3	1	D	1	1	2	1	2
K-RB	М	3	0	D	3	1	2	1	2
LBTrib-LB	С	3	2	D	1	2	2	1	2
LBTrib-RB	D	3	2	D	2	1	2	1	2

 $^{^{1/}}$ D=Deciduous, C=Conifer, M=Mixed, and N=None. 0=Absent, 1=Sparse (<10%), 2=Moderate (10-40%), 3=Heavy (40-75%) and 4=Very Heavy (>75%).

3.1.4 Fish Cover and LWD

Fish cover is limited throughout the survey area with most resulting from in-stream boulders and overhanging vegetation. All of the transects were documented as having some fish cover, mostly documented as sparse or moderate (Table 6). Three transects were noted as having "heavy" (40-75%) fish cover of some type, Transects E, G, and K, and none were documented as having "very heavy" (>75%) fish cover of any type (Table 6). Table 6 summarizes the abundance of fish cover by type for each of the major transects.

Table 6. Summary of Fish Cover

Transect	Algae	Macrophytes/ Bryophytes	Woody Debris	Brush	Overhanging Veg	Undercut Banks	Boulders Ledges	Artificial Structures
Α	0	1/0	0	0	0	0	2	1
В	0	0/0	1	1	1	0	0	1
С	0	0/0	0	0	2	0	0	0
D	0	0/0	0	0	1	0	0	0
E	0	0/0	0	0	2	0	3	3

^{2/} Big trees are defined as greater than 5 meters in height.

Table 6. Summary of Fish Cover (continued)

Transect	Algae	Macrophytes/ Bryophytes	Woody Debris	Brush	Overhanging Veg	Undercut Banks	Boulders Ledges	Artificial Structures
F	0	0/0	0	1	2	0	2	0
G	0	0/0	0	0	2	1	0	3
Н	0	0/0	1	0	1	1	2	0
I	0	0/1	2	0	2	1	1	0
J	0	0/0	2	1	2	0	1	0
K	0	0/3	1	0	2	0	3	0
LB Trib	0	0/0	1	1	2	0	2	0

Scale: 0=Absent, 1=Sparse (<10%), 2=Moderate (10-40%), 3=Heavy (40-75%), and 4=Very Heavy (>75%)

The quantity of LWD (diameter greater than 0.1 meter and length greater than 2 meters) in the survey area is also limited. Some LWD was found in all segments, with the exception of F-G, where no LWD was documented (Table 7). The smaller pieces of wood were more abundant and did function in the channel to form steps and scour pools. Table 7 includes LWD quantities for stream segments between the major transects.

Table 7. Summary of Large Woody Debris Inventory

	Log Dimensions (length / diameter)									
Segment	2-5 (m) / 0.1-0.3 (m)	2-5 (m) / 0.3-0.6 (m)	5-15 (m) / 0.1-0.3 (m)	5-15 (m) / 0.3-0.6 (m)						
A-B	1	0	0	0						
B-C	1	1	0	0						
C-D	0	2	0	0						
D-E	1	1	0	0						
E-F	3	0	0	0						
F-G	0	0	0	0						
G-H	0	0	1	0						
H-I	2	0	1	2						
I-J	1	1	2	0						
J-K	2	0	1	1						
K	0	0	1	0						
LBTrib	0	4	0	0						

3.1.5 Substrate Size and Embeddedness

Channel substrates in the survey area ranged from fines to cobbles with the most common dominate substrate type being fine gravel. Boulders placed along the channel for bank protection and within the channel for grade control are common. Table 8 contains the dominant and sub-dominant substrate types, as well as embeddedness for each of the major and minor

transects. The field data taken from the substrate cross-sections can be found on the field forms in Attachment B.

Table 8. Summary of Substrate Size and Embeddedness

Transect	Dominant Substrate	Dominant (%)	Sub- Dominant Substrate	Sub- Dominant (%)	Mean Embeddedness (%)
А	GF	46	SA	36	56
Α′	GF	46	GC	36	
В	GF	64	GC	27	30
B'	СВ	36	SA	27	
С	GF	82	FN	18	26
C'	GF	36	СВ	27	
D	GF	36	FN	27	57
D'	GF	55	GC	27	
E	BL	36	GC	36	40
Ε'	GF	45	SA	36	
F	GF	45	SA	18	66
F′	GC	55	GF	27	
G	GF	36	GC	18	61
G'	GC	82	BL	2	
Н	СВ	45	SA	36	53
H'	GF	55	GC	18	
I	GF	36	GC	27	56
1'	GC	45	GF	18	
J	СВ	27	GC	27	37
J'	SA	55	GC	27	
K	SA	73	СВ	9	84
LBTrib	SA	73	GC	18	78

BL=Boulder, CB=Cobble, GC=Gravel Coarse, GF=Gravel Fine, SA=Sand, FN=Fines, HP=Hardpan

3.2 Outfall Reconnaissance Inventory

During the habitat assessment, the location of additional previously unobserved outfalls was documented and Outfall Reconnaissance Inventory/Sample Collection Filed Forms completed. The completed Outfall Reconnaissance Inventory/Sample Collection Filed Forms are included as Attachment C.

Three additional outfalls were inventoried during the habitat assessment, which were dry at the time of survey. These were added to the eighteen outfalls detected during the landslide assessment, for a total of twenty-one out falls recorded on the surveyed portions of Vasa Creek.

Table 9 contains a summary of the data collected at the outfall reconnaissance inventory sites. The locations of the outfalls inventoried are shown on Figures 2 and 3 in Attachment A.

ID#	Reach	Material	Diameter (inches)	Flow	Notes about Discharge
OF-H1	F-G	PVC	4in	None	None
OF-H2	F-G	Concrete	8in	None	None
OF-H3	F-G	PVC	4in	None	None

4. Macroinvertebrate Samples

In 2011, macroinvertebrate samples were collected from Vasa Creek and delivered to Rithron and Associates for assessment (Rithron 2011). Analysis indicated that the B-IBI (Benthic Inventory of Biotic Integrity) site score was 24, typically a "poor" rating, however the RIVPACS (River Invertebrate Prediction and Classification System) result was 0.81, indicating unimpaired conditions. The B-IBI is a method of evaluating stream health by looking at the local macroinvertebrate community across ten metrics. Each metric is given a score of 5, 3 or 1, where 5 is little to no degradation, 3 is moderate degradation and 1 is serious degradation. These ten metrics are summed together creating a score ranging from 10 to 50. The RIVPACS is a statistical model that uses macroinvertebrate communities to evaluate stream conditions.

The analysis also revealed the presence of sensitive taxa, indicating decent water quality conditions. The overall species composition indicated a preference towards to cool water temperatures, while the cold stenotherm taxa (only lives in water less than 10 degrees Celsius) were not present in substantial numbers. Stoneflies were found to be common, which suggests the availability of coarse organic matter and that the macroinvertebrate community is not adversely affected by sediment deposition. Overall, taxa richness was high, with proportions that are typically appropriate for a lowland stream that ultimately feeds into the Puget Sound. The summary results from this sampling effort are included as Attachment F, and the full report is available from the City of Bellevue (Rithron 2011).

5. Electrofishing

A fish survey was conducted in July 2014 by the City of Bellevue to assess status and trends of resident populations of fish in Vasa Creek and identify resident species diversity and size classes (City of Bellevue 2014). Electrofishing was conducted along 151 feet of Vasa Creek at approximately river mile 0.38 using a backpack electrofishing unit. A total of 86 cutthroat trout were captured during this effort and no other fish species were found. Almost 92 percent of the

fish captured were less than 80 mm, with only 8 percent being between 80 mm and 150 mm. A description of the methods used and the data from this effort are included as Attachment E.

6. Discussion and Recommendations

During the habitat assessment, habitat metrics were collected to create a baseline data set with which to describe the current conditions of lower Vasa Creek. These data were summarized and presented in the above sections of this report, and the field data are contained in Attachment B. The field data can be used for additional analysis and comparison with other spawning tributaries to Lake Sammamish, and in support of future surveys on Vasa Creek. These field observations were also used to develop the recommendations included in this section.

Habitat conditions appear adequate for kokanee spawning (similar to existing Lake Sammamish tributaries where active spawning occurs). Yet, anecdotal evidence of kokanee usage of Vasa Creek is limited to downstream of the West Lake Sammamish Drive crossing (WDFW 2009). Immediately upstream of the crossing is a forested corridor, where casual observation may have been limited in the past. The 2008/2009 Lake Sammamish Late-Run Kokanee Survey and Summary report indicated that Vasa Creek was spot-checked (time permitting) three times during the standard run-timing for late-run kokanee (mid-November 2008 to the end of January 2009) (WDFW 2009). No live or dead kokanee were detected during these spot checks. Additionally, the escapement at the primary spawning streams during this same timeframe was nearly nonexistent when compared to other years (Figure 7).

Overall, conditions in Vasa Creek are adequate for kokanee spawning throughout the survey area. The active channel width, depth, and sediment composition are similar to that found in the three major kokanee spawning creeks that flow into Lake Sammamish: Ebright, Laughing Jacobs, and Lewis Creeks. Despite having a "poor" rating from the Benthic Inventory of Biotic Integrity index, the rest of the macroinvertebrate assessment indicates relatively unimpaired conditions.

The lowest portion of Vasa Creek, downstream of West Lake Sammamish Parkway, exhibits the most human impact with a heavily confined channel and armored stream banks surrounded by managed residential lawns. Additionally, that area was limited in fish cover, pool habitat, and LWD. Upstream of West Lake Sammamish Parkway there is more established riparian vegetation, although some intermittent residential lawns still occur within the riparian area, and other habitat elements are more diverse and abundant.

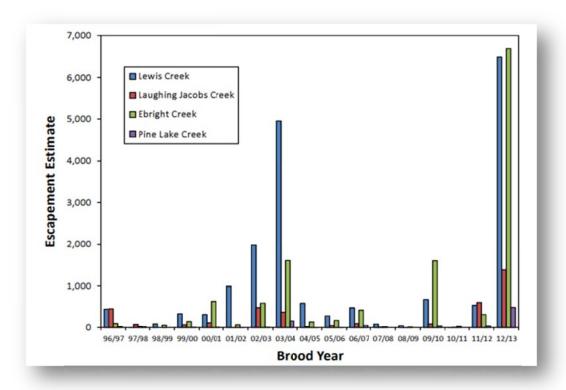


Figure 7. AUC Escapement Estimates for the Four Primary Kokanee Spawning Tributaries (LSKWG 2013)

Although a fish passage barrier assessment was not conducted as part of this survey, there were several potential fish passage barriers identified during field surveys. The maximum jump height recommended for adult kokanee is six inches, with a minimum approach pool depth of two feet (0.6 meter) (FHW 2007).

None of the plunge pools documented within the survey area met the minimum approach pool

depth criteria of 0.6 meter. Although jump heights were not specifically measured as part of the methods used during this survey, the following plunge pools were observed as being potential passage barriers to upstream adult kokanee movement due to unfavorable jump heights: D2, D4, D6, E4, and G6.

For example, the plunge pool at D4 splits the limited flow and the resulting pool is mostly full of fines and sand (Figure 8). The current pool depth is shallow (0.17 meter)



Figure 8. Split Plunge Pool D4 from Constructed Grade Control

and does not have sufficient depth for adult kokanee to attempt jumping upstream over the structure. Fish passage conditions may improve at higher flows.

There were also culverts that have been identified as partial fish passage barriers in the survey area. There were five culverts in the WDFW FPDSI database in the survey area (ID# 930484, 930485, 930486, 930487, and 930488). Two of these culverts were assessed as partial barriers; one culvert (930488) on private ownership near the mouth (Figure A-1) and the other culvert (930484) on City of Bellevue ownership under 163rd Avenue SE (Figure A-2) (WDFW, 2014).

The following recommendations are based on the findings of the fish habitat assessment and a review of existing data:

- Incorporate Vasa Creek into the late-run Lake Sammamish kokanee spawner surveys to develop baseline data prior to any restoration actions and to establish the upstream extent of kokanee access and redds. If possible, spawner surveys should cover the entire length of habitat surveyed (approximately 1,270 meters). However, if there are no kokanee or redds observed from the mouth to the second partial barrier culvert at 163rd Avenue SE (670 meters), surveys could be concluded.
- Conduct additional surveys of near-shore Lake Sammamish to detect littoral spawning activity by kokanee.
- Conduct a more thorough fish passage assessment including the two partial barrier culverts and other potential passage barriers identified during this assessment.
- Identify the factors limiting productivity in Vasa Creek and develop restoration alternatives to improve kokanee habitat.

Overall, the existing data coupled with the information gathered through this assessment indicate that habitat in the lower portion of Vasa Creek may be suitable to support kokanee. However, additional information regarding current use of Vasa Creek and nearshore Lake Sammamish by spawning kokanee, as well as any fish passage barriers or other limiting factors that kokanee may encounter in Vasa Creek would be helpful in better understanding the potential. This additional information would also help to focus restoration efforts within the Vasa Creek Watershed to implement the most effective projects to support kokanee.

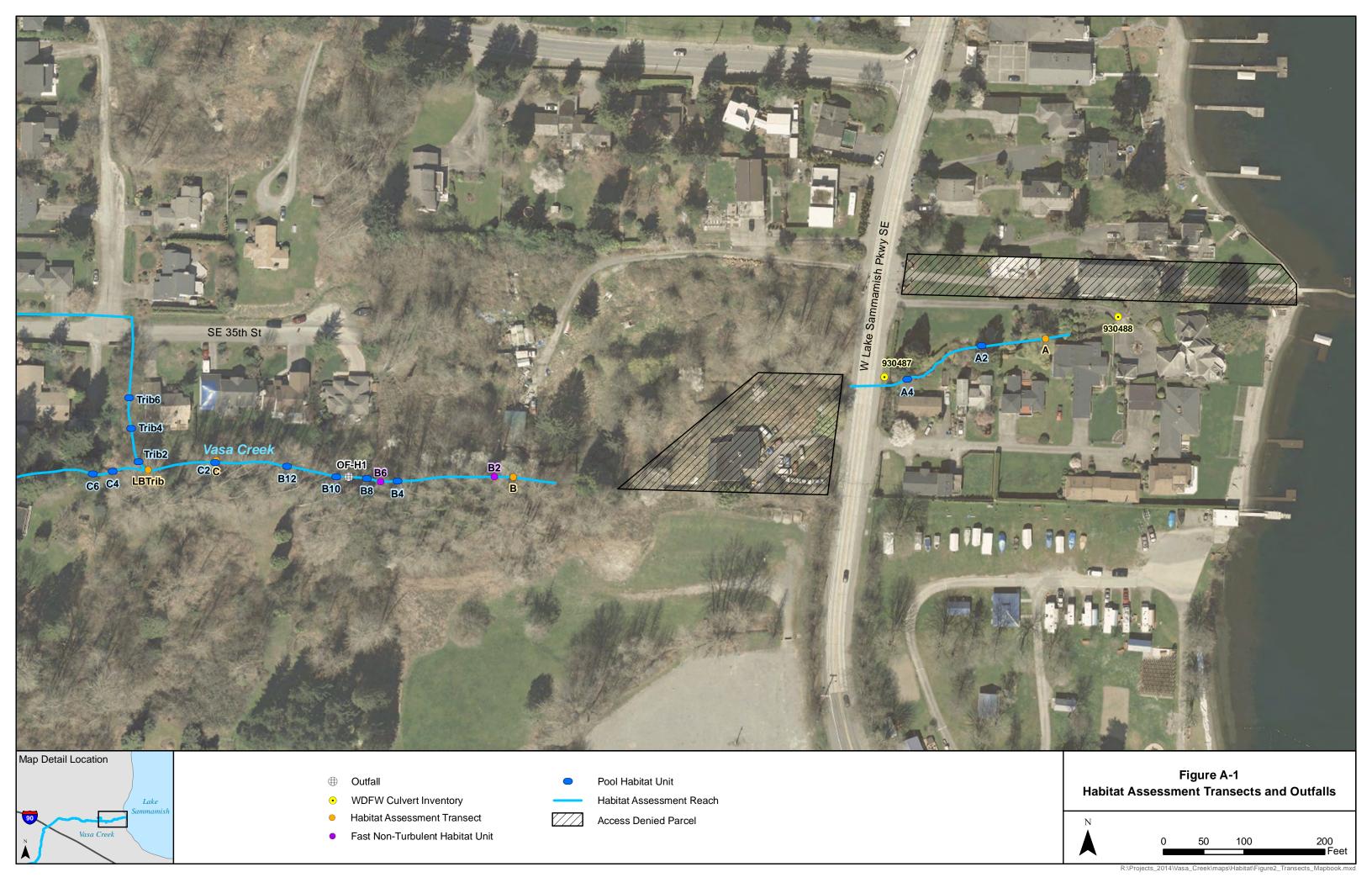
7. References

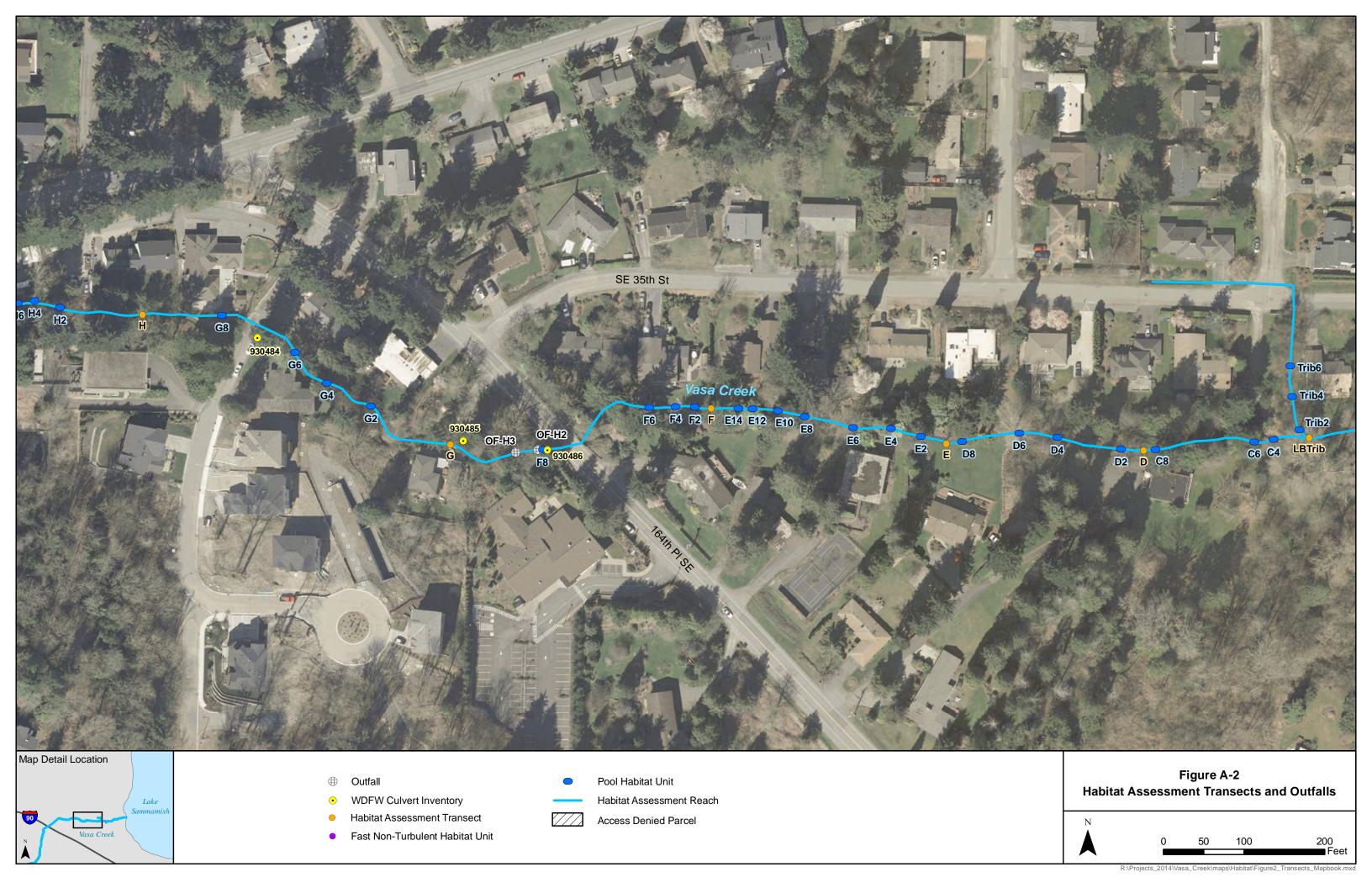
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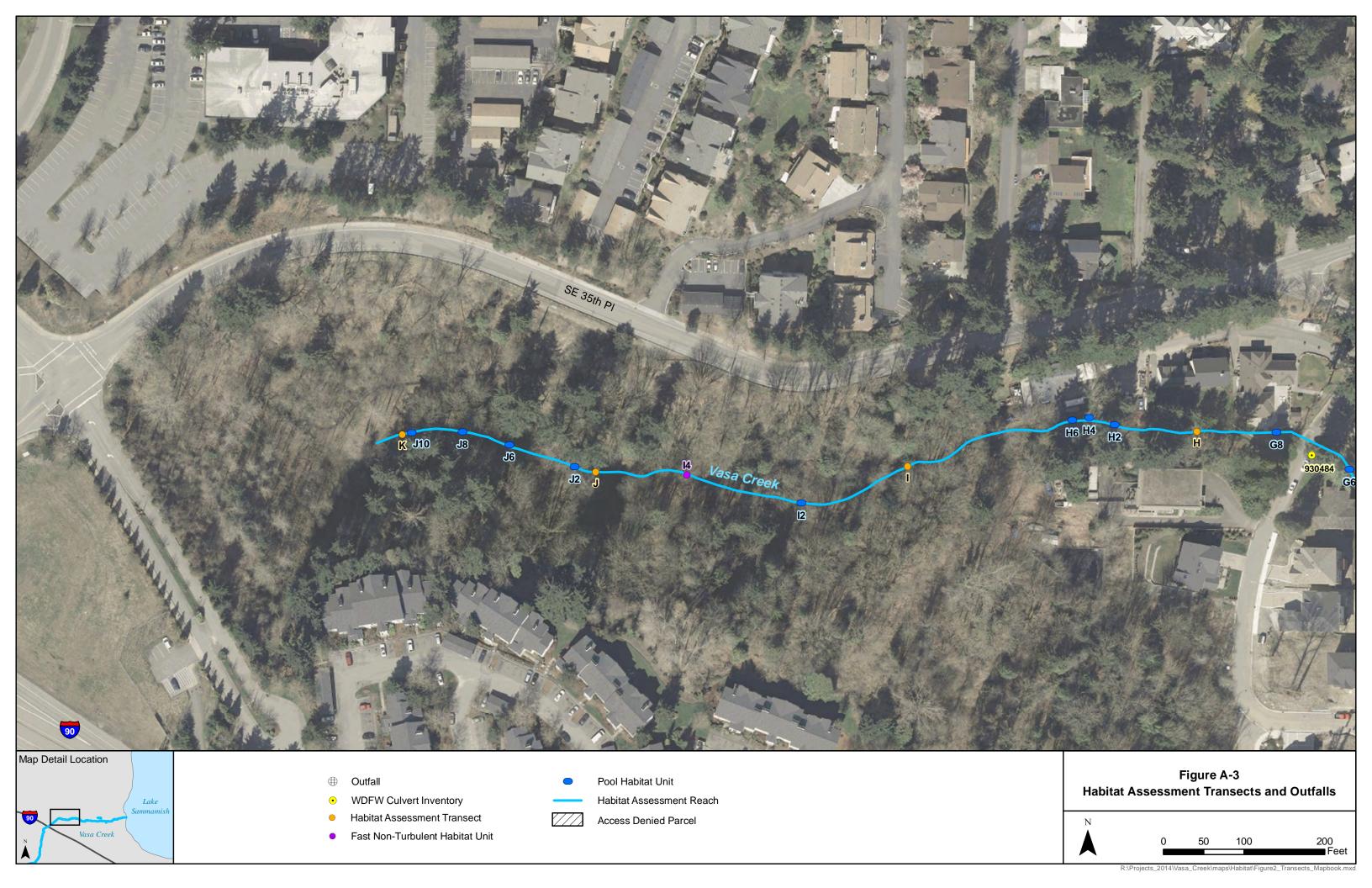
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ATTACHMENT A		
Maps		

Vasa Creek Fish Habitat Assessment









ATTACHMENT **B**

HABITAT ASSESSMENT FIELD FORMS

Site 1	Hab Name:				Ivia	Major: @139m Minor @67.5m Thalwag: @135m								
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	Thalwag	V	Edge	Habita	at Slor	A E 6	Side	' G g'	SC) 1 1	J j'	K		
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0.3	0.09	Y/N	Y/N	3	2			00			_			
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	Road Xing	Y/N	Y/N											
	No quess	Y/N	Y/N		_									
0.7		Y/N	Y/N	-						1,2,1				
0.8		Y/N	Y/N											
	labitat	Y/N	Y/N	Cad		live:								
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6						-						DC-Dry	cnannel	
7						(0)						Pool for	ming code	
8												N-Not a		
9												W- LWD		
10	-											R-Rootw		
11	1-1-12-22												er/Bedrock	
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14		Diet	(==)	FI	C1.							* landscap	21 timber	
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over		Moderate	W = W		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	3 = Heavy								
		Heavy				4 = Very Heavy								
	4 =	Very Heavy	14 - 140		Flor	Filamentous Algae								
Visu	al Ripari	an	Left Bank	Right Bank	Flag	Macrophytes								
						Woody Debris								
		Canopy	(> 5m Tall)		See	Brush								
	Type	-	None	None		Overhanging veg Undercut banks								
Vegetation	туре		0	0		Boulders/Ledges								
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Siliali Tiees		11 - de sebem	(0.5 to 5 m	tall		Bryophytes								
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	07	0.47	6F (GF)	40		CB = Cobble								
0.3	08	0.48	6F (6C)	50		GC = Coarse Gravel								
	03.	0.48	(B(GC)	100		GF = Fine Gravel								
	09	0.49	SA (CB)	1 20		SA = Sand								
	03	0.43	GC (15)	100		FN = Fines								
	02	0.42	SA (GC)	100	1	HP = Hardpan								
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	d Width	1,7	(1.1)		xx.x%)-360				2-5m		5-15m	>15m
Bar Wi		0	(0)		1.9		240	(270)	0.1 -	U 3	1	2		
	ll Width	2.5	(1.4)						0.1	0.5	4.	40		
	fuli Ht	0.3							0.3 -	0.6	1		12	
Bank	full + Ht	0.3								0.0	,			
O 1	.т.н. Г	%							0.6 -	0.8			_	1
	ability	<u>D</u>								0.0	-			
	ability [30							> 0.8	≀m Ì				
iomm Lul		()	1											
Hab.	-	1		15 re	20501	reb C	5	Rw	n h	0	ugl	4.	らいたの	tanes
	- 0		Pan	ot		ans		+ 3	5: 6	05	SC.	: 11	4	
V		nuh!	stea			Vov			3:		S C .	- []	5	
	AISO	-110	T CO	mer.	5 5	Lot	nf	TE	ans	e()	+ 2	,		

There was some LWO but spanning and outside

Ha	abitat fiel			Date:	6/19	5/14		
Site Name:		Creek		Surve		JKP JC	Р	
Site ID:		r Vasa	2 1 2 41	E o' E f'	G g' H h'	1 i' J j'	K	
Transect:				ecidious	G B 11 11	F	ish 0	= Absent
Riparian		bsent	C = Cc			Cover		= Sparse
Vegetation		parse		oadleaf Eve	rgreen	(10 m	/,	= Moderate
Cover		Moderate	M = V					= Heavy
		leavy						= Very Heavy
	4 = \	/ery Heav	y 10 = 10	Olic		Filamentous	Algae	0
Visua	l Riparia	n	Left Bank	Right Bank	Flag	Macrophytes		0
						Woody Debri	is	
		Canop	y (> 5m Tall)			Brush		-
	France .		0	0		Overhanging		
Vegetation 7	ype		3	3		Undercut ba		10
Big Trees			2			Boulders/Led		
Small Trees			10 F to F m	tall		Artificial Stru	1	
		Understo	y (0.5 to 5 m	Lali		Bryophytes	Doncity	
Vegetation						Canopy bank (
Woody Shri	ubs & Sap	lings		10		Up	17	
Non-Wood	v Herbs &	Grasses	2	1		Left	17	
110111111111111111111111111111111111111			Cover (<0.5	m)		Down	17	
		Ground				Right	17	
Woody Del	bris		9	2		LB	17	
Non-Wood	ly Herbs 8	& Grasses	2	2		RB	17	
Barren, Ba	re, Dry, o	r Duff		a				
			Substrate					
	Danah	AJ BF Depth	Size Class	s Embed	H Flag			461
	Depth	0,25	1 2 2 2 1 -	3 0 0		RS =	Bedrock (sm	100tn)
LB -	01	0,26	6F (C	3/20			Bedrock (ro	ugnij
		0.26	1/F (C	B120			Boulder	
	03	0.28	6F (61	c) 60			Cobble : Coarse Gra	امر
	01	0.26		3)10			Fine Gravel	
	04	0.29	12F G	F) 50			: Fine Graver	
	05	0.30	OC (C	B) 10			Fines	
	06	0.31	OC CS	A) 20			= Filles = Hardpan	
	06	0.31	6F (5	(A) 10			= Wood	
	00	0.33	6F (S	A) 10			= Other	
RB -	0	0.25	1	PV) 100				
			C	3-4				
Commer	nts		-	N.)				

iite N	lame:	tat fie	Creek			D.	ajor: @1			w6/	.5111			13.5m
ite II		er Vas	-			_	te: 6	118	15			19:31	2	
rans		A a		(C c')	ם איר		rveyors:		JKP		JCP			2
10113	Thalwag	A a	Edge		D d' E 1Slope	e F	r G g		i'	J j	' K			
	Depth	Bar	Pool	Unit				SC						
0		Y/N)	Y/N)	TI	Bearing		annel No	Width	ו	SCN	lotes		_	
0.1	0.06	Y/N	Y/(Ñ)	7			11	-		-	_			
0.2	0.06	YAN	Y/N)	3	28	2	No	-		-				
0.3	0.07	Y)N	Y/N)	3	241	-	No			-				
0.4	0.01	Y/N)	Y/N)	3		0	100			K	sul	wid	th	0.9
0.5	0.00	Y/N)		2	270)	NO							
0.6	0.05	-	Y/N)	3		0	No	-		-				111
0.7	0.07	Y/N)	Y/N	5	270		20	_			-			
-	0.07	Y/N)	Y/N	7	177	0	NO	-						
0.8	0.05	YAN	Y/(N)	+	280)	NO	_			~			
	U, 05 labitat	Y/N	Y/N)	7	260		100			91	_			
		Cod		Code	HU		Max		Crest			Unit ty	pes	6-3 ⁻
-	Туре	Code	1	Code 2	Wi	dth	Pool		Pool			FT- Tui		
1	DS	1/	11		1.				<u> </u>		1193	FN-No	n-Tu	rbulent
2	1 2	W-	small		1.	U	0.	16	0.	08	1125	PS-Sco	ur Po	ool
-	FT	11			9		-		-		Hab	PD-Da	mme	d Pool
4		W	1 -			.7	0.	27	D.	01	1130	PP-Plu	nge į	oool
5	FT		1			2.0		-	_		Hab-	仍C-Dry	cha	nnel
6	PP	1	3			1.9	0.	28	0	.06	133	3		
7	PI		N		0	0.9	^		-		H466=	Pool fo	rmir	ng code
8	PP.	W-	Small			1.3	D.	23	0.	06	134	N-Not	a pod	ol
9												W-LW		
10												R-Root	wad	
11												B-Bould	der/E	Bedrock
12														
13			March.											
14														
		Dist	t (m)	Flag	Slope	Bear	ing		L	ND (a	II/par	tially wit	hin I	3F)
	d Width	[.]	(1.)		xx.x%	0-36				2-5m		5-15m		>15m
r Wi	-	0	(0)		3.0	260	0 (270)	0.1						
		2.0	(16)					0.1 - (J.3					
	full Ht	0.3						0.0		1.1			7	
Bankt	full + Ht	0.4					- 1	0.3 - 0	0.6				ı	
		%											-+	
Inst	ability	0						0.6 - 0	0.8	1			- 1	
Insta	ability	50											-+	
mme	ents //		110	stre	an o	F		> 0.8	m					
	T	row		A C		SC.	123)		-				
	-	- 5	-			- 1					Λ.			
	V	200	20 4	150	10 5 1	1	7	201		-	1,00	75-1-	2	. 1/6 -
		ah	tc I	400	76	201	01	-001	Sh	8	202	poo	-	(5-ec)

3.0 1.2

701.1

1.4

		eld forms a Creek		Date:	6/19/	114	
te Name:				Survey		JKP JCP	
te ID:		wer Vasa a' B b' (C c' D d' E	e' F f'	G g' H h'	li' Jj' K	
ansect:		Absent	D = Dec			Fish	0 = Absent
iparian			C = Con			Cover/Other	1 = Sparse
egetation		: Sparse : Moderate		adleaf Ever	green	(10 m x 20m)	2 = Moderate
over			M = Mi				3 = Heavy
		Heavy					4 = Very Heavy
	4 =	Very Heav	y It Ito.		el	Filamentous Algae	0
Visua	l Ripari	an	Left Bank F	Right Bank	Flag	Macrophytes	1 2
		Canop	y (> 5m Tall)			Woody Debris Brush	0
			100 T	m		Overhanging veg	2
egetation T	ype		1	2		Undercut banks	0
Big Trees			4	0		Boulders/Ledges	0
Small Trees						Artificial Structures	0
		Understor	y (0.5 to 5 m t	all		Bryophytes	0
				D.		Canopy Density	4
Vegetation	hc 9. C-	nlings	2	3		bank (0-17)	
Woody Shru Non-Woody			3	3		Up 7	4 1 5 7 7
Non-woody	Heins	And the second second				Left 17	_
		Ground	Cover (<0.5m			Down 17	
Woody Deb	ris		2	a		Right 17	
Non-Woody		& Grasses		1		LB 17	
Barren, Bar			2			RB 17	
			Substrate				
		AJ BF Depth	Size Class	Embed	Flag		
	Depth		FN (6F	100	T	RS = Bedrock (
LB -)	0.35	1	10		RR = Bedrock (rough)
	03	0.38	6F 16F	10		BL = Boulder	
	.03	0.33	(60)	10		CB = Cobble	
	.04	6-38	1 (60)	10		GC = Coarse G	
	.03	0.39	GF	10		GF = Fine Grav	/el
	.04	0.40	(CB	10		SA = Sand	
	.05	0.38	(60	10		FN = Fines	
	03	0.39	TUE	4		HP = Hardpan	
	7.03	0.38	V 16F	1		WD = Wood	
		0.35	FNF			OT = Other	
RB -	0	5 57	ĹF.	Ч			
			GC	-3			
	.3		(, (
Comment							
Comment							
Comment							

			ld form	IS			Majo	or: @1	.35m	Mino	r @67	7.5m	Thalwag	: @13 5m	1
_	Name:		Creek				Date	: 6	118		/		· · · · · · · · · · · · · · · · · · ·	. @ 13.511	
Site I		er Vas					Surve	eyors:		JKP		JCF			
Trans		A a	' B b'	C c'	D d'	E e'	F f'	G g	' H h	' i	' J j	i' K			
	Thalwag		Edge	Habita	at Slope		Side		SC						
	Depth	Bar	Pool	Unit	Bearir	ng	Chan	nel	Widt	th	SCN	Votes			
0	0,0	Y/N	Y/N)	1	1231	0	N	D	-		1	-			
0.1	0.06	Y/N)	Y/(N)		27	70	1	0	-	_		_			2
0.2	0.07	Y/(1)	Y/N	3	26	0	1	20		-		-			
0.3	0.05	Y/Ŵ	Y/N	3	20	30		VO		_	1	_			
0.4	0.06	Y/N)	Y/N)	3	79	20		No	-			_			
0.5	0.06	YN	Y/(1)	5		20		OVI			R	4/ 1	v:dt	0.5	
0.6	0.13	Y/(V)	Y/N	17	2	80		No		-		_	7044	0,0	100
0.7	0.06		Y/(I)	7	3-	30		No		_	-				
0.8	0.04		Y/N)	7	22	70		Vo	-	_	-	-			
0.9	0.05	Y/N	Y/N)	0	21	O		VO		_		_			
	labitat		Pool	Code	I	-IU		Max	1-22-11-2	Cres	t	1000	Unit ty	nes	
	Туре	Code	1	Code 2	\	Nidth	- 1	Pool		Pool		Porh	FT- Tur	hulent	
1	FT	1	J			1.		_			_	1135	FN-Non	-Turbulo	nt
2	PP		3			1.0	9	0.3	77	17	14		PS-Scot		111
3	FT		N			1.		_			-	146b_(3PD-Dan	amed Por	al.
4	PP	Ī	3			1.	0	(1).	7	n	06	139	PP-Plun	ge pool	J1
5	FT	- 1	\bigvee			1.	0	4		V.	_	Heh	5DC-Dry	channel	
6	PP	W				2.	2	().	17	D	04	139		Citatiliei	
7	#1	1	1			1.	1		-	_	-		Pool for	ming cos	10
8	PP	ĺ	3			1.	8	0.	2	1)	04	1417	N-Not a	ming cot	ie .
9	FT	1	V			1.1	0	-		<u> </u>	-	Heh-	W- LWD	hooi	
10													R-Rootw		
11														rau er/Bedro	al.
12													D-BOUIU	er/ bearo	CK
13									-						
14															
		Dist	(m)	Flag	Slope	В	Bearing	2		11	WD (a	II/nar	tially with	in DC)	
/ettec	d Width	1.1	(P.D)		xx.x%	-	-360				2-5m	пурат	5-15m	>15m	
ar Wi		0	(0.5)		5.1		2800	270					2 13111	\\\\\\	
	ll Width	2.9	(2.2)		-	$\neg \uparrow$			0.1 -	0.3					
	full Ht	0.3							•		1			- 8	
Bankf	ull F Ht	0.33						10	0.3 -	U.6	1				
		%							0.5						
	ability	0							0.6 - (0.8					
	bility	0												+	
mme	nts				s — <u>— u — v</u>				> 0.8	m				12.	
	V:	ew,	UPS }	rem	on of	T	Van	Sec	tr	2:	DS		135		
	V,	ew	of.	tran	seil	-		+ di	DIAN	15 T	LCA	2	DSC	12	1
	* Hav	1.79+	Luv		ED:	2	mar		- a		179	-			0
	k	o Ka.	nei	m. 6x	ator	· F	Delas	0.1	1	10		010	Krrier Sl. h	1000	127
	* Itak	oitat	lin	+ 4	04	is	10 0	00	7	10 4	o h	ETT	5/0b	1800	134
	av	ndi	nas	G	RB «	SLAC	~~	00.0	mp	05-1	100	4-1	e- to of lar	KOK	snee (
	4 14.	h. t	1 + 1	10 1	1 1	000	2 ^	201	1	100	1.	~ -	0 + 100	5× 5×6	
	b	((VN	er J	FA L	6 h	as	74	יוטט	ITN	0	WWV	177	ream	150	COM
	0			. 0 10	pari	ساريد	_								

0.8 5+0.9

pools (6.3)

Ha	oitat field forms		Date:	6/19	114	
te Name:	Vasa Creek		Survey	0 1 0	JKP JCP	
te ID:	Lower Vasa	C c' (D d')	E e' F f'	g' H h'	li' Jj' K	
ansect:	A a' B b'	D = D	cidious		Light 0 -7 mag	
iparian	0 = Absent	C = Cc			Cover/Other 1 = Spars	
egetation	1 = Sparse		oadleaf Ever	green	(10 m x 20m) 2 = Mod	erate
over	2 = Moderate	M = N		Біссіі	3 = Heav	
	3 = Heavy				4 = Very	Heavy
	4 = Very Heav	/y N = N	one		Filamentous Algae	0
Vicual	Riparian	. o post	Dight Bank	Flag	Macrophytes	0
Visual	Tapana.	Left Bank	Kigiit Darik		Woody Debris	0_
	Canop	y (> 5m Tall)			Brush	0
					Overhanging veg	1
egetation Ty	/pe	<u></u>	1		Undercut banks	0
Big Trees		d			Boulders/Ledges	0
Small Trees		1 0			Artificial Structures	0
	Understo	ry (0.5 to 5 m	tall)		Bryophytes	U
ins variables	01140.310		TA		Canopy Density	
Vegetation	Amin's Edition	1	No.		bank (0-17)	
Woody Shru	bs & Saplings	U			Up 11	
Non-Woody	Herbs & Grasses		d		Left 17	
		d Cover (<0.5	m)		Down 15	
			10		Right 14	
Woody Deb	rist stums	0	10	+	LB 17	
Non-Woody	Herbs & Grasses	3	3	-	RB 19	
Barren, Bare	e, Dry, or Duff	0	10			
		Substrate				
	۸J		المراجعة المراجعة	Flag		
Wet [Tidg	RS = Bedrock (smooth)	
LB -	0 0.35	FN# (C)	10.0		RR = Bedrock (rough)	
	0-43	FN (C			BL = Boulder	
	06 0.41		F) 30		CB = Cobble	
10	07 1.42	-	F) 30		GC = Coarse Gravel	
	05 0,40	6F (6			GF = Fine Gravel	
	08 0.43	6F (G			SA = Sand	
	04 0.39		F) 10		FN = Fines	
	.05 0.40	GC (G	F)10		HP = Hardpan	
	.04 0,39	SAG	001()		WD = Wood	
	.04 0 ,39		0010		OT = Other	
0.5	0.35	FN (F 100			
NO	V	/ /	F6			
Commont		GF4 1	, 63			
Comment	3					
						N
			3			

		itat fiel		s			Maj	or: @1	.35m	Minor	@67	.5m	Thalwag:	@13.5m
	Name:		Creek				Date	e: (3/14	/			
Site I		er Vasa					Surv	eyors:		JKP		JCP		
Trans	sect:	A a'	B b'	C c'	D d	' E e'	F f	' G g	' H I	1' 1 i'	Ji			
	Thalwag		Edge	Habita	at Slope	•	Side		SC		1			
	Depth	Bar	Pool	Unit	Bear	ing	Cha	nnel	Wid	th	SCN	lotes		
0	0.06	Y/N	Y/N)	1.		05	_	ÛÜ			T -	0103		
0.1	0.11	Y/N	Ŷ/N	2	7	90		00				-		
0.2	0.09	Y/N	Y/Ñ	4		00	1	Vo		_	-			
0.3	0,05	Y/N	Y/N	5	5			NO		_		_		
0.4	0.06	Y/D	Y/N)	7		40	1	10		Mayor.				
0.5	0.08	Y/N)	Y/(Ń)	7	7	_		Vo		_				
0.6	0.07	1	Y/N	7		340		No			-			
0.7	0.08	Y/N)	Y/N)	9		30		No	<u> </u>					
0.8	0.06	The real Property lies and the	Y/(Ñ)	(1		30		No	_			_	V 100 - 1	
0.9	0.09		Y/N	12	12	90		No	_		_			
H	labitat		Pool	Code		HU		Max		Crest			Unit typ	100
	Type	Code 1		Code 2		Width	1	Pool		Pool			FT- Turk	
1	FT	\wedge				-	6	-	_		-	141		-Turbulent
2	PSTPP	u	5					0	17	0.0)5	Hab-	PS-Scou	r Bool
3	FT	1				1.	2	-		-		Hehl	PD-Dam	med Pool
4	PP	L)			1.	3	12	.31	17	06	143	PP-Plun	To pool
5	FT					1,1	9	_		0.	00	Heb	DC-Dry	se pool
6	PP	31	4.77)	U)	}	5	0.	7	n	09	140	UC-DIY	-namei
7	FT		V	1172		1	7	01	0	U:				ming code
8	pp	F				2.	-2	D.	21	D	06	14/	N-Not a	ming code
9	FT	1	J "			1	1			-		17 C	9W-LWD	poor
10	PP	Ī	3			1)	3	12.	13	().	19		R-Rootw	
11	FT		J				9	0.1	7	U.	01			
12	PP	R				1	3	n.	25	12	08			er/Bedrock
13	FT					0	.8		15		05			
14	PP	Z	,			1.	3		15		05	Hab	-E13	
		Dist	(m)	Flag	Slope		Beari					1/par	tialler eriale	i- DE)
ette	d Width	1.61	1.17		xx.x%		0-360	The same of the sa			2-5m	ı/ hai	tially with 5-15m	
r Wi	dth	0	(0)		5,0			(210)			- 5111		2-T2III	>15m
nkfu	ll Width	1.9	(1.7)				3 - 0		0.1 -	0.3)11			
Bank	full Ht	0.4	- '/											
Banki	full + Ht	0.3							0.3 -	0.6				
		%								-		-	N/ 30	+
Inst	ability	0 (arn	101)					(0.6 -	0.8		3.6		
Insta	ability [O (lone	Supel						-					+
mme	ents								> 0.8	3 m				
	upstr	eam	VIV	w	50	100	Tr	115	8.1.1	F	-	DSC	11	/ 1
	Down	ostr			Nou		of	TI			L =			147
	* Hab -	tat	un.		E4	15		hari	CIC	- D	2 1		DSC.	150, 11
							-14	73017	100		<u></u>	01-6	in Re	(See 14
-											_			

e'-

length (m)

pool 5-1,2

1.1+98

rescade 1.0

()

	Habitat fi				Date:	10 11	3114		
te Nan	10.	a Creek			Survey	- 10	JKP JC	P	
te ID:		ver Vasa	C c' D d'	(E f' (3 g' H h'	l i' J j'	K	
ansect				ecidio		5	F	ish 0 =	Absent
ipariar	•	Absent	_		us		Cover	/Other 1 =	Sparse
egetat		Sparse		onifer roadle	of Ever	green	(10 m	x 20m) 2 =	Moderate
over		Moderate			di Evei	giccii			: Heavy
		Heavy		Mixed			32	4 =	Very Heavy
	4 =	Very Heav	y = N = N	vone			Filamentous	Algae	0
	Visual Ripari	an		Diehe	Bank	Flag	Macrophytes		0
	Visual Kipan		Left Bank	Kigni	Dalik	-	Woody Debr		0
		Canopy	(> 5m Tall)				Brush		0
		Curren		-	1		Overhanging	veg	2
/egeta	tion Type		17	-	0		Undercut ba		0
Big Tre			3		0		Boulders/Le		3
Small 1			(C)		0		Artificial Str		3
		Understor	y (0.5 to 5 n	n tall)		zlawn	Bryophytes		0
		Officerstor	7 (0.0			1000	Canopy	Density	
Vegeta	ation		D	-	0		bank		
	y Shrubs & Sa	plings	2		0		Up	12	
Non-V	Voody Herbs	& Grasses			0		Left	14	
			Cover (<0.5	im)			Down	3	
		Glouila	COTOT				Right		
Wood	ly Debris 🗸	Stems	0		0		LB	15	
Non-\	Noody Herbs	& Grasses	3		3		RB	4	
Barre	n, Bare, Dry,	or Duff			0 2	1	- Ko		
Builte		9	Substrate				-		
		AJ				Flog			
	Wet Depth	BF Depth	Size Clas	1	mbed	Flag	RS =	Bedrock (smo	ooth)
LB	- 0	0.35	6F (S					Bedrock (rou	
0.1	0.01	0.36	6F (G	F) 3			The same of the sa	Boulder	
0.2	0.02	0.37		F) 30			1	Cobble	
0.3	0.06	0.41	0/1	F) 3				: Coarse Grav	el
0.4	0.07	0.42		F) 3				Fine Gravel	1000
0.5	0.03	0.43	10		0_			: Sand	
0.6	0.09	0,43	- Lu	(F) 2				Fines	
0.7	12:05	0.40		O	0			= Hardpan	
0.8	0.08	0,43	17	~ ~ ~	フ			= Wood	
0.9	0,09	0.44		SA) 9				= Other	
RB	- 0	0,35	BL (FN W	-				
1.5			6 = 3 6 C3 R1 1 CBZ CBZ	E5 44		الحرر	transe	t 01	DSC 19
Cor	nments	LAPST	reav		NE	W 01	ranse	01	700
201	111101110								
-									
-									

	abitat field fo				Majo	or: @1	135m	Mino	r @67.	5m	Thalwag:	@13.5m
Site Name:	Vasa Cre	ek			Date	(0/1	1//	4			
	ower Vasa				Surv	eyors:		JKP		JCP		
Fransect:		b' C	c' D d	d' E e'	(f f) G g	' H	ı' l i'	J j'	K		
Thalwa			itat Slop		Side		SC					
Depth 0 0 04	Bar Poo		The state of the s		Chan	nel	Wid	th	SC No	otes		
0.1 0.1			29			No			-			
0.1 0.	T(N) Y/N	- 0		ÎU		Vo			-			
0.3	4 Y/N Y/N	- /	6			NO		-	-	_		
	3 Y/N Y/N		2			NO		-	_	_		
0.4 0.0	+ Y/N Y/N		2	50		No		_	-			
- 1/	6 Y/N Y/N		P 19	0	Λ	10			~			
0.6 0 0	Y/N Y/N) 2	10	-	Vu						
	YN YN		12	FU	1	10		_	Bar	1	vidth	=1,0
0.8 0.0	6 MN Y/N	0	3	80		VU	_		1300	- 1	width	= 1.4
Habitat			0	tu.		No			_			
Туре	Code 1	ol Code		HU		Max		Crest			Unit typ	es
1 FT	Code 1	Code	2	Width	1	Pool		Pool			FT- Turb	ulent
2 88	13	-		2.	7			_		151	FN-Non-	Turbulent
3 FT	1 0/			1	4	0.	19	0.	04	155	PS-Scour	Pool
4 79	1 1	77.7		1.0)	-		_	-	1016-1	PD-Dam	med Pool
5 FT	PAT			1	_	0.	15	0.	07	154	PP-Plung	e pool
6 PP	12			-	9				- 1	46-1	SC-Dry c	hannel
7 74	1	-		0			26	0.	071	55	1	
8 PP	BCioncrete	1		1.	8					16b-1	Pool form	ning code
9 ET	N CLUNCY 140	4		1.	9	0.	24	<u> </u>	07	56	N-Not a p	ool
10 PP	B			1.	6				-		9W-LWD	
1 FT	1			2	0		26	0.0	26 1	Blf	R-Rootwa	ad
.2	10	+		0,	5		-	-			B-Boulde	r/Bedrock
3												
4	+											
17-2-1-2	Dist (m)	Flag	Clana	16								4
etted Width	0.7 (18		Slope		Bearin	g				/part	ially withi	n BF)
r Width	0 (0	/	xx.x%		0-360				2-5m		5-15m	>15m
nkfull Width	1. (1,6	7	5.7	- 0	290/2	40)	0.1 -	0.3	_	~		
Bankfull Ht	0,5	4	-			-		arra e		_		
ankfull - Ht	0.5	+					0.3 -	0.6	_	1	-	_
	%					-						
Instability	O (armor		+				0.6 -	0.8	1			A L A
Instability	0	4	1			-		-				
nments							> 0.8	m		.		
	w upstr	00	1	77				+	N 2	\perp		
1/ 0	W LANKI		Det	10	an	8ec		<u> </u>	13	(-	. 151	
* Ital	4	17 + 4	FB	,				250	et	F.	DSC	150
	1. 1 60.7 12/1/	1 1 10 1		15		-	3/1/	ar .				
il		ries		Sma	Ju 5	00/5	STO	am	OF	hr	Joge C	ross,27

(not a bank)

	Habitat fi			Inche:	1/10	1,4		
e Name:	Vas	a Creek		Date:	6/11	JKP JC	P	
e ID:		ver Vasa		Survey	013.		K	
ansect:	Α	a' B b'	C c' D d	E e' F f'	3 g 11 11		sh 0=	Absent
parian	0 =	Absent		Decidious		Cover		= Sparse
egetation		Sparse		Conifer	aroon.		x 20m) 2:	= Moderate
over	2 =	Moderate		Broadleaf Ever	Risen			= Heavy
	3 =	Heavy		Mixed			4	= Very Heavy
	4 =	Very Heav	/y N =	None		Filamentous /	Algae	0
	l Dinari	an .		at the Bank	Flag	Macrophytes		0
VIS	ıal Ripari	all	Left Bank	Right Bank		Woody Debri		12
		Canop	y (> 5m Tall)		Brush		1
			I D	TO		Overhanging		2
egetation/	Type		0	0		Undercut bar		2
Big Trees			1	0		Boulders/Led		0
mall Tree	S		1	, \		Artificial Stru	ictures	0
		Understo	ry (0.5 to 5	m tall)		Bryophytes		0
			TI	TO		Canopy		
Vegetatio Woody Sh	II muhe 9. Cr	nlings	7	0		bank (0-1/)	
Woody Sr	du Horbs	& Grasses	3	2		Up	1. =	
Non-woo	ay nerus			E)		Left	17	
		Groun	d Cover (<0.	5m)		Down	1 +	
Moody D	ehris 🕹	Stems	3	D		Right	16	
Non-Woo	dy Herbs	& Grasses	0	3		LB	15	
	are, Dry,		D	0	1	RB	13	
Darren, C	,,		Substrate			-		
	Ally	N	4	- Embed	Flag			
W	et Depth	BF Depth		4 1	Tiug	RS =	Bedrock (sm	ooth)
LB -	0	0.5		1 1 1 2 2		RR =	Bedrock (ro	ugh)
	.07	0.52		21	-		Boulder	
0.2).02	0-52		7	+		Cobble	
	2.06	0.56	SA	66)100 GF 40		GC =	Coarse Gra	vel
0.4	0,05	0,55		GF) 40	-	GF =	Fine Gravel	
0.5	0.04	0.50		6C) 40		SA =	Sand	
0.6	0.04	0 /54	7	GC 40		FN =	= Fines	
0.7	0.05	0.95		6C)40		HP:	= Hardpan	
0.8	0.05	0.55		6C) 30		WD	= Wood	
0.9	0.04	0,54		SA 100		OT:	= Other	
RB -	0	0.5	BL (GF3				
			EN-54-2	666				
Comm	ents							
						,		

			ld form	5					35m	Minor	@67.	5m '	Thalwag: @	⊋13.5m
	Name:		Creek				Date		6/1	9/1	4			
Site I		er Vas	-					eyors:		JKP		JCP		
Trans		A a	-	C c'		' E e'		G g		' 1 i'	J j'	K		
	Thalwag		Edge	Habita			Side		SC					
	Depth	Bar	Pool	Unit	Bear		Chan	-	Widt	h	SC N	otes		- Property
0		Y/N	Y/N)		27	~	-	20	-		-	1,16.		
0.1	0.04	Y/N	Y/N)	1	20		-	NO		-	130	W	width	1.1
0.2	0.07	Y/N	Y/N	1		50	_	Vo		~	-			
0.3	0.00	Y/10	Ý/N	2	20			10		_	-	-		
0.4	0.10	_	Y/(I)	3		90	_	VD	-			_		
0.5	0.05	YAN	Y/N)	5	-	10		No		-				
0.6		Y/N	Y/N	b	30	10		10						
0.7	0.10		Y/①	7	30	10		0			-			
0.9	0.09	-	Y/N)	9		90		Vo		-	-			
	labitat	17(14)	Y/V Pool	Code	9	70 HU		Vo			_	1,02		
#	Туре	Code		Code 2		Widtl		Max		Crest		6PS	Unit type	
1	FT		Ŋ	coue 2	-	_)	Pool	-	Pool		1.00	FT- Turbu	
2	PS	-	R			-	9		1	12 /	17	159		Turbulent
3	E-Y					0.	9	0.1	6	0,0	17	1	PS-Scour	
4	PP		B	W-5	mall	0	2		18		0.9		PD-Damr	
5	ET		N	10-3	10011	0	2	U.	10		09	160	PP-Plung DC-Dry c	e pool
6	PP	B/Ce	winted)			1	2	17	26	~	08			nannei
7	FT	سي را	V			1	1	0.	2.10	U 1	UD		Pool form	ning and
8	PP	6	PB			8), (0	0	.22	1	09		N-Not a p	
9	FT		V			0				_		16)	W-LWD	0001
10							0					1 4 300	R-Rootwa	he
11												4		r/Bedrock
12														., Dear oak
13												1		
14														
		Dis	t (m)	Flag	Slope		Bearii	ng		L\	ND (a	II/par	tially withi	in BF)
	d Width	2.0	(0.7)		xx.x%		0-360				2-5m		5-15m	>15m
Bar W		0	(0)		5.3	3	270	(320)	0.1 -	03		1	0	Marie Marie
	ull Width	2.8	((6,1)						U.1 -	0.5				
	kfull Ht	0.2							0.3 -	06	M.	11.5		
Bank	full F Ht	0.2							0.5	5.0			8	
		%							0.6 -	0.8				
	tability	10							1.5	5.5				
	tability	10							> 0.8	3 m				
omm		. 1									3 19			Maria No.
			upst	V-101		401	n	Tro	ens	ect	6		DSC	159
-	V:e	-		rstr	1 / /	-	Dt	Tr	an	seci		5:	DSC.	160
	X Hal	1777		-	+ 66		a	ser	125	pt	3	plu	7	
		1/e	+ pt	cuhie	and the last	1000	سر وسال	eam		Of	7	ve	V 1 I.	nice barri

e Name:	bitat field Vasa C			Date:	6/19		
te ID:	Lower	Vasa		Surve	yors:	JKP JCP	
ansect:	A a'		C c' D d'	E e' F f'	G g' H h'	i' j' K	A1
parian	0 = Abs			ecidious		Fish	0 = Absent
egetation	1 = Spa		C = C	onifer		Cover/Othe	
over	•	derate	E = B	roadleaf Eve	rgreen	(10 m x 20m	
ovei	3 = He		M = 1	Mixed			3 = Heavy
		ry Heavy	/ N = N	None			4 = Very Heavy
					Flag	Filamentous Algae	
Visua	l Riparian		Left Bank	Right Bank	riag	Macrophytes	0
						Woody Debris	0
		Canopy	(> 5m Tall)			Brush	2
(a setation T	vne		M	IN		Overhanging veg	2
egetation T	Ahe		3	10		Undercut banks	
Sig Trees			2	Q		Boulders/Ledges	0
mall Trees				1-11)		Artificial Structures	3
	Un	derstor	y (0.5 to 5 n	n tall)		Bryophytes	
Vegetation			D	D		Canopy Densit	У
Woody Shru	he & Sanlin	σς	2	2		bank (0-17)	
Woody Stitu Non-Woody			3			Up 7	
Non-woody						Left	7
		Ground	Cover (<0.5	im)		Down	
Maria de Dala	ris \$ 57	· me	12			Right /	7
Woody Deb			1	1			7
Non-Wood			2	9		RB 1	7
Barren, Bar	e, Dry, or D	S	ubstrate				
Wet		Depth	Size Clas	s Embed	Flag		
LB - 0		2.2	FN (B)	100		RS = Bedroo	
		0-28	the second second production	c) 100		RR = Bedroo	
	08 0	,23		C) 100		BL = Boulde	
	07 0	.27		e5 40		CB = Cobble	
	06 0		-	c) 40		GC = Coars	
	05 0	-		c) 40		GF = Fine G	ravei
	204 0		The second secon	c) 40		SA = Sand	
	0.04 0		-	50)40		FN = Fines	
	0,01			(c) 60		HP = Hardp	
	_	1,24		C 40		WD = Woo	
		0.2	1	31)100		OT = Other	
RB -				, , , ,			
Comment	c			BL-U			
Comment							
					100		
				the state of the s			

<u> </u>			ld form	S			Maj	or: @:	135m	Mino	r @67	.5m	Thalwag:	@13.5m
	Name:		Creek				Date	e:	6/1	9/1	4			
Site I		er Vas					Surv	eyors	6	JKP		JCP		
Trans	Thalwag	A a'		C c'	D d	' E e'		Gg		') I i	' Jj	K		
	Depth	Bar	Edge Pool	Habita			Side		SC					
0		Y/N	YAN	Unit	Bear		Char		Wid		4- 32	otes		
0.1	0.08	Y/N)	Y/N)	1	27	90	1	Jo No	-	-	-	_		
0.2	0.10	Y/N	Y/N)	1	2	_	1/	No	-		-			
0.3	0.09	Y/N	YAND	7	3	00		VD	-	-	1			
0.4	0.03	YN	Y/N)	3		190		VO	-		-		пл	100
0.5	0.08	Y/(N)	Y/N)	1	2	9.0		No	+-	_	Ba	_	width	- 0.9
0.6	10.09	Y/N	Y/80	7	2	60	7	VO	-		1	-		
0.7	0.09		Y/N)	7	9	The state of the s	-	Vio	-	-	Ba	,	width	= 2.5
0.8	0.04	Y/10	Y/N	7	2		-	No	-		Da		WINTIN	- 0,3
0.9	0.08	Y/N	Y/N	7		70		No	-	-	130	-	widt	-17
-	labitat		Pool	Code		HU	- 411	Max		Cres		I p	Unit typ	es
	Туре	Code	1	Code 2		Width	1	Pool		Pool		POW	FT- Turb	
1	FT		V			1.5			_	_		168	FN-Non-	Turbulent
2	PP	W- <	small			0,	9	12	H	0	60	117	PS-Scour	Pool
3	FI		V			1,0			_		-	Hab.	∄BD-Dam	med Pool
4	15	W-5	mall) •	U	0.	16	0	.06	11	PP-Plung	ge pool
5	FT		V			1.	1			_	_		H5DC-Dry c	hannel
7	FT	W	Small	4.3			1	0	19	0.	03	170		
8	99	- 1	- N		-	1.	à			_	-			ming code
9	ET	W-	5 mall			- 1	0	0			03		N-Not a	pool
10				21				-)		Hub-	W- LWD	
11					-								R-Rootw	
12					_								B-Boulde	r/Bedrock
13														
14														
		Dist	(m)	Flag	Slope	Ti	Bearir	וס			M/D /a	II/nar	tially with	in DE\
Vette	d Width	1.0	(1.7)		(x.x%		0-360	-			2-5m	ii/ þai	5-15m	>15m
Bar Wi	dth	0	103		7.9		270				2 3111	-	3 13111	713111
	ll Width	1.5	(2.3)					- 7	0.1 -	0.3	11		11	
	full Ht	0,4							0.3	0.6			1,	
Bank	full F Ht	0.4							0.3 -	0.6]]]	
		%							0.6 -	00				
	ability	40							0.0 -	0.8				
	ability [U							> 0.8	ı m				
omme						,				, , , ,				
	Vie. Vie.	WI	upstr dow	4 .		wine		egun	0	f 7	ro	-	116 1 NC	
Tb													12,)	

1egh 0.9 1.1 1.2

te Na	me: Va	eld forms sa Creek		Date: Survey	6/19/	JKP JCP	
te ID:		ver Vasa		E e' F f' C	g' H h'		
ranse			C C D a	ecidious	-	Fish	0 = Absent
iparia		Absent		onifer		Cover/Othe	
egeta		Sparse		roadleaf Ever	green	(10 m x 20m	1) 2 = Moderate
over		Moderate		Mixed	B. 00		3 = Heavy
		= Heavy					4 = Very Heavy
	4 =	Very Heavy	14-1	T	Class	Filamentous Algae	0
	Visual Ripari	ian	Left Bank	Right Bank	Flag	Macrophytes	0
						Woody Debris	
		Canopy	(> 5m Tall)			Brush	1
loget	ation Type		m	m		Overhanging veg	407
Big Tr			2	2		Undercut banks	2
_	Trees		L.			Boulders/Ledges Artificial Structures	13
Jindii		I I malauskam	(0.5 to 5 n	tall)			0
		Understory	(0.3 to 3 ii			Bryophytes Canopy Densit	v I
	ation		Δ	10		bank (0-17)	
Wood	y Shrubs & S	aplings		1		Up 15	
Non-	Woody Herbs	& Grasses				Left 15	
		Ground	Cover (<0.5	im)		Down 15	1
				12	T	Right 15	
Woo	dy Debris 😽	Stern S	2	3		LB	7
Non-	Woody Herbs	& Grasses	7	1		RB 16	
Barre	en, Bare, Dry,	or Dull	ubstrate				
-		Au					
	Wet Depth	BÉ Depth	Size Clas	s Embed	Flag	RS = Bedroo	ck (smooth)
LB	- 0	0.40	SA (6	F) 100	+	RR = Bedro	
0.1	10.6	0,41		A) 100	+	BL = Boulde	
0.2	0.03	0.43		C) 100		CB = Cobble	
0.3	0.07	0.47	SA 16	-	+	GC = Coars	e Gravel
0.4	0,00	0.91		F) 30 A) 20		GF = Fine G	
0.5	0.01	0.41	-	(A) 20 (F) 20		SA = Sand	
0.6	0.08	0.48	-	20.0		FN = Fines	
0.7	0.03	0.43		(F) 30		HP = Hard	oan
0.8	0.02	0.42		F) 30		WD = Woo	od
0.9	0.01	0.41		FM 30		OT = Other	r
RB	<u> </u>	0.70	0.0	F6			
				,cl			
Co	mments			3.107			
-							
-							

			ld forms				Major:	@1:	35m	Minor	@67.	5m '	Thalwag: (⊋13.5m
	Name:		Creek				Date:		6/1	9/1	4		Device	
Site I	D: Lowe	er Vasa					Survey	ors:		JKP		JCP		
Trans		A a'	' B b'	C c'	D d'	E e'	F f' (G g'	H h	(1 1)) j j'	K		
	Thalwag		Edge	Habita	1 Slope		Side	B	SC				/	
	Depth	Bar	Pool	Unit	Beari	ng	Chann	el	Widt	h	SC.Ne	otes		
0	0.08		Y/N)		220)	N)	_		-			
0.1	0.04		Y/N)	1	123	0	N	D			-			
0.2	0.04	Y/N)	Y/(1)	1	30	40		0	_		_			
0.3	0.15	Y/N	Y/N		4 6	30	N	U		_	-			
0.4	0.04	Y/N	Y/N	3	-	00	1	Ju		~	-		Jo -	- / - /
0.5	6 1/	Y/N Ŷ/N	Y/N)	3	-	70	1	0	_	-	•	MID	Jh - 0	,5 (mido
0.8	0 2	Y/N	Y/N)	3	30	0	IV	D		-	Bar	Wil	21 = 1	.4
0.8	0,06		Y/N	1	1	20		0			186		ulth	= 10+
0.9	0.07	_	Y/N)	1	2	11)	- 1	10						
	Habitat	10	-	Code	0	HU		/lax	- 09	Crest			Unit typ	
#	Туре	Code		Code 2)	Width		ool		Pool			FT- Turb	
1	FT	(N			-	2	-	_	-		170		Turbulent
2	PS		B			0.	9	0.	13	12.	01	179		
3	FY		TV			1			-	~		Holy	D-Dami	
4	FN		V.			2,	4		-	-		Hah =	PP-Plung	e pool
5	FT		N			1		-		-			DC-Dry c	
6														
7													Pool form	ning code
8													N-Not a	oool
9													W- LWD	
10							-						R-Rootw	
12													B-Boulde	r/Bedrock
13			-				-		_					
14											-			
		Dis	t (m)	Flag	Slope	INO IN	Bearing			11	WD (a	II/nar	tially with	in RE)
Wette	ed Width	1.6	(0.0)		xx.x%		0-360				2-5m	y pui	5-15m	>15m
Bar W	/idth	0	(0,5)		7.	_	220(2	770	0.1		1	1/2	1.0	
The same of the sa	ull Width	2.5	(3,1)						0.1 -	0.3	1		[/]	
	kfull Ht	0.3	()						0.3 -	0.5	1.			
L Bank	kfull + Ht	0.4	/						0.5	0.0	}	,		
		%	1				1		0.6 -	0.8		100		W
	tability	0			11/					5.5				
	tability	30		10-					> 0.8	3 m				
Comm		_ 1-			=15.5		1.5				_			
	The second secon		ream		ron		Van	Jul.	cf	I	- V)SC	17	4
-	View	10	OKIN	y d	oul	-	am	0		var	sect	I	1)50	178
	View	<u> </u>	15tr-	eam	10	OKU	1	af	,	tre.	nde	Cf	1 1	SC 18
	7 %	apite	-I W	V-7 7	-	7 1	5 (G	use	20 1	77 7	101 0	1	faller	Tree

	sa Creek		Date:	177						
Lo			Survey	ors:	JKP JCP					
	wer Vasa	C c' D d'	F e' F f'	G g' H h'	- C.	924				
	a' B b'		ecidious	<u> </u>	Fish	0 = Absent				
	= Absent	C = Cd			Cover/Other	1 = Sparse				
	= Sparse			green						
				Breen		3 = Heavy				
						4 = Very Heavy				
4	= Very Heav	y N = N	one		Filamentous Algae	0				
ual Ripar	ian	Left Bank	Right Bank	Flag	Macrophytes	0				
	Canop	y (> 5m Tall)				D				
Type		m	m		Overhanging veg					
Type		3	3		Undercut banks	/				
		Ī	2		Boulders/Ledges					
3		4.5.			Artificial Structures	0				
	Understor	y (0.5 to 5 m	tall)		Bryophytes					
1		D	D		Canopy Density					
	anlings	3	3		bank (0-17)					
		2	2		OP					
ay Herbs	===		,							
	Ground	Cover (<0.5r	n)		Down 17					
hris			12		Might					
	& Grasses	2	2							
		2	2		RB 17					
2. 0, 0. 4)		ubstrate								
	AV	0: 01	Park and	Elag						
t Depth		1.0		Tiag	RS = Bedrock	(smooth)				
0	0.35			-						
0,03	0.38		2			, ==0 ,				
0.05	0.40									
0.05	0.40	7				Gravel				
0.05	0,40		-							
0.07	0.42	-		+						
0.05	0.40	The second second								
0.04	0.39		1			n				
0.03	0.38	4 - 0	1							
v.0>	0.37									
0	0.35		11100		O1 = Other					
nts		663 161								
Vi										
		5								
	Type Type S Type Type S Type Typ	2 = Moderate 3 = Heavy 4 = Very Heav Jal Riparian Canop Type S Understor Trubs & Saplings dy Herbs & Grasses Ground Ebris dy Herbs & Grasses are, Dry, or Duff S A L Depth BF Depth D, 35 D, 05 D, 40 D, 05 D, 37 D, 05 D, 37 D, 35	2 = Moderate 3 = Heavy 4 = Very Heavy N = N Left Bank Canopy (> 5m Tall) Type S Understory (0.5 to 5 m Trubs & Saplings Sy Herbs & Grasses Ground Cover (<0.5r Substrate A D Substrate A C Substrate A C Substrate A C Substrate C Substrate A Substrate C Substrate A Substrate C Substrate Substrate C Substrate C Substrate Su	2 = Moderate 3 = Heavy 4 = Very Heavy N = None Left Bank Right Bank Canopy (> 5m Tall) Type Substrate Left Bank Right Bank Canopy (0.5 to 5 m tall) Canopy (0.5 to 5 m	2 = Moderate 3 = Heavy 4 = Very Heavy N = None Left Bank Right Bank Canopy (> 5m Tall) Type 3 3 1 Understory (0.5 to 5 m tall) Tubs & Saplings By Herbs & Grasses Ground Cover (<0.5m) Substrate t Depth BF Depth Size Class The Count C	2 = Moderate				

e Nam											_			g: @13.5m
e ID:			Cree				Dat	e: 6	1 19	1	1		de Xeile	
				1 6	-1 5		Sur	veyors:		JKP			P	
-				_	C. D	d, E	e' F	f' G g'		1 1		J)	K	
	_	Bar	-						SC					
			-	Uni					Wid	th	SG	Note	S	
-				+						_		_		
-			-	+->	7		1_	No	-	_	R	61	14110	H = 0
		_	-				_	No	~		1		10100	n U
_		-	-	15	_		_	No.		-	1			
-	1 07							No		_				
-	1.07		The second second	1				NO	•	_	Ro	~	WidT	= 0-1
_	1.09	-	THE OWNER OF TAXABLE PARTY.					· V	Pers	_		_	20100	
-	-		Section 2015					No	_			_		
		The Person Name of Street, or other Designation of the Person of the Per		17	-			No	_		13	a	widt	1 - 1
	the same of the sa	Y/N				_		NO	-	-	-			
		6 1		-	_	HU		Max		Crest		T	Unit tv	nes
Type	7	Code	1	Code	2	Widt	h	Pool		Pool				
4	_	- 1	1			1.	3	_		_		18		
	5	h	/			0.	8	0.15		0.	06	_		
		77	V	-		0.	9			_		- V		amed Bool
-		15	>	W-	Sma)].		0,/	6	D.	79	Wor	V-PP-Plun	THEU FOOL
	1	1	V	_		1.		_				the	30C D	
		W-S	mal			1.		12.1	6	().	05	18	5	CHarmer
			V				.7	,			_	thh.	S Pool for	mine es de
P	7	B				1.	0	0,0	101	0	DU	199	N-Not a	ming code
F	7	- 1				1.	2			~	/	Hal	191A/- 11A/D	hooi
	_		,			2.	1	0.2	29	0/	24			
+1			/			0.	9	_		- 010				
										M		เหติว	"D-DOulde	er/ pearock
	-								\neg					
									\neg					
12000			-	Flag	Slope	9 [Bearin	g		LV	VD (a	II/nar	tially with	in DC)
	th	-				6 (, pui		>15m
	, F				4.	2 1	3001	280)			1.4	Ti i i	3 23/11	
	1		4.0)					(J. I - C	0.3	11			E BALL
			1				110			+				-
iuli F F									ル. 3 - 0	.6				- Y
l. 1111	-													
								0	.6 - 0	.8				
_)								-				
					0.00			>	0.8 r	n				
		MP	str	ean	2 /	d.	tro	250	-+	7	,	000	1.	
THE WAY				v-e	in	DF	tro	4050	1 1	T				23
-Vi	ew	NO	str	ean	A 0	f				71	,	030	/ }	101
		U						A. C. Barrier	9	1	4	7)(100
	That Dep 1	Thalwag Depth O O O O O O O O O O O O O O O O O O O	Thalwag Depth Bar O O O Y Y/N 1 O O O Y Y/N 1 O O O Y Y/N 2 O O O Y Y/N 3 D O Y/N 4 D O Y Y/N 5 O O Y/N 8 O O Y/N 9 O O O Y/N Habitat Type Code FT PP P	Thalwag Edge Depth Bar Pool 0 0 0 7 Y/N Y/N 1 0,05 Y/N Y/N 2 0,05 Y/N Y/N 3 0.09 Y/N Y/N 4 0,04 Y/N Y/N 5 0,07 Y/N Y/N 6 0.08 Y/N Y/N 7 0.05 Y/N Y/N 8 0.05 Y/N Y/N 9 0,16 Y/N Y/N 1 PP	A a' B b' C Thalwag	A a' B b' C c' D Thalwag Depth Bar Pool Unit Be O O	## Proof Depth Bar Pool Unit Bearing	Suransect: A a' B b' C c' D d' E e' F	Surveyors: Surveyors: Surveyors: Surveyors: Surveyors: Thalwag Edge Habitat Slope Side Channel Channel	Surveyors: Surveyors: Surveyors: Surveyors: Side Thalway Edge Habitat Slope Side Sc Sc Sc Side Sc Sc Side Sc Side Sc Sc Side Sc Sc Sc Side Sc Sc Sc Sc Sc Sc Sc S	Surveyors: JKP JKP	Surveyors JKP Surveyors Surveyors Surveyors Surveyors Surveyors Surveyors JKP Surveyors Surveyors Surveyors Surveyors JKP JKP Surveyors JKP JKP Surveyors JKP JKP	Surveyors: JKP JKP	Surveyors JKP JCP

	Habitat fie	ld forms		Date:	6/19	14		
te Name		Creek		Surveyo		JKP JCF		
te ID:		er Vasa	c' D d' E	e' F f' G	g' H h'	1 i' (J j') k		= Absent
ansect:			D = Deci	dious		• • •)	
iparian		Absent	C = Coni			Cover		= Sparse = Moderate
egetatio		Sparse		dleaf Everg	reen	(10 m :		= Heavy
over		Moderate	M = Mix					= Very Heavy
		Heavy Very Heavy	N = Nor					= Very fices,
	4 =	Very ricavy			Flag	Filamentous A	ligae	0
V	isual Riparia	an	eft Bank R	ight Bank	,,,,,,	Macrophytes		2
						Woody Debri		
		Canopy	(> 5m Tall)			Brush Overhanging	veg	2
Vegetati	on Type		m	D		Undercut bar		0
vegetati Big Tree:			2	2		Boulders/Led		
Small Tr			0			Artificial Stru		0
Jilluli 11		Understory	(0.5 to 5 m t	all \		Bryophytes		U
		Uniderstory	<u> </u>	7		Canopy [Density	
Vegetat	ion			7		bank (
Woody	Shrubs & Sa	plings	3	1		Up	15	
Non-W	oody Herbs	& Grasses			1	Left	16	
		Ground	Cover (<0.5m)		Down	13	
		- lo -	2	2		Right	15	
Woody	Debris ₹	8. Grasses	Ī			LB	1	
Non-W	oody Herbs	or Duff	2	2		RB	1 /	
Barren	, Bare, Dry,	S	ubstrate					
-		1.1		- 1 - 4	Flag			
	Wet Depth	BF Depth	Size Class	Embed	Flag	RS =	Bedrock (sn	nooth)
LB	0	0.36	FN (SA)	100		RR =	Bedrock (ro	ough)
0.1	0.04	0.39	SA (SA)	/			Boulder	
0.2	0.04	0.39	GF (SA	-	+	CB =	Cobble	
0.3	0.06	0,41	GF GF		1		: Coarse Gra	
0.4	0,06	0.41	A	130			Fine Grave	1
0.5	0.06	0.41		10			: Sand	
0.6	0.05	0,40	180	-	1		= Fines	
0.7	0.07	0.42	<u> </u>				= Hardpan	
0.8	0.06	0,41	6C (SP				= Wood	
0.9	0.03	0.38	CB GA	A 0		от	= Other	
RB	1-V	V,00	GF3 Sal	-	21-20			
			GC 3 1 GC					
Com	ments		CIT					

()

	Hab	itat fie	ld form	ns		_	M	aior: @1	135m	Mino	r @67 '	5m	Thalwag:	@12 Fm
Site N	ame:	Vasa	Creek				Da	ate:	6	119	114	2111	maiwag.	w13.5m
Site ID	: Low	er Vas	a		No.		Su	rveyors		JKP		JCP		
ranse		A a	' B b	' C (c' D	d' E	e' F	f' G g	' H		' J j'	(K		
	Thalwag		Edge	Habi	tal Slo	pe	Sic		SC			-		
_	Depth	Bar	Pool	Unit		aring	Ch	annel	Wic	lth	SC No	otes		
0	0.04	Y/N	Y/N)		13	30		N	_	_	_	_		
0.1		Y/N	Y/N											
0.2		Y/N	Y/N											
0.3		Y/N	Y/N										-	
0.4		Y/N	Y/N									_		
0.5		Y/N	Y/N											
0.6		Y/N	Y/N				\top							
0.7		Y/N	Y/N											
8.0		Y/N	Y/N								-	-		
0.9		Y/N	Y/N			SI TO			-			-		
Ha	abitat		Pool	Code		HU		Max		Crest		-	Unit typ	
T	уре	Code	1	Code	2	Wid	th	Pool		Pool			FT- Turb	
1 F	T	1				10	a	1.001	_	_				uient Turbulent
2						1							PS-Scour	
3														
1				1			2			-				med Pool
5						+-		-		-			PP-Plung	
6						1							DC-Dry c	nannel
7						-		+		 			0. 16	
8						+-				_				ning code
9					TYTE								N-Not a	000
0						_		-					W- LWD	
1						+							R-Rootwa	
2						-							B-Boulde	r/Bedrock
3						_		+						
4						-		+						
		Dist	(m)	Flag	Slope	9	Bea	ring		- 11	A/D /all	lnaut	.:_Utal.:	0.51
tted	Width	no			xx.x9		0-36	-			2-5m	pari	ially withi	
Wid	th	0	<i>'</i>		1000		331				2-3111	_	5-15m	>15m
kfull	Width	1.4			Dir IV	70	ارر		0.1	- 0.3				
ankfu	ıll Ht	0.3	,									_		
nkfu	III F Ht	0.5	-		1				0.3	0.6				
	-	%						+						
nstal	bility [0							0.6	0.8				
	oility	0						-		-		-		
nmer	nts				ļ				> 0.8	8 m				
	Vien) ,	ipst	ner	100	01		-			1 10		0/:	
	VIPU	-	LOOK		VV	154		tra	4		L K		NSC	·· 191
	VIEC		CUE	ry	90	MO! F	rea	n 17	+ 1	vans	1ct	15	, 050	19=

		eld forms		Date:	6/19	114
te Name:		a Creek		Surveyo	ors:	JKP JCP
te ID:		ver Vasa	C c' D d' E	o' E f' G		1 i' J j' (K)
ansect:			D = Dec	idious		Fish 0 = Absent
iparian		Absent				Cover/Other 1 = Sparse
egetation		Sparse	C = Cor		reen	(10 m x 20m) 2 = Moderate
over	2 =	Moderate		adleaf Ever	green	3 = Heavy
	3 =	Heavy	M = M			4 = Very Heavy
	4 =	Very Heav	y N = No	ne		Filamentous Algae
	-1 Dimori	20			Flag	Macrophytes
Visua	al Ripari	all	Left Bank	Right Bank		Woody Debris
	***************************************	Canon	y (> 5m Tall)			Brush
		Carlop	y (- 1		Overhanging veg
/egetation	Туре		0	MI		Undercut banks
Big Trees			3	3		Boulders/Ledges 3
Small Trees						Artificial Structures
J.11411 11 000		11mdounts	ry (0.5 to 5 m t	all)		Bryophytes 3
		Ungerstol	1 y (0.5 to 5 m)		Canopy Density
Vegetation	7 71 00		D	D		bank (0-17)
Woody Shr	ubs & Sa	plings		3		
Non-Wood	v Herbs	& Grasses	I I		<u> </u>	Up 1 1
14011-44000	ly Hense		10 (40 Em	.,		Left /
		Ground	d Cover (<0.5m	"		Down 17
Waady Do	bris 1	Stems	7	2		Right
Woody De	dy Works	& Grasses				LB 16
Non-wood	TA LIELDS	or Duff	2	2		RB / f
Barren, Ba	ite, Diy,	Of Duit	Substrate	process and the second	2019	
-		A .	Provide the last			
Wet	t Depth	ВF Depth	Size Class	Embed	Flag	RS = Bedrock (smooth)
LB -	7)	D.柳叶		50		RR = Bedrock (rough)
).02	0.42	CB	30		
	0.03	0.43	SA	100		BL = Boulder
		0.44	SA	100		CB = Cobble
	0.04	0.44	SA	100		GC = Coarse Gravel
0.4		0.43	GC	40		GF = Fine Gravel
	5.03	0.43	SK	100		SA = Sand
	0.03	0.42	A	100		FN = Fines
	0.00	0.42		100		HP = Hardpan
	<u>0.07</u>	0,40	SA	100		WD = Wood
0.9	0.01	0,41		100		OT = Other
RB -	0	0.1	1 SA	11.0		
			548			
	nts		(B)			
Comme						
Comme						
Comme						

		tat field		S			Maj	or: @1	135m	Mino	e @67.	.5m	Thalwag: (@13.5m
_	Name:	Vasa C	Creek				Date	e: 6	118	3/14	1			
Site		er Vasa						veyors:		JKP		JCP	-	
Trar	sect:	-		C c	' D c	'E e	' F 1	f' G g	' H h	1' i'	J j'	К	(Lis	3 tn/b)
	Thalwag		Edge	Habit	at Slop	е	Side		SC					
	Depth		Pool	Unit	Bear		Cha	nnel	Widt	th	SC N	otes		
(Y/N)		30	0		NO		_	-	-		
0.3	0.01		Y/(N)	5	0			NO	-	-		-		
0.2		The second second	N	10	1	2		VD	-	_	_	_	Shaning.	
0.3	10		/)N	16		10		NU		_	-	_		
0.4	0.00		//Ñ)	17		10		No			-	_		
0.5		Y/N Y	//N											
0.6		Y/N Y	//N				100							
0.7		Y/N Y	//N											
0.8		Y/N Y	//N											
0.9		Y/N Y	/N											
	Habitat		Pool	Code	545	HU		Max		Crest			Unit type	95
	Туре	Code 1		Code	2	Widt	h	Pool		Pool			FT- Turbi	
1	FT	N				D.				-		127		Turbulent
2	PP	W				2	. 4	0.	37	12.	04	Trob:	PS-Scour	
3	FT	N				1.	1			-		ty.b	PD-Damr	med Pool
4	PP	W				2	.3	0.	31	0,0		128	PP-Plung	e nool
5	PN	N				1	2	-				Tr.b	DC-Dry c	hannel
6	PP	W				2.	.0	0.	35	D.	24	129	Je Diy C	ilanii ei
7	FT	1		744		1.	2	-	_	1/0				ning code
8							(//:						N-Not a p	_
9													W-LWD	0001
10													R-Rootwa	ad
11														r/Bedrock
12												- 7	D Doulde	I/ BEGIOCK
13														
14														
		Dist (m)	Flag	Slope		Beari	ng		L\	ND (al	I/par	tially withi	n RF)
ette	d Width	0.9			xx.x%		0-360				2-5m	,, pu.	5-15m	>15m
	idth	0			Ч.		320						3 23111	\
ankf	ull Width	1.7							0.1 -	0.3		į		
Ban	kfull Ht	0.4												
Banl	full Ht	0.3							0.3 -	0.6	1111			
		%									The same of the sa			
3 Ins	tability	20							0.6 -	0.8				
Ins	ability	40			14									
mm	ents								> 0.8	3 m				
	View	2 w	PSt	rear	\sim	n F	Tri	6	ra.	~ ^	ct.	05	C 12) / A ! !
	Vie	1	1	n < 7	~ec		av		Tr					26 A1501
		5 95	1777	5 8		AL			1		-anc			,
n:t	60 POOL	- V I	-	1. 1		05	109	5 U	2/1	10 Te	h C	-	out (Placed)
nit	6 POUL		210	1 < 0	1 1	1 11	the Control	(4	16	17 4	April 100			411
rit He	6 POOL				of of		- 21	10:11	35	th 5		ulv	ert ou	illet
vit	050		31	01	oto	0-1	r 04,	Sid		1. tol	- 12.		56 25	atlet 15 st artal h

1erg 12 2.0

1.5

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		ield forms		Date:	6/19/	14	
te Nam	<u>. </u>	sa Creek		Survey		JKP JCP	
ite ID:		wer Vasa	c cl D di	E e' F f' C		1 i' J j' K	
ransect			D = D	ecidious		FISH	= Absent
iparian		Absent	C = Co			6000.70	= Sparse
egetati	0	Sparse Moderate		oadleaf Ever	green	(TO III X TO III)	= Moderate
over			M = N				= Heavy
		= Heavy = Very Heavy					= Very Heavy
	4	= very neavy			Flag	Filamentous Algae	
1	/isual Ripar	ian	Left Bank	Right Bank	riag	Macrophytes	
						Woody Debris	
		Canopy	(> 5m Tall)			Brush	1
Vogetat	ion Type		(0		Overhanging veg	1)
vegetar Big Tree		t	3	3		Undercut banks	2
Small T			2	12		Boulders/Ledges	0
Jiiiali I		11	(0.5 to 5 m	tall		Artificial Structures	0
		understor	(0.5 to 5 iii			Bryophytes Canopy Density	
Vegeta	tion		D	P		bank (0-17)	
Woody	Shrubs & S	aplings	1	12		Up 17	
Non-W	oody Herbs	& Grasses	2			Left 17	
		Ground	Cover (<0.5	m)		Down 17	
	depline.			12	T	Right 17	
Wood	Debris/5	terms	2	1		LB 17	
	loody Herbs		-	2		RB 17	
Barrer	, Bare, Dry,	or Duff	ubstrate	0		5-1	
-			upstrate				
	Wet Depth	BF Depth	Size Class	Embed	Flag	Do Badrock (cm	nooth)
LB	- O	0.35	SA	100		RS = Bedrock (sn RR = Bedrock (ro	
0.1	0.01	0.36	SA	100		BL = Boulder	чь.,
0.2	0.04	0-39	SA	100		CB = Copple	
0.3	0,06	0.41	SA	100		GC = Cobble	vel
0.4	0,09	0.44	SA	100		GF = Fine Grave	
0.5	0.09	0.44	5A	100	ere e	SA = Sand	
0.6	0.12	0.47	GC	20		FN = Fines	
0.7	0.10	0.45	10C	30		HP = Hardpan	
0.8	0.05	0,40	BL	100		WD = Wood	
0.9	0.04	0.39	SA	100	-	OT = Other	
RB	- D	0.35	SPT	100			
			5. 8				
Com	ments		GCL	- 			

	Vasa Creek Fish Habitat Assessment
	ATTACHMENT C
Lower Vasa Outfall Reconn	AISSANCE INVENTORY/SAMPLE COLLECTION FIELD FORMS
	OOLLEGITOR FILLD FORWIS
	OOLLEGITOR FILLD FORWIS
	OOLLEGITOR TILLD TOKINS
	OOLLEGITOR TILLD TOKINS
	OOLLEGITOR TILLD TOKING
	OCCLEGITOR TILED TOKING
	OCCLEGITOR FILED FORWIS
	COLLEGITOR FILED FORWIS

OUTFALL RECONNAISSANCE INVENTORY/ SAMPLE COLLECTION FIELD SHEET

Subwatershed: Va	sa Greek		Outfall ID:	F_+1	
Today's date: 6	14/14	12/2/12/12	Time (Military):		
Investigators: TC	Pand TKP		Form completed	1 by: Jeff Phillips	(Tetra Tecl
Temperature (°F):	Rain	fall (in.): Last 24 hours	: Last 48 hou	urs:	
Latitude:	Longitude:		GPS Unit:	GPS LMK	#:
Camera: Gove			Photo #s:	5000120	
Land Use in Drainage	Area (Check all that apply):	"在一场大学"下。			
☐ Industrial			Open Space		
Ultra-Urban Reside	ential		☐ Institutional		
Suburban Resident	ial		Other:		
☐ Commercial			Known Industri		
Notes (e.g., origin of c	untfall if known):		Known maasin	Co	
Notes (e.g., origin of c	outian, ii known).				
Section 2: Outfall	Description				
LOCATION	MATERIAL	S	HAPE	DIMENSIONS (IN.)	SUBMERGED
	□ RCP □ CMP	Circular	Single	Diameter/Dimensions:	In Water:
	PVC HDPE	☐ Eliptical	☐ Double	4 inch	No Partially
Closed Pipe	☐ Steel	Box	☐ Triple	la a iMeha Kat	☐ Fully
	☐ Other:	☐ Other:	☐ Other:	1 - 1 - 1	With Sediment:
	Culci.	U Other.	Culci.		☐ Partially
	Concrete				Fully
		☐ Trapezoid		Depth:	
Open drainage	Earthen	Parabolic		Top Width:	
	rip-rap	☐ Other:		Bottom Width:	
	Other:				
☐ In-Stream	(applicable when collecting	g samples)			
Flow Present?	☐ Yes ☐N	o If No, S	Skip to Section 5		
Mow Description (If present)	☐ Trickle ☐ Modera	te Substantial			
ection 3: Quantit	ative Characterization				
		FIELD DATA FOR	FLOWING OUTFA	LIS	
PARA	METER	RESULT		UNIT	QUIPMENT
☐Flow #1	Volume			Liter	Bottle
Callion wi	Time to fill			Sec	
	Flow depth			In 1	Tape measure
Flow #2	Flow width	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		Ft, In	Tape measure
had a town	Measured length	<u> </u>		Ft, In	Tape measure
	Time of travel			S	Stop watch
Тетр	erature			°F	Thermometer
I	Н			pH Units To	est strip/Probe
Am	monia			mg/L	Test strip

Outfall Reconnaissance Inventory Field Sheet

THEOTON CHECK IF	CHECK if	1		7
INDICATOR	Present	DESCRIPTION	RELATIVE SEVERITY INDEX (1-3)	
Odor	0	☐ Sewage ☐ Rancid/sour ☐ Petroleum/gas ☐ Sulfide ☐ Other:	☐ 1 — Faint ☐ 2 — Basily detected ☐ 3 — No	☐ 3 – Noticeable from a distance
Color	0	☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ ☐ Green ☐ Orange ☐ Red ☐ ☐ Other:	☐ 1 – Faint colors in ☐ 2 – Clearly visible in ☐ 3 – Clearly visible in outfle	3 - Clearly visible in outfall flow
Turbidity		See severity	☐ 1 — Slight cloudiness ☐ 2 — Cloudy ☐ 3 — Opaque	Opaque
Floatables -Does Not Include Trash!!	0	☐ Sewage (Toilet Paper, etc.) ☐ Suds ☐ Petroleum (oil sheen) ☐ Other: not	□ 1 – Few/slight; origin	3 - Some, origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials)
Section 5: Physical Indicators for Both Flowing and Nor Are physical indicators that are not related to flow present?	dicators for Both	Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls Are physical indicators that are not related to flow present? Yes No	16)	
INDICATOR			COMMENTS	
Outfall Damage	CHECK If Present	DESCRI	COMMENTS	
Deposits/Stains	CHECK If Pr	DESCRI bling, Cracking or Chipping prosion		
Abnormal Vegetation	CHECK If Pr	DESCRI	Pale et	
Poor pool quality	CHECK If Pr	DESCRI palling, Cracking or Chipping prosion Flow Line Paint passive Inhibited	A W. at	
Pipe benthic growth	CHECK If Pr	pescral palling, Cracking or Chipping or C		
Southern 6: Owner II Out	CHECK If PY	pescripting, Cracking or Chipping orrosion Flow Line Paint ssive Inhibited Solution Property Paint state Property Prop		
DECIMON OF CARLSH ON	Outfall Damage Outfall Damage Deposits/Stains Abnormal Vegetation Poor pool quality Pipe benthic growth '	DESCRI Spalling, Cracking or Chipping Corrosion Oily Flow Line Paint Excessive Inhibited Suds Excessive Algae Brown Orange Gr	100 000 100 000	
Unlikely [CHECK IF Pr	Spalling, Cracking or Chipping Corrosion Oily Flow Line Paint Excessive Inhibited Suds Colors Flow Excessive Algae Brown Orange Gr		
Unlikely Pote Section 7: Data Collection	CHECK If Pr	Spalling, Cracking or Chip Corrosion Oily Flow Line P Excessive Inhibited Suds Excessive A Brown Orange		
Unlikely Section 7: Data Collec 1. Sample for the lab?	CHECK If Pr	Spalling, Cracking or Chip Corrosion Oily Flow Line Flo		
Section 7: Data Collect 1. Sample for the lab? 2. If yes, collected from:	CHECK If Pr	Spalling, Cracking or Chip Corrosion Oily Flow Line P Excessive Inhibited Odors Colors Excessive A Suds Excessive A Brown Orange Yes No		

Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?

OUTFALL RECONNAISSANCE INVENTORY/ SAMPLE COLLECTION FIELD SHEET

Subwatershed:	asa Creek		Outfall ID:	Outfall ID: 0 F H 2			
Today's date:	119/14		Time (Military)				
Investigators:	TCP +T	م ح	Form complete	dby: Jeff Philles	(Tetra Te		
Temperature (°F):		Rainfall (in.): Last 24 hour	rs: Last 48 ho	urs:			
Latitude:	Long	gitude:	GPS Unit:	GPS LMK	/ :		
Camera: 69vn	nin .		Photo #s:	56000157			
Land Use in Drainage	Area (Check all that appl	y):					
☐ Industrial			Open Space				
Ultra-Urban Resid	lential		☐ Institutional				
Suburban Residen	tial		Other:				
			Known Industri				
Notes (e.g., origin of			Kilowii ilidusii	ics			
Section 2: Outfall	Description						
LOCATION	MATERIA		SHAPE	DIMENSIONS (IN.)	SUBMERGED		
	□ RCP □	CMP Gircular	Single	Diameter/Dimensions:	In Water:		
	□ PVC □	HDPE Eliptical	☐ Double	8 inch	☐ Partially		
Closed Pipe	☐ Steel	Вох	☐ Triple		☐ Fully		
	Other: Corcu	Other:	Other:		With Sediment:		
					Partially Fully		
	Concrete				Liruty		
	☐ Earthen	☐ Trapezoid		Depth:			
Open drainage		☐ Parabolic		Top Width:			
	☐ rip-rap	Other:		Bottom Width:	17 40 4 4		
M	Other:						
In-Stream	(applicable when co	TO RESIDENCE THE PROPERTY OF SPECIFICATION OF SPECIFICATI					
Flow Present?	☐ Yes	No If No.	Skip to Section 5		JEY LILE		
Flow Description (If present)	☐ Trickle ☐	Moderate	145-	14 (5)			
ection 3: Quanti	tative Characterizat		2140 196 0.000		The control of the co		
		No. 2010 The second of the sec	FLOWING OUTFA				
PAR	AMETER	RESULT	14.4.8% 除 数	100/31 E11/15 14-14-14-1	QUIPMENT		
Flow#i	Volume			Liter	Bottle		
-	Time to fill			Sec			
	Flow depth		3		Tape measure		
Flow #2	Flow width				Tape measure		
-	Measured length	, , , , ,			Tape measure		
	Time of travel			S	Stop watch		
	perature				Thermometer		
	pH			pH Units T	est strip/Probe		
Am	monia			mg/L	Test strip		

Outfall Reconnaissance Inventory Field Sheet

INDICATOR	CHECK if Present	216-0	RELATIVE SEVERITY INDEX (1-3)
Odor	0	☐ Sewage ☐ Rancid/sour ☐ Petroleum/gas ☐ 1 - ☐ 1 -	☐ 1 — Faint ☐ 2 — Basily detected ☐ 3 — Noticeable from a distance
Color	0	☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ 1 -	☐ 1 — Faint colors in ☐ 2 — Clearly visible in ☐ 3 — Clearly visible in sample bottle cample bottle ☐ 3 — Clearly visible in outfall flow
Turbidity		See sevenity	☐ 1 - Slight cloudiness ☐ 2 - Cloudy ☐ 3 - Opaque
Floatables -Does Not Include Trash!	0	☐ Sewage (Toilet Paper, etc.) ☐ Suds ☐ 1 – Few/ not obvious	☐ 1 – Few/slight; origin of origin (e.g., obvious oil sheen, suds, or floating sanitary materials)
Section 5: Physical Indicators for Both Flowing and Nor Are physical indicators that are not related to flow present?	licators for Both I that are not related	Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls Are physical indicators that are not related to flow present? Yes No (If No, Skip to Section 6)	
INDICATOR			
Outfall Damage	CHECK if Present	Sent DESCRIPTION	COMMENTS
Deposits/Stains	CHECK If Pre	Spalling, Cracking or Chi	
Abnormal Vegetation	CHECK If Pre	DESCRIPTION □ Spalling, Cracking or Chipping □ □ Corrosion □ Oily □ Flow Line □ Paint □ □	
Poor pool quality	CHECK If Pre	DESCRIPTION □ Spalling, Cracking or Chipping □ Corrosion □ Chipping □ □ Corrosion □ Chipping □ □ Chipping □ □ Chipping □ □ Chipping □ Chippin	
	CHECK If Pre	DESCRIPTION Spalling, Cracking or Chipping	
Pipe benthic growth	CHECK If Pre	Spalling, Cracking or Chipping	
Pipe benthic growth ' Section 6: Overall Out	CHECK If Pre	Brown ☐ Orange ☐ Green	
Pipe benthic growth Section 6: Overall Out Unlikely	CHECK If Pre	Spalling, Cracking or Chipping	
Pipe benthic growth Section 6: Overall Out Unlikely	CHECK if Pre	Spalling, Cracking or Chipp Corrosion Oily Flow Line P Excessive Inhibited Suds Colors Suds Brown Orange	
Pipe benthic growth Section 6: Overall Out Unlikely Section 7: Data Collect Section 7: Data Collect Section 7: Data Collect	CHECK If Pre	D Spalling, Cracking or Chipp Corrosion □ Oily □ Flow Line □ Pr □ Excessive □ Inhibited □ Suds □ Colors □ Suds □ Excessive Al □ Brown □ Orange □ Yes □ No	
	CHECK if Pre	Spalling, Cracking or Chipp Corrosion Corrosion Corrosion Corrosion Recessive Inhibited Colors Suds Colors Colors Excessive Al Colors Co	

Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?

OUTFALL RECONNAISSANCE INVENTORY/ SAMPLE COLLECTION FIELD SHEET

Subwatershed: \/a	sa Creek		Outfall ID:	Outfall ID: 0F_H3			
Today's date:	119/14	14 12 12	Time (Military)	:	A		
Investigators:	CP'4 TKP		Form complete	d by: Jeff Phillips	Ctetra To		
Temperature (°F):	Rain	fall (in.): Last 24 hour	s: Last 48 ho	Last 48 hours:			
Latitude:	Longitude:		GPS Unit:	GPS Unit: GPS LMK #:			
Camera: Garr	nh		Photo #s:	15C00n 138			
Land Use in Drainage	Area (Check all that apply):						
☐ Industrial			Open Space				
Ultra-Urban Reside	ential		☐ Institutional				
Suburban Resident	ial		Other:				
☐ Commercial			Known Industri				
Notes (e.g., origin of c	outfall, if known):						
ection 2: Outfall		de la company	3496		Al-Car		
LOCATION	MATERIAL	S	HAPE	DIMENSIONS (IN.)	SUBMERGE		
	RCP CMP	Circular	Single	Diameter/Dimensions:	In Water:		
	PVC HDPE	☐ Eliptical	Double	4 meh	Partially Fully		
Closed Pipe	☐ Steel	☐ Box	☐ Triple				
	☐ Other:	☐ Other:	Other:		With Sediment: No Partially Fully		
	Concrete		THE PARTY	D. d.			
	☐ Earthen	Trapezoid		Depth:			
Open drainage	☐ rip-rap	☐ Parabolic		Top Width:			
	☐ Other:	Other:		Bottom Width:			
In-Stream	(applicable when collecting	z samples)					
Flow Present?	☐ Yes ☐ Ŋ	A STATE OF THE PARTY OF THE PAR	Skip to Section 5		CV PETERSON (VIII)		
lilow Description (If present)	☐ Trickle ☐ Modera		AR-P.				
ection 3: Quantit	ative Characterization						
		FIELD DATA FOR	FLOWING OUTFA	LLS .			
PARA	METER	RESULT		UNIT E	QUIPMENT		
Flow #1	Volume			Liter	Bottle		
	Time to fill			Sec			
	Flow depth		2 1 1		Tape measure		
Flow #2	Flow width	,			ape measure		
	Measured length	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			Tape measure		
	Time of travel				Stop watch		
Total Control of the	erature				Thermometer		
ļ	Н			pH Units Te	est strip/Probe		
Amı	monia			mg/L	Test strip		

Outfall Reconnaissance Inventory Field Sheet

2 - Easily de 2 - Clearly 2 - Cloudy 2 - Cloudy 2 - Some; in of origin (possible si sheen)	Clow 1 - Faint colors in 2 - Easily down content 1 - Faint colors in 2 - Clearly of Sample bottle 2 - Clearly of Sample bottle	er:	w ☐ 1 – Faint colors in ☐ sample bottle sai		cloudiness	slight; origin	Mary E	DESCRIPTION	Peeling Paint Cracked,		☐ Excessive ☐ Inhibited				□ No	☐ Yes ☐ No ☐ Flow ☐ Pool
2 - Easily detected 2 - Clearly visible in mple bottle	2 - Clearly visible in mple bottle 2 - Cloudy 2 - Cloudy 2 - Some; indications of origin (e.g., possible suds or oil sheen) COMMENTS 100 k S 1		y visible in	The state of the s		2 - Some; indications of origin (e.g., possible suds or oil sheen)		COMMENTS	ched looks like	4						

Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?

Vasa	Creek	Fish	Habitat	Assessment

ATTACHMENT D

DIGITAL DELIVERABLES (PROVIDED SEPARATELY)

Attachment D contains a summary of digital data that will be delivered separately including: 1) GPS point locations and associated digital photographs, and 2) a list of the GIS data that will be included the project geodatabase.

1) Photolog of Digital Photographs

DSC00109 20140618	Photo Name	Point Type	Latitude Longitude	Time	Comments
Transect A us Photo -122.11260800 17:20:49 Transect A DSC00110 20140618 47.57855200 2014/06/18 Downstream shot of Transect A ds Transect A ds Transect A 47.57851300 2014/06/18 DSC00111 20140618 47.57843000 2014/06/18 A2 PS Pool -122.11292600 17:30:16 Plunge Pool DSC00112 20140618 47.57843000 2014/06/18 Upstream shot of minor transect looking at road crossing DSC00113 20140618 47.57839600 2014/06/18 Upstream view from transect looking at road crossing DSC00114 20140618 47.57839600 2014/06/18 Upstream view from transect Booking at road crossing Transect B us Photo -122.1133000 17:50:55 from Transect Brown Transect Booking at road crossing DSC00113 20140618 47.57803000 2014/06/18 Upstream shot of Transect Brown Transect Booking at road crossing Transect B us Photo -122.11526300 18:19:38 Transect Brown	DSC00109 20140618		47.57852500	2014/06/18	Upstream view from
Transect A ds Transect -122.11261500 17:22:30 Transect A DSC00111 20140618 A2 PS 47.57851300 2014/06/18 Plunge Pool DSC00112 20140618 a' and crossing 47.57843000 2014/06/18 Upstream shot of minor transect looking at road crossing DSC00113 20140618 a' and crossing Transect -122.11310300 17:37:05 crossing DSC00113 20140618 Transect B us Photo -122.11335900 17:50:55 fromTransect B DSC00114 20140618 Transect B ds 47.5780700 2014/06/18 Downstream shot of TromTransect B DSC00118 20140618 B4 PP 47.57804300 2014/06/18 Downstream shot of Minor transect B DSC00119 20140618 B8 and b' us 47.57804300 2014/06/18 Upstream shot of minor transect B DSC00112 20140618 B10 PS 47.57804300 2014/06/18 Upstream shot of minor transect B DSC00122 20140618 B10 PS 47.57804300 2014/06/18 Upstream shot of minor transect B DSC00122 20140618 B12 PS 47.57810300 2014/06/18 Upstream shot of minor transect B DSC00122 20140618 B12 PS 47.57810300 2014/06/18 Upstream view from Transect C	Transect A us	Photo	-122.11260800	17:20:49	
DSC00111 20140618	DSC00110 20140618		47.57855200	2014/06/18	Downstream shot of
A2 PS	Transect A ds	Transect	-122.11261500	17:22:30	Transect A
DSC00112 20140618	DSC00111 20140618		47.57851300	2014/06/18	
DSC00112 20140618 a' and crossing Transect 47.57843000 2014/06/18 17:37:05 transect looking at road crossing at road crossing DSC00113 20140618 Transect B us Photo -122.11313900 17:50:55 fromTransect B DSC00114 20140618 Transect B ds 47.57800700 2014/06/18 Downstream shot of FromTransect B DSC00118 20140618 B4 PP 700l -122.11526300 18:19:38 Transect B DSC00119 20140618 B8 and b' us 47.57804300 2014/06/18 Upstream shot of minor transect DSC00119 20140618 B3 and b' us 47.57799600 2014/06/18 Upstream shot of minor transect DSC00120 20140618 B10 PS 47.57805500 2014/06/18 Upstream shot of minor transect DSC00121 20140618 B10 PS 47.57814800 2014/06/18 Upstream shot of minor transect DSC00122 20140618 B12 PS Pool -122.11608400 19:03:32 Outfall DSC00122 20140618 B12 PS Pool -122.1163900 19:17:49 Scour Pool DSC00123 20140618 Transect C us 47.57804800 2014/06/18 Upstream view from Transect C DSC00124 20140618 Transect LB Trib us and LBT2 PP 47.57807300	A2 PS	Pool	-122.11292600	17:30:16	Plunge Pool
a' and crossing Transect -122.11310300 17:37:05 crossing DSC00113 20140618 47.57839600 2014/06/18 Upstream view from Transect B DSC00114 20140618 47.57800700 2014/06/18 Downstream shot of Transect B DSC00118 20140618 47.57804300 2014/06/18 Downstream shot of Transect B DSC00118 20140618 47.57804300 2014/06/18 Dransect B B4 PP Pool -122.11585400 18:38:51 Plunge Pool DSC00119 20140618 47.57799600 2014/06/18 Upstream shot of minor transect B8 and b' us Transect -122.11600500 18:57:11 transect DSC00120 20140618 47.5780500 2014/06/18 Upstream shot of minor transect DSC00121 20140618 47.5780500 2014/06/18 Outfall DSC00122 20140618 47.5780500 2014/06/18 Scour Pool DSC00122 20140618 47.5780500 2014/06/18 Upstream view from Transect C us DSC00123 20140618 47.57808100 2014/06/18 Downstream shot of Transect C Us Transect C DSC00125 20140618			47.570.42000	2044/05/40	
DSC00113 20140618 Transect B us 47.57839600 -122.11335900 2014/06/18 17:50:55 Upstream view fromTransect B DSC00114 20140618 Transect B ds 47.57800700 2014/06/18 18:19:38 Downstream shot of Transect B DSC00118 20140618 B4 PP Pool -122.11526300 18:19:38 Transect B DSC00119 20140618 B8 and b' us 47.57804300 2014/06/18 18:38:51 Plunge Pool DSC00119 20140618 B8 and b' us 47.5789600 2014/06/18 2014/06/18 Upstream shot of minor transect DSC00120 20140618 B10 PS 47.57810300 2014/06/18 2014/06/18 Upstream shot of minor transect DSC00121 20140618 B10 PS Pool -122.11608400 19:03:32 Outfall DSC00122 20140618 B12 PS Pool -122.11614100 19:09:29 Scour Pool DSC00123 20140618 B12 PS Pool -122.11639900 19:17:49 Scour Pool DSC00123 20140618 Transect C us 47.57808100 2014/06/18 Upstream view from Transect C us DSC00124 20140618 Transect L us 47.57807800 2014/06/18 Downstream shot of Transect C DSC00125 20140618 Transect LB Trib us and LBT2 PP 47.57805200 2014/06/18 <td></td> <td>_</td> <td></td> <td></td> <td>_</td>		_			_
Transect B us Photo -122.11335900 17:50:55 fromTransect B DSC00114 20140618 Transect B ds 47.57800700 2014/06/18 Transect B Downstream shot of Transect B DSC00118 20140618 B4 PP 47.57804300 2014/06/18 B4 PP Plunge Pool DSC00119 20140618 B8 and b' us 47.57799600 2014/06/18 B4 7.57799600 Upstream shot of minor transect DSC00120 20140618 B7-H1 47.57810300 2014/06/18 B4 7.57805500 Upstream shot of minor transect DSC00121 20140618 B10 PS 47.57810300 2014/06/18 B4 7.57805500 Outfall DSC00122 20140618 B12 PS Pool -122.11608400 19:03:32 B4 7.57814800 Outfall DSC00122 20140618 B12 PS Pool -122.11639900 19:17:49 B4 7.57808100 Scour Pool DSC00123 20140618 Transect C us Photo -122.11675700 19:29:24 Transect C Transect C DSC00124 20140618 Transect C ds Transect 47.57821400 2014/06/18 Downstream shot of Transect C DSC00125 20140618 Transect LB Trib us and LBT2 PP Photo -122.11676200 19:30:34 Transect LB Trib us Upstream view from Transect LB Trib us 47.57801300 2014/06/18 Downstrea		Transect			
DSC00114 20140618 47.57800700 2014/06/18 Downstream shot of Transect B ds Transect B ds Transect -122.11526300 18:19:38 Transect B DSC00118 20140618 47.57804300 2014/06/18 Plunge Pool DSC00119 20140618 47.57799600 2014/06/18 Upstream shot of minor transect B8 and b' us Transect -122.11600500 18:57:11 transect DSC00120 20140618 47.57810300 2014/06/18 Outfall OF-H1 Outfall -122.11608400 19:03:32 Outfall DSC00121 20140618 47.57805500 2014/06/18 Outfall B10 PS Pool -122.11614100 19:09:29 Scour Pool DSC00122 20140618 47.57814800 2014/06/18 Upstream view from B12 PS Pool -122.11639900 19:17:49 Scour Pool DSC00123 20140618 47.57805100 19:29:24 Transect C DSC00124 20140618 47.57807800 2014/06/18 Downstream shot of Transect C ds Transect -122.11676200 19:					
Transect B ds Transect -122.11526300 18:19:38 Transect B DSC00118 20140618 B4 PP 47.57804300 2014/06/18 Pool -122.11585400 18:38:51 Plunge Pool DSC00119 20140618 B8 and b' us 47.57799600 2014/06/18 Upstream shot of minor transect DSC00120 20140618 OF-H1 47.57810300 2014/06/18 Outfall DSC00121 20140618 B10 PS Pool -122.11608400 19:03:32 Outfall DSC00122 20140618 B12 PS Pool -122.11614100 19:09:29 Scour Pool DSC00123 20140618 B12 PS Pool -122.11639900 19:17:49 Scour Pool DSC00123 20140618 Transect C us Photo -122.11675700 19:29:24 Transect C DSC00124 20140618 Transect C ds Transect 47.57801800 2014/06/18 Downstream shot of DSC00125 20140618 Transect LB Trib us and LBT2 PP Photo -122.11676200 19:41:41 Scour Pool DSC00127 20140618 Transect LB Trib ds 47.57801300 2014/06/18 20:10:00 Upstream view from DSC00128 20140618 Transect LB Trib ds 47.57805200 2014		Photo			fromTransect B
Name					Downstream shot of
B4 PP Pool -122.11585400 18:38:51 Plunge Pool DSC00119 20140618 B8 and b' us 47.57799600 2014/06/18 Upstream shot of minor transect DSC00120 20140618 OF-H1 47.57810300 2014/06/18 Upstream shot of minor transect DSC00121 20140618 B10 PS 47.57805500 2014/06/18 Outfall DSC00122 20140618 B12 PS Pool -122.11614100 19:09:29 Scour Pool DSC00123 20140618 Transect C us 47.57808100 2014/06/18 Upstream view from 19:17:49 Scour Pool DSC00124 20140618 Transect C us Photo -122.11675700 19:29:24 Transect C DSC00124 20140618 Transect C ds Transect -122.11667200 19:30:34 Transect C DSC00125 20140618 Transect LB Trib us 47.57807800 2014/06/18 Downstream shot of 19:41:41 Scour Pool DSC00126 20140618 Transect LB Trib us 47.57801300 2014/06/18 Upstream view from 19:41:41 Scour Pool DSC00127 20140618 Transect LB Trib ds 47.57805200 2014/06/18 Downstream shot of 19:41:41 Downstream shot of 19:41:41 Downstream shot of 19:41:41 Transect LBTrib		Transect			Transect B
DSC00119 20140618 B8 and b' us Transect DSC00120 20140618 BB and b' us Transect -122.11609000 18:57:11 transect DSC00120 20140618 OF-H1 Outfall DSC00121 20140618 B10 PS Pool -122.11614000 DSC00122 20140618 B12 PS Pool -122.11639900 DSC00123 20140618 Transect C us Photo -122.11675700 DSC00124 20140618 Transect C ds Transect LB Trib us A7.57801300 2014/06/18 Upstream view from Transect LBTrib DSC00127 20140618 Transect LBTrib ds Tra			47.57804300	2014/06/18	
B8 and b' us Transect -122.11600500 18:57:11 transect DSC00120 20140618 47.57810300 2014/06/18 Transect OF-H1 Outfall -122.11608400 19:03:32 Outfall DSC00121 20140618 47.57805500 2014/06/18 Scour Pool B10 PS Pool -122.11614100 19:09:29 Scour Pool DSC00122 20140618 47.57814800 2014/06/18 Upstream view from B12 PS Pool -122.11639900 19:17:49 Scour Pool DSC00123 20140618 47.57808100 2014/06/18 Upstream view from Transect C us Photo -122.11675700 19:29:24 Transect C DSC00124 20140618 47.57821400 2014/06/18 Downstream shot of Transect C ds Transect -122.11667200 19:30:34 Transect C DSC00125 20140618 47.57801300 2014/06/18 Upstream view from Transect LB Trib us 47.57801300 2014/06/18 Upstream view from Transect LB Trib ds Transect -122.11721300	B4 PP	Pool	-122.11585400	18:38:51	Plunge Pool
DSC00120 20140618			47.57799600	2014/06/18	Upstream shot of minor
OF-H1 Outfall -122.11608400 19:03:32 Outfall DSC00121 20140618 B10 PS Pool -122.11614100 19:09:29 Scour Pool DSC00122 20140618 B12 PS Pool -122.11639900 19:17:49 Scour Pool DSC00123 20140618 Transect C us Photo -122.11675700 19:29:24 Transect C DSC00124 20140618 Transect C ds Transect -122.11667200 19:30:34 Transect C DSC00125 20140618 C2 PS Pool -122.11676200 19:41:41 Scour Pool DSC00126 20140618 Transect LB Trib us and LBT2 PP Photo -122.11721300 2014/06/18 Upstream view from Transect LBTrib DSC00127 20140618 Transect LB Trib ds 47.57801300 2014/06/18 Upstream view from Transect LBTrib DSC00127 20140618 Transect LB Trib ds 47.57805200 2014/06/18 Downstream shot of Transect LBTrib ds DSC00128 20140618 LBT 4 PP Transect -122.11711000 20:24:21 Plunge Pool DSC00129 20140618 47.57829000 2014/06/18 Plunge Pool	B8 and b' us	Transect	-122.11600500	18:57:11	transect
DSC00121 20140618	DSC00120 20140618		47.57810300	2014/06/18	
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DSC00123 20140618 47.57808100 2014/06/18 Upstream view from Transect C us DSC00124 20140618 47.57821400 2014/06/18 Downstream shot of Transect C DSC00124 20140618 47.57821400 2014/06/18 Downstream shot of Transect C DSC00125 20140618 47.57807800 2014/06/18 Transect C DSC00126 20140618 47.57801300 2014/06/18 Upstream view from Transect LB Trib us and LBT2 PP Photo -122.11721300 20:10:00 Transect LBTrib DSC00127 20140618 47.57805200 2014/06/18 Downstream shot of Transect LBTrib Transect LB Trib ds Transect -122.11722500 20:10:34 Transect LBTrib DSC00128 20140618 47.57807700 2014/06/18 Plunge Pool DSC00129 20140618 47.57829000 2014/06/18 Plunge Pool	DSC00122 20140618		47.57814800	2014/06/18	
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Transect C us Photo -122.11675700 19:29:24 Transect C DSC00124 20140618 47.57821400 2014/06/18 Downstream shot of Transect C Transect C ds Transect -122.11667200 19:30:34 Transect C DSC00125 20140618 47.57807800 2014/06/18 Scour Pool DSC00126 20140618 47.57801300 2014/06/18 Upstream view from Transect LB Trib us and LBT2 PP Photo -122.11721300 20:10:00 Transect LBTrib DSC00127 20140618 47.57805200 2014/06/18 Downstream shot of Transect LB Trib ds Transect LB Trib ds Transect -122.11722500 20:10:34 Transect LB Trib DSC00128 20140618 47.57807700 2014/06/18 Plunge Pool DSC00129 20140618 47.57829000 2014/06/18 Plunge Pool	DSC00123 20140618		47.57808100	2014/06/18	Upstream view from
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C2 PS Pool -122.11676200 19:41:41 Scour Pool DSC00126 20140618 Transect LB Trib us and LBT2 PP 47.57801300 2014/06/18 Upstream view from Transect LBTrib DSC00127 20140618 Transect LB Trib ds 47.57805200 2014/06/18 Downstream shot of Transect LBTrib DSC00128 20140618 LBT 4 PP 47.57807700 2014/06/18 Transect LBTrib DSC00129 20140618 47.57807700 2014/06/18 Plunge Pool DSC00129 20140618 47.57829000 2014/06/18	Transect C ds	Transect	-122.11667200	19:30:34	Transect C
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and LBT2 PP Photo -122.11721300 20:10:00 Transect LBTrib DSC00127 20140618 Transect LB Trib ds 47.57805200 2014/06/18 Downstream shot of Transect LBTrib DSC00128 20140618 LBT 4 PP 47.57807700 2014/06/18 DSC00129 20140618 47.57829000 2014/06/18 DSC00129 20140618 47.57829000 2014/06/18	DSC00126 20140618				
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DSC00128 20140618			47.57805200	2014/06/18	Downstream shot of
LBT 4 PP Pool -122.11711000 20:24:21 Plunge Pool DSC00129 20140618 47.57829000 2014/06/18	Transect LB Trib ds	Transect	-122.11722500	20:10:34	Transect LBTrib
DSC00129 20140618 47.57829000 2014/06/18			47.57807700	2014/06/18	
DSC00129 20140618 47.57829000 2014/06/18	LBT 4 PP	Pool	-122.11711000	20:24:21	Plunge Pool
· · · · · · · · · · · · · ·	DSC00129 20140618		47.57829000	2014/06/18	
LBT 6 PP Pool -122.11716500 20:31:08 Plunge Pool	LBT 6 PP	Pool	-122.11716500	20:31:08	Plunge Pool

Photo Name	Point Type	Latitude Longitude	Time	Comments
DSC00130 20140618		47.57847300	2014/06/18	
LBTrib input at road	Photo	-122.11719100	20:38:55	Culvert on LB trib
DSC00131 20140618		47.5705.4000	2011/05/11	
LBTrib roadside ditch		47.57854800	2014/06/18	Roadside ditch line on
on 35th	Photo	-122.11765700	20:40:32	LB trib
DSC00132 20140618 C4 PP		47.57807900	2014/06/18	
	Pool	-122.11729500	21:12:56	Plunge Pool
DSC00133 20140618 C6 PP	DI	47.57810900	2014/06/18 21:22:08	Diverse Deed
DSC00134 20140618	Pool	-122.11736100 47.57806000	2014/06/18	Plunge Pool
C8 PP	Dool	-122.11787200	2014/06/18	Dlungo Dool
DSC00135 20140618	Pool	47.57804300	2014/06/18	Plunge Pool
Transect D us	Photo	-122.11792600	21:46:28	Upstream view from Transect D
DSC00136 20140618	PHOLO	47.57805000	2014/06/18	
Transect D ds	Transect	-122.11796100	21:47:04	Downstream shot of Transect D
DSC00137 20140618	Hansect	47.57808500	2014/06/18	Hanseet D
D2 PP	Pool	-122.11802400	21:51:26	Plunge Pool
DSC00138 20140618	1 001	47.57807100	2014/06/18	Trange roor
D4 PP	Pool	-122.11836500	22:02:28	Plunge Pool
DSC00139 20140618		47.57806200	2014/06/18	
D6 PP	Pool	-122.11855700	22:14:16	Plunge Pool
DSC00140 20140618		47.57815800	2014/06/18	. 0
D8 PP	Pool	-122.11884900	22:24:15	Plunge Pool
DSC00141 20140618		47.57800500	2014/06/18	Upstream view from
Transect E us	Photo	-122.11891800	22:49:31	Transect E
DSC00142 20140618		47.57799000	2014/06/18	Downstream shot of
Transect E ds	Transect	-122.11893600	22:50:12	Transect E
DSC00143 20140618		47.57804300	2014/06/18	
E2 PS	Pool	-122.11919600	22:57:18	Scour Pool
DSC00144 20140618		47.57811500	2014/06/18	
E4 PP	Pool	-122.11936900	23:06:07	Plunge Pool
DSC00145 20140618		47.57800500	2014/06/18	
E6 PP	Pool	-122.11952800	23:12:12	Plunge Pool
DSC00146 20140618		47.57808700	2014/06/18	
E8 PP	Pool	-122.11963100	23:21:54	Plunge Pool
DSC00147 20140618		47.57811900	2014/06/18	
E10 PP	Pool	-122.11976600	23:27:56	Plunge Pool
DSC00148 20140618	Dool			Dlungo Dool
E12 PP DSC00150 20140618	Pool	A7 E7007100	2014/06/18	Plunge Pool
E14 PP	Pool	47.57807100 -122.11992500	2014/06/18	Dlunge Dool
DSC00151 20140619	Pool	47.57798600	2014/06/19	Plunge Pool
Transect F us	Photo	-122.12004200	16:29:50	Upstream view from Transect F
DSC00152 20140619	FIIULU	47.57800900	2014/06/19	
Transect F ds	Transect	-122.12001300	16:30:22	Downstream shot of Transect F
	Hansect	-122.12001300	10.30.22	וומוואבנו ד

DSC00153 20140619 47.57793200 2014/06/19 F2 PP Pool -122.12018800 16:34:53 Plunge Pool DSC00154 20140619 47.57802900 2014/06/19 Plunge Pool F4 PP Pool -122.12020100 16:39:17 Plunge Pool DSC00155 20140619 47.57808200 2014/06/19 Plunge Pool DSC00156 20140619 47.57790400 2014/06/19 Plunge Pool DSC00157 20140619 47.57804300 2014/06/19 Outfall DSC00158 20140619 47.57790500 2014/06/19 Outfall DSC00158 20140619 47.57790500 2014/06/19 Outfall DF-H3 Outfall -122.12093900 17:16:42 Outfall	
DSC00154 20140619	
F4 PP Pool -122.12020100 16:39:17 Plunge Pool DSC00155 20140619 47.57808200 2014/06/19 F6 PP Pool -122.12041000 16:48:48 Plunge Pool DSC00156 20140619 47.57790400 2014/06/19 F8 PP Pool -122.12086400 17:05:45 Plunge Pool DSC00157 20140619 47.57804300 2014/06/19 OF-H3 Outfall -122.12087300 17:14:06 Outfall DSC00158 20140619 47.57790500 2014/06/19	
DSC00155 20140619	
F6 PP Pool -122.12041000 16:48:48 Plunge Pool DSC00156 20140619 47.57790400 2014/06/19 F8 PP Pool -122.12086400 17:05:45 Plunge Pool DSC00157 20140619 47.57804300 2014/06/19 OF-H3 Outfall -122.12087300 17:14:06 Outfall DSC00158 20140619 47.57790500 2014/06/19	
DSC00156 20140619	
F8 PP Pool -122.12086400 17:05:45 Plunge Pool DSC00157 20140619 47.57804300 2014/06/19 OF-H3 Outfall -122.12087300 17:14:06 Outfall DSC00158 20140619 47.57790500 2014/06/19	
DSC00157 20140619	
OF-H3 Outfall -122.12087300 17:14:06 Outfall DSC00158 20140619 47.57790500 2014/06/19	
DSC00158 20140619 47.57790500 2014/06/19	
OF-H3 Outfall -122.12093900 17:16:42 Outfall	
DSC00159 20140619 47.57797400 2014/06/19 Upstream view from	n
Transect G us Photo -122.12140900 17:49:32 Transect G	
DSC00160 20140619 47.57795600 2014/06/19 Downstream shot of	f
Transect G ds Transect -122.12139900 17:50:03 Transect G	
DSC00161 20140619 47.57813700 2014/06/19	
G2 PS Pool -122.12181500 17:57:21 Scour Pool	
DSC00162 20140619 47.57822300 2014/06/19	
G4 PP Pool -122.12200100 18:03:18 Plunge Pool	
DSC00164 20140619 47.57827600 2014/06/19	
G6 PP Pool -122.12222100 18:13:19 Plunge Pool	
DSC00165 20140619 47.57833900 2014/06/19	
G8 PP Pool -122.12259300 18:24:33 Plunge Pool	
DSC00168 20140619 47.57838100 2014/06/19 Upstream view from	n
Transect H us Photo -122.12296500 18:40:43 Transect H	
DSC00169 20140619 47.57840000 2014/06/19 Downstream shot of	f
Transect H ds Transect -122.12296300 18:41:13 Transect H	
DSC00170 20140619 47.57841600 2014/06/19	
H2 PP Pool -122.12337900 18:47:43 Plunge Pool	
DSC00171 20140619 47.57843800 2014/06/19	
H4 PP Pool -122.12350700 18:52:50 Plunge Pool	
DSC00172 20140619 47.57842900 2014/06/19	
H6 PP Pool -122.12359200 18:56:42 Plunge Pool	
DSC00173 20140619 47.57835700 2014/06/19 Downstream shot a	t
h' ds Transect -122.12377800 19:02:46 minor transect	
DSC00174 20140619 47.57814100 2014/06/19 Upstream view from	n
Transect I us Photo -122.12438100 19:41:42 Transect I	
DSC00178 20140619 47.57817900 2014/06/19 Downstream shot of	f
Transect I ds Transect -122.12450200 19:43:47 Transect I	
DSC00179 20140619 47.57817000 2014/06/19	
12 PS Pool -122.12495000 19:56:53 Scour Pool	
DSC00180 20140619 47.57820100 2014/06/19 Upstream shot of n	ninor
i' us Transect -122.12525900 20:05:35 transect	

Photo Name	Point Type	Latitude Longitude	Time	Comments
DSC00181 20140619		47.57816800	2014/06/19	Upstream view from
Transect J us	Photo	-122.12599300	20:40:38	Transect J
DSC00182 20140619		47.57822400	2014/06/19	Downstream shot of
Transect J ds	Transect	-122.12593100	20:41:17	Transect J
DSC00183 20140619		47.57838700	2014/06/19	
J2 PS	Pool	-122.12604500	20:47:03	Scour Pool
DSC00184 20140619 J4 PP	Pool			Plunge Pool
DSC00185 20140619		47.57831400	2014/06/19	
J6 PP	Pool	-122.12641500	20:58:43	Plunge Pool
DSC00186 20140619		47.57829600	2014/06/19	Upstream shot at minor
j' us	Transect	-122.12653900	21:06:15	transect
DSC00189 20140619		47.57830300	2014/06/19	
J8 PP	Pool	-122.12668100	21:14:24	Plunge Pool
DSC00190 20140619		47.57832000	2014/06/19	
J10 PP	Pool	-122.12697100	21:21:11	Plunge Pool
DSC00191 20140619		47.57832500	2014/06/19	Upstream view from
Transect K us	Photo	-122.12694400	21:33:44	Transect K
DSC00192 20140619		47.57834200	2014/06/19	Downstream shot of
Transect K ds	Transect	-122.12685400	21:34:37	Transect K

2) Geodatabase Structure:

- ☐ Tt_Vasa_Assessment.gdb
 - □ □ Geology
 - Fault_Strands
 - ☑ Geology_Britton_2013
 - ☑ Geology_Troost_2012
 - Landslide_Debris_Troost_2012
 - Scarp_Troost_2012
 - ☐ 🖶 Objects_Britton
 - Culvert
 - Drains
 - Gabian_Wall
 - Slope_Break
 - Transect_Location
 - Woody_Debris
 - ☐ 🖶 SlopeStability_Britton
 - : Erosional_Features
 - Landslide_Debris
 - Landslide_Scarp
 - Observed_Landslide_Location
 - - Bank_Erosion
 - FNT_Habitat
 - Foot_Bridge
 - Gorge_Scarp
 - Habitat_Transects
 - Landslide_Deposit
 - Observed_Landslide
 - Outfalls
 - Photo_Points
 - □ Pool_Habitat
 - Potential_Instability
 - Revetment
 - Scarp_Gorge
 - Scarp_Landslide
 - Seeps

	Vasa Creek Fish Habitat Assessment
	_
	ATTACHMENT E
2014 VASA CREEK ELECTRO-FISH	

Vasa Creek 2014 Summer Electrofishing Study

On July 9, 2014, summer fish sampling was conducted on a 151 foot reach of Vasa Creek starting at approximately river mile 0.38. This was the first sample for status and trends of resident fish populations at a macroinvertebrate monitoring location. The purpose of the sampling was to determine fish species diversity and size classes of resident fish. The reach was 100% shallow riffle, so aquatic habitat was limited.

The only fish observed were cutthroat trout, the majority (95%) were less than 80 mm in length. Only two fish were likely older than young-of-the-year. Two large stoneflies and three crayfish were also captured.

Methods

Methods of sampling in 2014 were consistent with previous efforts by the City. Electrofishing was conducted using a Smith-Root Backpack Electrofisher Model 12b. Settings on the electrofishing equipment for Vasa Creek were most effective at 200 volts (v), 40 Hertz (Hz), and 6 milliseconds (ms).

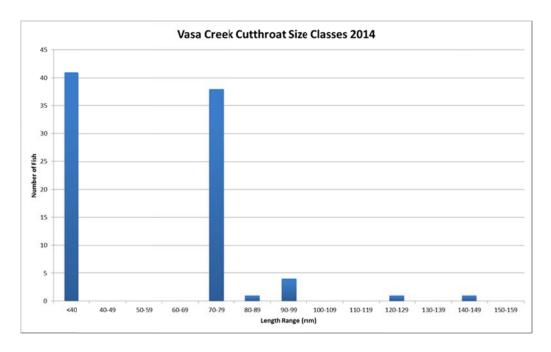
Block nets were placed at the bottom and top of the reach and a single pass was made with the electrofisher. One person utilized the electrofishing backpack and two people with long-handled dip nets followed closely alongside to capture stunned fish. Two netters were used throughout each reach. Netters were consistently swapped out and the team was comprised of at least one experienced netter and usually one inexperienced netter. Team members followed the electrofishing team with buckets of fresh stream water. Fish were tracked by habitat type (riffle or pool) and captured fish were placed in corresponding buckets. Captured fish were temporarily anesthetized on site using a dilute solution of MS-222 (Tricaine methanesulfonate) in water for identification and fork length measurements. Fish were then placed in fresh stream water supplied with an aerator until fully recovered. Once recovered, they were released on the outside of block nets so they would not be counted twice. Fish were captured as authorized under a Washington State Scientific Collection Permit.

Results

Species	Total	Percent of Total
Cutthroat	86	95%
Crayfish	3	3%
Stonefly	2	2%
Total organisms	91	100.0%
	Total	Percent of Total
Size (cutthroat)		
<80mm	79	91.9%
80-150 mm	7	8.1%
>150 mm	C	0.0%
Total	86	100.0%

Length (mm)	Cutthroat
Min	30
Max	145
Average	56
Median	75
Standard Deviation	27

Cutthroat	
Row Labels	Count
<40	41
70-79	38
80-89	1
90-99	4
120-129	1
140-149	1
Total	86



^{*}Fish lengths calculated as median from length range. Fish lengths are NOT precise to individual fish lengths.

Date:	7/9/2014
Stream:	Vasa Creek
River Mile:	0.38
Latitude:	47.57
Longitude:	-122.12
Visibility:	Clear
Water:	14.8 °C
Total Reach Length:	151 ft.
Pool Length:	N/A
Riffle Length:	151 ft
Wetted Width:	3.0-4.5 ft.
Wetted Depth	2-2.5 inches
Bank Full Width:	5.9 ft.
Electrofishing Setting:	200 v, 50 Hz, 6 mS
Start Time	0.36458
End Time	0.4375
Netter Success:	Moderate-High
Sampling done by:	Kit Paulsen (employee - fish ID)
	Jim Starkes (consultant-electrofishing)
	Laurie Devereaux (employee)
	Zane Beall (intern)
	Volunteers: Jim McRoberts, Donna Oliver, Betty Peltzer, Christina Green

Fish				
#	Species	Length (mm)	Habitat Type	Length Range
1	Cutthroat	75	Riffle	70-79
2	Cutthroat	75	Riffle	70-79
3	Cutthroat	95	Riffle	90-99
4	Cutthroat	75	Riffle	70-79
5	Cutthroat	75	Riffle	70-79
6	Cutthroat	75	Riffle	70-79
7	Cutthroat	75	Riffle	70-79
8	Cutthroat	85	Riffle	80-89
9	Cutthroat	75	Riffle	70-79
10	Cutthroat	30	Riffle	<40
11	Cutthroat	30	Riffle	<40
12	Cutthroat	30	Riffle	<40
13	Cutthroat	30	Riffle	<40
14	Cutthroat	30	Riffle	<40

Fish				
#	Species	Length (mm)	Habitat Type	Length Range
15	Cutthroat	30	Riffle	<40
16	Cutthroat	30	Riffle	<40
17	Cutthroat	75	Riffle	70-79
18	Cutthroat	75	Riffle	70-79
19	Cutthroat	75	Riffle	70-79
20	Cutthroat	75	Riffle	70-79
21	Cutthroat	75	Riffle	70-79
22	Cutthroat	30	Riffle	<40
23	Cutthroat	30	Riffle	<40
24	Cutthroat	30	Riffle	<40
25	Cutthroat	30	Riffle	<40
26	Cutthroat	30	Riffle	<40
27	Cutthroat	145	Riffle	140-149
28	Cutthroat	30	Riffle	<40
29	Cutthroat	30	Riffle	<40
30	Cutthroat	30	Riffle	<40
31	Cutthroat	30	Riffle	<40
32	Cutthroat	30	Riffle	<40
33	Cutthroat	30	Riffle	<40
34	Cutthroat	30	Riffle	<40
35	Cutthroat	30	Riffle	<40
36	Cutthroat	30	Riffle	<40
37	Cutthroat	95	Riffle	90-99
38	Cutthroat	30	Riffle	<40
39	Cutthroat	30	Riffle	<40
40	Cutthroat	30	Riffle	<40
41	Cutthroat	30	Riffle	<40
42	Cutthroat	30	Riffle	<40
43	Cutthroat	30	Riffle	<40
44	Cutthroat	30	Riffle	<40
45	Cutthroat	30	Riffle	<40
46	Cutthroat	30	Riffle	<40
47	Cutthroat	30	Riffle	<40
48	Cutthroat	30	Riffle	<40
49	Cutthroat	30	Riffle	<40
50	Cutthroat	30	Riffle	<40
51	Cutthroat	30	Riffle	<40
52	Cutthroat	30	Riffle	<40
53	Cutthroat	30	Riffle	<40
54	Cutthroat	30	Riffle	<40
55	Cutthroat	30	Riffle	<40

Fish				
#	Species	Length (mm)	Habitat Type	Length Range
56	Cutthroat	30	Riffle	<40
57	Cutthroat	30	Riffle	<40
58	Cutthroat	125	Riffle	120-129
59	Cutthroat	75	Riffle	70-79
60	Cutthroat	75	Riffle	70-79
61	Cutthroat	75	Riffle	70-79
62	Cutthroat	75	Riffle	70-79
63	Cutthroat	75	Riffle	70-79
64	Cutthroat	75	Riffle	70-79
65	Cutthroat	95	Riffle	90-99
66	Cutthroat	75	Riffle	70-79
67	Cutthroat	75	Riffle	70-79
68	Cutthroat	75	Riffle	70-79
69	Cutthroat	75	Riffle	70-79
70	Cutthroat	75	Riffle	70-79
71	Cutthroat	95	Riffle	90-99
72	Cutthroat	75	Riffle	70-79
73	Cutthroat	75	Riffle	70-79
74	Cutthroat	75	Riffle	70-79
75	Cutthroat	75	Riffle	70-79
76	Cutthroat	75	Riffle	70-79
77	Cutthroat	75	Riffle	70-79
78	Cutthroat	75	Riffle	70-79
79	Cutthroat	75	Riffle	70-79
80	Cutthroat	75	Riffle	70-79
81	Cutthroat	75	Riffle	70-79
82	Cutthroat	75	Riffle	70-79
83	Cutthroat	75	Riffle	70-79
84	Cutthroat	75	Riffle	70-79
85	Cutthroat	75	Riffle	70-79
86	Cutthroat	75	Riffle	70-79
87	Crayfish	47	Riffle	40-49
88	Crayfish	65	Riffle	60-69
89	Crayfish	42	Riffle	40-49

Vasa Creek Fish Hab	itat Assessment
Атта	CHMENT F
ATTA 2011 VASA CREEK MACROINVERTEBRATE SUMMAR	

Vasa Creek River Mile 0.38

Bioassessment scores: 2011

The B-IBI site score for this site was 24, indicating "poor" conditions. In contrast, the RIVPACS result (0.81) indicated unimpaired conditions.

Indicators of ecological condition: 2011

a. Water quality

A single mayfly taxon was collected at the Vasa Creek site in 2011: this was the ubiquitous taxon Baetis tricaudatus. Although low mayfly taxa richness suggests impaired water quality, the biotic index value (3.87) was not different from expectations for a Puget Sound Lowlands stream. The moderately-sensitive benthic fauna suggests that water quality was good in this reach. The presence of relatively sensitive taxa such as the stonefly Sweltsa sp. and the caddisfly Glossosoma sp. also suggest good water quality. The metals tolerance index value (3.79) indicates that metals contamination probably did not influence the biota.

b. Thermal condition

The composition of the benthic fauna suggested cool water temperatures: the calculated preference for the assemblage was 13.7°C. Cold stenotherm taxa were not well represented in the samples collected in this reach.

c. Sediment deposition

Fifteen "clinger" taxa and 6 caddisfly taxa were collected: it seems likely that colonization of benthic substrates was not limited by sediment deposition. The FSBI value (4.17) indicated a moderately sediment-tolerant assemblage. The nemourid stonefly Zapada cinctipes was abundant, suggesting that leafy and woody debris may have littered the channel floor.

d. Habitat diversity and integrity

Taxa richness (39) was relatively high, suggesting diverse instream habitats. The site supported at least 4 stonefly taxa: high richness in this group may be related to stable streambanks, natural channel morphology, and functional riparian zones. Four semivoltine taxa were collected in 2011; several of these taxa were common in the samples, suggesting stable instream conditions. Scour, toxic inputs, and thermal extremes seem unlikely. The abundance of shredders and the scarcity of scrapers suggest that riparian inputs of leafy and woody debris were ample, and that the channel may have been shaded. All other expected functional components were present in proportions that seemed appropriate for a Puget Sound Lowlands stream.