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Geotechnical & Pavement Engineering • Hydrogeology • Geoenvironmental • Inspection & Testing

TECHNICAL MEMORANDUM

TO: Kevin Kim, Jacobs Engineering, Inc.

FROM: Jeff Thompson, LG, LEG
Donald Huling, PE

SUBJECT: Analytical Results for Environmental Samples
West Sammamish River Bridge Project, Kenmore, Washington

DATE: September 16, 2015

This memorandum describes analytical results for soil samples collected from geotechnical borings advanced during June and July 2015 for the subject project. This memorandum was prepared in accordance with subconsulting agreement W3X66103-S15-0001 between Jacobs and HWA dated June 22, 2015.

The purpose of soil sampling and analysis activities was to evaluate concentrations of potential chemicals of concern (PCOCs) in soils to be removed during construction of the bridge (e.g., during grading and pile installation), that may require special handing or disposal, or pose a risk to on-site workers during construction. A list of PCOCs was compiled by HWA based on the following:

- History: the bridge supports daily and often heavy vehicular traffic, and is subject to leaks of petroleum and other fluids;
- Location: the bridge is near the mouth of the Sammamish River and the sediments and/or bank deposits are impacted by runoff from the bridge, the adjacent boat launch, upstream activities, and storm water runoff from nearby upland properties;
- Adjacent properties: these include retail gasoline stations, dry cleaning facilities, businesses that operate underground storage tanks (USTs) for petroleum storage, asphalt and concrete operations.

Based on our review of site information, the list of PCOCs included:

- Total petroleum hydrocarbons as gasoline (TPHg), as diesel (TPHd), and as lube oil (TPHo);
- Volatile constituents of gasoline: benzene, toluene, ethylbenzene and xylenes (BTEX);
- Volatile organic compounds (VOCs);

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- Polychlorinated biphenyls (PCBs)
- Polynuclear aromatic hydrocarbons (PAHs); and,
- Heavy metals.

Nine geotechnical borings (BH-2 through BH-10) were advanced by HWA to support our geotechnical evaluation. Boring locations are shown on Figure 1 (attached). Soil samples were selected from each geotechnical boring and submitted to a Washington Department of Ecology (Ecology) accredited analytical laboratory for chemical analysis to evaluate PCOC concentrations in the samples. Analytical results were compared to Model Toxics Control Act (MTCA) cleanup levels, Ecology guidance soil end use criteria, selected local permitted landfill acceptance criteria, and Ecology published natural background values (for metals), in order to evaluate the relative quality of the soils and provide handling and disposal recommendations for the project. Analytical results for the soil samples are summarized in Table 1 (attached) and described below. Copies of original laboratory reports are included in Appendix A (attached).

Our review of analytical results for the soil samples indicates the following:

- Relatively low concentrations (120 milligrams per kilogram [mg/kg] to 350 mg/kg) of TPH in the lube oil range were present in the samples from BH-2, BH-4, BH5-4, BH-6 and BH-8. The concentrations were detected in samples collected from approximately 1 foot below ground surface (bgs) to 11 feet bgs in these borings. There was no apparent pattern to their occurrence relative to location, depth, or soil type. Although below MTCA cleanup levels, TPH concentrations in these samples indicate that soil from these borings may be classified as Category II to Category III soils and require special handling and/or disposal, per Ecology guidance (Ecology, 2011).

- VOCs were detected at relatively low concentrations in samples collected from BH-2 through BH-5, and in BH-10. Of four VOCs detected (acetone, carbon disulfide, 2-butanone, and trichlorofluoromethane (Freon), only one VOC concentration in one sample exceeded a MTCA cleanup level (acetone in sample BH4-10). The other concentrations do not exceed Ecology cleanup levels, but are present at low concentrations.

- PCBs were not detected above laboratory reporting limits.

- Concentrations of some metals were detected, but are not expected to require special handling and/or disposal.

Based on the soil analytical results, shallow soils over most of the alignment may require special handling and disposal. The soils characterized classify as Category II or III per the Ecology guidance (Ecology, 2011). Category II soils may be used as fill above the water table in commercial areas, but the analytical data don't support a basis for segregating Category II versus III soils. Category II soils may be used as roadway subgrade (not applicable for the wet peat and silts to be encountered) or permitted landfill disposal.

Assuming 24, 8-foot-diameter drilled shafts, spoils generated would be around 3.3 tons per lineal foot (assuming a density of 1.8 tons per cubic yard). Although only one deep sample was collected, it is unlikely deeper alluvial or glacial soils are impacted. Assuming soils down to 15 feet may be impacted, the total volume is estimated to be 1,200 tons of soil. Assuming a cost of approximately $50/ton to haul and dispose at a licensed facility, total cost for disposal of impacted soil is estimated to be $60,000. Soil disposal costs may be reduced by segregating soils (Clean, Category II, Category III) by performing additional sampling during construction.

Construction bid documents (plans and specifications) should include all analytical results and provisions for contaminated soil handling, treatment/disposal, and health and safety requirements. Disposal of wet sediments at a licensed facility or landfill may require dewatering (decanting), with appropriate management of decanted water. Material transported to such facilities generally must pass the paint filter test (i.e. no free draining water).

HWA recommends the soil analytical results be provided to potential disposal facilities in advance of pile installation so that a cost comparison can be performed for potential disposal facilities, and a waste profile can be submitted and approved. We are happy to assist you in any way to support efficient and cost-effective disposal.

Please contact us if you have questions regarding the contents of this memorandum or other aspects of this project.

References

Washington Department of Ecology. September 2011. *Guidance for Remediation of Petroleum Contaminated Sites,* Toxics Cleanup Program, Publication No. 10-09-057.

Washington Department of Ecology. October 1994. *Natural Background Soil Metals Concentrations in Washington State,* Publication No. 94-115.

Attachments:

Figure 1: Site and Exploration Plan
Table 1: Soil Analytical Results
Appendix A: Copies of Original Laboratory Reports

Legend

BH-1 Boring Designation and Approximate Location Completed by HWA (2013)

BH-2 Boring Designation and Approximate Location Completed by HWA (2015)

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SITE AND EXPLORATION PLAN

WEST SAMMAMISH RIVER BRIDGE
KENMORE, WASHINGTON

FIGURE NO. **1**

PROJECT NO. 2013-070

Table 1 - Soil Analytical Results
West Sammamish River Bridge
Kenmore, WA

Sample ID	Sample Location	Depth (feet bgs)	Gasoline	Diesel	Oil	BTEX	VOCs	PAHs	PCBs	Total Metals
BH-2-12.5'	Boring 2	10 to 12.5	ND	ND	**320**	ND	**Acetone = 2.7 Carbon Disulfide = 0.0078 2-Butanone = 0.55**	ND	ND	**Chromium = 35 Copper = 18 Nickel = 23 Zinc = 22 All others ND**
BH-3-7.5'	Boring 3	6 to 7.5	ND	ND	ND	ND	**Acetone = 0.63 Carbon Disulfide = 0.0086 2-Butanone = 0.21**	ND	ND	**Chromium = 36 Copper = 19 Nickel = 30 Zinc = 58 All others ND**
BH-3-10'	Boring 3	8.5 to 10	ND	ND	ND	ND	**Acetone = 1.8 Carbon Disulfide = 0.0065 2-Butanone = 0.34**	ND	ND	**Arsenic = 10 'Chromium = 49 Copper = 22 Nickel = 35 Zinc = 59 All others ND**
BH4 10'	Boring 4	8.5 to 10	ND	ND	**350**	ND	**Acetone = 2.5 2-Butanone = 0.55**	ND	ND	**Chromium = 46 Copper = 15 Nickel = 27 Zinc = 66 All others ND**
BH-5-4'	Boring 5	2.5 to 4	ND	ND	**180**	ND	**Acetone = 0.52 Carbon Disulfide = 0.0027 2-Butanone = 0.19**	ND	ND	**Chromium = 39 Copper = 23 Nickel = 35 Zinc = 37 All others ND**
BH-5-10'	Boring 5	8.5 to 10	ND	ND	ND	ND	**Acetone = 1.7 Carbon Disulfide = 0.0038 2-Butanone = 0.43**	ND	ND	**Chromium = 52 Copper = 19 Nickel = 29 Zinc = 32 All others ND**
BH6-Sample 1-0'	Boring 6	0 to 1	ND	ND	**120**	ND	ND	ND	ND	**Chromium = 65 All others ND**
BH7-Sample 4-7.5'	Boring 7	7 to 8	ND	ND	ND	ND	ND	ND	ND	**Chromium = 64 Lead = 23 All others ND**
BH-8 5'	Boring 8	5 to 6	ND	ND	ND	ND	ND	**D below MTCA**	ND	**Chromium = 58 Lead = 130 All others ND**
BH-8 10'	Boring 8	10 to 11	ND	ND	**260**	ND	ND	ND	ND	**Chromium = 38 All others ND**
BH-9 5-10	Boring 9	5 to 10	ND	ND	ND	ND	ND	ND	ND	**Chromium = 40 All others ND**
BH-9 30.75-31.5	Boring 9	30.75 to 31.5	ND	ND	ND	ND	ND	ND	ND	**Chromium = 69 All others ND**
BH10-Sample 5-10'	Boring 10	10	ND	ND	ND	ND	**Trichlorofluoromethane = 0.0062 All others ND**	ND	ND	**Chromium = 36 All others ND**
State-wide / Puget Sound Background Metals Concentrations			N/A	N/A	N/A	N/A	N/A	N/A	N/A	**Arsenic = 7 / 7 Chromium = 42 / 48 Copper = 36 / 36 Nickel = 38 / 48 Lead = 17 / 24 Zinc = 86 / 85**
MTCA Method A/B Cleanup Levels			30/100 *	2000	2000	0.03	Acetone = 2.07 mg/kg 2-Butanone = 4800 Carbon Disulfide = 0.266 Trichlorofluoromethane = 2400	Varies	Varies	**Arsenic = 20 mg/kg Chromium = 2,000 mg/kg Lead = 250 mg/kg**

Notes:

All concentrations listed in milligrams per kilogram (mg/kg)

BTEX: benzene, toluene, ethylbenzene, xylenes

< Analyte not detected at or above laboratory reporting limit

Bold: concentrations listed in bold type indicate the compound was detected at a concentration greater than the laboratory reporting limit

Bold & Highlighted: concentrations listed in bold type and highlighted in yellow indicate the soil may require special handling and/or disposal, and incur higher disposal costs

Blank: sample not analyzed for these constituents

MTCA: Model Toxics Control Act regulation promulgated by Washingotn Admininstrative Code (WAC) 173-340

30/100 * The MTCA Method A cleanup level for gasoline is 100 mg/kg if the gasoline mixture does not contain benzene and if the total of ethyl benzene, toluene and xylene are less tl
The MTCA Method A cleanup level for all other gasoline mixtures is 30 mg/kg

ND: no VOCs, cPAHs , or PCBs detected above laboratory reporting limits, see lab report for complete list of analytes.