



## DRAFT TECHNICAL MEMORANDUM

From: Grette Associates, LLC

File No.: 213.001

Re: Beaux Arts Village Shoreline Fish Survey Results - 2016

### Introduction

The Washington Academy of Beaux Arts (WABA) completed shoreline habitat restoration at three locations on its private shoreline on the east shore of Lake Washington. Restoration actions included replacing sections of bulkhead with soft shoreline stabilization, installing large woody debris, planting emergent vegetation, and improving nearshore substrate and slope conditions by installing habitat mix. WABA contracted with Grette Associates, LLC (Grette) to conduct nighttime snorkel surveys to document pre- and post-construction conditions of fish presence based on common survey protocols in Lake Washington (Tabor et al. 2004, 2006). This technical memorandum summarizes the pre-construction survey findings from 2011 and reports the results of post-construction snorkel surveys conducted by Grette Biologists on April 1 and May 2, 2016.

### Fish Species in Lake Washington

Lake Washington provides habitat for many fish species, including the ESA-listed Cedar River population of Puget Sound Chinook salmon and the Lake Washington stock of Puget Sound steelhead trout. These and other fish species use the shoreline during migration and rearing (WDFW 2016). Another listed species, Coastal-Puget Sound bull trout, have been documented within Lake Washington (WDFW 2016), but the occurrence of bull trout within Lake Washington is rare.

#### *Chinook life-history*

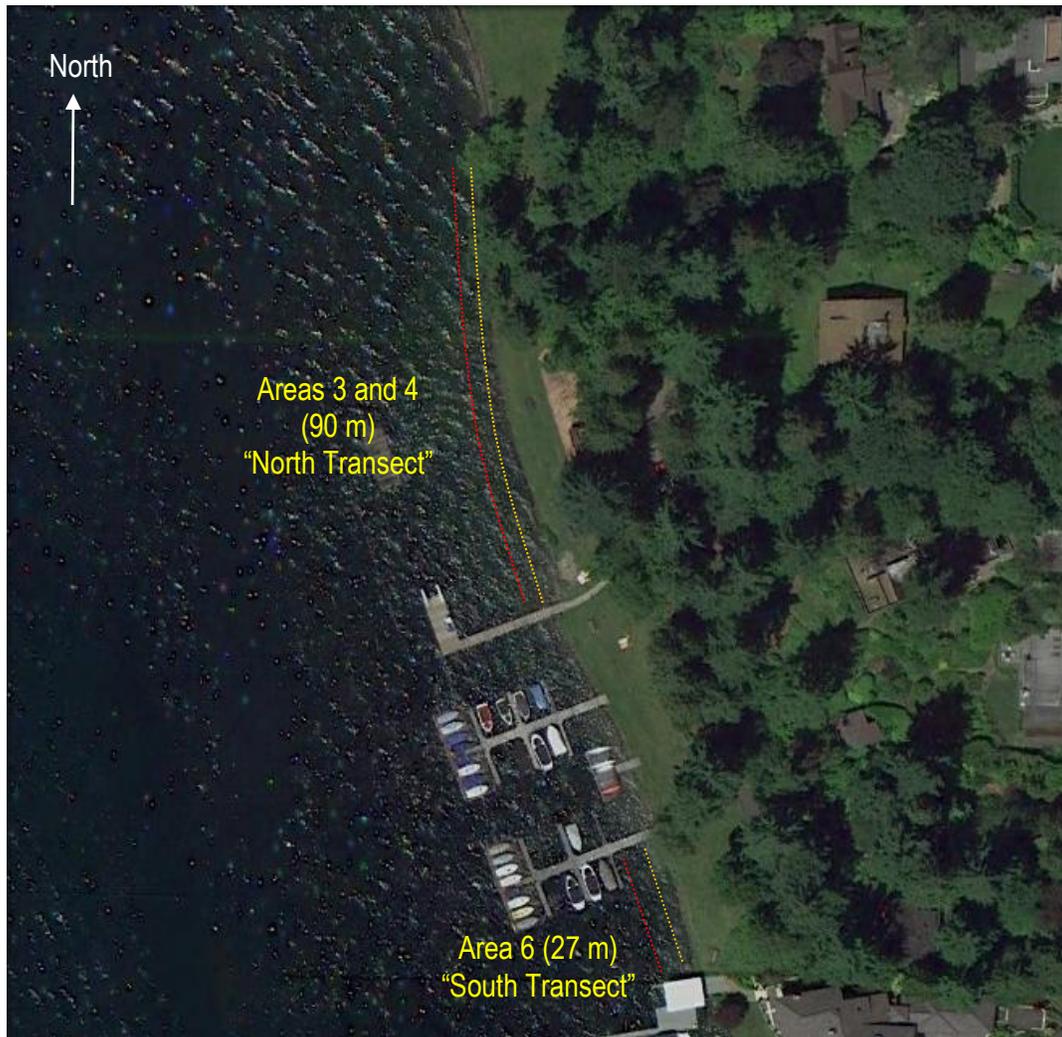
Juvenile Puget Sound Chinook (“ocean-type” Chinook) migrate relatively rapidly through freshwater into estuarine or coastal areas as compared to “stream-type” fish (NMFS 1998). Chinook rearing in Lake Washington exhibit a relatively rare alternative life history trait of extensive lake, rather than estuary, rearing, but still are considered to be ocean-type fish. Juvenile Chinook emigrate from rivers into Lake Washington between January and June; later fish tend to be larger, having spent more time rearing and feeding in riverine waters.

During their Lake Washington residence, juvenile Chinook prefer the littoral zone (shallow nearshore), especially in the daytime. They are often observed rearing in shallow-water habitats of Lake Washington with overhanging vegetation and small substrate (Kahler et al. 2000, USACE et al. 2001). In late May and June, some of the larger juveniles begin to use the limnetic zone (shallow water offshore). Whether this transition is triggered by increasing temperatures in the littoral zone or by other factors (e.g., changes in preferred prey items, decreasing reliance on nearshore refugia) is unclear.

Most juvenile Chinook proceed through the lake system and out to Puget Sound from the beginning of April through the end of July (USACE et al. 2001) with the majority emigrating from the lake in May and June (K. Fresh pers. comm. *in* Kahler et al. 2000). A few Chinook remain in Lake Washington year-round (USACE et al. 2001). Ocean-type adults spend 2 to 5 years in the ocean before returning to freshwaters to spawn.

## Methods

Two snorkel surveys were completed on April 1 and May 2, 2016 following U.S. Fish and Wildlife Service (USFWS) survey protocols described in Tabor et al. 2004 and 2006. Surveys were conducted at Area 3 and 4 (90 meters in length) and Area 6 (27 meters in length) for a total surveyed shoreline length of 117 meters (Figure 1). For each area, two transects were surveyed: one at the 0.4 m (approximately 1 ft) and the other at the 0.7 m (approximately 2 ft) depth contour. Each transect was sampled one time on each date. Two snorkelers, one on each depth contour, swam with an underwater flashlight pointed at the substrate and recorded the number of individual fish observed by species. Substrate characteristics were also recorded. Surveys were conducted starting one half hour after sunset each night.



**Figure 1. Aerial view of the Beaux Arts Village shoreline surveyed. The North transect (Areas 3 and 4) and South transect (Area 6) are indicated by dotted lines, with length in meters. Red indicates the 0.7 m depth contour and orange the 0.4 m depth contour. Photo courtesy of Google Earth, 2011.**

## Results

### *Pre-Construction (2011) Results Summary*

Three snorkel surveys were conducted in 2011: April 1<sup>st</sup>, April 15<sup>th</sup>, and May 12<sup>th</sup>. Conditions during the April 1, 2011 survey were poor due to a significant rainfall event that resulted in poor visibility and an influx of floating debris. As such, only four (4) fish were observed during the April 1<sup>st</sup> survey (3 unidentified salmonids and 1 pikeminnow). Ten (10) fish were observed during the April 15<sup>th</sup> survey including 3 Chinook, 1 unidentified salmonid, and 6 non-salmonids. On May 13<sup>th</sup>, 135 fish were observed including 2 Chinook, 1 unidentified salmonid, 7 cutthroat, 2 steelhead/rainbow trout, and 123 non-salmonids. Overall, a total of seven (7) taxa were observed during the 2011 surveys, of which three (3) species were salmonids. Substrate conditions within the North transect in 2011 were characterized by mud, sand, gravel, and large cobble. Substrate within the South transect was characterized by mud, sand, and gravel.

A summary of species counts during the 2011 surveys is included in Table 1.

**Table 1. Number (and density m<sup>-2</sup>) of salmonid and non-salmonid individuals observed by survey date.**

	<b>April 1</b>	<b>April 15</b>	<b>May 12</b>
<b>Survey conditions</b>	<i>poor</i>	<i>average</i>	<i>above average</i>
<b>Chinook</b>	0	3 (0.006 m <sup>-2</sup> )	2 (0.004 m <sup>-2</sup> )
<b>Cutthroat trout</b>	0	0	7 (0.013m <sup>-2</sup> )
<b>Steelhead/Rainbow trout</b>	0	0	2 (0.004 m <sup>-2</sup> )
<b>unidentified salmonids<sup>1</sup></b>	3 (0.006 m <sup>-2</sup> )	1 (0.002 m <sup>-2</sup> )	1 (0.002 m <sup>-2</sup> )
<b>non-salmonids</b>	1 (0.002 m <sup>-2</sup> )	6 (0.011 m <sup>-2</sup> )	123 (0.234 m <sup>-2</sup> )
<b>Total Fish</b>	<b>4</b>	<b>10</b>	<b>135</b>

<sup>1</sup> Unidentified salmonids were 2-3 inches in length and most closely resembled juvenile chinook.

<sup>2</sup> Densities corrected from 2011 for transect widths.

**Table 2. Fish species present along Beaux Arts shoreline transects in Lake Washington in April and May, 2011.**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Total Number of Individuals Observed (all 3 surveys)</b>
<b>Salmonids</b>		
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	5
Cutthroat trout	<i>O. clarki</i>	7
Steelhead/Rainbow trout	<i>O. mykiss</i>	2
unidentified salmonids		5

<b>Other</b>		
Northern pikeminnow	<i>Ptychocheilus oregonesis</i>	2
Threespine stickleback	<i>Gasterosteus aculeatus</i>	5
Yellow perch	<i>Perca flavescens</i>	54
Sculpin	<i>Cottus</i> (sp.)	68

### *Post-Construction (2016) Results*

Two snorkel surveys were conducted in 2016: April 1<sup>st</sup> and May 2<sup>nd</sup>. Conditions during both surveys were good, with above-average temperatures, light wind, and no recent rainfall. These favorable conditions attracted heavier boat traffic and public shoreline use (i.e., swimming) than is typical for this time of year.

On April 1, 2016, a total of 104 fish were observed, encompassing six (6) species. The only salmonid species observed was steelhead/rainbow trout. The two steelhead/rainbow trout observed in the north transect were juveniles, approximately 2- to 3-inches in length. The steelhead/rainbow trout observed in the south transect was a sub-adult/adult at approximately 8-inches in length. Of the non-salmonid species, yellow perch and sculpins were the most abundant during the April 1<sup>st</sup> survey with 61 and 27 individuals observed, respectively.

On May 2, 2016, a total of 142 fish were observed, encompassing seven (7) species. As in April, the only salmonid species observed on May 2<sup>nd</sup> was steelhead/rainbow trout. All six (6) of the steelhead/rainbow trout observed on May 2<sup>nd</sup> were sub-adults/adults between approximately 8- and 12-inches in length. Yellow perch and sculpins were the most abundant species observed with 62 and 38 individuals observed, respectively. During the May 2<sup>nd</sup> survey, panfish including pumpkinseed and bluegill were also fairly abundant (30 individuals observed between the two species), and were primarily found in the north transect. The one smallmouth bass was observed at the southern end of the south transect beneath the private dock immediately south of the WABA property.

Substrate composition within the north transect was fairly uniform rounded cobble and gravel, while substrates in the south transect were comprised of gravel, cobble, and sand.

Fish counts by date, transect, and depth are provided in Table 2.

**Table 3. Number (and density m<sup>-2</sup>) of salmonid and non-salmonid individuals observed by survey date.**

	<b>April 1</b>	<b>April 15</b>
<b>Survey conditions</b>	<i>good</i>	<i>good</i>
<b>Steelhead/Rainbow trout</b>	3 (0.006)	6 (0.011)
<b>non-salmonids</b>	101 (0.192)	136 (0.258)
<b>Total Fish</b>	<b>104</b>	<b>142</b>

**Table 4. Fish species present along Beaux Arts shoreline transects in Lake Washington in April and May, 2016.**

Common Name	Scientific Name	Total Number of Individuals Observed (both surveys)
<b>Salmonids</b>		
Steelhead/Rainbow trout	<i>Oncorhynchus mykiss</i>	6
<b>Other</b>		
Bluegill	<i>Lepomis macrochirus</i>	20
Pumpkinseed	<i>Lepomis gibbosus</i>	7
Smallmouth Bass	<i>Micropterus dolomieu</i>	1
Threespine stickleback	<i>Gasterosteus aculeatus</i>	19
Yellow perch	<i>Perca flavescens</i>	123
Sculpin	<i>Cottus</i> (sp.)	65
Unidentified)		2

## Discussion

### *Salmonid Density*

The only salmonid species observed during snorkel surveys in 2016 was steelhead/rainbow trout. Of the nine (9) individual steelhead/rainbow trout observed, only two were juveniles. The other seven (7) were sub-adults/adults that ranged in size from approximately 8- to 12-inches. In 2011, two “large” steelhead/rainbow trout were observed in the South transect on May 12<sup>th</sup>; similarly, two 8- to 12-inch rainbow trout were observed in the South transect on both April 1<sup>st</sup> and May 2<sup>nd</sup>, 2016. The presence of sub-adult/adult steelhead/rainbow trout in the South transect may be an indication of site fidelity, which would suggest that these individuals are resident rainbow trout and not anadromous steelhead.

No Chinook salmon or other salmon species were observed during the 2016 surveys. Chinook densities recorded on site in 2011 also were low, ranging from 0 to 0.006 individuals per square meter of shoreline. Therefore, the absence of juvenile Chinook during the 2016 surveys does not represent a substantial difference in density from the pre-construction condition, and should not be interpreted as a reduction in use relative to 2011 (pre-construction). These results are consistent with the general trends in spatial distribution and densities observed by Tabor et al (2004 and 2006), where juvenile Chinook numbers were negatively correlated with distance from the mouth of the Cedar River. The low densities (or no fish observed) at WABA also are consistent with the results described by Tabor et al. (2004 and 2006) at the two index sites closest to the WABA shoreline: Newcastle Beach (1.4 miles south) and Chism Beach (1.0 mile north). During sampling in 2002, only 2 Chinook were observed at Chism Beach during the entire January through June sampling period (Tabor et al. 2004). Over the same period at Newcastle Beach, fish densities were consistently well below 0.100, with the greatest density observed in early May (Figure 7 in Tabor et al. 2004). In 2003, Chinook densities were again consistently very low at Chism Beach and Newcastle Beach, even when much higher relative densities were observed further south (Kennydale Beach, Gene Coulon Beach) (Figure 4 in Tabor et al. 2006).

### *Habitat Conditions*

Habitat conditions along the shoreline and in the nearshore have been substantially enhanced since 2011, with shoreline softening, overhanging vegetation, and nearshore habitat mix providing improved habitat quality and availability compared to the pre-construction condition. Overall fish abundance was substantially greater in 2016 (246 total) than 2011 (149 total) even when considering that a third survey was performed in 2011. This suggests that improvements in nearshore habitat may be supporting a larger population and greater density of fish than the pre-construction condition.

As discussed above, the lack of direct observations of juvenile Chinook during the 2016 should not be interpreted as a reduction in habitat use relative to 2011. These results are consistent with the generally lower frequency and densities of juvenile Chinook observed during nearshore snorkel surveys in this area of Lake Washington. There is an expectation that some juvenile Chinook use this shoreline during their outmigration period, and would benefit from the shoreline habitat enhancements.

## References

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