Remedial Action Work Plan for Tacoma Smelter Plume Impacts

Star Lake Elementary School (and Totem Middle School)
4014 S 270th Street
Kent, Washington

Prepared for:
Jannine McDonald
Federal Way Public Schools
Capital Projects
1211 S. 232nd Street
Federal Way, Washington 98004

May 4, 2020
Project No. 41519.001

PBS
214 E GALER STREET
SUITE 300
SEATTLE, WA 98102
206.233.9639 MAIN
866.727.0140 FAX
PBSUSA.COM

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SUPPORTING DATA

1.0 INTRODUCTION

This Remedial Action Work Plan (work plan) was prepared on behalf of Federal Way Public Schools (FWPS) to guide the remediation of arsenic and lead impacted soils at Star Lake Elementary and Totem Middle Schools (the Project / site). The site is located at 4014 South 270th Street in Kent, Washington (see Site Vicinity Map, Figure 1). The work plan is intended to outline the approach and potential actions needed to address the soil contamination at the project site during a planned construction project. It is noted in this report that one area at Star Lake Elementary School requires remediation to comply with state regulations. FWPS has elected to remediate other areas at Star Lake Elementary and Totem Middle Schools based on the proposed land use as a school site. For the purposes of regulatory compliance, the site is referred to as the Star Lake Elementary Site. For the sake of simplicity in communication between FWPS, their contractors, state agencies and PBS, remedial efforts proposed for Totem Middle School area also described herein.

1.1 Project Location

The site consists of two tax lots (King County Assessor Parcels 2722049112 and 2722049152) comprising approximately 28 acres of land in a residential neighborhood. The Site is bounded to the north and east by residential lots, to the west by 40th Avenue S, and to the south by S 270th Street. (see Figure 2 – Site Plan).

2.0 BACKGROUND

2.1 Site History

The site is located within the widespread soil contamination plume of the former Asarco smelter operation. The Asarco Company operated a copper smelter in Tacoma from 1890 to 1985. Smelter operations emitted an airborne plume of particulates with arsenic, lead, and other heavy metals that were distributed over a wide region of the Puget Sound. As a result, these metals have been found in near surface soils at concentrations which may pose a threat to human health and/or the environment.

The Washington State Department of Ecology (Ecology) recommends soil sampling at properties in areas with estimated arsenic levels above the state cleanup level of 20 mg/kg. Ecology's "Everett and Tacoma Smelter Search" web page https://fortress.wa.gov/ecy/smeltersearch/ maps the site within a zone of potential arsenic concentrations ranging from 40 milligram per kilogram (mg/kg) to 100 mg/kg. Thus, the 40 mg/kg to 100 mg/kg range is considered the "baseline" for arsenic concentrations in near surface soils expected on site.

2.2 Regulatory Criteria

Ecology's Model Toxics Control Act (MTCA) has established cleanup levels for arsenic and lead for unrestricted land use that are protective of human health and the environment. Ecology's MTCA Method A cleanup levels (CULs) for unrestricted land use for arsenic and lead are:

- The CUL for arsenic is 20 milligrams per kilogram (mg/kg)
- The CUL for lead is 250 mg/kg.

Per Ecology's Tacoma Smelter Plume Model Remedies Guidance[1] (Smelter Plume Guidance), *"if arsenic or lead levels are elevated for any decision unit on the property, that decision unit needs cleanup."* Per the Smelter Plume Guidance, elevated is defined as:

- Average arsenic > 20 parts per million (ppm, equivalent to mg/kg) or average lead > 250 ppm; **or**
- Maximum (any one sample) arsenic >40 ppm or maximum lead > 500 ppm.

2.3 Initial Soil Characterization - 2018

Arsenic and Lead Soil Sampling, PBS, October 2018
In November 2018 PBS performed soil characterization sampling at the site to determine the levels of arsenic and lead in shallow soil. Soil characterization was conducted in accordance with the Smelter Plume Guidance. Findings of the sampling activities were presented in the Star Lake Elementary School and Totem Middle School - Arsenic and Lead Soil Sampling Reports. The reports were originally issued in November 2018 and were revised in May 2020 based on communication between FWPS, Ecology and PBS. Both reports are presented in Appendix A. The reports identified five locations at Star Lake Elementary and one location at Totem Middle where arsenic concentrations exceeded Washington State Department of Ecology's Model Toxics Control Act[2] (MTCA) Method A cleanup level (CUL) criteria for unrestricted land use. Of the sample locations exceeding CULs, one location at Star Lake had an arsenic concentration defined as elevated per the Ecology Guidance (See Section 2.3).

2.4 Remediation Goals

FWPS intends to remediate sample locations with elevated concentrations of arsenic or lead as directed by the Smelter Plume Guidance. Based on the intended land use as a school, FWPS has also elected to remediate areas where single sample locations contained concentrations of arsenic or lead exceeding the CUL, even if average concentrations within the decision unit are below the cleanup level, and as such are not defined as elevated per the Smelter Plume Guidance.

[1] "*Tacoma Smelter Plume Model Remedies Guidance: Sampling and Cleanup of Arsenic and Lead Contaminated Soils",* Washington State Department of Ecology, July 2019, Publication No. 19-09-101.
[2] "*Model Toxics Control Act Regulation and Statute",* Washington State Department of Ecology Toxics Cleanup Program, 2013, Publication No. 94-06.

Supplemental Arsenic and Lead Soil Sampling, PBS, June 2019
In October 2019, PBS performed supplemental soil sampling to further delineate the extent of arsenic and lead impacted soil surrounding the locations with concentrations of arsenic exceeding CULs as identified in 2018. The goal of the supplemental sampling was primarily to identify which trees within the proposed remediation area could be retained, and which trees required removal to facilitate remediation.

3.0 SOIL REMEDIATION PLAN

3.1 Remediation Areas

Based on the results of soil characterization sampling conducted at the site, and FWPS's goal of remediating any sample location where soil concentrations exceeded the CUL, three remediation areas were identified at the site based on detected arsenic concentrations. The remediation areas are presented in Drawing Sheets HM500 and HM600 presented in the figures section of this report.

3.2 Proposed Model Remedy – Mixing in Place

The Smelter Plume Guidance presents four model remedies for arsenic and lead contaminated soils based on concentrations detected at the site. Mixing in place had been selected as the model remedy for the site. The Smelter Plume Guidance considers mixing a permanent remedy that is acceptable for sites that meet the following criteria:

- Average arsenic concentrations less than 40 ppm and average lead concentrations less than 500 ppm
- Contamination is not deeper than 12 inches
- Arsenic and lead levels in deeper soils (12-18" and 18-24") have low enough arsenic and lead levels to dilute surface soils.

Based on soil characterization conducted in 2018 and 2019, the site meets all of the above criteria, and mixing in place is considered an acceptable and permanent remediation technique for the site.

3.3 Implementation of Model Remedy

Chapter Four of the Smelter Plume Guidance provides a worksheet to calculate the depth of mixing required to achieve CULs. Because the site surface consists of relatively undisturbed soils, Example B of the worksheet was used to calculate mixing depth for the three remediation areas. Below is the equation presented in Example B:

$$\frac{(\text{Surface Soil Arsenic Concentration} \times \text{depth}) + (\text{Deeper Soil Arsenic Concentration} \times \text{depth})}{\text{Surface depth} + \text{deeper depth}}$$

The equation is applied to the three remediation areas as follows:

Remediation area 1 (Star Lake):
Average arsenic concentration in top 6 inches as represented by samples SL-1-18a, SL-1-24, SL-1-25, SL-1-28a, SL-1-29a, SL-1-30a, SL-1-31a, and SL-1-32a is calculated below:

$Arsenic_{(Ave)}$ 0-6 inch = (26.6 ppm + 72.7 ppm + 25.1 ppm + 3.25 ppm + 7.55 ppm + 24.5 ppm +24.9 ppm + 8.41 ppm) / 7 samples
$Arsenic_{(Ave)}$ 0-6 inch = 24.1 ppm

Average arsenic concentration from 6 – 12 inches as represented by sample SL-1-18b
$Arsenic_{(Ave)}$ 6-12 inch = 6.88 ppm

Thus, using the equation from Example B in the Chapter Four worksheet:

$$Arsenic_{(Ave)}\ Mixed = \frac{(24.1\ ppm \times 6'') + (6.88 \times 6'')}{(6'' + 6'')}$$

$Arsenic_{(Ave)}$ Mixed = 15.5 ppm

Because 15.5 ppm meets the CUL for arsenic, mixing to a depth of 12 inches in Remediation Area 1 is expected to be enough to achieve the CUL.

Remediation area 2 (Star Lake):
Average arsenic concentration in top 6 inches as represented by samples SL-2-09a, SL-2-10, SL-2-14 and SL-2-15 is calculated below:

$Arsenic_{(Ave)}$ 0-6 inch = (13.5 ppm + 19.1 ppm + 17.5 ppm + 22.6 ppm) / 4 samples
$Arsenic_{(Ave)}$ 0-6 inch = 18.2 ppm

Because the average arsenic concentration in the top 6 inches of soil within Remediation Area 2 is below the CUL, mixing with deeper soils is not expected to be required to achieve CULs. As such, mixing to a depth of 6 inches within Remediation Area 2 is expected to be enough to achieve the CUL.

Remediation area 3 (Totem):
Average arsenic concentration in top 6 inches as represented by samples TM-1-22, TM-1-25a, TM-1-26 and TM-1-27 is calculated below:
$Arsenic_{(Ave)}$ 0-6 inch = (4.78 ppm + 16.1 ppm + 26 ppm + 4.67 ppm) / 4 samples
$Arsenic_{(Ave)}$ 0-6 inch = 12.9 ppm

Because the average arsenic concentration in the top 6 inches of soil within Remediation Area 3 is below the CUL, mixing with deeper soils is not expected to be required to achieve CULs. As such, mixing to a depth of 6 inches within Remediation Area 3 is expected to be enough to achieve the CUL.

3.4 Means and Methods for Remediation

Means and methods for soil remediation by mixing in place will be determined by the contractor selected by FWPS to perform the remediation based on project specifications prepared by PBS and presented to the contractor by FWPS in the bid package for the project. Means and methods include equipment to be used, as well as mixing techniques such as mixing in place, piling into rows or stockpiles for mixing and spreading back out, or other methods determined to be efficient and cost effective for the contractor and FWPS. The contractor will be required to follow the health and safety procedures outlined in Section 3.5.

3.5 Protection of Human Health and the Environment During Remediation

The contractor selected by FWPS to perform the remediation of soils at the site will be responsible for the health and safety of its own personnel and employees, as well as that of any subcontractors hired to perform the work. The contractor will follow the requirements of the Washington State Department of Labor and Industries Safety Standards for Arsenic[3]

Work will be performed with the periodic wetting of soils to prevent the generation of fugitive dust. Wetting of soils will be conducted such that surface runoff of water and/or sediment from the remediation area is prevented in accordance with the contractor's Construction Storm Water Pollution Prevention Plan specific to the project.

PBS will perform air monitoring at the perimeter of remediation areas while mixing activities are taking place. Air samples will be analyzed for particulate arsenic and lead to ensure that contaminants are not escaping the remediation area during the work.

4.0 POST-REMOVAL COMPLIANCE SOIL SAMPLING

Chapter Seven of the Smelter Plume Guidance specifies that compliance samples be collected after mixing is complete to determine if mixing worked, and that concentrations of arsenic and/or lead within the remediated area meet CULs.

[3] "*Safety Standards for Arsenic",* Washington Department of Labor and Industries, Chapter 296-848 WAC.

Chapter Seven Table 4 of the Smelter Plume Guidance presents the number of compliance samples required for each remediation area based on acreage and mapped arsenic concentrations. The number of compliance samples required for each remediation area based on the table is presented below:

- Remediation Area 1 (1.25 acres, mapped arsenic concentration <100 ppm) = 16 samples
- Remediation Area 2 (0.25 acres, mapped arsenic concentration <100 ppm) = 8 samples
- Remediation Area 3 (1 acre, mapped arsenic concentration <100 ppm) = 16 samples

Following the completion of mixing in soils in place, each remediation area will be divided into an evenly spaced grid based on the number of compliance samples required, as outlined above, and in accordance with Chapter Seven of the Smelter Plume Guidance. Soil samples will be collected at each grid point at depths of 0-6 inches and 6-12 inches in Remediation Area 1. Soil samples will be collected at each grid point at a depth of 0-6 inches in Remediation Areas 2 and 3. Soil samples will be collected and analyzed following the Smelter Plume Guidance Sampling Process as outlined in Chapter Seven of the guidance. Compliance soil samples will be analyzed for total arsenic and lead by EPA Method 6010/6020 at an Ecology accredited laboratory.

5.0 INTERPRETATION OF SAMPLING RESULTS

Concentrations of arsenic and lead in soil samples as determined by laboratory analysis will be compared to arsenic and lead CULs. If all concentrations meet CULs, remediation will be considered complete. If concentrations of either arsenic or lead in compliance samples exceed CULs, the area represented by the compliance samples in exceedance of CULs will be mixed in place to a depth 6 to 12 inches below the maximum mixing depth achieved in the prior remediation effort. Additional remediation by mixing in place will be conducted following the same procedures outlined in Section 3 and as specified in Chapter 4 of the Smelter Plume Guidance.

6.0 REPORTING

Upon completion of the soil removal and compliance sampling, a project completion report will be prepared that documents the specific depths and locations of the mixing of arsenic-impacted soil, locations and results of compliance soil samples, and evaluation of the lab results with respect to cleanup levels. An accompanying narrative will describe the sampling operations, and any deviations to the procedures that occurred. Corrective actions will be identified as needed, and the resolution of any discrepancies will be reported.

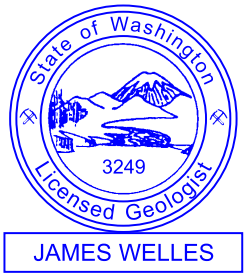
7.0 SIGNATURES

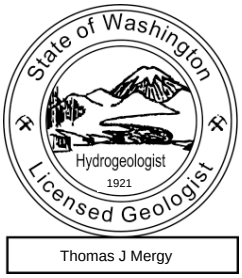
Digitally signed by James Welles
Date: 2020.05.04 10:49:35 -07'00'

James Welles, LG
Project Geologist

Digitally signed by Thomas Mergy
Date: 2020.05.04 10:59:41 -07'00'

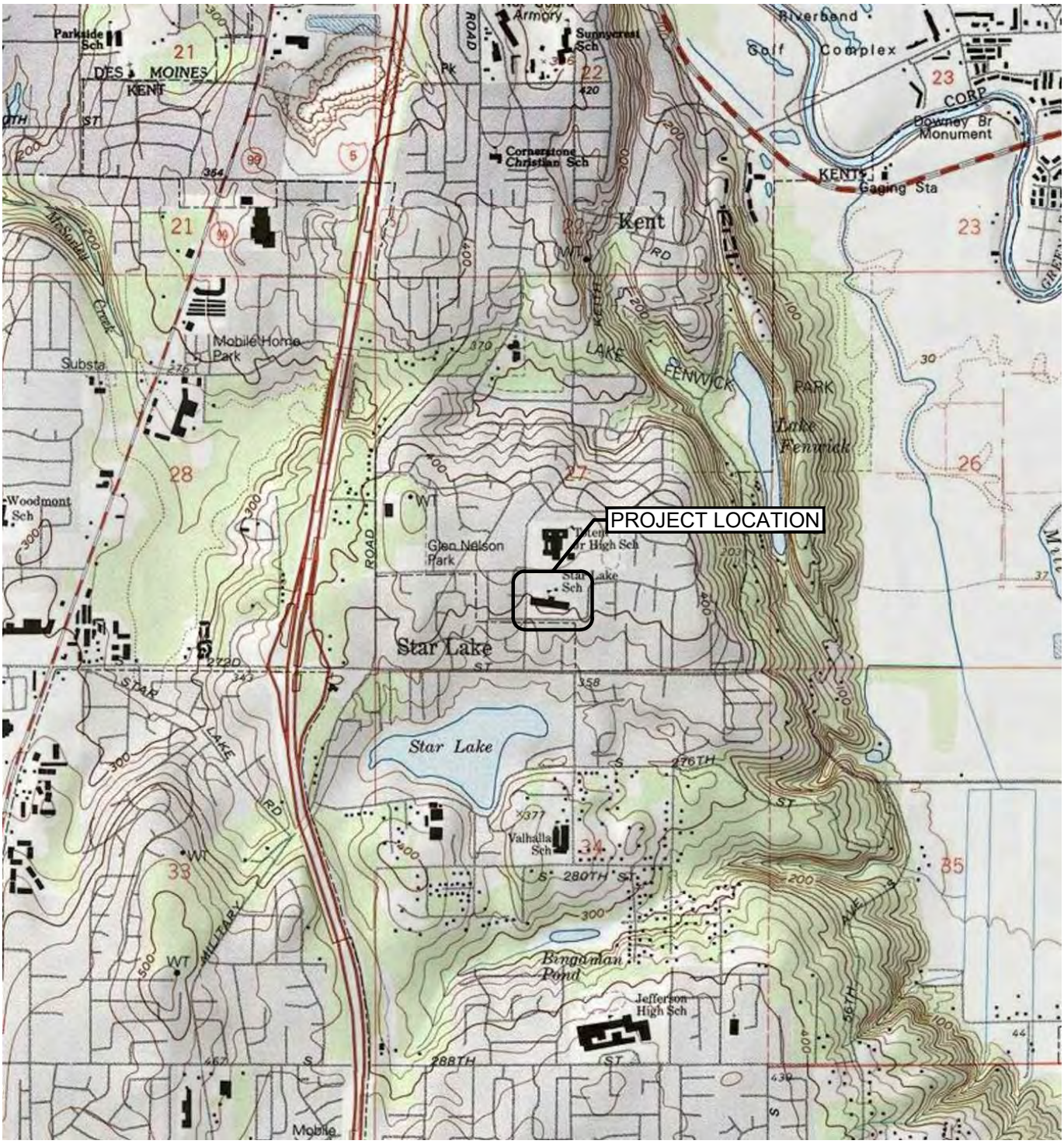
Thomas Mergy, LHG
Principal Hydrogeologist





FIGURES

Figure 1 — Vicinity Map
Sheet HM500 – Star Lake ES Arsenic Contaminated Soil Remediation Plan
Sheet HM600 – Totem MS Arsenic Contaminated Soil Remediation Plan



SOURCE: USGS POVERTY BAY, WA QUADRANGLE 1990, PHOTO REVISED 1994.

WASHINGTON

SCALE 1" = 2000'

0' 1,000' 2,000' 4,000'

PREPARED FOR: FEDERAL WAY PUBLIC SCHOOLS

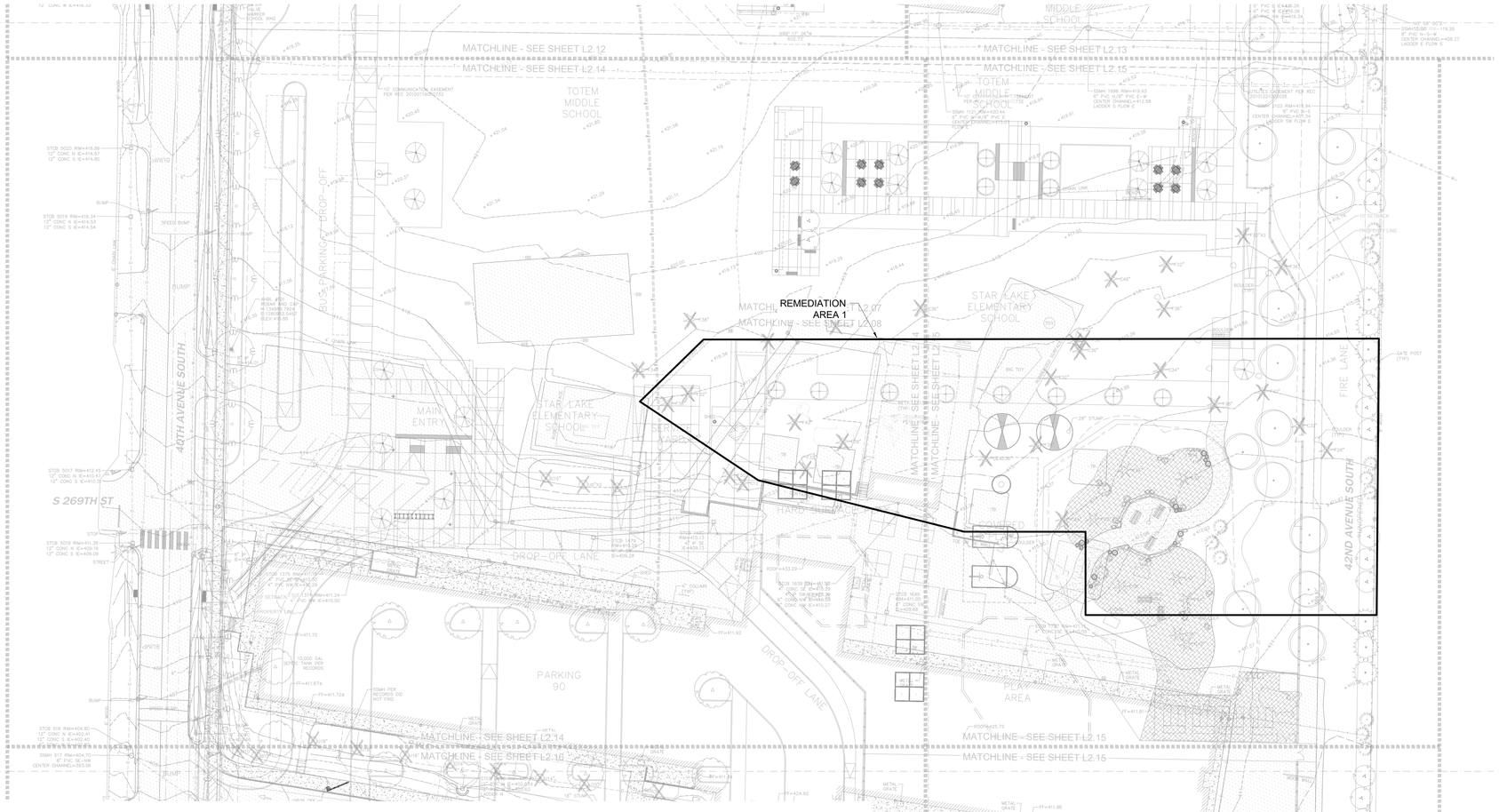
PBS

VICINITY MAP

STAR LAKE ELEMENTARY SCHOOL
4014 SOUTH 270TH STREET
KENT, WASHINGTON

MAY 2020
41519.001

FIGURE
1



GENERAL NOTES

1. A COPY OF THE APPROVED PLAN MUST BE ON SITE WHENEVER CONSTRUCTION IS IN PROGRESS.
2. PRIOR TO ANY CONSTRUCTION ACTIVITY, THE CONTRACTOR SHALL SCHEDULE AND ATTEND A PRE-CONSTRUCTION CONFERENCE WITH THE OWNER.
3. PAVED SURFACES INCLUDING ROADWAYS, SIDEWALKS, AND CURBS THAT ARE DAMAGED BY NEW CONSTRUCTION SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
4. ALL LOCATIONS OF EXISTING UTILITIES SHOWN HEREON HAVE BEEN OBTAINED FROM AVAILABLE RECORDS AND SHOULD THEREFORE BE CONSIDERED APPROXIMATE ONLY AND NOT NECESSARILY COMPLETE. IT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO INDEPENDENTLY VERIFY THE ACCURACY OF ALL UTILITY LOCATIONS SHOWN AND TO FURTHER DISCOVER AND AVOID ANY OTHER UTILITIES NOT SHOWN HEREON WHICH MAY BE AFFECTED BY THE IMPLEMENTATION OF THIS PLAN. NOTIFY ENGINEER OF UNFORESEEN UTILITY IMPEDIMENTS.
5. THE CONTRACTOR SHALL LOCATE AND PROTECT ALL CASTINGS AND UTILITIES DURING CONSTRUCTION AND SHALL CONTACT THE UNDERGROUND UTILITIES LOCATOR SERVICE (1-800-424-5555). AT LEAST 48 HOURS PRIOR TO CONSTRUCTION.
6. THE CONTRACTOR SHALL PROVIDE AND MAINTAIN TEMPORARY SEDIMENTATION COLLECTION FACILITIES TO ENSURE THAT SEDIMENT-LADEN WATER DOES NOT ENTER THE NATURAL OR PUBLIC DRAINAGE SYSTEM. AS CONSTRUCTION PROGRESSES AND UNEXPECTED (SEASONAL) CONDITIONS DICTATE, MORE SILTATION CONTROL FACILITIES MAY BE REQUIRED TO ENSURE COMPLETE SILTATION CONTROL OF THE PROJECT. THEREFORE, DURING THE COURSE OF CONSTRUCTION IT SHALL BE THE OBLIGATION AND RESPONSIBILITY OF THE CONTRACTOR TO ADDRESS ANY NEW CONDITIONS THAT MAY BE CREATED BY THEIR ACTIVITIES AND TO PROVIDE ADDITIONAL FACILITIES THAT MAY BE NEEDED TO PROTECT ADJACENT PROPERTIES.
7. THE CONTRACTOR SHALL KEEP OFF-SITE STREETS CLEAN AT ALL TIMES BY SWEEPING.
8. ANY DAMAGE TO EXISTING FACILITIES DURING COURSE OF WORK SHALL BE RESTORED OR REPLACED AT CONTRACTOR'S EXPENSE.
9. PERFORM ALL ARSENIC CONTAMINATED SOIL REMEDIATION IN ACCORDANCE WITH SPECIFICATION SECTION 026100.

PROJECT NOTES

1. MIX SOIL IN PLACE WITHIN REMEDIATION AREA FROM GROUND SURFACE TO 12" BELOW GROUND SURFACE IN AREA 1 AND 6" BELOW GROUND SURFACE IN AREA 2. ESTIMATED VOLUME OF SOIL FOR MIXING IN PLACE IS 2,060 CUBIC BANK YARDS.
2. REMOVE ALL SURFACE IMPROVEMENTS WITHIN REMEDIATION AREA.
3. SURFACE IMPROVEMENT REMOVED FROM REMEDIATION AREA, SUCH AS CONCRETE OR ASPHALT, MAY BE RECYCLED OR DISPOSED OF AT AN ACCEPTING FACILITY AFTER REMOVAL OF ANY RESIDUAL SOIL VIA DRY METHODS (EG. SWEEPING).

ORIGINAL SHEET IS 30" x 42"

mcg-ARC

architect_
MCGRANAHAN ARCHITECTS

civil engineer_
COUGHLIN PORTER LUNDEEN

landscape architect_
WEISMAN DESIGN GROUP

structural engineer_
PCS STRUCTURAL SOLUTIONS

mechanical engineer_
BCE ENGINEERS

electrical engineer_
BCE ENGINEERS

food service_
STAFFORD DESIGN GROUP

hazardous materials_
PBS ENGINEERING

surveyor_
AHBL

project_
STAR LAKE ES & TOTEM MS

client_
FEDERAL WAY PUBLIC SCHOOLS

location_
KENT, WA

Project No.1804

STAR LAKE ES - ARSENIC CONTAMINATED SOIL REMEDIATION PLAN

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sheet_
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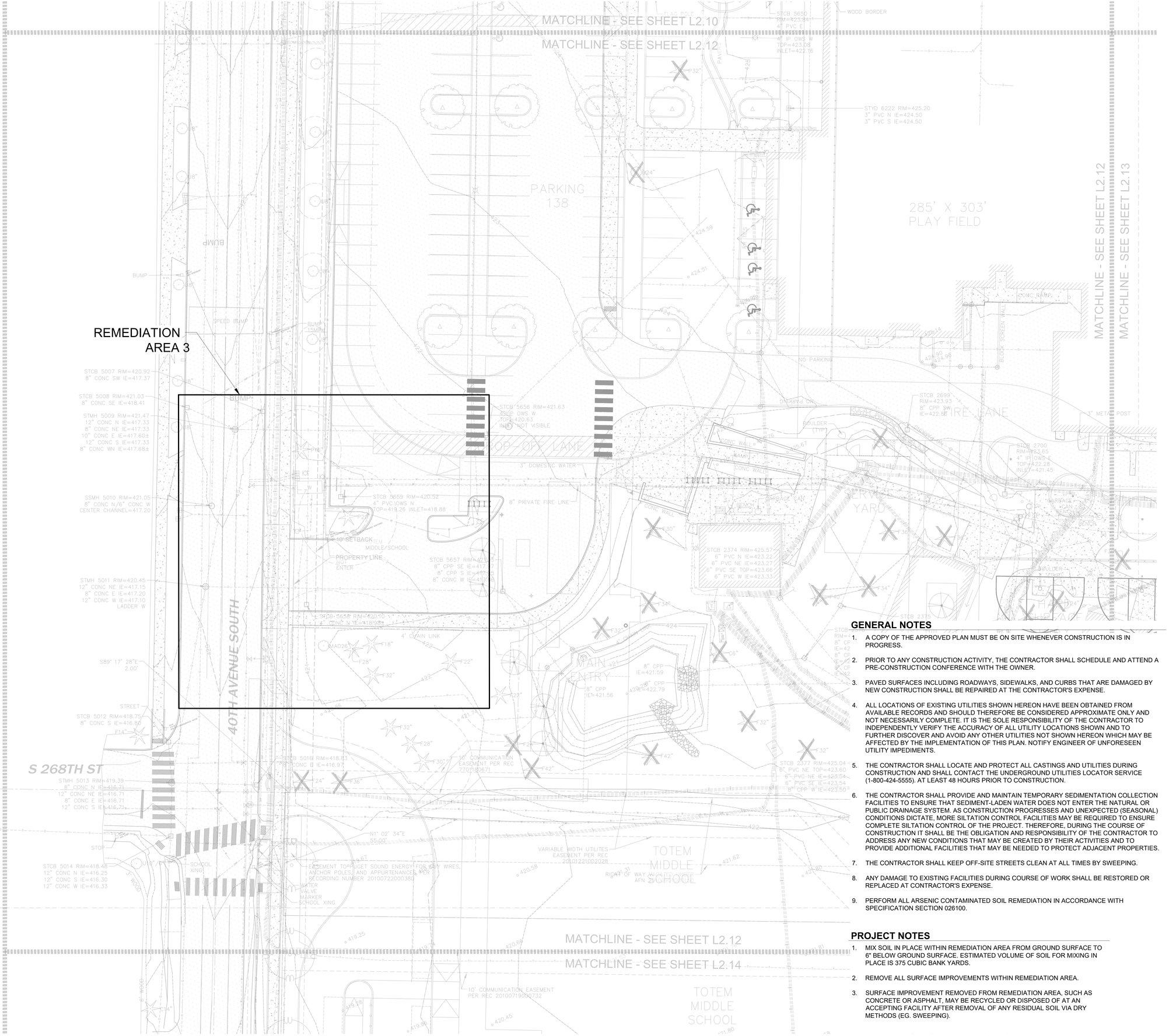

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PROJECT NOTES

1. MIX SOIL IN PLACE WITHIN REMEDIATION AREA FROM GROUND SURFACE TO 6" BELOW GROUND SURFACE. ESTIMATED VOLUME OF SOIL FOR MIXING IN PLACE IS 375 CUBIC BANK YARDS.
2. REMOVE ALL SURFACE IMPROVEMENTS WITHIN REMEDIATION AREA.
3. SURFACE IMPROVEMENT REMOVED FROM REMEDIATION AREA, SUCH AS CONCRETE OR ASPHALT, MAY BE RECYCLED OR DISPOSED OF AT AN ACCEPTING FACILITY AFTER REMOVAL OF ANY RESIDUAL SOIL VIA DRY METHODS (EG. SWEEPING).

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Project No.1804

TOTEM MS - ARSENIC CONTAMINATED SOIL REMEDIATION PLAN

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APPENDIX A

Initial and Supplemental Soil Characterization Reports for Star Lake Elementary and Totem Middle Schools

May 4, 2020

Federal Way Public Schools
Capital Projects
1211 S 232nd St
Federal Way, WA 98004
Email: fwpscp18@fwps.org

RE: Star Lake Elementary School – Arsenic and Lead Soil Sampling
4014 S 270th Street, Kent, Washington
PBS Project #41519.001

Federal Way Public Schools (FWPS) contracted PBS Engineering and Environmental Inc. (PBS) to evaluate the potential for arsenic and lead contaminants in near surface soils at the site of Star Lake Elementary School (SLES) prior to site redevelopment as part of the Star Lake Elementary School Replacement Project. This report was originally issued on November 30, 2018. The regulatory criteria and report conclusions have been revised in May 2020 based on communication between FWPS, PBS and the Washington State Department of Ecology (Ecology).

On November 5, 2018 PBS performed soil sampling activities to determine the levels of arsenic and lead in shallow soil at SLES in Kent, Washington (Figure 1). This report presents the findings of the sampling activities and provides recommendations for regulatory compliance as well as for the handling and management of impacted soils during future redevelopment. The scope of services was presented in the Proposal for Arsenic and Lead Soil Testing (WA28800) by PBS, dated August 2, 2018.

BACKGROUND

SLES is located within the widespread soil contamination plume of the former Asarco smelter operation. The Asarco Company operated a copper smelter in Tacoma from 1890 to 1985. Smelter operations emitted an airborne plume of particulates with arsenic, lead, and other heavy metals that were distributed over a wide region of the Puget Sound. As a result, these metals have been found in near surface soils at concentrations which may pose a threat to human health and/or the environment.

Ecology's Tacoma Smelter Plume Model Remedies Guidance (Smelter Plume Guidance) recommends soil sampling at properties in areas with estimated arsenic levels above the state cleanup level of 20 ppm[1]. Ecology's "Everett and Tacoma Smelter Search" web page https://fortress.wa.gov/ecy/smeltersearch/ maps the SLES site within a zone of potential arsenic concentrations ranging from 40 milligram per kilogram (mg/kg) to 100 mg/kg. Thus, the 40mg/kg to 100 mg/kg range can be considered the "baseline" for arsenic concentrations in near surface soils expected on site.

[1] *"Tacoma Smelter Plume Model Remedies Guidance: Sampling and cleanup of arsenic and lead contaminated soils"*, Washington State Department of Ecology, June 2012, Publication No. 12-09-086-A

REGULATORY CRITERIA

Per the Smelter Plume Guidance *"if arsenic or lead levels are elevated for any decision unit on the property, that decision unit needs cleanup."* Per the Smelter Plume Guidance, elevated is defined as:

- Average arsenic > 20 parts per million (ppm, equivalent to mg/kg) or average lead > 250 ppm; **or**
- Maximum (any one sample) arsenic >40 ppm or maximum lead > 500 ppm.

Ecology's Model Toxics Control Act (MTCA) has established cleanup levels for arsenic and lead for unrestricted land use that are protective of human health and the environment[2]. Results of soil sampling will be compared to the applicable MTCA standards.

Ecology's MTCA Method A cleanup levels (CULs) for unrestricted land use for arsenic and lead are applicable for comparison to any single soil sample concentration. The CULs for arsenic and lead are presented below:

- The CUL for arsenic is 20 milligrams per kilogram (mg/kg)
- The CUL for lead is 250 mg/kg.

For reference, Ecology conducted a study to determine natural background concentrations of metals in soil for the Puget Sound area[3]. The study found that the natural background concentration for arsenic in soil is 7.0 parts per million (ppm) and 24 ppm for lead. Parts per million is roughly equivalent to mg/kg.

Based on the land use as a school, FWPS has elected to clean up site soils found to be in exceedance of CULs, even if the soils are not defined as elevated per the Smelter Plume Guidance.

CHARACTERIZATION SOIL SAMPLING

On November 5, 2018, sixty (60) discrete soil samples were collected from forty-eight (48) locations around the building landscaping and playfields of SLES. Following Ecology guidance, the property was divided into two decision units (DUs) based on current use as playfield or landscape area. Decision units and sample locations are shown on Figure 2. A summary of the decision units is provided below. The number of samples screened and collected for analysis per DU for this project is based on the Ecology guidance.

Decision Units

Decision Unit ID	Soil disturbance planned?	Number of samples collected (0-6")	Number of samples collected (6-12")	Acres (approximate)	Total Number of Samples
1	unknown	27	7	4.3	34
2	unknown	21	5	4.2	26

0-6" = Soil samples were collected from the 0-6 inch depth interval
6-12" = Soil samples were collected from the 6-12 inch depth interval

[2] *"Model Toxics Control Act Regulation and Statute"*, Washington State Department of Ecology, 2013 Revision, Publication No. 94-06

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

One (1) discrete sample was collected at each sample location from a depth interval of zero to six inches below ground surface (bgs). A second discrete sample was collected at every fourth location from a depth interval of six to twelve inches bgs. Sample locations were chosen in a manner that maximized coverage of the decision units and did not contain areas with surface cover or buildings during the sampling activities.

Soil sample collection started just below any surface cover layer (e.g., sod or grass). A hand spade and a hand auger were used to complete 6-inch deep test holes. A soil sample was collected at a depth of less than 6 inches below ground surface at each location. At every fourth location, upon collection of the zero to six-inch sample, the hole was advanced to a depth of twelve inches, and a second sample was collected from the six to twelve-inch depth interval using the same methods described above.

PBS personnel wore disposable nitrile gloves to protect against cross-contamination between samples. Soil retained for analysis was packed into laboratory-provided containers, labeled and transported on ice under chain of custody documentation to Friedman and Bruya, Inc. in Seattle, an Ecology accredited analytical laboratory.

Samples were analyzed for total arsenic and lead using EPA Method 6020. Total arsenic and lead results were reported on a dry weight basis.

ANALYTIC RESULTS

Analytical results from soil samples collected on site are below MTCA Method A CULs for arsenic, except for five (5) samples from five different locations. Arsenic was detected in exceedance of the CUL in samples SL1-18a, SL1-20, SL1-24 and SL1-25 within DU1; and SL2-15 within DU2 at a maximum concentration of 72.7 mg/kg. All other sample results for arsenic were below the MTCA Method A cleanup level of 20 mg/kg.

All analytical results for lead from soil samples collected on-site are below the MTCA Method A cleanup level of 250 mg/kg.

Based on the analytical results of soil samples collected on-site, average arsenic and lead concentrations were calculated for each decision unit and are presented below.

Average Concentrations per Decision Unit

Decision Unit ID	Mean Concentration (0-6″)		Mean Concentration (6-12″)	
	As	Pb	As	Pb
1	12.5	21.7	6.1	9.0
2	9.9	16.9	8.5	14.5
MTCA A Cleanup Level	20	250	20	250

(0-6″) (Pb / As) = Average Concentration at the zero to six-inch interval for arsenic (As) and lead (Pb) in mg/kg
(6-12″) (Pb / As) = Average Concentration at the six to twelve-inch interval for arsenic (As) and lead (Pb) in mg/kg

Analytical results from soil samples collected on-site are summarized in Table 1. Figure 2 depicts the decision unit boundaries and the locations where analytical results indicated lead or arsenic concentrations above MTCA Method A CULs. Laboratory reports are provided in Attachment A.

CONCLUSIONS

Based on the analytical results of the soil sampling, and using Ecology's *Tacoma Smelter Plume Model Remedy Guidance, June 2012*[1], the following conclusion and recommendations were made regarding the handling and management of project site soils.

Decision Units 1 and 2

Analytical results from discrete soil samples collected within both decision units 1 and 2 of the SLES site identified four (4) locations within decision unit 1 (SL1-18, SL1-20, SL1-24 and SL1-25) and one (1) location within decision unit 2 (SL2-15) where arsenic concentrations are above MTCA Method A CULs in the top 6" bgs.

Further action will be required to address the arsenic concentrations in soil at the above referenced locations and achieve compliance with Ecology regulations. According to Ecology's Model Remedies Guidance, the impacted soil can be managed in-place or removed by excavation. Strategies for management of impacted soil in-place include dilution of arsenic concentrations via mixing of impacted soil with clean imported soil or capping of soil in place with clean soil and a geotextile or a hard cap. Mixing of soils is accepted for arsenic-impacted soil with an average concentration less than 40 ppm. Ecology does not consider capping in-place a permanent remediation strategy given the potential for exposure if the cap is removed. Capping in-place may require annual inspection of the cap's integrity, as well as the filing of an environmental land covenant for the property. Based on communication between FWPS, Ecology and PBS, mixing in place has been selected as the preferred model remedy at the site.

Remediation of impacted soils can be conducted by the contractor as part of the Star Lake Elementary School Replacement Project under PBS's supervision, but must be completed prior to any grading, excavation or earthwork activities that disturb on-site soil. The construction design and specifications for remediation of the arsenic-impacted soil as part of the Star Lake Elementary School Replacement Project shall incorporate health and safety requirements, methods for soil removal, disposal and confirmation sampling and soil management strategies.

LIMITATIONS

This investigation was conducted to characterize lead and arsenic distributions in shallow soils on-site, with a focus on protection of human health and the environment. The data collected in this investigation are not intended for the purposes of waste profiling for offsite disposal, or for estimation of volume or tonnage of soil requiring disposal.

PBS has prepared this report for use by FWPS. This report is not intended for use by others without the written consent of the FWPS. Our interpretation of soil conditions in this study was based on field observations and

analytical data from the indicated explorations. Regulated substances may exist in portions of the site that were not explored or analyzed. The conclusions in this report are not to be considered a legal opinion as the client's duty concerning due diligence relating to potential liabilities in leasing, owning, or purchasing real estate.

PBS ENGINEERING AND ENVIRONMENTAL INC.

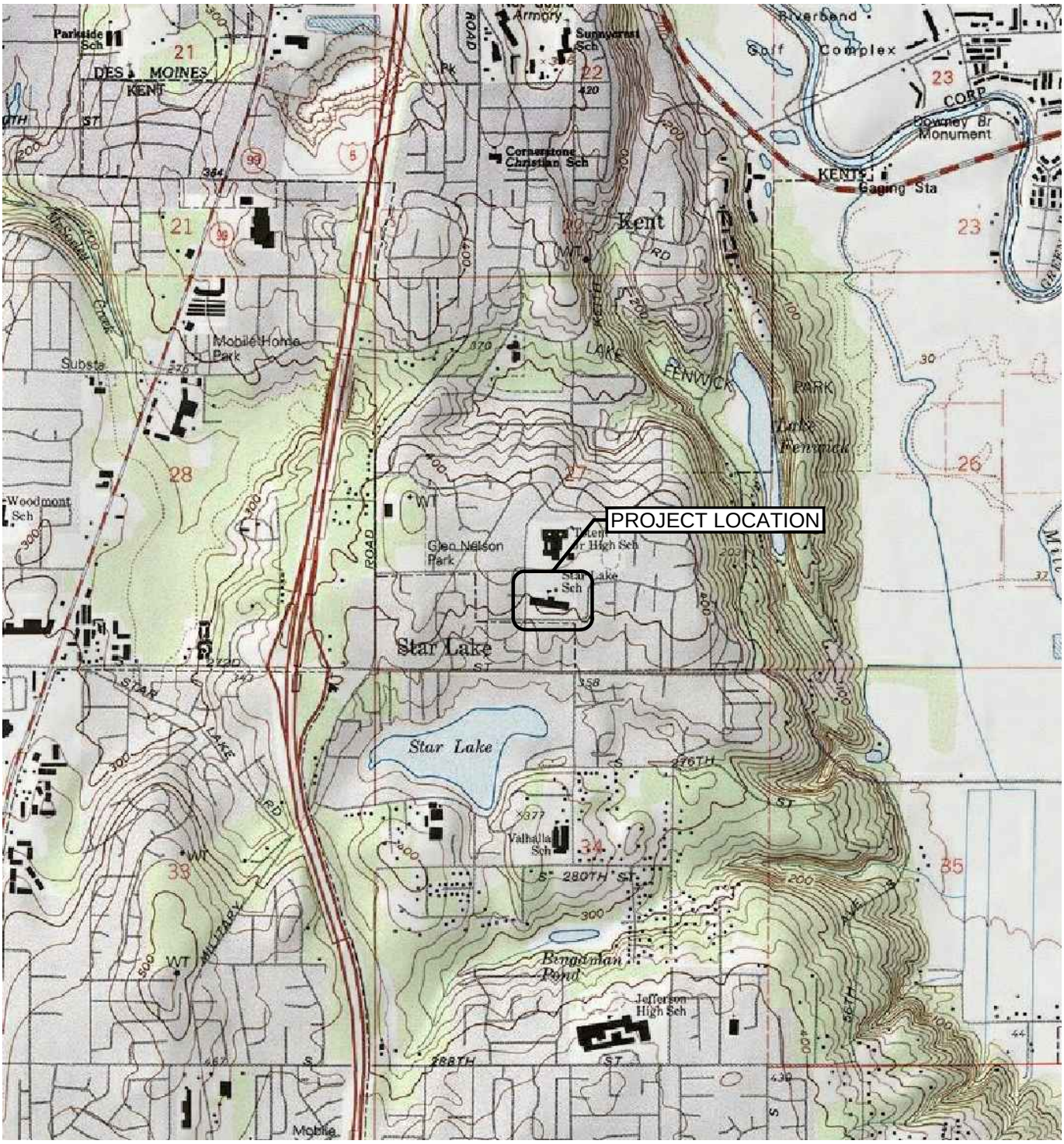
James Welles, LG
Project Geologist

Reviewed By:

Thomas Mergy, LHG
Environmental Services Manager

Attachments:
Figure 1: Vicinity Map
Figure 2: Sample Location Map
Table 1: Laboratory Data Summary Table
Attachment A: Laboratory Data

Figures



SOURCE: USGS POVERTY BAY, WA QUADRANGLE 1990, PHOTO REVISED 1994.

WASHINGTON

SCALE 1" = 2000'

0' 1,000' 2,000' 4,000'

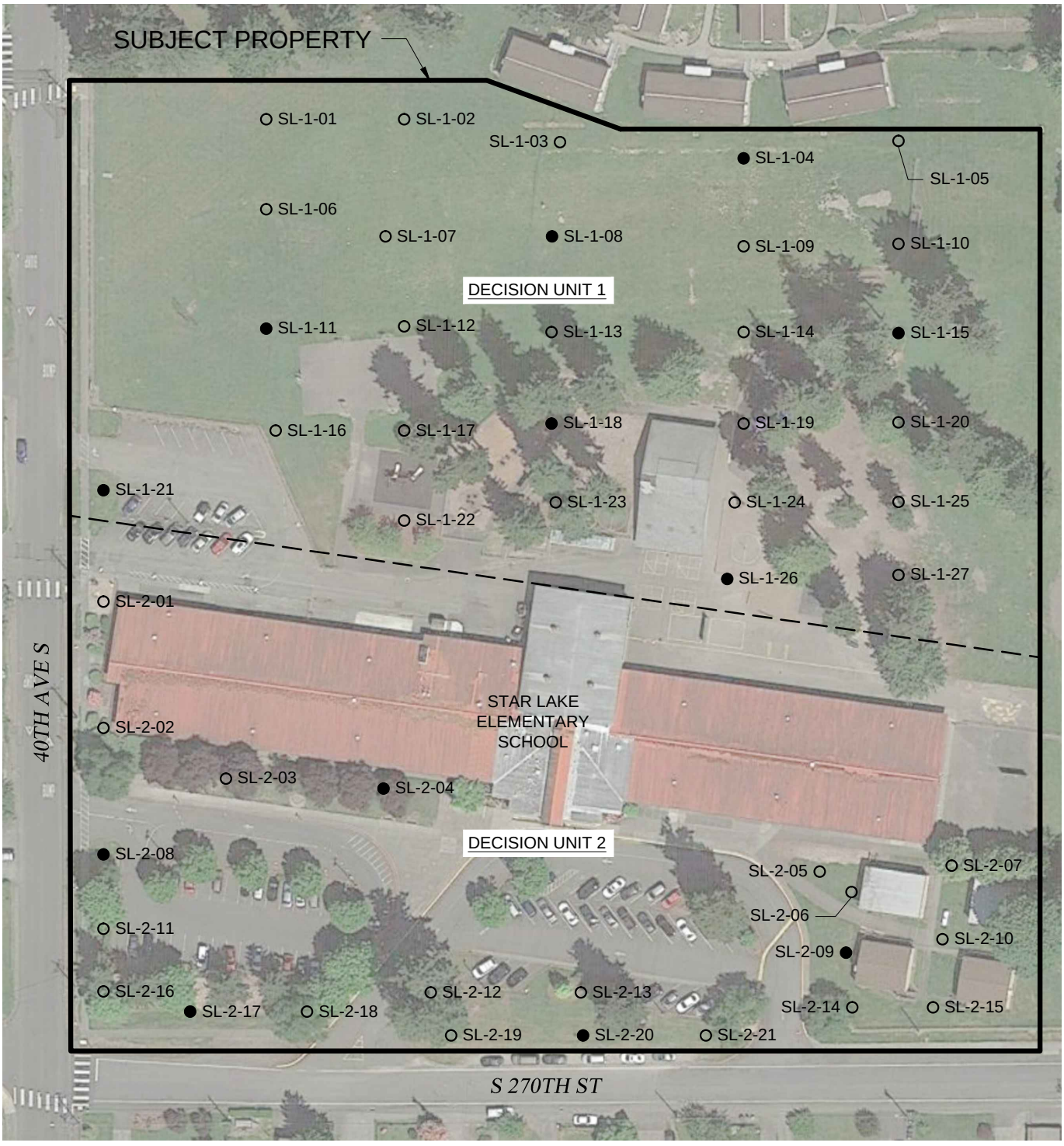
PREPARED FOR: FEDERAL WAY PUBLIC SCHOOLS

VICINITY MAP

STAR LAKE ELEMENTARY SCHOOL
4014 SOUTH 270TH STREET
KENT, WASHINGTON

MAY 2020
41519.001

FIGURE
1



SOURCE: © 2018 GOOGLE EARTH PRO

LEGEND

○ SL-1-01	SOIL SAMPLE LOCATION, DECISION UNIT AND IDENTIFICATION (0-6")
● SL-2-04	SOIL SAMPLE LOCATION, DECISION UNIT AND IDENTIFICATION (0-6", 6-12")

SCALE 1" = 125'

0' 62'-6" 125' 250'

PREPARED FOR: FEDERAL WAY PUBLIC SCHOOLS

PBS

As / Pb SOIL SAMPLE LOCATION MAP

STAR LAKE ELEMENTARY SCHOOL
4014 SOUTH 270TH STREET
KENT, WASHINGTON

MAY 2020
41519.001

FIGURE
2

Tables

Table 1 - Soil Sample Analytical Results

Site: Star Lake Elementary School
Address: 4014 S 270th Street, Kent, WA
PBS Project No. 41519.001

Location / Sample Identification	Sample Depth (inches bgs)	Metals	
		Arsenic (mg/kg)	Lead (mg/kg)
Regulatory Criteria	**MTCA Method A Cleanup Level**	**20**	**250**
Decision Unit 1 (~4.3 acres)			
SL1-01	0-6	6.37	8.35
SL1-02	0-6	6.21	6.61
SL1-03	0-6	4.73	5.32
SL1-04a	0-6	7.43	7.09
SL1-05	0-6	4.73	4.86
SL1-06	0-6	6.96	10.8
SL1-07	0-6	6.33	10.8
SL1-08a	0-6	7.45	10.2
SL1-09	0-6	8.31	17.2
SL1-10	0-6	17	28.7
SL1-11a	0-6	13.2	23.2
SL1-12	0-6	13.8	17.5
SL1-13	0-6	5.64	19.4
SL1-14	0-6	5.66	21.3
SL1-15a	0-6	4.99	16.9
SL1-16	0-6	10.6	12.2
SL1-17	0-6	6.49	18.8
SL1-18a	0-6	**26.6**	11.3
SL1-19	0-6	7.84	21.8
SL1-20	0-6	**22.6**	51.1
SL1-21a	0-6	12.5	27.4
SL1-22	0-6	5.83	18.2
SL1-23	0-6	7.69	17.6
SL1-24	0-6	**72.7**	122
SL1-25	0-6	**25.1**	39.8
SL1-26a	0-6	9.38	17.3
SL1-27	0-6	12.5	21
Average		12.5	21.7
SL1-04b	6-12	4.36	4.9
SL1-08b	6-12	5.39	4.9
SL1-11b	6-12	11.3	17.1
SL1-15b	6-12	4.35	15.9
SL1-18b	6-12	6.88	5.4
SL1-21b	6-12	6.5	11.3
SL1-26b	6-12	4.13	3.9
Average		6.1	9.0

Table 1 - Soil Sample Analytical Results

Site: Star Lake Elementary School
Address: 4014 S 270th Street, Kent, WA
PBS Project No. 41519.001

Location / Sample Identification	Sample Depth (inches bgs)	Metals	
		Arsenic (mg/kg)	Lead (mg/kg)
Regulatory Criteria	**MTCA Method A Cleanup Level**	**20**	**250**
Decision Unit 2 (~4.2 acres)			
SL2-01	0-6	5.9	19.4
SL2-02	0-6	6.7	12.1
SL2-03	0-6	5.1	10.2
SL2-04a	0-6	11.4	15.5
SL2-05	0-6	15.4	29.2
SL2-06	0-6	11.5	18.4
SL2-07	0-6	4.73	5.98
SL2-08a	0-6	4.96	13.4
SL2-09a	0-6	13.5	27.8
SL2-10	0-6	19.1	26.8
SL2-11	0-6	5.58	9.42
SL2-12	0-6	17.5	15.7
SL2-13	0-6	8.11	21.1
SL2-14	0-6	17.50	35.6
SL2-15	0-6	**22.6**	29.2
SL2-16	0-6	9.33	11.9
SL2-17a	0-6	4.53	8.7
SL2-18	0-6	4.7	13
SL2-19	0-6	5.93	10.6
SL2-20	0-6	6.32	7.84
SL2-21	0-6	8.23	13.4
Average		9.9	16.9
SL2-04b	6-12	11.3	23.4
SL2-08b	6-12	5.57	9.66
SL2-09b	6-12	11.7	19
SL2-17b	6-12	3.77	7.6
SL2-20b	6-12	9.95	13.1
Average		8.5	14.5

Arsenic and lead analyzed by US EPA Method 6020
mg/kg - milligrams per kilogram
bold = concentration exceeds adopted criteria
bgs = below ground surface

Attachment A

Laboratory Report and Chain of Custody Documentation

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

November 13, 2018

James Welles, Project Manager
PBS Engineering and Environmental, Inc.
2517 Eastlake Ave E, Suite 100
Seattle, WA 98102

Dear Mr Welles:

Included are the results from the testing of material submitted on November 6, 2018 from the Star Lake Elementary As and Pb, F&BI 811087 project. There are 40 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
PBS1113R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on November 6, 2018 by Friedman & Bruya, Inc. from the PBS Engineering and Environmental Star Lake Elementary As and Pb, F&BI 811087 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	PBS Engineering and Environmental
811087 -01	SL1-01
811087 -02	SL1-02
811087 -03	SL1-03
811087 -04	SL1-04a
811087 -05	SL1-04b
811087 -06	SL1-05
811087 -07	SL1-06
811087 -08	SL1-07
811087 -09	SL1-08a
811087 -10	SL1-08b
811087 -11	SL1-09
811087 -12	SL1-10
811087 -13	SL1-11a
811087 -14	SL1-11b
811087 -15	SL1-12
811087 -16	SL1-13
811087 -17	SL1-14
811087 -18	SL1-15a
811087 -19	SL1-15b
811087 -20	SL1-16
811087 -21	SL1-17
811087 -22	SL1-18a
811087 -23	SL1-18b
811087 -24	SL1-19
811087 -25	SL1-20
811087 -26	SL1-21a
811087 -27	SL1-21b
811087 -28	SL1-22
811087 -29	SL1-23
811087 -30	SL1-24
811087 -31	SL1-25
811087 -32	SL1-26a
811087 -33	SL1-26b
811087 -34	SL1-27

All quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-01	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-01
Date Analyzed:	11/08/18	Data File:	811087-01.235
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.37
Lead	8.35

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-02	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-02
Date Analyzed:	11/09/18	Data File:	811087-02.238
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.21
Lead	6.61

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-03	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-03
Date Analyzed:	11/09/18	Data File:	811087-03.239
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.73
Lead	5.32

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-04a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-04
Date Analyzed:	11/09/18	Data File:	811087-04.242
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.43
Lead	7.09

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-04b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-05
Date Analyzed:	11/09/18	Data File:	811087-05.243
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.36
Lead	4.89

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-05	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-06
Date Analyzed:	11/09/18	Data File:	811087-06.244
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.73
Lead	4.86

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-06	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-07
Date Analyzed:	11/09/18	Data File:	811087-07.245
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.96
Lead	10.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-07	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-08
Date Analyzed:	11/09/18	Data File:	811087-08.246
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.33
Lead	10.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-08a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-09
Date Analyzed:	11/09/18	Data File:	811087-09.247
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.45
Lead	10.2

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-08b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-10
Date Analyzed:	11/09/18	Data File:	811087-10.248
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.39
Lead	4.89

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-09	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-11
Date Analyzed:	11/09/18	Data File:	811087-11.249
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	8.31
Lead	17.2

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-10	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-12
Date Analyzed:	11/09/18	Data File:	811087-12.250
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	17.0
Lead	28.7

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-11a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-13
Date Analyzed:	11/09/18	Data File:	811087-13.251
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	13.2
Lead	23.2

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-11b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-14
Date Analyzed:	11/09/18	Data File:	811087-14.254
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	11.3
Lead	17.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-12	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-15
Date Analyzed:	11/09/18	Data File:	811087-15.255
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	13.8
Lead	17.5

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-13	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-16
Date Analyzed:	11/09/18	Data File:	811087-16.256
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.64
Lead	19.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-14	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-17
Date Analyzed:	11/09/18	Data File:	811087-17.257
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.66
Lead	21.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-15a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-18
Date Analyzed:	11/09/18	Data File:	811087-18.258
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.99
Lead	16.9

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-15b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-19
Date Analyzed:	11/09/18	Data File:	811087-19.259
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.35
Lead	15.9

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-16	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-20
Date Analyzed:	11/09/18	Data File:	811087-20.260
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	10.6
Lead	12.2

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-17	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-21
Date Analyzed:	11/09/18	Data File:	811087-21.265
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.49
Lead	18.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-18a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-22
Date Analyzed:	11/09/18	Data File:	811087-22.268
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	26.6
Lead	11.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-18b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-23
Date Analyzed:	11/09/18	Data File:	811087-23.269
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.88
Lead	5.35

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-19	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-24
Date Analyzed:	11/09/18	Data File:	811087-24.270
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.84
Lead	21.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-20	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-25
Date Analyzed:	11/09/18	Data File:	811087-25.271
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	22.6
Lead	51.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-21a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-26
Date Analyzed:	11/09/18	Data File:	811087-26.272
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	12.5
Lead	27.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-21b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-27
Date Analyzed:	11/09/18	Data File:	811087-27.273
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.50
Lead	11.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-22	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-28
Date Analyzed:	11/09/18	Data File:	811087-28.274
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.83
Lead	18.2

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-23	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-29
Date Analyzed:	11/09/18	Data File:	811087-29.280
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.69
Lead	17.6

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-24	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-30
Date Analyzed:	11/09/18	Data File:	811087-30.281
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	72.7
Lead	122

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-25	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-31
Date Analyzed:	11/09/18	Data File:	811087-31.282
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	25.1
Lead	39.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-26a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-32
Date Analyzed:	11/09/18	Data File:	811087-32.283
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	9.38
Lead	17.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-26b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-33
Date Analyzed:	11/09/18	Data File:	811087-33.284
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.13
Lead	3.90

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-27	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	811087-34
Date Analyzed:	11/09/18	Data File:	811087-34.285
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	12.5
Lead	21.0

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	PBS Engineering and Environmental
Date Received:	Not Applicable	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	I8-766 mb
Date Analyzed:	11/08/18	Data File:	I8-766 mb.233
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1
Lead	<1

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	PBS Engineering and Environmental
Date Received:	Not Applicable	Project:	Star Lake Elementary As and Pb
Date Extracted:	11/08/18	Lab ID:	I8-767 mb
Date Analyzed:	11/09/18	Data File:	I8-767 mb.261
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1
Lead	<1

Date of Report: 11/13/18
Date Received: 11/06/18
Project: Star Lake Elementary As and Pb, F&BI 811087

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 811087-01 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	5.41	106 b	84 b	75-125	23 b
Lead	mg/kg (ppm)	50	7.10	93	89	75-125	4

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	101	80-120
Lead	mg/kg (ppm)	50	104	80-120

Date of Report: 11/13/18
Date Received: 11/06/18
Project: Star Lake Elementary As and Pb, F&BI 811087

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 811087-21 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	5.78	94	83	75-125	12
Lead	mg/kg (ppm)	50	16.7	92	88	75-125	4

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	101	80-120
Lead	mg/kg (ppm)	50	104	80-120

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The compound is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

811087

SAMPLE CHAIN OF CUSTODY ME 11-06-18

BD3

Page # 1 of 4

Report To James Welles
Company PBS
Address
City, State, ZIP Seattle
Phone 206 348 6317 Email james.welles@pbsusa.com

SAMPLERS (signature)

PROJECT NAME: STAR Lake ELEMENTARY As/Pb

PO # 41519.001

REMARKS

INVOICE TO

TURNAROUND TIME
- [x] Standard Turnaround
- [ ] RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
- [x] Dispose after 30 days
- [ ] Archive Samples
- [ ] Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Pb only				Notes
SL1-01	01	11/5/2018	0905	soil	1								X				
SL1-02	02		0926														
SL1-03	03		0927														
SL1-04a	04		0954														
SL1-04b	05		0955														
SL1-05	06		0956														
SL1-06	07		0907														
SL1-07	08		0923 ~~0907~~														
SL1-08a	09		0930														
SL1-08b	10		0931														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	J. Welles	PBS	11/6/18	1430
Received by:	Nhan Phan	FCBI	V	V
Relinquished by:				
Received by:		Samples received at 14 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

811087

SAMPLE CHAIN OF CUSTODY

ME 11-06-18

RE3

Page # 2 of 4

Report To

Company PBS

Address

City, State, ZIP

Phone Email

SAMPLERS (*signature*)	
PROJECT NAME	PO #
REMARKS	INVOICE TO

TURNAROUND TIME
- ☐ Standard Turnaround
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	ANALYSES REQUESTED: TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Hg only				Notes
SL1-09	11	11/5/2018	0950	SOIL	1								X				
SL1-10	12		0958														
SL1-11a	13		0910														
SL1-11b	14		0912														
SL1-12	15		0921														
SL1-13	16		0933														
SL1-14	17		0948														
SL1-15a	18		1000														
SL1-15b	19		1001														
SL1-16	20		0914														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	S. Wellen	PBS	11/6/18	1430
Received by:	Nhan Phan	FEBI	V	V
Relinquished by:				
Received by:		Samples received at 14 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

811087

SAMPLE CHAIN OF CUSTODY ME 11-06-18

BI3

Page # 3 of 4

Report To

Company PBS

Address

City, State, ZIP

Phone Email

SAMPLERS (*signature*)	
PROJECT NAME	PO #
REMARKS	INVOICE TO

TURNAROUND TIME
- ☐ Standard Turnaround
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Pb only				Notes
SL1-17	21	11/5/2018	0918	SOIL	1								X				
SL1-18a	22		0936														
SL1-18b	23		0937														
SL1-19	24		0946														
SL1-20	25		1004														
SL1-21a	26		0915														
SL1-21b	27		0916														
SL1-22	28		0917														
SL1-23	29		0939														
SL1-24	30		0944														

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

	SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:		J. Welles	PBS	11/6/18	1430
Received by:		Khan Phan	FEBI	V	V
Relinquished by:					
Received by:			Samples received at 4 °C		

811087

SAMPLE CHAIN OF CUSTODY ME 11-06-18

Page # 4 of 4 BTS

Report To

Company PBS

Address

City, State, ZIP

Phone Email

SAMPLERS (*signature*)	
PROJECT NAME	PO #
REMARKS	INVOICE TO

TURNAROUND TIME
- ☐ Standard Turnaround
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	ANALYSES REQUESTED: TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Pb only				Notes
SL1-25	31	11/5/18	1008	Soil	1								X				
SL1-26a	32		0941														
SL1-26b	33		0942														
SL1-27	34		1010														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	J. Welles	PBS	11/6/18	1430
Received by:	Nhan Phan	FEBI	✓	✓
Relinquished by:				
Received by:		Samples received at 14 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

November 12, 2018

James Welles, Project Manager
PBS Engineering and Environmental, Inc.
2517 Eastlake Ave E, Suite 100
Seattle, WA 98102

Dear Mr Welles:

Included are the results from the testing of material submitted on November 6, 2018 from the Star Lake As/Pb 41519.001, F&BI 811088 project. There are 32 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
PBS1112R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on November 6, 2018 by Friedman & Bruya, Inc. from the PBS Engineering and Environmental Star Lake As/Pb 41519.001, F&BI 811088 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	PBS Engineering and Environmental
811088 -01	SL2-01
811088 -02	SL2-02
811088 -03	SL2-03
811088 -04	SL2-04a
811088 -05	SL2-04b
811088 -06	SL2-05
811088 -07	SL2-06
811088 -08	SL2-07
811088 -09	SL2-08a
811088 -10	SL2-08b
811088 -11	SL2-09a
811088 -12	SL2-09b
811088 -13	SL2-10
811088 -14	SL2-11
811088 -15	SL2-12
811088 -16	SL2-13
811088 -17	SL2-14
811088 -18	SL2-15
811088 -19	SL2-16
811088 -20	SL2-17a
811088 -21	SL2-17b
811088 -22	SL2-18
811088 -23	SL2-19
811088 -24	SL2-20a
811088 -25	SL2-20b
811088 -26	SL2-21

All quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-01	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-01
Date Analyzed:	11/09/18	Data File:	811088-01.296
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.90
Lead	19.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-02	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-02
Date Analyzed:	11/09/18	Data File:	811088-02.299
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.69
Lead	12.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-03	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-03
Date Analyzed:	11/09/18	Data File:	811088-03.302
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.13
Lead	10.2

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-04a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-04
Date Analyzed:	11/09/18	Data File:	811088-04.303
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	11.4
Lead	15.5

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-04b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-05
Date Analyzed:	11/09/18	Data File:	811088-05.304
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	11.3
Lead	23.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-05	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-06
Date Analyzed:	11/09/18	Data File:	811088-06.305
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	15.4
Lead	29.2

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-06	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-07
Date Analyzed:	11/09/18	Data File:	811088-07.306
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	11.5
Lead	18.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-07	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-08
Date Analyzed:	11/09/18	Data File:	811088-08.307
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.73
Lead	5.98

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-08a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-09
Date Analyzed:	11/09/18	Data File:	811088-09.308
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.96
Lead	13.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-08b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-10
Date Analyzed:	11/09/18	Data File:	811088-10.309
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.57
Lead	9.66

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-09a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-11
Date Analyzed:	11/09/18	Data File:	811088-11.310
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	13.5
Lead	27.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-09b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-12
Date Analyzed:	11/09/18	Data File:	811088-12.311
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	11.7
Lead	19.0

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-10	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-13
Date Analyzed:	11/09/18	Data File:	811088-13.314
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	19.1
Lead	26.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-11	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-14
Date Analyzed:	11/09/18	Data File:	811088-14.315
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.58
Lead	9.42

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-12	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-15
Date Analyzed:	11/09/18	Data File:	811088-15.316
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	17.5
Lead	15.7

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-13	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-16
Date Analyzed:	11/09/18	Data File:	811088-16.317
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	8.11
Lead	21.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-14	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-17
Date Analyzed:	11/09/18	Data File:	811088-17.318
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	17.5
Lead	35.6

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-15	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-18
Date Analyzed:	11/09/18	Data File:	811088-18.319
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	22.6
Lead	29.2

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-16	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-19
Date Analyzed:	11/09/18	Data File:	811088-19.320
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	9.33
Lead	11.9

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-17a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-20
Date Analyzed:	11/09/18	Data File:	811088-20.321
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.53
Lead	8.72

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-17b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-21
Date Analyzed:	11/09/18	Data File:	811088-21.286
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.77
Lead	7.55

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-18	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-22
Date Analyzed:	11/09/18	Data File:	811088-22.287
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.72
Lead	13.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-19	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-23
Date Analyzed:	11/09/18	Data File:	811088-23.290
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.93
Lead	10.6

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-20a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-24
Date Analyzed:	11/09/18	Data File:	811088-24.291
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.32
Lead	7.84

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-20b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-25
Date Analyzed:	11/09/18	Data File:	811088-25.292
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	9.95
Lead	13.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL2-21	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	811088-26
Date Analyzed:	11/09/18	Data File:	811088-26.293
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	8.23
Lead	13.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	PBS Engineering and Environmental
Date Received:	Not Applicable	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	I8-767 mb
Date Analyzed:	11/09/18	Data File:	I8-767 mb.261
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1
Lead	<1

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	PBS Engineering and Environmental
Date Received:	Not Applicable	Project:	Star Lake As/Pb 41519.001
Date Extracted:	11/08/18	Lab ID:	I8-768 mb
Date Analyzed:	11/09/18	Data File:	I8-768 mb.294
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1
Lead	<1

Date of Report: 11/12/18
Date Received: 11/06/18
Project: Star Lake As/Pb 41519.001, F&BI 811088

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 811087-21 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	5.78	94	83	75-125	12
Lead	mg/kg (ppm)	50	16.7	92	88	75-125	4

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	101	80-120
Lead	mg/kg (ppm)	50	104	80-120

Date of Report: 11/12/18
Date Received: 11/06/18
Project: Star Lake As/Pb 41519.001, F&BI 811088

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 811088-01 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	4.72	101	100	75-125	1
Lead	mg/kg (ppm)	50	15.5	93	90	75-125	3

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	103	80-120
Lead	mg/kg (ppm)	50	102	80-120

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The compound is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

811088

SAMPLE CHAIN OF CUSTODY

ME @ 11-06-18

BIY

Page # 1 of 3

Report To James Welles

Company PBS

Address Seattle

City, State, ZIP

Phone 206 348 6317 Email james.welles@pbsusa.com

SAMPLERS (*signature*)

PROJECT NAME: SUGAR LAKE As / Pb

PO #: 41519.001

REMARKS

INVOICE TO

TURNAROUND TIME
- [x] Standard Turnaround
- [ ] RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- [x] Dispose after 30 days
- [ ] Archive Samples
- [ ] Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Pb only				Notes
SL2-01	01	11/5/2018	1020	SOIL	1												
SL2-02	02		1024														
SL2-03	03		1027														
SL2-04a	04		1030														
SL2-04b	05		1031														
SL2-05	06		1105														
SL2-06	07		1107														
SL2-07	08		1125														
SL2-08a	09		1033														
SL2-08b	10		1034														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	J. Welles	PBS	11/6/18	1430
Received by:	Nhan Phan	FCBI	V	V
Relinquished by:				
Received by:		Samples received at 14 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

811088

SAMPLE CHAIN OF CUSTODY ME 11-06-18

BIY

Page # 2 of 3

Report To

Company PBS

Address

City, State, ZIP

Phone Email

SAMPLERS (*signature*)	
PROJECT NAME	PO #
REMARKS	INVOICE TO

TURNAROUND TIME
- ☐ Standard Turnaround
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Pb only				Notes
SL2-09a	11	11/5/2018	1110	SOIL	1								X				
SL2-09b	12		1111														
SL2-10	13		1120														
SL2-11	14		~~1035~~ 1038														
SL2-12	15 ~~1048a~~		1048														
SL2-13	16		1055														
SL2-14	17		1115														
SL2-15	18		1117														
SL2-16	19		1036														
SL2-17a	20		1041														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	J. Weller	PBS	11/6/18	1430
Received by:	Nhan Phan	FEBI	V	V
Relinquished by:				
Received by:		Samples received at 14 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

811088

SAMPLE CHAIN OF CUSTODY ME 11-06-18

BIY

Page # 3 of 3

Report To

Company PBS

Address

City, State, ZIP

Phone Email

SAMPLERS (*signature*)

PROJECT NAME | PO #

REMARKS | INVOICE TO

TURNAROUND TIME
- ☐ Standard Turnaround
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	ANALYSES REQUESTED: TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Pb only				Notes
SL2-17b	21	11/5/2018	1042	SOIL	1								X				
SL2-18	22		1044														
SL2-19	23		1051														
SL2-20a	24		1053														
SL2-20b	25		1054														
SL2-21	26		1100														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	J. Cuelles	PBS	11/6/18	1430
Received by:	Nhan Phan	FEBX	V	V
Relinquished by:				
Received by:		Samples received at 14 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

November 15, 2019

Jannine McDonald
Federal Way Public Schools
Capital Projects
1211 S 232nd St
Federal Way, WA 98004
Email: jmcdonald@fwps.org
fwpscp18@fwps.org

RE: Star Lake Elementary School – Supplemental Arsenic and Lead Soil Sampling Report
4014 S 270th Street, Kent, Washington
PBS Project #41519.001

Federal Way Public Schools (FWPS) has contracted PBS Engineering and Environmental Inc. (PBS) to evaluate the potential for arsenic and lead contaminants in near surface soils at the site of Star Lake Elementary School (SLES) prior to site redevelopment as part of the SLES Replacement Project. A Site Vicinity Map is presented as Figure 1.

This *Supplemental Arsenic and Lead Soil Sampling Report* presents the findings of supplemental sampling performed in October 2019 surrounding locations with arsenic concentrations in exceedance of the Washington State Department of Ecology's (Ecology's) Model Toxics Control Act (MTCA) Method A cleanup level for arsenic. The purpose of supplemental sampling was to better define the extent of arsenic impacted soils to determine which trees in the remediation area can be retained at the site and which trees will require removal to facilitate soil remediation.

Results of initial and supplemental soil sampling will provide basis for areas requiring soil remediation and associated trees for removal. Based on conversations with Ecology and FWPS, mixing with clean soils is expected to be the chosen model remedy for the site. Based on conversations with FWPS and the project arborist, mixing of soils within approximately 50 feet of the base of the tree will disturb the trees roots, and render survival of the tree unlikely. The remediation area requirements and details about remedial methods will be outlined in Specification 02 61 00 Contaminated Soil Management which will be included in the bid package for construction of the new school.

The scope of services for supplemental sampling was presented in the Proposal for Additional Soil Sampling, Contract Document Development and Construction Period Services (WA29088) by PBS, dated June 7, 2019.

BACKGROUND

On November 5, 2018 PBS performed soil sampling activities to determine the levels of arsenic and lead in shallow soil at SLES in accordance with Ecology's *2019 Tacoma Smelter Plume Model Remedies Guidance*[1]. Findings of the sampling activities and recommendations for regulatory compliance of impacted soils were presented in the Star Lake Elementary School Arsenic and Lead Soil Sampling Report dated November 30, 2018[2]. The report identified

[1] *Tacoma Smelter Plume Model Remedies Guidance,* Department of Ecology, July, 2019.
[2] *Star Lake Elementary School – Arsenic and Lead Soil Sampling Report*, PBS Engineering and Environmental, November 30, 2018.

five locations where arsenic concentrations exceeded Ecology's MTCA Method A cleanup level (CUL) criteria for unrestricted land use.
On October 25, 2019, Mr. James Welles of PBS met with Ms. Jannine McDonald of FWPS Capital Projects and Mr. Zeb Haney of Tree Resource to evaluate which trees FWPS would like to retain and determine additional soil sample locations required to determine if the trees would fall within the soil remediation area.

SUPPLEMENTAL SOIL SAMPLING

Additional soil samples were collected in October 2019 to delineate the extent of impacted soil in select areas. Supplemental sampling focused on the area surrounding sample locations SL-1-24 and SL-1-25 in attempts to retain trees in the remediation area as discussed during the October 25 site visit. Additional samples were not collected surrounding original sample locations SL1-20, SL-1-18 or SL-2-15 as the areas surrounding these sample locations do not contain trees proposed for retention. As such, existing sample data is sufficient to design the remediation effort. Supplemental and select original soil sample locations in areas with tree retention concerns are presented in Figure 2.

Soil sample collection started just below any surface cover layer (e.g., sod or grass). A hand spade and a hand auger were used to complete 6-inch deep test holes. A soil sample was collected at a depth of less than six inches below ground surface at each location.

PBS personnel wore disposable nitrile gloves to protect against cross-contamination between samples. Soil retained for analysis was packed into laboratory-provided containers, labeled and transported on ice under chain of custody documentation to Friedman and Bruya, Inc. in Seattle, an Ecology-accredited analytical laboratory.

Samples were analyzed for total arsenic and lead using EPA Method 6020. Total arsenic and lead results were reported on a dry weight basis.

ANALYTIC RESULTS

Analytical results from two out of five soil samples collected on site in October 2019 exceeded MTCA Method A CULs for arsenic. Detected arsenic concentrations did not exceed two times the CUL and are thus not considered "elevated" per the Smelter Plume Guidance. However, because the land is used as an elementary school, FWPS has elected to remediate soils in exceedance of the CUL, even if they are not considered elevated per the guidance.

CONCLUSIONS

Based on the analytical results of the supplemental soil sampling, the following conclusion and recommendations were made regarding the handling and management of project site soils.

The area surrounding sample locations SL-1-15, SL-1-19, SL-1-20, SL-1-24, SL-1-25, and SL-1-26 will require soil remediation. Currently, the proposed remedial method is mixing in place.

Based on analytical results of soil sampling to date, the area delineated for remediation by mixing in place will disturb the roots of trees 2572, 2573, 2574, 2575, 2578 and 2579 (see Figure 2). As such, these trees will require

removal prior to soil remediation. Trees 2570 and 2571 may be retained at the site, at the discretion of the project arborist. Action regarding trees previously slated for removal in the Tree Retention Plan for the project have not changed as a result of soil remediation, and are thus not discussed further herein.

The proposed remediation area is depicted on Figure 2. Please note that Figure 2 only depicts the remediation area in which further sampling was required to determine trees for retention versus removal. Additional remediation by mixing in place will be required at former sample location SL-1-18 to the west of the remediation area depicted in Figure 2 and at former sample location SL-2-15 in the southeast corner of the site. Total area for soil remediation at SLES is estimated at approximately 1.5 acres. Final remediation area boundaries, area, and associated survey coordinates will be provided in Specification 02 61 00 – Contaminated Soil Management.

LIMITATIONS

This investigation was conducted to characterize lead and arsenic distributions in shallow soils surrounding previously identified arsenic and lead contaminated locations on-site, with a focus on protection of human health and the environment. The data collected in this investigation are not intended for the purposes waste profiling for offsite disposal, or for estimation of volume or tonnage of soil requiring disposal.

PBS has prepared this report for use by FWPS. This report is not intended for use by others without the written consent of the FWPS. Our interpretation of soil conditions in this study was based on field observations and analytical data from the indicated explorations. Regulated substances may exist in portions of the site that were not explored or analyzed.

PBS ENGINEERING AND ENVIRONMENTAL INC.

James Welles, LG
Project Geologist

Reviewed By:

Melanie Young

Melanie Young, PE
Senior Environmental Engineer

Attachments:
Table 1: Laboratory Data Summary Table
Figure 1: Site Vicinity Map
Figure 2: As/Pb Supplemental Soil Sample Location Map
Attachment A: Laboratory Data

Tables

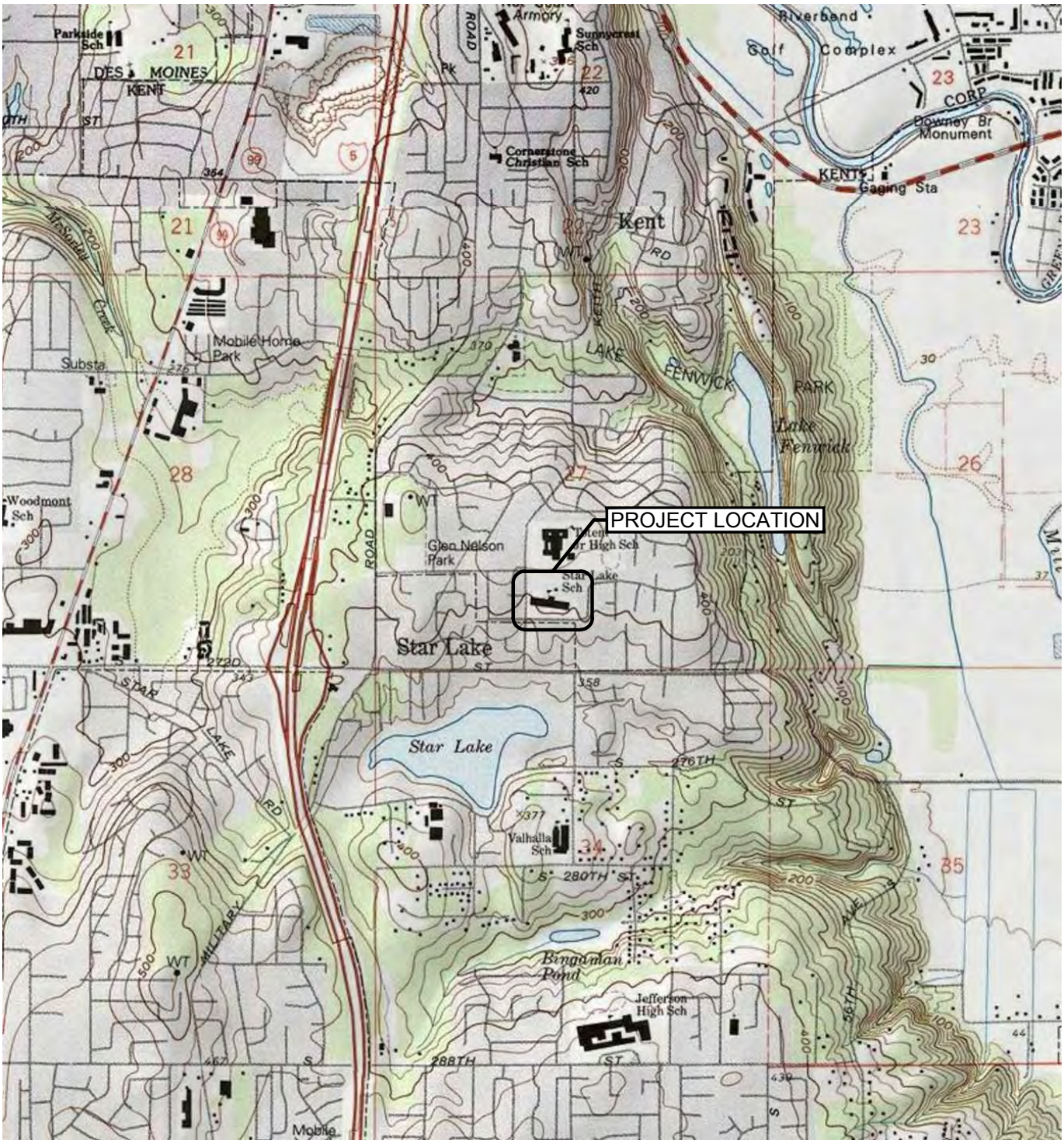
Table 1 - Soil Sample Analytical Results

Site: Star Lake Elementary School
Address: 4014 S 270th Street, Kent, WA
PBS Project No. 41519.001

Location / Sample Identification	Description	Sample Depth (inches bgs)	Metals	
			Arsenic (mg/kg)	Lead (mg/kg)
	Regulatory Criteria	**MTCA Method A Cleanup Level**	**20**	**250**
Supplemental Samples Surrounding Trees 2575, 2578 and 2579				
SL-1-28a	35' NW of 2575, 32' W of 2578	0-6	3.25	6.10
SL-1-29a	25' N of 2575, 8' W of 2578	0-6	7.55	6.88
SL-1-30a	16' E of 2578, 15' W of 2579	0-6	**24.5**	51.6
SL-1-31a	50' E of 2579	0-6	**24.9**	49.6
SL-1-32a	40' NW of 2575, 40' W of 2578	0-6	8.41	5.75
Original Samples Used to Delineate Remediation Boundary				
SL-1-15a	Grid Sample	0-6	4.99	16.9
SL-1-18a	Grid Sample	0-6	**26.6**	11.3
SL-1-19	Grid Sample	0-6	7.84	21.8
SL-1-20	Grid Sample	0-6	**22.6**	51.1
SL-1-24	Grid Sample	0-6	**72.7**	122
SL-1-25	Grid Sample	0-6	**25.1**	39.8
SL-1-26a	Grid Sample	0-6	9.38	17.3
SL-1-27	Grid Sample	0-6	12.5	21
Average			19.3	32.4

Arsenic and lead analyzed by US EPA Method 6020
mg/kg - milligrams per kilogram
bold = concentration exceeds adopted criteria
bgs = below ground surface

Figures



SOURCE: USGS POVERTY BAY, WA QUADRANGLE 1990, PHOTO REVISED 1994.

WASHINGTON

SCALE 1" = 2000'

0' 1,000' 2,000' 4,000'

PREPARED FOR: FEDERAL WAY PUBLIC SCHOOLS

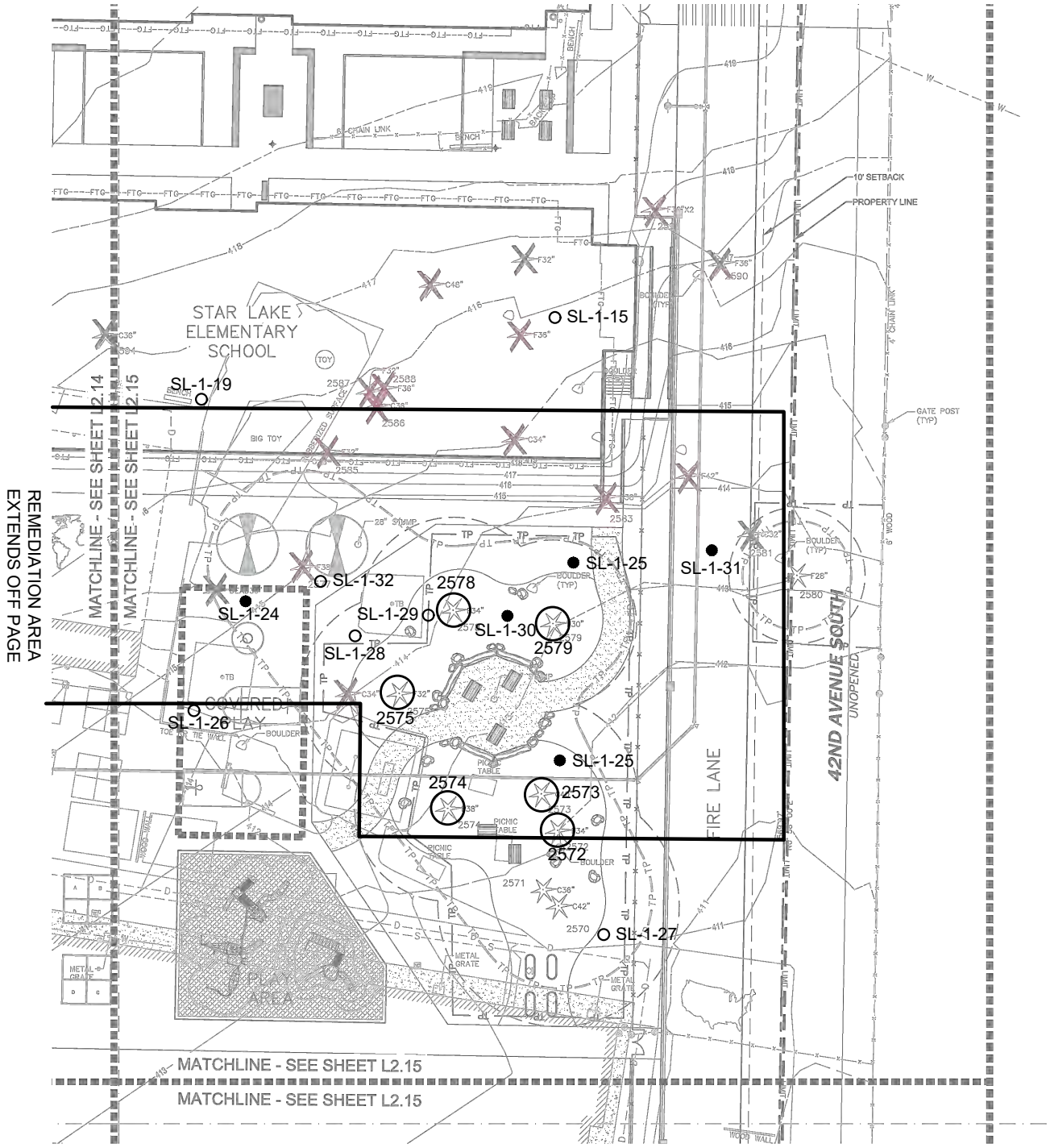
PBS

VICINITY MAP

STAR LAKE ELEMENTARY SCHOOL
4014 SOUTH 270TH STREET
KENT, WASHINGTON

NOV 2019
41519.001

FIGURE
1



SOURCE: © 2018 GOOGLE EARTH PRO

LEGEND

O SL-1-28	SOIL SAMPLE LOCATION As, Pb < MTCA METHOD A
● SL-1-24	SOIL SAMPLE LOCATION As, Pb > MTCA METHOD A
———	PROPOSED BOUNDARY FOR SOIL REMEDIATION
✳	TREE SELECTED FOR REMOVAL TO FACILITATE SOIL REMEDIATION
2574	TREE ID

SCALE 1" = 50'

0' 25' 50' 100'

PREPARED FOR: FEDERAL WAY PUBLIC SCHOOLS

PBS

As / Pb SUPPLEMENTAL SOIL SAMPLE LOCATION MAP

STAR LAKE ELEMENTARY SCHOOL
4014 SOUTH 270TH STREET
KENT, WASHINGTON

NOV 2019
41519.001

FIGURE
2

Attachment A

Laboratory Report and Chain of Custody Documentation

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

November 7, 2019

James Welles, Project Manager
PBS Engineering and Environmental, Inc.
214 E. Galer St, Suite 300
Seattle, WA 98102

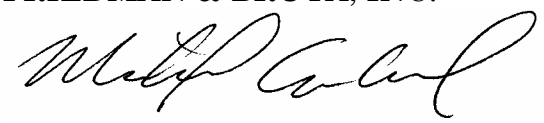
Dear Mr Welles:

Included are the results from the testing of material submitted on October 31, 2019 from the Star Lake Elementary 41519.001, F&BI 910605 project. There are 9 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days, or as directed by the Chain of Custody document. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.



Michael Erdahl
Project Manager

Enclosures
PBS1107R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on October 31, 2019 by Friedman & Bruya, Inc. from the PBS Engineering and Environmental Star Lake Elementary 41519.001, F&BI 910605 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	PBS Engineering and Environmental
910605 -01	SL1-28a
910605 -02	SL1-28b
910605 -03	SL1-28c
910605 -04	SL1-29a
910605 -05	SL1-29b
910605 -06	SL1-29c
910605 -07	SL1-30a
910605 -08	SL1-30b
910605 -09	SL1-30c
910605 -10	SL1-31a
910605 -11	SL1-31b
910605 -12	SL1-31c
910605 -13	SL1-32a
910605 -14	SL1-32b
910605 -15	SL1-32c

All quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-28a	Client:	PBS Engineering and Environmental
Date Received:	10/31/19	Project:	Star Lake Elementary 41519.001
Date Extracted:	11/04/19	Lab ID:	910605-01
Date Analyzed:	11/04/19	Data File:	910605-01.119
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.25
Lead	6.10

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-29a	Client:	PBS Engineering and Environmental
Date Received:	10/31/19	Project:	Star Lake Elementary 41519.001
Date Extracted:	11/04/19	Lab ID:	910605-04
Date Analyzed:	11/04/19	Data File:	910605-04.129
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.55
Lead	6.88

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-30a	Client:	PBS Engineering and Environmental
Date Received:	10/31/19	Project:	Star Lake Elementary 41519.001
Date Extracted:	11/04/19	Lab ID:	910605-07
Date Analyzed:	11/04/19	Data File:	910605-07.130
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	24.5
Lead	51.6

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-31a	Client:	PBS Engineering and Environmental
Date Received:	10/31/19	Project:	Star Lake Elementary 41519.001
Date Extracted:	11/04/19	Lab ID:	910605-10
Date Analyzed:	11/04/19	Data File:	910605-10.131
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	24.9
Lead	49.6

Analysis For Total Metals By EPA Method 6020B

Client ID:	SL1-32a	Client:	PBS Engineering and Environmental
Date Received:	10/31/19	Project:	Star Lake Elementary 41519.001
Date Extracted:	11/04/19	Lab ID:	910605-13
Date Analyzed:	11/04/19	Data File:	910605-13.132
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	8.41
Lead	5.75

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	PBS Engineering and Environmental
Date Received:	Not Applicable	Project:	Star Lake Elementary 41519.001
Date Extracted:	11/04/19	Lab ID:	I9-701 mb
Date Analyzed:	11/04/19	Data File:	I9-701 mb.034
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1
Lead	<1

Date of Report: 11/07/19
Date Received: 10/31/19
Project: Star Lake Elementary 41519.001, F&BI 910605

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 910604-01 x5 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	<5	83	85	75-125	2
Lead	mg/kg (ppm)	50	<5	90	92	75-125	2

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	89	80-120
Lead	mg/kg (ppm)	50	100	80-120

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

910605

SAMPLE CHAIN OF CUSTODY

MC 10-31-19

Page # 1 of 2

BI3

Send Report To James Welles

Company PBS Eng. + Env.

Address 214 E. Galer St. Suite 300

City, State, ZIP Seattle, WA 98102

Phone # 206.233.9639 Fax #

Email Address james.welles@pbsusa.com

SAMPLERS *(signature)*

PROJECT NAME/NO.	PO #
Star Lake Elementary	41519.001

PROJECT ADDRESS

4014 S. 270th St. Kent, WA

- ELECTRONIC DATA REQUESTED

TURNAROUND TIME
- Standard Turnaround
- RUSH 1 week

Rush charges authorized by:

SAMPLE DISPOSAL
- Dispose after 30 days
- Return samples
- Will call with instructions

Samples Received at ____ °C

Sample ID	Lab ID	Date	Time	Sample Type	# of containers	ANALYSES REQUESTED: TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260	SVOCs by 8270	HFS	PCB/Arc				Notes
SL1-28a	01	10/29	1410	Soil	1							X				
SL1-28b	02		1420	Soil	1											
SL1-28c	03		1430	Soil	1											
SL1-29a	04		1340	Soil	1							X				
SL1-29b	05	1350	~~PCBs~~	NW Soil	1											
SL1-29c	06	1400	~~PCBs~~	NW Soil	1											
SL1-30a	07		1440	Soil	1							X				
SL1-30b	08		1450	Soil	1											
SL1-30c	09		1500	Soil	1											
SL1-36a	10		1510	Soil	1							X				

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

	SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:		Nathan Dickey	PBS	10/31	750
Received by:		Eric Young	FB	10/31	750
Relinquished by:					
Received by:			Samples received at	9	°C

FORMS\COC\COC.DOC

910605

SAMPLE CHAIN OF CUSTODY

ME 10-31-19

BE3

Report To James Welles

Company PBS

Address Seattle

City, State, ZIP

Phone Email

SAMPLERS (*signature*)

PROJECT NAME: Stanley BS

PO #: 41519.001

REMARKS

Project specific RLs? - Yes / No

INVOICE TO

TURNAROUND TIME
- ☐ Standard turnaround
- ☒ RUSH 1 wk
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Archive samples
- ☐ Other
- Default: Dispose after 30 days

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	NWTPH-Dx	NWTPH-Gx	BTEX EPA 8021	NWTPH-HCID	VOCs EPA 8260	PAHs EPA 8270	PCBs EPA 8082	8011				Notes
SL1-31b	11	10/29	1520														
SL1-31c	12	"	1530														
SL1-32a	13	"	1540										X				
SL1-32b	14	"	1550														
SL1-32c	15	"	1600														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Nathan Digby	PBS	10/31	750
Received by:	Eric Glover	F&B	10/31	758
Relinquished by:				
Received by:				

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

May 4, 2020

Federal Way Public Schools
Capital Projects
1211 S 232nd St
Federal Way, WA 98004
Email: fwpscp18@fwps.org

RE: Totem Middle School – Arsenic and Lead Soil Sampling
26630 40th Avenue S, Kent, Washington
PBS Project #41519.005

Federal Way Public Schools (FWPS) contracted PBS Engineering and Environmental Inc. (PBS) to evaluate the potential for arsenic and lead contaminants in near surface soils at the site of Totem Middle School (TMS) prior to site redevelopment as part of the Totem Middle School Replacement Project. This report was originally issued on November 30, 2018. The regulatory criteria and report conclusions have been revised in May 2020 based on communications between FWPS, PBS and the Washington State Department of Ecology (Ecology).

On November 6, 2018 PBS performed soil sampling activities to determine the levels of arsenic and lead in shallow soil at TMS in Kent, Washington (Figure 1). This report presents the findings of the sampling activities and provides recommendations for regulatory compliance as well as for the handling and management of impacted soils during future redevelopment. The scope of services was presented in the Proposal for Arsenic and Lead Soil Testing (WA28822) by PBS, dated August 14, 2018.

BACKGROUND

TMS is located within the widespread soil contamination plume of the former Asarco smelter operation. The Asarco Company operated a copper smelter in Tacoma from 1890 to 1985. Smelter operations emitted an airborne plume of particulates with arsenic, lead, and other heavy metals that were distributed over a wide region of the Puget Sound. As a result, these metals have been found in near surface soils at concentrations which may pose a threat to human health and/or the environment.

Ecology's Tacoma Smelter Plume Model Remedies Guidance (Smelter Plume Guidance) recommends soil sampling at properties in areas with estimated arsenic levels above the state cleanup level of 20 ppm[1]. Ecology's "Everett and Tacoma Smelter Search" web page https://fortress.wa.gov/ecy/smeltersearch/ maps the TMS site within a zone of potential arsenic concentrations ranging from 40 milligram per kilogram (mg/kg) to 100 mg/kg. Thus, the 40mg/kg to 100 mg/kg range can be considered the "baseline" for arsenic concentrations in near surface soils expected on site.

[1] *"Tacoma Smelter Plume Model Remedies Guidance: Sampling and cleanup of arsenic and lead contaminated soils"*, Washington State Department of Ecology, June 2012, Publication No. 12-09-086-A

REGULATORY CRITERIA

Per the Smelter Plume Guidance *"if arsenic or lead levels are elevated for any decision unit on the property, that decision unit needs cleanup."* Per the Smelter Plume Guidance, elevated is defined as:

- Average arsenic > 20 parts per million (ppm, equivalent to mg/kg) or average lead > 250 ppm; **or**
- Maximum (any one sample) arsenic >40 ppm or maximum lead > 500 ppm.

Ecology's Model Toxics Control Act (MTCA) has established cleanup levels for arsenic and lead for unrestricted land use that are protective of human health and the environment[2]. Results of soil sampling will be compared to the applicable MTCA standards.

Ecology's MTCA Method A cleanup levels (CULs) for unrestricted land use for arsenic and lead are applicable for comparison to any single soil sample concentration. The CULs for arsenic and lead are presented below:

- The CUL for arsenic is 20 milligrams per kilogram (mg/kg)
- The CUL for lead is 250 mg/kg.

For reference, Ecology conducted a study to determine natural background concentrations of metals in soil for the Puget Sound area[3]. The study found that the natural background concentration for arsenic in soil is 7.0 parts per million (ppm) and 24 ppm for lead. Parts per million is roughly equivalent to mg/kg.

Based on the land use as a school, FWPS has elected to clean up site soils found to be in exceedance of CULs, even if the soils are not defined as elevated per the Smelter Plume Guidance.

CHARACTERIZATION SOIL SAMPLING

On November 6, 2018, seventy-five (75) discrete soil samples were collected from sixty-one (61) locations around the building landscaping and playfields of TMS. Following Ecology guidance, the property was divided into two decision units (DUs) based on current t use as playfield or landscape area. Decision units and sample locations are shown on Figure 2. A summary of the decision units is provided below. The number of samples screened and collected for analysis per DU for this project is based on the Ecology guidance.

Decision Units

Decision Unit ID	Soil disturbance planned?	Number of samples collected (0-6")	Number of samples collected (6-12")	Acres (approximate)	Total Number of Samples
1	unknown	31	7	9.75	38
2	unknown	30	7	9.75	37

0-6" = Soil samples were collected from the 0-6 inch depth interval
6-12" = Soil samples were collected from the 6-12 inch depth interval

[2] *"Model Toxics Control Act Regulation and Statute"*, Washington State Department of Ecology, 2013 Revision, Publication No. 94-06
[3] "*Natural Background Soil Metals Concentrations in Washington State*", Washington State Department of Ecology, October 1994, Publication No. 94-115

One (1) discrete sample was collected at each sample location from a depth interval of zero to six inches below ground surface (bgs). A second discrete sample was collected at every fourth location from a depth interval of six to twelve inches bgs. Sample locations were chosen in a manner that maximized coverage of the decision units and did not contain areas with surface cover or buildings during the sampling activities.

Soil sample collection started just below any surface cover layer (e.g., sod or grass). A hand spade and a hand auger were used to complete 6-inch deep test holes. A soil sample was collected at a depth of less than 6 inches below ground surface at each location. At every fourth location, upon collection of the zero to six-inch sample, the hole was advanced to a depth of twelve inches, and a second sample was collected from the six to twelve-inch depth interval using the same methods described above.

PBS personnel wore disposable nitrile gloves to protect against cross-contamination between samples. Soil retained for analysis was packed into laboratory-provided containers, labeled and transported on ice under chain of custody documentation to Friedman and Bruya, Inc. in Seattle, an Ecology accredited analytical laboratory.

Samples were analyzed for total arsenic and lead using EPA Method 6020. Total arsenic and lead results were reported on a dry weight basis.

ANALYTIC RESULTS

Analytical results from soil samples collected on site are below MTCA Method A CULs for arsenic, except for one (1) sample from decision unit 1. Arsenic was detected in exceedance of the CUL in sample TM1-26 at a concentration of 26 mg/kg. All other sample results for arsenic were below the MTCA Method A cleanup level of 20 mg/kg.

All analytical results for lead from soil samples collected on-site are below the MTCA Method A cleanup level of 250 mg/kg.

Based on the analytical results of soil samples collected on-site, average arsenic and lead concentrations were calculated for each decision unit and are presented below.

Average Concentrations per Decision Unit

Decision Unit ID	Mean Concentration (0-6″)		Mean Concentration (6-12″)	
	As	Pb	As	Pb
1	8.7	18.2	10.2	22.0
2	5.1	8.6	6.0	7.2
MTCA A Cleanup Level	20	250	20	250

(0-6″) (Pb / As) = Average Concentration at the zero to six-inch interval for arsenic (As) and lead (Pb) in mg/kg
(6-12″) (Pb / As) = Average Concentration at the six to twelve-inch interval for arsenic (As) and lead (Pb) in mg/kg

Analytical results from soil samples collected on-site are summarized in Table 1. Figure 2 depicts the decision unit boundaries and the locations where analytical results indicated lead or arsenic concentrations above MTCA Method A CULs. Laboratory reports are provided in Attachment A.

CONCLUSIONS

Based on the analytical results of the soil sampling, and using Ecology's *Tacoma Smelter Plume Model Remedy Guidance, June 2012*[1], the following conclusion and recommendations were made regarding the handling and management of project site soils.

Decision Unit 1

Analytical results from discrete soil samples collected within decision unit 1 of the TMS site identified one (1) location (TM1-26) where arsenic concentrations are above MTCA Method A CULs.

While soil sampling did not identify site soils with elevated arsenic or lead concentrations as defined in the Smelter Plume Guidance, FWPS has elected to take further action to address the one location identified where arsenic concentrations exceed CULs. According to Ecology's Model Remedies Guidance, the impacted soil can be managed in-place or removed by excavation. Strategies for management of impacted soil in-place include dilution of arsenic concentrations via mixing of impacted soil with clean imported soil or capping of soil in place with clean soil and a geotextile or a hard cap. Mixing of soils is accepted for arsenic-impacted soil with an average concentration less than 40 ppm. The mixing option requires testing to confirm levels meet the MTCA criteria. Ecology does not consider capping in-place a permanent remediation strategy given the potential for exposure if the cap is removed. Capping in-place may require annual inspection of the cap's integrity, as well as the filing of an environmental land covenant for the property. Based on communication between FWPS, Ecology and PBS, mixing in place has been selected as the preferred model remedy at the site.

Remediation of impacted soils can be conducted by the contractor as part of the Totem Middle School Replacement Project under PBS's supervision, but should be completed prior to any grading, excavation or earthwork activities that disturb on-site soil. The construction design and specifications for remediation of the arsenic-impacted soil as part of the Totem Middle School Replacement Project shall incorporate health and safety requirements, methods for soil removal, disposal and confirmation sampling and soil management strategies.

Decision Unit 2

Analytical results from discrete soil samples collected within decision unit 2 of the TMS site indicate arsenic and lead concentrations in soils are within the known local baseline for arsenic and lead contamination, and below MTCA Method A CULs for unrestricted land use.

No further regulatory action or evaluation is required for the soil within decision unit 1. Should soil from this area be scheduled for removal and exported from the site, additional testing may be required for the purposes of off-site use or disposal by the accepting user or facility.

LIMITATIONS

This investigation was conducted to characterize lead and arsenic distributions in shallow soils on-site, with a focus on protection of human health and the environment. The data collected in this investigation are not intended for the purposes waste profiling for offsite disposal, or for estimation of volume or tonnage of soil requiring disposal.

PBS has prepared this report for use by FWPS. This report is not intended for use by others without the written consent of the FWPS. Our interpretation of soil conditions in this study was based on field observations and analytical data from the indicated explorations. Regulated substances may exist in portions of the site that were not explored or analyzed. The conclusions in this report are not to be considered a legal opinion as the client's duty concerning due diligence relating to potential liabilities in leasing, owning, or purchasing real estate.

PBS ENGINEERING AND ENVIRONMENTAL INC.

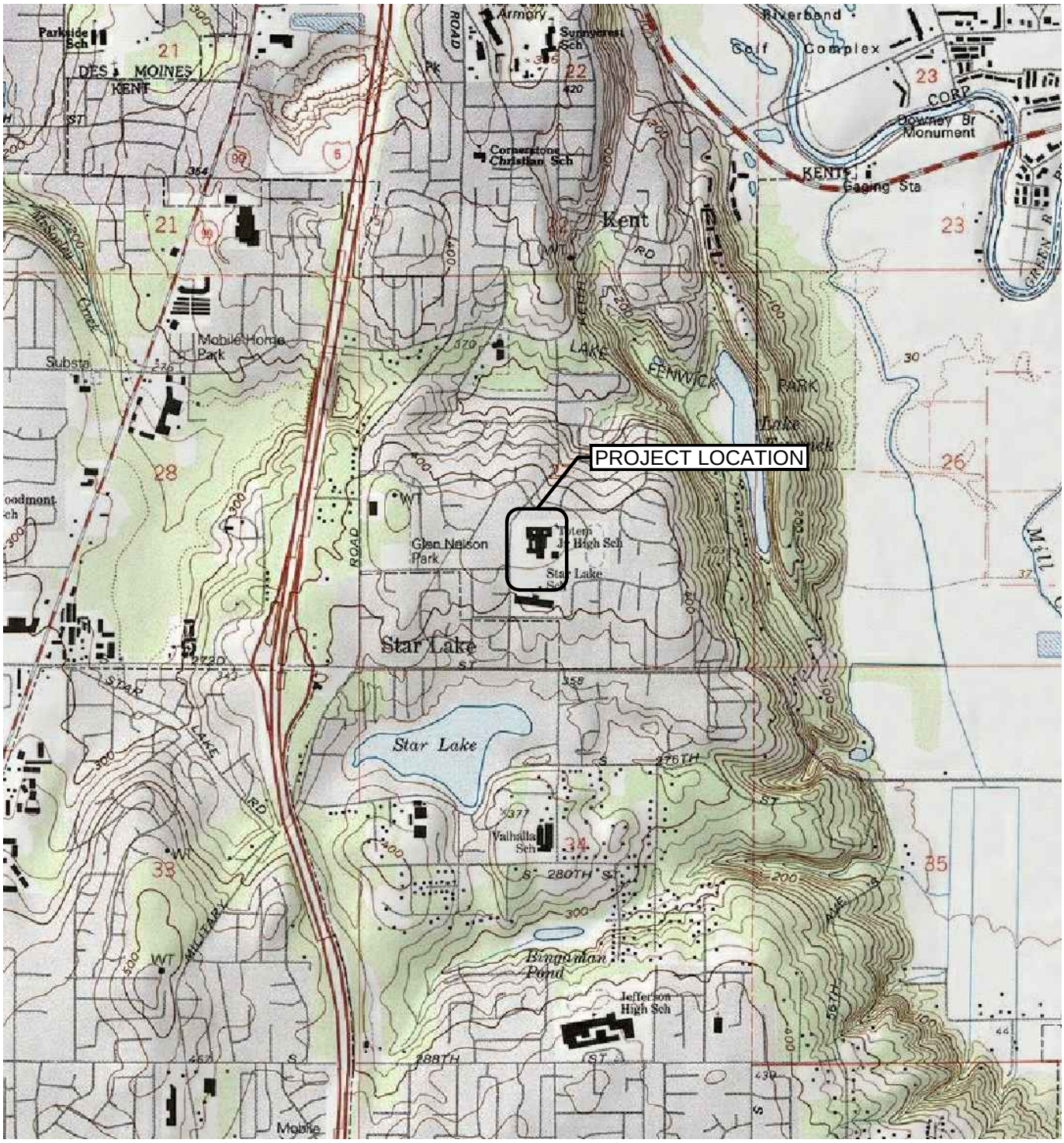
James Welles, LG
Project Geologist

Reviewed By:

Thomas Mergy, LHG
Environmental Services Manager

Attachments:
Figure 1: Vicinity Map
Figure 2: Sample Location Map
Table 1: Laboratory Data Summary Table
Attachment A: Laboratory Data

Figures



SOURCE: USGS POVERTY BAY, WA QUADRANGLE 1990, PHOTO REVISED 1994.

SCALE 1" = 2000'

0' 1,000' 2,000' 4,000'

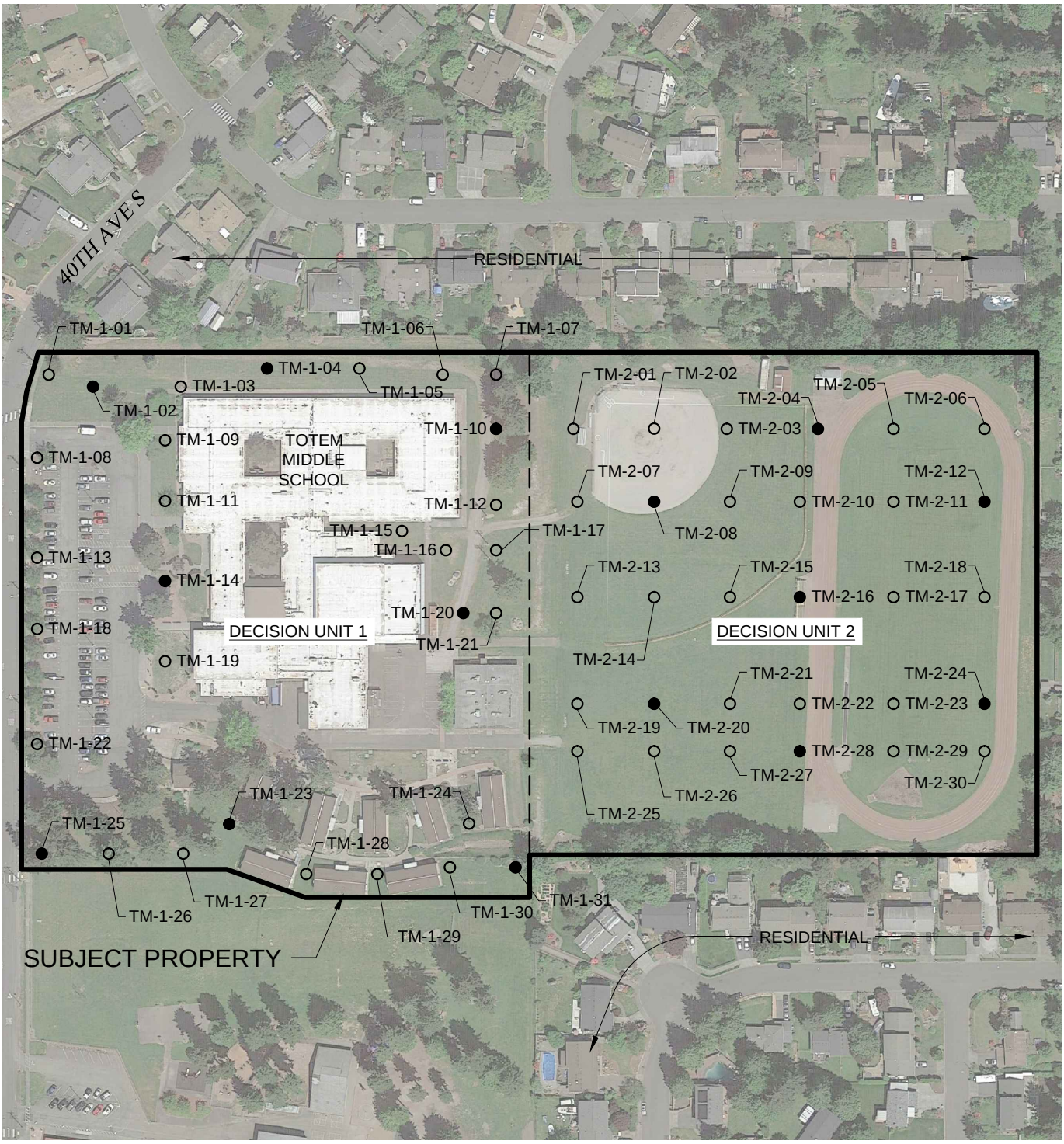
PREPARED FOR: FEDERAL WAY PUBLIC SCHOOLS

VICINITY MAP

TOTEM MIDDLE SCHOOL
26630 40TH AVENUE SOUTH
KENT, WASHINGTON

MAY 2020
41519.005

FIGURE
1



SOURCE: © 2018 GOOGLE EARTH PRO

LEGEND

○ TM-1-01	SOIL SAMPLE LOCATION, DECISION UNIT AND IDENTIFICATION (0-6")
● TM-2-04	SOIL SAMPLE LOCATION, DECISION UNIT AND IDENTIFICATION (0-6", 6-12")

SCALE 1" = 300'

0' 150' 300' 600'

PREPARED FOR: FEDERAL WAY PUBLIC SCHOOLS

PBS

As / Pb SOIL SAMPLE LOCATION MAP

TOTEM MIDDLE SCHOOL
26630 40TH AVENUE SOUTH
KENT, WASHINGTON

MAY 2020
41519.005

FIGURE
2

Tables

Table 1 - Soil Sample Analytical Results

Site: Totem Middle School
Address: 26630 40th Avenue S, Kent, WA
PBS Project No. 41519.005

Location / Sample Identification	Sample Depth (inches bgs)	Metals	
		Arsenic (mg/kg)	Lead (mg/kg)
Regulatory Criteria	**MTCA Method A Cleanup Level**	**20**	**250**
Decision Unit 1 (~9.75 acres)			
TM1-01	0-6	11.4	17.4
TM1-02a	0-6	13.6	25.7
TM1-03	0-6	7.1	11.1
TM1-04	0-6	6.67	9.7
TM1-05	0-6	9.21	21.3
TM1-06	0-6	6.5	17.1
TM1-07	0-6	11.4	15.9
TM1-08	0-6	6.51	19.9
TM1-09	0-6	10	26.3
TM1-10a	0-6	13.5	20.7
TM1-11	0-6	9.78	20.3
TM1-12	0-6	7.71	14.0
TM1-13	0-6	4.6	15.2
TM1-14a	0-6	8.98	20.6
TM1-15	0-6	8.99	18.6
TM1-16	0-6	3.92	7.5
TM1-17	0-6	6.09	10.8
TM1-18	0-6	5.7	17.4
TM1-19	0-6	8.78	20.3
TM1-20a	0-6	6.42	15.6
TM1-21	0-6	13.5	20
TM1-22	0-6	4.78	12.5
TM1-23a	0-6	8.99	24.8
TM1-24	0-6	4.53	9.2
TM1-25a	0-6	16.1	61.8
TM1-26	0-6	**26**	48.8
TM1-27	0-6	4.67	5.9
TM1-28	0-6	5.66	5.4
TM1-29	0-6	5.82	8.7
TM1-30	0-6	7.84	11
TM1-31a	0-6	5.96	12.1
Average		8.7	18.2
TM1-02b	6-12	10.9	17.3
TM-10b	6-12	12	18.1
TM1-14b	6-12	9.68	16.4
TM1-20b	6-12	7.4	18.2
TM1-23b	6-12	12.2	32.5
TM1-25b	6-12	13.8	42.5
TM1-31b	6-12	5.51	8.7
Average		10.2	22.0

Table 1 - Soil Sample Analytical Results

Site: Totem Middle School
Address: 26630 40th Avenue S, Kent, WA
PBS Project No. 41519.005

Location / Sample Identification	Sample Depth (inches bgs)	Metals	
		Arsenic (mg/kg)	Lead (mg/kg)
Regulatory Criteria	**MTCA Method A Cleanup Level**	**20**	**250**
Decision Unit 2 (~9.75 acres)			
TM2-01	0-6	11.3	17.3
TM2-02	0-6	11.5	16.4
TM2-03	0-6	5.4	11.9
TM2-04a	0-6	2.70	4.18
TM2-05	0-6	7.95	6.25
TM2-06	0-6	3.53	4.69
TM2-07	0-6	5.98	9.75
TM2-08a	0-6	11.1	15.6
TM2-09	0-6	5.87	9.89
TM2-10	0-6	6.45	11.1
TM2-11	0-6	3.22	5.57
TM2-12a	0-6	3.58	7.56
TM2-13	0-6	5.79	12.3
TM2-14	0-6	4.58	10.2
TM2-15	0-6	2.76	3.53
TM2-16a	0-6	4.50	7.39
TM2-17	0-6	2.49	5.11
TM2-18	0-6	2.11	3.75
TM2-19	0-6	4.58	10.4
TM2-20a	0-6	3.61	8.33
TM2-21	0-6	4.50	8.73
TM2-22	0-6	6.28	9.91
TM2-23	0-6	1.91	4.42
TM2-24a	0-6	3.19	5.93
TM2-25	0-6	3.50	8.50
TM2-26	0-6	4.69	5.36
TM2-27	0-6	4.65	10.7
TM2-28a	0-6	7.59	11.9
TM2-29	0-6	3.75	6.83
TM2-30	0-6	4.26	3.68
Average		5.1	8.6
TM2-04b	6-12	7.19	6.55
TM2-08b	6-12	10.4	14.6
TM2-12b	6-12	2.78	2.90
TM2-16b	6-12	5.38	5.67
TM2-20b	6-12	4.28	6.63
TM2-24b	6-12	2.23	2.54
TM2-28b	6-12	9.41	11.4
Average		6.0	7.2

Arsenic and lead analyzed by US EPA Method 6020
mg/kg - milligrams per kilogram
bold = concentration exceeds adopted criteria
bgs = below ground surface

Attachment A

Laboratory Report and Chain of Custody Documentation

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

November 14, 2018

James Welles, Project Manager
PBS Engineering and Environmental, Inc.
2517 Eastlake Ave E, Suite 100
Seattle, WA 98102

Dear Mr Welles:

Included are the results from the testing of material submitted on November 6, 2018 from the Totem Middle As and Pb 41519.005, F&BI 811089 project. There are 45 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
PBS1114R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on November 6, 2018 by Friedman & Bruya, Inc. from the PBS Engineering and Environmental Totem Middle As and Pb 41519.005, F&BI 811089 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	PBS Engineering and Environmental
811089 -01	TM1-01
811089 -02	TM1-02a
811089 -03	TM1-02b
811089 -04	TM1-03
811089 -05	TM1-04
811089 -06	TM1-05
811089 -07	TM1-06
811089 -08	TM1-07
811089 -09	TM1-08
811089 -10	TM1-09
811089 -11	TM1-10a
811089 -12	TM1-10b
811089 -13	TM1-11
811089 -14	TM1-12
811089 -15	TM1-13
811089 -16	TM1-14a
811089 -17	TM1-14b
811089 -18	TM1-15
811089 -19	TM1-16
811089 -20	TM1-17
811089 -21	TM1-18
811089 -22	TM1-19
811089 -23	TM1-20a
811089 -24	TM1-20b
811089 -25	TM1-21
811089 -26	TM1-22
811089 -27	TM1-23a
811089 -28	TM1-23b
811089 -29	TM1-24
811089 -30	TM1-25a
811089 -31	TM1-25b
811089 -32	TM1-26
811089 -33	TM1-27
811089 -34	TM1-28
811089 -35	TM1-29

CASE NARRATIVE (continued)

Laboratory ID	PBS Engineering and Environmental
811089 -36	TM1-30
811089 -37	TM1-31a
811089 -38	TM1-31b

All quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-01	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-01
Date Analyzed:	11/07/18	Data File:	811089-01.094
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	11.4
Lead	17.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-02a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-02
Date Analyzed:	11/07/18	Data File:	811089-02.097
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	13.6
Lead	25.7

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-02b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-03
Date Analyzed:	11/07/18	Data File:	811089-03.098
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	10.9
Lead	17.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-03	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-04
Date Analyzed:	11/07/18	Data File:	811089-04.099
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.10
Lead	11.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-04	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-05
Date Analyzed:	11/07/18	Data File:	811089-05.100
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.67
Lead	9.67

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-05	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-06
Date Analyzed:	11/07/18	Data File:	811089-06.101
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	9.21
Lead	21.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-06	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-07
Date Analyzed:	11/07/18	Data File:	811089-07.104
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.46
Lead	17.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-07	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-08
Date Analyzed:	11/07/18	Data File:	811089-08.105
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	11.4
Lead	15.9

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-08	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-09
Date Analyzed:	11/07/18	Data File:	811089-09.106
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.51
Lead	19.9

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-09	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-10
Date Analyzed:	11/07/18	Data File:	811089-10.107
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	10.4
Lead	26.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-10a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-11
Date Analyzed:	11/07/18	Data File:	811089-11.108
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	13.5
Lead	20.7

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-10b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-12
Date Analyzed:	11/07/18	Data File:	811089-12.109
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	12.0
Lead	18.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-11	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-13
Date Analyzed:	11/07/18	Data File:	811089-13.111
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	9.78
Lead	20.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-12	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-14
Date Analyzed:	11/07/18	Data File:	811089-14.112
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.71
Lead	14.0

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-13	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-15
Date Analyzed:	11/07/18	Data File:	811089-15.113
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.56
Lead	15.2

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-14a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-16
Date Analyzed:	11/07/18	Data File:	811089-16.116
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	8.98
Lead	20.6

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-14b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-17
Date Analyzed:	11/07/18	Data File:	811089-17.117
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	9.68
Lead	16.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-15	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-18
Date Analyzed:	11/07/18	Data File:	811089-18.118
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	8.99
Lead	18.6

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-16	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-19
Date Analyzed:	11/07/18	Data File:	811089-19.119
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.92
Lead	7.51

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-17	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-20
Date Analyzed:	11/07/18	Data File:	811089-20.120
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.09
Lead	10.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-18	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-21
Date Analyzed:	11/07/18	Data File:	811089-21.149
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.70
Lead	17.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-19	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-22
Date Analyzed:	11/07/18	Data File:	811089-22.163
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	8.78
Lead	20.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-20a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-23
Date Analyzed:	11/07/18	Data File:	811089-23.164
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.42
Lead	15.6

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-20b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-24
Date Analyzed:	11/07/18	Data File:	811089-24.176
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.40
Lead	18.2

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-21	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-25
Date Analyzed:	11/07/18	Data File:	811089-25.177
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	13.5
Lead	20.0

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-22	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-26
Date Analyzed:	11/07/18	Data File:	811089-26.189
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.78
Lead	12.5

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-23a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-27
Date Analyzed:	11/07/18	Data File:	811089-27.190
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	8.99
Lead	24.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-23b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-28
Date Analyzed:	11/07/18	Data File:	811089-28.202
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	12.2
Lead	32.5

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-24	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-29
Date Analyzed:	11/07/18	Data File:	811089-29.203
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.53
Lead	9.20

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-25a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-30
Date Analyzed:	11/08/18	Data File:	811089-30.215
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	16.1
Lead	61.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-25b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-31
Date Analyzed:	11/08/18	Data File:	811089-31.216
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	13.8
Lead	42.5

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-26	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-32
Date Analyzed:	11/08/18	Data File:	811089-32.228
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	26.0
Lead	48.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-27	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-33
Date Analyzed:	11/08/18	Data File:	811089-33.229
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.67
Lead	5.92

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-28	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-34
Date Analyzed:	11/08/18	Data File:	811089-34.239
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.66
Lead	5.35

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-29	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-35
Date Analyzed:	11/08/18	Data File:	811089-35.240
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.82
Lead	8.65

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-30	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-36
Date Analyzed:	11/08/18	Data File:	811089-36.241
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.84
Lead	11.0

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-31a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-37
Date Analyzed:	11/08/18	Data File:	811089-37.242
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.96
Lead	12.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-31b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	811089-38
Date Analyzed:	11/08/18	Data File:	811089-38.243
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.51
Lead	8.70

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	PBS Engineering and Environmental
Date Received:	Not Applicable	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	I8-758 mb
Date Analyzed:	11/07/18	Data File:	I8-758 mb.092
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1
Lead	<1

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	PBS Engineering and Environmental
Date Received:	Not Applicable	Project:	Totem Middle As and Pb 41519.005
Date Extracted:	11/07/18	Lab ID:	I8-759 mb
Date Analyzed:	11/09/18	Data File:	I8-759 mb.095
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1
Lead	<1

Date of Report: 11/14/18
Date Received: 11/06/18
Project: Totem Middle As and Pb 41519.005, F&BI 811089

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 811089-01 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	9.55	94	82	75-125	14
Lead	mg/kg (ppm)	50	14.7	107	95	75-125	12

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	101	80-120
Lead	mg/kg (ppm)	50	109	80-120

Date of Report: 11/14/18
Date Received: 11/06/18
Project: Totem Middle As and Pb 41519.005, F&BI 811089

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 811089-21 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	4.85	86	92	75-125	7
Lead	mg/kg (ppm)	50	14.8	103	97	75-125	6

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	106	80-120
Lead	mg/kg (ppm)	50	117	80-120

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The compound is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

811089

SAMPLE CHAIN OF CUSTODY

ME 11-06-18

Page # 1 of 4 BI4

Report To James welles

Company PBS

Address Seattle

City, State, ZIP

Phone 206 348 6317 Email james.welles@pbsusa.com

SAMPLERS (*signature*)

PROJECT NAME: Totem Middle As/Pb

PO # 415/9.005

REMARKS

INVOICE TO

TURNAROUND TIME
- [x] Standard Turnaround
- [ ] RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- [x] Dispose after 30 days
- [ ] Archive Samples
- [ ] Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Pb only				Notes
TM1-01	01	11/6/2018	1110	Soil	1								X				
TM1-02a	02		1112														
TM1-02b	03		1113														
TM1-03	04		1115														
TM1-04	05		1119														
TM1-05	06		1120														
TM1-06	07		1124														
TM1-07	08		1126														
TM1-08	09		1227														
TM1-09	10	"	1230	"	"								"				

	SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:		J. welles	PBS	11/6/18	1432
Received by:		Nhan Phan	FCBI	V	V
Relinquished by:					
Received by:			Samples received at 14 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

811089

SAMPLE CHAIN OF CUSTODY

ME 11-06-18

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Report To

Company PBS

Address

City, State, ZIP

Phone Email

SAMPLERS (*signature*)	
PROJECT NAME	PO #
REMARKS	INVOICE TO

TURNAROUND TIME
- ☐ Standard Turnaround
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Pb only				Notes
TM1-10a	11	11/6/2016	1030	Soil	1								X				
TM1-10b	12		1129														
TM1-11	13		1233														
TM1-12	14		1131														
TM1-13	15		1225														
TM1-14a	16		1234														
TM1-14b	17		1235														
TM1-15	18		1138														
TM1-16	19		1136														
TM1-17	20		1134														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	J. Weller	PBS	11/6/18	1430
Received by:	Nhan Phan	FEBI	V	V
Relinquished by:				
Received by:		Samples received at 14 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

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SAMPLE CHAIN OF CUSTODY

ME 11-06-18

Page # 3 of 4 BI4

Report To

Company PBS

Address

City, State, ZIP

Phone Email

SAMPLERS (*signature*)	
PROJECT NAME	PO #
REMARKS	INVOICE TO

TURNAROUND TIME
- ☐ Standard Turnaround
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	ANALYSES REQUESTED: TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Pb only			Notes
TM1-18	21	11/6/2018	1222	Soil	1								X			
TM1-19	22		1238													
TM1-20a	23		1142													
TM1-20b	24		1141													
TM1-21	25		1144													
TM1-22	26		1218													
TM1-23a	27		1205													
TM1-23b	28		1205													
TM1-24	29		1151													
TM1-25a	30		1215													

Friedman & Bruya, Inc.
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Seattle, WA 98119-2029
Ph. (206) 285-8282

	SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:		J. Welles	PBS	11/6/18	1439
Received by:		Nhan Phan	FEBI	V	V
Relinquished by:					
Received by:			Samples received at 14 °C		

811089

SAMPLE CHAIN OF CUSTODY

ME 11-06-18 Page # 4 of 4 BIY

Report To

Company PBS

Address

City, State, ZIP

Phone Email

SAMPLERS (*signature*)	
PROJECT NAME	PO #
REMARKS	INVOICE TO

TURNAROUND TIME
- ☐ Standard Turnaround
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Pb only				Notes
TM1-25b	31	11/6/2018	1214	SOIL	1								X				
TM1-26	32		1212														
TM1-27	33		1209														
TM1-28	34		1203														
TM1-29	35		1200														
TM1-30	36		1158														
TM1-31a	37		1156														
TM1-31b	38		1155														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	J. Weller	PBS	11/6/18	1430
Received by:	Nhan Phan	FCBI	V	V
Relinquished by:				
Received by:		Samples received at 4 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

November 16, 2018

James Welles, Project Manager
PBS Engineering and Environmental, Inc.
2517 Eastlake Ave E, Suite 100
Seattle, WA 98102

Dear Mr Welles:

Included are the results from the testing of material submitted on November 6, 2018 from the Totem Middle As and Pb, F&BI 811090 project. There are 43 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
PBS1116R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on November 6, 2018 by Friedman & Bruya, Inc. from the PBS Engineering and Environmental Totem Middle As and Pb, F&BI 811090 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	PBS Engineering and Environmental
811090 -01	TM2-01
811090 -02	TM2-02
811090 -03	TM2-03
811090 -04	TM2-04a
811090 -05	TM2-04b
811090 -06	TM2-05
811090 -07	TM2-06
811090 -08	TM2-07
811090 -09	TM2-08a
811090 -10	TM2-08b
811090 -11	TM2-09
811090 -12	TM2-10
811090 -13	TM2-11
811090 -14	TM2-12a
811090 -15	TM2-12b
811090 -16	TM2-13
811090 -17	TM2-14
811090 -18	TM2-15
811090 -19	TM2-16a
811090 -20	TM2-16b
811090 -21	TM2-17
811090 -22	TM2-18
811090 -23	TM2-19
811090 -24	TM2-20a
811090 -25	TM2-20b
811090 -26	TM2-21
811090 -27	TM2-22
811090 -28	TM2-23
811090 -29	TM2-24a
811090 -30	TM2-24b
811090 -31	TM2-25
811090 -32	TM2-26
811090 -33	TM2-27
811090 -34	TM2-28a
811090 -35	TM2-28b
811090 -36	TM2-29
811090 -37	TM2-30

All quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-01	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-01
Date Analyzed:	11/08/18	Data File:	811090-01.180
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	11.3
Lead	17.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-02	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-02
Date Analyzed:	11/08/18	Data File:	811090-02.183
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	11.5
Lead	16.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-03	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-03
Date Analyzed:	11/08/18	Data File:	811090-03.184
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.43
Lead	11.9

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-04a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-04
Date Analyzed:	11/08/18	Data File:	811090-04.185
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	2.70
Lead	4.18

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-04b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-05
Date Analyzed:	11/08/18	Data File:	811090-05.186
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.19
Lead	6.55

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-05	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-06
Date Analyzed:	11/08/18	Data File:	811090-06.187
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.95
Lead	6.25

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-06	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-07
Date Analyzed:	11/09/18	Data File:	811090-07.107
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.53
Lead	4.69

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-07	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-08
Date Analyzed:	11/09/18	Data File:	811090-08.108
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.98
Lead	9.75

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-08a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-09
Date Analyzed:	11/09/18	Data File:	811090-09.109
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	11.1
Lead	15.6

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-08b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-10
Date Analyzed:	11/09/18	Data File:	811090-10.110
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	10.4
Lead	14.6

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-09	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-11
Date Analyzed:	11/09/18	Data File:	811090-11.111
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.87
Lead	9.89

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-10	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-12
Date Analyzed:	11/09/18	Data File:	811090-12.112
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.45
Lead	11.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-11	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-13
Date Analyzed:	11/09/18	Data File:	811090-13.113
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.22
Lead	5.57

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-12a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-14
Date Analyzed:	11/09/18	Data File:	811090-14.161
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.58
Lead	7.56

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-12b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-15
Date Analyzed:	11/09/18	Data File:	811090-15.162
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	2.78
Lead	2.90

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-13	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-16
Date Analyzed:	11/09/18	Data File:	811090-16.187
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.79
Lead	12.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-14	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-17
Date Analyzed:	11/09/18	Data File:	811090-17.188
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.58
Lead	10.2

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-15	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-18
Date Analyzed:	11/09/18	Data File:	811090-18.189
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	2.76
Lead	3.53

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-16a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-19
Date Analyzed:	11/09/18	Data File:	811090-19.190
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.50
Lead	7.39

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-16b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-20
Date Analyzed:	11/09/18	Data File:	811090-20.198
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	5.38
Lead	5.67

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-17	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-21
Date Analyzed:	11/08/18	Data File:	811090-21.210
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	2.49
Lead	5.11

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-18	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-22
Date Analyzed:	11/08/18	Data File:	811090-22.213
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	2.11
Lead	3.75

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-19	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-23
Date Analyzed:	11/08/18	Data File:	811090-23.214
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.58
Lead	10.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-20a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-24
Date Analyzed:	11/08/18	Data File:	811090-24.215
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.61
Lead	8.33

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-20b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-25
Date Analyzed:	11/08/18	Data File:	811090-25.218
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.28
Lead	3.63

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-21	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-26
Date Analyzed:	11/08/18	Data File:	811090-26.219
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.50
Lead	8.73

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-22	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-27
Date Analyzed:	11/08/18	Data File:	811090-27.220
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	6.28
Lead	9.91

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-23	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-28
Date Analyzed:	11/08/18	Data File:	811090-28.221
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	1.91
Lead	4.42

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-24a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-29
Date Analyzed:	11/08/18	Data File:	811090-29.222
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.19
Lead	5.93

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-24b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-30
Date Analyzed:	11/08/18	Data File:	811090-30.223
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	2.23
Lead	2.54

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-25	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-31
Date Analyzed:	11/08/18	Data File:	811090-31.224
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.50
Lead	8.50

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-26	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-32
Date Analyzed:	11/08/18	Data File:	811090-32.225
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.69
Lead	5.36

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-27	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-33
Date Analyzed:	11/08/18	Data File:	811090-33.226
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.65
Lead	10.7

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-28a	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-34
Date Analyzed:	11/08/18	Data File:	811090-34.227
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	7.59
Lead	11.9

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-28b	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-35
Date Analyzed:	11/08/18	Data File:	811090-35.230
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	9.41
Lead	11.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-29	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-36
Date Analyzed:	11/08/18	Data File:	811090-36.231
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.75
Lead	6.83

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM2-30	Client:	PBS Engineering and Environmental
Date Received:	11/06/18	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	811090-37
Date Analyzed:	11/08/18	Data File:	811090-37.232
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.26
Lead	3.68

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	PBS Engineering and Environmental
Date Received:	Not Applicable	Project:	Totem Middle As and Pb
Date Extracted:	11/08/18	Lab ID:	I8-760 mb
Date Analyzed:	11/09/18	Data File:	I8-760 mb.097
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1
Lead	<1

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	PBS Engineering and Environmental
Date Received:	Not Applicable	Project:	Totem Middle As and Pb
Date Extracted:	11/07/18	Lab ID:	I8-761 mb
Date Analyzed:	11/08/18	Data File:	I8-761 mb.206
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1
Lead	<1

Date of Report: 11/16/18
Date Received: 11/06/18
Project: Totem Middle As and Pb, F&BI 811090

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 811090-01 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	9.25	71 b	72 b	75-125	1 b
Lead	mg/kg (ppm)	50	14.1	71 b	73 b	75-125	3 b

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	98	80-120
Lead	mg/kg (ppm)	50	108	80-120

Date of Report: 11/16/18
Date Received: 11/06/18
Project: Totem Middle As and Pb, F&BI 811090

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 811090-21 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	2.07	100	102	75-125	2
Lead	mg/kg (ppm)	50	4.24	95	95	75-125	0

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	103	80-120
Lead	mg/kg (ppm)	50	111	80-120

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The compound is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

811090

SAMPLE CHAIN OF CUSTODY

MC 11-06-18

Page 1 of 4 BI 4

Report To James Welles

Company PBS

Address Seattle

City, State, ZIP

Phone 206 348 6317 Email james.welles@pbsusa.com

SAMPLERS (signature)

PROJECT NAME: Totem Middle As/Pb

PO #

REMARKS

INVOICE TO

TURNAROUND TIME
- [x] Standard Turnaround
- [ ] RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- [x] Dispose after 30 days
- [ ] Archive Samples
- [ ] Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	ANALYSES REQUESTED: TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	As/Pb only				Notes
TM2-01	01	11/6/2018	0916	SOIL	1								X				
TM2-02	02		0918														
TM2-03	03		0920														
TM2-04a	04		0923														
TM2-04b	05		0924														
TM2-05	06		0926														
TM2-06	07		0929														
TM2-07	08		0953														
TM2-08a	09		0949														
TM2-08b	10		0950														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	J. Welles	PBS	11/6/18	1443
Received by:	Khan Phan	FCBT	V	V
Relinquished by:				
Received by:		Samples received at 4 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

811090

SAMPLE CHAIN OF CUSTODY

ME 11-06-18

Page # 2 of 4 FC4

Report To

Company PBS

Address

City, State, ZIP

Phone Email

SAMPLERS (*signature*)	
PROJECT NAME	PO #
REMARKS	INVOICE TO

TURNAROUND TIME
- ☐ Standard Turnaround
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs/8270D SIM	As/Pb only				Notes
TM2-09	11	11/6/2018	0947	Soil	1								X				
TM2-10	12		0937														
TM2-11	13		0935														
TM2-12a	14		0937														
TM2-12b	15		0938														
TM2-13	16		0956														
TM2-14	17		0944														
TM2-15	18		0943														
TM2-16a	19		0940														
TM2-16b	20		0941														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	S. Wells	PBS	11/6/18	1443
Received by:	Nhan Phan	FEBI	11/6/18	V
Relinquished by:				
Received by:		Samples received at	4 °C	

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

811090

SAMPLE CHAIN OF CUSTODY

ME 11-06-18

Page # 3 of 4

BI4

Report To _____

Company PBS

Address _____

City, State, ZIP _____

Phone _____ Email _____

SAMPLERS (*signature*)	
PROJECT NAME	PO #
REMARKS	INVOICE TO

TURNAROUND TIME
- ☐ Standard Turnaround
- ☐ RUSH _____
- Rush charges authorized by: _____

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other _____

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	Npo only				Notes
TM2-17	21	11/6/2018	1017	SOIL	1								X				
TM2-18	22		1016														
TM2-19	23		0958														
TM2-20a	24		1002														
TM2-20b	25		1001														
TM2-21	26		1005														
TM2-22	27		1007														
TM2-23	~~28~~		1010														
TM2-24a	29		1012														
TM2-24b	30	↓	1013	↓	↓								4				

	SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:		J. Welles	PBS	11/6/18	1443
Received by:		Nhan Phan	FCBI	V	V
Relinquished by:					
Received by:			Samples received at 4 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

811090

SAMPLE CHAIN OF CUSTODY

ME 11-06-18 Page 4 of 4 BF4

Report To

Company PBS

Address

City, State, ZIP

Phone Email

SAMPLERS (*signature*)	
PROJECT NAME	PO #
REMARKS	INVOICE TO

TURNAROUND TIME
- ☐ Standard Turnaround
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	ANALYSES REQUESTED: TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	Pb/As Only				Notes
TM2-25	31	11/6/2018	1035	SOIL	1								X				
TM2-26	32		1033														
TM2-27	33		1031														
TM2-28a	34		1028														
TM2-28b	35		1028														
TM2-29	36		1025														
TM2-30	37		1023														

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	J. Welles	PBS	11/6/18	1943
Received by:	Nhan Phan	FCBI	11/6/18	1443
Relinquished by:				
Received by:		Samples received at 4 °C		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

November 15, 2019

Jannine McDonald
Federal Way Public Schools
Capital Projects
1211 S 232nd St
Federal Way, WA 98004
Email: jmcdonald@fwps.org
fwpscp18@fwps.org

RE: Totem Middle School – Supplemental Arsenic and Lead Soil Sampling Report
26630 40th Avenue S, Kent, Washington
PBS Project #41519.005

Federal Way Public Schools (FWPS) has contracted PBS Engineering and Environmental Inc. (PBS) to evaluate the potential for arsenic and lead contaminants in near surface soils at the site of Totem Middle School (TMS) prior to site redevelopment as part of the TMS Replacement Project. A Site Vicinity Map is presented as Figure 1.

This *Supplemental Arsenic and Lead Soil Sampling Report* presents the findings of supplemental sampling performed in October 2019 beneath a location with arsenic concentrations in exceedance of the Washington State Department of Ecology's (Ecology's) Model Toxics Control Act (MTCA) Method A cleanup level for arsenic. The purpose of supplemental sampling was to determine the vertical extent of arsenic impacted soils in the remediation area. Trees within the remediation area requiring removal were also recorded during the site visit for soil sampling.

Results of initial and supplemental soil sampling will provide basis for areas requiring soil remediation and associated trees for removal. Based on conversations with Ecology and FWPS, mixing with clean soils is expected to be the chosen model remedy for the site. Based on conversations with FWPS and the project arborist, mixing of soils within approximately 50 feet of the base of the tree will disturb the trees roots, and render survival of the tree unlikely. The area requiring remediation and details about remedial methods will be outlined in Specification 02 61 00 Contaminated Soil Management which will be included in the bid package for construction of the new school.

BACKGROUND

On November 5, 2018 PBS performed soil sampling activities to determine the levels of arsenic and lead in shallow soil at TMS in accordance with Ecology's *2019 Tacoma Smelter Plume Model Remedies Guidance*[1]. Findings of the sampling activities and recommendations for regulatory compliance of impacted soils were presented in the Totem Middle School Arsenic and Lead Soil Sampling Report dated November 30, 2018[2]. The report identified one location where arsenic concentrations exceeded Ecology's MTCA Method A cleanup level (CUL) criteria for unrestricted land use.

[1] *Tacoma Smelter Plume Model Remedies Guidance,* Department of Ecology, July 2019.
[2] *Totem Middle School – Arsenic and Lead Soil Sampling Report*, PBS Engineering and Environmental, November 30, 2018.

On October 25, 2019, Mr. James Welles of PBS met with Ms. Jannine McDonald of FWPS Capital Projects and Mr. Zeb Haney of Tree Resource to evaluate which trees FWPS would like to retain and determine additional soil sample locations required to determine if the trees would fall within the soil remediation area.

SUPPLEMENTAL SOIL SAMPLING

Additional soil samples were collected in October 2019 to delineate the vertical extent of impacted soils in the location of previous soil sample TM-1-26. Additional samples were collected in the same location as sample TM-1-26 at depths of 12, 18 and 24 inches below ground surface (bgs). Original and supplemental soil sample locations in the area of concern are presented in Figure 2.

A hand spade and a hand auger were used to complete a 24-inch deep test hole. Soil samples were collected for laboratory analysis at depths of 12, 18 and 24 inches.

PBS personnel wore disposable nitrile gloves to protect against cross-contamination between samples. Soil retained for analysis was packed into laboratory-provided containers, labeled and transported on ice under chain of custody documentation to Friedman and Bruya, Inc. in Seattle, an Ecology-accredited analytical laboratory.

Samples were analyzed for total arsenic and lead using EPA Method 6020. Total arsenic and lead results were reported on a dry weight basis.

ANALYTIC RESULTS

Analytical results from the three soil samples collected from location TM-1-26 were below MTCA Method A CULs.

Detected arsenic concentrations did not exceed two times the CUL and are thus not considered “elevated” per the Smelter Plume Guidance. However, because the land is used as an elementary school, FWPS has elected to remediate soils in exceedance of the CUL, even if they are not considered elevated per the guidance.

CONCLUSIONS

Based on the analytical results of prior and supplemental soil sampling the following conclusion and recommendations were made regarding the handling and management of project site soils.

The area surrounding sample location TM-1-26 will require soil remediation to a depth of 12 inches bgs. Currently, the proposed remedial method is mixing in place.

Based on analytical results of soil sampling to date, the area delineated for remediation by mixing in place will disturb the roots of trees 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619 and 2815 (see Figure 2). As such, these trees will require removal prior to soil remediation. Action regarding trees previously slated for removal in the Tree Retention Plan for the project have not changed and are not discussed further herein.

The proposed remediation area is depicted on Figure 2. Total area for soil remediation at TMS is estimated at approximately one acre. Final remediation area boundaries, area, and associated survey coordinates will be provided in Specification 02 61 00 – Contaminated Soil Management.

LIMITATIONS

This investigation was conducted to characterize lead and arsenic distributions in shallow soils surrounding previously identified arsenic and lead contaminated locations on-site, with a focus on protection of human health and the environment. The data collected in this investigation are not intended for the purposes of waste profiling for offsite disposal, or for estimation of volume or tonnage of soil requiring disposal.

PBS has prepared this report for use by FWPS. This report is not intended for use by others without the written consent of the FWPS. Our interpretation of soil conditions in this study was based on field observations and analytical data from the indicated explorations. Regulated substances may exist in portions of the site that were not explored or analyzed.

PBS ENGINEERING AND ENVIRONMENTAL INC.

James Welles, LG
Project Geologist

Reviewed By:

Melanie Young

Melanie Young, PE
Senior Environmental Engineer

Attachments:
Table 1: Laboratory Data Summary Table
Figure 1: Site Vicinity Map
Figure 2: As/Pb Supplemental Soil Sample Location Map
Attachment A: Laboratory Data

Tables

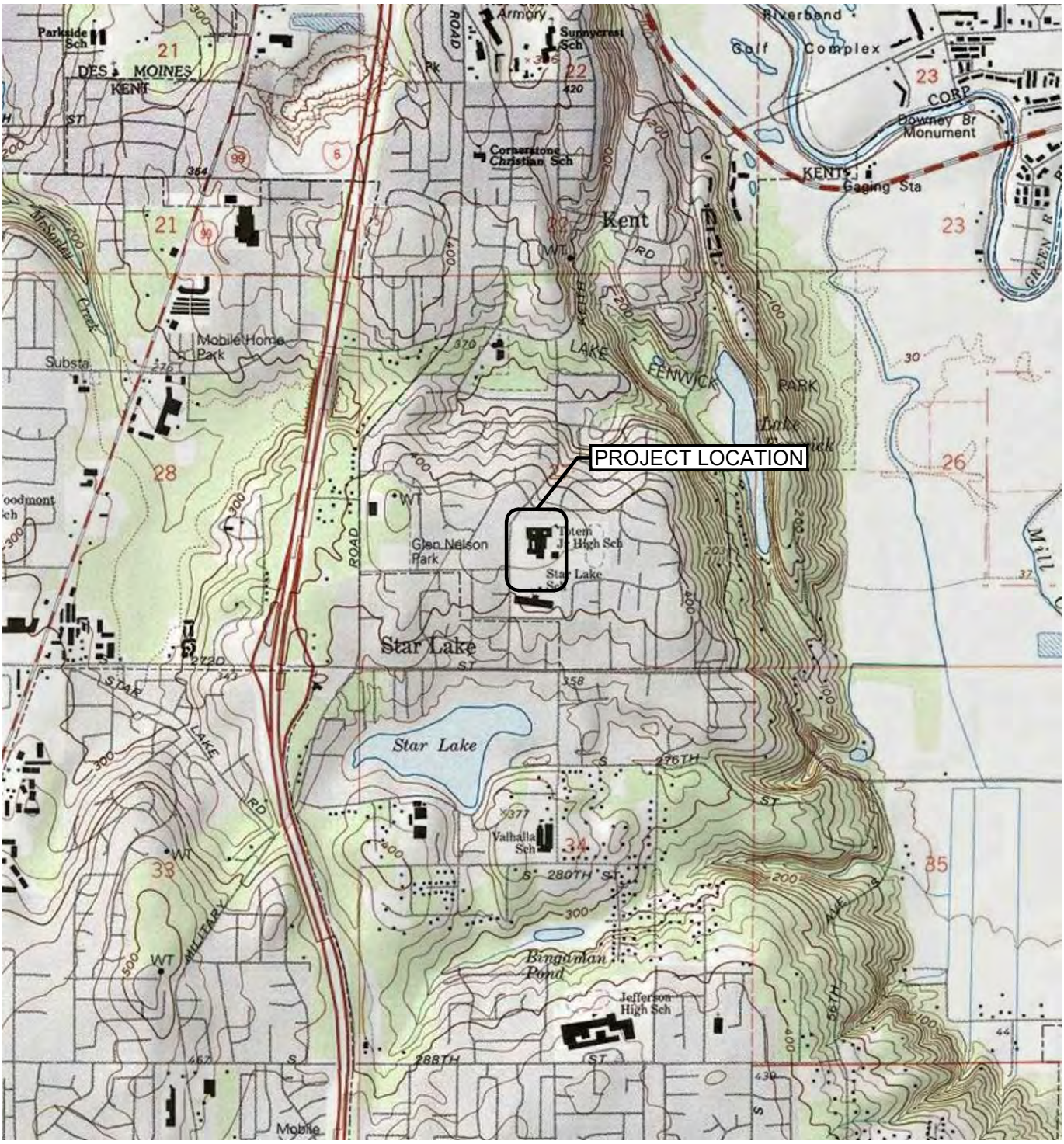
Table 1 - Soil Sample Analytical Results

Site: Totem Middle School
Address: 26630 40th Avenue S, Kent, WA
PBS Project No. 41519.005

Location / Sample Identification	Description	Sample Depth (inches bgs)	Metals	
			Arsenic (mg/kg)	Lead (mg/kg)
	Regulatory Criteria	**MTCA Method A Cleanup Level**	**20**	**250**
Delineation Samples Surrounding Sample WW-2-01				
TM-1-26b	6" below TM-1-26	6-12	3.81	5.29
TM-1-26c	12" below TM-1-26	12-18	3.92	4.50
TM-1-26d	18" below TM-1-26	18-24	4.38	3.96
TM-1-26	original sample location	0-6	**26.0**	48.8

Arsenic and lead analyzed by US EPA Method 6020
mg/kg - milligrams per kilogram
bold = concentration exceeds adopted criteria
bgs = below ground surface

Figures



SOURCE: USGS POVERTY BAY, WA QUADRANGLE 1990, PHOTO REVISED 1994.

WASHINGTON

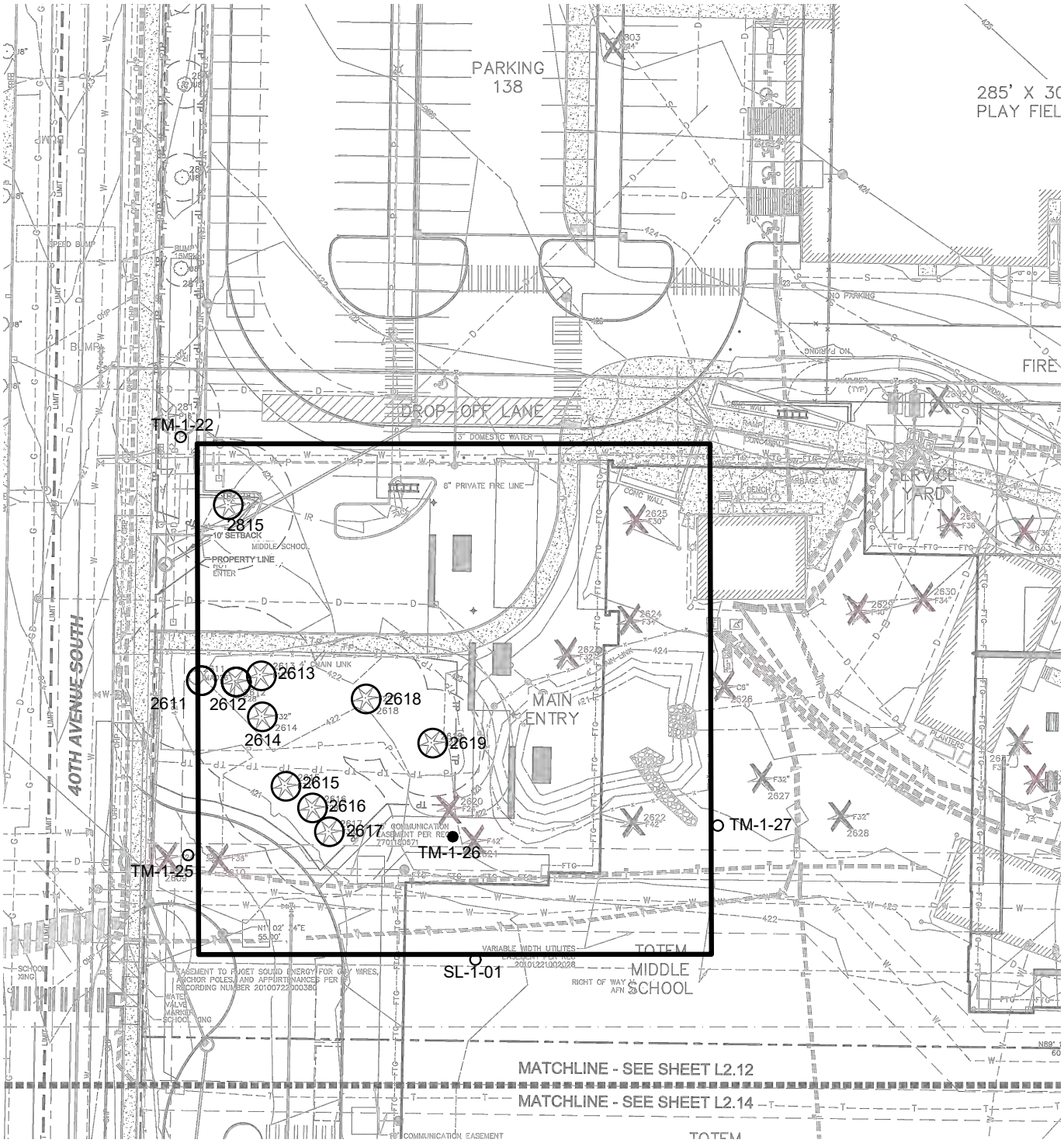
PREPARED FOR: FEDERAL WAY PUBLIC SCHOOLS

VICINITY MAP

TOTEM MIDDLE SCHOOL
26630 40TH AVENUE SOUTH
KENT, WASHINGTON

NOV 2019
41519.005

FIGURE
1



SOURCE: © 2018 GOOGLE EARTH PRO

LEGEND

○ TM-1-28	SOIL SAMPLE LOCATION As, Pb < MTCA METHOD A
● TM-1-26	SOIL SAMPLE LOCATION As, Pb > MTCA METHOD A
———	PROPOSED BOUNDARY FOR SOIL REMEDIATION
✳	TREE SELECTED FOR REMOVAL TO FACILITATE SOIL REMEDIATION
2618	TREE ID

SCALE 1" = 50'

0' 25' 50' 100'

PREPARED FOR: FEDERAL WAY PUBLIC SCHOOLS

PBS

As / Pb SUPPLEMENTAL SOIL SAMPLE LOCATION MAP

TOTEM MIDDLE SCHOOL
26630 40TH AVENUE SOUTH
KENT, WASHINGTON

NOV 2019
41519.005

FIGURE
2

Attachment A

Laboratory Report and Chain of Custody Documentation

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

November 8, 2019

James Welles, Project Manager
PBS Engineering and Environmental, Inc.
214 E. Galer St, Suite 300
Seattle, WA 98102

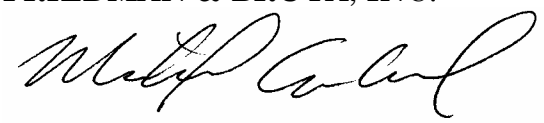
Dear Mr Welles:

Included are the results from the testing of material submitted on October 31, 2019 from the Totem Middle School 41519.005, F&BI 910604 project. There are 7 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days, or as directed by the Chain of Custody document. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.



Michael Erdahl
Project Manager

Enclosures
PBS1108R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on October 31, 2019 by Friedman & Bruya, Inc. from the PBS Engineering and Environmental Totem Middle School 41519.005, F&BI 910604 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	PBS Engineering and Environmental
910604 -01	TM1-26b
910604 -02	TM1-26c
910604 -03	TM1-26d

All quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-26b	Client:	PBS Engineering and Environmental
Date Received:	10/31/19	Project:	Totem Middle School 41519.005
Date Extracted:	11/04/19	Lab ID:	910604-01
Date Analyzed:	11/04/19	Data File:	910604-01.039
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.81
Lead	5.29

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-26c	Client:	PBS Engineering and Environmental
Date Received:	10/31/19	Project:	Totem Middle School 41519.005
Date Extracted:	11/04/19	Lab ID:	910604-02
Date Analyzed:	11/04/19	Data File:	910604-02.088
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	3.92
Lead	4.50

Analysis For Total Metals By EPA Method 6020B

Client ID:	TM1-26d	Client:	PBS Engineering and Environmental
Date Received:	10/31/19	Project:	Totem Middle School 41519.005
Date Extracted:	11/04/19	Lab ID:	910604-03
Date Analyzed:	11/04/19	Data File:	910604-03.089
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.38
Lead	3.96

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	PBS Engineering and Environmental
Date Received:	Not Applicable	Project:	Totem Middle School 41519.005
Date Extracted:	11/04/19	Lab ID:	I9-701 mb
Date Analyzed:	11/04/19	Data File:	I9-701 mb.034
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	<1
Lead	<1

Date of Report: 11/08/19
Date Received: 10/31/19
Project: Totem Middle School 41519.005, F&BI 910604

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 910604-01 x5 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	<5	83	85	75-125	2
Lead	mg/kg (ppm)	50	<5	90	92	75-125	2

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	89	80-120
Lead	mg/kg (ppm)	50	100	80-120

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

910604

SAMPLE CHAIN OF CUSTODY

ME 10-31-19

Page # 1 of 1

BI 1

Send Report To James Welles

Company PBS Eng. + Env.

Address 214 E. Galer St. Suite 300

City, State, ZIP Seattle, WA 98102

Phone # 206.233.9639 Fax #

Email Address james.welles@pbsusa.com

SAMPLERS (signature)

PROJECT NAME/NO.: Totem Middle School

PO #: 41519.005

PROJECT ADDRESS: 4014 S. 270th St. Kent, WA

• ELECTRONIC DATA REQUESTED

TURNAROUND TIME
- ~~Standard Turnaround~~
- RUSH 1 week

Rush charges authorized by:

SAMPLE DISPOSAL
- Dispose after 30 days
- Return samples
- Will call with instructions

Samples Received at ____ °C

Sample ID	Lab ID	Date	Time	Sample Type	# of containers	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260	SVOCs by 8270	HFS	PLAs					Notes
TM1-26b	01			Soil	1							X					
TM1-26c	02			Soil	1							X					
TM1-26d	03			Soil	1							X					
																	Samples received at 9 °C

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Nathan Rickey	PBS	10/31	0752
Received by:	Eric Young	[illegible]	10/31	752
Relinquished by:				
Received by:				

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

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