A Phase I and Phase II Environmental Site Assessment of Langus Riverfront Park, Everett, Washington

Joshua Hilderbrand

A report prepared in partial fulfillment of
the requirements for the degree of

Master of Science
Earth and Space Sciences: Applied Geosciences

University of Washington

December 2016

Project mentor:
Kathy G. Troost

Internship coordinator:
Kathy G. Troost

Reading committee:
Juliet Crider
Steven Walters

Message Technical Report Number: [044]

Executive Summary

The smelting process in older smelters resulted in the release of heavy metals and oxides into the air. Remediation has begun at a former smelter site in Everett, Washington. The site has seen extremely high levels of arsenic and lead in the soil. Surrounding areas tested have also shown high levels of these contaminants. Langus Riverfront Park near the site has never been tested. A Phase I and II Environmental Site Assessment was conducted to evaluate the likelihood of arsenic and lead contamination from the smelter plume and determine the levels of contamination from these elements in park soils.

As part of the Phase I assessment a records review was conducted to determine the site history of the park. The review determined that prior to being a park it was a primitive campsite with a boat launch. The area was also used to store sand dredged from the River. The review also revealed that the dominant wind direction in Everett is straight at the park from the smelter. The wind direction gives reason enough to assume that there is contamination from the smelter at the park's location.

The Phase II (sampling) portion of the project was conducted by taking 11 total samples from different media around the park. The samples consisted of 10 near-surface soil samples and a water sample from the adjacent river. All of the samples were tested by an independent commercial laboratory. The results show lead and arsenic levels in all but two samples were well within background limits. The two samples taken from near a two-inch drainpipe on the riverbank had contaminant concentration 2 to 15 times greater than the other samples (although still below required-cleanup levels).

The Phase I investigation provided enough information to determine that there could be contamination from the smelter at the park. It also gave insight into why most surface samples showed areas with only background concentrations of contamination due to the dumping of dredged sand on top of the park location. The Phase II investigation revealed that there was likely contamination at the park caused by the smelter; however, it also revealed that the dredged sand was acting as a buffer between a possible highly contaminated layer and the surface thus protecting humans from exposure. Further investigation should be done to determine the actual depth of the contaminated layer around the park and to determine the maximum level of contamination. The results of those studies could be used to determine if remediation of the park is required to keep people safe.

Contents

1.0 Introduction

The smelting process is used to separate metal from impurities and other elements in ore by heating it to very high temperatures. The process results in the release of contaminant-laden air emissions (Pollution Issues, 2016). Air emissions from older smelters contained high levels of metals, such as lead, and oxides, such as arsenic. In the past two decades cleanup efforts have begun around two Washington smelter sites with the more serious one in Tacoma and the lesser known one in Everett. Prior to this study, a park to the southeast of the Everett smelter site had not been tested for lead and arsenic levels. Given the close proximity to the smelter location, I sought to answer the question, "What are the levels of contamination, if any, at the park that hundreds or thousands of people visit annually?"

1.1 Scope of Work

The goal of this project was to complete a Phase I and Phase II Environmental Site Assessment (ESA) of Langus Riverfront Park to determine if the presence of lead and arsenic is likely, where the contamination is present, and determine the concentration of each contaminant. The Phase I assessment examined historical records and photographs of the park to determine the history of the land use at the park location. In addition, the Phase I assessment examined documents regarding nearby properties and their past and current uses, to determine if they could be a source of lead and arsenic contamination to the park. Records, photos, and land use information were collected via Internet searches, library searches, and public records. An interview was conducted with Everett city officials at the Parks Department to gain information about the creation of the park along with any other historical uses the property may have had. The Phase I assessment also included a site reconnaissance to determine if there are any other possible sources of lead and arsenic contamination to the park. The site reconnaissance was conducted concurrently with the Phase II sampling.

The Phase II portion of the project consisted of taking ten soil samples from different horizons across the park property. A water sample was also taken to determine if any contamination is being introduced to the property from the river. Given the size of the property and the limited amount of undisturbed areas available for sampling, ten soil samples produced adequate coverage of the site. The water and soil sampling resulted in a total of 11 samples to be tested. Because main air-born pollutants caused by the smelting process are lead and arsenic (Pollution Issues, 2016), the samples were tested only for these two contaminants.

2.0 Background

Langus Riverfront Park is located along the east bank of the Snohomish River in Everett, Washington (Figure 1). The park has a shell house (boat storage), boat launch, restrooms, and a sheltered picnic area (Figure 2;Everettwa.gov, 2016). The park is attached to a 3-mile paved trail that encompasses 96 square acres (Everettwa.gov, 2016). This location was chosen for this project because it is located one mile southwest of the Everett smelter site and is well within the distance the smelter plume could have travelled. For comparison, the Tacoma smelter plume covered 1,000 square miles (Department of Ecology, 2016).

2.1 Smelter History

The Everett smelter was in operation from 1894 to 1912 and was located at the delta of the Snohomish River (Figure 1). The smelter processed high arsenic ore containing copper and lead from the Monte Cristo mine located 34 miles east of Granite Falls, WA (Everett Herald, 2012). In 1990 the Washington Department of Ecology was notified, by a local company conducting an environmental assessment of their own property, about increased levels of lead and arsenic in the soil (Dept. of Ecology, 2016).

In 1999 a Cleanup Action Plan was finalized by the Department of Ecology. In 2007 the Department of Ecology received a $188 million settlement, from Grupo Mexico (the company that owned the smelter) to clean up the Tacoma and Everett sites. Of the total $44 million was allotted for the Everett site cleanup (Dept. of Ecology, 2016). Cleanup includes removing contaminated soils that are not covered and replacing the removed materials with clean soil.

The Washington Department of Ecology database shows that no soil samples have been taken at Langus Riverfront Park (Figure 3). The park is visited regularly by local residents for barbeques, sunbathing, walking, and biking. To ensure the safety of the people that utilize the park it is important to know the contamination levels of soil or water within the park.

2.2 Contaminants of Concern

Lead

Lead is one of the primary “contaminants of concern” for soils and water affected by the Everett smelter. Both prolonged and short-term exposures of lead can be harmful to humans. According to the United States Centers for Disease Control (CDC), short-term, high level, exposures can cause loss of memory, weakness, loss of appetite, and abdominal pain (CDC, 2013). Lead is more harmful to children than adults. Exposure in children can lead to neurological effects and mental retardation

(CDC, 2013). The U.S. Department of Health and Human Services (DHHS) reports that nearly one million children in the United States have blood lead levels high enough to impair their ability to think and learn (DHHS, 2016). Prolonged exposure can cause depression, irritability, abdominal pain, and nausea (CDC, 2013). At extremely high levels lead exposure can cause coma, convulsions, and death (DHHS, 2016).

Arsenic

Arsenic is the other primary "contaminant of concern" for soils and water affected by the Everett smelter. One of the most common effects of long-term exposure to arsenic is a number of skin changes. These changes can include darkened areas of skin, warts, and corns (CDC, 2007). Ingestion of arsenic can cause decreased production of red and white blood cells potentially resulting in fatigue, abnormal heart rhythm, and bruising. Inhalation of high concentrations of arsenic can result in irritated lungs and a sore throat. Long-term low level inhalation concentrations can lead to circulatory and peripheral nervous disorders (CDC, 2015). The International Agency for Cancer Research (IARC) has also classified inorganic arsenic as a carcinogen to humans (IARC, 2004).

The Washington State Department of Ecology has set cleanup levels for lead and arsenic. Any soils with arsenic levels greater than 20 parts per million (ppm) and lead levels greater than 250 ppm require remediation (Dept. of Ecology, 2016). Concentration levels in the area surrounding the smelter site range from 0 to >700 ppm for arsenic and 0.1 to 50 ppm for lead (Dept. of Ecology, 2016). Natural background levels in Washington State for lead are 2-20 ppm (higher with higher population densities) and are 1-10ppm for arsenic (San Juan, 1994).

3.0 Methods

Both the Phase I and II assessments were conducted using the American Society for Testing and Materials (ASTM) standards. ASTM is a not-for-profit organization that develops standards for materials, products, systems, and services (ASTM, 2016 website). ASTM does not mandate the use of their standards but their standards can be written into laws by government regulators (ASTM, 2016 website).

3.1 Phase I Environmental Site Assessment

The purpose of the Phase I ESA is to determine if a property is, or may become, a liability due to the presence of hazardous substances on or related to the property (Hess, 1998). A Phase I assessment consists of four components. The first component is a records review. The records review is used to help identify

recognized environmental conditions in connection with the property (ASTM, 2011). The second component is a site reconnaissance. The purpose of the site visit is to obtain information about the likelihood of identifying recognized environmental conditions of the property (ASTM, 2011). The third component is conducting interviews with past or present owners and local government officials to obtain any further information about environmental conditions related to the property. The final component of a Phase I ESA is a report that documents the findings of the investigation.

3.1.1 Records Review

The majority of the records review was conducted through Internet searches. The following sources were contacted to provide historical/land use information about the site:

Everett Parks and Recreation website (City of Everett) – A search of the Parks Department website revealed the amenities the park has to offer as well as the size and hours of the park. The website did not give any historical information about the park.

Snohomish County Public Records (snoco.org) – A search of the tax records revealed the years that the buildings were built, which helped to give a better timeframe in which the park was created. The search also revealed the parcel number of the property.

Washington State Archives (sos.wa.gov) – The parcel number obtained through the search of the Snohomish County Public Records was used to find any information about the park. The search returned city council minutes from 1893 – 2002 that were of no use.

Everett Museum of History (everett-museum.org) – Multiple attempts of contact were sent via email and telephone. No responses were received.

Everett Public Library (epls.org) – The Everett Public Library was contacted via email and telephone. A telephone call revealed the library had no historical information about the park.

University of Washington Library (lib.washington.edu) – A search of the aerial photography section of the University of Washington library system produced pictures that provided insight into prior land uses of the site.

Washington State Department of Ecology website (ecy.wa.gov) – The website provided information about the smelter as well as a wind rose diagram for the city of Everett.

3.1.2 Site Visit

The visit revealed that the park sits adjacent to a City of Everett water treatment and testing facility. An examination of that site showed that the facility is not a likely source of contamination of arsenic and lead to the site under review. The treatment facility consists of large holding ponds and a building that do not release any air-born contamination. Inspection of the site also revealed that there was a possibility that fill was used in the creation of the park with some grassy areas being higher in elevation than the parking lots. The visit also revealed that the bank of the river was lined with riprap showing that there was likely further modification of the land that the park sits upon.

The site visit was conducted at the same time as the sampling to reduce the number of required trips to the site.

3.1.3 Interviews

An Interview was attempted with Lori Cummings the Director of the Parks, Recreation, and Community Services Department. She was unaware of any historical information of the park and referred me to Jeff Price, the Business Manager for the City of Everett. He forwarded me a three-page excerpt on Langus Riverfront Park from the book "The History of Everett Parks, A Century of Service and Vision" by Allen May and Dale Preboski (1989). This source was the single most helpful piece of information for interpreting the results of the Phase II sampling.

3.1.4 Final Report

The final report portion of the Phase I assessment is included in the Discussion and Conclusion sections of this paper with the results of the Phase II sampling.

3.2 Phase II Environmental Site Assessment

The Phase II ESA follows the Phase I assessment when the Phase I investigation reveals that there is viable concern for contamination within the property. A Phase II ESA is the acquisition of data that can rule out uncertainty of the environmental conditions of the site (ASTM, 2012). Data are obtained through the sampling and testing of media from the property that is then tested to determine the occurrence of specific contaminants as well as the concentration of contaminants if any exist. If the Phase II reveals that there is significant contamination or a significant concentration of a contaminant, then the review would move on to a Phase III Environmental Site Assessment that investigates possible remediation methods for the property.

3.2.1 Sampling

A total of 10 soil samples and a water sample were taken at Langus Riverfront Park (Figure 4).

Samples 1-A and 1-B were taken on the north side of the park using a hand auger. The hand auger was driven 18 inches into the soil. 1-A was taken from 0-9 inches in depth and 1-B was taken from 9-18 inches. Both 1-A and 1-B consisted of fine grain sands.

Samples 2-A and 2-B were taken roughly 20 yards south of samples 1-A/B using the same method. These two samples consisted of the same fine grain sand as samples 1-A and 1-B.

Sample 3-A and 3-B were taken along the riverbank using a small shovel near a white two-inch PVC discharge pipe southwest of the first two samples locations. Sample 3-A was taken from a horizon six feet below the parking lot grade. Sample 3-B was taken from the horizon below 3-A at seven feet below parking lot grade. Both 3-A and 3-B consisted of fine to medium grain sand.

Sample 4 was taken from the edge of the river north of the bathrooms using a small hand shovel. The sample consisted of high organic content with high plasticity silts (OH).

Sample 5-A was taken from a soil layer below the grass using a sample container at the same location as sample 4. The sample was mostly organics with some fines (PT).

Sample 6 was taken from a muddy bank next to the boat launch using a small hand shovel. The sample contained high organic content with high plasticity silts (OH).

Sample 7 was taken below the sod next to the southern side of the restroom facility using a small hand shovel. The sample contained inorganic silts and fine grain sands (ML).

Sample 8 was taken from the end of the northern dock at the boat launch.

All sample locations are shown in Figures 4, 5, and 6.

Spectra Laboratories in Tacoma, Washington conducted the sample testing. The samples were taken, and submitted to the lab in containers provided by the lab to ensure that the correct amount of sample was taken to run each test. Chain of custody procedure was followed showing that the samples were handled only by me, to ensure confidence in the testing results (Figure 7). All samples were tested using the EPA 6010C method that is a standard method for this type of testing (EPA, 2000).

4.0 Results

4.1 Phase I Environmental Site Assessment

The excerpt from May and Preboski (1989) provided historical land use information as well as information about the timeline of the creation of the park. The excerpt states that the park is located on what is called Smith Island. Because the location was cutoff from the mainland the area was ignored for development. Eventually the Washington State Department of Natural Resources built two boat launches and a camping area at the park location. No dates were given but the boat launches can be seen in a 1970 aerial photograph of the park obtained from the University of Washington Library (Figure 8). The boat launches and camping area were essentially abandoned due to a lack of funding and a portion of the area was used to store sand dredged from the Snohomish River (May and Preboski, 1989). In 1983 the City of Everett annexed about half of the island that included the boat launches and the sand pile. The park was officially named and opened on September 7, 1988.

A survey map drawn in 1887 (figure 9) along with an aerial photograph taken in 1958 (figure 10), the aerial photograph taken in 1970 (figure 8), a Google Earth image from 1990 (figure 11A), and a current Google Earth image (figure 11B) all show that the shape of the river or riverbanks has not largely changed during the past century.

A search of the Snohomish County Tax Records website using the park's parcel number revealed that the outhouse structure was built in 1989 and the covered picnic area and rowing building were built in 1991.

A search of the Washington State Department of Ecology website produced the smelter background information contained in the background portion of this paper as well as a wind rose diagram from 1996 (Figure 12). The diagram shows that the most common wind direction is to the southeast (17.5%) with a wind speed of up to 15.7 miles per hour. A rose diagram obtained from the Puget Sound Clean Air Agency from 1992 (Figure 13) also shows that the highest percent of wind is to the southeast (about 16%) with a wind speed of 12.5 miles per hour.

The site visit revealed no other obvious modes of arsenic or lead contamination.

4.2 Phase II Environmental Site Assessment

The lab testing provided the following results (Table 1):

Table 1: Sample test results from Phase II Environmental Site Assessment

Sample	Analyte	Result (PPM)	Matrix

1-A	Total Arsenic	5	Soil
1-A	Total Lead	5	Soil
1-B	Total Arsenic	7	Soil
1-B	Total Lead	6	Soil
3-A	Total Arsenic	<5	Soil
3-A	Total Lead	11	Soil
3-B	Total Arsenic	10	Soil
3-B	Total Lead	78	Soil
4	Total Arsenic	5	Soil
4	Total Lead	<4	Soil
5-A	Total Arsenic	<5	Soil
5-A	Total Lead	<4	Soil
6	Total Arsenic	<4	Soil
6	Total Lead	5	Soil
7	Total Arsenic	<5	Soil
7	Total Lead	5	Soil
8	Total Arsenic	<0.05	Water
8	Total Lead	<0.04	Water

* The Washington Department of Ecology action levels for lead are 250 ppm and 20 ppm for arsenic.

5.0 Discussion

5.1 Phase I Environmental Site Assessment

The Phase I portion of the ESA proved to be the toughest and most challenging part of this project. It was very difficult to find any useful information about the creation of the park and even harder to find information about prior land use of the park's location. It did however lead to a couple of key pieces of information. The two biggest pieces of data were the wind directions and the fact that dredged sand had been placed somewhere near the park's location.

The rose diagrams showed that the prevailing wind is to the southeast, which is the direction of the park from the smelter site (Figures 13 and 14). The wind direction shows that it is very likely that the wind-driven contaminants could have been deposited on the park.

Discovering that the area had been used to store sand dredged from the river was unexpected since the park appeared to be at the same elevation as the opposite bank. The presence of dredged material may mean that the heavily contaminated portions of the soil are buried beneath feet of fill that can help shield citizens from the contaminants. Conversely, the dredged spoils make it impossible to evaluate the extent of contamination from surface samples alone.

Given the proximity of the park to the smelter site, its position directly downwind of the smelter (Figures 13 and 14), and the results from other sites suggesting elevated soil contamination outside the smelter property (Department of Ecology, 2016), soil contamination was expected. The smelter was in operation from 1894 to 1912, and dredge spoils are observed in photographs from the 1970's; thus, the dredge spoils were deposited much later than the contamination. The majority of samples suggest that the spoils likely buried any affected soils, since every sample came back well under the safe limits set by the Department of Ecology (Table 1).

5.2 Phase II Environmental Site Assessment

The original sample plan consisted of taking uniform samples using the hand auger. The samples were to be taken at depths of 0-9 inches and 9-18 inches. Once the site was inspected, the sample plan was modified to ensure different types of geologic media were tested. It was also a concern that repeating the sampling in the same way would return the same repeating results, so a variety of sampling techniques were used in an attempt to capture any signature of lead or arsenic contamination.

The results came back as I would have expected them to be if the original sample plan was followed. Although different types of exposed and unexposed media were tested, results indicate that the majority of the media were not exposed at the time of the smelter's operation. One sample location that contained samples 3-A and 3-B, did show lead and arsenic levels that were well above both the normal background values of 2-20 ppm for lead and 1-10 ppm for arsenic (San Juan, 1994) and above the concentrations of the other samples. This observation is very surprising considering that these samples were taken near the drainage pipe on the river bank, and hence was the only sample site with significant evidence of recent modification. To install the pipe, the entire area surrounding the pipe must have been excavated. There are two possible explanations for elevated contamination at the site: First, the pipe could have been placed at a depth that was exposed during the time the smelter was in operation. If this was the case the excavation of the trench could have upturned contaminated soil that was then used as the backfill and placed over the pipe. The second possible explanation for the increased concentration is that the backfill used was from a contaminated source from a different location. In many construction projects different media from different locations are used during the backfill process to achieve required, or desired, compaction.

If any future modifications are made at the park resulting in the upturning of soil, it is recommended that the soil should be tested to ensure that the modifications do not result in the exposure of contaminated soil.

6.0 Conclusions

The Phase I ESA turned out to be very useful for this project. It revealed that contamination from the Everett smelter was a possibility at Langus Riverfront Park. It also revealed that any contamination that may have been there could have been covered up by the spoils. This piece of information helped to explain why the majority of the levels that were found from the sampling were as low as they were.

The Phase II ESA revealed that there was some contamination at the park from the smelter shown by the elevated levels of arsenic and lead in samples 3-A and 3-B. However, all the levels that were obtained from the different media sources were well below the limits of concern. This suggests that park visitors are not directly exposed to contaminated soils at the ground surface.

Additional sampling and analyses are required to evaluate the possibility of soil contamination at Langus Riverfront Park from the Everett smelter. Deep core tests should be done to determine which sediments hold the higher contaminant levels, and at what depths. Testing sub-surface soils in multiple areas to determine contaminant distribution as well as its maximum concentration of lead and arsenic will help to ensure that the residents that use the park really are safe. It will also reveal if a Phase III ESA (remediation) will need to be conducted to remove any potentially harmful material.

7.0 Limitations

Without testing the lead and arsenic isotopes against known lead and arsenic samples from the smelter site, it is not possible to know if the contamination found at the park is actually from the smelter operation.

8.0 References

American Society for Testing and Materials, 2011, Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process, Washington, DC, Environmental Protection Agency, 17 p.

American Society for Testing and Materials, 2012, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, Washington, DC, Environmental Protection Agency, 34 p.

American Society for Testing and Materials, 2016, Frequently Asked Questions https://www.astm.org/ABOUT/faqs.html#used (accessed November, 2016)

Center for Disease Control and Prevention, 2013, Public Health Statement for Arsenic http://www.atsdr.cdc.gov/phs/phs.asp?id=18&tid=3 (accessed November, 2016)

Center for Disease Control and Prevention, 2013, Lead http://www.cdc.gov/niosh/topics/lead/health.html (accessed November 2016)

City of Everett, 2016, Langus Riverfront Park https://everettwa.gov/Facilities/Facility/Details/Langus-Riverfront-Park-27 (accessed November 2016)

Department of Health and Human Services, 2016, Healthy Homes and Lead Poisoning Program http://www.dhhs.nh.gov/dphs/bchs/clpp/ (accessed November, 2016)

Department of Ecology, 2016, Everett Smelter Cleanup: Site History http://www.ecy.wa.gov/programs/tcp/sites_brochure/asarco/2011/es-history.html (accessed November, 2016)

Department of Ecology, 2016, Tacoma Smelter Plume https://fortress.wa.gov/ecy/publications/publications/1109095.pdf (accessed November,2016)

Environmental Protection Agency, 2000, Method 6010C https://www.epa.gov/sites/production/files/2015-07/documents/epa-6010c.pdf (accessed November, 2016)

Everett Herald, 2012, Cleanup begins of what Monte Cristo miners leave behind
http://www.heraldnet.com/news/cleanup-begins-of-what-monte-cristo-miners-left-behind/
(accessed November 2012)

Hess, Kathleen, 1998, Environmental Site Assessment Phase I: A Basic Guide
Boca Raton, Florida, CRC Press LLC, 334 p.

International Agency for Cancer Research, 2004, Arsenic and Arsenic Compounds
http://monographs.iarc.fr/ENG/Monographs/vol100C/mono100C-6.pdf
(accessed November, 2016)

May, A., Preboski, D., 1989, The History of Everett Parks: A Century of Service and Vision, Donning Company, Virginia Beach, p. 98-99

Pollution Issues, 2016, Smelting
http://www.pollutionissues.com/Re-Sy/Smelting.html
(accessed November, 2016)

San Juan, Charles, 1994, Natural Background Soil Metals Concentration in Washington State
https://fortress.wa.gov/ecy/publications/documents/94115.pdf
(accessed November, 2016)

9.0 Figures

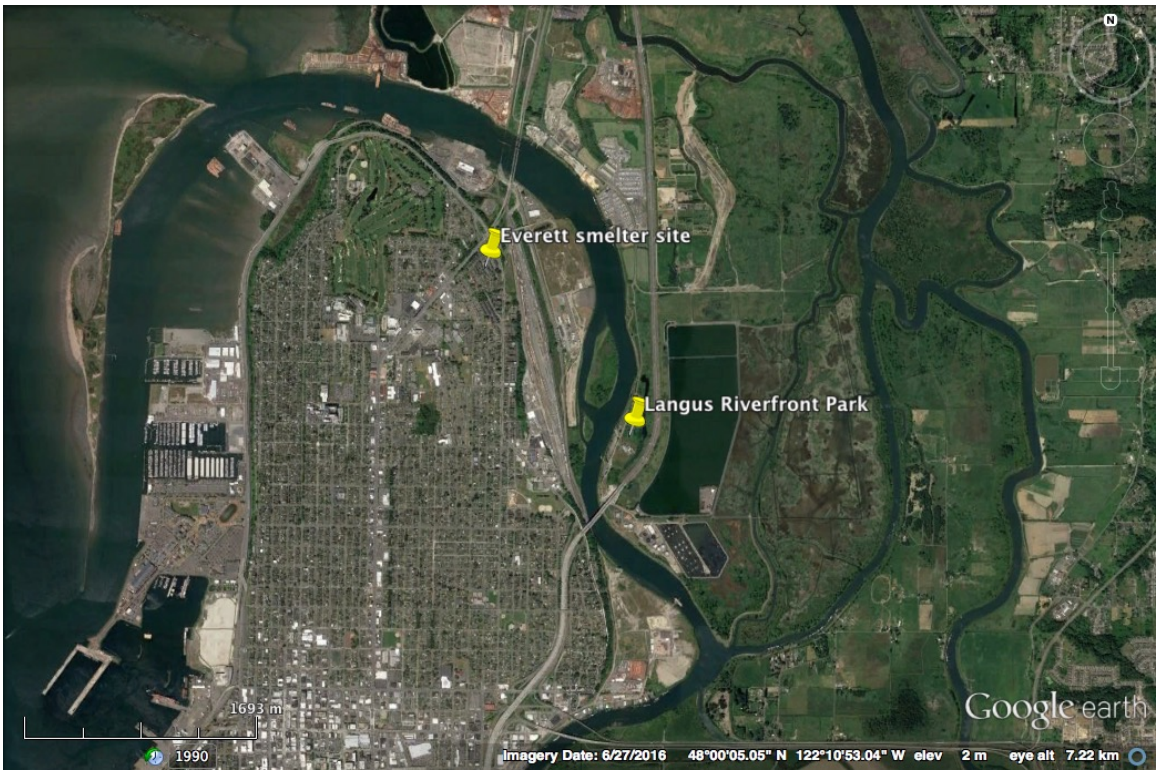


Figure 1. Google Earth map of the Everett smelter site and investigation location.

Figure 2: Google Earth image showing the extent of Langus Riverfront Park, with buildings labeled.

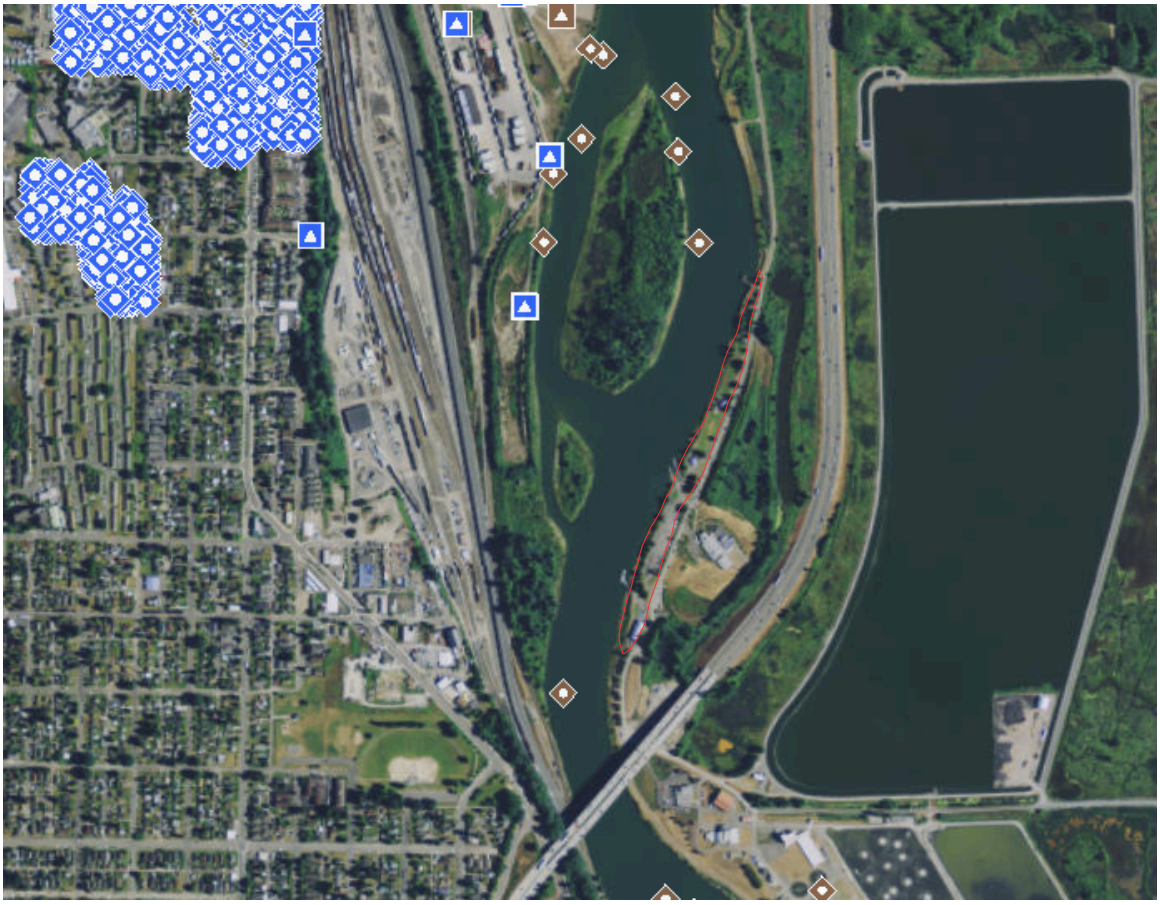
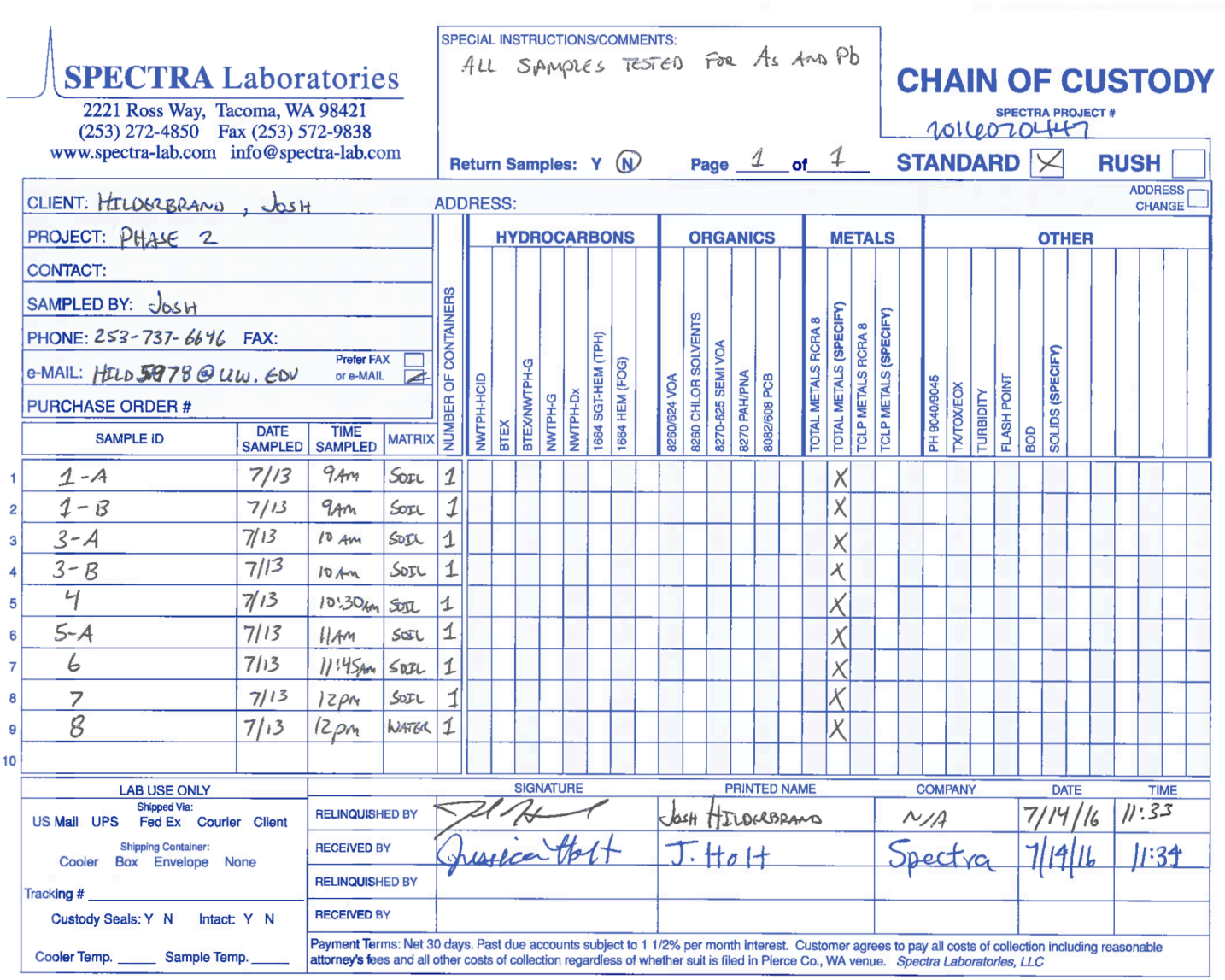


Figure 3. Photo showing known sample sites from the Dept. of Ecology website. Brown symbols are water-sampling locations. Blue symbols are soil-sampling locations.

Figure 4: Google Earth image of sample locations, overview.

Figure 5: Enlarged aerial photo, showing sample locations 1-5 (Google Earth).

Figure 6: Enlarged aerial photo, showing sample locations 6-8 (Google Earth).



SPECTRA Laboratories
2221 Ross Way, Tacoma, WA 98421
(253) 272-4850 Fax (253) 572-9838
www.spectra-lab.com info@spectra-lab.com

SPECIAL INSTRUCTIONS/COMMENTS: ALL SAMPLES TESTED FOR As AND Pb

CHAIN OF CUSTODY

SPECTRA PROJECT # 1011607044H7

Return Samples: Y (N) Page 1 of 1 STANDARD [X] RUSH [ ]

CLIENT: HILDERBRAND , JOSH ADDRESS: ADDRESS CHANGE [ ]

PROJECT: PHASE 2

CONTACT:

SAMPLED BY: JOSH

PHONE: 253-737-6646 FAX:

e-MAIL: HILD5978@UW.EDU Prefer FAX or e-MAIL [ ] [X]

PURCHASE ORDER #

	SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	NUMBER OF CONTAINERS	HYDROCARBONS: NWTPH-HCID	BTEX	BTEX/NWTPH-G	NWTPH-G	NWTPH-Dx	1664 SGT-HEM (TPH)	1664 HEM (FOG)	ORGANICS: 8260/624 VOA	8260 CHLOR SOLVENTS	8270-625 SEMI VOA	8270 PAH/PNA	8082/608 PCB	METALS: TOTAL METALS RCRA 8	TOTAL METALS (SPECIFY)	TCLP METALS RCRA 8	TCLP METALS (SPECIFY)	OTHER: PH 9040/9045	TX/TOX/EOX	TURBIDITY	FLASH POINT	BOD	SOLIDS (SPECIFY)
1	1-A	7/13	9AM	SOIL	1														X									
2	1-B	7/13	9AM	SOIL	1														X									
3	3-A	7/13	10 AM	SOIL	1														X									
4	3-B	7/13	10 AM	SOIL	1														X									
5	4	7/13	10:30AM	SOIL	1														X									
6	5-A	7/13	11AM	SOIL	1														X									
7	6	7/13	11:45AM	SOIL	1														X									
8	7	7/13	12PM	SOIL	1														X									
9	8	7/13	12PM	WATER	1														X									
10																												

LAB USE ONLY

Shipped Via: US Mail UPS Fed Ex Courier Client

Shipping Container: Cooler Box Envelope None

Tracking # _____

Custody Seals: Y N Intact: Y N

Cooler Temp. _____ Sample Temp. _____

	SIGNATURE	PRINTED NAME	COMPANY	DATE	TIME
RELINQUISHED BY		JOSH HILDERBRAND	N/A	7/14/16	11:33
RECEIVED BY	Jessica Holt	J. Holt	Spectra	7/14/16	11:34
RELINQUISHED BY					
RECEIVED BY					

Payment Terms: Net 30 days. Past due accounts subject to 1 1/2% per month interest. Customer agrees to pay all costs of collection including reasonable attorney's fees and all other costs of collection regardless of whether suit is filed in Pierce Co., WA venue. *Spectra Laboratories, LLC*

Figure 7: Chain of custody document for samples.

Figure 8: Aerial photograph of the park location taken in 1970.

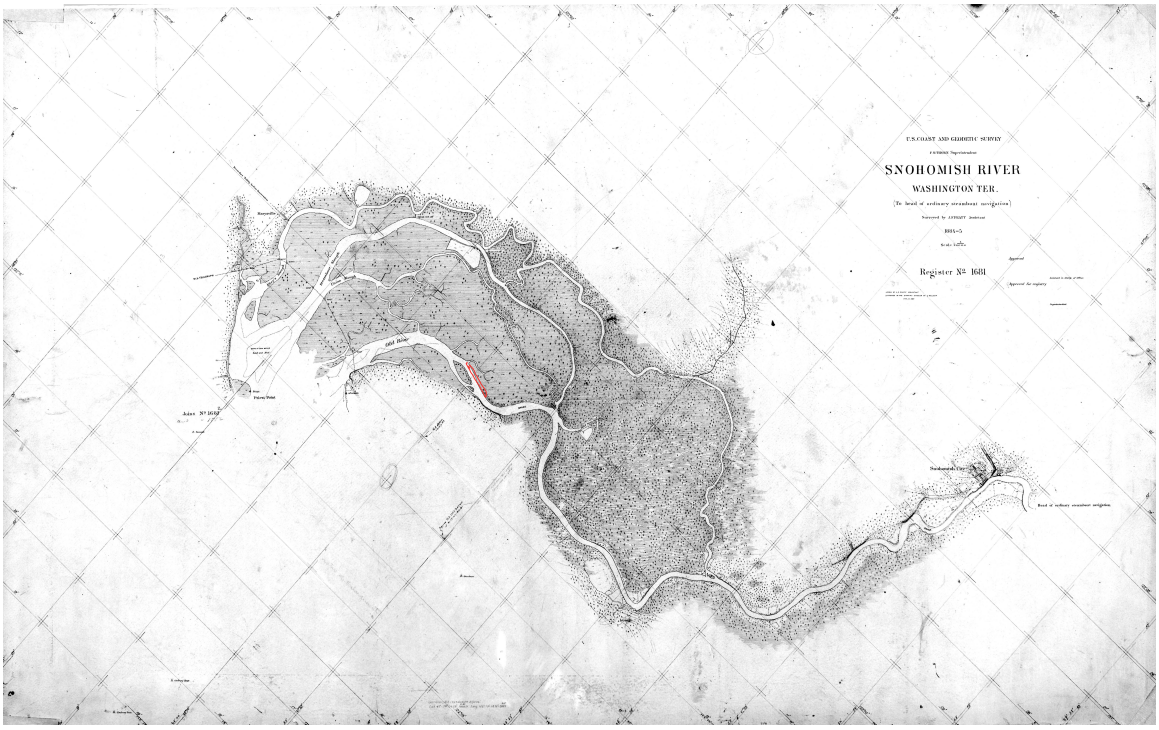


Figure 9: Survey of the Snohomish River drawn in 1887 by J. F. Pratt, U.S. Coast and Geodetic Survey.

Figure 10: Aerial photograph of the park location taken in 1958 Courtesy of the University of Washington Library.


7/1990
Langus Riverfront Park
Image U.S. Geological Survey
Image NASA
Google earth
367 m
1990
Imagery Date: 7/9/1990 47°59'52.34" N 122°10'31.30" W elev 3 m eye alt 1.60 km

Figure 11. A: Google Earth image of the park location from 1990.
B: Google Earth image of the park location in 2016.

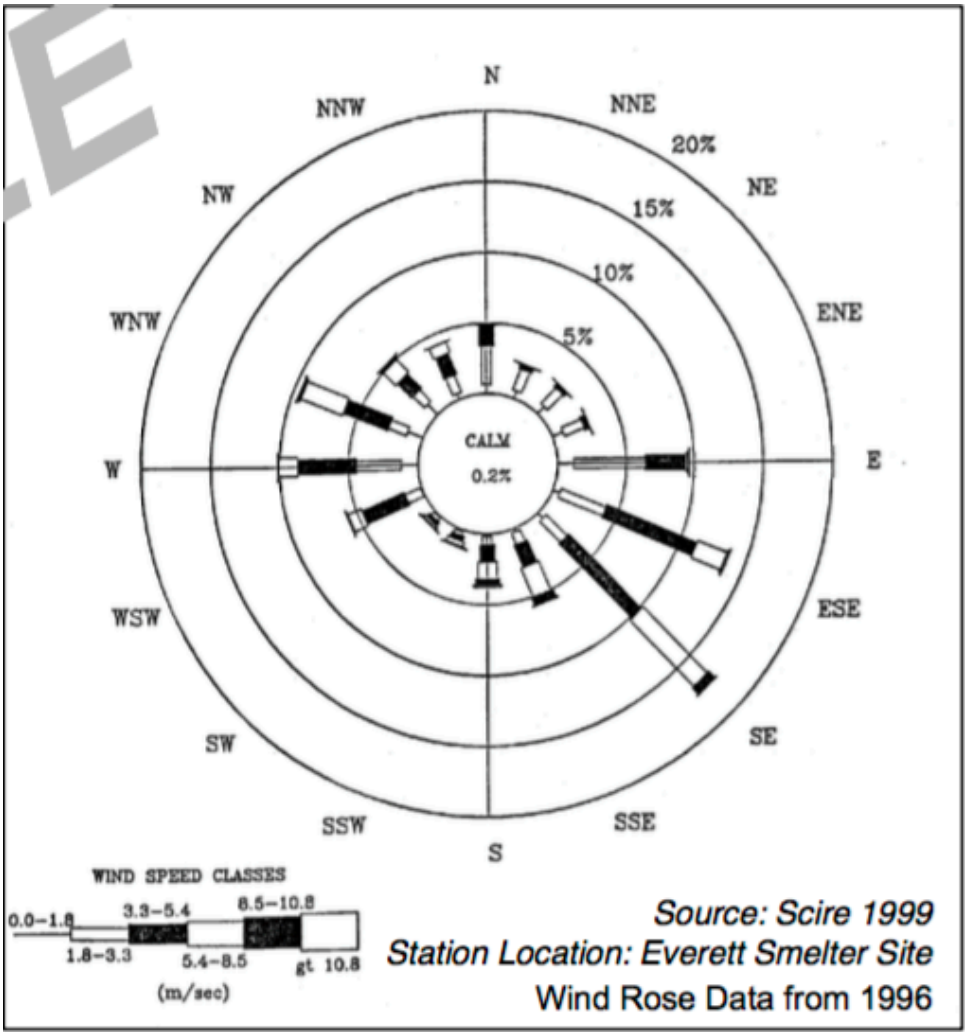


Figure 12: Rose diagram showing the wind direction and magnitude in the city of Everett from 1996.

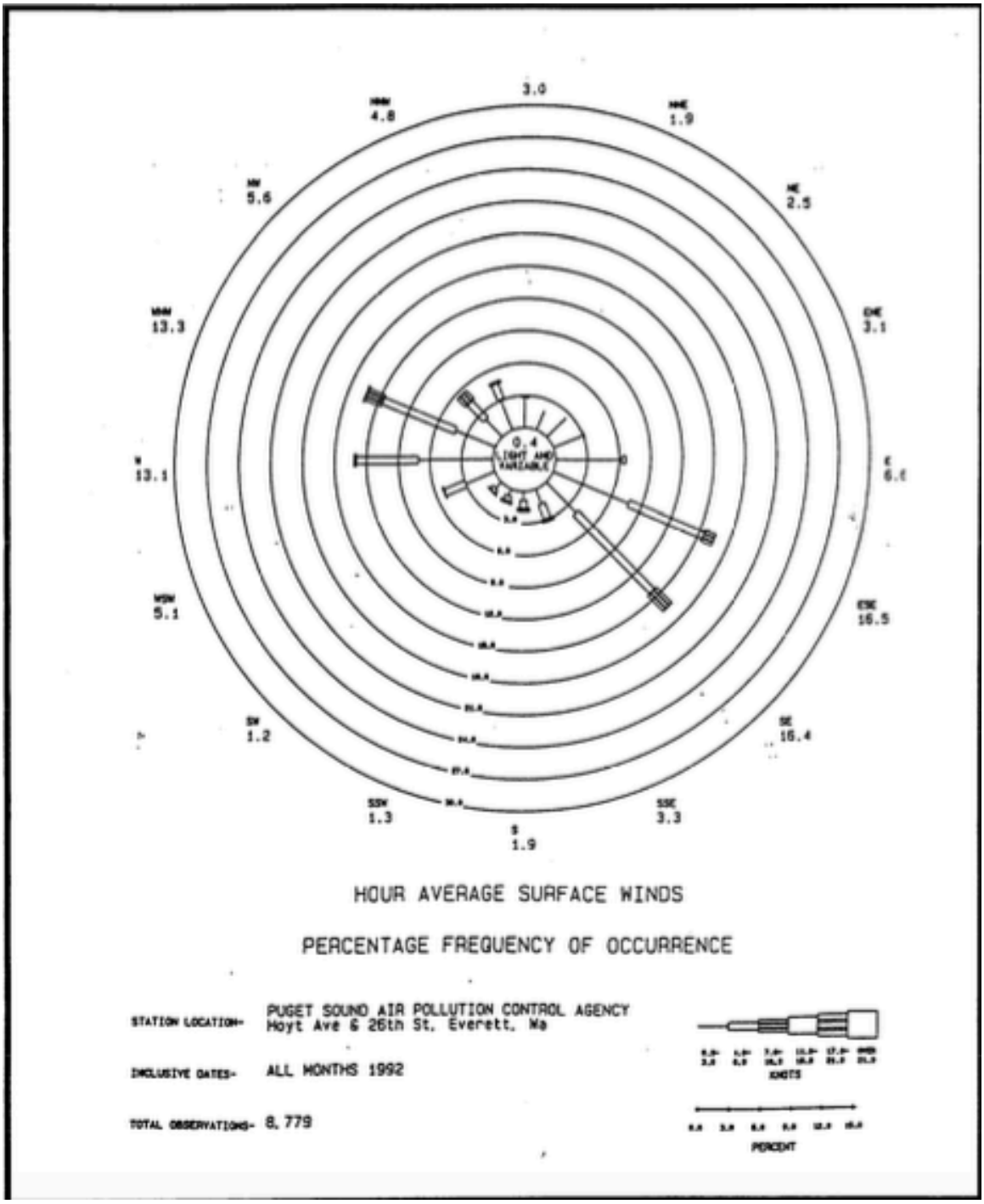


Figure 13: Rose diagram showing wind directions and magnitude for the city of Everett 1992.

Appendix A: Lab Test Results

SPECTRA Laboratories ...*Where experience matters*

2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

07/25/2016

Josh Hilderbrand
5325 N Frace St
Tacoma, WA 98407
Attn: Josh Hilderbrand

Project: Phase 2
Date Received: 07/14/2016
Spectra Project: 2016070447

Client ID	Spectra #	Analyte	Result	Units	Method	Matrix	Date Sampled
1-A	1	Total Arsenic	5	mg/Kg	SW846 6010C	Soil	07/13/2016
1-A	1	Total Lead	5	mg/Kg	SW846 6010C	Soil	07/13/2016
1-B	2	Total Arsenic	7	mg/Kg	SW846 6010C	Soil	07/13/2016
1-B	2	Total Lead	6	mg/Kg	SW846 6010C	Soil	07/13/2016
3-A	3	Total Arsenic	< 5	mg/Kg	SW846 6010C	Soil	07/13/2016
3-A	3	Total Lead	11	mg/Kg	SW846 6010C	Soil	07/13/2016
3-B	4	Total Arsenic	10	mg/Kg	SW846 6010C	Soil	07/13/2016
3-B	4	Total Lead	78	mg/Kg	SW846 6010C	Soil	07/13/2016
4	5	Total Arsenic	5	mg/Kg	SW846 6010C	Soil	07/13/2016
4	5	Total Lead	< 4	mg/Kg	SW846 6010C	Soil	07/13/2016
5-A	6	Total Arsenic	< 5	mg/Kg	SW846 6010C	Soil	07/13/2016
5-A	6	Total Lead	< 4	mg/Kg	SW846 6010C	Soil	07/13/2016
6	7	Total Arsenic	< 4	mg/Kg	SW846 6010C	Soil	07/13/2016
6	7	Total Lead	5	mg/Kg	SW846 6010C	Soil	07/13/2016
7	8	Total Arsenic	< 5	mg/Kg	SW846 6010C	Soil	07/13/2016
7	8	Total Lead	5	mg/Kg	SW846 6010C	Soil	07/13/2016

SPECTRA LABORATORIES

Steve Hibbs, Laboratory Manager
a8/scj

SPECTRA Laboratories ...*Where experience matters*
2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

07/25/2016

Josh Hilderbrand
5325 N Frace St
Tacoma, WA 98407
Attn: Josh Hilderbrand

Project: Phase 2
Date Received: 07/14/2016
Spectra Project: 2016070447

Client ID	Spectra #	Analyte	Result	Units	Method	Matrix	Date Sampled
8	9	Arsenic	< 0.05	mg/L	EPA 200.7	Water	07/13/2016
8	9	Lead	< 0.04	mg/L	EPA 200.7	Water	07/13/2016

SPECTRA LABORATORIES

Steve Hibbs, Laboratory Manager
a8/scj