PACIFIC groundwater GROUP

Soil and Groundwater Data Report
Oregon Street Right-of-Way
Port of Seattle

January 8, 2007

Soil and Groundwater Data Report

To: Roy Kuroiwa and Kathy Bahnick, Port of Seattle

From: Janet Knox and Inger Jackson, Pacific Groundwater Group

Re: Oregon Street Right-of-Way, Phase II Investigation, Data Report

Date: January 8, 2007

This technical memorandum documents the Phase II Environmental Investigation performed within the Oregon Street right-of-way for the Port of Seattle (Port). The Port is considering ownership of the southern half of the right-of-way, adjacent to the Port's Terminal 108 (T-108), from the City of Seattle through a street vacation.

A previous study, South Oregon Street 2006 Environmental Data Review and Summary (Pacific Groundwater Group February 10, 2006) found that while evidence of contaminated soil or groundwater in the right-of-way is not definitive in previous studies, soil contamination is likely, based on the existence of a historic drainage channel and typical historic fill practices. The objective of this Phase II investigation was to understand the environmental setting of the right-of-way to the extent possible from soil and groundwater sampling.

The work was performed, and this letter report prepared using generally accepted hydrogeologic practices used at this time and in this vicinity, for exclusive application to the study area and for the exclusive use of the Port of Seattle. This is in lieu of other warranties, express or implied.

SUMMARY OF FINDINGS

Soil and groundwater samples were collected from five boreholes drilled in the Oregon Street right-of-way and intertidal sediment samples were collected from three locations on the banks of the Duwamish Waterway within the right-of-way (Figure 1). The Phase II Investigation followed a scope of work developed by Pacific Groundwater Group and Port staff; the findings are summarized below. Analytical soil results are compared to Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Cleanup Regulation (WAC 173-340) Method A Soil Cleanup Levels for Industrial Properties and analytical groundwater results are compared to MTCA Method A Cleanup Levels for Ground Water. The analytical sediment results are compared to the Ecology Sediment Quality Standards (WAC 173-204-320). Contaminant concentrations are expressed in milligrams per kilogram (mg/kg) or parts per million in soil and micrograms per liter (ug/L) or parts per billion in water.

Soil Samples

- Polychlorinated Biphenyls (PCBs) are a family of 209 toxic compounds for which there are no known natural sources. PCBs were detected in soil samples collected from each borehole drilled for this investigation. The majority of the PCB detections in soil occurred in samples collected within 3 feet of ground surface and PCB concentrations do not exceed state cleanup criteria for industrial sites.
- Polynuclear Aromatic Hydrocarbons (PAHs) are a group of over 1000 carcinogenic and non-carcinogenic compounds that can be found in coal tar, crude oil, creosote, and roofing tar. The potential carcinogenic risk of PAH concentrations found in soil collected from borehole B06-2 at 7.5 feet below ground (111.7 mg/kg) exceeds the MTCA Method A soil cleanup level for industrial properties (2 mg/kg). The high PAH concentrations in soil from this borehole may be related to historic contamination in a former tide channel that extended through this area.
- The concentration of diesel (4500 mg/kg) in one soil sample collected at 2.5 feet below ground and lube oil (4900 and 5400 mg/kg) in two soil samples collected at 5 and 2.5 feet below ground exceed the MTCA Method A soil cleanup level for industrial properties (2000 mg/kg).
- Gasoline and benzene, ethylbenzene, toluene, and xylenes (BETX), and arsenic were not detected in the soil samples collected for this investigation. Cadmium, copper, lead, nickel, and zinc were detected in the soil samples but the concentrations do not exceed MTCA Method A soil cleanup levels for industrial properties.

Groundwater Samples

- The potential risk of carcinogenic PAH concentrations found in the groundwater sample collected farthest from the Duwamish Waterway is elevated slightly above the MTCA Method A groundwater cleanup level. The concentrations of lube oil and dissolved arsenic in this sample are also slightly elevated above the cleanup levels.
- PCBs were detected in both groundwater samples collected for this investigation; the concentrations of total PCBs in the samples do not exceed the MTCA Method A cleanup level.

Intertidal Samples

- The intertidal area within the right-of-way was dredged and capped in 2003 and 2004 during the Duwamish/Diagonal CSO/SD Sediment Remediation Project. Sediment samples collected under this scope of work contain measurable concentrations of PAHs and metals; however, they do not exceed state sediment criteria.
- PCBs were not detected in the sediment samples.
- Diesel and lube oil were detected; however state sediment criteria for these parameters are not established.

SITE DESCRIPTION

The City of Seattle Oregon Street right-of-way extends from the Duwamish Waterway to East Marginal Way. The right-of-way is bordered by T-108, Metro property, and Port of Seattle parcel 7666700510 to the south; and Port of Seattle T-106 (parcel 7666700390) and State of Washington parcel 1824049063 to the north (Figure 1 shows the shaded yellow portion for possible vacation to the Port of Seattle). The northern portion of the right-of-way is paved with asphalt and is actively used by the Washington Liquor Control Board. The south-eastern portion is vacant, covered by gravel, and protected by "Ecology" blocks placed by the Port. The south-western portion upland from the Duwamish Waterway is paved with asphalt or covered with gravel and is actively used by Port tenant ConGlobal Industries as a throughway between properties they lease (T-108 and T-106).

Two major combined sewer lines are buried under the Oregon Street right-of-way, a City of Seattle 84-inch diameter mainline and a King County Metro 54-inch diameter mainline. Both sewers discharge to the Duwamish Waterway at the western end of the right-of-way.

A former tide channel extended from the Duwamish Waterway along Oregon Street that is visible in aerial photographs of the vicinity taken in 1940 and 1962. Based on research performed for the South Oregon Street 2006 Environmental Data Review and Summary (Pacific Groundwater Group February 10, 2006), the channel was likely filled between 1962 and 1976. Based on historical records, the tide channel is likely significant due to sources of contamination in the Duwamish Waterway, sources in runoff and drainage from upland industry, and sources introduced by the use of contaminated channel backfill. The underground sewer lines are in close proximity to the former channel and may have been installed within the channel.

SUMMARY OF WORK PERFORMED

The methods used to collect and analyze data for this project are briefly described in this section. Detailed narratives of the work performed are provided in Appendix A.

The Oregon Street Phase II Investigation scope of work was developed by representatives of Pacific Groundwater Group (PGG) and the Port. To meet the investigation objectives, five boreholes (B06-1 through B06-5) were drilled using direct-push technology within the right-of-way (Figure 1). Geologic logs for the boreholes are presented in Figures 2 through 6. Four soil samples collected at various depths were selected from each borehole for laboratory analysis based on observations made in the field of suspected contamination and to represent the total exploration depth in the right-of-way. The samples are identified by borehole name followed by sample depth in feet[1]. Groundwater samples were collected from temporary wells installed in two of the boreholes. B06-2 was drilled

[1] For example, soil sample B06-4-12.5 was collected from borehole B06-4 at an approximate depth of 12.5 feet below ground surface.

in the estimated location of the former tide channel; therefore a groundwater sample was collected in this borehole. B06-5 was drilled closest to the Duwamish Waterway and in the position perceived to be furthest downgradient; therefore a groundwater sample was collected in this borehole. Following completion of soil and/or groundwater sampling, the boreholes were backfilled with bentonite pellets.

Sediment samples were collected from the intertidal zone along the banks of the Duwamish Waterway. Three sample locations were selected, on an outcrop of the upland (IT-1), along a gently sloped beach (IT-2), and in the interstices of rip rap surrounding the City of Seattle sewer outfall (IT-3). Sediment samples were collected at two depths from each sampling location and the samples are identified by sampling location followed by depth in inches[2].

Approximate locations of the boreholes, groundwater samples, and intertidal sediment samples are presented in Figure 1. The locations and elevations of the boreholes and sediment sampling locations will be surveyed by the Port of Seattle and the survey coordinates will be provided in an amendment to this technical memo in the future.

Samples collected for the Oregon Street Phase II Investigation were analyzed by OnSite Environmental Inc., a Washington State-certified lab. Analytical methods are presented in the summary tables and Appendix A. Oregon Street samples were analyzed for the following parameters:

- Borehole soil samples: diesel-extended hydrocarbons, polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and metals (arsenic, cadmium, lead, copper, zinc, and nickel). In addition, a minimum of one soil sample per borehole was analyzed for gasoline; and benzene, ethylbenzene, toluene, and xylenes (BETX).
- Groundwater samples: diesel-extended hydrocarbons, PAHs, PCBs, dissolved metals (arsenic, cadmium, lead, copper, zinc, and nickel), gasoline, and BETX.
- Intertidal sediment samples: diesel-extended hydrocarbons, PAHs, PCBs, and metals (arsenic, cadmium, lead, copper, zinc, and nickel). PAH analysis was not requested for IT-1-12 because the material was not visually distinguishable in the field from IT-1-6.

ANALYTICAL RESULTS

Analytical results of the Oregon Street soil, groundwater, and sediment samples are discussed in the following sections and summarized in Tables 1 through 11. Laboratory reports are presented in Appendix B.

[2] For example, IT-2-16 was collected at intertidal sediment sampling location IT-2 at a depth of approximately 16 inches below ground.

Soil

Analytical results of the Oregon Street soil samples are compared to Method A soil cleanup levels for industrial properties established in the Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Cleanup Regulation (Chapter 173-340 WAC). For brevity, these are referred to as MTCA Method A-industrial soil cleanup levels throughout the remainder of this technical memo and are presented on the analytical tables for reference.

The results of PAH analysis in Oregon Street soil samples are summarized in Table 1. Non-carcinogenic PAHs were detected in soil samples collected in most boreholes. MTCA Method A-industrial soil cleanup levels are not established for non-carcinogenic PAHs with the exception of naphthalene. The concentrations of naphthalene in the right-of-way soil samples were below the MTCA Method A-industrial soil cleanup level (5 mg/kg) with the exception of sample B06-2-7.5 (72 mg/kg).

MTCA Method A-industrial soil cleanup levels are not established for individual carcinogenic PAHs. Instead, the potential carcinogenic risk of PAH mixtures in a sample is assessed by adding the concentrations of individual carcinogenic PAHs weighted according to their toxicity. This methodology is referred to as a toxicity equivalency evaluation and the results are also presented in Table 1. The evaluation indicates that the toxicity of carcinogenic PAHs in Oregon Street soil samples do not exceed the MTCA Method A-industrial soil cleanup level (2 mg/kg) with the exception of B06-2-7.5 (111.7 mg/kg). The PAH concentrations in this sample are significantly higher than concentrations in the remaining soil samples. B06-2 was drilled within the estimated location of the former tide channel; underground utilities prevented other boreholes from being drilled within the channel. Therefore, the elevated concentrations of PAHs in B06-2-7.5 are likely related to historical and residual contaminated fill associated with the historic tide channel.

PCB results are commonly reported as concentrations of Aroclors, a manufacturing trade name, containing the same percentage of chlorine by mass. MTCA Method A cleanup levels are not established for individual Aroclors, instead the Aroclors are added for a total PCB cleanup level. PCBs were detected in Oregon Street soil samples collected in each borehole (Table 2). The total PCB concentrations in the Oregon Street soil samples do not exceed MTCA Method A-industrial soil cleanup levels. In most cases, PCBs were detected in the shallow samples within 3 feet of ground surface (B06-1, B06-3, B06-4, and B06-5); however, PCBs were also detected at 5- and 12.5- feet below ground (B06-2 and B06-4 respectively). In the mid-1970s, sediment contaminated with PCBs by a spill was dredged from the Duwamish and placed in pits to the south of Oregon Street for de-watering (AGI 1992). It is possible that PCBs detected in Oregon Street soil samples may be associated with this activity.

Petroleum hydrocarbon analytical results for the Oregon Street soil samples are presented in Table 3. The volatile and lighter hydrocarbons, gasoline and BTEX, were not detected in the soil samples. Diesel and lube oil range hydrocarbons were detected in soil samples collected in each borehole. The concentrations do not exceed MTCA Method A-industrial

soil cleanup levels (2000 mg/kg for diesel and lube oil) with the exceptions of lube oil in B06-1-5 (4900 mg/kg) and diesel and lube oil in B06-3-2.5 (4500 and 5400 mg/kg, respectively).

The results of the metals analyses performed on Oregon Street soil samples are summarized in Table 4. Arsenic was not detected in any of the samples analyzed. Cadmium and lead were detected in samples collected from each borehole, but the concentrations do not exceed MTCA Method A-industrial soil cleanup levels. Copper, nickel, and zinc for which MTCA Method A-industrial soil cleanup levels are not established, were detected in all soil samples analyzed.

Groundwater

Analytical results of the Oregon Street groundwater samples collected at B06-2 and B06-5 are compared to Method A groundwater cleanup levels established in MTCA. For brevity, these are referred to as MTCA Method A-groundwater cleanup levels throughout the remainder of this technical memo and are presented on the groundwater analytical tables for reference.

Non-carcinogenic and carcinogenic PAHs were detected in groundwater samples collected at B06-2 and B06-5 during this investigation (Table 5). Under MTCA, Method A-groundwater cleanup levels are not established for non-carcinogenic PAHs with the exception of naphthalene (160 ug/L). The concentration of naphthalene in B06-2 does not exceed the MTCA Method A-groundwater cleanup level and naphthalene was not detected in sample B06-5. MTCA Method A-groundwater cleanup levels are not established for individual carcinogenic PAHs. Instead, the potential carcinogenic risk of PAH mixtures in a sample is assessed by adding the concentrations of individual carcinogenic PAHs weighted according to their toxicity. This methodology is referred to as a toxicity equivalency evaluation and the results are also presented in Table 5. The evaluation indicates that the toxicity of carcinogenic PAHs in groundwater sample B06-2 (0.19 ug/L) slightly exceeds the MTCA Method A-groundwater cleanup level (0.1 ug/L). The toxicity of carcinogenic PAHs in sample B06-5 (0.02 ug/L) does not exceed the cleanup level.

PCBs quantified as Aroclor 1254 were detected in both Oregon Street groundwater samples (Table 6). However, the total PCB concentrations in B06-2 and B06-5 (0.053 and 0.070 ug/L, respectively) do not exceed the MTCA Method A-groundwater cleanup level.

Petroleum hydrocarbons and dissolved metals results for groundwater samples are summarized in Table 7. Lighter range hydrocarbons gasoline and BETX were not detected in either groundwater samples. Diesel was also not detected in the samples. The concentration of lube oil and dissolved arsenic in sample B06-2 slightly exceed the MTCA Method A-groundwater cleanup levels.

Intertidal Sediment

Analytical results of the Oregon Street intertidal sediment samples are compared to the Sediment Quality Standards (SQS) established by Ecology in Chapter 173-204 WAC. The SQS are presented in the intertidal sediment analytical tables for reference. The established standards for PAHs and PCBs are "normalized" or expressed on a total organic carbon (TOC) basis. The PAH concentrations in the intertidal sediment samples are normalized using estimated TOC values based on analysis of soils collected from borings sampled during an environmental assessment at an adjacent Port property T-108 (Pacific Groundwater Group December 18, 2006). Organic carbon results from T-108 soils with visual classifications or descriptions comparable to the intertidal sediment samples were selected.

The intertidal sediment sample results for PAH analyses are summarized in Table 8. PAHs were detected in each sediment sample with the exception of IT-2-6. The PAH concentrations normalized to the estimated total organic carbon values are also presented in Table 8 and do not exceed the SQS.

PCBs were not detected in the intertidal sediment samples collected for this investigation and therefore the normalized calculations have not been performed. The analytical results are summarized in Table 9.

Diesel range hydrocarbons were detected in the deeper samples at IT-2 and IT-3 and lube oil was detected in the deeper sample at IT-2 and both samples at IT-3 (Table 10). SQS are not established for diesel and lube oil.

Intertidal sediment samples were analyzed for arsenic, cadmium, copper, lead, nickel, and zinc and the results are summarized in Table 11. Copper, nickel, and zinc were detected in each of the intertidal sediment samples. Lead was detected in the deeper IT-2 sample and in both IT-3 samples. Arsenic and cadmium were not detected in the intertidal samples. The concentrations of copper, nickel, lead, and zinc in the intertidal sediment samples do not exceed the SQS.

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