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CLEANUP ACTION PLAN

SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON
VOLUNTARY CLEANUP PROGRAM NO. SW1208

Submitted by:
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ACRONYMS AND ABBREVIATIONS

ARARs	applicable or relevant and appropriate requirements
bgs	below ground surface
CAP	Cleanup Action Plan
CFR	Code of Federal Regulations
CMSAP	Compliance Monitoring and Sampling and Analysis Plan
COC	constituent of concern
Ecology	Washington State Department of Ecology
EnCo	EnCo Environmental Corporation
Farallon	Farallon Consulting, L.L.C.
FFS	Focused Feasibility Study
HASP	Health and Safety Plan
mg/kg	milligrams per kilogram
µg/l	micrograms per liter
MTCA	Washington State Model Toxics Control Act Cleanup Regulation
NFA	No Further Action
PMI	Port Maritime and Industrial District
RCW	Revised Code of Washington
RI	Remedial Investigation
RI/FFS Report	*Remedial Investigation and Focused Feasibility Study Report, Sound Battery, 2310 East 11th Street, Tacoma, Washington* dated November 19, 2013, prepared by Farallon Consulting, L.L.C.
Site	property at 2310 East 11th Street in Tacoma, Washington
Sound Battery	Sound Battery Company
TEE	Terrestrial Ecological Evaluation
VCP	Voluntary Cleanup Program
WAC	Washington Administrative Code

1.0 INTRODUCTION

Farallon Consulting, L.L.C. (Farallon) has prepared this Cleanup Action Plan (CAP) for the Sound Battery Company (Sound Battery) property at 2310 East 11th Street in Tacoma, Washington (herein referred to as the Site) (Figure 1). The CAP describes the cleanup action for remediation of lead in soil at concentrations exceeding the Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A cleanup level for industrial land use, as established in Chapter 173-340 of the Washington Administrative Code (WAC 173-340). The Site is enrolled in the Washington State Department of Ecology (Ecology) Voluntary Cleanup Program (VCP) and has been assigned Identification No. SW1208.

In 2002, soil with concentrations of lead exceeding the 250 milligrams per kilogram (mg/kg) MTCA Method A cleanup level for unrestricted land use was excavated from the areas surrounding the Site building footprint and from adjacent properties under terms of Agreed Order No. DE 01TCPSR-3130 entered into by Sound Battery and Ecology in 2001, and according to Enforcement Order No. DE97TC-S137. According to the Cleanup Site Details report obtained from the Ecology (2013) Toxics Cleanup Program website, the Site was removed from the Hazardous Sites List, and the Site status was updated to “NFA” (No Further Action) on May 21, 2003.

Lead was detected at concentrations exceeding MTCA Method A cleanup levels in soil and reconnaissance groundwater samples collected from localized areas beneath and adjacent to the Site building footprint in 2011. According to the Ecology (2013) Cleanup Site Details report, Ecology re-opened the Site on February 21, 2012, and the Site was enrolled in the Ecology VCP.

The cleanup action described in this CAP includes permitted demolition of the Site building and floor slab, and excavation and off-Site disposal of soil with concentrations of lead exceeding the 1,000 mg/kg MTCA Method A cleanup level for industrial land use. A Closure Report will be submitted to Ecology to document the cleanup action and to request an NFA determination for the Site from Ecology.

1.1 PURPOSE AND OBJECTIVE

The purpose of the CAP is to describe the scope of work for the cleanup action selected, described in the *Remedial Investigation and Focused Feasibility Study Report, Sound Battery, 2310 East 11th Street, Tacoma, Washington* dated November 19, 2013, prepared by Farallon (RI/FFS Report). The cleanup action entails removal of soil with concentrations of lead exceeding the MTCA Method A cleanup level for industrial land on the Site. The objective of the cleanup action is to protect human health and the environment and meet the requirements for an NFA determination for the Site from Ecology. The CAP has been prepared in accordance with WAC 173-340-380.

1.2 ORGANIZATION

The CAP includes the following information:

- **Section 2—Site Background** provides a description of the Site and history, a brief description of the local geology and hydrogeology, and a summary of the environmental investigations and cleanup action previously conducted at the Site.
- **Section 3—Remedial Investigation/Focused Feasibility Study Results** provides a brief description of the results of the RI/FFS completed by Farallon, detailed in the RI/FFS Report.
- **Section 4—Technical Elements** identifies the cleanup action technical elements, including media and constituents of concern, extent of affected media, Terrestrial Ecological Evaluation (TEE), cleanup standards, applicable or relevant and appropriate requirements (ARARs), and the estimated restoration time frame.
- **Section 5—Selected Cleanup Action** presents the objective, description, and elements of the cleanup action selected, including compliance monitoring, and a summary of the documentation requirements.
- **Section 6—Implementation Schedule** provides an approximate schedule for completion of the cleanup action and compliance monitoring.
- **Section 7—Bibliography** provides a list of the source materials used in preparing this CAP.
- **Section 8—Limitations** provides Farallon’s standard limitations.

2.0 SITE BACKGROUND

Site description and background information from sources referenced in the RI/FFS Report are summarized in the following sections. Additional Site description and background details are provided in the RI/FFS Report.

2.1 SITE DESCRIPTION AND HISTORY

The Site, zoned as part of the Port Maritime and Industrial District (PMI) defined in the Tacoma Municipal Code, is located in the industrial Port of Tacoma area of the former Commencement Bay tide flats of the City of Tacoma on Puget Sound (Figure 1). The tide flats area was filled beginning in the early 1900s, and currently is used for industrial and commercial purposes. The topography at the Site is flat, with a slope of less than 1 percent toward the northwest, and an elevation of approximately 10 to 15 feet above mean sea level.

The Site is developed with a combined one- and two-story masonry building containing approximately 6,125 square feet of interior space, with a roofed exterior area at the southeast corner that contains approximately 1,225 square feet. Sound Battery reportedly occupied the original building in 1947 for the manufacture of batteries. Approximately 1,000 square feet of exterior asphalt pavement surrounds the Site building, for a total of approximately 7,000 square feet of impervious surface at the Site. The area behind and southeast of the Site building and portions of both side yards are unpaved. The building and paved and unpaved areas are shown on Figure 2.

2.2 GEOLOGY AND HYDROGEOLOGY

Land forms within this region comprise a system of glacially and fluvially sculpted features (EnCo Environmental Corporation [EnCo] 2011). The last glacial event occurred approximately 10,000 to 14,000 years ago, when the terminus of the Vashon Stade began to retreat from as far south as the Olympia area, leaving behind a range of glacial and alluvial recessional outwash features. The mapped soil consists of recent sand, silt, and gravel deposited in stream channels, on flood plains, and on terraces.

Soil observed in borings advanced at the Site consists of sand with varying silt and gravel content to approximately 10 feet below ground surface (bgs), underlain by sand and silt to the maximum depth investigated of approximately 14 feet bgs. Groundwater was encountered between approximately 4 and 7 feet bgs; the groundwater flow direction has been estimated to be northwest.

2.3 SUMMARY OF ENVIRONMENTAL INVESTIGATIONS AND PRIOR CLEANUP ACTION

Several soil and groundwater investigations were completed at the Site between 1991 and 2011 to evaluate environmental conditions and characterize the extent of lead in soil and groundwater outside and inside the building footprint. In 2002, a soil cleanup action was conducted outside the Site building. Environmental investigations and prior cleanup work are summarized below.

A cleanup action was conducted by GeoSystems Analysis, Inc. (2002c) in 2002 that included excavation of 880 tons of soil containing lead exceeding the MTCA Method A cleanup level for unrestricted land use to a depth of 1.5 feet bgs, and to a depth of 5.5 feet bgs in some areas, from around the Site building and from adjacent areas of the surrounding three parcels (Figure 2). The excavated soil was treated ex-situ with a chemical stabilizing agent and disposed of at the Subtitle D Pierce County Recycling, Composting, and Disposal Landfill operated by Land Recovery, Inc. The excavations were backfilled with clean imported gravel, and compacted and graded to pre-excavation topography. Dissolved or total lead was not detected at concentrations exceeding the laboratory reporting limit of 1 microgram per liter (µg/l) in groundwater samples collected from any of the four Site monitoring wells during post-excavation groundwater monitoring.

According to the Cleanup Site Details report, the Site was removed from the Hazardous Sites List in 2003, and the Site status was updated to “NFA” (Ecology 2013).

Lead was detected at concentrations exceeding the MTCA Method A cleanup level for industrial land use in soil samples and at concentrations exceeding the 15 µg/l MTCA Method A cleanup level in reconnaissance groundwater samples collected by EnCo (2011) from beneath the Site building and associated exterior paved surfaces. Results of the EnCo (2011) investigation are summarized on Figure 2. According to the Cleanup Site Details report, a Site Discovery/Release Report was received in 2012, and Ecology (2013) re-opened the Site on February 21, 2012. Ecology received a VCP application for the Site on February 24, 2012.

3.0 REMEDIAL INVESTIGATION/FOCUSED FEASIBILITY STUDY RESULTS

Farallon conducted an RI/FFS in accordance with WAC 173-340-350 to collect, develop, and evaluate sufficient subsurface information to select a cleanup action under WAC 173-340-360 through 173-340-390. The analytical results of the remedial investigation (RI) are summarized in Tables 1 and 2 and shown on Figure 3.

Total lead was detected at concentrations exceeding the MTCA Method A cleanup level for industrial land use in soil samples collected beneath the building during the RI to a depth of 6.5 feet bgs, the approximate depth of groundwater. Arsenic, cadmium, chromium, copper, mercury, or zinc were not detected in soil at concentrations exceeding MTCA cleanup levels.

Groundwater was measured at depths ranging from approximately 6.5 to 7 feet bgs in the seven drilling locations where groundwater was encountered. Lead was detected at concentrations exceeding the MTCA Method A cleanup level in one reconnaissance groundwater sample collected by EnCo (2011) near the outlet end of an abandoned floor drain and field-filtered prior to analysis.

Lead has not been detected at a concentration exceeding the MTCA Method A cleanup level in groundwater samples collected from the four Site monitoring wells during groundwater monitoring conducted since 1997. As shown in Table 2, total lead was detected at a concentration slightly exceeding the 1 µg/l reporting limit and considerably below the MTCA Method A cleanup level in one unfiltered groundwater sample collected from down-gradient monitoring well MW-1 during the most-recent groundwater monitoring event conducted in August 2012. Dissolved lead was not detected in the groundwater sample collected from monitoring well MW-1. Neither total nor dissolved lead was detected in any other groundwater sample collected from the four Site monitoring wells during the most-recent groundwater monitoring event.

The RI included collection of groundwater samples from the four Site monitoring wells for analysis for dissolved concentrations of arsenic, cadmium, chromium, copper, mercury, and zinc. Dissolved arsenic was the only metal detected at a concentration exceeding the laboratory detection limit and was detected only in up-gradient monitoring well MW-2 at a concentration less than the MTCA Method A cleanup level.

The nature and extent of lead in soil and groundwater on the Site was delineated as part of the RI to support evaluation and selection of a cleanup action in the Focused Feasibility Study (FFS). Technically feasible cleanup alternatives were identified, developed, and evaluated during the FFS to enable selection of a preferred cleanup action in accordance with WAC 173-340-360. Based on the results from the EnCo (2011) investigation and the RI, it is estimated that approximately 350 tons of soil with concentrations of lead exceeding the MTCA Method A cleanup level for industrial land use remains at Areas A, A1, A2, B, and C, shown on Figure 4.

Technically feasible cleanup alternatives for Site cleanup evaluated in the FFS included: (1) excavation, off-Site stabilization, and off-Site disposal; (2) excavation, on-Site stabilization, and off-Site disposal; and (3) institutional and engineering controls. Cleanup Alternatives 1 and 2 included demolition of the Site building and appropriate disposal of hazardous building materials.

Each of the three cleanup alternatives was evaluated as part of the FFS in accordance with the requirements of WAC 173-340-350 and the criteria defined in WAC 173-340-360. The FFS included an evaluation of cleanup alternatives to satisfy the following threshold requirements, as specified in WAC 173-340-360(2)(a):

- Protection of human health and the environment;
- Compliance with cleanup standards;
- Compliance with applicable state and federal laws; and
- Provision for compliance monitoring.

The cleanup alternatives were evaluated also for other requirements, defined in WAC 173-340-360(2)(b), which included:

- Use of permanent solutions to the maximum extent practicable, including protectiveness, permanence, effectiveness over the long term, management of short-term risks, technical and administrative implementability, consideration of public concerns, and cost; and
- Provision for a reasonable restoration time frame.

Based on the results of the FFS, Cleanup Alternative 2—Excavation, On-Site Stabilization, and Off-Site Disposal was selected as the preferred cleanup alternative for the Site. The FFS evaluation showed that Cleanup Alternative 1—Excavation, Off-Site Stabilization, and Off-Site Disposal provides the same degree of environmental benefit as Cleanup Alternative 2, and is a cost-effective and permanent technically feasible cleanup alternative. The FFS selected Cleanup Alternative 2 as the preferred cleanup alternative based on the cost, which was estimated to be slightly less than the cost for implementing Cleanup Alternative 1. Since the completion of the RI/FFS Report, a less-expensive off-Site stabilization option was identified. Therefore, Cleanup Alternative 1—Excavation, Off-Site Stabilization, and Off-Site Disposal is the selected cleanup alternative for the Site.

4.0 TECHNICAL ELEMENTS

The technical elements of the cleanup action are presented in this section, including identification of the medium and constituent of concern (COC), the extent of affected soil, determination of need for a Terrestrial Ecological Evaluation (TEE), cleanup standards, and ARARs and permits. The restoration time frame also is discussed.

4.1 MEDIUM AND CONSTITUENT OF CONCERN

Soil from the bottom of the pavement to the approximate depth to the groundwater table is the affected medium of concern.

Lead is the COC in soil beneath the Site building and associated paved surfaces.

Groundwater is not a medium of concern. Concentrations of total lead and/or dissolved lead were detected in turbid reconnaissance groundwater samples collected from two borings during the EnCo (2011) investigation. However, total or dissolved lead was not detected at concentrations exceeding laboratory reporting limits in groundwater samples collected from monitoring wells MW-1 through MW-4 in the RI, with one exception. Total lead was detected at a concentration exceeding the laboratory reporting limit and considerably less than the MTCA Method A cleanup level in one groundwater sample collected from monitoring well MW-1. These results are consistent with the results from prior investigations, which showed that lead was not detected in groundwater samples collected from monitoring wells MW-1 through MW-4 or, if lead was detected, concentrations were considerably less than the MTCA Method A cleanup level.

4.2 EXTENT OF AFFECTED SOIL

Based on the analytical results for soil samples collected by EnCo (2011) and during the RI completed by Farallon (RI/FFS Report), total lead is present at concentrations exceeding the MTCA Method A cleanup level for industrial land use in shallow soil (i.e., shallower than about 2 feet bgs) in the following areas, shown on Figure 4:

- Remediation Area A—beneath the second addition to the Site building and covered exterior;
- Remediation Area B—near the center of the first addition; and
- Remediation Area C—outside the northeast wall of the Site building.

Total lead was detected at concentrations exceeding the MTCA Method A cleanup level for industrial land use in soil as deep as the approximate depth to groundwater (approximately 6.5 to 8.5 feet bgs) in the areas proximate to the inlet and outlet to the abandoned drain line (Remediation Areas A1 and A2, respectively).

4.3 TERRESTRIAL ECOLOGICAL EVALUATION

A TEE is required by WAC 173-340-7490 where a hazardous substance has been released to soil. The regulation requires that one of the following actions be taken:

- Documenting a TEE exclusion using the criteria presented in WAC 173-340-7491;
- Conducting a simplified TEE in accordance with WAC 173-340-7492; or
- Conducting a site-specific TEE in accordance with WAC 173-340-7493.

Based on the criteria for TEE exclusion in WAC 173-340-7491(1)(c)(i), the Site is excluded from a TEE because fewer than 1.5 acres of contiguous undeveloped land are on the Site or within 500 feet of any area of the Site. The TEE form is provided in Appendix A. No further consideration of ecological impacts is required under MTCA.

4.4 CLEANUP STANDARDS

As defined in WAC 173-340-700, cleanup standards for the Site include establishing COC cleanup levels and points of compliance for each medium of concern at which the cleanup levels will be attained. The cleanup standards for the Site have been established in accordance with WAC 173-340-700 through 173-340-760 to be protective of human health and the environment, and to comply with the ARARs identified for the Site.

The cleanup level is the concentration of a hazardous substance that protects human health and the environment under specific exposure scenarios. The Site meets the definition of an industrial property under WAC 173-340-200 in that the Site and vicinity are zoned as industrial (PMI) by the City of Tacoma. Therefore, the 1,000 mg/kg MTCA Method A soil cleanup level for industrial land use, protective of a general industrial land use human direct contact exposure pathway, is selected as the cleanup level for the one COC, lead, in soil at the Site.

The point of compliance defines the point(s) at a site where cleanup levels must be attained. Once the cleanup levels have been attained at the defined point(s) of compliance, the Site is no longer considered to be a threat to human health or the environment. Per WAC 173-340-740(6)(b), the point of compliance for the Site is soil throughout the Site.

4.5 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND PERMITS

WAC 173-340-710 requires that cleanup actions comply with applicable local, state, and federal laws. MTCA defines applicable local, state, and federal laws to include legally applicable requirements and relevant and appropriate requirements, herein referred to as ARARs.

The following ARARs are anticipated to be the applicable requirements because they encompass the cleanup action framework, including applicable and relevant regulatory guidelines, cleanup standards, waste disposal criteria, and documentation standards:

- The Washington State Model Toxics Control Act, Chapter 70.105D of the Revised Code of Washington (RCW 70.105D);
- MTCA (WAC 173-340);
- Water Quality Standards for Groundwaters of the State of Washington (WAC 173-200);
- The Hazardous Waste Management Act (RCW 70.105);
- Washington State Solid Waste Management Laws and Regulations (RCW 70.95; WAC 173-304 and 173-351);
- Dangerous Waste Regulations (WAC 173-303);
- Accreditation of Environmental Laboratories (WAC 173-50);
- The Occupational Safety and Health Act (Part 1910 of Title 29 of the Code of Federal Regulations [29 CFR 1910] and WAC 296-62);
- The State Environmental Policy Act Checklist (RCW 43.21);
- Maximum Containment Levels, National Primary Drinking Water Regulations (WAC 246-290-310; 46 CFR 141);
- Safety Standards for Construction Work (WAC 296-155);
- Minimum Standards for Construction and Maintenance of Wells (WAC 173-160);
- National Primary and Secondary Air Quality Standards (40 CFR 50);
- Washington State General Requirements for Air Pollution Sources (WAC 173-400); and
- Local permits required by the City of Tacoma.

4.6 RESTORATION TIME FRAME

The selected cleanup action alternative will meet threshold requirements and cleanup action objectives in a reasonable restoration time frame. Excavation, removal, and off-Site disposal of soil with concentrations of lead exceeding the MTCA Method A cleanup level for industrial use will result in immediate achievement of the cleanup action objectives for soil at the Site.

5.0 SELECTED CLEANUP ACTION

This section presents the objective of the cleanup action, describes the selected cleanup action and work elements, including compliance monitoring, and documentation requirements.

5.1 OBJECTIVE OF CLEANUP ACTION

The objective of the cleanup action at the Site is to remove soil with concentrations of lead that poses a potential threat to human health in an efficient and cost-effective manner to the maximum extent practicable. The specific cleanup action objective for the Site is to meet the cleanup levels for lead in soil throughout the Site to meet the requirements for a Site-specific NFA determination from Ecology.

5.2 DESCRIPTION OF CLEANUP ACTION

Excavation, off-Site stabilization, and off-Site disposal of soil is the selected cleanup action for the Site to achieve a Site-specific NFA determination. This cleanup action was selected based on the FFS evaluation performed by Farallon (RI/FFS Report), and satisfies the threshold and other requirements, as specified in WAC 173-340-360(2)(a) and (b).

The sequence of work for implementing the selected cleanup action includes:

- Obtaining necessary permits and approvals;
- Implementing erosion control and Site security measures;
- Demolishing the Site building and disposing of waste materials off the Site;
- Mitigating and disposing of hazardous building materials contained in the Site building;
- Removing the concrete floor slab and asphaltic pavement in excavation areas;
- Excavating soil with concentrations of lead exceeding the cleanup level from Areas A, A1, A2, B, and C (Figure 4), transporting the soil off the Site to a permitted facility for stabilization to reduce the mobility of lead, and subsequently disposing of stabilized soil at a Subtitle D landfill; and
- Backfilling the excavation areas with clean imported fill.

5.3 ELEMENTS OF CLEANUP ACTION

This section describes the cleanup action elements to be completed for each major component of the cleanup action. Appendix B includes Engineering Drawings prepared by a licensed Farallon Engineer. The Engineering Drawings detail excavation areas, Site preparation and erosion-control notes, and excavation and demolition plan notes. Appendix C contains a report of hazardous building materials included in the EnCo (2011) survey. Appendix D contains a City of Tacoma Planning and Development Services building permit for clearing and grading at the Site, and permit application materials.

5.3.1 Permitting and Property Preparation

The selected cleanup action includes obtaining permitting for the demolition of the Site building and disposal of hazardous building materials, as necessary. Proper disposal of hazardous building materials, including asbestos-containing materials and lead-based paint on some surfaces tested by Pacific Rim Environmental and described by EnCo (2011), will be required as part of the building demolition. The Limited Lead-Based Paint Testing and Hazardous Building Materials Survey documents are included in Appendix C.

The Site property boundaries will be surveyed and staked by a Washington-State licensed Land Surveyor, underground utilities will be located and marked, and existing concrete and asphalt floor paving will be removed in the excavation areas and disposed of or recycled off the Site. Erosion-control measures, Site security, and traffic control will be implemented to meet Pierce County and City of Tacoma requirements.

The cleanup action will be performed in compliance with all local, state, and federal laws, rules, and regulations, including any and all permits and notices required. A City of Tacoma permit for clearing and grading has been obtained and is included in Appendix D. A qualified contractor for building demolition, excavation and disposal of contaminated soil, dewatering, and Site restoration will be selected for the work. Any additional permits and authorizations will be the responsibility of the contractor.

5.3.2 Excavation

Field observations and the analytical results from in-situ soil sampling documented by EnCo (2011) and in the RI/FFS Report have been used to define the expected distribution of contaminated soil requiring excavation, treatment, and off-Site disposal. The assumptions for the selected cleanup action are based on the results from the RI/FFS and include the following:

- The lateral extent of soil with concentrations of lead exceeding the cleanup level corresponds approximately to the areas and depths shown on Figure 4, and Sheet 4 of 5 of the Engineering Drawings (Appendix B) as Areas A, A1, A2, B, and C, and totals approximately 220 cubic yards or 350 tons.
- Contaminated soil in Areas A, B, and C (Figure 4) will be excavated to a depth of 2 feet bgs. Final limits of the excavations will be based on the results from the confirmational soil sampling.
- Excavation areas A1 and A2 will be advanced to a depth of 2 feet below the groundwater table, which is expected to be encountered at an approximate depth of between 6 and 7 feet bgs.
- Confirmation soil samples will be collected by Farallon to confirm that cleanup levels have been attained in the excavation. A detail description for compliance soil sampling is included in the Compliance Monitoring and Sampling and Analysis Plan (CMSAP) included in Appendix E.
- Excavations will be secured and left open until analytical results for confirmation soil samples confirm that soil exceeding the cleanup level has been removed. Farallon

expects that the laboratory confirmation results will be received within 1 to 2 days of soil sample submittals.

- There is sufficient area on the Site for materials management, including soil stockpiling and truck loading and off-loading activities. Therefore, obtaining permission from adjacent property owners for truck and equipment access to the Site will not be necessary.
- Excavated soil will be transported and managed in accordance with all applicable requirements, including MTCA, Washington State Solid Waste Handling Standards (WAC 173-350), and Washington State Dangerous Waste Regulations (WAC 173-303).
- Stabilization will be conducted by a permitted off-Site facility of the contractor's choice such as the Chemical Waste Management of the Northwest facility in Arlington, Oregon. Following stabilization, the soil will be transported for disposal at a Subtitle D landfill of the contractor's choice such as the Waste Management, Inc. Columbia Ridge Landfill and Recycling Center Subtitle D landfill facility in Arlington, Oregon. Successful stabilization at an off-Site facility will be measured by a reduction in the mobility of lead such that samples of treated soil meet the toxicity characteristic leaching procedure standard of 5 milligrams per liter for lead.
- Dewatering of the two deeper excavations in Areas A1 and A2 will occur to facilitate soil excavation, if necessary. The dewatering will be accomplished by using a tanker truck with a suction pump. Farallon estimates that up to 4,000 gallons of water will be extracted from the two areas and directly transported to a permitted off-Site facility for potential treatment and for disposal.

5.3.3 Temporary Storage of Contaminated Soil

Excavated soil may be temporarily stockpiled and stored on the Site pending transport and disposal at an approved treatment and disposal facility. Stockpiled soil will be placed on plastic sheeting and/or a physical barrier. If stockpiled soil is left overnight or in the event of inclement weather, the stockpile will be covered with plastic sheeting until the soil has been loaded into trucks and/or containers.

5.3.4 Site Restoration

Site restoration will consist of backfilling the excavations with clean imported backfill materials consisting of:

- Self-compacting aggregate material (e.g., pea gravel) in the deep excavations at Areas A1 and A2; and
- A well-graded granular soil material suitable for standard construction use above the water table in Areas A, B, and C, compacted in lifts to meet acceptable compaction standards.

5.3.5 Compliance Monitoring

Compliance monitoring, described in the CMSAP (Appendix E), will be performed in accordance with WAC 173-340-140 and will include the following:

- Protection monitoring to ensure that human health and the environment are protected during the construction phase of the cleanup action;
- Performance monitoring during the cleanup action to confirm that the cleanup action has attained cleanup standards; and
- Confirmational monitoring to confirm that cleanup standards have been attained.

5.3.5.1 Protection Monitoring and Health and Safety

Protection monitoring will be performed during the construction phase of the cleanup action. A Site-specific Health and Safety Plan (HASP) that includes protection monitoring and measures to minimize potential short-term exposure during cleanup activities has been prepared to protect Farallon field personnel during cleanup activities. The HASP for Farallon field personnel is included in Attachment A of the CMSAP (Appendix E). A HASP is required for all field personnel and all activities that involve potential exposure to hazardous materials (WAC 173-340-820). The HASP complies with the requirements of the Occupational Safety and Health Act of 1970 and the Washington Industrial Safety and Health Act (RCW 49.17). Although a HASP is required, Ecology approval of the plan is not necessary.

Employees of the contractor performing excavation of potentially contaminated soil will be 40-hour health and safety-trained as hazardous waste operators in accordance with 29 CFR 1910.120. The contractor will prepare a separate HASP pertaining to his/her workers.

5.3.5.2 Performance Monitoring

Performance monitoring provides soil analytical results to refine, classify, and/or identify the presence of lead in an excavation area. Farallon will conduct performance monitoring by screening discrete excavation sidewall and floor soil samples using a hand-held X-ray florescence analyzer, a portable monitoring device capable of quantifying concentrations of lead in soil samples. Performance monitoring results help determine whether lead remains in the subsurface at concentrations exceeding the applicable cleanup level as excavation progresses. Once performance monitoring results indicate that excavation has removed soil with lead exceeding the cleanup level, confirmation samples will be collected.

5.3.5.3 Confirmation Monitoring

Confirmation monitoring for soil will be conducted once performance monitoring results indicate that the cleanup standards have been attained at the limits of the excavations. Confirmation monitoring will consist of collecting discrete in-situ soil samples from the base and sidewalls at the final limits of the completed excavation areas. If confirmation monitoring indicates that lead remains in the subsurface at concentrations exceeding the cleanup level, additional excavation will be conducted, guided by the results from additional performance monitoring. Once confirmation monitoring laboratory analytical results confirm that lead concentrations in soil are less than the cleanup level, the excavations will be backfilled with imported material.

5.4 DOCUMENTATION REQUIREMENTS

Following completion of the excavation, a Closure Report will be prepared to document that the cleanup action has met the requirements for an NFA determination for the Site, and submitted to Ecology. The Closure Report will include a summary of the results from the cleanup action completed at the Site, and will provide the technical basis supporting a request for an NFA determination for the Site from Ecology. The Closure Report will include the following elements:

- A summary of the characterization and remediation completed at the Site;
- Transport and disposal manifests for soil transported, treated, and disposed of off the Site;
- Plan maps and summary tables documenting confirmation sampling results;
- Conclusions regarding the effectiveness of the cleanup; and
- A request for an NFA determination for the Site from Ecology under the VCP.

6.0 IMPLEMENTATION SCHEDULE

The cleanup action will be conducted and completed during the second or third quarter of 2014. The cleanup action is expected to require less than 1 month to complete.

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8.0 LIMITATIONS

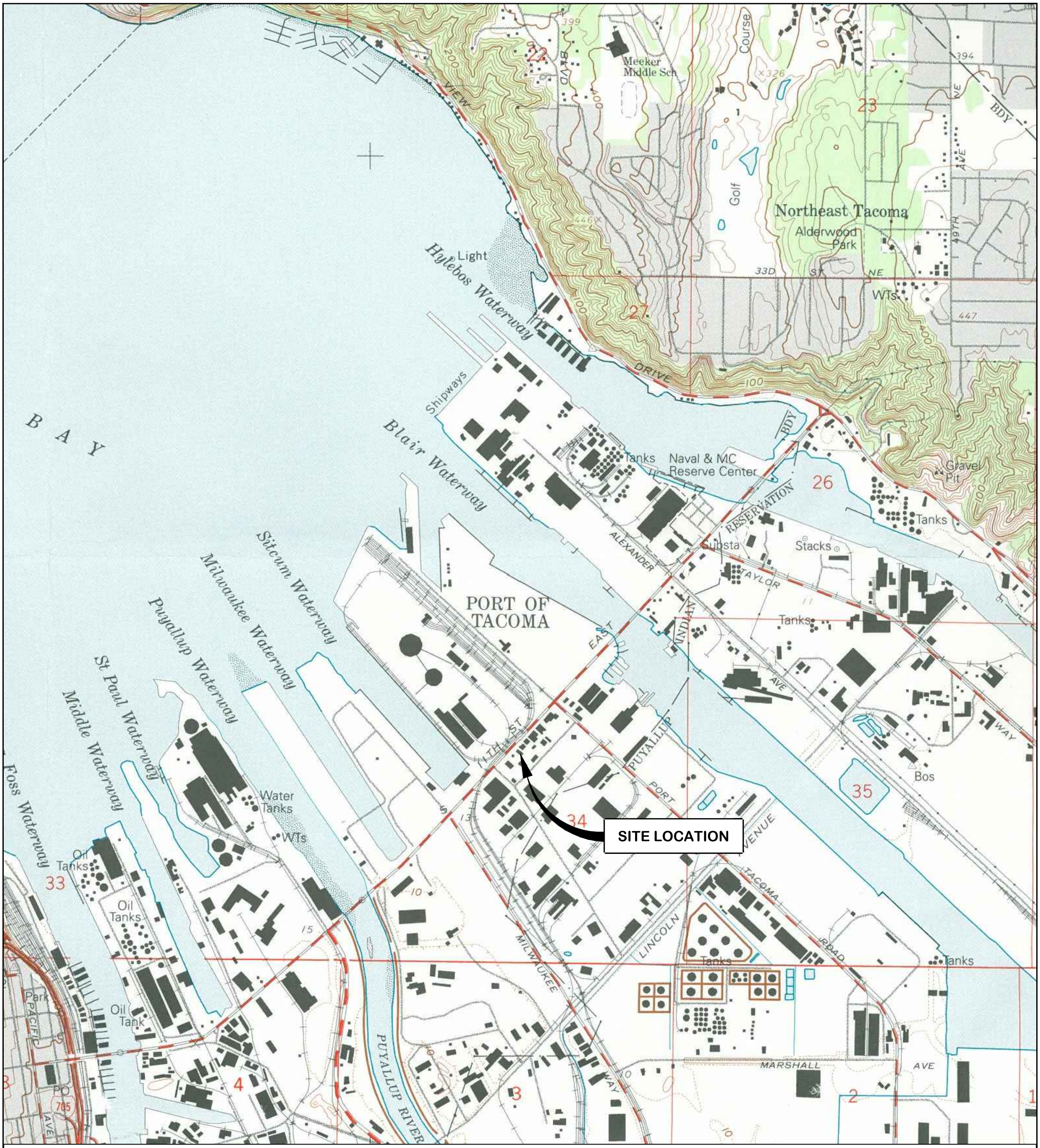
The conclusions and recommendations contained in this report/assessment are based on professional opinions with regard to the subject matter. These opinions have been arrived at in accordance with currently accepted hydrogeologic and engineering standards and practices applicable to this location and are subject to the following inherent limitations:

- **Accuracy of Information.** Certain information used by Farallon in this report/assessment has been obtained, reviewed, and evaluated from various sources believed to be reliable. Although Farallon's conclusions, opinions, and recommendations are based in part on such information, Farallon's services did not include verification of its accuracy or authenticity. Should such information prove to be inaccurate or unreliable, Farallon reserves the right to amend or revise its conclusions, opinions, and/or recommendations.
- **Reconnaissance**. Farallon performed a reconnaissance of the Site that is the subject of this report/assessment to document current conditions. Farallon focused on areas deemed more likely to exhibit hazardous materials conditions, while other areas received limited attention or were inaccessible at the time of the reconnaissance.

FIGURES

CLEANUP ACTION PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001



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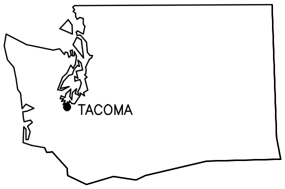


WASHINGTON

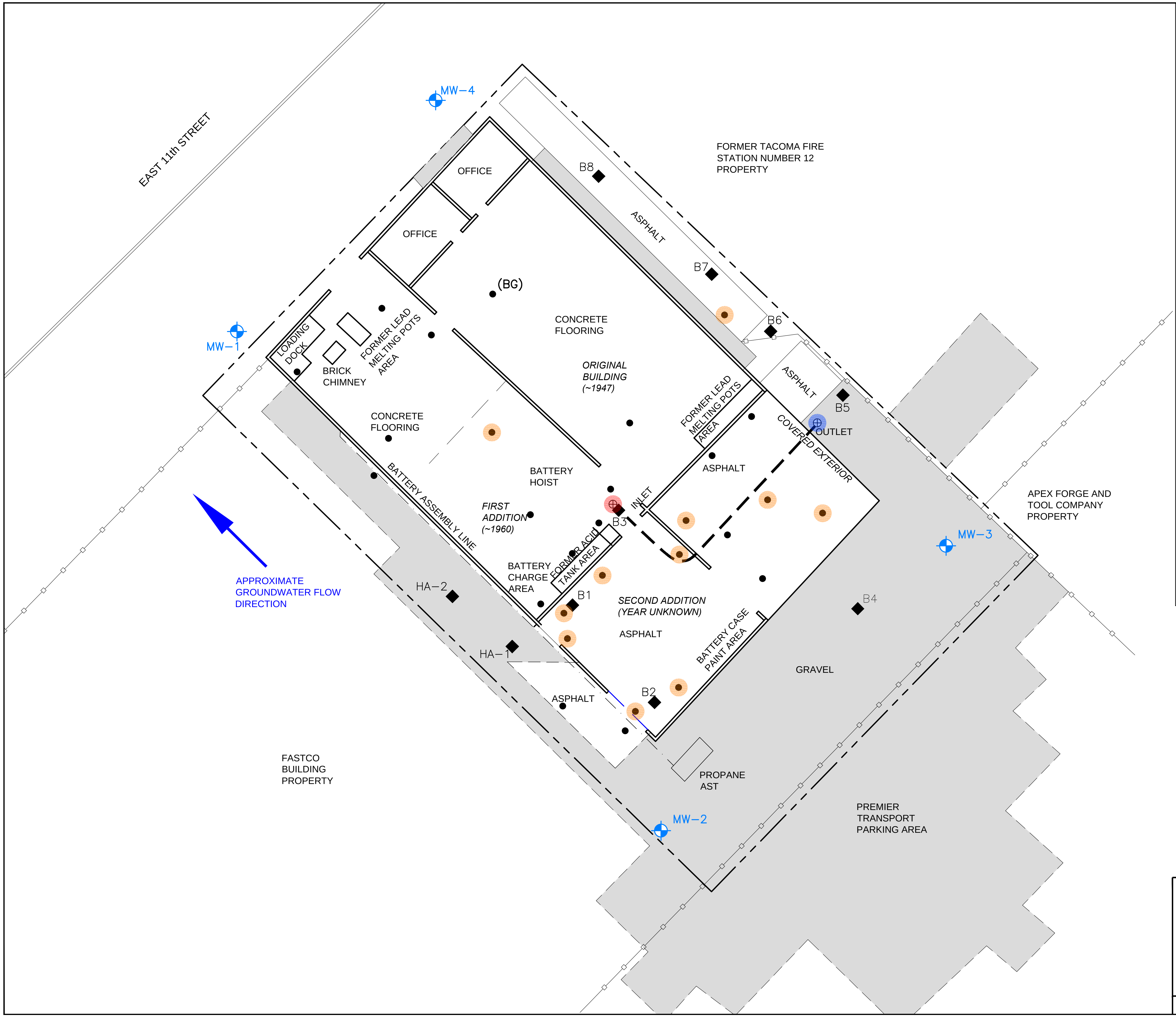
FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

FIGURE 1

SITE VICINITY MAP
SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

FARALLON PN:1117-001

Drawn By: DEW	Checked By: TC	Date: 10/22/12	Disk Reference: 1117001

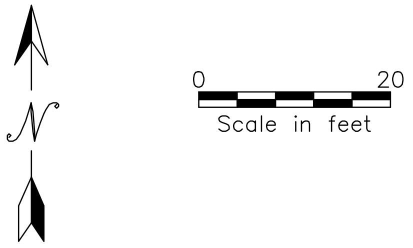


LEGEND

●	JULY 2011 SOIL SAMPLING LOCATION (ENCO CORPORATION, SEPTEMBER 2011) BG = BACKGROUND SAMPLING LOCATION
⊕	JULY 2011 RECONNAISSANCE GROUNDWATER SAMPLING LOCATION (ENCO CORPORATION, SEPTEMBER 2011)
MW−4 ⊕	SHALLOW MONITORING WELL (GEOSYSTEMS ANALYTICS, INC. OCTOBER, 1998) REDEVELOPED AND RESAMPLED FOR CURRENT INVESTIGATION BY FARALLON
B7 ◆	SHALLOW SOIL SAMPLING LOCATIONS (FARALLON 2012)
—□—□—	FENCE
— — —	CONCRETE-FILLED FLOOR DRAIN
▨	APPROXIMATE EXTENT OF 2002 SHALLOW SOIL EXCAVATION (GEOSYSTEMS ANALYTICS, INC. APRIL, 2002)
🟠	AREA SAMPLED IN JULY 2011 WHERE LEAD DETECTED GREATER THAN MTCA METHOD A SOIL CLEANUP LEVEL FOR INDUSTRIAL LAND USE (1,000 mg/kg) IN SOIL SHALLOWER THAN TWO FEET BGS (ENCO CORPORATION SEPTEMBER 2011)
🔴	AREA SAMPLED IN JULY 2011 WHERE LEAD DETECTED GREATER THAN MTCA METHOD A SOIL CLEANUP LEVEL FOR INDUSTRIAL LAND USE (1,000 mg/kg) IN SOIL GREATER TWO FEET BGS OR DEEPER (ENCO CORPORATION SEPTEMBER 2011)
🔵	AREA SAMPLED IN JULY 2011WHERE DISSOLVED LEAD DETECTED IN RECONNAISSANCE GROUNDWATER SAMPLE GREATER THAN MTCA METHOD A CRITERION (15 ug/L) (ENCO CORPORATION SEPTEMBER 2011)

MILLIGRAMS PER KILOGRAM (mg/kg)
MICROGRAMS PER LITER (ug/L)
BELOW GROUND SURFACE (BGS)

ALL LOCATIONS ARE APPROXIMATE



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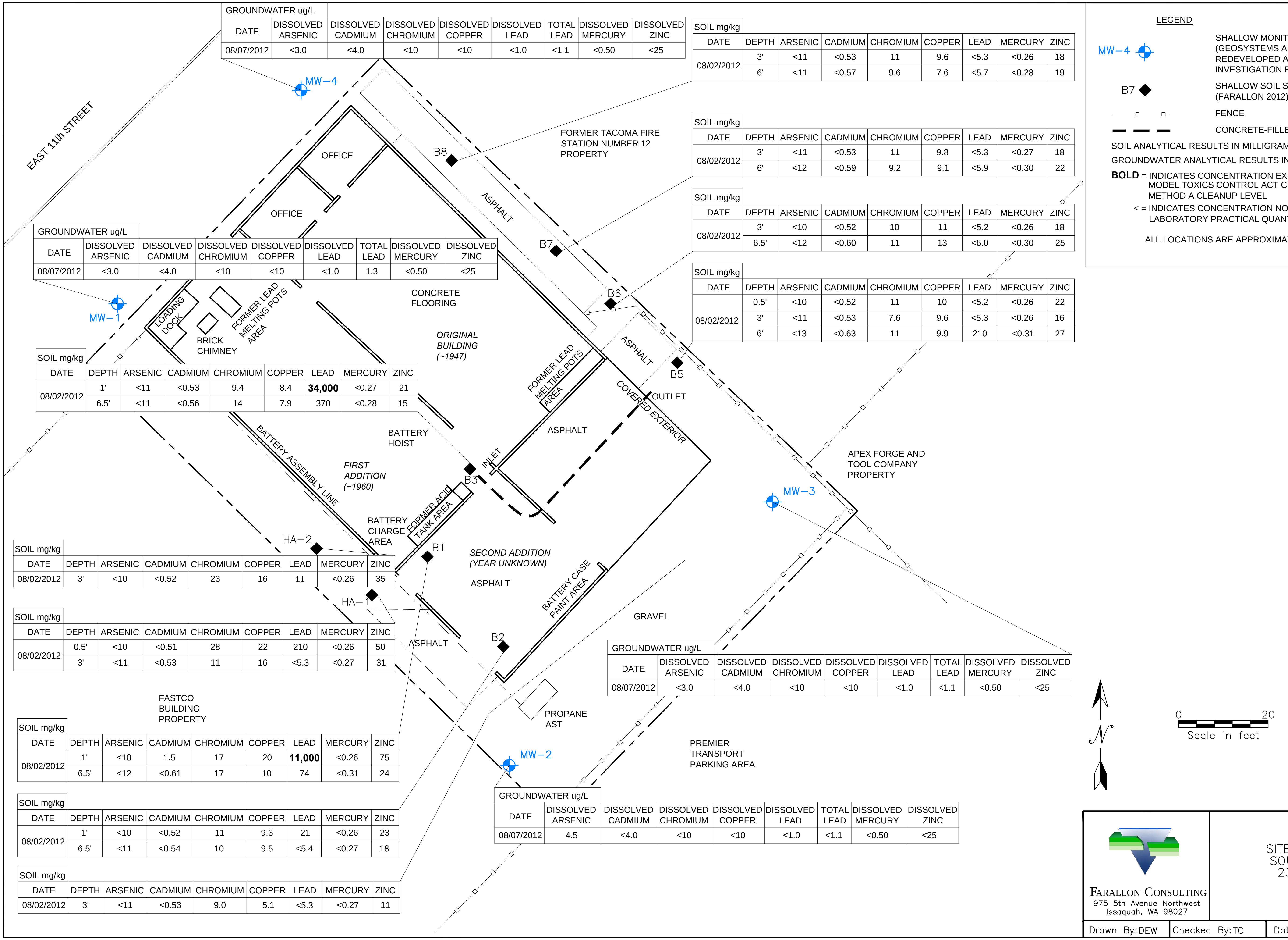
975 5th Avenue Northwest
Issaquah, WA 98027

FIGURE 2

SITE PLAN
SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

FARALLON PN:1117−001

Drawn By:DEW	Checked By:TC	Date8/7/13	Disk Reference:1117001



GROUNDWATER ug/L

DATE	DISSOLVED ARSENIC	DISSOLVED CADMIUM	DISSOLVED CHROMIUM	DISSOLVED COPPER	DISSOLVED LEAD	TOTAL LEAD	DISSOLVED MERCURY	DISSOLVED ZINC
08/07/2012	<3.0	<4.0	<10	<10	<1.0	<1.1	<0.50	<25

SOIL mg/kg

DATE	DEPTH	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	ZINC
08/02/2012	3'	<11	<0.53	11	9.6	<5.3	<0.26	18
	6'	<11	<0.57	9.6	7.6	<5.7	<0.28	19

SOIL mg/kg

DATE	DEPTH	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	ZINC
08/02/2012	3'	<11	<0.53	11	9.8	<5.3	<0.27	18
	6'	<12	<0.59	9.2	9.1	<5.9	<0.30	22

SOIL mg/kg

DATE	DEPTH	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	ZINC
08/02/2012	3'	<10	<0.52	10	11	<5.2	<0.26	18
	6.5'	<12	<0.60	11	13	<6.0	<0.30	25

SOIL mg/kg

DATE	DEPTH	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	ZINC
08/02/2012	0.5'	<10	<0.52	11	10	<5.2	<0.26	22
	3'	<11	<0.53	7.6	9.6	<5.3	<0.26	16
	6'	<13	<0.63	11	9.9	210	<0.31	27

GROUNDWATER ug/L

DATE	DISSOLVED ARSENIC	DISSOLVED CADMIUM	DISSOLVED CHROMIUM	DISSOLVED COPPER	DISSOLVED LEAD	TOTAL LEAD	DISSOLVED MERCURY	DISSOLVED ZINC
08/07/2012	<3.0	<4.0	<10	<10	<1.0	1.3	<0.50	<25

SOIL mg/kg

DATE	DEPTH	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	ZINC
08/02/2012	1'	<11	<0.53	9.4	8.4	**34,000**	<0.27	21
	6.5'	<11	<0.56	14	7.9	370	<0.28	15

SOIL mg/kg

DATE	DEPTH	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	ZINC
08/02/2012	3'	<10	<0.52	23	16	11	<0.26	35

SOIL mg/kg

DATE	DEPTH	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	ZINC
08/02/2012	0.5'	<10	<0.51	28	22	210	<0.26	50
	3'	<11	<0.53	11	16	<5.3	<0.27	31

GROUNDWATER ug/L

DATE	DISSOLVED ARSENIC	DISSOLVED CADMIUM	DISSOLVED CHROMIUM	DISSOLVED COPPER	DISSOLVED LEAD	TOTAL LEAD	DISSOLVED MERCURY	DISSOLVED ZINC
08/07/2012	<3.0	<4.0	<10	<10	<1.0	<1.1	<0.50	<25

SOIL mg/kg

DATE	DEPTH	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	ZINC
08/02/2012	1'	<10	1.5	17	20	**11,000**	<0.26	75
	6.5'	<12	<0.61	17	10	74	<0.31	24

SOIL mg/kg

DATE	DEPTH	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	ZINC
08/02/2012	1'	<10	<0.52	11	9.3	21	<0.26	23
	6.5'	<11	<0.54	10	9.5	<5.4	<0.27	18

SOIL mg/kg

DATE	DEPTH	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	ZINC
08/02/2012	3'	<11	<0.53	9.0	5.1	<5.3	<0.27	11

GROUNDWATER ug/L

DATE	DISSOLVED ARSENIC	DISSOLVED CADMIUM	DISSOLVED CHROMIUM	DISSOLVED COPPER	DISSOLVED LEAD	TOTAL LEAD	DISSOLVED MERCURY	DISSOLVED ZINC
08/07/2012	4.5	<4.0	<10	<10	<1.0	<1.1	<0.50	<25

LEGEND

MW−4 ⊕	SHALLOW MONITORING WELL (GEOSYSTEMS ANALYTICS, INC. OCTOBER, 1998) REDEVELOPED AND RESAMPLED FOR CURRENT INVESTIGATION BY FARALLON
B7 ◆	SHALLOW SOIL SAMPLING LOCATIONS (FARALLON 2012)
—◇—◇—	FENCE
▬ ▬ ▬	CONCRETE-FILLED FLOOR DRAIN

SOIL ANALYTICAL RESULTS IN MILLIGRAMS PER KILOGRAM (mg/kg)

GROUNDWATER ANALYTICAL RESULTS IN MICROGRAMS PER LITER (ug/L)

BOLD = INDICATES CONCENTRATION EXCEEDS WASHINGTON STATE MODEL TOXICS CONTROL ACT CLEANUP REGULATION METHOD A CLEANUP LEVEL

< = INDICATES CONCENTRATION NOT DETECTED AT OR ABOVE THE STATED LABORATORY PRACTICAL QUANTITATION LIMIT

ALL LOCATIONS ARE APPROXIMATE

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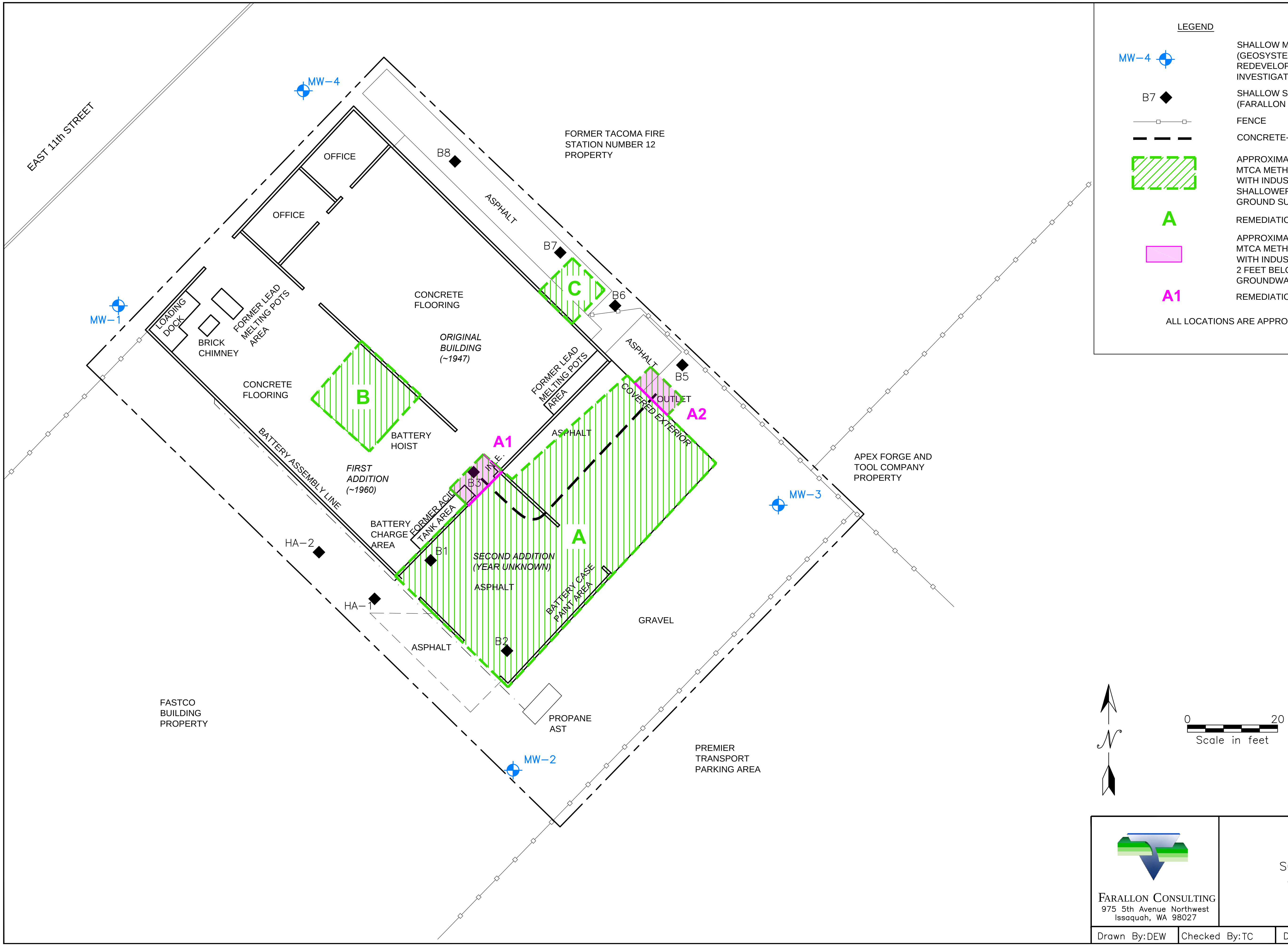
Issaquah, WA 98027

FIGURE 3

SITE INVESTIGATION RESULTS
SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

FARALLON PN:1117−001

Drawn By:DEW | Checked By:TC | Date:7/24/13 | Disk Reference:1117001



LEGEND

MW–4 ⌖	SHALLOW MONITORING WELL (GEOSYSTEMS ANALYTICS, INC. OCTOBER, 1998) REDEVELOPED AND RESAMPLED FOR CURRENT INVESTIGATION BY FARALLON
B7 ◆	SHALLOW SOIL SAMPLING LOCATIONS (FARALLON 2012)
—□—□—	FENCE
— — —	CONCRETE-FILLED FLOOR DRAIN
▨	APPROXIMATE EXTENT OF SOIL EXCEEDING THE MTCA METHOD A SOIL CLEANUP LEVEL FOR LEAD WITH INDUSTRIAL LAND USE (1,000 MG/KG) SHALLOWER THAN 2 FEET BELOW GROUND SURFACE
A	REMEDIATION AREA
🟪	APPROXIMATE EXTENT OF SOIL EXCEEDING THE MTCA METHOD A SOIL CLEANUP LEVEL FOR LEAD WITH INDUSTRIAL LAND USE (1,000 MG/KG) BETWEEN 2 FEET BELOW GROUND SURFACE AND DEPTH TO GROUNDWATER
A1	REMEDIATION SUB-AREA

ALL LOCATIONS ARE APPROXIMATE

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Issaquah, WA 98027

FIGURE 4

REMEDIATION AREAS
SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

FARALLON PN:1117–001

Drawn By:DEW
Checked By:TC
Date:6/26/13
Disk Reference:1117001

TABLES

CLEANUP ACTION PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

Table 1
Summary of Soil Analytical Results
Sound Battery Property
2310 East 11th Street
Tacoma, Washington
Farallon PN: 1117-001

Sample Location	Sample Identification	Sample Date	Sample Depth (feet below ground surface)	Analytical Results (milligrams per kilogram, except as noted)[6]							
				Arsenic	**Cadmium**	**Chromium**	**Copper**	**Lead**	**TCLP Lead (milligrams per liter)**	**Mercury**	**Zinc**
B-1	B1-1.0	08/02/2012	1	< 10	1.5	17	20	**11,000**	**470**	< 0.26	75
	B1-6.5	08/02/2012	6.5	< 12	< 0.61	17	10	74	2.9	< 0.31	24
B-2	B2-1.0	08/02/2012	1	< 10	< 0.52	11	9.3	21	-	< 0.26	23
	B2-6.5	08/02/2012	6.5	< 11	< 0.54	10	9.5	< 5.4	< 0.20	< 0.27	18
B-3	B3-1.0	08/02/2012	1	< 11	< 0.53	9.4	8.4	**34,000**	**230**	< 0.27	21
	B3-6.5	08/02/2012	6.5	< 11	< 0.56	14	7.9	370	< 0.20	< 0.28	15
B-4	B4-3.0	08/02/2012	3	< 11	< 0.53	9.0	5.1	< 5.3	-	< 0.27	11
B-5	B5-0.5	08/02/2012	0.5	< 10	< 0.52	11	10	< 5.2	-	< 0.26	22
	B5-3.0	08/02/2012	3	< 11	< 0.53	7.6	9.6	< 5.3	-	< 0.26	16
	B5-6.0	08/02/2012	6	< 13	< 0.63	11	9.9	210	-	< 0.31	27
B-6	B6-3.0	08/02/2012	3	< 10	< 0.52	10	11	< 5.2	-	< 0.26	18
	B6-6.5	08/02/2012	6.5	< 12	< 0.60	11	13	< 6.0	-	< 0.30	25
B-7	B7-3.0	08/02/2012	3	< 11	< 0.53	11	9.8	< 5.3	-	< 0.27	18
	B7-6.0	08/02/2012	6	< 12	< 0.59	9.2	9.1	< 5.9	-	< 0.30	22
B-8	B8-3.0	08/02/2012	3	< 11	< 0.53	11	9.6	< 5.3	-	< 0.26	18
	B8-6.0	08/02/2012	6	< 11	< 0.57	9.6	7.6	< 5.7	-	< 0.28	19
HA-1	HA-1-0.5	08/02/2012	0.5	< 10	< 0.51	28	22	210	-	< 0.26	50
	HA-1-3.0	08/02/2012	3	< 11	< 0.53	11	16	< 5.3	-	< 0.27	31
HA-2	HA-2-3.0	08/02/2012	3	< 10	< 0.52	23	16	11	-	< 0.26	35
MTCA Method A Cleanup Levels for Soil[1]				**20**	**2**	**2000[2]**	**3,200[3]**	**1,000**	**5[4]**	**2**	**24,000[5]**

NOTES:

Results in **bold** denote that sample results exceed applicable screening level

< denotes analyte not detected at or exceeding the reporting limit listed.

[1] Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A Soil Cleanup Levels for Industrial Land Uses, Table 745-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised November 2007.

[2] Value provided is for Chromium III. The MTCA Method A soil cleanup level for Chromium VI is 19 milligrams per kilogram.

[3] No MTCA Method A soil cleanup level available. The most stringent cleanup level available in CLARC is 3,200 micrograms per kilogram using MTCA Method B cleanup level for soil (standard formula value for direct contact--ingestion).

[4] MTCA Method A soil cleanup level not applicable. Value indicated is the maximum concentration of contaminants for the toxicity characteristic triggering dangerous waste classification number D008 for lead per Washington State Dangerous Waste Regulation Section 090(8) of Chapter 173-303 of the Washington Administrative Code, as revised January 2005.

[5] No MTCA Method A soil cleanup level available. The most stringent cleanup level available in CLARC is 24,000 micrograms per kilogram using MTCA Method B cleanup level for soil (standard formula value for direct contact--ingestion).

[6] Analyzed by U.S. Environmental Protection Agency Methods 6010B/7471A except for TCLP lead, which was analyzed using U.S. Environmental Protection Agency Method 1311/6010B.

CLARC = Washington State Department of Ecology Cleanup Levels and Risk Calculations Database (https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx) queried 8/24/2012.

TCLP = Toxicity Characteristic Leaching Procedure, Test Method 1311 in U.S. Environmental Protection Agency Publication SW-846.

Table 2
Summary of Groundwater Analytical Results
Sound Battery Property
2310 East 11th Street
Tacoma, Washington
Farallon PN: 1117-001

Sample Location	Sample Identification	Sample Date	Analytical Results (micrograms per liter)[4] Dissolved Arsenic	Dissolved Cadmium	Dissolved Chromium	Dissolved Copper	Dissolved Lead	Total Lead	Dissolved Mercury	Dissolved Zinc
MW-1	MW-1-080712	08/07/2012	< 3.0	< 4.0	< 10	< 10	< 1.0	1.3	< 0.50	< 25
MW-2	MW-2-080712	08/07/2012	4.5	< 4.0	< 10	< 10	< 1.0	< 1.1	< 0.50	< 25
MW-3	MW-3-080712	08/07/2012	< 3.0	< 4.0	< 10	< 10	< 1.0	< 1.1	< 0.50	< 25
MW-4	MW-4-080712	08/07/2012	< 3.0	< 4.0	< 10	< 10	< 1.0	< 1.1	< 0.50	< 25
MTCA Method A Cleanup Levels for Groundwater[1]			**5**	**5**	**50**	**640[2]**	**15**	**15**	**2**	**4,800[3]**

NOTES:

Results in **bold** denote that sample results exceed applicable screening level

< denotes analyte not detected at or exceeding the reporting limit listed.

[1] Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A Groundwater Cleanup Levels, Table 720-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised November 2007.

[2] No MTCA Method A groundwater cleanup level available. The most stringent cleanup level available in CLARC is 640 micrograms per liter using MTCA Method B cleanup level for groundwater.

[3] No MTCA Method A groundwater cleanup level available. The most stringent cleanup level available in CLARC is 4,800 micrograms per liter using MTCA Method B cleanup level for groundwater.

[4] Analyzed by U.S. Environmental Protection Agency Methods 200.8/7470A

CLARC = Washington State Department of Ecology Cleanup Levels and Risk Calculations Database (https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx) queried 8/24/2012.

Dissolved = Field filtered with 0.45-micron filter

APPENDIX A
TERRESTRIAL ECOLOGICAL EVALUATION FORM

CLEANUP ACTION PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

DEPARTMENT OF
ECOLOGY
State of Washington

Voluntary Cleanup Program

Washington State Department of Ecology
Toxics Cleanup Program

TERRESTRIAL ECOLOGICAL EVALUATION FORM

Under the Model Toxics Control Act (MTCA), a terrestrial ecological evaluation is necessary if hazardous substances are released into the soils at a Site. In the event of such a release, you must take one of the following three actions as part of your investigation and cleanup of the Site:

1. Document an exclusion from further evaluation using the criteria in WAC 173-340-7491.
2. Conduct a simplified evaluation as set forth in WAC 173-340-7492.
3. Conduct a site-specific evaluation as set forth in WAC 173-340-7493.

When requesting a written opinion under the Voluntary Cleanup Program (VCP), you must complete this form and submit it to the Department of Ecology (Ecology). The form documents the type and results of your evaluation.

Completion of this form is not sufficient to document your evaluation. You still need to document your analysis and the basis for your conclusion in your cleanup plan or report.

If you have questions about how to conduct a terrestrial ecological evaluation, please contact the Ecology site manager assigned to your Site. For additional guidance, please refer to www.ecy.wa.gov/programs/tcp/policies/terrestrial/TEEHome.htm.

Step 1: IDENTIFY HAZARDOUS WASTE SITE

Please identify below the hazardous waste site for which you are documenting an evaluation.

Facility/Site Name: Sound Battery Property

Facility/Site Address: 2310 East 11th Street, Tacoma, Washington

Facility/Site No: 1247

VCP Project No.: SW1208

Step 2: IDENTIFY EVALUATOR

Please identify below the person who conducted the evaluation and their contact information.

Name: Branislav Jurista

Title: Senior Geologist

Organization: Farallon Consulting, LLC

Mailing address: 975 5th Avenue Northwest

City: Issaquah

State: WA

Zip code: 98027

Phone: (425) 295-0800

Fax: (425) 295-0850

E-mail: bjurista@farallonconsulting.com

Step 3: DOCUMENT EVALUATION TYPE AND RESULTS

A. Exclusion from further evaluation.

1. Does the Site qualify for an exclusion from further evaluation?

☒ Yes — *If you answered **"YES,"** then answer **Question 2**.*

☐ No or Unknown — *If you answered **"NO" or "UKNOWN,"** then skip to **Step 3B** of this form.*

2. What is the basis for the exclusion? *Check all that apply. Then skip to **Step 4** of this form.*

Point of Compliance: WAC 173-340-7491(1)(a)

☐ All soil contamination is, or will be,* at least 15 feet below the surface.

☐ All soil contamination is, or will be,* at least 6 feet below the surface (or alternative depth if approved by Ecology), and institutional controls are used to manage remaining contamination.

Barriers to Exposure: WAC 173-340-7491(1)(b)

☐ All contaminated soil, is or will be,* covered by physical barriers (such as buildings or paved roads) that prevent exposure to plants and wildlife, and institutional controls are used to manage remaining contamination.

Undeveloped Land: WAC 173-340-7491(1)(c)

☒ There is less than 0.25 acres of contiguous# undeveloped± land on or within 500 feet of any area of the Site and any of the following chemicals is present: chlorinated dioxins or furans, PCB mixtures, DDT, DDE, DDD, aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor, heptachlor epoxide, benzene hexachloride, toxaphene, hexachlorobenzene, pentachlorophenol, or pentachlorobenzene.

☐ For sites not containing any of the chemicals mentioned above, there is less than 1.5 acres of contiguous# undeveloped± land on or within 500 feet of any area of the Site.

Background Concentrations: WAC 173-340-7491(1)(d)

☐ Concentrations of hazardous substances in soil do not exceed natural background levels as described in WAC 173-340-200 and 173-340-709.

* An exclusion based on future land use must have a completion date for future development that is acceptable to Ecology.

± "Undeveloped land" is land that is not covered by building, roads, paved areas, or other barriers that would prevent wildlife from feeding on plants, earthworms, insects, or other food in or on the soil.

"Contiguous" undeveloped land is an area of undeveloped land that is not divided into smaller areas of highways, extensive paving, or similar structures that are likely to reduce the potential use of the overall area by wildlife.

B. Simplified evaluation.

1. Does the Site qualify for a simplified evaluation?

☐ Yes *If you answered **"YES,"** then answer **Question 2** below.*

☐ No or Unknown *If you answered **"NO"** or **"UNKNOWN,"** then skip to **Step 3C** of this form.*

2. Did you conduct a simplified evaluation?

☐ Yes *If you answered **"YES,"** then answer **Question 3** below.*

☐ No *If you answered **"NO,"** then skip to **Step 3C** of this form.*

3. Was further evaluation necessary?

☐ Yes *If you answered **"YES,"** then answer **Question 4** below.*

☐ No *If you answered **"NO,"** then answer **Question 5** below.*

4. If further evaluation was necessary, what did you do?

☐ Used the concentrations listed in Table 749-2 as cleanup levels. *If so, then skip to **Step 4** of this form.*

☐ Conducted a site-specific evaluation. *If so, then skip to **Step 3C** of this form.*

5. If no further evaluation was necessary, what was the reason? *Check all that apply. Then skip to **Step 4** of this form.*

Exposure Analysis: WAC 173-340-7492(2)(a)

☐ Area of soil contamination at the Site is not more than 350 square feet.

☐ Current or planned land use makes wildlife exposure unlikely. Used Table 749-1.

Pathway Analysis: WAC 173-340-7492(2)(b)

☐ No potential exposure pathways from soil contamination to ecological receptors.

Contaminant Analysis: WAC 173-340-7492(2)(c)

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 15 feet at concentrations that exceed the values listed in Table 749-2.

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 6 feet (or alternative depth if approved by Ecology) at concentrations that exceed the values listed in Table 749-2, and institutional controls are used to manage remaining contamination.

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 15 feet at concentrations likely to be toxic or have the potential to bioaccumulate as determined using Ecology-approved bioassays.

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 6 feet (or alternative depth if approved by Ecology) at concentrations likely to be toxic or have the potential to bioaccumulate as determined using Ecology-approved bioassays, and institutional controls are used to manage remaining contamination.

C. Site-specific evaluation. A site-specific evaluation process consists of two parts: (1) formulating the problem, and (2) selecting the methods for addressing the identified problem. Both steps require consultation with and approval by Ecology. *See* WAC 173-340-7493(1)(c).

1. Was there a problem? *See* WAC 173-340-7493(2).

☐ Yes *If you answered **"YES,"** then answer **Question 2** below.*

☐ No *If you answered **"NO,"** then identify the reason here and then skip to **Question 5** below:*

☐ No issues were identified during the problem formulation step.

☐ While issues were identified, those issues were addressed by the cleanup actions for protecting human health.

2. What did you do to resolve the problem? *See* WAC 173-340-7493(3).

☐ Used the concentrations listed in Table 749-3 as cleanup levels. *If so, then skip to **Question 5** below.*

☐ Used one or more of the methods listed in WAC 173-340-7493(3) to evaluate and address the identified problem. *If so, then answer **Questions 3 and 4** below.*

3. If you conducted further site-specific evaluations, what methods did you use? *Check all that apply. See* WAC 173-340-7493(3).

☐ Literature surveys.

☐ Soil bioassays.

☐ Wildlife exposure model.

☐ Biomarkers.

☐ Site-specific field studies.

☐ Weight of evidence.

☐ Other methods approved by Ecology. If so, please specify:

4. What was the result of those evaluations?

☐ Confirmed there was no problem.

☐ Confirmed there was a problem and established site-specific cleanup levels.

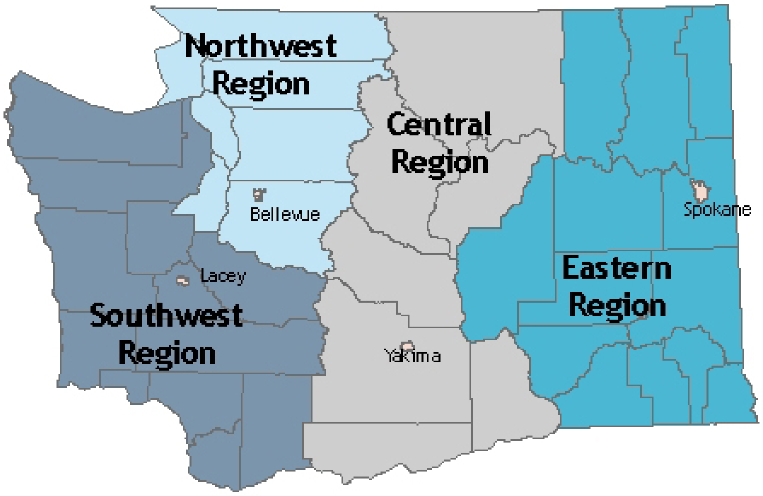
5. Have you already obtained Ecology's approval of both your problem formulation and problem resolution steps?

☐ Yes If so, please identify the Ecology staff who approved those steps:

☐ No

Step 4: SUBMITTAL

Please mail your completed form to the Ecology site manager assigned to your Site. If a site manager has not yet been assigned, please mail your completed form to the Ecology regional office for the County in which your Site is located.



Northwest Region: Attn: VCP Coordinator 3190 160th Ave. SE Bellevue, WA 98008-5452	**Central Region:** Attn: VCP Coordinator 15 W. Yakima Ave., Suite 200 Yakima, WA 98902
Southwest Region: Attn: VCP Coordinator P.O. Box 47775 Olympia, WA 98504-7775	**Eastern Region:** Attn: VCP Coordinator N. 4601 Monroe Spokane WA 99205-1295

If you need this publication in an alternate format, please call the Toxics Cleanup Program at 360-407-7170. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

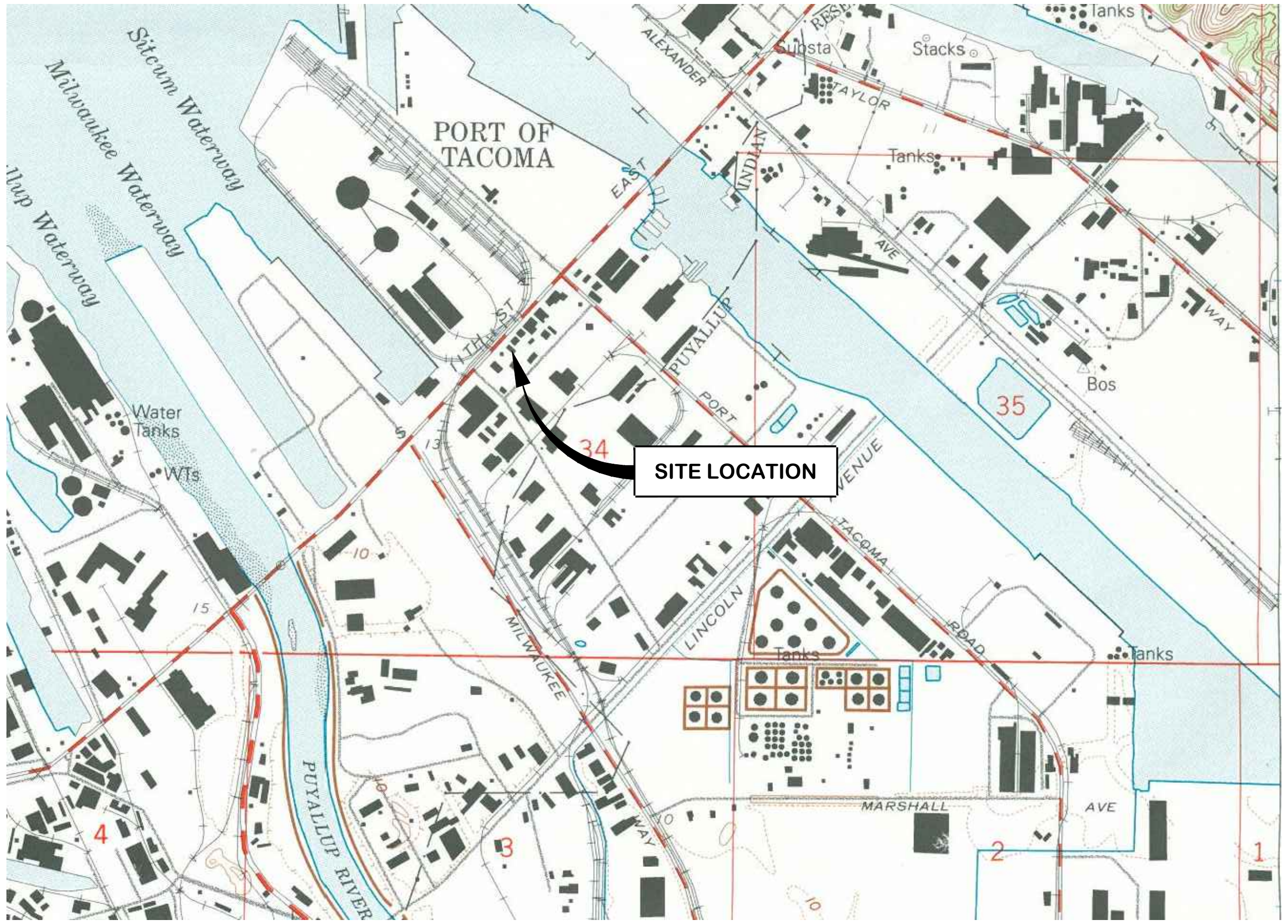
APPENDIX B
ENGINEERING DRAWINGS

CLEANUP ACTION PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

SITE REMEDIATION

SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON



REFERENCE: 7.5 MINUTE USGS QUADRANGLE TACOMA NORTH, WASHINGTON. DATED 1953 AND PHOTOREVISED 1981

SITE LOCATION MAP

(NOT TO SCALE)

DRAWING INDEX

SHEET NO.	DRAWING TITLE
1	TITLE SHEET, SITE LOCATION MAP, AND DRAWING INDEX
2	GENERAL NOTES, LEGEND, SYMBOLS, AND ABBREVIATIONS
3	EXISTING CONDITIONS
4	EROSION CONTROL, EXCAVATION PLAN, AND NOTES
5	DETAILS

THADDEUS J. CLINE
29637

5/16/2014

	7/9/14	ISSUED FOR CONSTRUCTION	DEW/AV	JH	TC
	DATE	DESCRIPTION	BY	CKD.	APP.

PREPARED BY

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

PREPARED FOR

SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

SOUND BATTERY PROPERTY
SITE REMEDIATION
TACOMA, WASHINGTON
TITLE SHEET,
SITE LOCATION MAP, AND
DRAWING INDEX

SCALE
AS SHOWN

PROJECT NO.
1117-001

FILE NAME
EXCAVATION.dwg

SHEET NO. 1 OF 5

ELECTRICAL ABBREVIATIONS

A/AMP	AMP
AC	ALTERNATING CURRENT
BD	BUS DUCT
C	CURRENT
CB	CIRCUIT BREAKER
CLG	CEILING
DC	DIRECT CURRENT
DIS	DISCONNECT
DP	DOUBLE POLE
DT	DOUBLE THROW
EG	ENCLOSED AND GASKETED
E(OH)	ELECTRICAL (OVERHEAD)
E(UG)	ELECTRICAL (UNDERGROUND)
EMER	EMERGENCY
EPO	EMERGENCY POWER OFF
EMT	ELECTRICAL METALLIC TUBING
EXP	EXPOSED
FBO	FURNISHED BY OTHERS
FLEX	FLEXIBLE METAL CONDUIT
FRN	DUAL ELEMENT FUSE
GEN	GENERATOR
GFIC	GROUND FAULT INTERRUPTER
GND	GROUND
GRC	GALVANIZED RIGID CONDUIT
HOA	HAND-OFF-AUTO SWITCH
IRD	INFRARED DETECTOR
HP	HORSE POWER
HZ	CYCLES PER SECOND
JB	JUNCTION BOX
LFMC	LIQUID TIGHT FLEXIBLE METAL CONDUIT
M	MOTOR/MOTOR STARTER COIL
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRIC CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NF	NON-FUSED
NO	NORMALLY OPEN
OL	OVERLOADS
PBS	PUSHBUTTON
PF	POWER FACTOR
PL	PILOT LIGHT
PLC	PROGRAMMABLE LOGIC CONTROLLER
RC	RIGID CONDUIT
RCPT	RECEPTACLE
SN	SOLID NEUTRAL
SP	SINGLE POLE
ST	SINGLE THROW
SW	SWITCH
TF/TRAN	TRANSFORMER
UF	UNDERFLOOR
UG	UNDERGROUND
V	VOLTS
VFD	VARIABLE FREQUENCY DRIVE
VP	VAPOR PROOF
WHT	WHITE
WP	WEATHER PROOF
XP	EXPLOSION PROOF

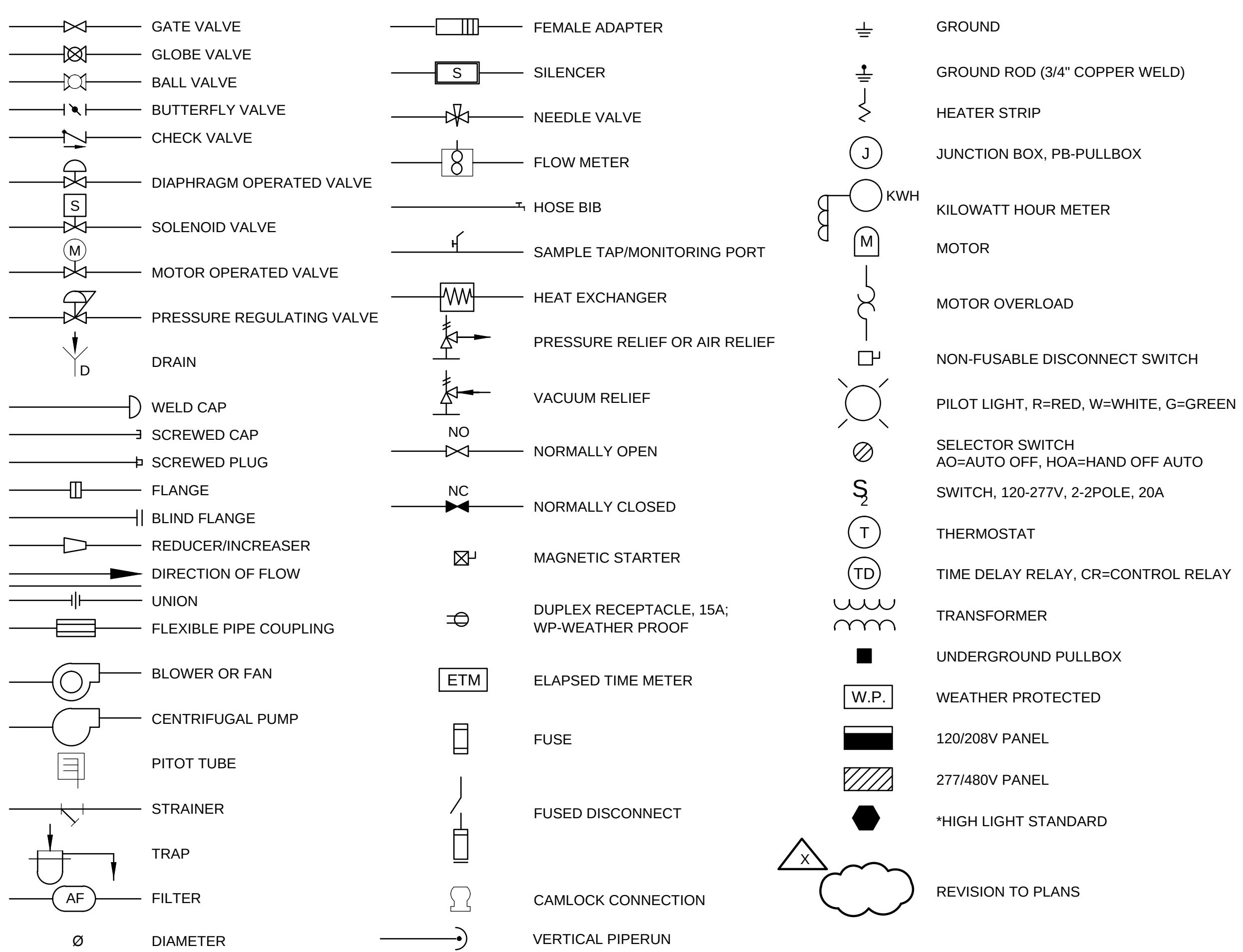
STANDARD ABBREVIATIONS

AF	AIR FILTER
AB	AGGREGATE BASE
AC	ASPHALTIC CONCRETE
APPROX	APPROXIMATELY
AF	AIR FILTER
AS	AIR SPARGE
BF	BLIND FLANGE
B.G.S.	BELOW GROUND SURFACE
BLDG	BUILDING
BOP	BOTTOM OF PIPE
BV	BALL VALVE
CONC	CONCRETE
CPLG	COUPLING
℄/CL	CENTERLINE
CV	CONTROL VALVE/CHECK VALVE
DC	DOUBLE CONTAINED
Ø/DIA	DIAMETER
DWG	DRAWING
DP	DUAL PHASE
DPI	DIFFERENTIAL PRESSURE INDICATOR
EF	EACH FACE
EL/ELEV	ELEVATION
ELEC	ELECTRICAL
ELB	ELBOW
EPDM	ETHYLENE PROPYLENE RUBBER
EXIST/(E)	EXISTING
EXP	EXPANSION
EW	EACH WAY
EA	EACH
FC	FAIL CLOSE
FO	FAIL OPEN
FLXC	FLEXIBLE CONNECTION
FM	FLOW METER
FL	FLOW LINE
FT	FOOT
FUT	FUTURE
FIN GR	FINISHED GRADE
FE	FLANGED END
FNPT	FEMALE NATIONAL PIPE THREAD
GA	GAUGE
GAC	GRANULAR ACTIVATED CARBON
GALV	GALVANIZED
GI	GALVANIZED IRON
GPM	GALLONS PER MINUTE
GR	GRADE
GND	GROUND
GSKT	GASKET
GW	GROUNDWATER
GV	GATE VALVE

HDPE	HIGH DENSITY POLYETHYLENE
HORIZ	HORIZONTAL
HP	HORSEPOWER/HIGH PRESSURE
HR	HOUR
HS	HOSE
HYD	HYDRANT
HOA	HAND OFF AUTOMATIC
ID	INSIDE DIAMETER
IN	INCHES
INV	INVERT
IPS	IRON PIPE SIZE
JT	JOINT
JB	JUNCTION BOX
KO	KNOCK OUT
LSHH	LEVEL SWITCH
M	MOTOR
MAX	MAXIMUM
MH	MANHOLE
MJ	MECHANICAL JOINT
MIN	MINUTE/MINIMUM
MISC	MISCELLANEOUS
MNPT	MALE NATIONAL PIPE THREAD
MP	METER PUMP
MON.PORT	MONITORING PORT
MW	MONITORING WELL
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NO.	NUMBER
N	NEW
NTS	NOT TO SCALE
NPDES	NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM
OC	ON CENTER
OD	OUTSIDE DIAMETER
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OVHD	OVERHEAD
#/LB	POUND
PB	PULL BOX
PBF	PROVIDED BY FARALLON
PC	PORTLAND CEMENT
PCC	PORTLAND CEMENT CONCRETE
PG	PRESSURE GAS
PL	PROPERTY LINE/PIPE LINE
PO	PUMP OUT
P	PRESSURE

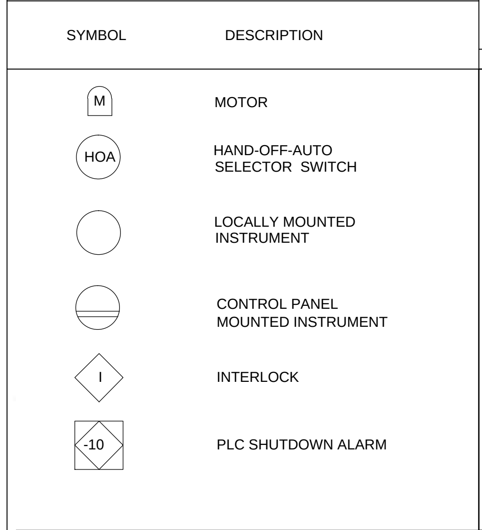
PRV	PRESSURE RELEASE VALVE
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH, ABSOLUTE
PSIG	POUNDS PER SQUARE INCH, GAUGE
PTW	PRESSURE TREATMENT
PVC	POLYVINYL CHLORIDE
PV	PROCESS VARIABLE
PR	PAIR
PUE	PUBLIC UTILITY EASEMENT
R	RADIUS/RISER
RC	REINFORCED CONCRETE
REQ	REQUIRED
REF	REFERENCE
SCH	SCHEDULE
SDR	STANDARD DIMENSION RATIO
SECT	SECTION
SHT	SHEET
SPEC	SPECIFICATION
SQ	SQUARE
STA	STATION
STD	STANDARD
STL	STEEL
SBO	SUPPLIED BY OWNER
ST	SAMPLE TAP
STR	STRAINER
SS	STAINLESS STEEL
STL	STEEL
SVE	SOIL VAPOR EXTRACTION
SW	SWITCH
TYP	TYPICAL
TOC	TOP OF CASING/CURB
TOS	TOP OF STEEL
TOW	TOP OF WALL
UBC	UNIFORM BUILDING CODE
UGPS	UNDERGROUND PULL SECTION
UTIL	UTILITY
V	VALVE/VENT/VOLTS
VAC	VACUUM
VAR	VARIES/VARIABLE
VERT	VERTICAL
VP	VAPOR
VRV	VACUUM RELIEF VALVE
W/	WITH
W/O	WITHOUT
WS	WATER SURFACE/WATER STOP

PIPING, ELECTRICAL AND EQUIPMENT SYMBOLS

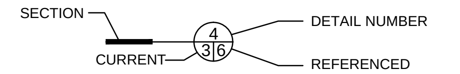


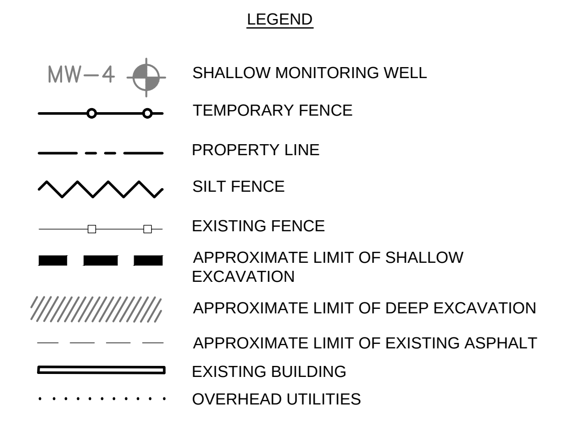
INSTRUMENTATION ABBREVIATIONS AND SYMBOLS

INSTRUMENT SYMBOLS



STANDARD SYMBOLS





THADDEUS J. CLINE
29637
5/16/2014

GENERAL NOTES

1. A COPY OF THE PROJECT DESIGN DRAWINGS AND SPECIFICATIONS SHALL BE MAINTAINED ON THE JOB SITE AT ALL TIMES.
2. COPIES OF ALL PERMITS SHALL BE MAINTAINED ON THE JOB SITE AT ALL TIMES. THE CONTRACTOR SHALL COMPLY WITH ALL PERMIT REQUIREMENTS.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL DIMENSIONS.
4. BURIED UTILITIES SHOWN ON THE DRAWINGS ARE FOR GENERAL INFORMATION ONLY. UTILITY LOCATIONS ARE APPROXIMATE AND MAY NOT BE INCLUSIVE OF ALL UTILITIES THAT EXIST ON THE PROPERTY.
5. THE CONTRACTOR SHALL HAVE A PRIVATE UTILITY LOCATE SERVICE VERIFY ALL UTILITIES AND MARK THEIR LOCATIONS ON THE GROUND PRIOR TO STARTING CONSTRUCTION. FARALLON SHALL BE CONTACTED IMMEDIATELY IF A CONFLICT IS FOUND BETWEEN EXISTING UTILITIES AND THE PROJECT DESIGN.
6. FARALLON SHALL BE NOTIFIED OF DISCREPANCIES BETWEEN CONTRACT DRAWINGS AND ACTUAL SITE CONDITIONS.
7. THE CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR THE JOB SITE CONDITIONS AND ENSURE THE SAFETY OF ALL PERSONS AND PROPERTY FOR THE DURATION OF ON SITE PROJECT WORK. THE CONTRACTOR SHALL PROTECT STRUCTURES, UTILITIES, AND PAVING FROM DAMAGE, DIRECT OR INDIRECT, RESULTING FROM THE WORK. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY OVER THE DURATION OF ON SITE ACTIVITIES AND NOT BE LIMITED TO NORMAL WORKING HOURS.
8. ALL EXCAVATIONS SHALL BE PERFORMED IN STRICT ACCORDANCE WITH APPLICABLE U.S. DEPARTMENT OF LABOR OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE WASHINGTON INDUSTRIAL SAFETY AND HEALTH ACT (WISHA) REGULATIONS. THE CONTRACTOR ASSUMES FULL RESPONSIBILITY FOR THE SAFETY OF ALL CONSTRUCTION OPERATIONS.
9. NO TRENCHES SHALL BE LEFT OPEN WHEN WORK IS NOT IN PROGRESS. ALL OPEN EXCAVATIONS SHALL BE FENCED.

	7/9/14	ISSUED FOR CONSTRUCTION	DEW/AV	JH	TC
	DATE	DESCRIPTION	BY	CKD.	APP.

PREPARED BY

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

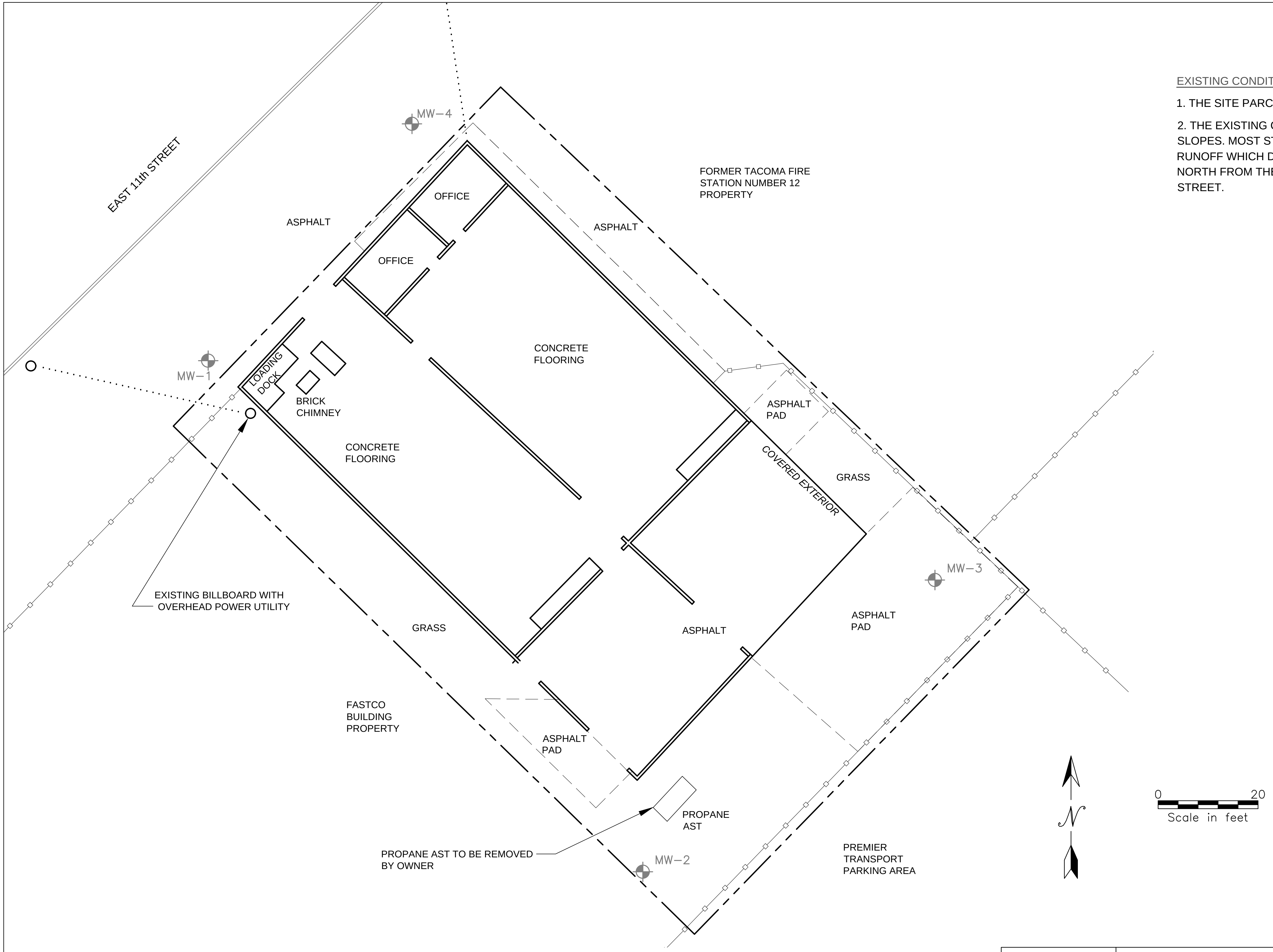
PREPARED FOR

SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

SOUND BATTERY PROPERTY
SITE REMEDIATION
TACOMA, WASHINGTON

GENERAL NOTES,
LEGEND, SYMBOLS,
AND ABBREVIATIONS

SCALE
AS SHOWN
PROJECT NO.
1117-001
FILE NAME
EXCAVATION.dwg
SHEET NO. 2 OF 5



EXISTING CONDITIONS NOTES:

1. THE SITE PARCEL NUMBER IS 2275200770.
2. THE EXISTING GROUND SURFACE OF THE SITE IS FLAT WITH O TO 5% SLOPES. MOST STORMWATER RUNOFF INFILTRATES IN GRASS AREAS. RUNOFF WHICH DOES NOT INFILTRATE TRAVELS BY SHEET FLOW NORTH FROM THE SITE TO CATCH BASINS LOCATED ON EAST 11TH STREET.

THADDEUS J. CLINE
29637
5/16/2014

	7/9/14	ISSUED FOR CONSTRUCTION	DEW/AV	JH	TC
	DATE	DESCRIPTION	BY	CKD.	APP.

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FARALLON CONSULTING
975 5th Avenue Northwest
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SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

SOUND BATTERY PROPERTY
SITE REMEDIATION
TACOMA, WASHINGTON

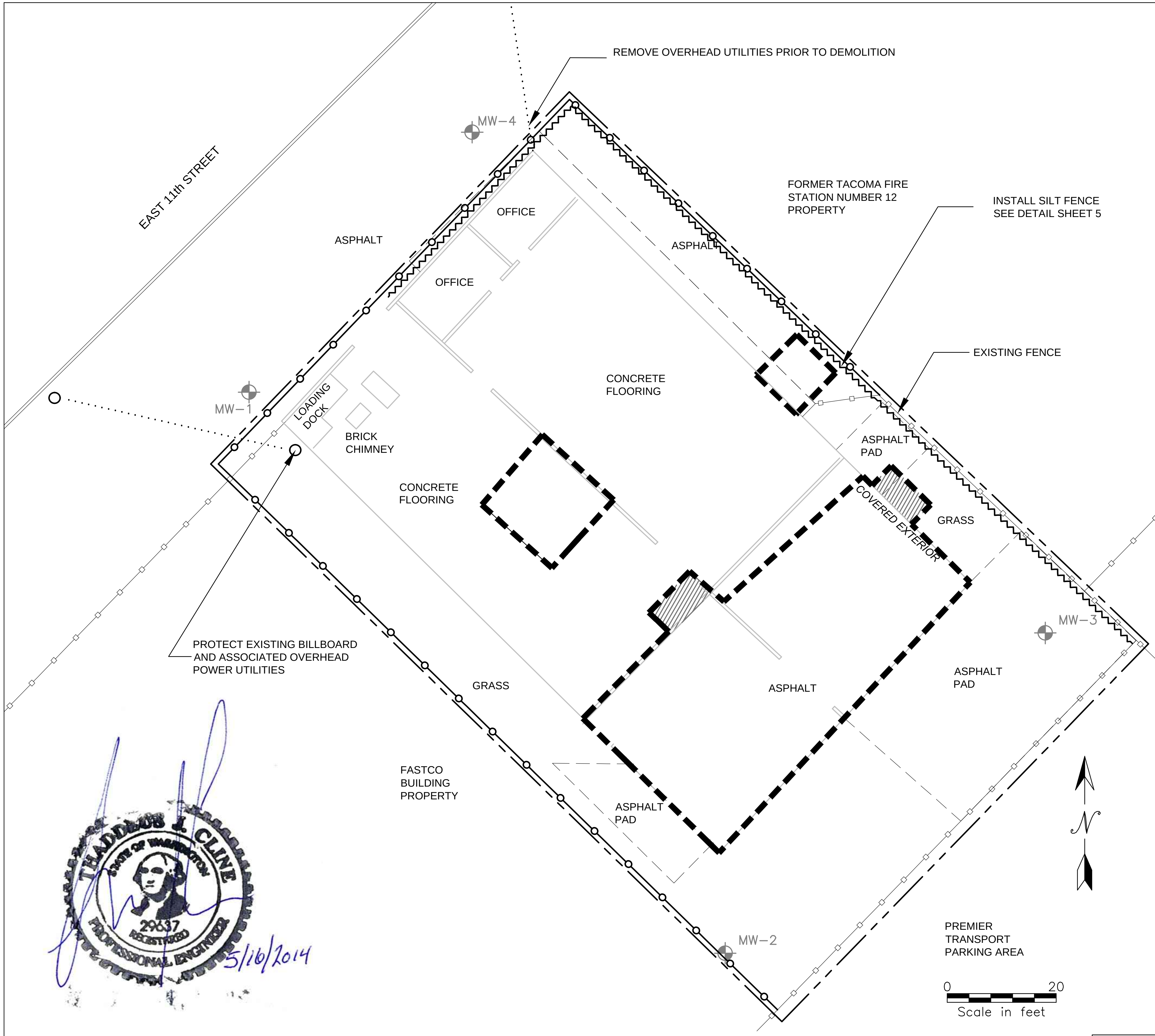
EXISTING CONDITIONS

SCALE
AS SHOWN

PROJECT NO.
1117-001

FILE NAME
EXCAVATION.dwg

SHEET NO. 3 OF 5



THADDEUS J. CLINE
29637
5/16/2014

SITE PREPARATION AND EROSION CONTROL NOTES:

1. SITE PREPARATION AND EROSION CONTROL SHALL BE IN PLACE BEFORE INITIATING ANY CONSTRUCTION ACTIVITIES.

2. CONTRACTOR SHALL LOCATE AND CLEARLY MARK PROPERTY BOUNDARIES PRIOR TO CONSTRUCTION.

3. PROTECT CATCH BASINS ADJACENT TO TRUCK LOADING AREA PER DETAIL, SHEET 5.

4. TRACKING OF SEDIMENT ONTO ROADWAY IS NOT ALLOWED. IF SEDIMENT IS TRACKED ONTO THE ROAD, THE ROAD SHALL BE THOROUGHLY AND IMMEDIATELY CLEANED BY SHOVELING OR PICKUP SWEEPING. STREET WASHING OF SEDIMENT TO THE STORM DRAIN SYSTEM IS NOT ALLOWED. TRANSPORT SEDIMENT TO A CONTROLLED SEDIMENT DISPOSAL AREA.

5. OVERHEAD UTILITIES WITHIN EXCAVATION AND DEMOLITION AREA SHALL BE REMOVED BY THE CONTRACTOR PRIOR TO BEGINNING WORK AS INDICATED ON PLANS.

6. PROVIDE TEMPORARY CONSTRUCTION FENCING AS SHOWN ON PLANS FOR SITE SECURITY.

7. EXISTING MONITORING WELLS SHALL BE PROTECTED AND REPAIRED IF DAMAGED.

8. ALL TEMPORARY STOCKPILES SHALL BE COVERED WITH PLASTIC SHEETING AND SECURED TO CONTROL EROSION.

9. PROVIDE SILT FENCE AS NEEDED PER DETAIL, SEE SHEET 5.

10. CONTRACTOR SHALL INSTALL SILT FENCE AND/ OR BERMS SUCH THAT STORMWATER RUNOFF DOES NOT LEAVE THE SITE.

11. BMPS SHALL BE MAINTAINED AS DESCRIBED IN SITE SPECIFIC CONSTRUCTION SWPPP UNTIL CONSTRUCTION COMPLETION AND SITE STABILIZATION.

12. CONTRACTOR SHALL MAINTAIN EQUIPMENT FREE OF LEAKS. ANY SPILLS SHALL BE CLEANED IMMEDIATELY FROM THE SITE.

EXCAVATION AND DEMOLITION PLAN NOTES:

1. THE CONTRACTOR SHALL HAVE DEMOLITION AND BUILDING PERMITS ON SITE DURING CONSTRUCTION. UPON COMPLETION OF THE BUILDING DEMOLITION THE CONTRACTOR SHALL NOTIFY TACOMA FIRE PREVENTION BUREAU AT 253-591-5740.

2. THE CONTRACTOR SHALL LOCATE AND ABANDON SIDE SEWERS AT CONNECTION TO MAINLINE IN THE PRESENCE OF THE CITY OF TACOMA CONSTRUCTION INSPECTOR PER DETAIL, SEE SHEET 5.

3. CONTRACTOR SHALL LOCATE AND ABANDON ALL SITE UTILITIES IN ACCORDANCE WITH APPROPRIATE UTILITY REQUIREMENTS AND STANDARDS PRIOR TO BUILDING DEMOLITION.

4. DEMOLISH AND REMOVE BUILDING ABOVE EXISTING CONCRETE SLAB. FINAL GRADE SHALL BE CLEANED SURFACE OF SLAB, FREE OF SHARP EDGES AND PUNCTURE POINTS.

5. CONTRACTOR SHALL BE LICENSED AND INSURED TO PERFORM EXCAVATION AND HANDLING OF CONTAMINATED SOILS INCLUDING THE REQUIREMENTS OF WASHINGTON HAZARDOUS WASTE OPERATIONS REGULATIONS (CHAPTER 296-843 WAC).

6. CONTRACTOR SHALL PROVIDE SUPPORT AS REQUIRED BY ENGINEER TO COLLECT ENVIRONMENTAL SOIL SAMPLES.

7. CONTRACTOR MAY BE REQUIRED TO EXCAVATE CONTAMINATED SOIL FROM ADDITIONAL OUTSIDE AREAS DESIGNATED AS CONTAMINATED ON DRAWINGS AS DIRECTED BY ENGINEER.

8. CONTAMINATED SOIL SHALL BE TRANSPORTED OFFSITE FOR STABILIZATION AND DISPOSAL AT AN APPROPRIATE WASTE FACILITY.

9. GROUNDWATER ENCOUNTERED IN DEEP EXCAVATIONS SHALL BE PUMPED OUT AND DISPOSED OF AT AN APPROPRIATE WASTE FACILITY.

10. EXCAVATIONS WHERE CONTAMINATED SOIL HAS BEEN REMOVED SHALL REMAIN OPEN UNTIL ENGINEER RECEIVES SOIL SAMPLE ANALYTICAL DATA. BACKFILLING OF EXCAVATIONS SHALL COMMENCE ONLY AFTER CONFIRMATION OF SAMPLING RESULTS AND APPROVAL BY THE ENGINEER.

11. EXCAVATIONS SHALL BE BACKFILLED TO MATCH SURROUNDING GRADE.

12.STABILIZE THE AREA UPON COMPLETION OF FINAL ROUGH GRADING OR IF AREA IS UNWORKED FOR A PERIOD OF FIVE DAYS.

	7/9/14	ISSUED FOR CONSTRUCTION	DEW/AV	JH	TC
	DATE	DESCRIPTION	BY	CKD.	APP.

PREPARED BY

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

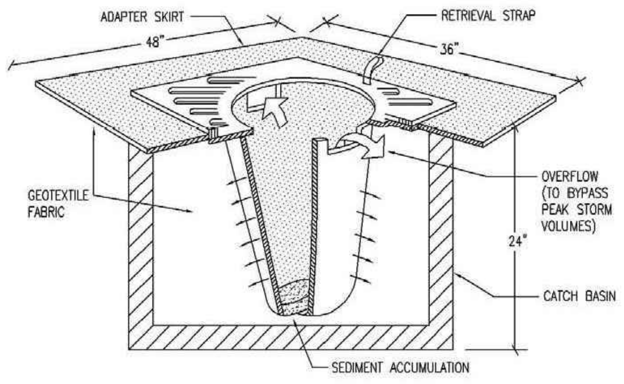
PREPARED FOR

SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

SOUND BATTERY PROPERTY
SITE REMEDIATION
TACOMA, WASHINGTON

EROSION CONTROL, EXCAVATION PLAN, AND NOTES

SCALE AS SHOWN
PROJECT NO. 1117-001
FILE NAME EXCAVATION.dwg
SHEET NO. 4 OF 5

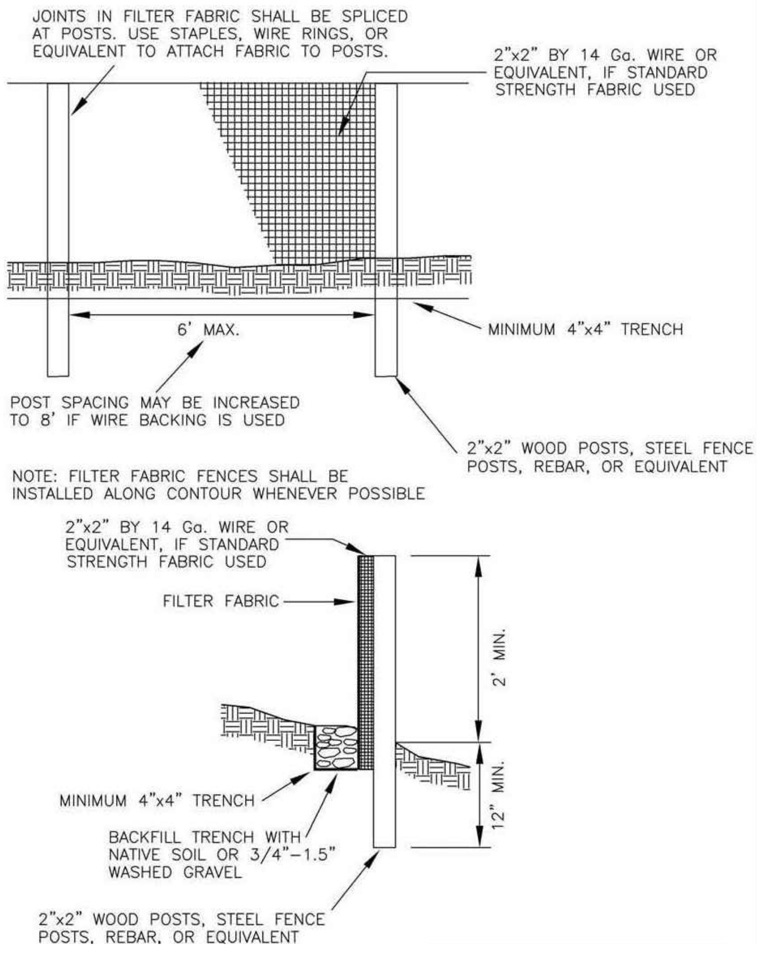


INLET PROTECTION NOTES:

1. FILTERS SHALL BE INSPECTED AFTER EACH STORM EVENT AND CLEANED OR REPLACED WHEN 1/3 FULL.

CATCH BASIN PROTECTION DETAIL

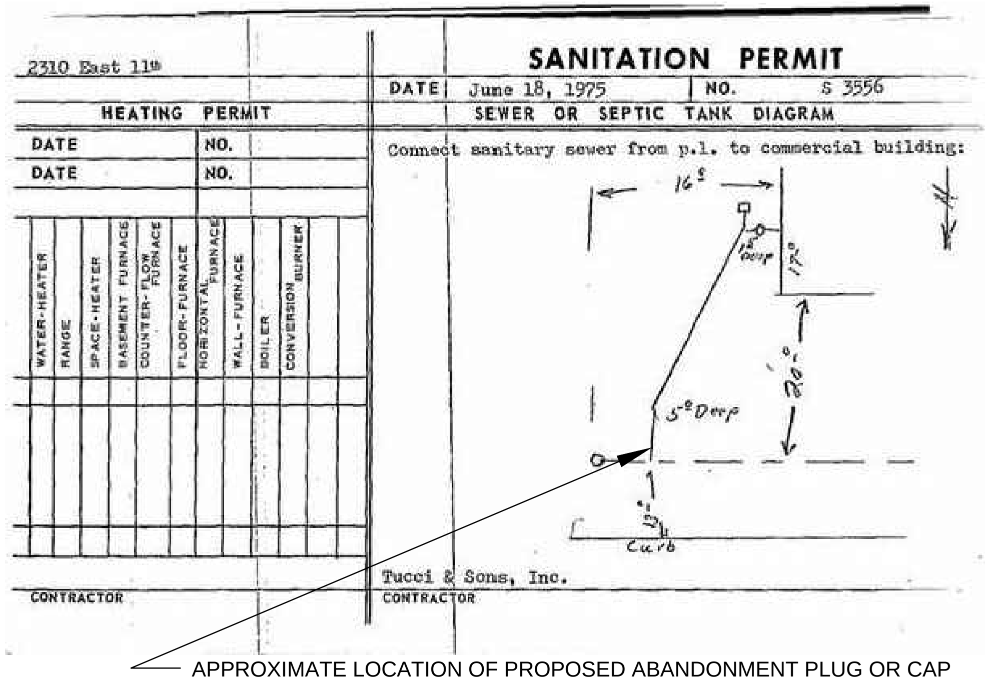
NTS



NOTE: FILTER FABRIC FENCES SHALL BE INSTALLED ALONG CONTOUR WHENEVER POSSIBLE

SILT FENCE DETAIL

NTS


2310 East 11th

HEATING PERMIT

DATE NO.

DATE NO.

WATER-HEATER
RANGE
SPACE-HEATER
BASEMENT FURNACE
COUNTER-FLOW FURNACE
FLOOR-FURNACE
HORIZONTAL FURNACE
WALL-FURNACE
BOILER
CONVERSION BURNER

CONTRACTOR

SANITATION PERMIT

DATE June 18, 1975 NO. S 3556

SEWER OR SEPTIC TANK DIAGRAM

Connect sanitary sewer from p.l. to commercial building:

Tucci & Sons, Inc.
CONTRACTOR

APPROXIMATE LOCATION OF PROPOSED ABANDONMENT PLUG OR CAP TO BE INSTALLED BY CONTRACTOR

SANITARY SIDE SEWER DETAIL

NTS

THADDEUS J. CLINE
29637
5/16/2014

	7/9/14	ISSUED FOR CONSTRUCTION	DEW/AV	JH	TC
	DATE	DESCRIPTION	BY	CKD.	APP.

PREPARED BY	PREPARED FOR		
FARALLON CONSULTING 975 5th Avenue Northwest Issaquah, WA 98027	SOUND BATTERY PROPERTY 2310 EAST 11th STREET TACOMA, WASHINGTON	SOUND BATTERY PROPERTY SITE REMEDIATION TACOMA, WASHINGTON DETAILS	SCALE AS SHOWN PROJECT NO. 1117-001 FILE NAME EXCAVATION.dwg SHEET NO. 5 OF 5

APPENDIX C
ENCO HAZARDOUS BUILDING MATERIALS REPORT

CLEANUP ACTION PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

PRE
PACIFIC RIM ENVIRONMENTAL, INC.

Limited Lead-based Paint Testing
PacRim #14423

On April 26, 2011, Todd P. Carter of Pacific Rim Environmental, Inc. (PacRim) performed limited lead-based paint (LBP) testing at Sound Battery in Tacoma, WA. The inspection and testing was limited to painted interior wall and roof structure components. The testing was performed using a Niton XRF device. Field inspection, data collection, and report generation were performed according to the following Scope of Work:

1. XRF testing of suspect lead-based paints (LBP) using Niton XLp-303A portable XRF device.
2. Written descriptions of testing combinations and painted component locations
3. Prepare final written report including: Sample descriptions, condition, locations, analytical results, and recommendations.

All requirements for the NITON XRF usage contained in the Performance Characteristics Sheet for the specific XRF were followed.

Limited Lead-Based Paint Screening

A limited investigation for lead-based paint at the aforementioned building was conducted on April 26, 2011 using a NITON X-Ray Fluorescence Spectrometer (XRF) model XLp-303A, serial number 7029.

Lead-based paint was identified on the following components.

- White painted wood post 1
- White painted wood wall at door to 2nd floor
- Green painted concrete wall in warehouse
- Red painted metal window frames in warehouse
- Gray painted wood post
- White painted concrete walls in original building

(See attached XRF Data Sheets)

It is important to keep in mind that although the EPA/HUD standard uses a criterion of 5,000 parts per million dry weight or 1.00 milligrams per square centimeter (1.00 mg/cm^2) for lead-based paint, there still may be lead present in those results reported as negative. In the event that lead is present, Federal OSHA and Washington State Department of Labor & Industries regulations will still apply, since neither agency has established a concentration of lead in paint below which the lead in construction standards do not apply. Workers wearing respiratory protection and who have received proper training in the handling of lead contaminated materials must be used for any construction activities (including manual scraping, manual/power sanding, heat gun applications, general cleanup, and demolition) that affect a paint film containing lead.

If you have any questions regarding this project, please contact our office at 206-244-8965.

Respectfully,

Todd P. Carter
WA State Lead Inspector

XRF DATA SHEETS

Client:	ENCO P.O. Box 1212 Puyallup, WA	*XRF Serial #:*	XLP303A-7029
		Inspection Date:	26-Apr-2011
		Inspection By:	Matt DeDominces
Project:	Sound Battery 2310 East 11th Street Tacoma, WA	*PRE Job#:*	14423

PRE#	Test #	Substrate	Component / Side	Description / Location	Color	Result	Pbc mg/cm2
1	1383	*First calibration check*				Positive	1.1
2	1384	*First calibration check*				Positive	1.1
3	1385	*First calibration check*				Positive	1
4	1386	Wood	Post	Post 1 from west side	Whitish-Natural	Positive	3.5
5	1387	Wood	Post	Post 1 from west side	Whitish-Natural	Negative	0.01
6	1388	Wood	Post	Post 1 from west side	Whitish-Natural	Negative	0.5
7	1389	Concrete	Wall	Wall A by garage door	Green	Negative	0.12
8	1390	Concrete	Wall	Wall A, right of garage door	Green	Negative	0.08
9	1391	Concrete	Wall	Wall A, left of garage door	Green	Negative	0.07
10	1392	Wood	Wall	Wall B, door to upstairs	White	Positive	3.4
11	1393	Wood	Door	Wall B, warehouse	Brown	Negative	0.03
12	1394	Concrete	Wall	Wall B in warehouse, west	Green	Null	0.17
13	1395	Concrete	Wall	Wall B in warehouse, east	Green	Negative	0.18
14	1396	Concrete	Wall	Wall C, warehouse	Green	Negative	0.3
15	1397	Concrete	Wall	Wall C, warehouse	Green	Positive	3.4
16	1398	Concrete	Wall	Wall B, warehouse	Green	Negative	0.8

Client:	ENCO P.O. Box 1212 Puyallup, WA	XRF Serial #:	XLP303A-7029
		Inspection Date:	26-Apr-2011
		Inspection By:	Matt DeDominces
Project:	Sound Battery 2310 East 11th Street Tacoma, WA	PRE Job#:	14423

PRE#	Test #	Substrate	Component / Side	Description / Location	Color	Result	Pbc mg/cm2
17	1399	Concrete	Wall	Wall B, warehouse	Green	Negative	0.4
18	1400	Concrete	Wall	Wall C, warehouse, center	Gray	Negative	0.3
19	1401	Concrete	Wall	Wall C, warehouse, south	Green	Negative	0.22
20	1402	Concrete	Wall	Wall D, warehouse, east	Green	Negative	0.18
21	1403	Metal	Frame	Wall D, warehouse, window 5	Red	Positive	7.2
22	1404	Concrete	Wall	Wall C, center	Acid	Negative	0.02
23	1405	Concrete	Wall	Wall D, center	Green	Negative	0.22
24	1406	Concrete	Wall	Wall D, west side	Green	Negative	0.27
25	1407	Wood	Post	Post 2 from west	Natural	Negative	0.05
26	1408	Wood	Post	Post 3 from west	Natural	Negative	0.17
27	1409	Wood	Post	Post 4 from west	Gray	Positive	1.7
28	1410	Wood	Post	Post 3 from west	Natural	Negative	0.09
29	1411	Wood	Main beam	West end warehouse	Natural	Negative	0.02
30	1412	Wood	Deck ceiling	Roof deck boards, west	Natural	Negative	0.01
31	1413	Wood	Beam 1	Left beam, warehouse	Natural	Negative	0.04
32	1414	Wood	Beam 5	Left, warehouse	Natural	Negative	0.01
33	1415	Wood	Beam 9	Left, warehouse	Natural	Negative	0
34	1416	Wood	Deck ceiling boards	Center, warehouse	Natural	Negative	0.01
35	1417	Wood	Beam 14	Left side warehouse	Natural	Negative	0.01
36	1418	Wood	Deck ceiling boards	Left side warehouse	Natural	Negative	0.03
37	1419	Wood	Beam 14	Right side warehouse	Natural	Negative	0.01
38	1420	Wood	Deck ceiling boards	Right side warehouse, east	Natural	Negative	0.01

Client: ENCO
P.O. Box 1212
Puyallup, WA

Project: Sound Battery
2310 East 11th Street
Tacoma, WA

XRF Serial #: XLP303A-7029
Inspection Date: 26-Apr-2011
Inspection By: Matt DeDominces

PRE Job#: 14423

PRE#	Test #	Substrate	Component / Side	Description / Location	Color	Result	Pbc mg/cm2
39	1421	Wood	Beam 10	Right side warehouse, center	Natural	Negative	0.01
40	1422	Wood	Deck ceiling boards	Right side warehouse, center	Natural	Negative	0.02
41	1423	Wood	Beam 6	Right side warehouse, center	Natural	Negative	0.01
42	1424	Wood	Deck ceiling boards	Right side warehouse, center	Natural	Negative	0.04
43	1425	Wood	Beam 2	Right side warehouse, west	Natural	Negative	0.01
44	1426	Wood	Deck ceiling boards	Right side warehouse, west	Natural	Negative	0.01
45	1427	Concrete	Wall	Warehouse, wall A, south	Green	Negative	0.1
46	1428	Concrete	Wall	Warehouse, wall D, west	Green	Negative	0.12
47	1429	Metal	Frame	Warehouse, wall D, window 1	Red	Positive	3.1
48	1430	Wood	Beam 1	Original building, west side	Natural	Negative	0.01
49	1431	Wood	Deck ceiling boards	Original building, west	Natural	Negative	0.02
50	1432	Concrete	Wall	Wall D	White	Negative	0.09
51	1433	Wood	Beam 4	Original building, center	Natural	Negative	0.01
52	1434	Wood	Deck ceiling boards	Original building, center	Natural	Negative	0.02
53	1435	Wood	Beam 6	Original building, center	Natural	Negative	0.01
54	1436	Wood	Deck ceiling boards	Original building, center	Natural	Negative	0.01
55	1437	Wood	Beam 8	Original building, east	Natural	Negative	0.04
56	1438	Wood	Deck ceiling boards	Original building, east	Natural	Negative	0.02
57	1439	Wood	Ceiling lead pot vents	Original building, east	Natural	Negative	0.08
58	1440	Metal	O-ring to vent	Original building, east	Metal	Negative	0.04
59	1441	Metal	O-ring to vent	Original building, east	Metal	Negative	0.1
60	1442	Concrete	Wall	Original building, wall C	White	Negative	0.5

Client: ENCO
P.O. Box 1212
Puyallup, WA

XRF Serial #: XLP303A-7029
Inspection Date: 26-Apr-2011
Inspection By: Matt DeDominces

Project: Sound Battery
2310 East 11th Street
Tacoma, WA

PRE Job#: 14423

PRE#	Test #	Substrate	Component / Side	Description / Location	Color	Result	Pbc mg/cm2
61	1443	Concrete	Wall	Original building, wall B, center	White	Positive	1.7
62	1444	Concrete	Wall	Original building, wall B, center	White	Negative	0.1
63	1445	Concrete	Wall	Original building, wall B, center	White	Positive	1.4
64	1446	Metal	Frame	Original building, wall B, window 2	Red	Positive	18.3
65	1447	Concrete	Wall	Original building, wall B, center left	White	Negative	0.4
66	1448	Concrete	Wall	Original building, wall B, center left	White	Negative	0.7
67	1449	Concrete	Wall	Original building, wall B, east end	white	Positive	2.1
68	1450	Concrete	Wall	Original building, wall B, east end	white	Positive	6.9
69	1451	Concrete	Wall	Original building, wall B, east corner	Concrete	Positive	1.2
70	1452	Concrete	Wall	Original building, wall B, east corner	White	Positive	4.8
71	1453	Concrete	Wall	Original building, wall B, east corner	White	Positive	4.9
72	1454	Concrete	Wall	Original building, wall B, east corner	White	Negative	0.3
73	1455	Concrete	Wall	Original building, wall B, east corner	White	Positive	1.7
74	1456	Concrete	Sill	Original building, wall B, window 3	White	Positive	4.7
75	1457	Concrete	Wall	Original building, wall C	Green	Negative	0.22
76	1458	Concrete	Wall	Original building, wall C	Natural	Negative	0.6
77	1459	Concrete	Wall	Original building, wall C, 2' from north corner	White	Positive	19.7
78	1460	Concrete	Wall	Original building, wall C, 2' from north corner	White	Negative	0.2
79	1461	Concrete	Wall	Original building, wall C, 2' from north corner	White	Negative	0.6
80	1462	Concrete	Wall	Original building, wall C, 8' from north corner	White	Positive	7
81	1463	Concrete	Wall	Original building, wall C, center	White	Negative	0.26
82	1464	Concrete	Wall	Original building, wall D, east	White	Negative	0.12

Client: ENCO
P.O. Box 1212
Puyallup, WA

XRF Serial #: XLP303A-7029
Inspection Date: 26-Apr-2011
Inspection By: Matt DeDominces

Project: Sound Battery
2310 East 11th Street
Tacoma, WA

PRE Job#: 14423

PRE#	Test #	Substrate	Component / Side	Description / Location	Color	Result	Pbc mg/cm2
83	1465	Concrete	Wall	Original building, wall D, east	White	Negative	0.15
84	1466	Concrete	Wall	Original building, wall D, east	White	Negative	0.06
85	1467	Concrete	Wall	Original building, wall D, west	White	Negative	0.16
86	1468	Wood	Wall	Original building, office 1, wall A	White	Negative	0.25
87	1469	Wood	Wall	Original building, office 1, wall D	Natural	Negative	0.02
88	1470	Wood	Wall	Original building, office 2, wall B	Natural	Negative	0.01
89	1471	Concrete	Wall	Original building, wall B, locker room	Blue	Negative	0.13
90	1472	Wood	Wall	Original building, wall A, locker room	Blue	Negative	0.14
91	1473	*Last calibration check*				Positive	1.1
92	1474	*Last calibration check*				Positive	1.1
93	1475	*Last calibration check*				Positive	1.1

Report By: Amy German
Report Date: 27-Apr-2011

NITON XRF PERFORMANCE CHARACTERISTICS

Performance Characteristic Sheet

EFFECTIVE DATE: September 24, 2004 **EDITION NO.: 1**

MANUFACTURER AND MODEL:

Make:	*Niton LLC*
Tested Model:	*XLp 300*
Source:	^{109}Cd
Note:	This PCS is also applicable to the equivalent model variations indicated below, for the Lead-in-Paint K+L variable reading time mode, in the XLi and XLp series: XLi 300A, XLi 301A, XLi 302A and XLi 303A. XLp 300A, XLp 301A, XLp 302A and XLp 303A. XLi 700A, XLi 701A, XLi 702A and XLi 703A. XLp 700A, XLp 701A, XLp 702A, and XLp 703A.

Note: The XLi and XLp versions refer to the shape of the handle part of the instrument. The differences in the model numbers reflect other modes available, in addition to Lead-in-Paint modes. The manufacturer states that specifications for these instruments are identical for the source, detector, and detector electronics relative to the Lead-in-Paint mode.

FIELD OPERATION GUIDANCE

OPERATING PARAMETERS:

Lead-in-Paint K+L variable reading time mode.

XRF CALIBRATION CHECK LIMITS:

0.8 to 1.2 mg/cm^2 (inclusive)

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film).

If readings are outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instruments into control before XRF testing proceeds.

SUBSTRATE CORRECTION:

For XRF results using Lead-in-Paint K+L variable reading time mode, substrate correction is not needed for:

Brick, Concrete, Drywall, Metal, Plaster, and Wood

INCONCLUSIVE RANGE OR THRESHOLD:

K+L MODE READING DESCRIPTION	SUBSTRATE	THRESHOLD (mg/cm^2)
Results not corrected for substrate bias on any substrate	Brick	1.0
	Concrete	1.0
	Drywall	1.0
	Metal	1.0
	Plaster	1.0
	Wood	1.0

BACKGROUND INFORMATION

EVALUATION DATA SOURCE AND DATE:

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown on this sheet are calculated from the EPA/HUD evaluation using archived building components. Testing was conducted in August 2004 on 133 testing combinations. The instruments that were used to perform the testing had new sources; one instrument's was installed in November 2003 with 40 mCi initial strength, and the other's was installed June 2004 with 40 mCi initial strength.

OPERATING PARAMETERS:

Performance parameters shown in this sheet are applicable only when properly operating the instrument using the manufacturer's instructions and procedures described in Chapter 7 of the HUD Guidelines.

SUBSTRATE CORRECTION VALUE COMPUTATION:

Substrate correction is not needed for brick, concrete, drywall, metal, plaster or wood when using Lead-in-Paint K+L variable reading time mode, the normal operating mode for these instruments. If substrate correction is desired, refer to Chapter 7 of the HUD Guidelines for guidance on correcting XRF results for substrate bias.

EVALUATING THE QUALITY OF XRF TESTING:

Randomly select ten testing combinations for retesting from each house or from two randomly selected units in multifamily housing. Use the K+L variable time mode readings.

Conduct XRF retesting at the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

> Compute the Retest Tolerance Limit by the following steps:
>
> > Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family housing a result is defined as the average of three readings. In multifamily housing, a result is a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.
> >
> > > Calculate the average of the original XRF result and retest XRF result for each testing combination.
> > >
> > > Square the average for each testing combination.
> > >
> > > Add the ten squared averages together. Call this quantity C.
> > >
> > > Multiply the number C by 0.0072. Call this quantity D.
> > >
> > > Add the number 0.032 to D. Call this quantity E.
> > >
> > > Take the square root of E. Call this quantity F.
>
> Multiply F by 1.645. The result is the Retest Tolerance Limit.
>
> Compute the average of all ten original XRF results.
>
> Compute the average of all ten re-test XRF results.
>
> Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

TESTING TIMES:

For the Lead-in-Paint K+L variable reading time mode, the instrument continues to read until it is moved away from the testing surface, terminated by the user, or the instrument software indicates the reading is complete. The following table provides testing time information for this testing mode. The times have been adjusted for source decay, normalized to the initial source strengths as noted above. Source strength and type of substrate will affect actual testing times. At the time of testing, the instruments had source strengths of 26.6 and 36.6 mCi.

Testing Times Using K+L Reading Mode (Seconds)

	All Data			Median for laboratory-measured lead levels (mg/cm^2)		
Substrate	25th Percentile	Median	75th Percentile	Pb < 0.25	0.25 ≤ Pb<1.0	1.0 ≤ Pb
Wood Drywall	4	11	19	11	15	11
Metal	4	12	18	9	12	14
Brick Concrete Plaster	8	16	22	15	18	16

CLASSIFICATION RESULTS:

XRF results are classified as positive if they are greater than or equal to the threshold, and negative if they are less than the threshold.

DOCUMENTATION:

A document titled *Methodology for XRF Performance Characteristic Sheets* provides an explanation of the statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. For a copy of this document call the National Lead Information Center Clearinghouse at 1-800-424-LEAD.

This XRF Performance Characteristic Sheet was developed by the Midwest Research Institute (MRI) and QuanTech, Inc., under a contract between MRI and the XRF manufacturer. HUD has determined that the information provided here is acceptable when used as guidance in conjunction with Chapter 7, Lead-Based Paint Inspection, of HUD's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*.

PERSONNEL CERTIFICATION

STATE OF WASHINGTON

Department of Commerce

Lead-Based Paint Program

Matthew R. De Dominces

Has fulfilled the certification requirements of Washington Administrative code (WAC) 365-230 and has been certified to conduct lead-based paint activities pursuant to WAC 365-230-200 as a:

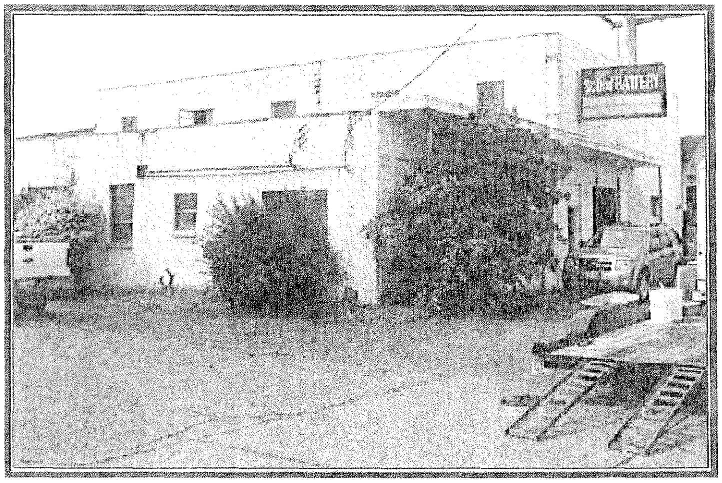
Inspector

Certification #	Issuance Date	Expiration Date
6277	12/8/2010	12/8/2013

PRE
Pacific Rim Environmental, Inc.
[illegible]

Regulated Building Material Survey

Sound Battery
2310 E. 11th Street
Tacoma, WA



Performed for:

ENCO
P.O. Box 1212
Puyallup, WA 98371

Prepared By:

Todd P. Carter, AHERA Inspector
CTED Lead Risk Assessor

Date Prepared: 08/03/2011
PRE#: 14463

Table of Contents

Section 1.0 Scope of Work
Sound Battery – 2310 East 11th Street, Tacoma, WA

On July 18th, 2011 Pacific Rim Environmental (PacRim) performed a regulated building material survey at the Commercial Building located at 2310 East 11th Street, Tacoma, WA.

Site: The site is occupied by an approximately 4,865 square foot, two-story building, masonry and wood-framed.

Limitations: The electrical panel power boxes will need to be checked for transite backings on the breaker switches when power is turned off.

Field inspection, data collection, and report generation were performed according to the following **Scope of Work**:

Asbestos-Containing Materials (ACM)

1. Bulk sampling and analysis of suspect asbestos-containing materials (ACM).
2. Analysis of suspect ACM by a NVLAP accredited laboratory.
3. Quantity estimates of ACM.
4. Written report including recommendations based on the technician's observations, abatement (removal) cost estimates, sample descriptions, and sample location.
5. Statement of Compliance with W.A.C. 296-62-07721 Sign-off form.

Lead-Based Paints (LBP)

6. Perform limited screening of suspect lead-based paints using XRF.
7. Written report including: Sample descriptions, conditions, locations, analytical results, and recommendations.

Universal Waste Inventory

8. Inspect and inventory lights and equipment to identify fixture and lamp type to determine presence of PCB and/or mercury.

The survey was intended to identify possible asbestos-containing materials (ACM) on the interior and exterior of the building. This inspection covered only those areas, which were exposed and/or physically accessible to the inspector. Materials uncovered during the course of demolition, renovation, or maintenance activities that are not identified in this inspection report must be presumed to contain asbestos until PLM analysis proves that this material is not asbestos-containing.

This survey is not intended for, nor should be used as a design specification. The Asbestos in Schools Hazard Amendment and Reauthorization Act (ASHARA), effective November 20, 1990, expanded accreditation requirements to apply to persons who work with asbestos in public and commercial buildings as well as schools. Specifically, ASHARA expanded the Toxic Substances Control Act (TSCA) Section 206 (a) (1) and (3) to require accreditation for any person who designs or conducts a response action with respect to friable ACM in a building. TSCA Section 207 provides for civil penalties of $5,000 for each day of a violation for not employing accredited individuals to design and conduct response actions. Sampling of suspect asbestos-containing materials was conducted as prescribed in 40 CFR 763.86.

Suspect asbestos-containing materials within the structure were identified and classified as a surfacing material, thermal system insulation, or miscellaneous materials. Surfacing materials are those, which are either spray applied or troweled-on for acoustical, decorative, or fireproofing purposes. Thermal system insulation (TSI) is insulation used to inhibit heat transfer or to prevent condensation on pipes, boilers, tanks, ducts and various other components. Miscellaneous materials include all other materials not included in the above categories such as floor tile, ceiling tile, roofing felt, cementitious materials, wallboard systems and products such as caulking, mastics and putties.

A total of twenty-seven (27) samples were collected and submitted for PLM laboratory analysis. Fifteen (15) of these samples were found to contain greater than 1% asbestos.

Section 2.0 Survey Narrative
Sound Battery – 2310 East 11th Street, Tacoma, WA

Bulk samples collected were submitted for sample analysis in accordance with method EPA-600/R-93/116: "Method for the Determination of Asbestos in Bulk building Materials". Analyses were performed in Pacific Rim Environmental Inc.'s NVLAP Accredited Laboratory (Lab Code 101631-0). Materials are positive for asbestos if they are found to contain greater than 1% or 1% asbestos.

Thermal Systems Insulation (TSI)

No suspect asbestos-containing TSI was identified on the subject Property.

If during the course of wall, ceiling or floor demolition, any TSI materials that are not listed in this report are uncovered, sampling ***must*** be performed prior to disturbing these materials.

Surface Materials

Suspect asbestos-containing **surfacing on wall** was identified on the west and south exterior walls. The material was sampled two times and found to contain ***1-3% Chrysotile asbestos***. (Sample # 14 & 16)

Suspect asbestos-containing **surfacing on wall** was identified on the north exterior wall. The material was sampled and no asbestos was detected. (Sample # 15)

If during the course of wall, ceiling or floor demolition, any surfacing materials not identified in this report are uncovered, sampling ***must*** be performed prior to disturbing these materials.

Miscellaneous Materials

Suspect asbestos-containing **CAB** was identified at the first rack in the main area – 1, west side. The material was sampled and found to contain ***60-65% Chrysotile asbestos***. (Sample #01)

Suspect asbestos-containing **window putty** was identified at the main area – 1, south and north interior wall and 2nd floor north and south wall. The material was sampled and no asbestos was detected. (Sample #02, 03, 17 & 18)

Suspect asbestos-containing **sealant at concrete seams** was identified at the main area – 1, center of floor. The material was sampled and found to contain ***1-3% Chrysotile asbestos***. (Sample #04)

Suspect asbestos-containing **sealant at concrete seams** was identified at the pot room, west end of floor. The material was sampled and no asbestos was detected. (Sample #05)

Suspect asbestos-containing **window putty** was identified at the Pot Room north wall exterior and interior and west wall exterior. The material was sampled and found to contain ***1-3% Chrysotile asbestos***. (Sample #06, 12 & 13)

Suspect asbestos-containing **window putty** was identified at the 2nd floor, north wall window 2. The material was sampled and found to contain ***<1% Chrysotile asbestos***. (Sample #19)

Suspect asbestos-containing **9 x 9 floor tile and associated mastic** was identified in the 2nd office. The material was sampled and found to contain ***5-7% Chrysotile asbestos in the tile and 7-10% Chrysotile asbestos in the mastic***. (Sample #09)

Suspect asbestos-containing **16x16 ceiling tiles** was identified in office 1. The material was sampled and no asbestos was detected. (Sample #10)

Suspect asbestos-containing **sealant** was identified at the exterior west wall of office 1. The material was sampled and no asbestos was detected. (Sample #11)

Miscellaneous Materials - continue

Suspect asbestos-containing **silver coat, rolled roofing and tar** was identified on the Pot roof, warehouse roof and addition sheet metal roof. The material was sampled and found to contain **1-3% Chrysotile asbestos in the tar** and **1-3% Chrysotile asbestos in the roofing**. (Sample #20, 22, 24, 25, & 26)

Suspect asbestos-containing **seam sealant** was identified on the Pot roof, and addition sheet metal roof. The material was sampled and found to contain **1-3% Chrysotile asbestos in the tar.** (Sample #21, & 27)

Suspect asbestos-containing **seam sealant** was identified at the warehouse roof. The material was sampled and no asbestos was detected. (Sample #23)

If during the course of wall, ceiling or floor demolition, any miscellaneous materials that are not listed in this report are uncovered, sampling ***must*** be performed prior to disturbing these materials.

Section 3.0 Asbestos Abatement Cost Estimate
Sound Battery – 2310 East 11th Street, Tacoma, WA

The following abatement costs are "best-effort" estimates and are based on current industry averages. The following estimates are subject to many variables beyond the control of PRE. Such variables include, but are not limited to: project duration, contractor work schedule, hours of work allowed by the owner, contractor performance, regulatory agency interpretation of changing regulations, logistics of removal of material and miscellaneous delays. The estimate is meant only as a guideline to assist in the selection of an abatement contractor and may not reflect the actual final costs of asbestos removal. They do not include owner costs such as abatement project oversight and monitoring for compliance to law, and compliance to project plans and/or specifications. These estimates assume that adequate, professional plans and specifications are prepared. Generally, abatement costs are minimized by professional project management as well as utilizing the same asbestos abatement contractor to remove all asbestos containing materials during a single project. It is in no way intended to serve as, or replace, a comprehensive abatement specification. Estimates include permitting, removal and disposal.

CAB (Main area 1)	25 Sq. Ft.	@	$125.00 Lump Sum	$ 125.00
Sealant in concrete (Main area 1)	90 Ln. Ft.	@	$ 3.00 Ln. Ft.	$ 270.00
Window Putty (Pot Room and 2nd floor window 2)	11 Windows	@	$100.00 Each	$ 1,100.00
9x9 Tile and Mastic (Office 2)	500 Sq. Ft.	@	$ 2.00 Sq. Ft.	$ 1,000.00
Surfacing (Exterior walls)	6300 Sq. Ft.	@	$ 5.00 Sq. Ft.	$31,500.00
Silver Coat, Rolled Roof and Tar (Pot Roof, Warehouse Roof and Addition Sheet Metal Roof)	6240 Sq. Ft.	@	$ 2.00 Sq. Ft.	$12,480.00
Seam and Edge Sealant (Pot Roof and Addition Sheet Metal Roof)	400 Ln. Ft.	@	$ 2.00 Ln. Ft.	$ 800.00
			TOTAL	**$47,275 .00**

Section 4.0 Statement of Compliance
Sound Battery – 2310 East 11th Street, Tacoma, WA

In accordance with W.A.C. 296-62-07721 and PSCAA Regulation III, Article 4, Pacific Rim Environmental, Inc. performed an asbestos survey of the subject structure located at 2310 East 11th Street, Tacoma, WA. Should employees or contract personnel encounter any suspect asbestos-containing materials (ACM) it is their responsibility to:

1. Contact a representative of the owner.
2. Consult the inspection report to determine whether or not the suspect material contains asbestos.
3. If the suspect material does not appear in the inspection report, then that material was not sampled and must be presumed to contain asbestos until proven otherwise by sampling and PLM analysis.
4. Ensure that all employees and contractors are informed and advised of the location and type of materials that contain asbestos.

The following asbestos-containing materials were identified at the subject property:

- CAB (Main Area 1)
- Sealant in Concrete (Main Area 1)
- Window Putty (Pot Room and 2nd floor north wall window 2)
- 9x9 Tile and Mastic (office 2)
- Surfacing (Exterior walls)
- Silver Coat, Rolled Roof and Tar (Pot Roof, Warehouse Roof and Addition Sheet Metal Roof)
- Seam and Edge Sealant (Pot Roof and Addition Sheet Metal Roof)

I Hereby Attest:

The inspection report has been made available to me. I will inform all subcontractors of the location and types of materials containing asbestos. I am authorized to sign on behalf of my company.

Contractor:		Owner's Rep:	
Signature:		Signature:	
Print Name:		Print Name:	
Title:		Title:	
Date:		Date:	

Section 5.0 Lead-Based Paint Screening Summary
Sound Battery – 2310 East 11th Street, Tacoma, WA

The inspection and testing performed on the interior and exterior painted surfaces of the subject Property did identify lead-based paint concentrations at or above the EPA/HUD standard of 1.0 mg/m^2

Lead-based Paint was identified in detectable concentrations on the following components:

White painted wood door and door jamb front office door.

White painted wood door jamb to lunch room.

White painted concrete interior wall and column west wall of pot room.

Bare concrete interior wall of south & southeast corner wall of pot room

Red painted metal window frame south wall window pot room.

Red painted metal beam strap 2nd floor, northwest corner & warehouse center.

Red painted concrete floor center of pot room.

Brown painted metal, exterior post, warehouse entrance.

The XRF sample results are provided in Appendix D.

The only state rules or regulations that currently apply to lead-based paints are WAC 296-155-17603 Scope* and WAC 296-155-17607 Permissible Exposure Limit**. The WAC code states that if lead is detectable in the workplace in any quantity, initial air monitoring must be performed on employees doing demolition, renovation or remodeling work in areas found to have materials containing lead. Also, workers performing lead removal must be trained in accordance with WAC 296-155-17625.

The EPA/HUD standard uses a criterion of 5,000 parts per million (PPM) dry weight or 1.0 milligrams per square centimeter (1.0 mg/cm2) for lead-based paint. However, if lead is detected in any concentration, Federal OSHA and Washington State Department of Labor and Industries regulations will still apply, since neither agency has established a concentration of lead in paint below which the lead in construction standards do not apply.

Section 6.0 Universal Waste Inventory
Sound Battery – 2310 East 11th Street, Tacoma, WA

Universal Waste Rules

The Universal Waste Rule (UWR) establishes alternative, streamlined waste management standards in place of most of the Dangerous Waste Regulations, Chapter 173-303 WAC, except for, WAC 173-303-050, 173-303-145 and 173-303-960.

The following lamp types may be characterized as universal waste: fluorescent tubes, high intensity discharge (HID) lamps (mercury vapor, metal halide, high pressure sodium) and compact fluorescent.

The following Universal Waste was identified:

- **Fluorescent tubes and fixtures**

  Approximately 62 four-foot fluorescent tubes

  Approximately 25 eight-foot fluorescent tubes

- **Mercury Thermostat Capsule**

  Two thermostat capsules

- **PCB Ballasts**

  Approximately 88 PCB ballasts

The universal waste must be removed and properly disposed of or recycled prior to building demolition.

Disposal of individual lamps is not regulated. However disposal of large quantities of lamps is subject to dangerous waste regulations (WAC 173-303) and the waste stream must be subjected to TCLP (Toxicity Characteristic Leaching Procedure) analysis to determine the amount of mercury that could leach out of the waste. The TCLP limit for mercury is 0.2 mg/L.

PCBs belong to a broad family of organic chemicals known as chlorinated hydrocarbons. PCBs are produced by the combination of one or more chlorine atoms and a biphenyl molecule. PCBs range in consistency from heavy oily liquids to waxy solids. Prior to 1979, PCBs were widely used in electrical equipment such as transformers, capacitors, switches, and voltage regulators.

A copy of the Washington State Department of Ecology *Universal Waste Rule for Dangerous Waste Lamps WAC 173-303-573*, Publication # 00-04-020 is provided in Appendix F.

A copy of the Universal Waste General Rule is provided in Appendix G.

Appendix A: **Asbestos Sample Summary**

Pacific Rim Environmental, Inc

Asbestos Summary

Project Name / Address: Sound Battery, 2310 E 11th ST, Tacoma, WA

Project ID	*Sample #*	*Sample Location*	*AHERA Category*	*Sample Description*	*Asbestos Type/%*	*Approximate Quant.*
14463	01	At first rack in main area-1, west side	Miscellaneous	CAB	Chrysotile 60-65%	25 Sq. Ft.
14463	02	Main area-1, south wall, window 5	Miscellaneous	window putty (interior)	None Detected	N/A
14463	03	Main area-1, north wall, interior window 2	Miscellaneous	window putty (interior)	None Detected	N/A
14463	04	Main area-1, center of floor	Miscellaneous	sealant at concrete seams	Chrysotile 1-3%	90 Lin. Ft.
14463	05	Pot room, west end of floor	Miscellaneous	sealant at concrete seams	None Detected	N/A
14463	06	Pot room, north side window 4	Miscellaneous	window putty (interior)	Chrysotile 1-3%	11 windows
14463	07	Pot room, southwest corner	Miscellaneous	red floor covering	None Detected (both layers)	N/A
14463	08	Sht metal addition, window 2	Miscellaneous	window putty	None Detected	N/A
14463	09	Office 2	Miscellaneous	9x9 tile and mastic	Layer 1 (Tile): Chrysotile 5-7%, Layer 2 (Mastic): Chrysotile 7-10%	500 Sq. Ft.
14463	10	Office 1	Miscellaneous	16x16 ceiling tile	None Detected	N/A
14463	11	Exterior west wall at office 1 entrance	Miscellaneous	sealant	None Detected	N/A
14463	12	North wall exterior, window 4	Miscellaneous	window putty	Chrysotile 1-3%	See sample #06

Project ID	*Sample #*	*Sample Location*	*AHERA Category*	*Sample Description*	*Asbestos Type/%*	*Approximate Quant.*
14463	13	West wall exterior, window 4	Miscellaneous	window putty	Chrysotile 1-3%	See sample #06
14463	14	West wall exterior	Surfacing	surfacing on wall	Chrysotile 1-3%	6,300 Sq. Ft.
14463	15	North wall exterior	Surfacing	surfacing on wall	None Detected	N/A
14463	16	South wall exterior	Surfacing	surfacing on wall	Chrysotile 1-3%	See sample #14
14463	17	South exterior, bottom window 3	Miscellaneous	window putty	None Detected	N/A
14463	18	2nd Floor, north wall, window 4	Miscellaneous	window putty	None Detected	N/A
14463	19	2nd Floor, north wall, window 2	Miscellaneous	window putty	Chrysotile <1%	See sample #06
14463	20	Pot roof	Miscellaneous	silver coat and tar	Layer 1: None Detected, Layer 2 (Tar): Chrysotile 3-5%	2,100 Sq. Ft.
14463	21	Pot roof	Miscellaneous	seam sealant	Layers 1 & 3: None Detected, Layer 2 (Tar): Chrysotile 1-3%	200 Sq. Ft.
14463	22	Warehouse roof	Miscellaneous	silver coat and tar	Layer 1: None Detected, Layer 2 (Tar material): Chrysotile 1-3%	2,800 Sq. Ft.
14463	23	Warehouse roof	Miscellaneous	seam sealant	None Detected	N/A
14463	24	Pot roof	Miscellaneous	rolled roof and silver coat	Layers 1 & 3: None Detected, Layer 2 (Roofing): Chrysotile 1-3%	See sample #20
14463	25	Warehouse roof	Miscellaneous	silver coat and rolled roof	Layers 1 & 3: None Detected, Layer 2 (Roofing): Chrysotile 1-3%	See sample #22
14463	26	Addition sht metal, back area	Miscellaneous	silver coat and rolled roof	Layer 1: None Detected, Layer 2 (Roofing): Chrysotile 1-3%	1,340 Sq. Ft.
14463	27	Addition sht metal, back area	Miscellaneous	sealant on edges	Chrysotile 1-3%	200 Sq. Ft.

Appendix B: **Bulk Sample Analysis Report**

PRE

PACIFIC RIM ENVIRONMENTAL, INC.

SEATTLE [illegible] ANCHORAGE

BULK SAMPLE ANALYSIS REPORT

CLIENT:	Enco Environmental Corporation P.O. Box 1212 Puyallup, WA 98371	PRE # :	14463
		REPORT # :	2011-07-206
		DATE RECEIVED :	07/18/2011
		ANALYST :	William F. Golloway
PROJECT:	Sound Battery 2310 E. 11th St. Tacoma, WA	DATE ANALYZED :	07/20/2011 & 07/21/11
		REPORT BY :	Dai Le
		REPORT DATE :	07/22/2011
		TURNAROUND:	3 Days
SAMPLE DATE:	07/18/2011	PAGE :	1 of 6

Attached are the results of analysis of 27 bulk samples submitted for asbestos identification: lab ID #2011-07-206 through 2011-07-232.

Samples were analyzed in accordance with method EPA-600/R-93/116: "Method for the Determination of Asbestos in Bulk Building Materials".

Unless otherwise noted, samples were inhomogeneous; subsamples of components were analyzed to achieve representative analysis. Separate layers of layered samples are analyzed and reported separately. Unless otherwise stated, asbestos content was quantified by calibrated visual estimation (CVES). CVES concentrations are reported in 2 to 3 percent ranges for fiber concentrations ranging from 1-10%, and 5 percent ranges for concentrations greater than 10%. Samples in which asbestos was not observed are reported as "none detected".

Limitations and Uncertainty:

Factors such as sample quality, sample size, interfering matrix material, fiber size, and fiber concentration contribute to the uncertainty of asbestos concentration measurements in bulk materials. Relative errors exceeding 100% may occur in samples containing <1-10% asbestos. Relative errors are typically below 30% in samples with greater than 10% asbestos, and approach zero as the asbestos concentration approaches 100%.

Asbestos fibers with diameters below approximately 0.25 micrometers are not detectable by PLM. These extremely fine fibers may occur in such products as floor tile, adhesives, and cement products. This limitation can be overcome, however, by the use of alternate analytical methods, such as Transmission Electron Microscopy (TEM).

This report cannot be represented by the client to claim product endorsement by NVLAP or any agency of the U.S. Government. Test results pertain only to the samples submitted for analysis.

This report shall not be reproduced except in full without written permission of the laboratory.

NVLAP Accredited LAB #: 101631-0
Samples submitted by: PRE

Reports Reviewed By:

Approved Signatory

Pacific Rim Environmental, Inc.
BULK SAMPLE ANALYSIS REPORT

CLIENT:	Enco Environmental Corporation P.O. Box 1212 Puyallup, WA 98371	PRE # :	**14463**
		REPORT # :	2011-07-206
		DATE RECEIVED :	07/18/2011
PROJECT:	Sound Battery 2310 E. 11th St. Tacoma, WA	ANALYST :	William F. Golloway
		DATE ANALYZED :	07/20/2011 & 07/21/11
		REPORT BY :	Dai Le
SAMPLE DATE:	07/18/2011	REPORT DATE :	07/22/2011
TURNAROUND:	3 Days	PAGE :	2 of 6

Field/Lab ID Number	Sample Location and Description	Asbestos Type(s) / %	Other Material(s)	Date Analyzed
01 2011-07-206	**At first rack in main area-1, west side (CAB).** White, fibrous insulation material with black surface residue.	**Chrysotile 60-65%**	Fibrous Glass (10-15%), Cellulose (<1%), Binder, Soot.	07/20/11
02 2011-07-207	**Main area-1, south wall, window 5 (window putty).** Light gray, brittle window putty material.	None Detected	Cellulose (<1%), Binder, Mineral Aggregate, Paint.	07/20/11
03 2011-07-208	**Main area-1, north wall, interior window 2 (window putty).** Green-painted, light grayish-brown, brittle window putty with brown surface residue.	None Detected	Cellulose (<1%), Binder, Mineral Aggregate, Paint, Ash.	07/20/11
04 2011-07-209	**Main area-1, center of floor (sealant at concrete seams).** Red-painted, black tar material.	**Chrysotile 1-3%**	Cellulose (7-10%), Tar, Mineral Aggregate, Paint.	07/20/11
05 2011-07-210	**Pot room, west end of floor (sealant at concrete seams).** Red-painted, black tar material.	None Detected	Cellulose (7-10%), Tar, Paint, Mineral Aggregate.	07/20/11
06 2011-07-211	**Pot room, north side window 4 (window putty).** White, brittle putty with gray surface residue.	**Chrysotile 1-3%**	Cellulose (<1%), Binder, Mineral Aggregate.	07/20/11

Pacific Rim Environmental, Inc.
BULK SAMPLE ANALYSIS REPORT

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		DATE RECEIVED :	07/18/2011
PROJECT:	Sound Battery 2310 E. 11th St. Tacoma, WA	ANALYST :	William F. Golloway
		DATE ANALYZED :	07/20/2011 & 07/21/11
		REPORT BY :	Dai Le
SAMPLE DATE:	07/18/2011	REPORT DATE :	07/22/2011
TURNAROUND:	3 Days	PAGE :	3 of 6

Field/Lab ID Number	Sample Location and Description	Asbestos Type(s) / %	Other Material(s)	Date Analyzed
07 2011-07-212	**Pot room, southwest corner (red floor covering).** Red-painted, gray cement material (layer 1) on black tar material with red gravel (layer 2).	**Layer 1** (Cement material): None Detected **Layer 2** (Tar material): None Detected	**Layer 1:** Mineral Aggregate, Cement Binder, Paint. **Layer 2:** Cellulose (5-7%), Tar, Mineral Aggregate.	07/20/11
08 2011-07-213	**Sheet metal addition, window 2 (window putty).** Gray, brittle window putty.	None Detected	Cellulose (<1%), Binder, Mineral Aggregate.	07/20/11
09 2011-07-214	**Office 2 (9x9 tile and mastic).** Light gray floor tile with green, pink, brown, white, and yellow splotches (layer 1) and black tar mastic (layer 2).	**Layer 1** (Tile): **Chrysotile 5-7%** **Layer 2** (Mastic): **Chrysotile 7-10%**	**Layer 1:** Mineral Aggregate, Binder. **Layer 2:** Cellulose (<1%), Tar, Mineral Aggregate.	07/20/11
10 2011-07-215	**Office 1 (16x16 ceiling tile).** Brown, fibrous material with gray surface residue.	None Detected	Cellulose (85-90%), Binder.	07/20/11
11 2011-07-216	**Exterior west wall at office 1 entrance (sealant at front porch to wall).** Black tar clump with pale green and white paint.	None Detected	Cellulose (10-15%), Animal Hair (<1%), Tar, Mineral Aggregate.	07/20/11
12 2011-07-217	**North wall exterior, window 4 (window putty).** Brown-painted, white to light gray-brown, brittle window putty.	**Chrysotile 1-3%**	Cellulose (<1%), Binder, Mineral Aggregate, Paint.	07/20/11

Pacific Rim Environmental, Inc.
BULK SAMPLE ANALYSIS REPORT

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		REPORT # :	2011-07-206
		DATE RECEIVED :	07/18/2011
PROJECT:	Sound Battery 2310 E. 11th St. Tacoma, WA	ANALYST :	William F. Golloway
		DATE ANALYZED :	07/20/2011 & 07/21/11
		REPORT BY :	Dai Le
SAMPLE DATE:	07/18/2011	REPORT DATE :	07/22/2011
TURNAROUND:	3 Days	PAGE :	4 of 6

Field/Lab ID Number	Sample Location and Description	Asbestos Type(s) / %	Other Material(s)	Date Analyzed
13 2011-07-218	**West wall exterior, window 4 (window putty).** Brown-painted, light grayish-brown, brittle window putty.	**Chrysotile 1-3%**	Cellulose (<1%), Binder, Mineral Aggregate, Paint.	07/20/11
14 2011-07-219	**West wall exterior (surfacing on wall).** White-painted, white, chalky texture material.	**Chrysotile 1-3%**	Cellulose (<1%), Binder, Mineral Aggregate, Paint.	07/20/11
15 2011-07-220	**North wall exterior (surfacing on wall).** White-painted, gray cement material.	None Detected	Cellulose (<1%), Mineral Aggregate, Binder, Paint.	07/20/11
16 2011-07-221	**South wall exterior (surfacing on wall).** White-painted, white, chalky texture material.	**Chrysotile 1-3%**	Cellulose (<1%), Binder, Mineral Aggregate, Paint.	07/20/11
17 2011-07-222	**South exterior, bottom window 3 (window putty).** Brown-painted, light gray, brittle window putty.	None Detected	Cellulose (<1%), Binder, Mineral Aggregate, Paint.	07/20/11
18 2011-07-223	**2nd Floor, north wall, window 4, interior (window putty).** White, brittle window putty with gray surface residue.	None Detected	Cellulose (<1%), Binder, Mineral Aggregate.	07/20/11
19 2011-07-224	**2nd Floor, south wall, window 2, interior (window putty).** White, brittle window putty with gray paint.	**Chrysotile <1%**	Cellulose (<1%), Binder, Mineral Aggregate, Paint.	07/20/11

Pacific Rim Environmental, Inc.
BULK SAMPLE ANALYSIS REPORT

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		REPORT # :	2011-07-206
		DATE RECEIVED :	07/18/2011
PROJECT:	Sound Battery 2310 E. 11th St. Tacoma, WA	ANALYST :	William F. Golloway
		DATE ANALYZED :	07/20/2011 & 07/21/11
		REPORT BY :	Dai Le
SAMPLE DATE:	07/18/2011	REPORT DATE :	07/22/2011
TURNAROUND:	3 Days	PAGE :	5 of 6

Field/Lab ID Number	Sample Location and Description	Asbestos Type(s) / %	Other Material(s)	Date Analyzed
20 2011-07-225	**Pot roof (silver coat and tar).** Silver paint/coating (layer 1) on black tar material (layer 2).	**Layer 1** (Paint): None Detected **Layer 2** (Tar): **Chrysotile 3-5%**	**Layer 1:** Binder, Mineral Aggregate. **Layer 2:** Cellulose (<1%), Tar, Mineral Aggregate.	07/20/11
21 2011-07-226	**Pot roof (seam sealant).** Tar on white paint (layer 1) on tar on green paint (layer 2) on white to light gray, brittle and chalky material (layer 3).	**Layers 1** (Tar): None Detected **Layer 2** (Tar): **Chrysotile 1-3%** **Layer 3** (Gray material): None Detected	**Layer 1:** Cellulose (10-15%), Tar, Mineral Aggregate, Paint. **Layer 2:** Cellulose (<1%), Tar, Mineral Aggregate, Paint. **Layer 3:** Cellulose (<1%), Binder, Mineral Aggregate.	07/21/11
22 2011-07-227	**Warehouse roof (silver coat and tar).** Silver-paint/coating (layer 1) with black tar material (layer 2).	**Layer 1** (Paint/coating): None Detected **Layer 2** (Tar material): **Chrysotile 1-3%**	**Layer 1:** Cellulose (<1%), Binder, Mineral Aggregate. **Layer 2:** Cellulose (<1%), Synthetics (10-15%), Tar, Mineral Aggregate.	07/21/11
23 2011-07-228	**Warehouse roof (seam sealant).** Black tar material.	None Detected	Cellulose (7-10%), Tar, Mineral Aggregate.	07/21/11
24 2011-07-229	**Pot roof (rolled roof and silver coat).** Silver coating (layer 1) on black tar roofing (layer 2) on black tar roofing (layer 3).	**Layers 1** (Coating): None Detected **Layer 2** (Roofing): **Chrysotile 1-3%** **Layer 3** (Roofing): None Detected	**Layer 1:** Cellulose (<1%), Binder, Mineral Aggregate. **Layer 2:** Cellulose (<1%), Fiberglass (7-10%), Tar, Mineral Aggregate. **Layer 3:** Cellulose (20-25%), Tar, Mineral Aggregate.	07/21/11

Pacific Rim Environmental, Inc.
BULK SAMPLE ANALYSIS REPORT

CLIENT:	Enco Environmental Corporation P.O. Box 1212 Puyallup, WA 98371	PRE # :	14463
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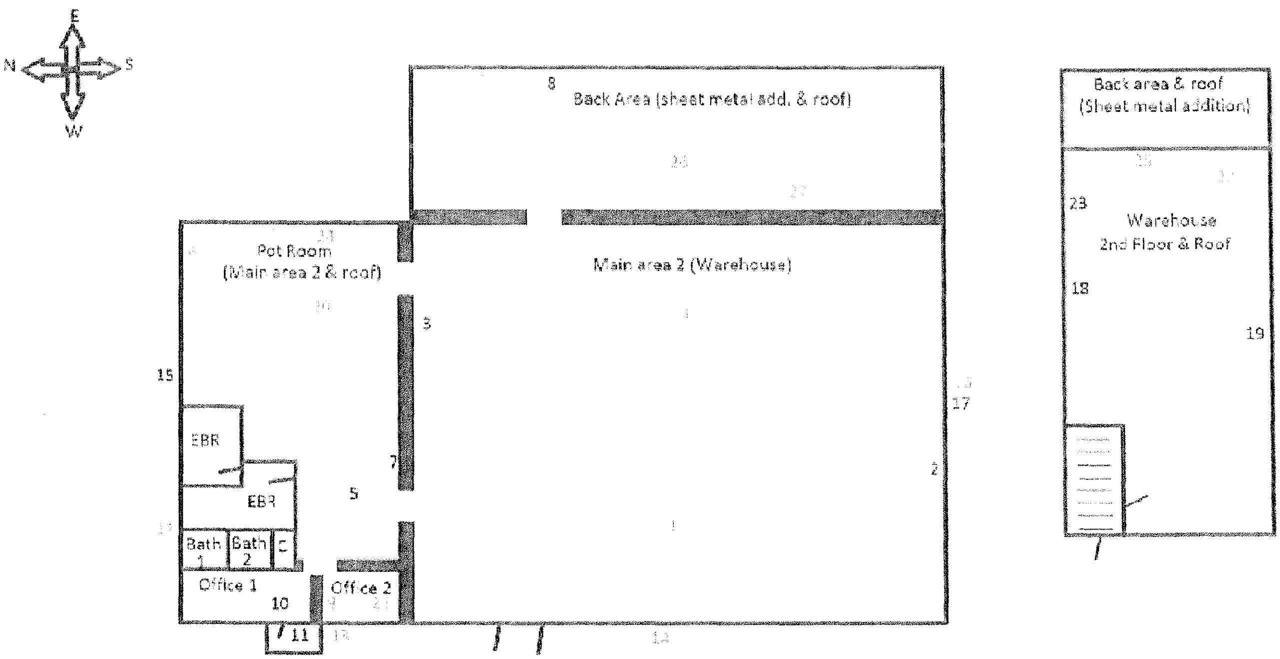
PROJECT:	Sound Battery 2310 E. 11th St. Tacoma, WA	ANALYST :	William F. Golloway
		DATE ANALYZED :	07/20/2011 & 07/21/11
		REPORT BY :	Dai Le
SAMPLE DATE:	07/18/2011	REPORT DATE :	07/22/2011
TURNAROUND:	3 Days	PAGE :	6 of 6

Field/Lab ID Number	Sample Location and Description	Asbestos Type(s) / %	Other Material(s)	Date Analyzed
25 2011-07-230	**Warehouse roof (silver coat and rolled roof).** Silver coating (layer 1) on black tar roofing (layer 2) on black tar roofing (layer 3) on black tar roofing (layer 4).	**Layers 1** (Coating): None Detected **Layer 2** (Roofing): **Chrysotile 1-3%** **Layer 3** (Roofing): None Detected **Layer 4** (Roofing): None Detected	**Layer 1:** Cellulose (<1%), Mineral Aggregate, Binder. **Layer 2:** Cellulose (<1%), Synthetics (3-5%), Tar, Mineral Aggregate. **Layer 3:** Cellulose (30-35%), Tar, Mineral Aggregate. **Layer 4:** Cellulose (30-35%), Tar, Mineral Aggregate.	07/21/11
26 2011-07-231	**Addition sheet metal, back area (silver coat and rolled roof).** Silver coating (layer 1) on black tar roofing (layer 2).	**Layers 1** (Coating): None Detected **Layer 2** (Roofing): **Chrysotile 1-3%**	**Layer 1:** Cellulose (<1%), Mineral Aggregate, Binder. **Layer 2:** Cellulose (20-25%), Synthetics (3-5%), Tar, Mineral Aggregate.	07/21/11
27 2011-07-232	**Addition sheet metal, back area (sealant on edges).** Black tar material with gray surface hue and silver coat residue.	**Chrysotile 1-3%**	Cellulose (7-10%), Fiberglass (<1%), Tar, Mineral Aggregate, Adhesive.	07/21/11

Appendix C: **Sample Location Drawings**



Sample #	Sample Location	Sample Description
01	At first rack in main area-1, west side	CAB
02	Main area-1, south wall, window 5	window putty
03	Main area-1, north wall, interior window 2	window putty
04	Main area-1, center of floor	sealant at concrete seams
05	Pot room, west end of floor	sealant at concrete seams
06	Pot room, north side window 4	window putty
07	Pot room, southwest corner	red floor covering
08	Sheet metal addition, window 2	window putty
09	Office 2	9x9 tile and mastic
10	Office 1	16x16 ceiling tile
11	Exterior west wall at office 1 entrance	sealant
12	North wall exterior, window 4	window putty
13	West wall exterior, window 4	window putty
14	West wall exterior	surfacing on wall
15	North wall exterior	surfacing on wall
16	South wall exterior	surfacing on wall
17	South exterior, bottom window 3	window putty
18	2nd Floor, north wall, window 4	window putty

Red = Sample positive for asbestos.

Page1 of 2

Enco Env. Corp. P.O. Box 1212 Puyallup, WA 98371	*Pacific Rim Environmental, Inc* 6510 Southcenter Boulevard, #4 Tukwila, WA 98188 Tel. (206) 244-8965 FAX (206) 244-9096	Project #: 14463 Drawing #: 01 Sampling Date: 7/18/2011 Drawing By: Dai Le Drawing Not To Scale

Sample #	Sample Location	Sample Description
19	2nd Floor, north wall, window 2	window putty
20	Pot roof	silver coat and tar
21	Pot roof	seam sealant
22	Warehouse roof	silver coat and tar
23	Warehouse roof	seam sealant
24	Pot roof	rolled roof and silver coat
25	Warehouse roof	silver coat and rolled roof
26	Addition sheet metal, back area	silver coat and rolled roof
27	Addition sheet metal, back area	sealant on edges

Red Sample positive for asbestos.

Enco Env. Corp. P.O. Box 1212 Puyallup, WA 98371	*Pacific Rim Environmental, Inc* 6510 Southcenter Boulevard, #4 Tukwila, WA 98188 Tel (206) 244-8965 FAX (206) 244-9096	Project #: 14463 Drawing #: 01 Sampling Date: 7/18/2011 Drawing By: Dai Le Drawing Not To Scale

Appendix D: **XRF Data Sheets**

Client:	Enco Environmental Corporation P.O. Box 1212 Puyallup, WA 98371	XRF Serial #: Inspection Date: Inspection By:	XLP303A-7029 18-Jul-2011 Todd Carter
Project:	Sound Battery 2310 E. 11th St. Tacoma, WA	PRE Job#:	14463

PRE#	Test #	Substrate	Component / Side	Description / Location	Color	Result	Pbc mg/cm2
1	363	*First calibration check*				Positive	1
2	364	*First calibration check*				Negative	0.9
3	365	*First calibration check*				Positive	1.2
4	366	Concrete	Exterior wall	Front of office building	Ivory	Negative	-0.41
5	367	Concrete	Exterior wall	Front of office building	Ivory	Negative	0.03
6	368	Wood	Door jamb	Front office door	White	Positive	3
7	369	Wood	Door	Front office door	White	Positive	5.4
8	370	Concrete	Exterior sill	Front office windows	Ivory	Negative	0.15
9	371	Concrete	Exterior wall CMU	Front of waehouse	Ivory	Negative	0.07
10	372	Concrete	Floor	Electrical room	Red	Negative	0.8
11	373	Concrete	Interior wall east	Front corner waehouse	Green	Negative	0.2
12	374	Concrete	Interior wall north	Front of waehouse	Green	Negative	0.1
13	375	Concrete	Interior column	Warehouse at breaker	Green	Negative	0.18
14	376	Wood	Door jamb	Door to lunch room	White	Positive	7.5
15	377	Concrete	Interior wall	Bathroom	Blue	Negative	0.19
16	378	Concrete	Interior column	West wall pot room	White	Positive	3
17	379	Concrete	Interior wall	West wall pot room	White	Positive	1.9

Client:	Enco Environmental Corporation P.O. Box 1212 Puyallup, WA 98371	XRF Serial #: Inspection Date: Inspection By:	XLP303A-7029 18-Jul-2011 Todd Carter
Project:	Sound Battery 2310 E. 11th St. Tacoma, WA	PRE Job#:	14463

PRE#	Test #	Substrate	Component / Size	Description / Location	Color	Result	Pbc mg/cm2
18	380	Concrete	Interior wall	South wall pot room	White	Negative	0.3
19	381	Concrete	Interior wall	South wall pot room	Bare	Positive	1.5
20	382	Concrete	Interior wall	Southeast corner, pot room	Bare	Positive	2.2
21	383	Concrete	Interior wall	South wall pot room	White	Negative	0.11
22	384	Concrete	Interior wall	South wall pot room	White	Negative	0.15
23	385	Concrete	Interior wall	South wall pot room	Green	Negative	0.12
24	386	Concrete	Interior wall	West wall pot room	White	Negative	0.21
25	387	Concrete	Interior CMU wall	North wall metal addition	Green	Negative	0.11
26	388	Concrete	Tank pad	Acid tank area	Yellow	Negative	0.05
27	389	Concrete	Floor	Southwest corner acid tank area	Red	Negative	0.16
28	390	Concrete	Exterior wall	South wall pot room	Yellow	Negative	0.17
29	391	Metal	Window frame	South wall window pot room	Red	Positive	6.8
30	392	Metal	Window frame	South wall metal addition	Bare	Negative	0.04
31	393	Concrete	Exterior wall	West wall warehouse	Ivory	Negative	0.3
32	394	Concrete	Exterior sill	West wall window warehouse	Ivory	Negative	0.29
33	395	Metal	Window frame	West wall window warehouse	Red	Negative	0.03
34	396	Metal	Window frame	West wall window warehouse	Red	Negative	0.03
35	397	Wood	6x6 post	Metal addition mezzanine	Red	Negative	0.06
36	398	Wood	Stair tread	Stairs to 2nd floor	Red	Negative	0.6
37	399	Wood	Post 6x8	2nd floor	Bare	Negative	0
38	400	Wood	Roof beams	2nd floor	Bare	Negative	0
39	401	Wood	2x6 T&G roof	2nd floor	Bare	Negative	0
40	402	Metal	Beam strap	2nd floor, northwest corner	Red	Positive	2.5

Client:	Enco Environmental Corporation P.O. Box 1212 Puyallup, WA 98371	XRF Serial #:	XLP303A-7029
		Inspection Date:	18-Jul-2011
		Inspection By:	Todd Carter
Project:	Sound Battery 2310 E. 11th St. Tacoma, WA	PRE Job#:	14463

PRE#	Test #	Substrate	Component / Side	Description / Location	Color	Result	Pbc mg/cm^2
41	403	Concrete	Interior CMU wall	2nd floor, east wall	Bare	Negative	0.01
42	404	Wood	8x8 post	Warehouse center	Bare	Negative	0.08
43	405	Wood	8x8 post	Warehouse center	Bare	Negative	0.09
44	406	Wood	8x8 post	South end waehouse center	Black	Negative	0.23
45	407	Concrete	Floor	Center of pot room	Red	Positive	2.3
46	408	Concrete	Floor	Center of pot room	Bare	Negative	0.3
47	409	Metal	Exterior post	Warehouse entrance	Brown	Positive	9.7
48	410	Wood	Beam main	Warehouse center	Bare	Negative	0.01
49	411	Wood	Beam cross	Warehouse center	Bare	Negative	0.02
50	412	Metal	Beam strap	Warehouse center	Red	Positive	1.6
51	413	*Last calibration check*				Positive	1.1
52	414	*Last calibration check*				Positive	1.1
53	415	*Last calibration check*				Positive	1.1

Report By: Dai Le
Report Date: 21-Jul-2011

Appendix E: **XRF Performance Characteristic Sheet**

Performance Characteristic Sheet

EFFECTIVE DATE: **September 24, 2004** **EDITION NO.: 1**

MANUFACTURER AND MODEL:

Make:	*Niton LLC*
Tested Model:	*XLp 300*
Source:	^{109}Cd
Note:	This PCS is also applicable to the equivalent model variations indicated below, for the Lead-in-Paint K+L variable reading time mode, in the XLi and XLp series:

XLi 300A, XLi 301A, XLi 302A and XLi 303A.
XLp 300A, XLp 301A, XLp 302A and XLp 303A.
XLi 700A, XLi 701A, XLi 702A and XLi 703A.
XLp 700A, XLp 701A, XLp 702A, and XLp 703A.

Note: The XLi and XLp versions refer to the shape of the handle part of the instrument. The differences in the model numbers reflect other modes available, in addition to Lead-in-Paint modes. The manufacturer states that specifications for these instruments are identical for the source, detector, and detector electronics relative to the Lead-in-Paint mode.

FIELD OPERATION GUIDANCE

OPERATING PARAMETERS:

Lead-in-Paint K+L variable reading time mode.

XRF CALIBRATION CHECK LIMITS:

0.8 to 1.2 mg/cm^2 (inclusive)

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film).

If readings are outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instruments into control before XRF testing proceeds.

SUBSTRATE CORRECTION:

For XRF results using Lead-in-Paint K+L variable reading time mode, substrate correction is <u>not</u> needed for:

Brick, Concrete, Drywall, Metal, Plaster, and Wood

INCONCLUSIVE RANGE OR THRESHOLD:

K+L MODE READING DESCRIPTION	SUBSTRATE	THRESHOLD (mg/cm^2)
Results not corrected for substrate bias on any substrate	Brick	1.0
	Concrete	1.0
	Drywall	1.0
	Metal	1.0
	Plaster	1.0
	Wood	1.0

BACKGROUND INFORMATION

EVALUATION DATA SOURCE AND DATE:

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown on this sheet are calculated from the EPA/HUD evaluation using archived building components. Testing was conducted in August 2004 on 133 testing combinations. The instruments that were used to perform the testing had new sources; one instrument's was installed in November 2003 with 40 mCi initial strength, and the other's was installed June 2004 with 40 mCi initial strength.

OPERATING PARAMETERS:

Performance parameters shown in this sheet are applicable only when properly operating the instrument using the manufacturer's instructions and procedures described in Chapter 7 of the HUD Guidelines.

SUBSTRATE CORRECTION VALUE COMPUTATION:

Substrate correction is not needed for brick, concrete, drywall, metal, plaster or wood when using Lead-in-Paint K+L variable reading time mode, the normal operating mode for these instruments. If substrate correction is desired, refer to Chapter 7 of the HUD Guidelines for guidance on correcting XRF results for substrate bias.

EVALUATING THE QUALITY OF XRF TESTING:

Randomly select ten testing combinations for retesting from each house or from two randomly selected units in multifamily housing. Use the K+L variable time mode readings.

Conduct XRF retesting at the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

> Compute the Retest Tolerance Limit by the following steps:
>
> > Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family housing a result is defined as the average of three readings. In multifamily housing, a result is a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.
> >
> > > Calculate the average of the original XRF result and retest XRF result for each testing combination.
> > >
> > > Square the average for each testing combination.
> > >
> > > Add the ten squared averages together. Call this quantity C.
> > >
> > > Multiply the number C by 0.0072. Call this quantity D.
> > >
> > > Add the number 0.032 to D. Call this quantity E.
> > >
> > > Take the square root of E. Call this quantity F.
>
> Multiply F by 1.645. The result is the Retest Tolerance Limit.
>
> Compute the average of all ten original XRF results.
>
> Compute the average of all ten re-test XRF results.
>
> Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

TESTING TIMES:

For the Lead-in-Paint K+L variable reading time mode, the instrument continues to read until it is moved away from the testing surface, terminated by the user, or the instrument software indicates the reading is complete. The following table provides testing time information for this testing mode. The times have been adjusted for source decay, normalized to the initial source strengths as noted above. Source strength and type of substrate will affect actual testing times. At the time of testing, the instruments had source strengths of 26.6 and 36.6 mCi.

Testing Times Using K+L Reading Mode (Seconds)

	All Data			Median for laboratory-measured lead levels (mg/cm^2)		
Substrate	25th Percentile	Median	75th Percentile	Pb < 0.25	0.25 ≤ Pb<1.0	1.0 ≤ Pb
Wood Drywall	4	11	19	11	15	11
Metal	4	12	18	9	12	14
Brick Concrete Plaster	8	16	22	15	18	16

CLASSIFICATION RESULTS:

XRF results are classified as positive if they are greater than or equal to the threshold, and negative if they are less than the threshold.

DOCUMENTATION:

A document titled *Methodology for XRF Performance Characteristic Sheets* provides an explanation of the statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. For a copy of this document call the National Lead Information Center Clearinghouse at 1-800-424-LEAD.

This XRF Performance Characteristic Sheet was developed by the Midwest Research Institute (MRI) and QuanTech, Inc., under a contract between MRI and the XRF manufacturer. HUD has determined that the information provided here is acceptable when used as guidance in conjunction with Chapter 7, Lead-Based Paint Inspection, of HUD's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*.

Appendix F: **Universal Waste Rule WAC 173-303-573**

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Focus

Universal Waste Rule for Dangerous Waste Lamps WAC 173-303-573

Background

The Universal Waste Rule (UWR) establishes alternative, streamlined waste management standards in place of most of the Dangerous Waste Regulations, Chapter 173-303 WAC, except for, WAC 173-303-050, 173-303-145 and 173-303-960. Universal wastes are certain dangerous wastes that are frequently generated, and that are able to be managed appropriately under less stringent regulatory requirements. The Universal Waste Rule for batteries and mercury-containing thermostats has been in place in Washington State since 1998. For more information on the original UWR, refer to Ecology publication number 98-407 (Revised).

In June 2000, Ecology added lamps that are dangerous waste to the UWR. This rule replaces the "Interim Policy on Waste Management of Spent Fluorescent Light Tubes," dated January 30, 1995.

Universal Waste Categories of Lamps

The types of lamps that may be universal waste include:

- Fluorescent tubes
- High density (HID) lamps (mercury vapor, metal halide, high pressure sodium)
- Compact fluorescent
- Neon lamps[1]
- Any other lamps that are dangerous waste

[1] *"Neon" lamp manufacturers do not always use the inert gas neon, some are manufactured using mercury and phosphor powder.*

June 2000

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Publication # 00-04-020

Why Do We Care About Lamps?

Nationally, about 600 million lamps are disposed of annually, most to solid waste disposal facilities, including landfills and solid waste incinerators. In fluorescent lamps, mercury is the main concern and is present in lamps primarily in vapor form.

- ➢ The average mercury content in a fluorescent tube manufactured in 1999 is approximately 12 milligrams.
- ➢ Pre-1999 manufactured fluorescent tubes can have from 15 to 50 milligrams.
- ➢ High intensity discharge lamps may contain up to 250 milligrams, depending on the lamp wattage.

During solid waste handling and disposal many lamps break releasing mercury vapor and potentially exposing solid waste handlers to inhalation of those vapors. Solid waste incineration of mercury containing lamps also releases the mercury into the atmosphere. Mercury in the atmosphere is eventually deposited back to the earth.

Health & Environmental Hazards of Mercury

- Health risk from inhalation or absorption
- Causes neurological disorders
- Persistent, bioaccumulative and toxic
- Major cause of contaminated fish advisories

Some lamps may also contain lead in the glass and lead solder used in the lamp base. Lead is a toxic metal that may leach from solid waste landfills into the ground water. Manufacturers are eliminating the lead by using nonleaded glass and solders in newer lamps.

How to Know if a Lamp is Dangerous Waste

Lamps are known to designate as dangerous waste because of their mercury and/or lead content. Lamps may be assumed to be dangerous waste, they may be "book designated" using manufacturers' information, or they may be designated through sampling and testing.

Certain "green" lamps are available that contain less mercury and do not designate as dangerous waste. Ask your lamp manufacturer for data sheets to use when making waste determinations for these lamps. Check with your local health department, solid waste agency, or landfill for recycling or disposal options.

Should Fluorescent Lamps Still be Used?

YES! Fluorescent tubes use one-quarter of the energy used by incandescent lamps for the same amount of light and last as much as ten times longer than incandescent bulbs. Compact fluorescent lamps last far longer than conventional tubes. The lamps used for lighting streets, playfields, and parking lots should also be selected for energy conservation. Energy conservation reduces mercury emissions from fossil fuel burning power plants. Using less electricity – which we can do by using energy-saving lighting – is the best protection for health and the environment.

Who is Affected by the UWR for Lamps?

- Regulated generators of dangerous waste (Medium Quantity and Large Quantity Generators)
- Businesses that generate or accumulate dangerous waste lamps in regulatedquantities (this category may include commercial building/property owners that maintain the lighting for tenants)
- Businesses that provide collection and management services (e.g., lighting contractors)

Regulated generators of dangerous waste generate over 220 pounds of total dangerous waste per month or batch (or 2.2 pounds of extremely hazardous waste), or accumulate greater than 2,200 pound of dangerous waste (or 2.2 pounds of extremely hazardous waste) at any time. As a point of reference, four (4), four-foot long, linear fluorescent tubes equal approximately 2.2 pounds. It would take about 400 of those tubes to equal 220 pounds and approximately 4,000 of those tubes to equal 2,200 pounds.

***NOTE:** Small Quantity Generators (SQGs) are exempt from the UWR (they are subject to WAC 173-303-070(8)) and can manage dangerous waste lamps as SQG dangerous waste. Households are also exempt from the rule. Local governments and/or landfills, however, may restrict disposal by SQGs and households. (If a SQG generates dangerous waste lamps in quantities that would put them into a higher generator category, they should choose to manage those lamps as universal waste to retain their SQG status.*

Under the UWR, there are small quantity handlers, large quantity handlers, transporters and destination facilities.

- Handlers are the generators of the universal waste or businesses that receive and collect universal waste before shipping to another handler or to a destination facility.
- Transporters transport the lamps between handlers, or to a destination facility.
- Destination facilities recycle the lamps, or provide treatment, storage and disposal to a dangerous waste landfill.

NOTE: Businesses that generate and manage dangerous wastes and universal wastes are considered both a dangerous waste generator, and a universal waste handler.

Significant Benefits

Benefits for managing dangerous waste lamps as universal waste include:

- Waste is not counted toward waste generation totals to determine generator status.
- Waste is not reported on the Dangerous Waste Annual Report.
- Waste does not need to be manifested when sent off-site.
- Accumulation time limit for universal waste is increased to one year.

What is the Difference Between the 1998 UWR and the UWR with Lamps?

There is one significant difference regarding when a lamp handler becomes a large quantity handler, subject to more requirements:

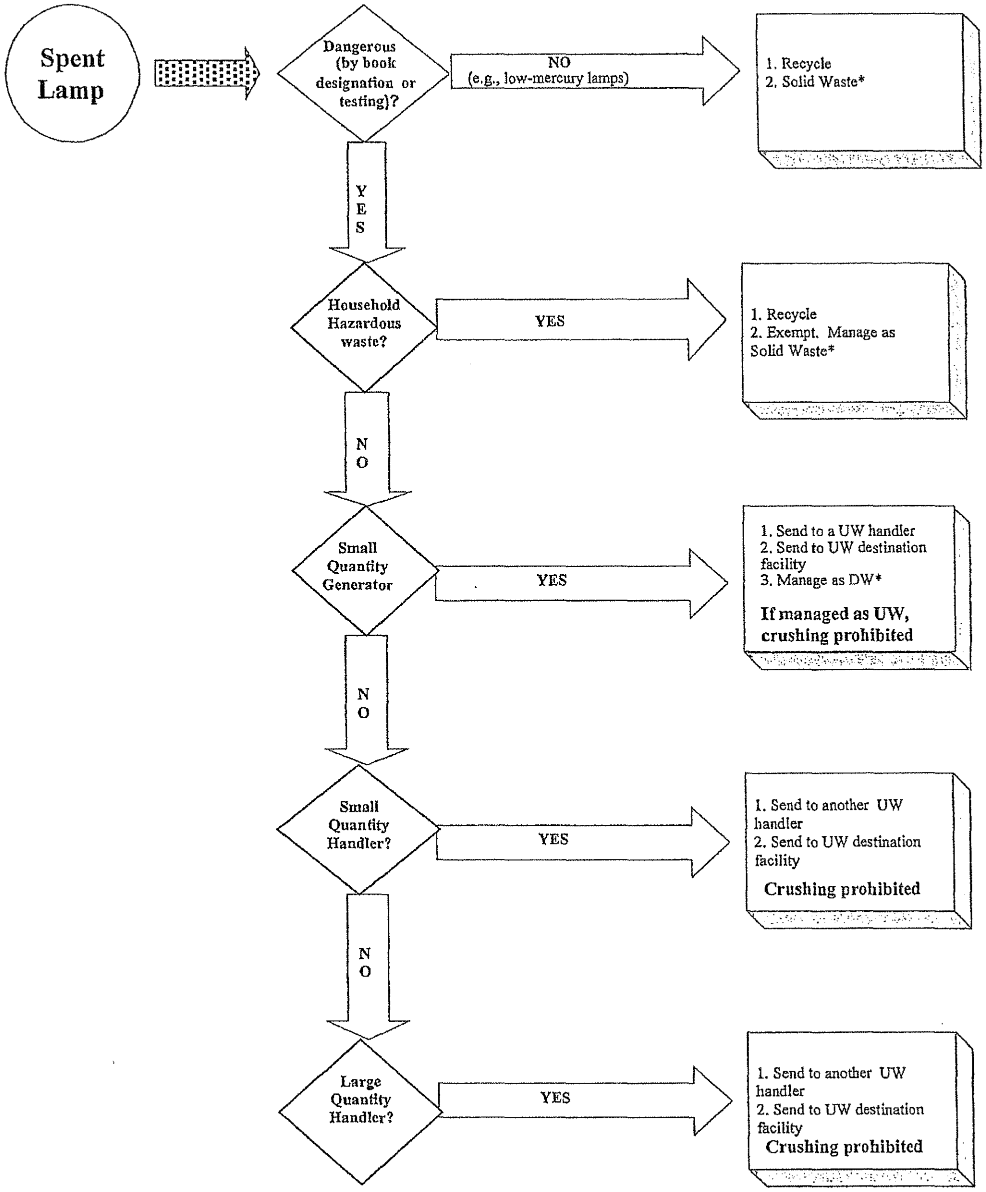
Handler Type	Pre-2000 Rule	New Rule with Lamps
Small Quantity Handler	Accumulate less than 11,000 pounds of Universal Waste	Accumulate less than 2,200 pounds of lamps, or less than 11,000 pounds of total universal waste, including lamps.
Large Quantity Handler	Accumulate 11,000 or more pounds of Universal Waste	Accumulate 2,200 or more pounds of dangerous waste lamps or 11,000 pounds of total universal waste (including lamps)

Is On-Site Lamp Crushing to Reduce Volume Allowed?

Universal waste lamp handlers and transporters cannot dispose of or treat universal waste lamps. **This prohibition on treatment includes lamp crushing**. Lamp crushing is considered a treatment-by-generator activity, subject to full regulation under the *Dangerous Waste Regulations*. Crushed lamps must be managed as dangerous waste unless they are shown to be non-dangerous through the designation process.

Attachment 1

GENERATOR MANAGEMENT OPTIONS FOR WASTE LAMPS



*Check with local health department, solid waste agency or solid waste landfill operator

Attachment 2

UNIVERSAL WASTE LAMP MANAGEMENT REQUIREMENTS

NOTE: Small Quantity Generators (SQGs) are exempt from the UWR (they are subject only to WAC 173-303-070 (8)) and can manage dangerous waste lamps as SQG dangerous waste. Households are also exempt from the rule. Local governments and/or landfills, however, may restrict disposal by SQGs and households. (If a SQG generates dangerous waste lamps in quantities that would put them into a higher generator category, then they should choose to manage those lamps as universal waste to retain their SQG status.)

REQUIREMENTS	SMALL QUANTITY HANDLER	LARGE QUANTITY HANDLER	UW TRANSPORTER	UW DESTINATION FACILITY
Notification and EPA I.D.#	Not required	YES	Not required	YES
Immediately contain by placing in a container any lamps showing evidence of leakage, damage, etc.	YES	YES	YES	Regulated as a TSD or 24 hour recycler (WAC 173-303-140; 173-303-141; 173-303-280 through 173-303-525; 173-303-600 through –173-303-695; 173-303-800 through 173-303-840. OR, If a 24 hour recycler, WAC 173-303-120 (4)(c) ↓
Containerize in closed, structurally sound, compatible containers	YES	YES	YES	
Cardboard/fiber containers may be used (inside storage only)	YES	YES		
Container label required: "Waste Lamps", or "Universal Waste Lamps"	YES	YES		
Track length of time since waste lamp generation. Acceptable methods of proof: date on label, inventory system, etc.	YES	YES		
Response to Releases - Contain releases; determine if DW; if so, manage as specified in Chapter 173-303, WAC	YES	YES	YES	
Prohibited from disposing of Universal Waste	YES	YES	YES	
Treatment (includes crushing) prohibited	YES	YES	YES	
Accumulation Time Limit	One year (longer if proved necessary for proper management)	One year (longer if proved necessary for proper management)	10 days or less at UW transfer facility, otherwise becomes UW handler	
Employee Training	Inform appropriate employees of proper handling and emergency procedures	Ensure appropriate employees are thoroughly familiar with proper handling and emergency procedures	Not required under rule, but recommended	
Tracking of Waste Shipments	Recommended, but not required	Keep records (invoice, manifest, etc.) for 3 years of all shipments received and all shipments sent off-site	If UW is hazardous material under 49CFR171.8, describe in shipping papers per 49CFR Part 172	Keep records (invoice, manifest, etc.)for 3 years of all shipments received
Exporting	EPA Acknowledgment of Consent form from receiving country	EPA Acknowledgment of Consent form from receiving country	EPA Acknowledgment of Consent form must accompany shipment	EPA Acknowledgment of Consent form must accompany shipment
If UW is hazardous material under 49CFR171.8, follow applicable Dept. of Transportation regulations in 49CFR Part 171-180	If self-transporting, defined as a Universal Waste Transporter	If self-transporting, defined as a Universal Waste Transporter	YES	If self-transporting, defined as a Universal Waste Transporter

Attachment 3

FREQUENTLY ASKED QUESTIONS ABOUT UNIVERSAL WASTE LAMPS

Q **What types of lamps are included in the UW rule?**

A The rule includes, but is not limited to, fluorescent tubes, compact fluorescent, mercury vapor, metal halide, high-pressure sodium and neon lamps. The rule targets those lamps that are frequently used by businesses, institutions, government and utilities, and that are known to have hazardous properties that may cause them to be a dangerous waste, such as mercury and lead. Other types of lamps, such as incandescent, may also have hazardous properties, such as lead in the lamp base, that can cause them to be dangerous waste and as such could be managed as universal waste.

Q **What is the difference between a generator and a handler under the UW rule?**

A Under the universal waste rule a generator of universal waste is also considered a handler. A handler can be the generator of the lamp, or a business that receives, collects and then sends lamps on to another handler, or to a destination facility.

Q **What does the UW rule mean for regulated generators of dangerous waste (medium quantity and large quantity generators)?**

A Regulated generators of dangerous waste that also generate dangerous waste lamps should begin managing those lamps as universal waste. The benefits of managing the lamps as universal waste include no counting, no manifesting, no reporting on annual reports, and a longer accumulation time. The January 1995 policy on fluorescent tubes is being replaced by the universal waste rule, so regulated generators no longer have the option of sending their dangerous waste fluorescent tubes to a Municipal Solid Waste landfill.

Q **A business doesn't generate any other dangerous waste, but they do have a lot of fluorescent lamps that get changed out – how does the UW rule affect them?**

A The affect of the rule on the business depends on a few things. The first is whether or not the lamps are dangerous waste. If the lamps are dangerous waste, then the number of lamps generated and the local regulations for business lamp disposal will affect that business. For such a business, the quantity of dangerous waste lamps generated is going to determine their regulatory status. If the business generates more than 220 pounds of lamps at one time or during one month or accumulates more than 2,200 pounds of lamps at any time, then they would become a regulated dangerous waste generator unless they manage the lamps under the universal waste rule. If the business generates less than 220 pounds of dangerous waste lamps, then they would be considered a small quantity generator (SQG) and subject to the less stringent small quantity generator regulations found at WAC 173-303-070(8). They could choose to manage the lamps as universal waste, or choose to manage the lamps as SQG dangerous waste. The business should check with their local health department, solid waste agency or landfill operator for requirements.

Q **A business is currently a small quantity generator (SQG) of dangerous waste, how does the UW rule affect them?**

A A business that generates dangerous waste at the small quantity generator level may be affected by the rule. If, in addition to other dangerous wastes they generate, they generate or accumulate dangerous waste lamps in quantities that may push them over the SQG quantity exclusion limits, then they should manage those lamps as universal waste to retain their SQG status. If a business generates dangerous wastes, including dangerous waste lamps, under the SQG quantity exclusion limits, then they may manage the lamps as SQG dangerous waste. The business should check with their local health department, solid waste agency or landfill operator for requirements.

Q Are manufacturers making lamps that are non-dangerous waste?

A The major lamp manufacturers are producing lamps that pass both the federal Toxicity Characteristic Leaching Procedure (TCLP) test and Ecology's static acute fish toxicity test for state criteria. Check with the lamp manufacturer, your local lamp distributor, or lighting contractor for more information on specific lamp models.

Q Can those non-dangerous waste lamps be managed as solid waste or do they need to be managed as universal waste?

A The universal waste rule only requires that dangerous waste lamps be managed as universal waste. Lamp models that have been shown to be non-dangerous waste would be eligible for disposal to a Municipal Solid Waste landfill, subject to local regulations and landfill operator approval. Of course, the non-dangerous waste lamps still have recyclable components, including glass and the aluminum end caps and metal bases. Additionally, these types of "green" lamps still contain mercury, and pass the TCLP not simply because of the lower mercury content, but because there are other unique lamp components or additives that aid in binding up the mercury so that it doesn't leach during the TCLP test. The manufacturers have all stated that removal of the unique components or additives will generally cause these lamps to fail the TCLP. As always, Ecology recommends recycling over disposal.

Q Will on-site lamp crushing to reduce volume space be allowed under the UW rule?

A No, Ecology did not include an on-site lamp crushing management option in the final universal waste rule. During the rule development, it was determined that the as-proposed performance-based lamp crushing standards were not enough to ensure that uncontrolled releases of mercury and other hazardous constituents would not occur from the use of lamp crushing units currently on the market. Because of this, Ecology could not ensure that handlers would be crushing lamps properly and in a way that did not release mercury or other hazardous constituents into the environment. To address this issue, Ecology would need to add layers of complexity to the universal waste rule in explaining such requirements as engineering controls and maintenance schedules. Adding more complex language and requirements would conflict with the purpose of the universal waste management system.

Q What happens if a universal waste lamp handler mismanages universal wastes?

A The universal waste rule is a subset of the full dangerous waste regulations, and a handler that mismanages universal waste is subject to enforcement. A handler that receives universal waste from others and mismanages the waste would be held liable for the actual regulatory violation, but the other handlers would also be responsible for that mismanagement under our state cleanup law, the Model Toxics Control Act. Since universal wastes are still dangerous wastes, persons remain liable under dangerous waste and cleanup regulations for remediation of any releases from universal waste management.

Q Can a handler of universal waste lamps self-transport universal wastes to another handler or destination facility?

A Yes, that handler may self-transport, but in doing so, must meet the UW transporter requirements.

Q Is a Hazardous Waste Manifest needed if a UW lamp handler chooses to send their UW lamps to a destination facility located in a state that hasn't adopted the universal waste rule for lamps?

A If those lamps are considered hazardous waste in the state the destination facility is located, then a Hazardous Waste Manifest would be required by the receiving state. Additionally, interstate transport of UW lamps may take the lamps through states that have not adopted the universal waste rule for lamps. Those states that have not adopted the universal waste rule for lamps may require a Hazardous Waste Manifest for the portion of the trip those lamps are in their state. Check with the destination facility and/or the states the lamps will travel through to be sure of the requirements.

Q Can I be a generator and a handler?

A Yes, a business that generates dangerous waste, (for example, a flammable solvent) and that generates and manages their universal waste would be considered both a dangerous waste generator and a universal waste handler. A handler of universal waste could also become a generator of dangerous waste. For example, a universal waste handler of lamps may have some lamps break, releasing mercury. The residue from the spill would most likely designate as a dangerous waste and would need managed as such. Residues from such spills could not continue to be managed as universal waste.

Attachment 4

SERVICES DIRECTORY FOR LAMPS AND BALLASTS

The Department of Ecology does not assume any liability for the accuracy or completeness of this information. A listing of a firm in this directory does not constitute a recommendation.

Name of Company	City	State	Phone	E-Mail Address	SERVICE
Able Clean-Up Technologies	Spokane	WA	(509) 466-5255	ksilverh2o@email.msn.com	Transportation of lamps and ballasts
Advanced Environmental Solutions	Seattle	WA	(206) 652-2323	justin@advenvironmental.com	Equipment & containers
Big Sky Industrial	Spokane	WA	(509) 624-4949	bigsky@iea.com	Arrange for ballast disposal
Creative Environmental Technologies	Tacoma	WA	(888) 627-3347, (253) 627-3347	ceti@cetinw.com	Arrange for lamp and ballast transportation
Earth Protection Services	Lake Oswego	OR	(503) 620-2466 (800) 588-7190	earthpro@cyberhighway.net	Lamp recycling and ballast management
Eastern Environmental Technologies	Port Chester	NY	(800) 808-PCBS	eet@erols.com	Lamp recycling and ballast management
Eco Lights NW	Seattle	WA	(206) 343-1247	amyf@totalreclaim.com	Full service lamp recycler and ballast management
Envirotech Systems	Seattle	WA	(800) 922-9395	envsys1@aol.com	Arrange for lamp recycling and ballast disposal
Evergreen Environmental	Aberdeen	WA	(360) 533-6141	LarryM@olynet.com	Arrange for ballast disposal
FBN Enterprises	Kirkland	WA	(425) 820-8115		Arrange for lamp and ballast reycling or disposal
Foss Environmental Services	Seattle	WA	(206) 768-1426	seattleinfo@foss.com	Transportation of lamps and ballasts
Lighting Resources	Phoenix	AZ	(800) 572-9253	ben@voidnet.com	Lamp recycling and ballast management
MCS Environmental	Spokane	WA	(509) 924-9236	mcsspok@ez.eznet	Arrange for lamp and ballast recycling or disposal
Mercury Technologies of Minnesota	Pine City	MN	(800) 864-3821	merctech@ecenet.com	Lamp recycling and ballast management
Midwest Recycling & Recovery Services	Dubuque	IA	(800) 311-9636		Arrange for lamp and ballast recycling or disposal
NSSI Recovery Services	Houston	TX	(713) 641-0391	rdgallagher@nssihouston.com	Limited lamp and ballast disposal services
Nu-Life Industries	Aldergrove	BC	(604) 857-5588	info@nulife-ind.com	Lamp recycling and non-PCB ballast management
Onyx Environmental Services, LLC	Tukwila	WA	(206) 241-3900 or (800) 334-2387	jim_beck@wastemanagement.com	Transportation of lamps and ballasts

Name of Company	City	State	Phone	E-Mail Address	SERVICE
Philip Services	Renton	WA	(425) 227-0311 or (800) 228-7872	londamay@philip-serv.com	Transportation of lamps and ballasts
Philip Services	Washougal	WA	(800) 547-2436	londamay@philip-serv.com	Transportation of lamps and ballasts
Phoenix Environmental	Fife	WA	(253) 779-8474		Limited transportation of lamps and ballasts
Prezant Associates	Seattle	WA	(206) 368-4252 or (206) 281-8858	prezant@prezant.com	Industrial hygiene, safety and health consulting
Recyclights West LLC	Glendora Las Vegas	CA NV	(626) 335-3042 (702) 633-7900	recwest@aol.com	Lamp recycling at Las Vegas facility – no ballast management
Romic Environmental	Tacoma	WA	(253) 229-6569	gregc@romic.com	Transportation of lamps and ballasts to CA facility
RTW	University Place	WA	(253) 566-5819	mthinc@foxinternet.net	Arrange for lamp and ballast recycling or disposal
Safety Kleen, Auburn	Auburn	WA	(206) 939-2022		Transportation of lamps and ballasts
Safety Kleen, Lynnwood	Lynnwood	WA	(425) 775-7030		Transportation of lamps and ballasts
Safety Kleen, Pasco	Pasco	WA	(509) 547-8771	mikekendall@safetykleen.com	Transportation of lamps and ballasts
Safety Kleen, Spokane	Spokane	WA	(509) 928-8353	DavidBlackham@safetykleen.com	Transportation of lamps and ballasts
Superior Special Services (formerly Salesco Systems)	Phoenix	AZ	(800) 368-9095	mdezelon@ssusa.com	Lamp recycling and ballast management
Van Waters & Rogers, Kent	Kent	WA	(800) 909-4897	kraen.troutman@dwr-inc.com	Arrange for lamp recycling and ballast management
Van Waters & Rogers, Spokane	Spokane	WA	(800) 909-4897	ietxp@vwr-inc.com	Arrange for lamp recycling and ballast management
WasteXpress	Portland	OR	(503) 224-3206	wastex@easystreet.com	Transportation of lamps and ballasts

Appendix G: **Universal Waste Rule Fact Sheet**

Universal Waste Rule

Fact Sheet January 1999

Introduction

The US EPA finalized the Universal Waste Rule (UWR) in the May 11, 1995 Federal Register. Many states have since adopted it.

Universal Waste (UW) is a general descriptive term used to describe wastes that are generated by a large, diverse population. Businesses as well as unregulated households generate UW. This term is intended to be broad so that a wider range of wastes may be managed under the reduced requirements of the UWR. The UWR is intended to promote recycling as well as the proper disposal of wastes, if recycling is not a viable option by easing certain regulatory requirements.

The UWR's reduced management requirements will encourage UW collection programs. These programs may include the collection of household waste. The collection of household UW will keep these wastes out of the municipal waste streams.

Types of Universal Waste

The following wastes constitute the three categories of UW that may be managed under the UWR.

Unused Pesticides

This category includes hazardous waste pesticides that are either suspended and recalled under Section 6 of the Federal Insecticide, fungicide and Rodenticide Act (FIFRA), or collected in waste pesticide programs.

Mercury-containing Thermostats

This category includes all mercury-containing thermostats that fail the Toxicity Characteristic Leaching Procedure (TCLP).

Spent Batteries

This category includes all hazardous waste batteries such as nickel-cadmium batteries. Spent lead-acid batteries may also fall under this category. The handler has the option of managing spent lead-acid batteries as hazardous waste or universal waste.

Definitions

Battery- This device consists of one or more electrically connected electrochemical cells which is designed to receive, store, and deliver electric energy. An electrochemical cell consists of an anode, cathode, and electrolyte. A device is also considered a battery if it is intact, unbroken, and all of the electrolyte has been removed.

Mercury-containing thermostat- This temperature control device contains metallic mercury in an ampule attached to a bimetal sensing element and a mercury-containing ampule that has been removed from the device in compliance with the UWR.

Large Quantity Handler of Universal Waste (LQHUW)- This handler manages any of the three types of UW. A LQHUW collects greater than or equal to 5,000 kg. of the total accumulation of UW at any one given time, not by each type. A LQHUW may receive UW from other handlers and foreign destinations.

Small Quantity Handler of Universal Waste (SQHUW)- This handler manages any of the three types of UW. A SQHUW collects less than 5000 kg. of the total accumulation of UW at any one given time, not by each type. A SQHUW may receive UW from other handlers and foreign destinations.

Destination Facility- This handler may either treat, dispose of, or recycle UW. The owner of a destination facility receives Uws from transporters, SQHUW, and LQHUW. If storage of the waste is necessary prior to recycling then the destination facility must comply with haz waste storage facility provisions. If the handler is storing UW prior to recycling or is storing or treating UW before disposal, the facility must obtain a hazardous waste installation and operation permit prior to building the destination facility.

Transfer Facility- This transportation-related facility includes; loading docks, parking areas, storage areas, and other similar areas where shipments of UWs are held during the normal course of transportation.

Transporter- This handler engages in the off-site transfer of UW by air, rail, highway or water. This handler may transport UW from one UW handler to another, to destination facilities, or to foreign destinations.

Requirements for Handlers of Universal Waste

Conditionally Exempt Small Quantity Generator (CESQG)- A CESQG (generates £100 kg of hazardous waste per month) has the option of handling its UW under the UWR or under the CESQG requirements in the regs. It should be noted that CESQGs must ensure delivery of their hazardous waste to a permitted facility.

Storage Time Limits

Small Quantity Handler of Universal Waste (SQHUW). A SQHUW may store UW on-site for up to one year. If greater than one year is required, the handler must prove that the UW has a feasible recycling market.

Large Quantity Handler of Universal Waste (LQHUW). A LQHUW may store UW on-site for up to one year. If greater than one year is needed, the handler must prove that the UW has a feasible recycling market.

Transporter of Universal Waste. This handler may store UW at a transfer facility for up to ten days before delivering it to a LQHUW, a SQHUW, or a destination facility.

Destination Facility. A hazardous waste installation and operation permit for storage is required for facilities that store UW prior to recycling. If a facility is intended to be used for disposal of UW, then that facility must be permitted for hazardous waste disposal.

Packaging & Labeling

The labeling requirements are identical for LQHUW and SQHUW. In addition to the requirements listed below, each container or outer container must be labeled with the date the material became a waste; the date when it was received from another handler; or some other method that identifies when the waste was received or generated. The containers should **never** be labeled "HAZARDOUS WASTE." The other general guidelines are as follows:

Universal Waste Batteries. Each battery or container holding batteries must be marked, "Universal Waste Battery(ies)" or "Waste Battery(ies)" or "Used Battery(ies)."

Universal Waste Mercury- Containing Thermostats. The containers must be labeled, "Universal Waste - Mercury Thermostat(s)" or "Waste Mercury Thermostat(s)" or "Used Mercury Thermostat(s)."

Universal Waste Canceled Pesticides. The containers must be marked either, "Universal Waste - Pesticide(s)" or "Waste - Pesticide(s)." Containers other than original packaging may be used.

Universal Waste Recalled Pesticides. Tanks or containers holding the recalled pesticides must be marked with the original FIFRA label that would be required under FIFRA if the pesticide were a product.

Containers

Universal Waste Unused Pesticides. Pesticides are allowed to be stored in containers other than original packaging containers provided that:

- The container remains closed;
- The container is structurally sound;

APPENDIX D
PERMIT FOR CLEARING AND GRADING

CLEANUP ACTION PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

Tacoma

CITY OF TACOMA
Planning and Development Services

747 Market St
Tacoma, WA 98402
Inspections: (253)
573-2587

BUILDING PERMIT

PERMIT NO: 40000223991 ISSUED: 07/02/2014 EXPIRES: 12/29/2014
SITE ADDRESS: / 2310 E 11TH ST / TACOMA WA 98421-3303
PARCEL NO: PA2275200770
SUBDIVISION: LOT & BLOCK:

FULL LEGAL DESCRIPTION ON FILE

24 Hour Inspection Line - Call (253) 573-BLUS (2587)

OWNER
DYKMAN MARVIN & GLEE
2310 E 11TH ST
TACOMA WA 98421-3303

CONTRACTOR/SOLD TO PARTY
BP 0400678388
MARVIN W DYKMAN
9223 169TH ST E
PUYALLUP WA 98375
Phone 253-446-0322
Lic No:
Exp date:

PROJECT DESCRIPTION
BLD2014 2310 E 11TH ST
Grade & fill 250 cy for site remediation - Sound Battery

City Contact:	Patricia C	**IBC Constr Type**	**UBC Constr Type**
Type of Permit:	Building Commercial	V B	
Number of Units:	1		
Est value:	$360,000.00		
Type of Work:	Grading & Clearing		
SWPPP:			
Grading:	250.00		

BUILDING AREA (Sq ft)

Number of Floors:		Garage/Carport:	0.00
Total Floor Area:	0.00	Storage Bldgs:	0.00
Attached Garage:	0.00	Other Access Bldg:	0.00
Basement:	0.00	Miscellaneous:	0.00
Decks:	0.00	Tot Acc Bldg Area:	0.00
Other Area:	0.00		

Building Info	**Zoning**	**Building Use**			
Sprinklers	PMI	UBC	IBC	AREA (sq ft)	Bldg Type
Other Fire Supp.					
Fire Alarm Zone					

CONDITIONS OF APPROVAL

PERMIT MUST BE KEPT ON SITE DURING CONSTRUCTION
All plumbing, heating and electrical work will be performed by either the home owner or by a contractor licensed to do same. Separate permits are required for other work, including but not limited to, sanitary and storm sewer, sidewalk, curb and gutter, driveways, parking lot paving, street improvements, plumbing, mechanical, fire protection and signs.

x Marvin Dykman
Signature of Owner/Contractor

THIS PERMIT SHALL BECOME NULL AND VOID IF ANY OF THE ABOVE INFORMATION IS FOUND TO BE INCORRECT

P611

PM017A1A

GENERAL:

PERMISSION IS HEREBY GIVEN TO DO THE DESCRIBED WORK, AS NOTED ON THE REVERSE SIDE, ACCORDING TO THE CONDITIONS HEREON AND ACCORDING TO THE APPROVED PLANS AND SPECIFICATIONS PERTAINING THERETO, SUBJECT TO COMPLIANCE WITH THE ORDINANCES OF THE CITY OF TACOMA.,

YOUR ATTENTION IS CALLED TO THE FACT THAT IT SHALL BE THE DUTY OF THE PERMITEE (General Contractor) to assure that all necessary inspections are called for and approved by the City Inspectors.

YOUR ATTENTION IS CALLED to the fact that in addition to the called for inspections specified by the applicable codes, the Building Official may make or require any other inspections of any construction work necessary to ascertain compliance with the provisions of City Codes and other laws which are enforced by the City of Tacoma.

YOUR ATTENTION IS CALLED to the fact that in addition to regularly scheduled inspections during construction there shall be a final inspection and approval on all buildings or structures when completed and ready for occupancy. All required off-site improvements (curbs, sidewalks, storm sewers, etc.) must be completed at time a final inspection and prior to occupancy of building. Construction of off-site improvements requires scheduled inspections during construction in addition to the final inspection.

SPECIAL PERMITS

The holder of Special Permits agrees to the following stipulations:

1. To complete the work encompassed by the Special Permit in accordance with the current edition of the WSDOT/APWA Standard Specifications as amended by the City of Tacoma General Special Provisions and in accordance with any special provisions or conditions set forth before final acceptance as required by the provisions of the Street Obstruction Bond.
2. To indemnify and hold the City of Tacoma harmless from any and all damages done to any person or property which may arise from the construction encompassed by the Special Permit.
3. To submit for review and approval to the Traffic Engineer a traffic control plan developed in accordance with the "Manual on Uniform Traffic Control Devices" (MUTCD). The traffic control plan shall show pedestrian access through the work zone.
4. To protect the public by placing adequate barricades, signs, cones, lights or other traffic control devices in accordance with the approved traffic control plan. It is understood that traffic lane closures and or sidewalk closures are limited to that which is specifically permitted herein. No other closures will be allowed without prior written approval of the City Engineer.
5. To provide and maintain protected pedestrian and ADA compliant disability access on walkways at all times.
6. The City of Tacoma does not guarantee sewer location or depth information. It shall be the permittee's responsibility to verify sewer and sewer stub locations and depths.
7. To restore Rights-of-Way in accordance with the City's Rights-of-Way Restoration Policy and City of Tacoma Standard Plans
8. Trench backfill within all improved streets or streets proposed for improvement shall be full depth bank run gravel or approved equal by the Construction Division.
9. All cuts in arterial streets shall be patched and maintained with Hot Mix Asphalt until permanent repairs are completed. All cuts in residential streets or alleys shall be patched and maintained with cold mix asphalt until permanent repairs are made. Permanent repairs shall be per current City of Tacoma Standard Plans. Streets and alleys shall be permanently repaired within 30 days.
10. To be responsible for the preservation of any utilities within the construction area.
    CALL TOLL FREE BEFORE YOU DIG -1-800-424-5555 (Utilities Underground Location Center)
11. 24 Hour notice is required prior to any inspection. Construction Division 253-591-5760, Traffic Signal/Streetlight 253-591-5287.
12. The Special Permit Expiration date is 30 days from the issue date unless otherwise noted.

OVERTIME PARKING PERMITS

1. An Overtime Parking Permit is valid only in time zone parking areas within 1 city block of the permit address. All loading zones and special zones are excluded.
2. The Overtime Parking Permit must be displayed on the vehicle dashboard on the curbside. The permit must be visible at all times.

SPECIAL MOTOR VEHICLE PERMIT

Liability of Permittee: The Special Motor Vehicle Permit is granted with the specific understanding that the permittee shall be responsible and liable for all accidents, damage or injury to any person or property resulting from the operation of the piece of equipment encompassed by the permit upon the public streets of the City of Tacoma. The permittee shall hold blameless and harmless and shall indemnify the City of Tacoma, its officers, agents, and employees against any and all claims, demands, loss, injury, damage, actions and costs of actions whatsoever which they may sustain by reason of the acts, conducts or operations of the permittee encompassed by the Special Motor Vehicle Permit. The permittee shall defend and pay expenses of defending any action and suit which may be commenced by any third person alleging any injury to person or property arising out of the activities encompassed by the Special Motor Vehicle Permit.

Tacoma

Planning and Development Services Department

PERMIT APPLICATION FOR GRADING, PARKING LOT PAVING AND/OR STRIPING

Property Information			
Site Address:	2310 East 11th Street		
Parcel Number:	2275200770	Zip Code:	98421
Contact Information			
Property Owner:	Marvin Dykman	Phone No:	(253) 858-9423
Mailing Address:	Care of Davis Law Office; 7525 Pioneer Way Su	E-Mail:	
Contractor Name:	To Be Determined	Phone No:	
Mailing Address:		E-Mail:	
Engineer Name:	Tad Cline	Phone No:	(425) 295-0849
Mailing Address:	720 Olive Way Suite 840 Seattle, WA 98101	E-Mail:	tcline@farallonconsulting.con
Contact Person:	Andrew Vining	Phone No:	(425) 295-0847
Mailing Address:	975 5th Avenue Northwest, Issaquah, WA 9802	E-Mail:	avining@farallonconsulting.co

Project Information		
Value of Work: $ 360,000.00	Soil Amt. to be Moved: 250.00 Cubic Yards	○ Fill ○ Cut ● Cut and Fill
Site Area to be Disturbed: 7,500.00 Sq. Ft.	Area to be Paved: 0.00 Sq. Ft.	No of Parking Stalls: 0
Area of Landscaping: 0.00 Sq. Ft.	Will Work Occur Within the Critical Area? No	

Excavation, grading, clearing, paving, parking configuration and construction of retaining walls and vaults are all regulated within the City of Tacoma. If re-striping of an existing parking lot will change the configuration or size of stalls, driveway aisle, or pedestrian walkways, a permit is required. Control of clearing, excavation, grading, and paving, including fills and embankments; administrative procedures for issuing permits; fees associated with permits and procedures for approval of plans and inspection are outlined in the Tacoma Municipal Code (TMC).

This application is for work to be completed on private property. Work within the right of way requires separate permits.

Permits for grading are required if 50 cubic yards of soil or more are moved, or if an area 7,000 square feet or greater is grubbed, or if any amount of soil or a significant amount of vegetation is moved or disturbed within a critical area.

Grading in excess of 500 cubic yards or in a critical area requires a grading plan prepared by a civil engineer. **See Next Page to Attach Required Documents*

Work in critical areas are subject to the requirements in TMC 13.11.

Additional reports and information may be required depending on the project per TMC 2.02.370 and other applicable codes.

SEPA may be required. **Contact the Land Use Planner at (253) 591-5577.**

Stormwater mitigation may be required. Refer to the City of Tacoma Surface Water Management Manual (SWMM) for requirements. **Contact Environmental Services at (253) 591-5218.**

For assistance please contact Planning and Development Services at (253) 591-5030. Page 1 of 2

Date Submitted: 5/16/14

Submittal Package for Excavation, Grading, Clearing, Parking Lot Paving and/or Striping, Paving and Retaining Walls / Vaults Permit

All items listed in the submittal checklist that are applicable to the project shall be provided for review and permit approval. **Attach Required Documents Below*

Documents to be submitted

Have? Yes	No	Not Reqd	
●	○	☐	Application
●	○	☐	Three (3) sets of plans, drawn to scale
○	●	☑	SEPA Checklist and filing fee, when applicable
○	●	☑	Engineering Design Required per TMC 2.02.370
○	●	☑	Geotechnical Engineering Report, when applicable
○	●	☑	Stormwater Site Plan (SSP) per SWMM when applicable
●	○	☐	Stormwater Pollution Prevention Plan (SWPPP) per SWMM when applicable
○	●	☑	Design information for structures (retaining walls and vaults)
○	●	☑	Permit numbers for all related permits and land use actions.
○	●	☑	Landscape plan, when required by TMC 13.06.502

Required Information for Structures

Have? Yes	No	Not Reqd	
○	●	☑	Retaining Wall Details and Cross-Sections
○	●	☑	Retaining Wall and other Structures Calculations
○	●	☑	Vault Calculations
○	●	☑	Vault Structural Details and Cross Sections

Plan Showing Existing Conditions Including Those 50 Ft Beyond the Boundary Lines of the Project

Have? Yes	No	Not Reqd	
○	●	☑	Topography 2 Ft Contours Max. slopes less than 15%
○	●	☑	5 Ft Contours Max slopes between 15% and 40%
○	●	☑	Existing Structures and Utilities, Including Those Outside the Site but within 15 Ft of the Grading Limits
○	●	☑	Natural Drainage Courses
○	●	☑	Trees 6 Inches or more in Diameter Existing Trees and Vegetation to be retained
○	●	☑	Flood plain boundary, including 10 year and 50 year flood lines, if available
●	○	☐	Streets, Property Boundary Lines, Off-Site Improvements, Easements, etc.

Plan Showing Final Conditions

Have? Yes	No	Not Reqd	
●	○	☐	Clearing and Grading Limits
○	●	☑	Retaining Wall Locations
○	●	☑	Vault Locations
○	●	☑	Fill and Cut Setbacks from the Property Lines
○	●	☑	Topography (Contours not to exceed 5 Feet)
○	●	☑	Final Site Stabilization
○	●	☑	Stormwater Mitigation per the City of Tacoma Surface Water Management Manual

Required Information for Parking Lots

Have? Yes	No	Not Reqd	
○	●	☑	Delineated Parking Stalls with Sizes Dimensioned (Include Regular and Van Accessible Stalls and Details for Accessible Parking Including Sign(s)).
○	●	☑	Sidewalk, Curbs, Gutters and Other Street Improvements; Include Driveway locations and Sizes. **Offsite Improvements require a Separate Permit.**
○	●	☑	Contours, profiles and/or sections necessary to show grading and slope of parking lot. NOTE: Accessible stalls and access aisles are permitted a maximum slope of 2% in any direction.
○	●	☑	Show Height Obstructions Over Parking Lot.
○	●	☑	Show Parking Lot Lighting, if installed, with Fixture (Lamp and Ballast) Wattage. Provide Documentation to Show Compliance with WSEC Chapter 15.
○	●	☑	Show Interior Curbs or Islands.

General Requirements

Have? Yes	No	Not Reqd	
●	○	☐	Location of Work
●	○	☐	Property Boundary with streets and north directional arrow
○	●	☑	Legal Description
●	○	☐	Temporary Erosion and Sedimentation Control (TESC) Drawing
○	●	☑	Source of Fill Material
○	●	☑	Location of Disposal Area for Excavated Material
●	○	☐	Written Construction Sequence

I certify that the information contained herein is complete and accurate to the best of my knowledge.

Applicant's Signature: **Andrew Vining** Date: **5/16/2014**

Submit ▾ Submit

For assistance please contact Planning and Development Services at (253) 591-5030.

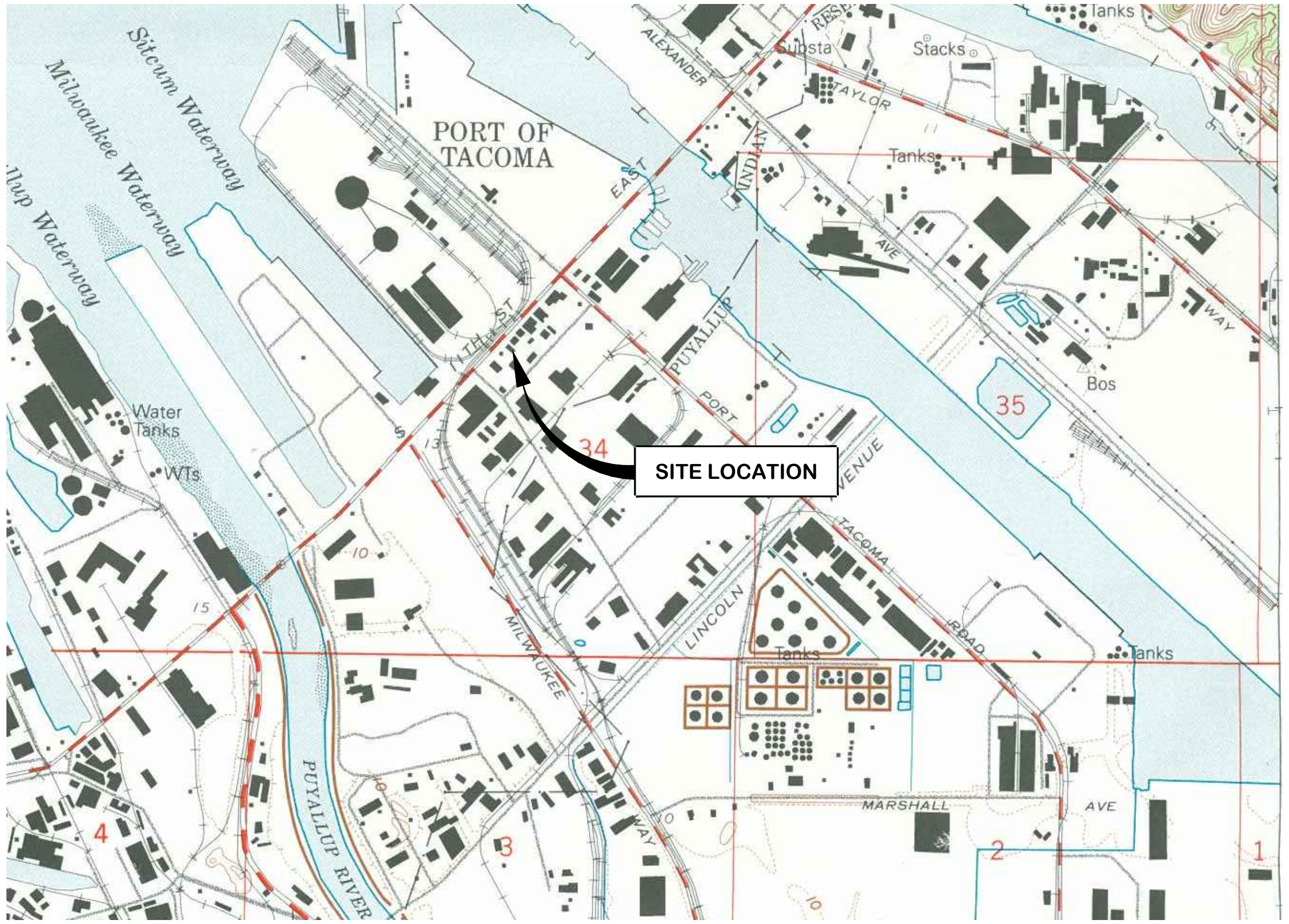
SITE REMEDIATION

SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

CITY OF TACOMA PLAN APPROVAL

CATEGORY	APPROVED BY	DATE	PRE-CON YES	PRE-CON NO
BUILDING	Frank Terrill	JUN 4, 2014	☐	☒
STRUCTURAL			☐	☐
ENERGY			☐	☐
FIRE	Chris Seaman	MAY 28, 2014	☐	☒
PLUMBING			☐	☐
MECHANICAL			☐	☐
ZONING	Shirley Schultz	JUN 3, 2014	☐	☒
LANDSCAPING	Not Applicable		☐	☐
ENVIRONMENTAL	Not Applicable		☐	☐
WETLANDS	Not Applicable		☐	☐
CONCURRANCY			☐	☐
TRAFFIC			☐	☐
URBAN FORESTRY			☐	☐
SITE DEVELOPMENT	Jason Miller	JUN 17, 2014	☐	☐
SANITARY SEWER			☐	☐
STORM SEWER	Jason Miller	JUN 17, 2014	☐	☐
SOURCE CONTROL			☐	☐
REAL PROPERTY SERV.			☐	☐
REFUSE			☐	☐
HISTORICAL			☐	☐
HEALTH DEPT.			☐	☐
TPU WATER			☐	☐
TPU POWER			☐	☐
			☐	☐
IN LIEU OF ASSESSMENT			☐	☐

N



REFERENCE: 7.5 MINUTE USGS QUADRANGLE TACOMA NORTH, WASHINGTON. DATED 1953 AND PHOTOREVISED 1981

SITE LOCATION MAP
(NOT TO SCALE)

DRAWING INDEX

SHEET NO.	DRAWING TITLE
1	TITLE SHEET, SITE LOCATION MAP, AND DRAWING INDEX
2	GENERAL NOTES, LEGEND, SYMBOLS, AND ABBREVIATIONS
3	EXISTING CONDITIONS
4	EROSION CONTROL, EXCAVATION PLAN, AND NOTES
5	EROSION AND SEDIMENT CONTROL DETAILS

REVIEWED BY ENVIRONMENTAL SERVICES FOR STORM DRAINAGE, SANITARY SEWER AND SOURCE CONTROL. BY:___J Miller______ DATE:__6/17/14_______

Upon the completion of the building demolition the applicant shall notify the Tacoma Fire Prevention Bureau at 253-591-5740.

THADDEUS J. CLINE
29637
5/16/2014

	5/16/14	ISSUED FOR PERMITTING	DEW/AV	JH	TC
	DATE	DESCRIPTION	BY	CKD.	APP.

PREPARED BY
FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

PREPARED FOR
SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

SOUND BATTERY PROPERTY
SITE REMEDIATION
TACOMA, WASHINGTON
TITLE SHEET,
SITE LOCATION MAP, AND
DRAWING INDEX

SCALE
AS SHOWN
PROJECT NO.
1117-001
FILE NAME
EXCAVATION.dwg
SHEET NO. 1 OF 5

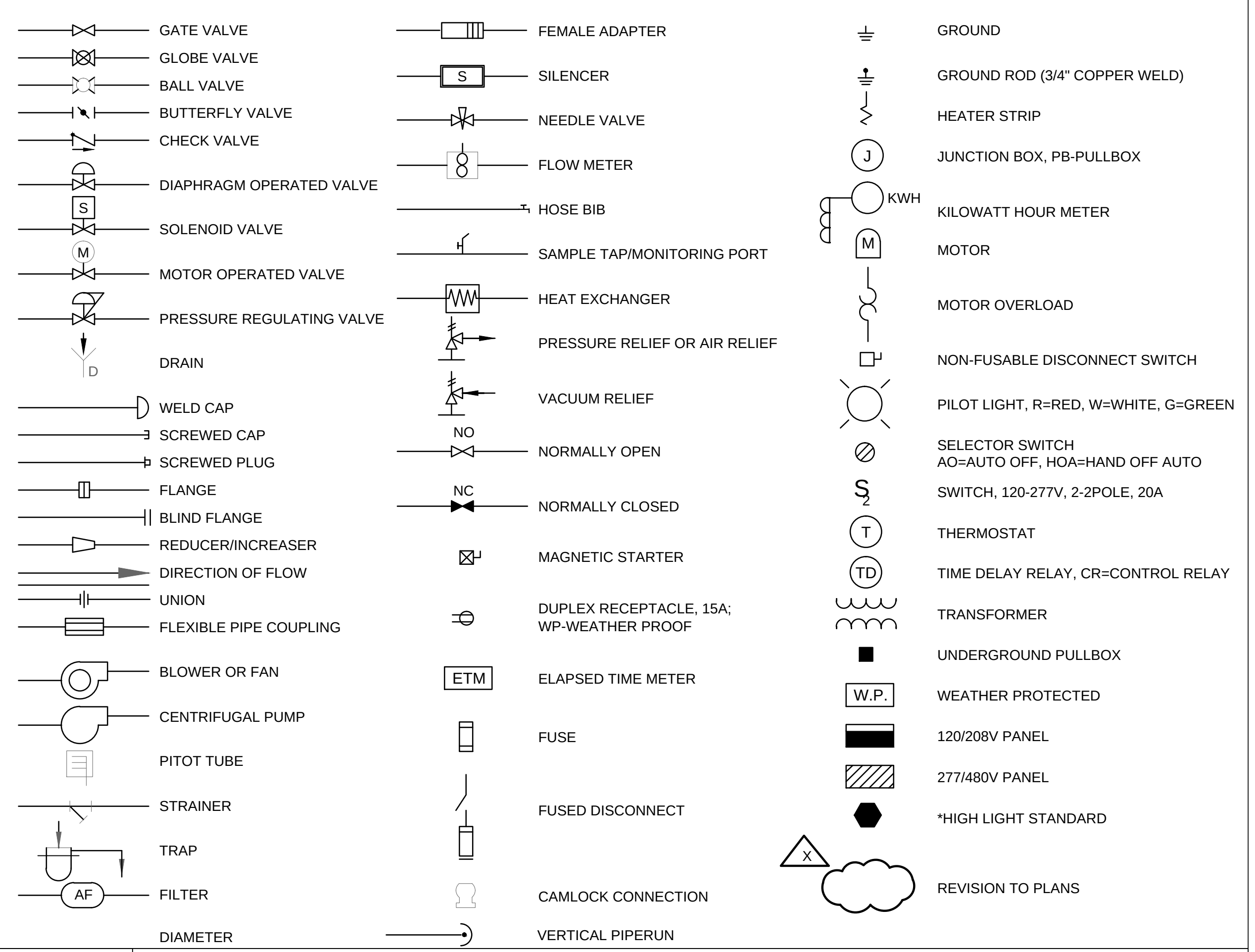
ELECTRICAL ABBREVIATIONS

A/AMP	AMP
AC	ALTERNATING CURRENT
BD	BUS DUCT
C	CURRENT
CB	CIRCUIT BREAKER
CLG	CEILING
DC	DIRECT CURRENT
DIS	DISCONNECT
DP	DOUBLE POLE
DT	DOUBLE THROW
EG	ENCLOSED AND GASKETED
E(OH)	ELECTRICAL (OVERHEAD)
E(UG)	ELECTRICAL (UNDERGROUND)
EMER	EMERGENCY
EPO	EMERGENCY POWER OFF
EMT	ELECTRICAL METALLIC TUBING
EXP	EXPOSED
FBO	FURNISHED BY OTHERS
FLEX	FLEXIBLE METAL CONDUIT
FRN	DUAL ELEMENT FUSE
GEN	GENERATOR
GFIC	GROUND FAULT INTERRUPTER
GND	GROUND
GRC	GALVANIZED RIGID CONDUIT
HOA	HAND-OFF-AUTO SWITCH
IRD	INFRARED DETECTOR
HP	HORSE POWER
HZ	CYCLES PER SECOND
JB	JUNCTION BOX
LFMC	LIQUID TIGHT FLEXIBLE METAL CONDUIT
M	MOTOR/MOTOR STARTER COIL
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRIC CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NF	NON-FUSED
NO	NORMALLY OPEN
OL	OVERLOADS
PBS	PUSHBUTTON
PF	POWER FACTOR
PL	PILOT LIGHT
PLC	PROGRAMMABLE LOGIC CONTROLLER
RC	RIGID CONDUIT
RCPT	RECEPTACLE
SN	SOLID NEUTRAL
SP	SINGLE POLE
ST	SINGLE THROW
SW	SWITCH
TF/TRAN	TRANSFORMER
UF	UNDERFLOOR
UG	UNDERGROUND
V	VOLTS
VFD	VARIABLE FREQUENCY DRIVE
VP	VAPOR PROOF
WHT	WHITE
WP	WEATHER PROOF
XP	EXPLOSION PROOF

STANDARD ABBREVIATIONS

AF	AIR FILTER
AB	AGGREGATE BASE
AC	ASPHALTIC CONCRETE
APPROX	APPROXIMATELY
AF	AIR FILTER
AS	AIR SPARGE
BF	BLIND FLANGE
B.G.S.	BELOW GROUND SURFACE
BLDG	BUILDING
BOP	BOTTOM OF PIPE
BV	BALL VALVE
CONC	CONCRETE
CPLG	COUPLING
℄ /CL	CENTERLINE
CV	CONTROL VALVE/CHECK VALVE
DC	DOUBLE CONTAINED
/DIA	DIAMETER
DWG	DRAWING
DP	DUAL PHASE
DPI	DIFFERENTIAL PRESSURE INDICATOR
EF	EACH FACE
EL/ELEV	ELEVATION
ELEC	ELECTRICAL
ELB	ELBOW
EPDM	ETHYLENE PROPYLENE RUBBER
EXIST/(E)	EXISTING
EXP	EXPANSION
EW	EACH WAY
EA	EACH
FC	FAIL CLOSE
FO	FAIL OPEN
FLXC	FLEXIBLE CONNECTION
FM	FLOW METER
FL	FLOW LINE
FT	FOOT
FUT	FUTURE
FIN GR	FINISHED GRADE
FE	FLANGED END
FNPT	FEMALE NATIONAL PIPE THREAD
GA	GAUGE
GAC	GRANULAR ACTIVATED CARBON
GALV	GALVANIZED
GI	GALVANIZED IRON
GPM	GALLONS PER MINUTE
GR	GRADE
GND	GROUND
GSKT	GASKET
GW	GROUNDWATER
GV	GATE VALVE
HDPE	HIGH DENSITY POLYETHYLENE
HORIZ	HORIZONTAL
HP	HORSEPOWER/HIGH PRESSURE
HR	HOUR
HS	HOSE
HYD	HYDRANT
HOA	HAND OFF AUTOMATIC
ID	INSIDE DIAMETER
IN	INCHES
INV	INVERT
IPS	IRON PIPE SIZE
JT	JOINT
JB	JUNCTION BOX
KO	KNOCK OUT
LSHH	LEVEL SWITCH
M	MOTOR
MAX	MAXIMUM
MH	MANHOLE
MJ	MECHANICAL JOINT
MIN	MINUTE/MINIMUM
MISC	MISCELLANEOUS
MNPT	MALE NATIONAL PIPE THREAD
MP	METER PUMP
MON.PORT	MONITORING PORT
MW	MONITORING WELL
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NO.	NUMBER
N	NEW
NTS	NOT TO SCALE
NPDES	NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM
OC	ON CENTER
OD	OUTSIDE DIAMETER
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OVHD	OVERHEAD
#/LB	POUND
PB	PULL BOX
PBF	PROVIDED BY FARALLON
PC	PORTLAND CEMENT
PCC	PORTLAND CEMENT CONCRETE
PG	PRESSURE GAS
PL	PROPERTY LINE/PIPE LINE
PO	PUMP OUT
P	PRESSURE
PRV	PRESSURE RELEASE VALVE
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH, ABSOLUTE
PSIG	POUNDS PER SQUARE INCH, GAUGE
PTW	PRESSURE TREATMENT
PVC	POLYVINYL CHLORIDE
PV	PROCESS VARIABLE
PR	PAIR
PUE	PUBLIC UTILITY EASEMENT
R	RADIUS/RISER
RC	REINFORCED CONCRETE
REQ	REQUIRED
REF	REFERENCE
SCH	SCHEDULE
SDR	STANDARD DIMENSION RATIO
SECT	SECTION
SHT	SHEET
SPEC	SPECIFICATION
SQ	SQUARE
STA	STATION
STD	STANDARD
STL	STEEL
SBO	SUPPLIED BY OWNER
ST	SAMPLE TAP
STR	STRAINER
SS	STAINLESS STEEL
STL	STEEL
SVE	SOIL VAPOR EXTRACTION
SW	SWITCH
TYP	TYPICAL
TOC	TOP OF CASING/CURB
TOS	TOP OF STEEL
TOW	TOP OF WALL
UBC	UNIFORM BUILDING CODE
UGPS	UNDERGROUND PULL SECTION
UTIL	UTILITY
V	VALVE/VENT/VOLTS
VAC	VACUUM
VAR	VARIES/VARIABLE
VERT	VERTICAL
VP	VAPOR
VRV	VACUUM RELIEF VALVE
W/	WITH
W/O	WITHOUT
WS	WATER SURFACE/WATER STOP

PIPING, ELECTRICAL AND EQUIPMENT SYMBOLS

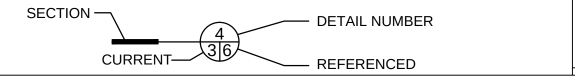


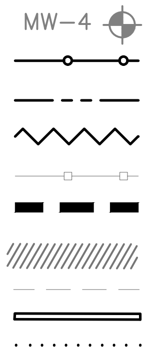
INSTRUMENTATION ABBREVIATIONS AND SYMBOLS

INSTRUMENT SYMBOLS

SYMBOL	DESCRIPTION
M	MOTOR
HOA	HAND-OFF-AUTO SELECTOR SWITCH
○	LOCALLY MOUNTED INSTRUMENT
⊖	CONTROL PANEL MOUNTED INSTRUMENT
◇ I	INTERLOCK
-10	PLC SHUTDOWN ALARM

STANDARD SYMBOLS





LEGEND

- MW–4 SHALLOW MONITORING WELL
- TEMPORARY FENCE
- PROPERTY LINE
- SILT FENCE
- EXISTING FENCE
- APPROXIMATE LIMIT OF SHALLOW EXCAVATION
- APPROXIMATE LIMIT OF DEEP EXCAVATION
- APPROXIMATE LIMIT OF EXISTING ASPHALT
- EXISTING BUILDING
- OVERHEAD UTILITIES

THADDEUS J. CLINE
29637
5/16/2014

GENERAL NOTES

1. A COPY OF THE PROJECT DESIGN DRAWINGS AND SPECIFICATIONS SHALL BE MAINTAINED ON THE JOB SITE AT ALL TIMES.
2. COPIES OF ALL PERMITS SHALL BE MAINTAINED ON THE JOB SITE AT ALL TIMES. THE CONTRACTOR SHALL COMPLY WITH ALL PERMIT REQUIREMENTS.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL DIMENSIONS.
4. BURIED UTILITIES SHOWN ON THE DRAWINGS ARE FOR GENERAL INFORMATION ONLY. UTILITY LOCATIONS ARE APPROXIMATE AND MAY NOT BE INCLUSIVE OF ALL UTILITIES THAT EXIST ON THE PROPERTY.
5. THE CONTRACTOR SHALL HAVE A PRIVATE UTILITY LOCATE SERVICE VERIFY ALL UTILITIES AND MARK THEIR LOCATIONS ON THE GROUND PRIOR TO STARTING CONSTRUCTION. FARALLON SHALL BE CONTACTED IMMEDIATELY IF A CONFLICT IS FOUND BETWEEN EXISTING UTILITIES AND THE PROJECT DESIGN.
6. FARALLON SHALL BE NOTIFIED OF DISCREPANCIES BETWEEN CONTRACT DRAWINGS AND ACTUAL SITE CONDITIONS.
7. THE CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR THE JOB SITE CONDITIONS AND ENSURE THE SAFETY OF ALL PERSONS AND PROPERTY FOR THE DURATION OF ON SITE PROJECT WORK. THE CONTRACTOR SHALL PROTECT STRUCTURES, UTILITIES, AND PAVING FROM DAMAGE, DIRECT OR INDIRECT, RESULTING FROM THE WORK. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY OVER THE DURATION OF ON SITE ACTIVITIES AND NOT BE LIMITED TO NORMAL WORKING HOURS.
8. ALL EXCAVATIONS SHALL BE PERFORMED IN STRICT ACCORDANCE WITH APPLICABLE U.S. DEPARTMENT OF LABOR OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE WASHINGTON INDUSTRIAL SAFETY AND HEALTH ACT (WISHA) REGULATIONS. THE CONTRACTOR ASSUMES FULL RESPONSIBILITY FOR THE SAFETY OF ALL CONSTRUCTION OPERATIONS.
9. NO TRENCHES SHALL BE LEFT OPEN WHEN WORK IS NOT IN PROGRESS. ALL OPEN EXCAVATIONS SHALL BE FENCED.

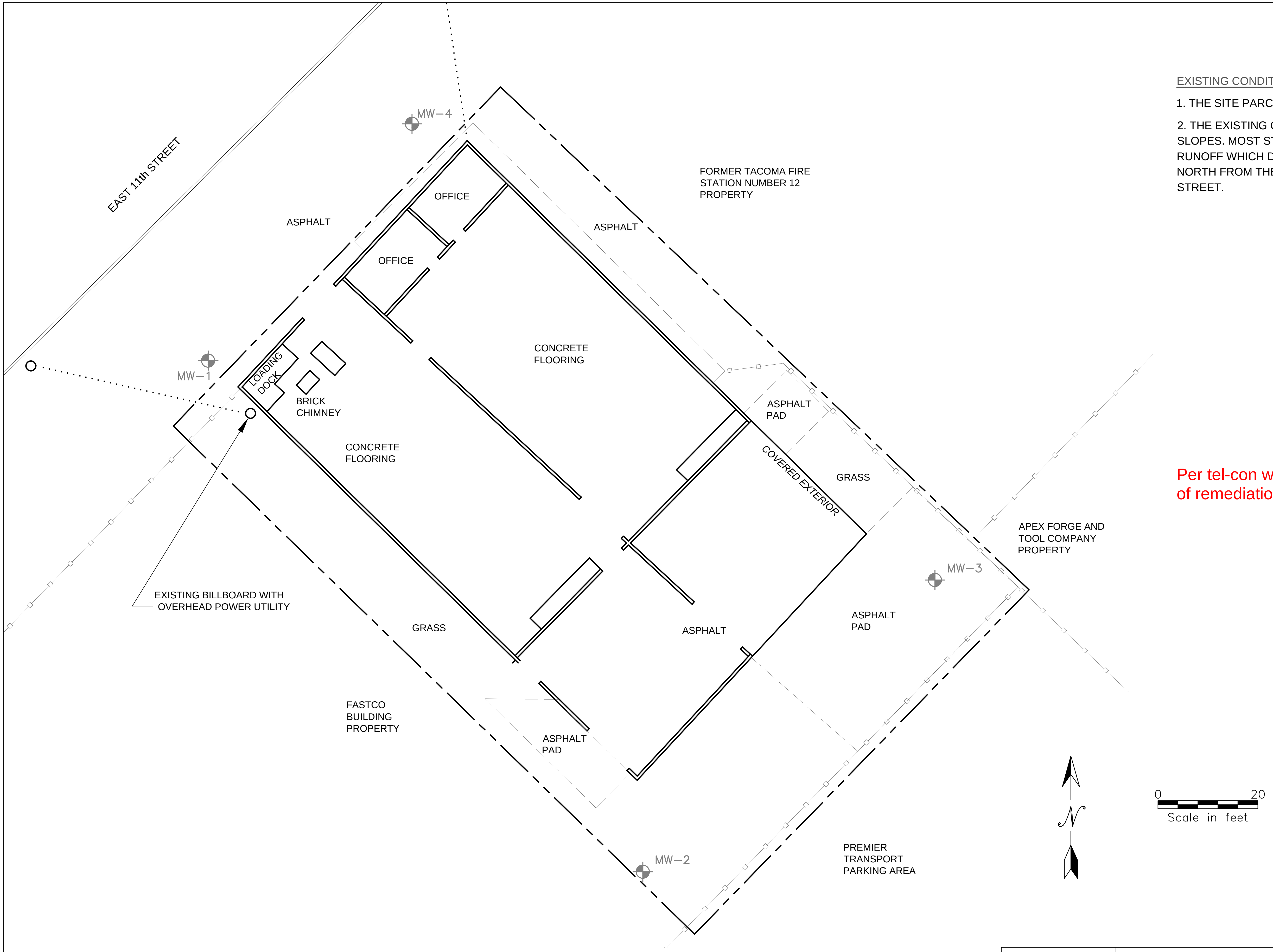
	5/16/14	ISSUED FOR PERMITTING	DEW/AV	JH	TC
	DATE	DESCRIPTION	BY	CKD.	APP.

PREPARED BY
FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

PREPARED FOR
SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

SOUND BATTERY PROPERTY
SITE REMEDIATION
TACOMA, WASHINGTON
GENERAL NOTES,
LEGEND, SYMBOLS,
AND ABBREVIATIONS

SCALE
AS SHOWN
PROJECT NO.
1117-001
FILE NAME
EXCAVATION.dwg
SHEET NO. 2 OF 5



EXISTING CONDITIONS NOTES:

1. THE SITE PARCEL NUMBER IS 2275200770.
2. THE EXISTING GROUND SURFACE OF THE SITE IS FLAT WITH O TO 5% SLOPES. MOST STORMWATER RUNOFF INFILTRATES IN GRASS AREAS. RUNOFF WHICH DOES NOT INFILTRATE TRAVELS BY SHEET FLOW NORTH FROM THE SITE TO CATCH BASINS LOCATED ON EAST 11TH STREET.

Per tel-con with engineer, bldg to be demolished prior to start of remediation work. Separate demolition permit reqd.

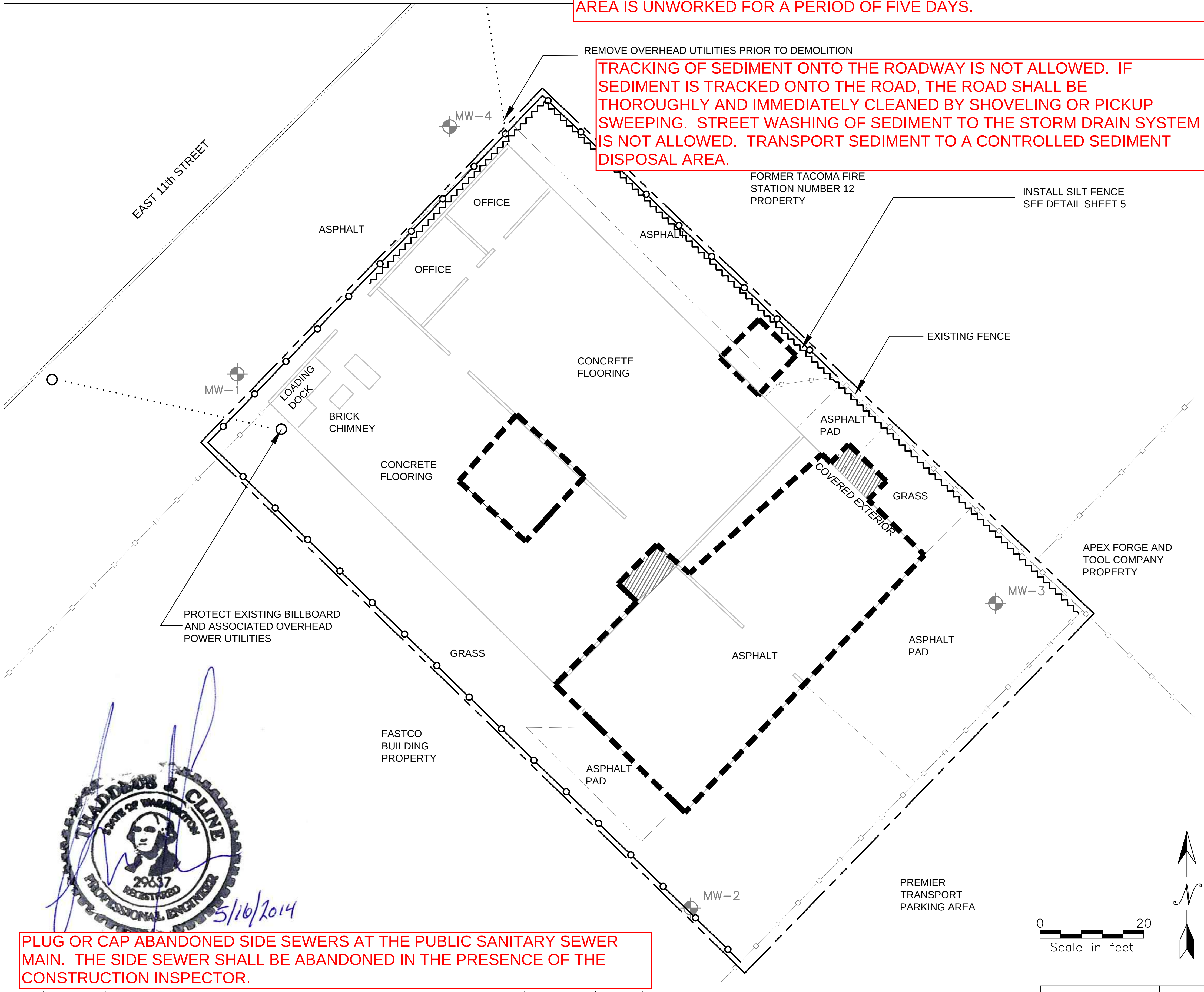
THADDEUS J. CLINE
29637
5/16/2014

	5/16/14	ISSUED FOR PERMITTING	DEW/AV	JH	TC
	DATE	DESCRIPTION	BY	CKD.	APP.

PREPARED BY	PREPARED FOR		
Farallon Consulting 975 5th Avenue Northwest Issaquah, WA 98027	SOUND BATTERY PROPERTY 2310 EAST 11th STREET TACOMA, WASHINGTON	SOUND BATTERY PROPERTY SITE REMEDIATION TACOMA, WASHINGTON EXISTING CONDITIONS	SCALE AS SHOWN PROJECT NO. 1117-001 FILE NAME EXCAVATION.dwg SHEET NO. 3 OF 5

STABILIZE THE AREA UPON COMPLETION OF FINAL ROUGH GRADING OR IF AREA IS UNWORKED FOR A PERIOD OF FIVE DAYS.

TRACKING OF SEDIMENT ONTO THE ROADWAY IS NOT ALLOWED. IF SEDIMENT IS TRACKED ONTO THE ROAD, THE ROAD SHALL BE THOROUGHLY AND IMMEDIATELY CLEANED BY SHOVELING OR PICKUP SWEEPING. STREET WASHING OF SEDIMENT TO THE STORM DRAIN SYSTEM IS NOT ALLOWED. TRANSPORT SEDIMENT TO A CONTROLLED SEDIMENT DISPOSAL AREA.



THADDEUS J. CLINE 29637 5/16/2014

PLUG OR CAP ABANDONED SIDE SEWERS AT THE PUBLIC SANITARY SEWER MAIN. THE SIDE SEWER SHALL BE ABANDONED IN THE PRESENCE OF THE CONSTRUCTION INSPECTOR.

SITE PREPARATION AND EROSION CONTROL NOTES:

1. SITE PREPARATION AND EROSION CONTROL SHALL BE IN PLACE BEFORE INITIATING ANY CONSTRUCTION ACTIVITIES.
2. CONTRACTOR SHALL LOCATE AND CLEARLY MARK PROPERTY BOUNDARIES PRIOR TO CONSTRUCTION.
3. PROTECT CATCH BASINS ADJACENT TO TRUCK LOADING AREA PER DETAIL, SEE SHEET 5.
4. OVERHEAD UTILITIES WITHIN EXCAVATION AND DEMOLITION AREA SHALL BE REMOVED BY THE CONTRACTOR PRIOR TO BEGINNING WORK AS INDICATED ON PLANS.
5. PROVIDE TEMPORARY CONSTRUCTION FENCING AS SHOWN ON PLANS FOR SITE SECURITY.
6. EXISTING MONITORING WELLS SHALL BE PROTECTED AND REPAIRED IF DAMAGED.
7. ALL TEMPORARY STOCKPILES SHALL BE COVERED WITH PLASTIC SHEETING AND SECURED TO CONTROL EROSION.
8. PROVIDE SILT FENCE AS NEEDED PER DETAIL, SEE SHEET 5.
9. CONTRACTOR SHALL INSTALL SILT FENCE AND/ OR BERMS SUCH THAT STORMWATER RUNOFF DOES NOT LEAVE THE SITE.
10. BMPS SHALL BE MAINTAINED AS DESCRIBED IN SITE SPECIFIC CONSTRUCTION SWPPP UNTIL CONSTRUCTION COMPLETION AND SITE STABILIZATION.
11. CONTRACTOR SHALL MAINTAIN EQUIPMENT FREE OF LEAKS. ANY SPILLS SHALL BE CLEANED IMMEDIATELY FROM THE SITE.

EXCAVATION AND DEMOLITION PLAN NOTES:

1. CONTRACTOR SHALL LOCATE AND ABANDON ALL SITE UTILITIES IN ACCORDANCE WITH APPROPRIATE UTILITY REQUIREMENTS AND STANDARDS PRIOR TO BUILDING DEMOLITION.
2. DEMOLISH AND REMOVE BUILDING ABOVE EXISTING CONCRETE SLAB. FINAL GRADE SHALL BE CLEANED SURFACE OF SLAB, FREE OF SHARP EDGES AND PUNCTURE POINTS.
3. CONTRACTOR SHALL BE LICENSED AND INSURED TO PERFORM EXCAVATION AND HANDLING OF CONTAMINATED SOILS INCLUDING THE REQUIREMENTS OF WASHINGTON HAZARDOUS WASTE OPERATIONS REGULATIONS (CHAPTER 296-843 WAC).
4. CONTRACTOR SHALL PROVIDE SUPPORT AS REQUIRED BY ENGINEER TO COLLECT ENVIRONMENTAL SOIL SAMPLES.
5. CONTRACTOR MAY BE REQUIRED TO EXCAVATE CONTAMINATED SOIL FROM ADDITIONAL OUTSIDE AREAS DESIGNATED AS CONTAMINATED ON DRAWINGS AS DIRECTED BY ENGINEER.
6. CONTAMINATED SOIL SHALL BE TRANSPORTED OFFSITE FOR STABILIZATION AND DISPOSAL AT AN APPROPRIATE WASTE FACILITY.
7. GROUNDWATER ENCOUNTERED IN DEEP EXCAVATIONS SHALL BE PUMPED OUT AND DISPOSED OF AT AN APPROPRIATE WASTE FACILITY.
8. EXCAVATIONS WHERE CONTAMINATED SOIL HAS BEEN REMOVED SHALL REMAIN OPEN UNTIL ENGINEER RECEIVES SOIL SAMPLE ANALYTICAL DATA. BACKFILLING OF EXCAVATIONS SHALL COMMENCE ONLY AFTER CONFIRMATION OF SAMPLING RESULTS AND APPROVAL BY THE ENGINEER.
9. PRIOR TO CONSTRUCTION COMPLETION EXCAVATIONS SHALL BE BACKFILLED TO MATCH SURROUNDING GRADE AND SITE SHALL BE STABILIZED.

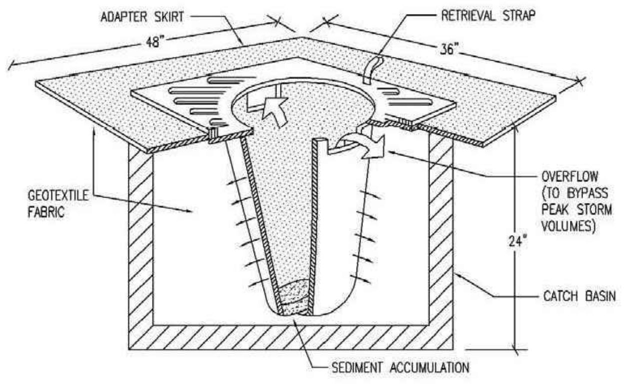
	DATE	DESCRIPTION	BY	CKD.	APP.
	5/16/14	ISSUED FOR PERMITTING	DEW/AV	JH	TC

PREPARED BY
FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

PREPARED FOR
SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

SOUND BATTERY PROPERTY
SITE REMEDIATION
TACOMA, WASHINGTON
EROSION CONTROL, EXCAVATION PLAN, AND NOTES

SCALE AS SHOWN
PROJECT NO. 1117-001
FILE NAME EXCAVATION.dwg
SHEET NO. 4 OF 5

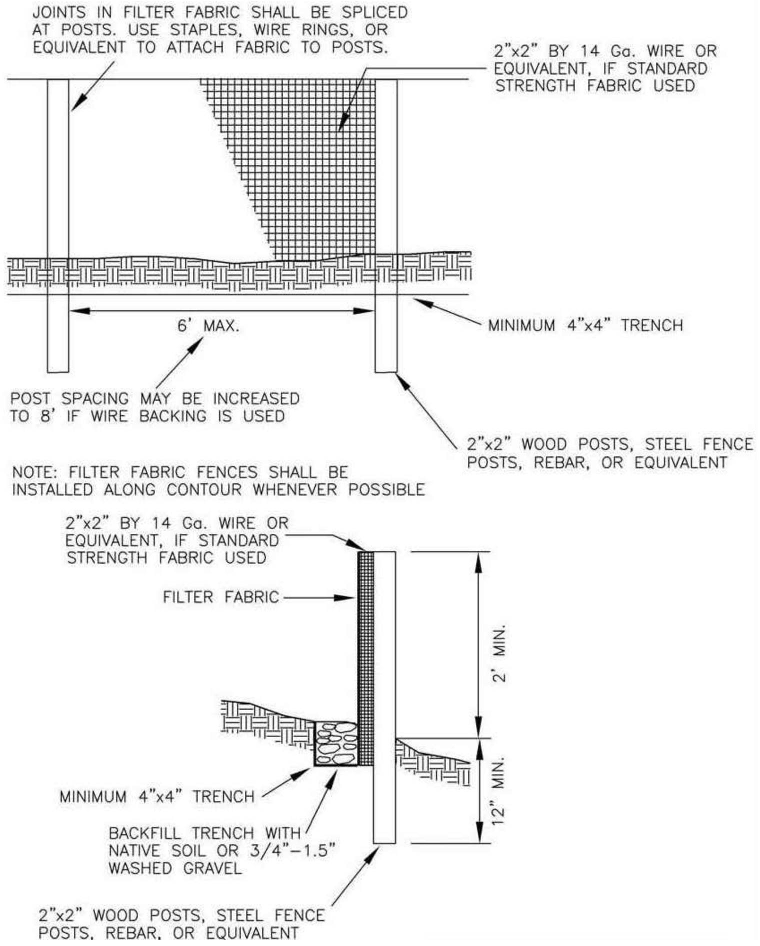


INLET PROTECTION NOTES:

1. FILTERS SHALL BE INSPECTED AFTER EACH STORM EVENT AND CLEANED OR REPLACED WHEN 1/3 FULL.

CATCH BASIN PROTECTION DETAIL

NTS



SILT FENCE DETAIL

NTS

THADDEUS J. CLINE
29637
5/16/2014

	5/16/14	ISSUED FOR PERMITTING	DEW/AV	JH	TC
	DATE	DESCRIPTION	BY	CKD.	APP.

PREPARED BY

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

PREPARED FOR

SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

SOUND BATTERY PROPERTY
SITE REMEDIATION
TACOMA, WASHINGTON

EROSION AND SEDIMENT
CONTROL DETAILS

SCALE
AS SHOWN
PROJECT NO.
1117-001
FILE NAME
EXCAVATION.dwg
SHEET NO. 5 OF 5

REVIEWED BY ENVIRONMENTAL SERVICES FOR STORM DRAINAGE, SANITARY SEWER AND SOURCE CONTROL. BY:___J Miller______ DATE:__6/17/14_______

Appendix C Construction SWPPP Short Form

Projects falling within the thresholds listed below may use this short form instead of preparing a professionally-designed Construction Stormwater Pollution Prevention Plan (SWPPP). If your project meets the following thresholds and includes or may impact a critical area, please contact the City to determine if the SWPPP short form may be used.

The thresholds for using this form are projects that propose to:

- Add or replace between 2,000 and 5,000 square feet of impervious surface. No.

  OR

- Clear or disturb between 7,000 square feet and 1 acre of land. No.

  OR

- Grade/fill 50-499 cubic yards. Yes.

If project quantities exceed either of these thresholds, prepare a formal Construction SWPPP as described in Chapter 2 of this volume.

City of Tacoma
Construction Stormwater Pollution Prevention Plan Short Form

Project Name: Sound Battery
Address: 2310 East 11th Street
Contact/Owner: Marvin Dykman Phone:
Erosion Control Supervisor: Andrew Vining
Phone: (425) 295-0847 Cell: (425) 765-4501 Pager: NA
Emergency (After hour) contact: Tad Cline Phone: (206) 271-4122
Permit No:
Parcel No.: 2275200770

Required Submittals

1. Project Narrative

The Construction Stormwater Pollution Prevention Plan (SWPPP) Short-Form Narrative must be completed as part of this packet. Any information described, as part of the narrative, should be shown on the site plan.

NOTE: From October 1 thru April 30, clearing, grading, and other soil disturbing activities shall only be permitted by special authorization from the City of Tacoma Building and Land Use Services (BLUS).

A. Project Description (Check all that apply)

☐ New Structure ☐ Building Addition ☒ Grading/Excavation ☐ Paving

☐ Utilities ☒ Other: Building demolition

1. Total project area 14,025 (square feet)
2. Total proposed impervious area 0 (square feet)
3. Total existing impervious area 8,860 (square feet)
4. Total proposed area to be disturbed 2,767 (square feet)
5. Total volumes of proposed cuts/fill 220 (cubic yards)

Additional Project Information: The total impervious surface area of the site will be reduced by approximately 2,750 square feet. Stormwater from the site will continue to infiltrate on the site as it does currently.

B. Existing Site Conditions (Check all that apply)

- Describe the existing vegetation on the site. (Check all that apply)

☐ Forest ☒ Pasture/prairie grass ☒ Pavement ☐ Landscaping ☒ Brush

☐ Trees ☐ Other____________________________________

- Describe how surface water (stormwater) drainage flows across/from the site. (Check all that apply)

☒ Sheet Flow ☒ Gutter ☐ Catch Basin ☐ Ditch/Swale ☐ Storm sewer

☐ Stream ☒ Other Stormwater from the site infiltrates in grass areas.

- Describe any unusual site condition(s) or other features of note.

☐ Steep Grades ☐ Large depression ☐ Underground tanks ☐ Springs

☐ Easements ☒ Existing Structures ☐ Existing Utilities

☒ Other Existing building will be demolished.

C. Adjacent Areas (Check all that apply)

1. Check any adjacent areas that may be affected by site disturbance and describe in fully describe in item 2 below:

☐ Streams* ☐ Lakes* ☐ Wetlands* ☐ Steep Slopes*

☐ Residential Areas ☒ Roads ☐ Ditches, pipes, culverts

☒ Other Street catch basins will be protected with bag filters per City of Tacoma.

** If site is on or adjacent to a critical area, the City of Tacoma may require additional information, engineering, and other permits to be submitted with this short-form.*

2. Describe how and where surface water enters the site from upstream properties: ___

Some surface water runs onto the Site from the adjacent property located southwest of the Site. The runoff from the adjacent site infiltrates on site.

____

____

____

3. Describe the downstream drainage path leading from the site to the receiving body of water. (Minimum distance of ¼-mile (1320 feet)) {E.g. water flows from site, into curb-line to catch basin at intersection of X and Y streets. A 10-inch pipe system conveys water another 1000 feet to a ravine/wetland.}

Stormwater from the site currently infiltrates on the site. Soil borings indicate
site geology to consist of sand, gravel, and small to medium-size cobbles to a
depth of 10 feet below ground surface. Runoff which does not infiltrate travels by
by sheet flow north from the site to catch basins located on East 11th Street.

D. Soils (Check all that apply)

The intent of this section is to identify when additional soils information may be required for applicants using this short form. There are other site-specific issues that may necessitate a soils investigation or more extensive erosion control practices. The City will determine these situations on a case-by-case basis as part of their review.

1. Does the project propose infiltration? Infiltration systems require prior City approval.

   ☒ Yes ☐ No ☐ South Tacoma Groundwater Protection District

2. Does the project propose construction near or on steep slopes?

   ☐ Yes ☒ No

   If infiltration is proposed for the site or steep slopes have been identified, the City will require soils information as part of the project design. The applicant must contact a soil professional or civil engineer specializing in soil analysis to perform an in-depth soils investigation. If yes is checked for either question, the City may not permit the use of this short-form.

E. Construction Sequencing/Phasing

1. Construction sequence: The standard construction sequence is as follows:

   - Mark clearing/grading limits.
   - Call Building Inspector to inspect clearing/grading limits.
   - Install initial erosion control practices (construction entrance, silt fence, catch basin inserts).
   - Contact Building Inspector to inspect initial erosion control practices.
   - Clear, grade, and fill site as outlined in the site plan while implementing and maintaining temporary erosion and sediment control practices at the same time.
   - Install permanent erosion protection (impervious surface, landscaping, etc.).
   - Contact Building Inspector for approval of permanent erosion protection and site grades.
   - Remove erosion control methods as permitted by the Building Inspector and repair permanent erosion protection as necessary.
   - Monitor and maintain permanent erosion protection until fully established.

List any changes from the standard construction sequence outlined above.

No structures will be constructed for this project. Based on conversations with the City of Tacoma, contacting a building inspector is not necessary for this project. The remaining standard construction sequence will be followed.

2. Construction phasing: If construction is going to occur in separate phases, describe:

Construction is planned for Summer 2014. Construction will consist of building demolition, followed by excavation and backfill.

F. Construction Schedule

1. Provide a proposed construction schedule (dates construction starts and ends, and dates for any construction phasing).

Start Date: August 1, 2014 End Date: September 1, 2014

Interim Phasing Dates: Not applicable

Wet Season Construction Activities: Wet season occurs from October 1 to April 30. Describe construction activities that will occur during this time period.

Not applicable

NOTE: Additional erosion control methods may be required during periods of increased surface water runoff.

2. Site Plan (See attached example)

A site plan, to scale, shall be included with this checklist that shows the following items:

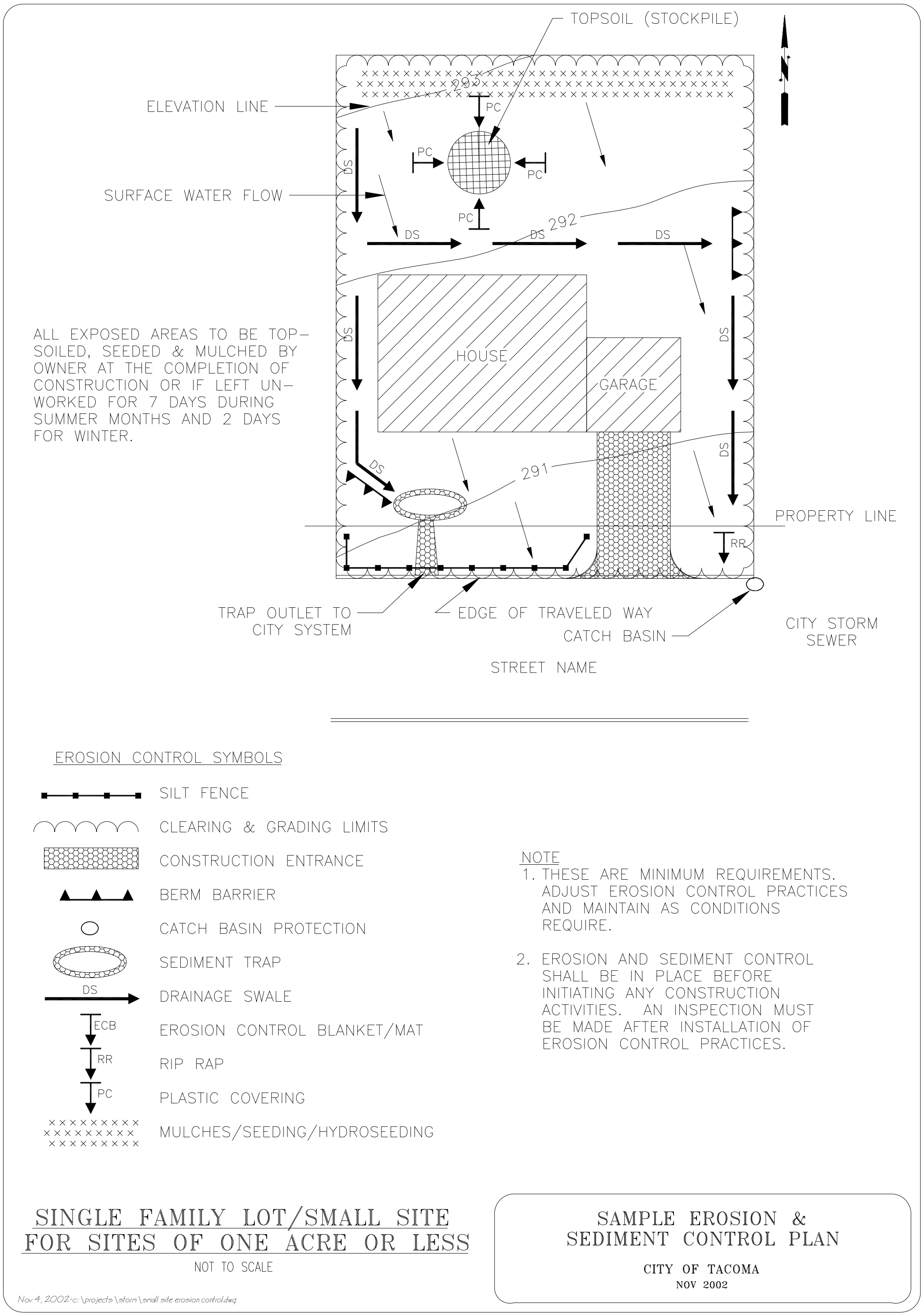
_X_ a. Address, Parcel Number, Permit Number and Street names
_X_ b. North Arrow
_X_ c. Indicate boundaries of existing vegetation (e.g. tree lines, grassy areas, pasture areas, fields, etc.)
_NA_ d. Identify any on-site or adjacent critical areas and associated buffers (e.g. wetlands, steep slopes, streams, etc.).
_NA_ e. Identify any FEMA base flood boundaries and Shoreline Management boundaries.
_X_ f. Show existing and proposed contours.
_X_ g. Delineate areas that are to be cleared and graded.
_NA_ h. Show all cut and fill slopes, indicating top and bottom of slope catch lines
_X_ i. Show locations where upstream runon enters the site and locations where runoff leaves the site.
_X_ j. Indicate existing surface water flow direction(s).
_NA_ k. Label final grade contours and indicate proposed surface water flow direction and surface water conveyance systems (e.g. pipes, catch basins, ditches, etc.).
_NA_ l. Show grades, dimensions, and direction of flow in all (existing and proposed) ditches, swales, culverts, and pipes.
_NA_ m. Indicate locations and outlets of any dewatering systems (usually to sediment trap).
_X_ n. Identify and locate all erosion control techniques to be used during and after construction.

See attached: **Guidelines for Erosion Control Practices and sample Site Plan.**

This information is available on the City of Tacoma GIS at

http://www.govme.cityoftacoma.org.

Onsite field verification of actual conditions is required.



ALL EXPOSED AREAS TO BE TOP-SOILED, SEEDED & MULCHED BY OWNER AT THE COMPLETION OF CONSTRUCTION OR IF LEFT UN-WORKED FOR 7 DAYS DURING SUMMER MONTHS AND 2 DAYS FOR WINTER.

NOTE

1. THESE ARE MINIMUM REQUIREMENTS. ADJUST EROSION CONTROL PRACTICES AND MAINTAIN AS CONDITIONS REQUIRE.
2. EROSION AND SEDIMENT CONTROL SHALL BE IN PLACE BEFORE INITIATING ANY CONSTRUCTION ACTIVITIES. AN INSPECTION MUST BE MADE AFTER INSTALLATION OF EROSION CONTROL PRACTICES.

SINGLE FAMILY LOT/SMALL SITE
FOR SITES OF ONE ACRE OR LESS
NOT TO SCALE

SAMPLE EROSION &
SEDIMENT CONTROL PLAN
CITY OF TACOMA
NOV 2002

Figure 44. Sample Erosion and Sediment Control Plan

Guidelines for Erosion Control Practices

As required by Ecology, this SWPPP must contain the 12 required elements. Check off each element as it is addressed in the SWPPP Short Form and/or on your site plan.

_X_ 1. Mark Clearing Limits (orange construction fence, staking with ribbon).
_X_ 2. Establish Construction Access (gravel entrance, tire wash area).
_X_ 3. Control Flow Rates (using pipe, drainage swales, berms).
_X_ 4. Install Sediment Controls (silt fence, sediment traps).
_X_ 5. Stabilize Soils (mulch, hydroseed, straw).
_X_ 6. Protect Slopes (divert water from top of slope, cover with plastic or erosion control blanket).
_X_ 7. Protect Drain Inlets (catch basin inserts).
_X_ 8. Stabilize Channels and Outlets (cover with grass, riprap).
_X_ 9. Control Pollutants (maintain equipment to prevent leaks).
_X_ 10. Control Dewatering (pump to sediment trap).
_X_ 11. Maintain BMPs (weekly maintenance/replacement, preparation for storm events).
_X_ 12. Manage the Project (establish construction schedule, phasing, contact numbers).

Several common erosion control techniques are explained and described in this section. Standard details for installation of these methods are included in this document. The applicant does not need to reproduce these drawings, but must indicate where each BMP will be used on a site plan and indicate which detail will be used. An example site plan and symbols list is provided to assist the applicant in preparation of their own site plan.

Only those erosion and sediment control techniques most pertinent to small construction sites are included here. More detailed information on construction BMPs can be found in Volume II of the City of Tacoma Surface Water Management Manual. The BMP numbers referenced are BMPs located in the City of Tacoma SWMM.

For phased construction plans, clearly indicate erosion control methods to be used for each phase of construction.

Mark Clearing Limits

All construction projects must clearly mark any clearing limits, sensitive areas and their buffers, and any trees that will be preserved prior to beginning any land disturbing activities, including clearing and grading. Clearly mark limits both in the field and on the plans. Plastic, metals, or stake wires may be used to mark the clearing limits. Do not staple or wire fences to trees. See Figure 7 for Stake and Wire fencing

Applicable BMPs include:

- BMP C101: Preserving Natural Vegetation
- BMP C102: Buffer Zones
- BMP C103: High Visibility Plastic and Wire Fence
- BMP C104: Stake and Wire Fence

Construction Entrance

All construction projects subject to vehicular traffic shall provide a means of preventing vehicle "tracking" of soil from the site onto City streets. At a minimum, there shall be a rock pad construction entrance at every construction access point. *Note: The applicant should consider placing the entrance in the area for future driveway(s), as the rock can be used for driveway base material*. The entrance(s) shall be inspected weekly and if excessive sediment is found, more rock shall be added to ensure proper functioning.

If sediment is tracked off site, it shall be swept or shoveled from the paved surface on a daily basis. Washing of the streets to remove the sediment is not permitted because wash water can transport sediments to streams and other water courses via the City storm drainage system.

The entrance must be identified on the site plan and must conform to Figure 45.

Applicable BMPs include:

- BMP C105: Stabilized Construction Entrance
- BMP C106: Wheel Wash
- BMP C107: Construction Road/Parking Area Stabilization

Sediment Barriers (Figure 47 through Figure 51)

Sediment barriers should be used downslope of disturbed areas. Sediment barriers are intended to create a barrier to slow the "sheet" flow of stormwater and allow the sediment to settle out behind the barrier. Do not use sediment barriers in streams, channels, ditches or around inlets/outlets of culverts. Sediment barriers selected shall be identified on the site plan and must conform to those shown in Figure 47 through Figure 51.

1. Silt fence

A silt fence is a temporary sediment barrier consisting of filter fabric, attached to supporting posts and entrenched into the soil. See Figure 47.

2. Berm Barriers

A continuous berm is a temporary diversion dike or sediment barrier. It may be constructed with:

- Soil, sand, or aggregate encased within a geosynthetic fabric (see Figure 48 and Figure 49).
- Straw wattles (see Figure 50).
- Sand bags (see Figure 51).

Applicable BMPs include:

- BMP C231: Brush Barrier
- BMP C232: Gravel Filter Berm
- BMP C233: Silt Fence
- BMP C234: Vegetated Strip
- BMP C235: Straw Wattles

Catch Basin Protection (Figure 52 and Figure 53)

To prevent sediment from entering drainage systems prior to site stabilization, install catch basin protection within onsite and nearby downstream catch basins. Figure 52 and Figure 53 are acceptable methods of catch basin protection.

NOTE: Only Figure 52 is approved for use in City of Tacoma right of way.

Applicable BMPs include:

- BMP C220: Storm Drain Inlet Protection

Water Runoff Containment/Control

As an alternative to or in conjunction with sediment barriers, a combination of drainage swales and possibly a sediment trap may be used to control runoff and trap sediment before it leaves the construction site.

1. Sediment traps (Figure 54 and Figure 55)

Sediment traps are small temporary ponds (typically less than 3 feet deep) used to trap sediment suspended in site runoff before it leaves a construction site. As concentrated surface water pools within the pond, sediment is allowed to settle out of the water. Typically, a sediment trap will not be required for small sites as long as concentrated stormwater runoff (swales or ditches) does not occur.

Use the following table for sizing your sediment trap.

Table 15. Sediment Trap Sizing

Contributing Area (Acres)	Required Surface Area of Pond (sq. ft.)
1/8 acre or less	130
¼ acre or less	260
½ acre or less	520
¾ acre or less	780
1 acre or less	1040

If expected time of construction or downstream conditions warrant more protection, see BMP C240 for sizing information.

NOTE: If dewatering or significant stormwater runoff is expected, a sediment trap should be used to settle out solids before discharging to the City system.

2. Drainage Swales (Figure 56)

Drainage swales are temporary ditches (minimum slope of 0.5% and a maximum of 10%) used to convey concentrated stormwater flows away from construction activities into a temporary sediment trap. Drainage swales carrying concentrated flows must discharge into a sediment trap or pond. Swales should be stabilized with erosion protection (see below). *Note: Swales should be completely stabilized before directing concentrated flows or they themselves will erode.*

Applicable BMPs include:

- BMP C240: Sediment Trap
- BMP C201: Grass-Lined Channnels
- BMP C202: Channel Lining
- BMP C207: Check Dams

Soil Erosion Protection

Soil erosion protection is applied over the soil surface to reduce erosion from rainfall and wind. It can also be used to aid the establishment of vegetation. Between October 1st and April 30th, no soils shall remain exposed for more than 2 days unless they are being actively worked. From April 1st to September 30th, no soils shall remains exposed for more than 7 days unless they are being actively worked. See Table 16, Table 17 and Figure 57 through Figure 60.

1. Mulches/Seeding/Hydroseeding (Table 16 and Table 17)

Mulching is the application of a protective layer of straw or other suitable material to the soil surface. Mulch can be applied to any site where soil has been disturbed and the protective vegetation has been removed. Materials that may be used for mulching include:

- Straw or hay
- Compost material
- Wood or bark chips
- Hydraulically applied grass seed (Hydroseed)
- Bonded Fiber Matrix

Applicable BMPs include:

- BMP C121: Mulching
- BMP C120: Temporary and Permanent Seeding
- BMP C124: Sodding
- BMP C125: Compost
- BMP C126: Topsoiling
- BMP C130: Surface Roughening
- BMP C140: Dust Control

NOTE: The applicant may wish to mix in grass seed with the above practices to further aid in soil stabilization. Please refer to Table 16 and Table 17**.**

2. Erosion Control Blankets/ Mats (Figure 57)

Erosion control blankets are suited for post-construction site stabilization, but may be used for temporary stabilization of highly erosive soils. Erosion control blankets are suitable for steep slopes, stream banks, and areas where vegetation will be slow to establish. These blankets are typically made from straw, coconut fiber, excelsior, or synthetic material that is enveloped in plastic, biodegradable netting, jute, polypropylene, or nylon.

Applicable BMPs include:

- BMP C122: Nets and Blankets

3. Gravel/Riprap (Figure 58 and Figure 59)

Gravel and Riprap are used to protect hillsides, drainage channels, stream banks, and pipe outlets from erosion due to surface water flow.

4. Plastic Sheeting (Figure 60)

Plastic sheeting is a temporary method of erosion control. Plastic covering provides immediate, short-term erosion protection to slopes, soil stockpiles, and other disturbed areas. Unlike the other erosion protection techniques mentioned above, plastic sheeting shall be removed prior to applying permanent erosion protection.

Applicable BMPs include:

- BMP C123: Plastic Covering

Protect Slopes

Design, construct and phase projects in a manner that will minimize erosion. Protect slopes by diverting water at the top of the slope. Reduce slope velocities by minimizing the continuous length of slope. This can be accomplished by terracing and roughening slope sides. Seeding and establishing vegetation on slopes will help protect slopes as well.

Applicable BMPs include:

- BMP C120: Temporary and Permanent Seeding
- BMP C130: Surface Roughening
- BMP C131: Gradient Terraces
- BMP C200: Interceptor Dike and Swale
- BMP C204: Pipe Slope Drains

Control Pollutants Other Than Sediment

All pollutants must be disposed of in a manner that does not cause contamination of surface waters. Do not maintain or repair any heavy equipment or vehicles onsite. Clean any spills immediately. Handle concrete and concrete waste appropriately.

Applicable BMPs include:

- BMP C150: Materials on Hand
- BMP C151: Concrete Handling
- BMP C152: Sawcutting and Surfacing Pollution Prevention
- BMP C153: Materials Delivery, Storage and Containment
- BMP C154: Concrete Washout Area

Control Dewatering

All discharges to the City sewer system require City approval. This approval may be obtained through a Special Approval Discharge (SAD) permit.

Any dewatering water must be discharged through a stabilized channel to a sediment pond.

Maintain BMPs

Maintain and repair temporary erosion and sediment control BMPs as needed. Inspect all BMPs at least weekly and after every storm event. Remove all temporary erosion and sediment control BMPs within 30 days after final site stabilization.

Table 16. Temporary Erosion Control Seed Mix

	% Weight	**% Purity**	**% Germination**
Chewings or annual bluegrass *Festuca rubra var. commutate or Poa anna*	40	98	90
Perennial rye *Lolium perenne*	50	98	90
Redtop or colonial bentgrass *Agrostis alba or Agrostis tenuis*	5	92	85
White Dutch clover *Trifolium repens*	5	98	90

Table 17. Mulch Standards and Guidelines

Mulch Material	Quality Standards	Application Rates	Remarks
Straw	Air-dried; free from undesirable seed and coarse material.	3" thick; 5 bales per 1000 sf or 2 to 3 tons per acre.	Cost-effective protection when applied with adequate thickness. Hand-application generally requires greater thickness than blown straw. The thickness of straw may be reduced by half when used in conjunction with seeding. In windy areas, straw must be held in place by crimping, using a tackifier, or covering with netting. Blown straw always has to be held in place with a tackifier as even light winds will blow it away. Straw, however, has several deficiencies that should be considered when selecting mulch materials. If often introduces and/or encourages the propagation of weed species and it has no significant long-term benefits. Straw should be used only if mulches with long-term benefits are unavailable locally. It should also not be used within the ordinary high-water elevation of surface waters (due to flotation).
Hydro-mulch	No growth inhibiting factors.	Approx. 25-30 lbs per 1000 sf or 1500-2000 lbs per acre.	Shall be applied with hydromulcher. Shall not be used without seed and tackifier unless the application rate is at least doubled. Fivers longer than about ¾ - 1 inch clog hydromulch equipment. Fibers should be kept to less than ¾ inch.
Composted Mulch and Compost	No visible water or dust during handling. Must be purchased from supplier with a Solid Waste Handling permit (unless exempt)	3" thick, min.; approx. 100 tons per acre (approx. 800 lbs. per yard).	More effective control can be obtained by increasing thickness to 3". Excellent mulch for protecting final grades until landscaping because it can be directly seeded or tilled into soil as an amendment. Composted mulch has a coarser size gradation than compost. It is more stable and practical to use in wet areas and during rainy weather conditions.
Chipped Site Vegetation	Average size shall be several inches. Gradations from fine to 6-inches in length for texture, variation, and interlocking properties.	3" minimum thickness	This is a cost-effective way to dispose of debris from clearing and grubbing, and it eliminates the problems associated with burning. Generally, it should not be used on slopes above approx. 10% because of its tendency to be transported by runoff. It is not recommended within 200 feet of surface waters. If seeding is expected shortly after mulch, the decomposition of the chipped vegetation may tie up nutrients important to grass establishment.

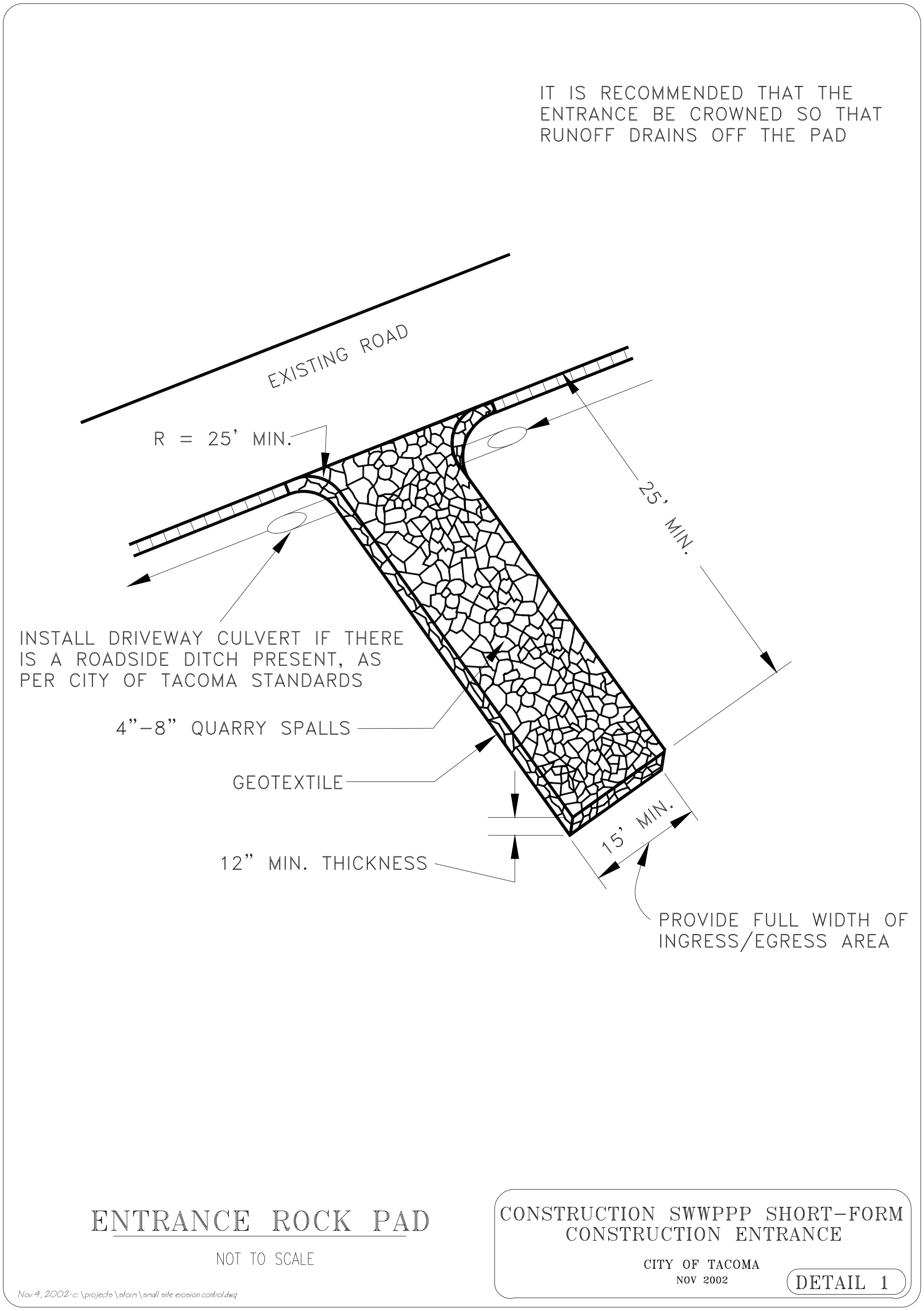


Figure 45. Construction Entrance

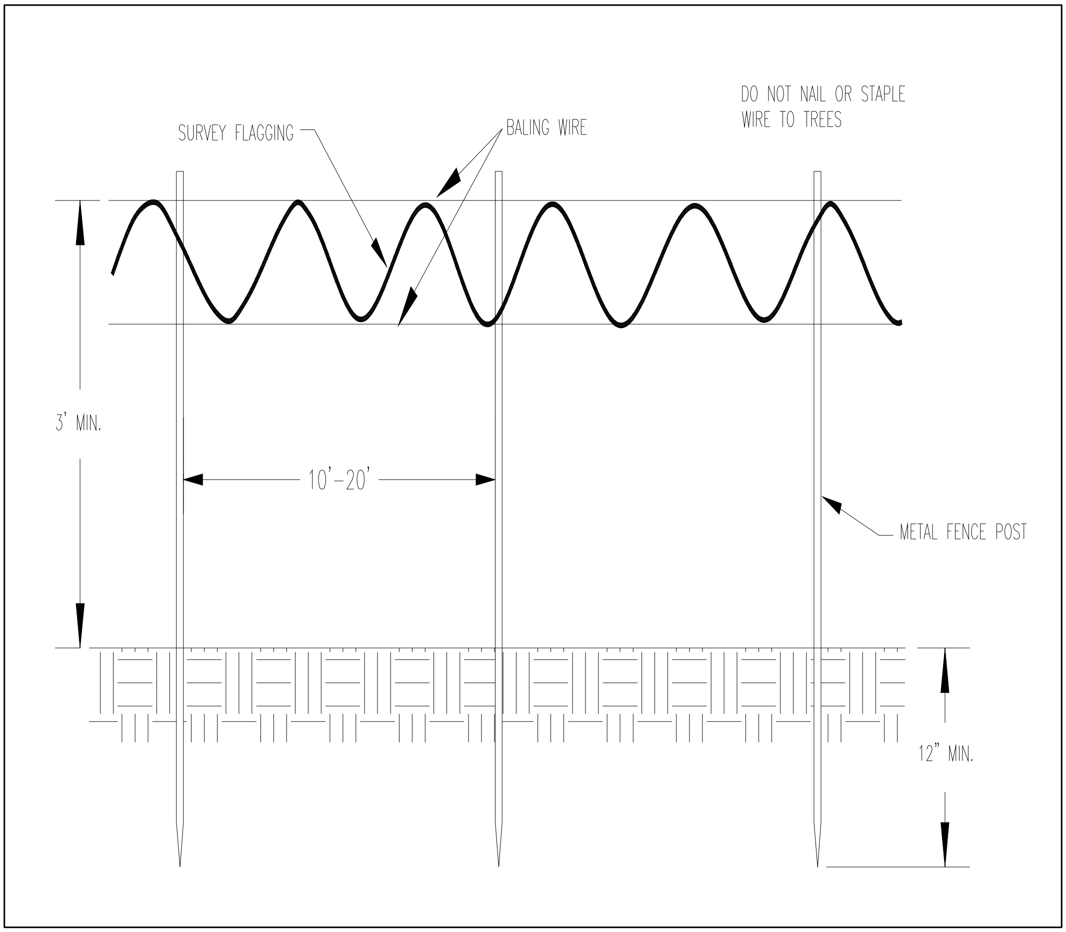


Figure 46. Stake and Wire Fence

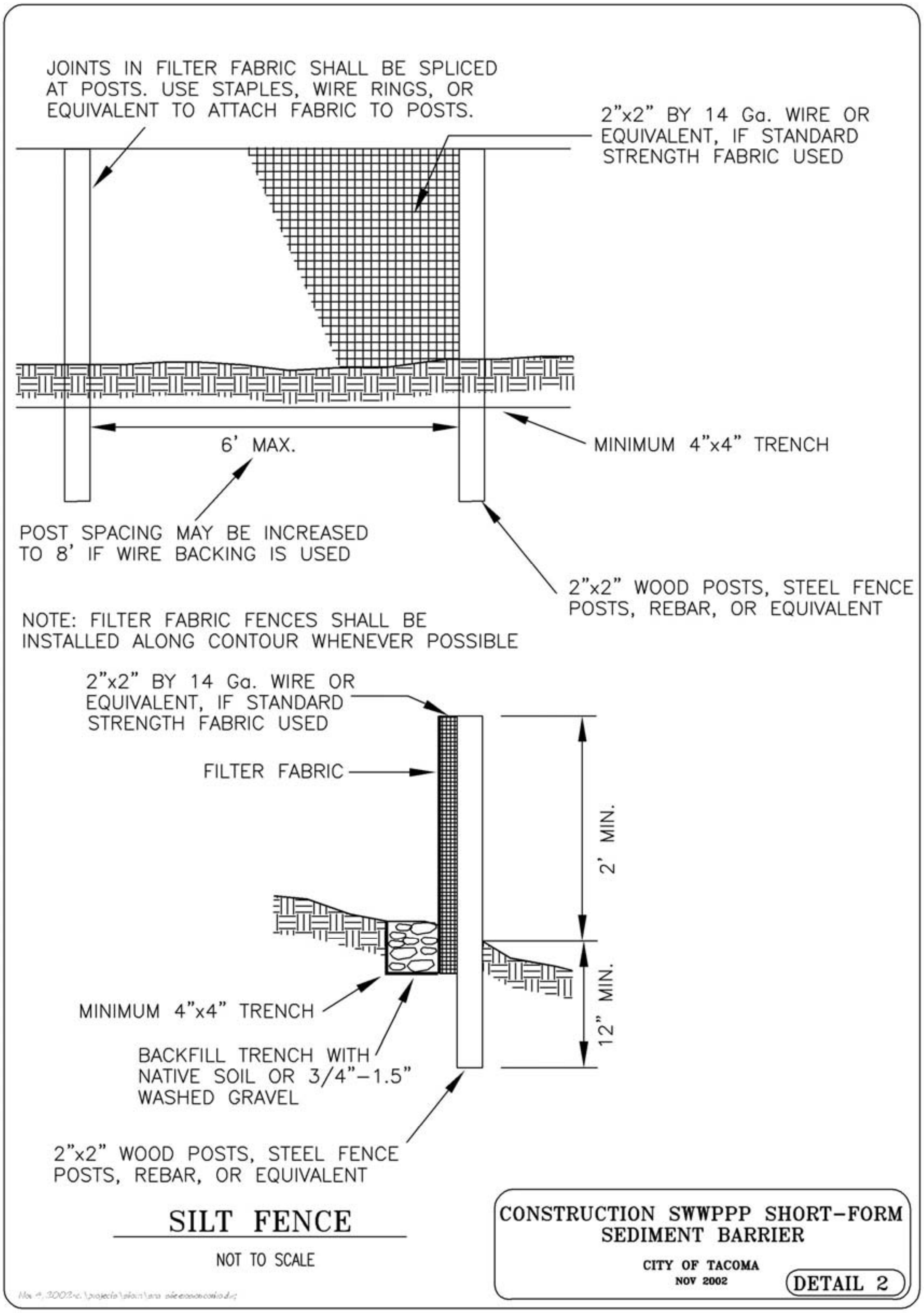


Figure 47. Sediment Barrier – Silt Fence

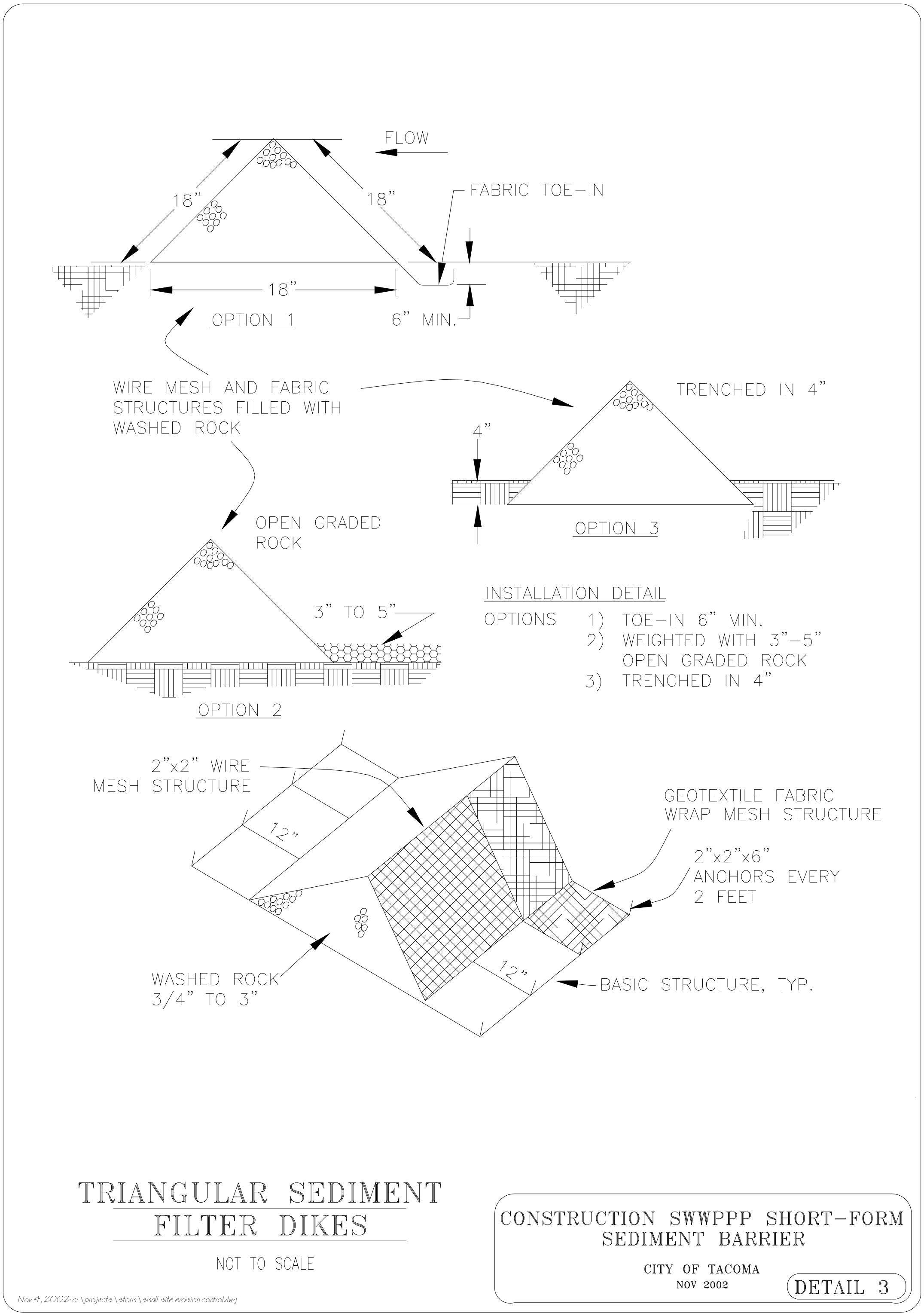


Figure 48. Sediment Barrier – Triangular Sediment Filter Dikes

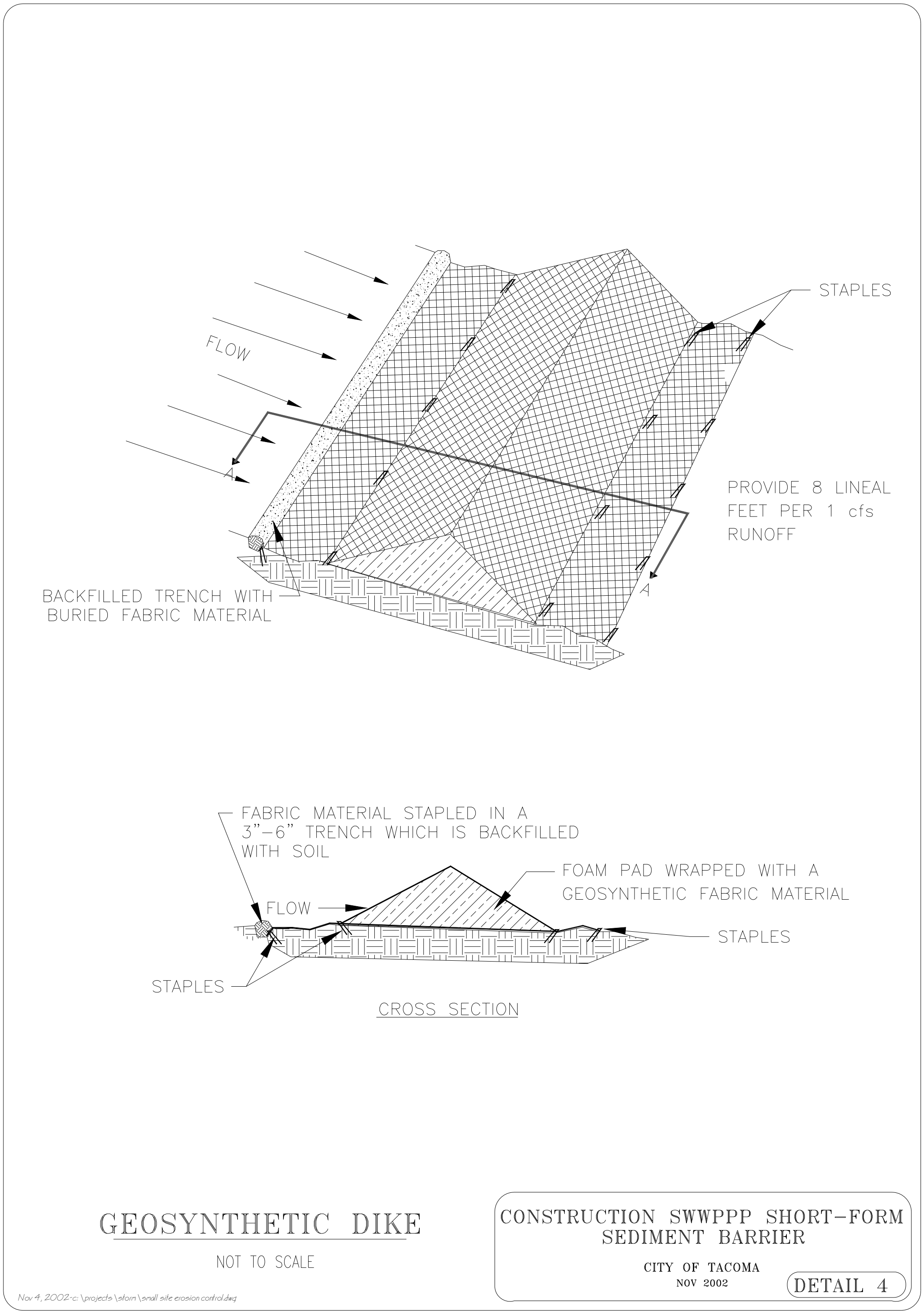
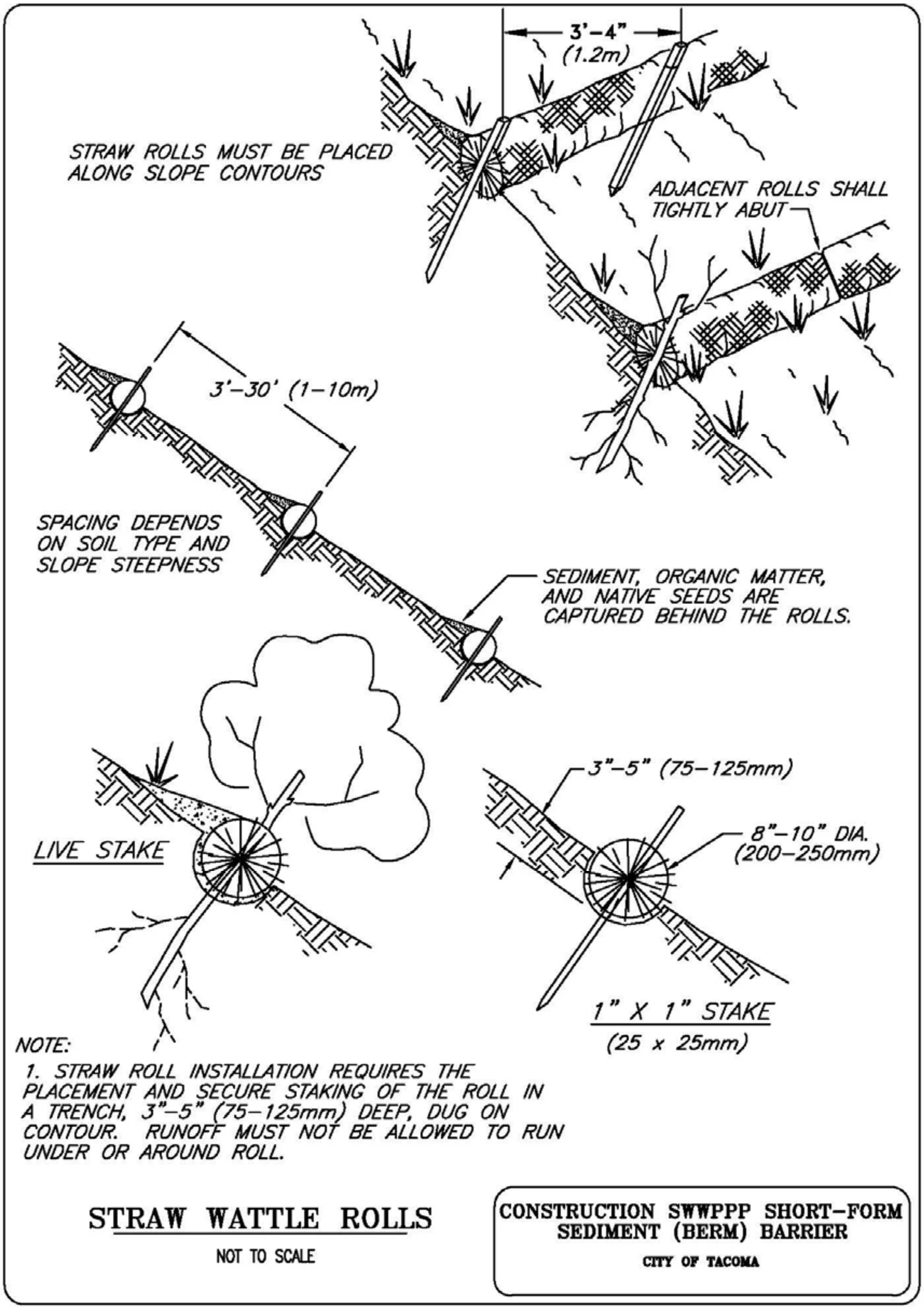


Figure 49. Sediment Barrier – Geosynthetic Dike



NOTE:

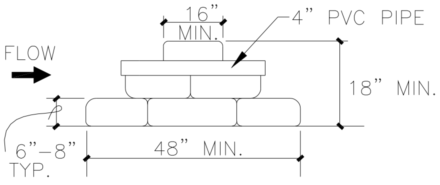
1. STRAW ROLL INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE ROLL IN A TRENCH, 3"–5" (75–125mm) DEEP, DUG ON CONTOUR. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.

STRAW WATTLE ROLLS

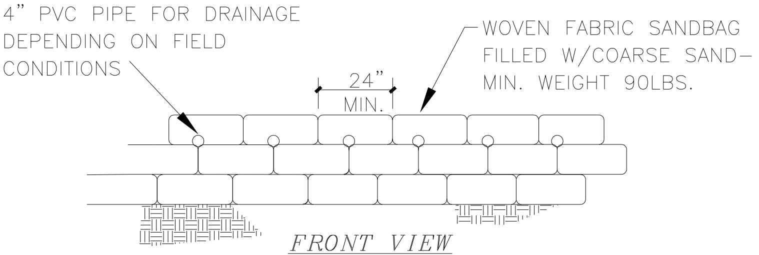
NOT TO SCALE

CONSTRUCTION SWWPPP SHORT–FORM
SEDIMENT (BERM) BARRIER
CITY OF TACOMA

Figure 50. Sediment (Berm) Barrier – Straw Wattle Rolls



CROSS SECTION



FRONT VIEW

1) WHEN SANDBAG IS FILLED WITH COARSE GRADE SAND MATERIAL, THE OPEN END SHOULD BE STAPLED OR TIED WITH NYLON OR POLY CORD. THE WEIGHT SHALL BE 90 – 125 LBS.
2) SANDBAGS SHOULD BE STACKED IN AT LEAST THREE VERTICAL ROWS ABUTTING EACH OTHER, AND IN STAGGERED ARRANGEMENT. (REFER TO FRONT VIEW).
3) THE BASE OF THE BERM SHOULD BE AT LEAST 3 SANDBAGS DEEP AND CAN BE REDUCED TO 2 AND 1 BAG IN THE SECOND AND THIRD ROWS RESPECTIVELY. (REFER TO CROSS SECTION).

SANDBAG BERM

NOT TO SCALE

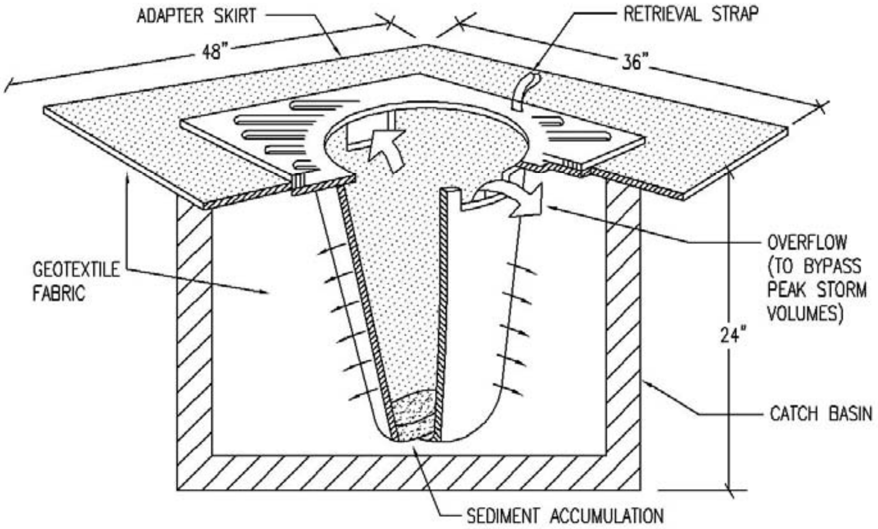
Nov 4, 2002-c:\projects\storm\small site erosion control.dwg

CONSTRUCTION SWWPPP SHORT–FORM
SEDIMENT (BERM) BARRIER

CITY OF TACOMA
NOV 2002

DETAIL 6

Figure 51. Sediment (Berm) Barrier – Sandbag Berm



INLET PROTECTION NOTES:

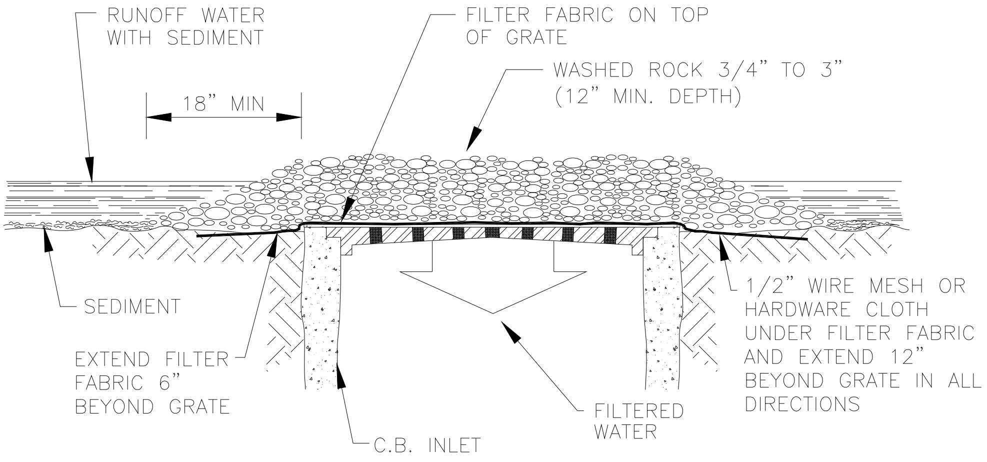
1. FILTERS SHALL BE INSPECTED AFTER EACH STORM EVENT AND CLEANED OR REPLACED WHEN 1/3 FULL.

BAG FILTER

NOT TO SCALE

CONSTRUCTION SWWPPP SHORT-FORM
CATCH BASIN PROTECTION
CITY OF TACOMA

Figure 52. Catch Basin Protection – Bag Filter



WARNING: DO NOT USE IN STREET OR R.O.W.

INLET GRAVEL & FILTER FABRIC

NOT TO SCALE

CONSTRUCTION SWWPPP SHORT-FORM
CATCH BASIN PROTECTION

CITY OF TACOMA
NOV 2002

DETAIL 8

Nov 4, 2002-c:\projects\storm\small site erosion control.dwg

Figure 53. Catch Basin Protection – Inlet Gravel and Filter Fabric

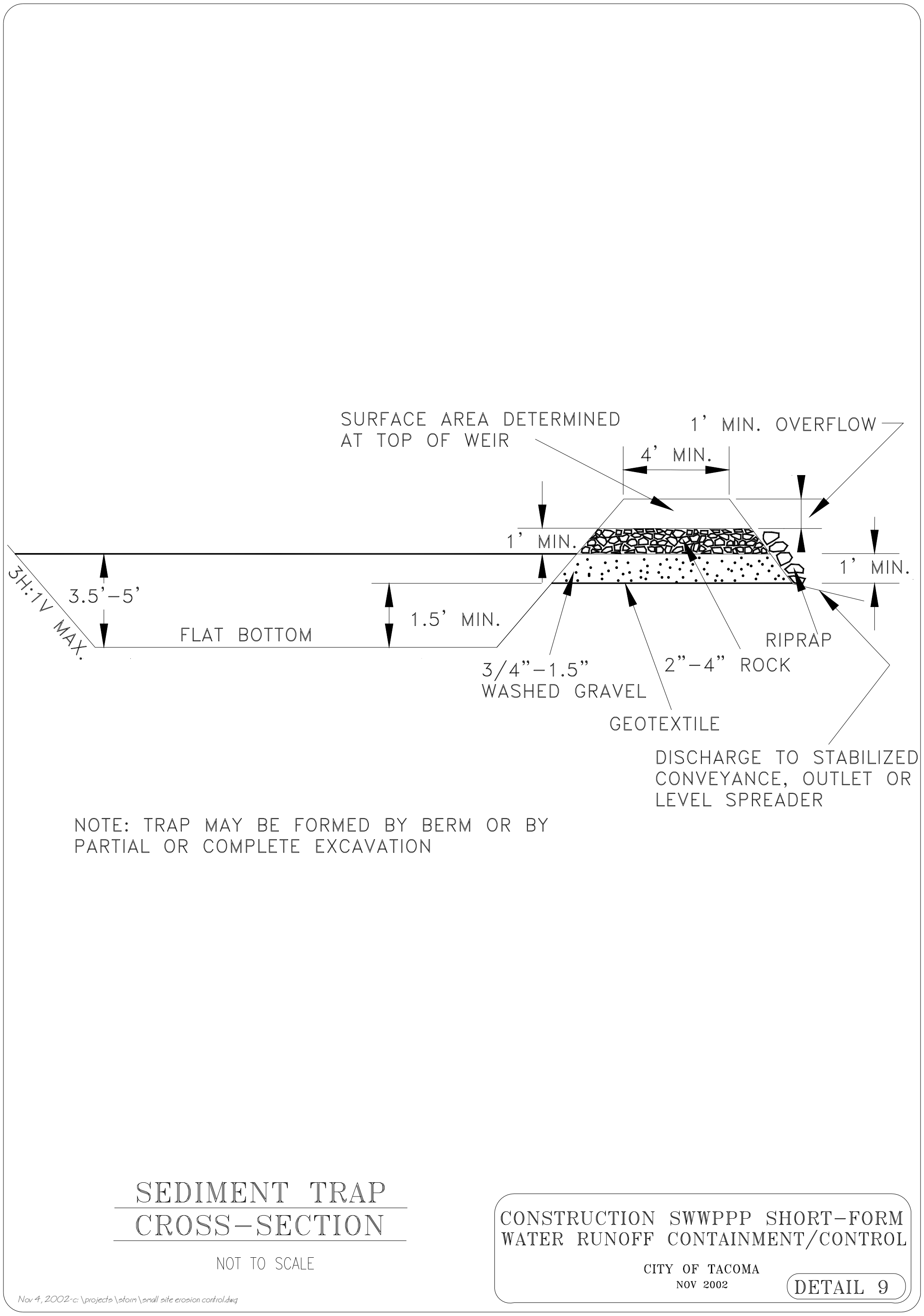
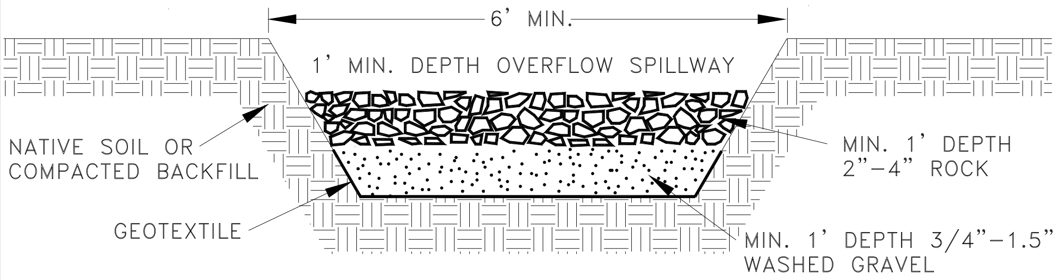


Figure 54. Water Runoff Containment/Control – Sediment Trap Cross-Section



SEDIMENT TRAP OUTLET

NOT TO SCALE

CONSTRUCTION SWWPPP SHORT-FORM
WATER RUNOFF CONTAINMENT/CONTROL

CITY OF TACOMA
NOV 2002

DETAIL 10

Nov 4, 2002-c:\projects\storm\small site erosion control.dwg

Figure 55. Water Runoff Containment/Control – Sediment Trap Outlet

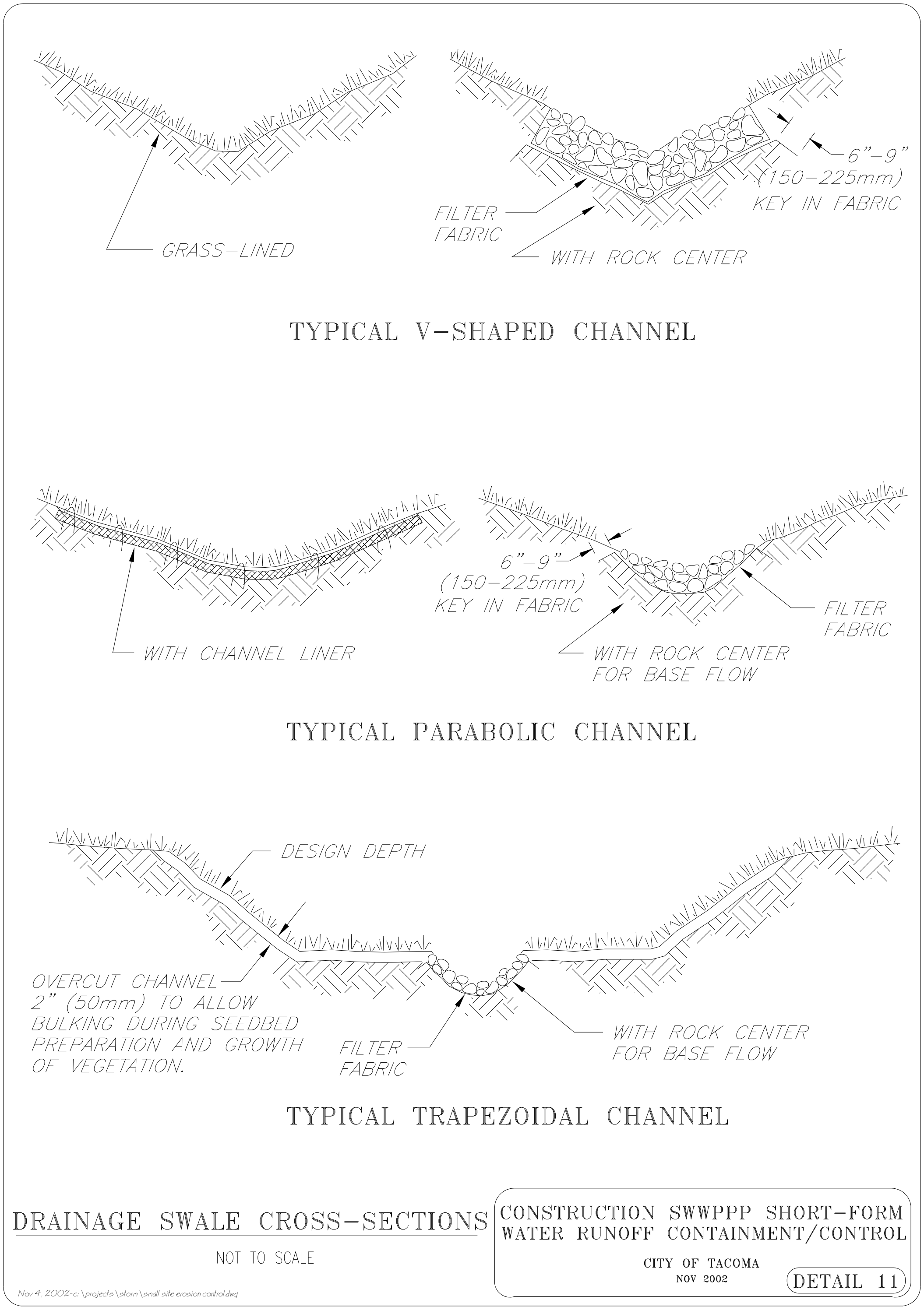
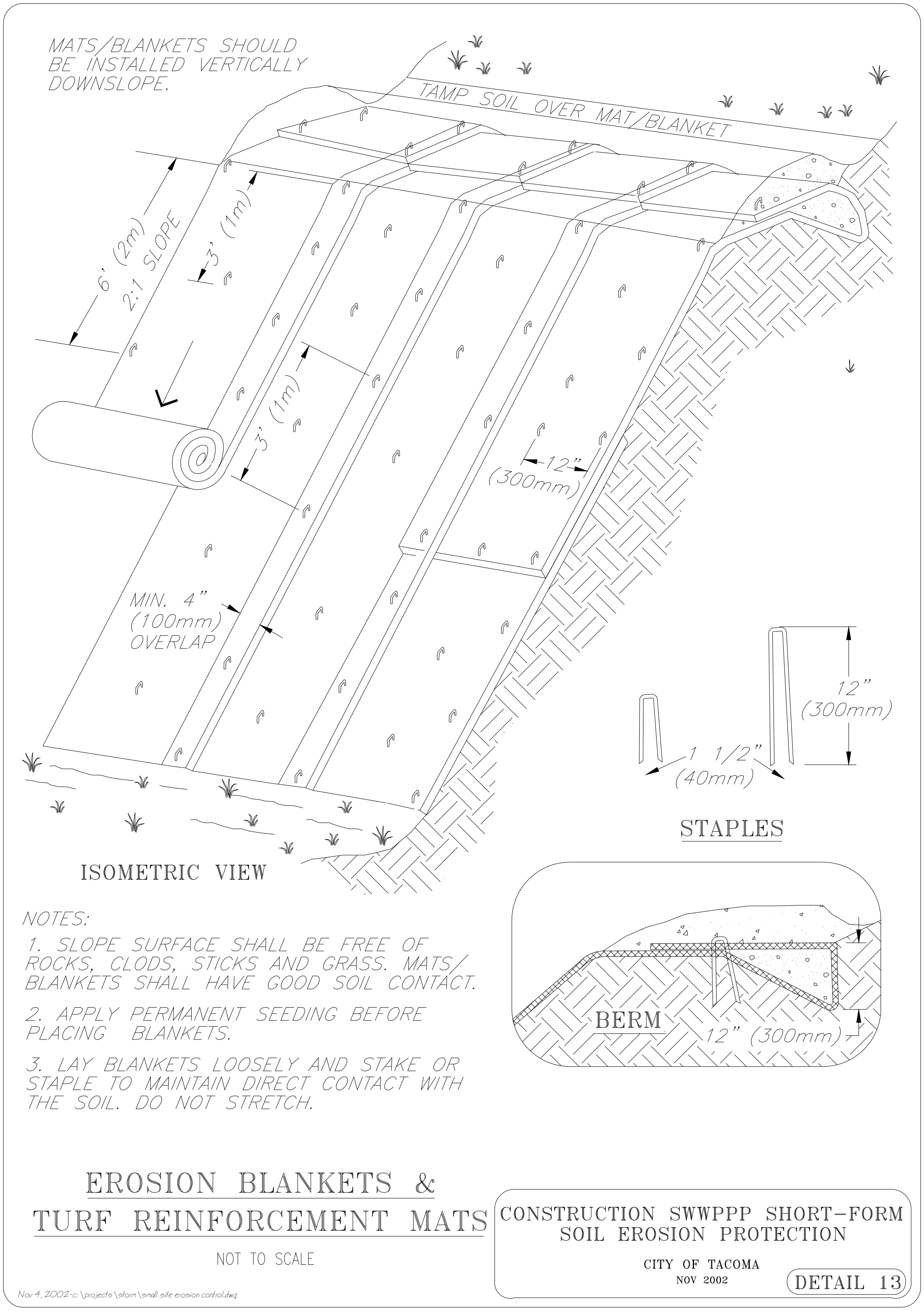


Figure 56. Water Runoff Containment/Control – Drainage Swale Cross-Sections



NOTES:

1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS. MATS/ BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.

EROSION BLANKETS &
TURF REINFORCEMENT MATS

NOT TO SCALE

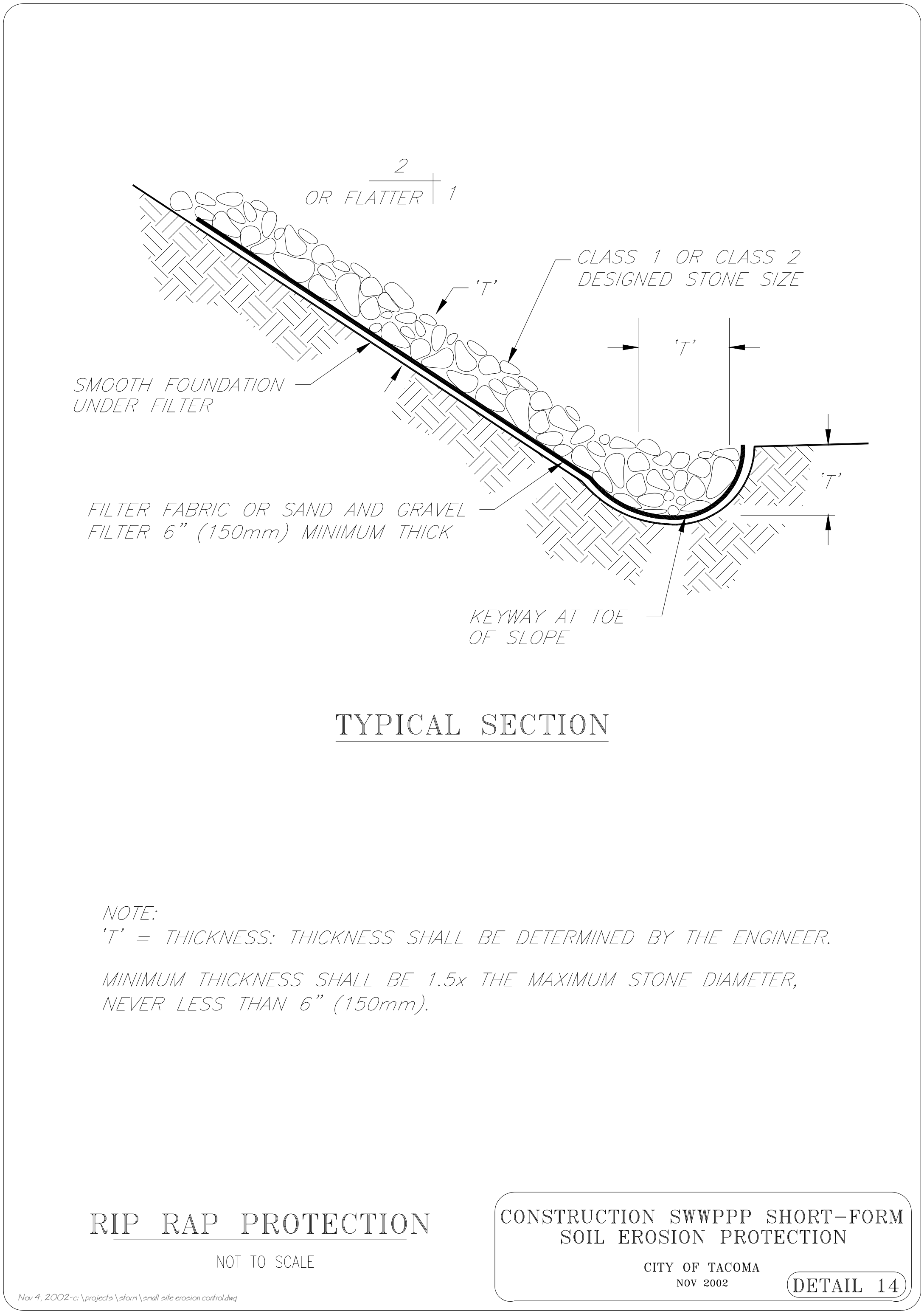
CONSTRUCTION SWWPPP SHORT-FORM
SOIL EROSION PROTECTION

CITY OF TACOMA
NOV 2002

DETAIL 13

Nov 4, 2002-c:\projects\storm\small site erosion control.dwg

Figure 57. Soil Erosion Protection – Erosion Blankets and Turf Reinforcement Mats



NOTE:
'T' = THICKNESS: THICKNESS SHALL BE DETERMINED BY THE ENGINEER.

MINIMUM THICKNESS SHALL BE 1.5x THE MAXIMUM STONE DIAMETER, NEVER LESS THAN 6" (150mm).

Figure 58. Soil Erosion Protection – Rip Rap Protection

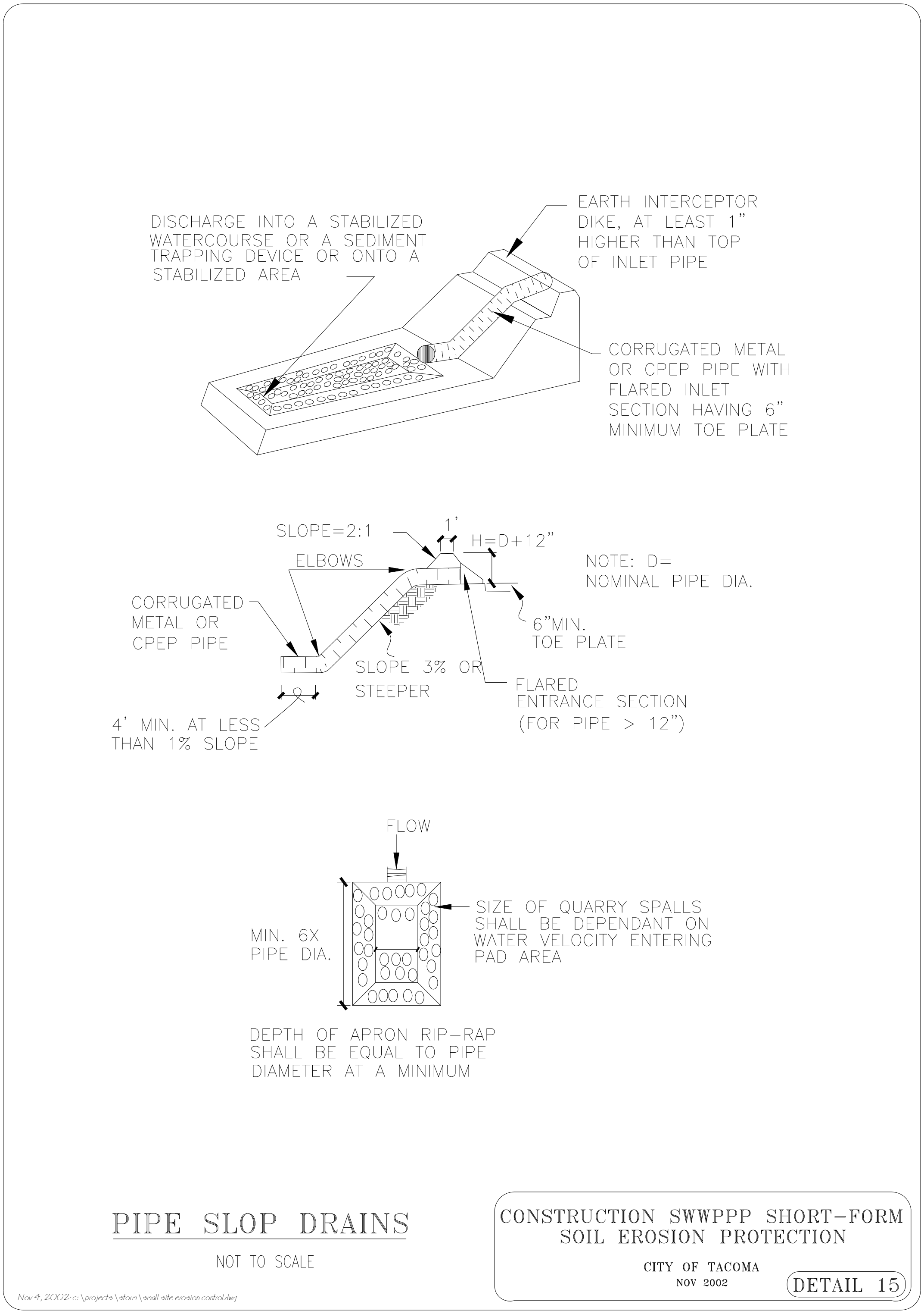


Figure 59. Soil Erosion Protection – Pipe Slope Drains

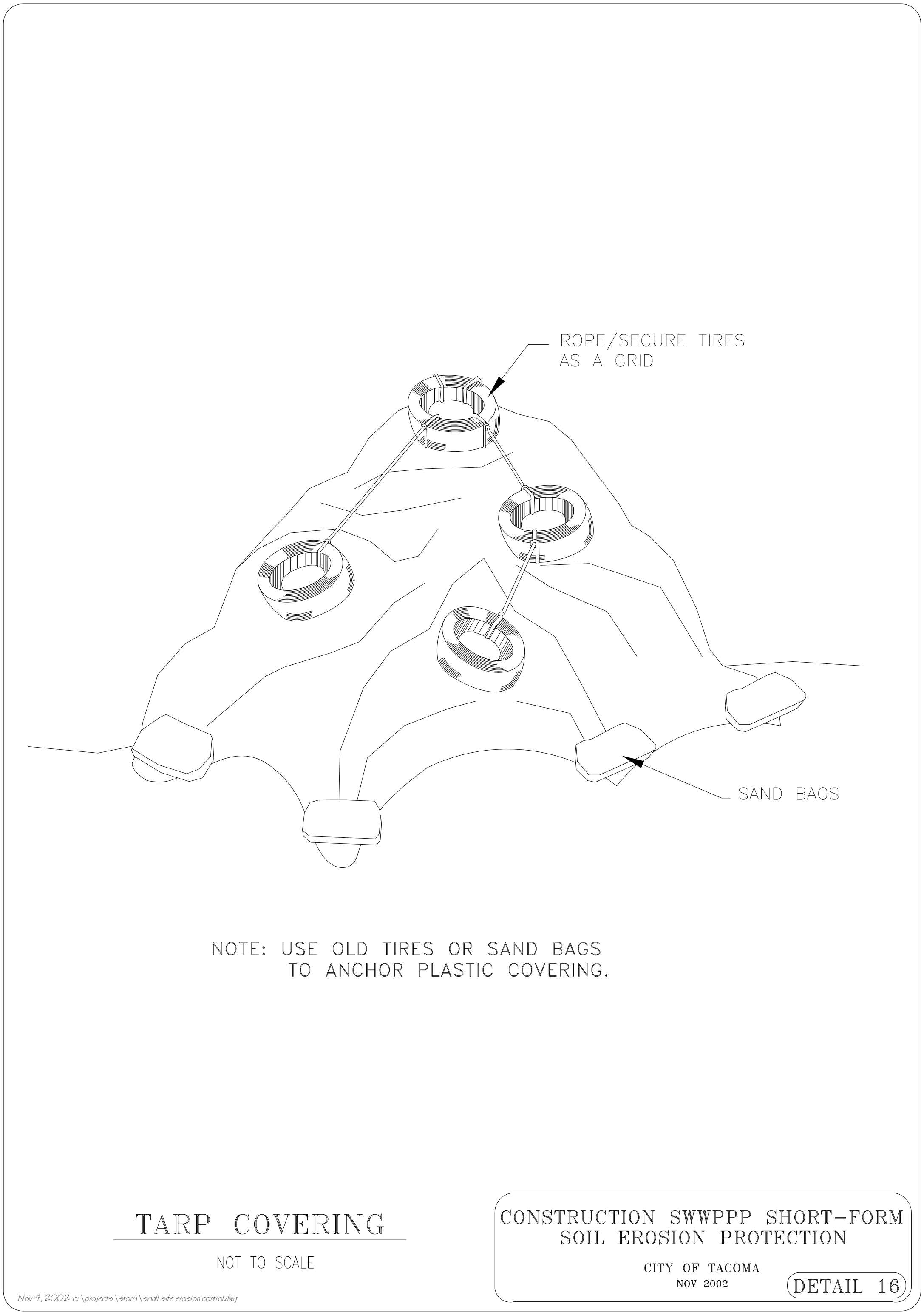


Figure 60. Soil Erosion Protection – Tarp Covering

APPENDIX E
COMPLIANCE MONITORING AND SAMPLING AND ANALYSIS PLAN

CLEANUP ACTION PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

FARALLON consulting

975 5th Avenue Northwest, Issaquah, Washington 98027
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COMPLIANCE MONITORING AND SAMPLING AND ANALYSIS PLAN

Appendix E of Cleanup Action Plan

SOUND BATTERY PROPERTY
2310 EAST 11th STREET
TACOMA, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027

Farallon PN: 1117-001

For:
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c/o Mr. Clark Davis
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July 15, 2014

Prepared by:

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Project Engineer

Reviewed by:

Branislav Jurista

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Senior Geologist

TABLE OF CONTENTS

ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CAP	Cleanup Action Plan
CMSAP	Compliance Monitoring and Sampling and Analysis Plan
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
Farallon	Farallon Consulting, L.L.C.
HASP	Health and Safety Plan
mg/kg	milligrams per kilogram
MTCA	Washington State Model Toxics Control Act Cleanup Regulation
OnSite	OnSite Environmental Inc. of Redmond, Washington
QA/QC	quality assurance/quality control
Site	Sound Battery property at 2310 East 11th Street in Tacoma, Washington
WAC	Washington Administrative Code
XRF	x-ray fluorescence

1.0 INTRODUCTION

This Compliance Monitoring and Sampling and Analysis Plan (CMSAP) has been prepared by Farallon Consulting, L.L.C. (Farallon) to present the specific requirements for field monitoring and sample collection and analysis in support of the compliance monitoring program that will be implemented in conjunction with the cleanup action to be conducted at the Sound Battery property at 2310 East 11th Street in Tacoma, Washington (herein referred to as the Site). The cleanup action will include excavation of soil containing lead at concentrations exceeding the Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A cleanup level for industrial land use from three areas beneath and proximate to the Site building. Descriptions of the cleanup action are provided in the Cleanup Action Plan (CAP), to which this CMSAP is an appendix.

Compliance monitoring for the cleanup action will primarily be conducted by collecting soil grab samples for field screening and for laboratory analysis. A hand-held X-ray fluorescence (XRF) analyzer, a portable monitoring device capable of detecting concentrations of lead, will be used for field screening during the field program. The overall objective of the CMSAP is to provide guidance for compliance monitoring while the cleanup action is being implemented, and to define the specific requirements for field monitoring and sample collection and analysis, if required, to ensure that compliance monitoring summarized in the CAP is conducted in accordance with technically acceptable protocols.

The specific objectives of the CMSAP are to:

- Provide the basis for conducting and documenting field activities described in the CAP;
- Describe the sample locations, sample frequency, sample quantities, analytical methods, and documentation protocols for the compliance monitoring program;
- Identify the equipment and methodology to be used for field screening and soil sampling; and
- Describe the procedures and documentation requirements for construction observation of contaminated soil excavation.

The CMSAP will apply to monitoring and sampling and analysis activities to be conducted during cleanup action construction.

2.0 COMPLIANCE MONITORING PROGRAM

Compliance monitoring during the cleanup action includes protection, performance, and confirmational monitoring.

Protection monitoring will be performed in accordance with MTCA, as defined in Section 410(1)(a) of Chapter 173-340 of the Washington Administrative Code (WAC 173-340-410[1][a]) to confirm that human health and the environment are adequately protected during the excavation of the contaminated soil at the Site. The primary objective of protection monitoring during the cleanup action is to protect the health and safety of workers conducting compliance monitoring tasks. Protection monitoring and sampling is addressed in detail in the Health and Safety Plan (HASP) included in Attachment A.

Performance monitoring in accordance with WAC 173-340-410(1)(b) will confirm that the cleanup action has attained cleanup standards and, if appropriate, other performance standards such as construction quality control and monitoring necessary to demonstrate compliance with a permit or permitted construction plan. The primary objectives of performance monitoring during the cleanup action are to ensure that the components of the cleanup action are constructed per design and that contaminated soil is excavated as described in the CAP. Performance monitoring will be completed by field observations and grab sample field screening.

Confirmational monitoring per WAC 173-340-410(1)(c) will confirm the effectiveness of the cleanup action. The primary objectives of confirmational monitoring during the cleanup action are to document the completion of the cleanup action and support preparation of the Closure Report, to be completed following the cleanup action. Confirmational monitoring will include collection of soil samples for laboratory analysis during the excavation field program.

2.1 SUMMARY OF FIELD TASKS

This section provides a summary of the field tasks for protection, performance, and confirmational monitoring.

Protection monitoring will include visual observation of dust generation and application of water to the working surfaces as necessary to mitigate airborne transfer of dust. Additional information regarding protection monitoring is provided in the HASP prepared for the Site (Attachment A).

Performance monitoring will include:

- Documentation of daily construction and excavation limits using the Field Report form provided in Attachment B;
- Observation of soil conditions using the Soil Sample Data form provided in Attachment B; and
- Collection of soil grab samples for field screening that will be field-analyzed for concentrations of lead using an XRF in general accordance with U.S. Environmental Protection Agency (EPA) Method 6200 (Attachment C).

Confirmational monitoring will include collection of soil samples for laboratory analysis after performance monitoring results indicate that concentrations of lead in soil are less than 1,000 milligrams per kilogram (mg/kg) at the final limits of excavation.

2.2 SAMPLE LOCATIONS AND FREQUENCY

The locations and frequency for cleanup action soil sampling are described below. The field procedures for soil sampling are provided in Section 3, Sampling and Analysis Plan.

2.2.1 Protection Monitoring

Protection monitoring will include visual observation of dust generation, and application of water to the working surfaces as necessary to mitigate airborne transfer of dust. Additional information regarding protection monitoring is provided in the HASP (Attachment A).

2.2.2 Performance Soil Sampling

After reaching the planned soil excavation depth of approximately 2.0 feet below ground surface (bgs) in the areas of shallow excavation, performance soil samples will be collected from the excavation bottom and sidewalls at a maximum interval spacing of 20 feet (20 by 20-foot grids). Farallon estimates that the initial round of performance samples will consist of 8 (grid) bottom performance samples, and 12 sidewall performance samples collected from Remediation Area A. Remediation Areas B and C will each have one bottom performance sample and four sidewall performance samples.

After the anticipated groundwater depth of approximately 6 to 8 feet bgs is reached in the areas of deep excavation in Remediation Subareas A1 and A2 and the excavation has been advanced an additional 2 feet bgs, performance soil samples will be collected from the excavation bottom. Additional sidewall soil samples also may be collected from Remediation Subareas A1 and A2.

Each performance sample will be screened using a hand-held XRF analyzer to measure the approximate concentration of lead in each soil sample. Specific procedures for XRF analyzer operation and recording of XRF analyzer field data are provided in Attachment C.

If the lead concentration for a screening sample as measured by the XRF is greater than 1,000 mg/kg, an additional 0.5 foot of soil will be excavated from that grid or excavation area, followed by collection and field screening of an additional performance soil sample, as described above. If the lead concentration for a screening sample as measured by the XRF analyzer is less than 1,000 mg/kg, the performance soil sample will be submitted as a confirmation soil sample to the analytical laboratory for analysis for lead by EPA Method 6020.

2.2.3 Confirmation Soil Sampling

Confirmation monitoring for soil will be conducted once performance monitoring results indicate that lead concentrations are less than 1,000 mg/kg at the limits of the excavations. Confirmation monitoring will consist of collecting in-situ soil samples from the base and/or sidewalls at the final limits of the completed excavation areas. Performance monitoring soil sample locations will be used as confirmation soil sampling points in cases where the analytical results of the performance soil samples confirm that lead concentrations are less than 1,000 mg/kg at the limits of the excavations. Confirmation soil samples will be collected from the final limits of the excavation area using the sampling methodology described herein.

If the lead concentration for a confirmational sample detected by laboratory analysis is greater than 1,000 mg/kg, an additional 0.5-foot of soil will be excavated from that grid or excavation area, followed by collection and field screening of an additional performance soil sample, as described in Section 2.2.2. Performance Soil Sampling. If the lead concentration for a confirmation sample detected by laboratory analysis is less than 1,000 mg/kg, no further excavation is required in that grid area, and that grid area may be backfilled with clean imported soil.

3.0 SAMPLING AND ANALYSIS PLAN

This section summarizes the field procedures and protocols that will be followed for performance and confirmational monitoring as part of the cleanup action compliance monitoring program. The HASP (Attachment A) defines the protection monitoring for the cleanup action compliance monitoring program.

3.1 SAMPLING PROCEDURES AND PROTOCOLS

The field sampling procedures and sample handling protocols for samples collected during the cleanup action will be in accordance with Standard Operating Procedures detailed in Attachment C and summarized below. Field sampling data will be documented on Field Report forms (Attachment B) as described in Section 3.4, Field Documentation.

3.1.1 X-Ray Fluorescence Analyzer Calibration

Calibration checks will be performed daily on the XRF analyzer in accordance with manufacturer specifications. An instrument blank will be analyzed at the beginning and end of each workday that the instrument is used, and documented on monitoring logs. Calibration verification checks will be performed at the beginning and end of each workday that the instrument is used using standard reference materials certified by the National Institute of Standards and Technology. The calibration results will be compared to the specifications provided by the instrument manufacturer, and documented on monitoring logs.

Duplicate XRF analyzer sample analyses will be performed on a minimum of 10 percent of the field samples analyzed with the XRF analyzer. If the precision between duplicate field sample results is consistently greater than 25 percent, corrective action will be implemented. If the results fall outside the acceptable range, immediate corrective action(s) such as instrument recalibration and sample re-analysis will be performed, as appropriate.

3.1.2 Soil Sample Designation and Labeling

Sample labels will be filled out and affixed to appropriate containers immediately prior to sample collection. The label will be filled out in indelible ink and will include the following information: media, date, time sampled, sample identification and number, project name, project number, sampler’s initials, and analyte preservatives, if any.

Soil sample identification will be as follows:

- Excavation area location (e.g., “A”);
- Unique location identifier (Grid location 1, 2…etc., predetermined by Field Staff and Project Manager);
- Identifier as to whether the soil sample is collected from the bottom or the sidewall of the excavation (e.g., “B” or “SW”)
- Sample date (e.g., “080414”); and

- Sample depth in feet (e.g., 0.5, 1.0 ,1.5).

For example, a confirmational soil sample collected from the base of the excavation in grid 1 in excavation Area A on September 15, 2014 from a depth of 0.5 foot bgs would be designated as A1-B-091514-0.5.

Duplicate samples will be labeled in a similar manner, with the letter “D” placed at the end of the sample number. Duplicate soil samples may include duplicates of soil samples analyzed with the XRF analyzer that are being submitted for laboratory analysis, or duplicate soil samples using the XRF analyzer for Quality Assurance (QA)/Quality Control (QC) evaluation. Sample numbers and the nature of each duplicate sample will be clearly recorded in the field notes.

3.1.3 Field Documentation

The primary purpose of field documentation is to provide a record of sample collection procedures. The field sampling forms will become permanent records of collection procedures. The field team will be responsible to the Project Manager for monitoring compliance with field sample collection protocols. At a minimum, field sampling forms will include the following:

- Sample date and time;
- Sample number and location;
- Designation as a performance or confirmation sample;
- Initials of sampling personnel;
- Sample depth;
- Unified Soil Classification System soil description;
- Soil moisture; and
- Any deviation from sampling protocols.

All sampling data will be written with waterproof indelible ink. A sampling form for use during the cleanup action is provided in Attachment B.

3.1.4 Chain of Custody

The primary purpose of chain-of-custody procedures is to document possession of the samples from collection through storage and analysis to reporting. Chain of Custody forms will become permanent records of sample handling and shipment. The field team will be responsible to the Project Manager for monitoring compliance with chain-of-custody procedures.

Field sampling personnel are responsible for the care and security of field and laboratory samples from the time the samples are collected until they have been turned over to the shipper or analytical laboratory. A sample is considered to be in one's custody if it is in plain view at all times, in the physical possession of the sampler, or stored in a locked place where tampering is prevented.

A Chain of Custody form will accompany each cooler containing samples stored at the Site or sent to the analytical laboratory. At a minimum, each Chain of Custody form will contain the following information:

- Sample identification number and location of sampling point;
- Date and time of sampling;
- Type of sample and number of containers of samples from each sampling point;
- List of analyses requested/performed;
- Names and signatures of sampling personnel;
- Shipping air bill number, if applicable; and
- Spaces for transfer-of-custody acknowledgment.

When the Chain of Custody form has been completed or when all samples that will fit into a single cooler have been collected, the field team members will cross-check the form for possible errors and sign the Chain of Custody form. Any corrections to the form will be made with a single strike mark, dated, and initialed. The signed Chain of Custody form will be sealed in a plastic bag and placed in the shipping container before the container is sealed for transport or shipment to the analytical laboratory. Samples packaged for shipment and dispatched to the laboratory will contain a separate Chain of Custody form accompanying each cooler. A copy of each Chain of Custody form will be retained by the sampling team for the project file, and the original will be sent with the samples. A sample of the Chain of Custody form that will be used during the cleanup action is provided in Attachment B.

3.1.5 Photographs

Representative digital photographs may be taken during field activities to identify and locate sampling locations, document a sample location’s appearance, identify Site features, and/or document field activities or field observations. A photographic log will be maintained in the daily field notes. Once downloaded, all photos will be named in accordance with the corresponding sample designation or given a more-descriptive name that can be correlated with the field documentation.

3.1.6 Soil Quality Assurance/Quality Control

QA/QC samples will be collected during the course of the cleanup action to provide for data quality assessment. QA/QC samples will include duplicates. QA/QC samples will be collected and shipped to the laboratory with the other samples. The exact number of QA/QC samples will be dependent on the number of samples collected during the cleanup action. The anticipated frequency is 1 duplicate sample for every 20 samples collected.

3.1.7 Laboratory Analysis

OnSite Environmental Inc. of Redmond, Washington (OnSite) has been selected as the laboratory to conduct the analysis of the samples collected during the cleanup action. Analysis of lead will be by EPA Method 6020. OnSite is certified by the Washington State Department of Ecology (Ecology) and meets Ecology and EPA QA/QC requirements. A copy of the laboratory Quality Assurance Manual for OnSite that will be followed throughout the cleanup action is on file at the Farallon office for review and reference.

3.2 SAMPLE HANDLING

This section discusses the sample handling methods to be used for the cleanup action. The protocols discussed include sample containers, preservation procedures, and hold times; sample packaging and shipment; sample documentation; and collection of QA/QC samples.

Upon transfer of the samples to laboratory personnel or arrival of the samples at the laboratory facility, the laboratory will assume responsibility for custody of the samples. Laboratory personnel will document the status of shipping and handling containers and will adhere to standard chain-of-custody protocols to track each sample through all stages of laboratory processing.

3.2.1 Sample Containers, Preservation Procedures, and Hold Times

Sample container requirements for the cleanup action are based on the medium to be sampled and the type of analysis to be performed. The containers, preservation procedures, and hold times for each medium to be sampled are in accordance with standard laboratory protocols and are described below:

- **Soil Samples—**Soil samples from excavations and for waste soil characterization will be placed in clear 8-ounce wide-mouth jars and sealed with a Teflon-lined screw cap. Once sealed, the containers will be stored in a cooler for transport to the laboratory. All of the samples will be submitted to the laboratory for analysis for lead by EPA Method 6020. The typical hold time for this type of sample chilled to 4 degrees Celsius is 6 months.

3.2.2 Sample Packaging and Shipment

All samples shipped for laboratory analysis will be packaged according to applicable regulations and the recommendations of the laboratory performing the analysis. After being sealed in coolers, the samples will be expeditiously transported to the analytical laboratory.

The following procedures (representing the minimum shipping and handling requirements) will be used for sample packaging:

- A sample label will be affixed to the corresponding sample container at the time of sample collection;
- Sample containers will be placed into a cooler and checked against the Chain of Custody form to ensure that all samples are listed and are placed into the correct cooler;
- One copy of the Chain of Custody form will be detached and retained by the Farallon Field Scientist;
- Remaining paperwork will be sealed in a resealable plastic bag and taped to the inside of the cooler lid; and

- One to three resealable bags will be filled with ice and/or chemical equivalent and included in the cooler containing water samples.

3.2.3 Sample Documentation

All sample containers will be identified with a durable label, and the sample identifier will be recorded in the Soil Sample Data Log and the Field Report forms (Attachment B). Other sample documentation to be maintained by field personnel includes Chain of Custody forms and seals, sample labels, and shipment bills. Examples of these forms are provided in Attachment B.

Sample containers will be labeled with the client name, project name and number, date and time sampled, sample identifier, sampler's initials, analysis, and analyte preservative(s), if any.

At the time of sampling, the appropriate sample containers will be selected, and the sample number for each sample will be recorded on the Soil Sample Data Log and on the Field Report form. Entries for all samples will be made on the Chain of Custody form prior to the transfer of the samples off the Site. Each Chain of Custody form will indicate the medium, date, time sampled, sample identification and number, project name, project number, sampler's initials, and analyte preservative(s) if any.

3.2.4 Field Quality Assurance/Quality Control Samples

Farallon will collect one field duplicate soil sample per 20 samples collected during confirmation soil sampling. Duplicate soil samples will be analyzed using the XRF analyzer during performance soil sampling, as described in Section 3.1.1, X-Ray Fluorescence Analyzer Calibration.

3.3 MANAGEMENT OF WASTE

Waste soil and disposables will be managed as described below

3.3.1 Soil

Soil will be generated by excavation of contaminated soil and through the collection of performance and confirmation soil sampling. Contaminated soil will be disposed of off the Site in accordance with Washington State Regulations and other applicable or relevant and appropriate requirements defined in the CAP.

3.3.2 Disposables

Disposable personal protective clothing (e.g., Tyvek suits, rubber gloves, boot covers) and disposable sampling devices (e.g., plastic scoops and bailers) will be cleaned, placed into plastic garbage bags, and disposed of as nonhazardous waste.

3.4 FIELD DOCUMENTATION

Documentation of field activities will be provided on Field Report forms, Soil Sample Data logs, sample and waste material labels, Waste Inventory forms, and Chain of Custody forms.

Documentation generated during the field program will be retained in the project file and included in the reports generated, as appropriate.

3.4.1 Field Report Form

Field personnel will be required to keep a daily field log on a Field Report form. Field notes will be as descriptive and inclusive as possible, enabling independent parties to reconstruct the sampling situation from the recorded information. Language will be objective, factual, and free of inappropriate terminology. A summary of each day's events will be provided on the Field Report form. At a minimum, field documentation will include the date, job number, project identification and location, weather conditions, sample collection data, personnel present and responsibilities, field equipment used, and any activities performed in a manner other than as specified in the CMSAP. In addition, if other forms or documents such as surveys or maps are completed or used, they will be cited in and attached to the Field Report form. Field personnel will sign the completed Field Report form. A copy of the Field Report form is included in Attachment B.

3.4.2 Soil Sample Data Log

A Soil Sample Data Log will be used by the Field Scientist during soil sampling activities to record information pertaining to the soil samples being collected. This form includes entries for the sample location, identification, and depth; the time sampled; field-screening results; the types and number of containers collected; and a brief lithologic description. These forms will be maintained in the project files. A copy of a Soil Sample Data Log is included in Attachment B.

3.4.3 Sample Label

A sample label is filled out and affixed to appropriate sample containers immediately prior to sample collection. The label is filled out in indelible ink and includes the medium, date, time sampled, sample identification and number, project name, project number, sampler’s initials, and analyte preservative(s), if any.

3.4.4 Waste Material Label

A waste material label is filled out and affixed to the appropriate waste container immediately upon filling. The label is filled out in indelible ink and includes the job number and name, the address where the waste was generated, container contents, date, consultant’s name and telephone number, and sampler’s initials.

3.4.5 Waste Inventory Form

A Waste Inventory form will be used to document and track the wastes generated during the cleanup action. The form will include information on the waste container, the origin of the waste, the type of waste, the date generated, the date removed from the Site, the transporter, and the disposal location. A copy of the Waste Inventory form is included in Attachment B.

3.4.6 Chain of Custody Form

The written procedures that are followed whenever samples are collected, transferred, stored, analyzed, or destroyed are designed to create an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis and reporting of analytical values. This written record, the Chain of Custody form, will be filled out by field sampling personnel at the time a sample is obtained.

All samples submitted to the laboratory are accompanied by the Chain of Custody form. This form is checked for accuracy and completeness, signed, and dated by the laboratory sample custodian accepting the sample. At the laboratory, each sample is assigned a unique sequential laboratory identification number that is stamped or written on the Chain of Custody form.

All samples are held under internal chain-of-custody in the Sample Control room under appropriate storage conditions (e.g., ambient, refrigeration, frozen). The laboratory Project Manager assigned to a particular client is responsible for tracking the status of the samples throughout the laboratory. Samples are signed out of the Sample Control room in a sample control logbook by the analyst who will prepare the samples for analysis.

The Chain of Custody form includes the client name, project name and number, date and time sampled, sample identifier, sampler's initials, analysis, and analyte preservative(s), if any. A copy of the Chain of Custody form is included in Attachment B.

ATTACHMENT A
HEALTH AND SAFETY PLAN

COMPLIANCE MONITORING AND
SAMPLING AND ANALYSIS PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

FARALLON consulting

975 5th Avenue Northwest, Issaquah, Washington 98027
Tel: (425) 295-0800   Fax: (425) 295-0850
www.farallonconsulting.com

HEALTH AND SAFETY PLAN

Attachment A of the Compliance Monitoring Plan

CLEANUP ACTION
SOUND BATTERY PROPERTY
2310 EAST 11TH STREET
TACOMA, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027

Farallon PN: 1117-001

For:
Mr. Marvin Dykman
c/o Mr. Clark Davis
Davis Law Office, PLLC
7525 Pioneer Way, Suite 101
Gig Harbor, Washington 98335

July 15, 2014

Prepared by:

Andrew Vining, E.I.T.
Project Engineer

Reviewed by:

Branislav Jurista

Brani Jurista, L.G.
Senior Geologist

HEALTH AND SAFETY PLAN
REVIEW AND APPROVAL

Client: Mr. Marvin Dykman, c/o Mr. Clark Davis, Davis Law Office, PLLC
Facility Name: Sound Battery Property
Project Name: Cleanup Action
Project Number: 1117-001
Start Date: August 2014
End Date: December 2014

Plan Expiration Date: February 2015

APPROVED BY:

Tad Cline Project Manager		July 15, 2014
	Signature	***Date***
Jeff Hamlin Office Health and Safety Coordinator		July 15, 2014
	Signature	***Date***
Ryan Ostrom Site Health and Safety Officer	Ryan Ostrom	July 15, 2014
	Signature	***Date***
Peter Jewett Principal-in-Charge		July 15, 2014
	Signature	***Date***

This Health and Safety Plan (HASP) was written for the use of Farallon Consulting, L.L.C. (Farallon) and its employees. It may be used also by trained and experienced Farallon subcontractors as a guidance document. However, Farallon does not guarantee the health or safety of any person entering this Site.

Due to the potentially hazardous nature of the site and the activities occurring thereon, it is not possible to discover, evaluate, or provide protection for all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but does not eliminate, the potential for injury. The health and safety guidelines in this HASP were prepared specifically for this site, its conditions, purposes, dates of field work, and personnel, and must be amended if conditions change.

Farallon claims no responsibility for the use of this HASP by others. This HASP will provide useful information to subcontractors and will assist them in developing their own HASP, but it should not be construed as a substitute for their own HASP. Subcontractors should sign this HASP (see *Health and Safety Plan Acknowledgment and Agreement Form*, Exhibit 1) as an acknowledgement of hazard information and as notice that this HASP does not satisfy their requirement to develop their own HASP.

CONTENTS

EXHIBITS

1.0 SCOPE OF WORK

This Health and Safety Plan (HASP) was prepared for the use of Farallon Consulting, L.L.C. (Farallon) personnel while performing the tasks outlined in the *Compliance Monitoring and Sampling and Analysis Plan, Sound Battery Property, 2310 East 11th Street, Tacoma, Washington* dated July 11, 2014 prepared by Farallon (CMP).

The scope of work for the CMP includes;

- Construction observation and soil sampling of lead-contaminated soil in shallow spot excavations to approximately 2 feet below ground surface (bgs) at three locations inside and adjacent to the Sound Battery building footprint; and
- Construction observation and soil sampling of lead-contaminated soil in deep spot excavations to approximately 2 feet below the existing water table estimated to be approximately 6 to 8 feet bgs at one location inside and one location outside the Sound Battery building.

2.0 BACKGROUND INFORMATION

Background regarding the Site history and environmental data is provided in the *Cleanup Action Plan, Sound Battery Property, 2310 East 11th Street, Tacoma, Washington* (CAP) dated July 11, 2014 prepared by Farallon, and should be referenced in conjunction with this HASP.

In 2002, soil containing lead at concentrations exceeding the Washington State Model Toxics Control Action Cleanup Regulation Method A cleanup level for unrestricted land use was excavated from the areas outside the Site building footprint and on adjacent properties under terms of an Agreed Order entered into by Sound Battery and the Washington State Department of Ecology (Ecology). The Site received a No Further Action determination from Ecology on May 21, 2003. In 2011, lead was detected at concentrations exceeding the MTCA Method A cleanup level for industrial land use in soil and reconnaissance groundwater samples collected from localized areas beneath and adjacent to the Site building footprint. The cleanup action for which this HASP has been prepared will be conducted under the Ecology Voluntary Cleanup Program and includes permitted demolition of the Site building and floor slab, and excavation and transport of soil containing lead at concentrations exceeding the MTCA Method A cleanup level for industrial land use for stabilization and disposal off the Site at a permitted facility.

The sequence of work for implementing the selected cleanup action includes:

- Obtaining necessary permits and approvals;
- Implementing erosion control and site security measures;
- Mitigating and disposing of hazardous building materials contained in the Site building;
- Demolishing the Site building and disposing of waste materials off-Site;
- Removing the concrete floor slab and asphaltic pavement in excavation areas;
- Excavating lead-contaminated soil with concentrations exceeding the cleanup level from five areas, and transporting the soil off the Site to a permitted facility for stabilization to reduce mobility of lead, and subsequently disposing stabilized soil at a Subtitle D landfill;
- Collecting performance and confirmation soil samples for field screening and laboratory analysis for lead by U.S. Environmental Protection Agency (EPA) Method 6020.
- Removing groundwater from deeper excavations at Areas A1 and A2 and transporting the extracted water off the Site for potential treatment and disposal; and
- Backfilling the excavation areas with clean imported fill.

3.0 DRUG AND ALCOHOL POLICY

It is Farallon's policy to maintain a drug-free workplace. Farallon has a responsibility to all of its staff members to provide a safe and inoffensive work environment, and a responsibility to its clients to provide accurate and consistent service. For these reasons, Farallon prohibits the following behavior by staff members in the field:

- Use of tobacco in any form by any person at any time in sensitive or hazardous areas that may pose a health and safety or environmental risk. The Site Health and Safety Officer (SHSO) may designate an area away from hazards that is safe for tobacco use;
- Possession or consumption of alcohol, or being under the influence of alcohol during field activities;
- Abuse of prescription and/or over-the-counter drugs in such a manner as to negatively impact performance or field safety; and
- Possession, use, sale, or being under the influence of illicit drugs while in the field or during any work hours.

Violation of any of the above codes of conduct is grounds for immediate removal from the project site and discipline in accordance with Farallon company policy. If an incident occurs as a result of an employee's actions, drug and alcohol testing will be performed in accordance with Farallon company policy.

4.0 WEAPONS POLICY

Farallon employees, contractors, subcontractors, and their employees working at the site are to ensure that they do not bring weapons onto the work site. Weapons include but are not limited to guns, knives, and explosives. Tools that are used during the course of field events, including but not limited to box knives, are exempt from this weapons policy. All vehicles and persons can be subjected to search while working at the property.

Failure to comply with the weapons policy can result in disciplinary action for the individual(s) involved in accordance with Farallon company policy.

5.0 INCIDENT PREPAREDNESS AND RESPONSE

Farallon employees and subcontractors working on site must be prepared to respond appropriately to an incident involving injury, illness, death, spills, or utility breaches. This section outlines the degree of preparedness required for employees at a work site, and describes the actions to be taken in the event of a health and safety incident.

5.1 HEALTH AND SAFETY PREPAREDNESS

All individuals working at the site are required to be familiar with the contents of this HASP. Additionally, the items on the following health and safety preparedness list should be reviewed prior to the commencement of work and during daily health and safety meetings:

- The directions to the hospital (provided in Exhibit 2);
- The locations of first aid kits, personal eye washes, and fire extinguishers (located in site vehicles);
- The locations of the keys to site vehicles; and
- Hand sign language providing for the immediate stoppage of work (such as a horizontal hand movement in front of the neck).

Additional topics for daily health and safety meetings are included in Exhibit 3, Potential Topics for Daily Health and Safety Meeting. Participation in daily health and safety meetings should be documented in the Daily Health and Safety Briefing Log (Exhibit 4).

5.2 INJURY OR ILLNESS

If an injury or illness occurs, the following actions should be taken, regardless of the severity of the injury or illness:

- Stop work.
- Determine whether emergency response staff (e.g., fire, ambulance) are necessary. If so, dial 911 on a cell phone or the closest available telephone. Describe the location of the injured person and provide other details as requested. If an individual requires non-emergency medical care at a hospital, follow the directions to the nearest hospital, which are provided in Exhibit 2. IF EMERGENCY MEDICAL CARE IS NEEDED CALL 911.
- Administer first aid to the individual immediately, using the first aid kit provided in the site vehicle. Use the bloodborne pathogens kit and personal eyewash, as needed.
- Notify the SHSO immediately. The SHSO is responsible for preparing and submitting an Incident Report form to Farallon's Health and Safety Coordinator (HSC) within 24 hours of the incident, and for notifying the employee's supervisor and the Principal in Charge. The Incident Report form is provided in Exhibit 5.

- ***All incidents must be reported to the HSC within 24 hours; however, the actual investigation need not be completed within 24 hours.* A telephone message that includes the date, time, and general incident circumstances should be left at one of the following numbers if the HSC cannot be reached directly:**
    - HSC work phone: (425) 295-0800
    - HSC cell phone: (425) 466-1032
    - If the HSC cannot be located contact the Principal-in-Charge.
- The SHSO will assume responsibility during a medical emergency until emergency response personnel arrive at the site.

5.3 REPORTING PROCEDURES FOR MINOR CUTS, SCRATCHES, BRUISES, ETC.

Every occupational illness or injury is to be reported immediately by the employee to the SHSO. The SHSO is to complete the Incident Report form provided in Exhibit 5, and report the incident to the HSC.

5.4 NEAR MISSES

A near miss is defined as an incident in which no personal injury is sustained and no property damage is incurred, but where injury and/or property damage could have occurred under slightly different timing or location.

In the event of a near miss, the following actions are to be taken:

- Stop work.
- Report the near miss to an SHSO immediately.
- The SHSO is to report the near miss to the HSC and complete the Near Miss Report form in Exhibit 6.
- Resume work upon satisfactory resolution of the near-miss condition and documentation of the corrective action(s) taken by the SHSO.

5.5 MEDICAL INCIDENTS NOT REQUIRING AMBULANCE SERVICE

Medical incidents not requiring ambulance services include injuries and conditions such as minor lacerations, and sprains. In the event of an injury, an illness, or a condition that does not require ambulance service, the following actions are to be taken:

- Stop work.
- Administer first aid as necessary to stabilize the individual for transport to the hospital.
- The SHSO is to facilitate prompt transportation of the individual to the hospital. Directions to the nearest hospital are provided in Exhibit 2.

- A representative of Farallon or the subcontractor is to drive the individual to the medical facility and remain at the facility until the individual is able to return to the jobsite, or arrangements for further care have been established.
- If the driver is not familiar with the route to the hospital, a second person who is familiar with the route is to accompany the driver and the injured employee to the hospital.
- If it is necessary for the SHSO to accompany the injured employee to a medical facility, provisions must be made for another employee who is trained and certified in first aid to act as the temporary SHSO before work at the jobsite can resume.
- If the injured employee is able to return to the jobsite the same day, he/she is to bring a statement from the doctor that provides the following information:
  - Date of incident
  - Employee's name
  - Diagnosis
  - Date he/she is able to return to work, and whether regular or light duty
  - Date he/she is to return to the doctor for a follow-up appointment, if necessary
  - Signature and address of doctor
- The SHSO is to complete the Incident Report form provided in Exhibit 5, and report the incident to the HSC.
- If the injured employee is unable to return to the jobsite the same day, the employee who transported him/her should bring the statement from the doctor back to the jobsite. The information on this statement should be reported to the HSC immediately.

5.6 EMERGENCY CASES REQUIRING AMBULANCE SERVICE

In the event of an injury or illness that requires emergency response and transport to a hospital by ambulance the following actions should be taken:

- **Dial 911** to request ambulance service.
- Notify the SHSO.
- Administer first aid until the ambulance service arrives.
- One designated company representative should accompany the injured employee to the medical facility and remain there until final diagnosis, treatment plan, and other relevant information has been obtained.
- The SHSO is to complete the Incident Report form provided in Exhibit 5, and report the incident to the HSC immediately.

5.7 EMPLOYEE DEATH, OR HOSPITALIZATION OF THREE OR MORE EMPLOYEES

The procedures outlined in Section 6.2 should be followed in the event of an employee injury or illness. If an employee fatality occurs, the HSC, local emergency personnel and the coroner must be notified **immediately**. **The HSC will initiate the required State of Washington Department of Labor and Industries and Occupational Safety and Health Administration (OSHA) notifications within 8 hours of a fatality or the hospitalization of three or more employees.**

5.8 RESPONSE TO SPILLS OR UTILITY BREACHES

The location of underground utilities (e.g., product, sewer, telephone, fiber optic) and facilities (e.g., USTs, septic tanks, utility vaults) is to be noted prior to commencement of intrusive subsurface work activities. Use the public and private locate services as required and complete the Utility Clearance Log (Exhibit 7). If a utility line or tank is breached or a spill or release occurs, the event is to be documented on the Incident Report form provided in Exhibit 5 as soon as possible. The date, time, name of the person(s) involved, actions taken, and discussions with other affected parties are to be included. The SHSO, Project Manager (PM) and client are to be notified immediately. The PM is to notify the regulatory authority and/or utility company, as necessary.

In the event of a spill or release, the following actions should be taken:

1. Stay upwind of the spill or release.
2. Don appropriate personal protective equipment (PPE).
3. Turn off equipment and other sources of ignition.
4. Turn off pumps and shut valves to stop the flow or leak.
5. Plug the leak or collect drippings, when possible.
6. Use sorbent pads to collect the product and impede its flow, if possible.
7. Dial 911 or telephone the local fire department immediately if a fire or another emergency situation develops.
8. Inform the Farallon PM of the situation.
9. Determine whether the client would like Farallon to repair the damage or would rather use an emergency repair contractor.
10. Advise the client of spill discharge notification requirements, and establish who will complete and submit the required forms. ***Do not report or submit information to an agency without the client's consent.*** Document each interaction with the client and regulators, and note in writing names, titles, authorizations, refusals, decisions, and commitments to any action.

11. Do not transport or approve transportation of contaminated soils or product until proper manifests have been completed and approved. Be aware that soil and/or product may meet criteria for hazardous waste.
12. Do not sign manifests as a generator of wastes. Contact the PM to discuss waste transportation.

5.9 NOTIFICATIONS

A spill or release requires completion of an Incident Report form (provided in Exhibit 5) per Farallon's Health and Safety program. **The PM must involve the client and/or generator in the incident reporting process. The client and/or generator is under obligation to report the incident to the appropriate government agency(ies). If the spill extends into waterways, the Coast Guard and the National Response Center must be notified immediately by the client or with his permission (800 424-8802).**

5.10 SHUTOFF VALVES AND/OR SWITCHES FOR UTILITIES AND PRODUCTS

Before starting work locate and list below the location of utility and product line shutoff valves and switches on the project site. Review the location of shutoff valves and switches with field personnel before beginning work.

The shutoff valves and/or switches for electrical, natural gas, gasoline, water lines, etc.:

Shutoff valves will be located in the field prior to beginning work at the Site.

6.0 EMERGENCY RESPONSE AND EVACUATION PLAN

Farallon personnel and subcontractors working on site are to be aware of site-specific emergency and evacuation procedures, including alarm systems and evacuation plans and routes. If an incident occurs that requires emergency response, such as a fire or spill, **CALL 911 and request assistance**. Farallon staff, subcontractors, and/or others working in an area where an emergency occurs are to evacuate to a safe location away from the incident area, preferably upwind, and take attendance.

For this project, the emergency evacuation gathering location is the north entrance to the Site along East 11th Street.

If the emergency causes the route to be obstructed, Farallon personnel and subcontractors are to move to an open area upwind of the hazard area, and remain there until instructed by emergency response personnel (e.g., police, fire, ambulance personnel, paramedics) to do otherwise.

Subcontractors have the responsibility to account for their own employees and provide requested information to emergency response personnel immediately upon request. Farallon staff, subcontractors, and/or contractors may not reenter the scene of the emergency without specific approval from emergency response personnel.

7.0 LOCAL EMERGENCY CONTACT NAMES AND TELEPHONE NUMBERS

Local emergency response personnel can be contacted at the following numbers. Directions and a map to the hospital are included in Exhibit 2.

Emergency Contact	Name and Location	Telephone No.
Hospital	Tacoma General Hospital 315 Martin Luther King Jr. Way Tacoma, Washington	(253) 403-1000 or **911**
Police	Tacoma Police Department 3524 McKinley Avenue Tacoma, Washington	(253) 594-7947 or **911**
Fire	Tacoma Fire Department 901 Fawcett Avenue Tacoma, Washington	(253) 591-5737 or **911**
National Response Center		**1-800-424-8802**
Washington State Department of Ecology		**(360) 407-6300**
Poison Control		**1-800-424-5555**

8.0 PROJECT PERSONNEL AND RELEVANT INFORMATION

Questions about this project that are posed by neighbors, the press, or other interested parties should be directed to the Principal in Charge at Farallon: (425) 295-0800.

Project Name: **Sound Battery** **Project No. 1117-001**	**General Project Responsibilities**	**Field Personnel Training Dates**			**Medical Surveillance Date**
		40-Hour HAZWOPER	**8-Hour Refresher**	**CPR/ First Aid**	
Site Health and Safety Officer Ryan Ostrom Office (425) 394-4151 Cell: (425) 417-5348	Implement this HASP. Has authority to stop work. Perform air quality tasks. Take charge of all incidents. Review subcontractor's HASP.	5/2013	1/2014	NA	12/2013
Farallon Personnel Ryan Ostrom Office (425) 394-4151 Cell: (425) 417-5348	Be familiar with HASP requirements and the Farallon Accident Prevention Program and Hazardous Waste Operations Program	TBD	TBD	TBD	TBD
Principal-in-Charge Peter Jewett Office (425) 295-0800 Cell: (425) 765-3366	Provide immediate support upon notice of any incident.	NA	NA	NA	NA
Health and Safety Coordinator Jeff Hamlin Office (425) 295-0800 Cell: (206) 409-2601	Provide support in implementing HASP. Provide immediate support upon notice of any incident.	NA	NA	NA	NA
Client Contact Marvin Dykman Office: (253) 858-9423	Provide known analytical data from work performed by others. Provide notice of site hazards. Provide access to site. Provide information regarding available emergency supplies at the site.	NA	NA	NA	NA

9.0 POTENTIAL AIRBORNE CONTAMINANTS

The potential airborne contaminants of concern in the immediate vicinity at the site are listed in the table on the following page. The table should be reviewed, and any questions directed to the SHSO.

POTENTIAL AIRBORNE CHEMICALS ON SITE FOR THIS PROJECT
REVIEW THIS TABLE AND CONTACT THE SHSO WITH ANY QUESTION

Chemical (or Class)	OSHA PEL ACGIH TLV	Other Pertinent Limits	Properties	Routes of Exposure or Irritation	Acute Health Effects	Chronic Health Effects/ Target Organs
Lead	PEL - 0.05 mg/m^3 TLV - 0.05 mg/m^3	IDLH - 100 mg/m^3	A heavy, flexible, soft, gray solid	Inhalation; dermal; ingestion; eye contact	Lassitude (weakness, exhaustion); abdominal pain; gingival lead line; tremor; irritation to eyes; hypotension	Insomnia; facial pallor; anorexia; weight loss; malnutrition; constipation; colic; anemia; paralysis: wrist, ankles; encephalopathy; kidney disease; potential for damage to eyes, gastrointestinal tract, CNS, kidneys, blood, gingival tissue

NOTES:
ACGIH = American Conference of Governmental Industrial Hygienists
AIHA = American Industrial Hygiene Association
AIHA WEEL = AIHA-set workplace environmental exposure limits
C = ceiling limit
CNS = central nervous system
CVS = cardiovascular system
IDLH = immediately dangerous to life or health
mg/m^3 = milligrams per cubic meter
NIOSH = National Institute for Occupation Safety and Health
OSHA = Occupation Safety and Health Administration
PEL = permissible exposure limit
ppm = parts per million
RBC = red blood cells
REL = recommended exposure limit set by National Institute for Occupational Safety and Health (NIOSH)
Skin = skin absorption
STEL = short-term exposure limit
TLV = threshold limit value set by ACGIH
TWA = time-weighted average

10.0 POTENTIAL SITE HAZARDS AND APPROPRIATE PRECAUTIONS

Activities listed may be associated with work performed by others. The information contained in this section is for the use of Farallon personnel and not intended for use by others. The following tables list potential hazards and appropriate precautions associated with planned field work:

10.1 EXCAVATION ACTIVITIES

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
Clear excavation locations.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Traffic hazards, overhead and underground installations, product releases, property damage, dealer inconvenience.	• Refer to Utility Clearance Log. • Coordinate with facility contact (or designee) to minimize potential conflicts. • Review proposed locations against available construction drawings and known utilities, tanks, product lines, etc. • Mark out the proposed excavation locations. • Call the underground utility locating service for public line location clearance. Obtain a list of utilities being contacted. If necessary, coordinate private line locator for private property.
Set up necessary traffic control.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Being struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	• Use buddy system to place traffic control. • Implement traffic control plan as required.
Set up exclusion zone(s) and stockpile area and establish work areas/heavy equipment pathways.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Injury or exposure to public or other onsite personnel. Slip or fall hazards. Onsite vehicular accident with heavy equipment.	• Implement exclusion zone set-up instructions. • Establish clear walking paths between work stations.

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
Hand digging/post-holing where necessary to expose and protect underground installations as needed.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with P100 particulate cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Damage to lines and associated physical hazards or property damage. Back strain. Injury or vehicle damage from falling into a hole.	• Use hand tools whenever possible. • Use proper lifting techniques. • Barricade or cover holes until job has been completed.
Assist with set up of heavy equipment.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Damage caused by heavy equipment while accessing set-up location. Being struck by equipment.	• Verify a clear pathway to excavation and stockpiling locations. • Provide hand signals and guidance to driver as needed to place rig. • Visually inspect equipment (fire extinguisher on board, no oil or other fluid leaks, cabling and associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute, jacks in good condition). • Maintain eye contact with operator.
Commence excavation.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with appropriate particulate cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Heat or cold exposure. Exposure to chemical hazards. Hitting an underground or overhead utility. Trip or fall. Side wall cave-in. Equipment failure. Noise.	• Monitor weather conditions and take breaks as needed for cold or hot weather. • Maintain required excavation set-backs for workers and equipment. Monitor condition of side walls and surrounding ground conditions. • Keep work area clear of tripping or slipping hazards. Perform periodic visual inspections of heavy equipment and keep equipment a minimum of 5 feet from excavation edge, or one foot away from the edge for every foot of depth, if greater than 5 feet deep. • Perform necessary soil classification. Slope or bench walls, or shore excavation to prevent cave-in. Keep all spoils > 2 feet from excavation edge. Keep excavation entry controlled and equipped with required ladders and crosswalks.

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
Collect samples in accordance with sampling plan.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with P100 particulate cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Cave-in of side wall if entering excavation. Injury from heavy equipment. Exposure to site contaminants.	• Stay out of excavation whenever possible (collect samples from backhoe bucket). • Use agreed-upon hand signals with heavy equipment operators. • Monitor air around excavation in accordance with the protocol presented in Exhibit 8.
Store excavated materials according to site-specific requirements.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with P100 particulate cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Exposure to public. Traffic hazard, obstruction, or inconvenience to business operation. Improper storage or disposal.	• Have necessary storage containment and labeling available onsite. • Place materials in isolated location away from traffic and other site functions. • Stockpile excavated materials on suitable plastic or in appropriately designed container. Cover with plastic, and barricade access to waste in accordance with local regulations. • Coordinate proper disposal offsite, where applicable.
Backfill excavation.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with P100 particulate cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Being struck by heavy equipment. Side wall collapse. Damage or accidents resulting from subsequent subsidence.	• Use agreed-upon hand signals with heavy equipment operators. • Compact soils to meet specifications. • Maintain eye contact with equipment operators.
Clean site. Demobilize.	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves.	Traffic. Safety hazard left on site. Lifting hazards.	• Use buddy system to remove traffic control, as necessary. • Leave site clear of refuse and debris. • Notify business personnel of departure. • Use proper lifting techniques or use mechanical assistance.
Package and deliver samples to laboratory.		Back strain. Traffic accidents	• Handle and pack bottles carefully (e.g., bubble wrap bags). • Use proper lifting techniques. • Apply safe driving practices

Job Steps	Personal Protective Equipment	Potential Hazard	Critical Actions
General			
Typical work.	Steel-toed and -shank shoes, hard hat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for non-chemical aspects of the work. If equipment contamination is suspected, wear chemical-resistant gloves during decontamination of equipment.	Weather-related incidents: automobile accidents, slips or falls.	• Check weather reports daily. Project visits are not to be performed during inclement weather. Sampling may be performed during light rain mist. Wear raincoats. • Drive at the speed limit or less as needed to keep safe distance from vehicle in front. Avoid short stops.
No eating, drinking, or smoking on-site. No contact lenses to be worn on-site. No facial hair that would interfere with respirator fit.			
A safety meeting will be held each day, even if only one person is working on the project on any given day.			• Topics are always to include the work scheduled for that day, and restatement of hazards and the means to avoid them. Other topics may include sampling in general, and advances in technology and how they may be applied to the project. Use the *Daily Health and Safety Briefing Log* provided in Exhibit 4 to log the topics discussed.

11.0 WASTE CHARACTERISTICS

Waste anticipated to be generated on the project site:

Type(s): ☒ Liquid ☒ Solid ☐ Sludge ☐ Other________________

The approximate volume for each anticipated waste stream:

Waste: Lead-contaminated soil Approximate Volume: 220 cubic yards

Waste: Excavation wastewater Approximate Volume: 4,000 gallons

Waste: Approximate Volume:

Characteristics**:**

☐ Corrosive ☐ Flammable/Ignitable ☐ Radioactive ☒ Toxic

☐ Reactive ☐ Unknown ☐ Other *(specify)*______________________

12.0 TRAFFIC CONTROL

Work on this project site will be performed in areas of uncontrolled traffic access. Traffic control/warning devices will be placed around the work area to prevent undesirable interface between pedestrian and automotive traffic and project workers and equipment. These devices may include:

- Cones
- Tubular markers
- Barricades
- Temporary fencing
- Barricade tape

The traffic control/warning devices will be placed around the work in such a way that traffic access is inhibited (i.e. place cones less than 8 feet apart so cars cannot easily drive through work area without moving a cone). Barricade tape or temporary fencing will be used to inhibit access to the work area in locations where pedestrians will be encountered.

EXHIBIT 1
HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT AND AGREEMENT FORM

HEALTH AND SAFETY PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

HEALTH AND SAFETY PLAN ACKNOWLEDGMENT AND AGREEMENT FORM

(All Farallon and subcontractor personnel must sign)

This Health and Safety Plan (HASP) has been developed for the purpose of informing Farallon employees of the hazards they are likely to encounter on the project site, and the precautions they should take to avoid those hazards. Subcontractors and other parties at the site must develop their own HASP to address the hazards faced by their own employees. Farallon will make a copy of this HASP available to subcontractors and other interested parties to fully disclose hazards we may be aware of, and to satisfy Farallon's responsibilities under the Occupational Safety and Health Administration (OSHA) Hazard Communication standard. Similarly, subcontractors and others on site are required to inform Farallon of any hazards they are aware of or that their work on site might possibly pose to Farallon employees, including but not limited to Material Safety Data Sheets for chemicals brought on site. This plan should NOT be understood by contractors to provide information pertaining to all of the hazards that a contractor's employees may be exposed to as a result of their work.

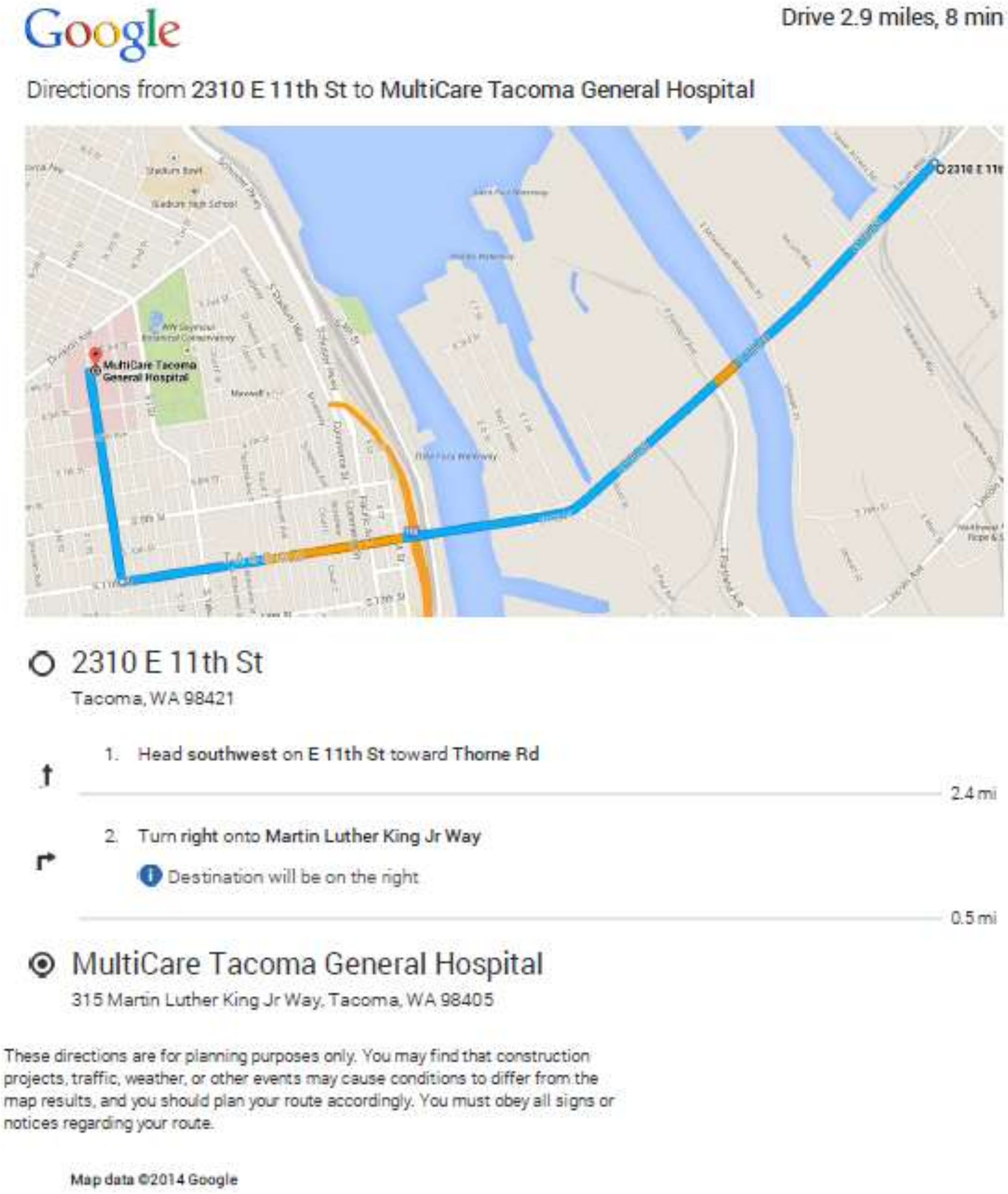
All parties conducting site activities are required to coordinate their activities and practices with the project Site Health and Safety Officer (SHSO). Your signature below affirms that you have read and understand the hazards discussed in this HASP, and that you understand that subcontractors and other parties working on site must develop their own HASP for their employees. Your signature also affirms that you understand that you could be prohibited by the SHSO or other Farallon personnel from working on this project for not complying with any aspect of this HASP.

Name	Title	Signature	Company	Date

EXHIBIT 2
DIRECTIONS TO HOSPITAL

HEALTH AND SAFETY PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001



Drive 2.9 miles, 8 min

Directions from **2310 E 11th St** to **MultiCare Tacoma General Hospital**

○ 2310 E 11th St

Tacoma, WA 98421

1. Head **southwest** on **E 11th St** toward **Thorne Rd**

2.4 mi

2. Turn **right** onto **Martin Luther King Jr Way**

Destination will be on the right

0.5 mi

◎ MultiCare Tacoma General Hospital

315 Martin Luther King Jr Way, Tacoma, WA 98405

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2014 Google

EXHIBIT 3
POTENTIAL TOPICS FOR DAILY HEALTH AND SAFETY MEETING

HEALTH AND SAFETY PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

POTENTIAL TOPICS FOR DAILY HEALTH AND SAFETY MEETING

☐ Emergency response plan, emergency vehicle (full of fuel) and muster point
☐ Route to medical aid (hospital or other facility)
☐ Work hours. Is night work planned?
☐ Hand signals around heavy equipment
☐ Traffic control
☐ Pertinent legislation and regulations
☐ Above- and below-ground utilities (energized or de-energized)
☐ Material Safety Data Sheets
☐ Reporting an incident: to whom, what, why, and when to report
☐ Fire extinguisher and first aid kit locations
☐ Excavations, trenching, sloping, and shoring
☐ Personal protective equipment and training
☐ Safety equipment and training
☐ Emergency telephone location(s) and telephone numbers (in addition to 911)
☐ Eye wash stations and washroom locations
☐ Energy lock-out/tag-out procedures. Location of "kill switches," etc.
☐ Weather restrictions
☐ Site security. Site hazards. Is special waste present?
☐ Traffic and people movement
☐ Working around machinery (both static and mobile)
☐ Sources of ignition, static electricity, etc.
☐ Stings, bites, large animals, and other nature-related injuries and conditions
☐ Working above grade
☐ Working at isolated sites
☐ Decontamination procedures (for both personnel and equipment)
☐ How to prevent falls, trips, sprains, and lifting injuries
☐ Right to refuse unsafe work
☐ Adjacent property issues (e.g., residence, business, school, daycare center)

EXHIBIT 4
DAILY HEALTH AND SAFETY BRIEFING LOG

HEALTH AND SAFETY PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

DAILY HEALTH AND SAFETY BRIEFING LOG

DATE:	PROJECT NAME:	FARALLON PN:

MEETING CONDUCTED BY:	WEATHER:

MAJOR JOB TASK:

HEALTH AND SAFETY DAILY CHECKLIST

☐ Site Check In
☐ Proper Identification
☐ Hard Hat
☐ Safety Glasses
☐ Orange Reflective Vest (H or X back BNSF)
☐ Safety Toe Boots (lace up and leather BNSF)

☐ First Aid Kit
☐ Fire Extinguisher
☐ Eye Wash Station
☐ Traffic Control

☐ Ear Plugs (if required)
☐ Hand Protection (if required)
☐ Face Shield (if required)
☐ Respirator (if required)
☐ ___________________________
☐ ___________________________

HEALTH AND SAFETY BRIEFING

Head Count	Excavation Safety (if applicable)
Emergency Response	Health Hazards
Who will call 911 (Name):	Environmental Hazards
Alternate to call 911 (Name):	Physical Hazards
First Aid/ CPR (Name):	Slips, Trips and Falls
Emergency Exits/ Rally Points/ Hospital Route	Utility Locates
Site Security	Near Miss Reporting (reminder to look)
Conducting Work Safely	Incident Reporting (Procedures and forms)
Stop Work Authority	Traffic Control
Vehicle/ Equipment Safety	

ADDITIONAL HEALTH AND SAFETY ISSUES DISCUSSED

1)
2)
3)
4)
5)

ATTENDEES

NAME	COMPANY	SIGNATURE

EXHIBIT 5
INCIDENT REPORT FORM

HEALTH AND SAFETY PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

INCIDENT REPORT

NEAR MISS, ACCIDENTAL INJURY, OCCUPATIONAL ILLNESS, OR WORK PLACE INCIDENT

INCIDENT TYPE **(TO BE COMPLETED BY HEALTH AND SAFETY COORDINATOR)**

INCIDENT DATE

☐ FATALITY
☐ LOST WORKDAY (LW)
☐ LW RESTRICTED DUTY
☐ OSHA MEDICAL OR ILLNESS WITHOUT LW
☐ FIRST AID
☐ INDUSTRIAL NON-RECORDABLE
☐ NON-INDUSTRIAL
☐ OFF-THE-JOB INJURY
☐ MOTOR VEHICLE ACCIDENT
☐ FIRE
☐ SPILL/LEAK
☐ PRODUCT INTEGRITY
☐ EQUIPMENT
☐ BUSINESS INTERRUPTION
☐ GENERAL LIABILITY
☐ CRIMINAL ACTIVITY
☐ NOTICE OF VIOLATION
☐ NEAR MISS

This report must be completed by the employee or Health and Safety Coordinator immediately upon learning of the incident. The completed report must be reviewed and signed by a Farallon Principal within 24 hours of the incident, even if employee is not available to review and sign. Employee or employee's doctor must submit a copy of the doctor's report, and any subsequent exams, to Jeff Hamlin at Farallon within 24 hours of the initial exam. After hours or weekends, telephone Mr. Hamlin via cell phone: (206) 409-2601.

EMPLOYEE INFORMATION

LAST NAME	FIRST NAME AND MIDDLE INITIAL	TITLE	DATE OF BIRTH

EMPLOYMENT STATUS ☐ FULL-TIME ☐ PART-TIME ☐ HOURLY-AS-NEEDED

LENGTH OF EMPLOYMENT

DATE OF INJURY OR ONSET OF ILLNESS (MM/DD/YYYY)

TIME OF EVENT OR EXPOSURE ☐ AM ☐ PM

INJURY OR ILLNESS INFORMATION

EXACT LOCATION OF INCIDENT (GEOGRAPHICAL LOCATION, FLOOR, BUILDING, ETC.)

COUNTY

ON EMPLOYER'S PREMISES? ☐ YES ☐ NO

COMPLETE DESCRIPTION OF INCIDENT; INCLUDE SPECIFIC ACTIVITY AT TIME OF INCIDENT (e.g., Lifting, Pushing, Walking)

DESCRIBE THE EQUIPMENT, MATERIALS, OR CHEMICALS THAT DIRECTLY HARMED THE EMPLOYEE (e.g., the machine that the employee struck or that struck the employee; the vapor inhaled; the material swallowed; what the employee was lifting or pulling)

DESCRIBE THE SPECIFIC INJURY OR ILLNESS (e.g., cut, strain, fracture, skin rash)

BODY PART(S) AFFECTED (e.g., back, left wrist, right eye)

DATE EMPLOYER NOTIFIED

TO WHOM REPORTED

MEDICAL PROVIDER INFORMATION (e.g., hospital, doctor, clinic)

NAME AND ADDRESS OF MEDICAL CARE PROVIDER

TELEPHONE NO.

TREATED IN EMERGENCY ROOM? ☐ NO ☐ YES

HOSPITALIZED OVERNIGHT AS INPATIENT? ☐ NO ☐ YES

INCIDENT REPORT, CONTINUED

SEVERITY OF INJURY OR ILLNESS	TIME LOSS (Check all that apply)	PHASE OF WORKDAY
☐ NO TREATMENT REQUIRED	☐ NO TIME LOSS	☐ PERFORMING NORMAL WORK DUTIES
☐ FIRST AID ONLY	☐ RETURN TO WORK THE NEXT DAY	☐ MEAL PERIOD
☐ MEDICAL TREATMENT	☐ RESTRICTED ACTIVITY:	☐ REST PERIOD
☐ FATALITY (ENTER DATE):	BEGIN DATE	☐ ENTERING/LEAVING
	RETURN DATE	☐ CHRONIC EXPOSURE
	☐ LOST WORKDAY, NOT AT WORK:	☐ OTHER (SPECIFY):
	BEGIN DATE	
	RETURN DATE	

MOTOR VEHICLE ACCIDENT		PROFESSIONAL DRIVER? ☐ YES ☐ NO	
TOTAL YEARS DRIVING	COMPANY VEHICLE? ☐ YES ☐ NO	VEHICLE TYPE	
NO. OF VEHICLES TOWED	NO. OF INJURIES	NO. OF FATALITIES	

THIRD PARTY INCIDENTS		
NAME OF OWNER	ADDRESS	TELEPHONE NO.
DESCRIPTION OF DAMAGE		
INSURANCE INFORMATION		
WITNESS NAME	ADDRESS	PHONE NO.
WITNESS NAME	ADDRESS	PHONE NO.

REVIEWED BY			
NAME (PRINT)	SIGNATURE	TITLE	DATE

EXHIBIT 6
NEAR MISS REPORT FORM

HEALTH AND SAFETY PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

NEAR MISS REPORT

This report is to be filled out by any employee involved in or witnessing a near miss. A near miss is an incident that did not result in any personal injury, property damage, or work interruption. It is a very important indicator of potentially harmful future accident.

Project No. ___________________ Project Name ____

Project Address ____

Date of incident: ____________________________________ Time:__________ ☐ AM ☐ PM

Exact location of incident ____

____

Description of incident or potential hazard ____

____

____

____

____

____

____

Corrective action taken ____

____

____

____

____

____

Employee Signature ____________________________________ Date __________________________

Printed Name ____

Supervisor Signature ____________________________________ Date __________________________

Printed Name ____

EXHIBIT 7
UTILITY CLEARANCE LOGS

HEALTH AND SAFETY PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

UTILITY CLEARANCE LOG

Project Name: ______________________________ **Project Number:** ___________________

Location: __________________________________ **Date of Work:** ______________________

Instructions. This log must be completed by a Farallon staff member **before** any Farallon-directed excavation (e.g., test pit excavation) or drilling operation.

DRILLING OR EXCAVATION WORK MAY NOT COMMENCE
UNTIL UTILITY LOCATES HAVE BEEN COMPLETED
(See the One-Call Utility Locate Request Procedure on the following page)

Farallon is responsible for having underground utilities and structures located and marked when drilling or directing test pit excavation operations. Any drilling or excavation within 2 feet of a marked utility must be done with hand tools.

Owners of underground utilities are required by law to mark underground facilities on public and private property. Owners of underground utilities are **not required** to mark existing service laterals or appurtenances. Utility owners in Washington are required to subscribe to the One-Call service.

Private utility locate services must be hired to locate service laterals and other buried utilities (e.g., on-site electric distribution lines, irrigation pipes) on private property.

Re-mark after 10 days or maintain as appropriate.

Utility Locate Checklist

- ☐ Attach map showing drilling and/or excavation sites and known utilities
- ☐ Attach copy of One-Call Utility Notification Ticket (http://www.searchandstatus.com/)
  One-Call Utility Notification Ticket Number: ____
- ☐ Attach copy of Side Sewer Card (available for City of Seattle; check municipality for availability)
- ☐ Attach copy of Private Locate Receipt
- ☐ Photograph all excavation and/or drilling locations and download to project file
- ☐ Review utilities with Site Contact:
  Name: _________________________________ Phone: ______________________________

Utilities and Structures

Utility Type	Utility Name	Public Utilities Marked (Y/N)	Private Utilities/Laterals Marked (Y/N)	Marking Method (Flags, paint on pavement, wooden stakes, etc.)
Petroleum product lines				
Natural gas line				
Water line				
Sewer line				
Storm drain				
Telephone cable				
Electric power line				
Product tank				
Septic tank/drain field				
Other				

Farallon Consulting, L.L.C.
Field Team Leader: ____________________________________ Date: _________________________

Electric = **RED**	*Gas-Oil-Steam =* **YELLOW**	*Comm-CATV =* **ORANGE**	*Water =* **BLUE/PURPLE**	*Sewer =* **GREEN**	*Temp Survey =* **PINK**

ONE-CALL UTILITY LOCATE REQUEST PROCEDURE

THE ONE-CALL UTILITY NOTIFICATION CENTER REQUIRES 48 HOURS NOTICE TO MARK UTILITIES BEFORE YOU CAN DIG OR DRILL

Washington: 1-800-424-5555
Oregon: 1-800-332-2344

Washington state law states that "before commencing **any** excavation," the excavator or driller must provide notice to all owners of underground utilities by use of the One-Call locator service, and that the excavator or driller shall not dig or drill until all known utilities are marked. To fully comply with the law, you **must** take the following steps:

1. **Call before you dig or drill:** Notify the One-Call Utility Notification Center (OCUNC) a minimum of 48 hours (two full business days) before digging or drilling. Provide the following **required** information:
   a. Your name and phone number, company name and mailing address, and Farallon Account Number 25999.
   b. The type of work being done.
   c. Who the work is being done for.
   d. The county and city where the work is being done.
   e. The address or street where the work is being done.
   f. Marking Instructions: "Generally locate entire site including rights-of-way and easements"

   Provide the following information if applicable or requested:
   a. The name and phone number of an alternate contact person.
   b. If the work is being done within 10 feet of any overhead power lines.
   c. The nearest cross street.
   d. The distance and direction of the work site from the intersection.
   e. Township, range, section, and quarter section of the work site.

2. **Record the utilities that will be notified:** OCUNC will tell you the utilities that are on or adjacent to the site, based on their database. Record the name(s) of the utility on the reverse side of this form.

3. **After the 48-hour waiting period, confirm that the utility locations have been marked:** Before digging or drilling, walk the site and confirm that the utility companies have marked the utility locations in the field.

4. **If a locate appears to be missing:** If a utility locate appears to be missing and the utility company has not notified you that there are no utilities in the area, call OCUNC and:

   a. **Provide the OCUNC locate number.**
   b. **Clearly state which utility has not been marked. The call is being recorded.**
   c. **Ask for a contact person at that utility.**
   d. **Call the contact person for the missing utility locate:** Determine why there is no utility locate in the field.
   e. **Record the reason(s) for the missing locate(s):** There are valid reasons that locates do not appear in the field (e.g., there are no utilities located on the site or the utility has been abandoned). However, IF THEY ARE LATE, **YOU MUST WAIT** TO DRILL OR DIG. If the utility fails to mark a locate within the required 48 hours (two full business days), the utility is liable for delay costs.

5. **Hand dig within 2 feet of a marked utility:** When digging or drilling within 2 feet of any marked utility, the utility must be exposed first by using hand tools.

Electric = **RED**	*Gas-Oil-Steam =* **YELLOW**	*Comm-CATV =* **ORANGE**	*Water =* **BLUE/PURPLE**	*Sewer =* **GREEN**	*Temp Survey =* **PINK**

6. **Record reason(s) for missing locate(s)** – There may be reasons that locates do not appear in the field (e.g., no utilities are located on the site, utility has been abandoned). Record the reason given. IF THEY ARE LATE – YOU WAIT TO DRILL OR DIG. If the utility failed to mark within the required two days they are liable for delay costs.
7. **Hand dig within two feet** – When digging or drilling within two feet of any marked utility the utility must be exposed <u>first</u> by using hand tools.

Electric =	*Gas-Oil-Steam =*	*Comm-CATV =*	*Water =*	*Sewer =*	*Temp Survey =*
RED	**YELLOW**	**ORANGE**	**BLUE/PURPLE**	**GREEN**	**PINK**

FARALLON CONSULTING, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington
98027

TELEPHONE CONVERSATION

Date:____________________**Time:**__________

Project Name:_____________________________

Job No:__________________________________

Phone No:1-800-424-5555 WA, 1-800-332-2344 OR ____________________

Prepared By/Initials: ______________________

Call: ☐ **Placed** ☐ **Received**

Contact/Title:____

Agency/Region: One-Call Utility Notification Center

PROJECT:____

1. Your name and the Farallon Account Number #25999_____________________________

2. What is the type of work being conducted? (Environmental drilling, test pit excavation)

____

3. Who is the property owner? ____

4. County and city were work is being done?____

5. Address or street where work is taking place?______________________________________

____

6. Nearest cross street?____

7. Distance and direction of the worksite from the intersection?__________________________

8. Marking Instructions (Generally locate on entire site including rights-of-way and easements):____

____

____

9. What time and date will the locate be completed?___________________________________

10. Utility Locate Request Number?____

11. Utilities that will be notified?____

____

12. Any Overhead Concerns?____

____

cc:____**Page**____________**of**__________

Note: Bold indicates required information

EXHIBIT 8
AIR MONITORING TABLE AND FORMS

HEALTH AND SAFETY PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

ACTION LEVEL TABLE FOR AIR MONITORING

The Air Monitoring table (following page) presents protocol for monitoring ambient air for constituents of concern and other parameters that may affect worker safety. Please note the following with respect to use of this table:

- The Level for Respirator Use indicates the concentration at which a respirator must be donned. It does not require that the job stop. The respirator is a piece of equipment that is to be used while determining why a concentration has reached that level. Implement engineering controls such as water mist, spray foam, plastic cover, etc. to reduce the concentration.

- The Level for Work Stoppage indicates the concentration at which work on the job must stop. Determine why a concentration has reached that level, and how it can be decreased. Site evacuation is not necessary at this level. Stopping work does not imply that the concentration level will decrease. Implement engineering controls to reduce the concentration; resume work when it is safe to do so.

- These values can be modified under particular site conditions and with specific knowledge of the contaminant(s). Should such conditions arise, contact Farallon's Health and Safety Officer, Jeff Hamlin at (425) 295-0800.

AIR MONITORING

Chemical (or Class)	Monitoring Equipment	Task	Monitoring Frequency and Location	Level for Respirator Use	Level for Work Stoppage
Lead or Dust Particulates	Mini-Rae particulate meter, and Laser dust particle counter for metals, and dust. Filter/Sample pump for lead. Laser particle counter for total dust.	From start until finish of potential dust generating activities.	Sampling should be continuous during the project while visible fugitive dust generated from construction activities is observed and cannot be suppressed. Continuously sample during each soil excavation. Air sampling is not required if no fugitive dust is visible or if all workers potentially exposed to dust generating activities are wearing a half mask respirator with P100 cartridges.	For dust particulates the level for respirator use is to be 25 mg/m3 to for total dust, and 15 mg/m as respirable dust. See table in section 9 for lead pertinent limits.	For metal and dust particulates see table in section 9 for level of work stoppage.

AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG

Date	Instrument/ Model No.	Serial No.	Battery Check OK?	Zero Adjust OK?	Calibration Gas (ppm)	Reading (ppm)	Leak Check	Performed By	Comments

AIR MONITORING LOG

Date	Time	Location	Source/Area/ Breathing Zone	Instrument	Concentration/Units	Sampled by

ATTACHMENT B
FIELD FORMS

COMPLIANCE MONITORING AND
SAMPLING AND ANALYSIS PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

OnSite Environmental Inc.

14648 NE 95th Street
Redmond, WA 98052
(425) 883-3881

Client ____________________

Project ____________________

Sample ID ____________________

Date __________ Time __________

Analysis __________ Preservative __________

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FIELD REPORT

Page ___ of ___

Date: _____________ **Project #:** __________________________________ **Task #:**_______________

Project: _____________________________________ **Site Address:** _____________________________________

Client: ______________________________________ **Contractor:** _______________________________________

Weather: ____________________________________ **Temp:** ____________

Equipment Used: ____

Hours: _________ __________ **Mileage:** __________ **Project Manager:** __________________________________

Contractor *Staff*

Prepared By: _________________________________ **Reviewed By:** ______________________________________

Comments: ....

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FIELD REPORT (continued)

Page ___ of ___

Project: ______________________________ **Date:** ____________ **Project #:** _____________ **Task #:**_______

OnSite Environmental Inc.
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • Fax: (425) 885-4603

Chain of Custody

Page ______ of ______

Company:

Project Number:

Project Name:

Project Manager:

Sampled by:

Turnaround Request (in working days)

(Check One)

☐ Same Day ☐ 1 Day

☐ 2 Day ☐ 3 Day

☐ Standard (7 working days)

☐ ________ (other)

Laboratory Number:

Requested Analysis

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	# of Cont.	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Dx	Volatiles by 8260B	Halogenated Volatiles by 8260B	Semivolatiles by 8270C	PAHs by 8270C / SIM	PCBs by 8082	Pesticides by 8081A	Herbicides by 8151A	Total RCRA Metals (8)	TCLP Metals	HEM by 1664	VPH	EPH					% Moisture

	Signature	Company	Date	Time	Comments/Special Instructions:
Relinquished by					
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by					
Reviewed by/Date		Reviewed by/Date			Chromatograms with final report ☐

DISTRIBUTION LEGEND: White - OnSite Copy Yellow - Report Copy Pink - Client Copy

WASTE INVENTORY TRACKING SHEET

Project Number:
Project Name:
Project Address:
Field Work:
Project Manager:

Page of
Date:
Prepared By:
Date Removed:
Transporter:
Disposal Location:

Container ID	Fullness	**Contents** (soil-gw-decon water) / Origin (boring or well number)	Date(s) Accumulated	Labled (Y/N)	Sampled (Y/N)	Comments

NOTES: Contents should be specified and include identification of well/boring, media, souce, depth of soil (if applicable), and any other applicable information.

Location of Drums (sketch or describe):

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SOIL SAMPLE DATA

PROJECT NAME:
PROJECT NO:
SHEET OF
PROJECT LOCATION:
PID MODEL & SERIAL NO:
CALIBRATION DATE/STANDARD:
HEADSPACE CONTAINER: ☐ 16 OZ GLASS ☐ 8 OZ GLASS ☐ 4 OZ GLASS ☐ ZIP-LOC
SAMPLE METHOD: ☐ SONIC ☐ HAND AUGER ☐ HOLLOW STEM ☐ SPLIT SPOON ☐ GEOPROBE ☐ BACKHOE BUCKET
EQUIP DECON: ☐ TAP WATER WASH ☐ DIST/DEION 1 RINSE ☐ ISOPROPANOL ☐ ANALYTE FREE FINAL RINSE
☐ ALCONOX WASH ☐ LIQUINOX WASH ☐ DIST/DEION 2 RINSE ☐ OTHER SOLVENT ☐ DIST/DEION FINAL RINSE ☐ AIR DRY

LOCATION	DATE	SAMPLE NAME/ NUMBER OF CONTAINERS	DEPTH	TIME	STAINING	ODOR	PID	SHEEN	LITHOLOGIC DESCRIPTION REMARKS

PREPARED BY:

NON-HAZARDOUS WASTE

OPTIONAL INFORMATION

Shipper ____________________

Address ____________________

City, State, Zip ____________

Contents __________________

NON-
HAZARDOUS
WASTE

FARALLON consulting

Quality Service for Environmental Solutions

Log of Test Pit:

Page 1 of 1

Client:
Project:
Location:

Farallon PN:

Logged By:

Date/Time Started:
Date/Time Completed:
Equipment:
Excavating Company:
Excavating Foreman:
Excavating Method:

Sampler Type:
Depth of Water (ft bgs):
Total Excavation Depth (ft bgs):

Depth (feet bgs)	Sample Interval	Lithologic Description	USCS	PID (ppm)	Sample ID	Sample Analyzed
0						
5						
10						
15						

ATTACHMENT C
FIELD EQUIPMENT
STANDARD OPERATING PROCEDURES

COMPLIANCE MONITORING AND
SAMPLING AND ANALYSIS PLAN
Sound Battery Property
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

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STANDARD OPERATING PROCEDURES

Attachment C of the Compliance Monitoring Plan

SOUND BATTERY
2310 EAST 11th STREET
TACOMA, WASHINGTON

Submitted by:
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975 5th Avenue Northwest
Issaquah, Washington 98027

Farallon PN: 1117-001

For:
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c/o Mr. Clark Davis
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July 15, 2014

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Branislav Jurista

Brani Jurista, L.G.
Senior Geologist

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EXHIBITS

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Exhibit B	Operating Procedure—Field X-Ray Fluorescence Measurement

1.0 EXCAVATION SOIL SAMPLING PROCEDURES
SOP NO. FAR-101

1.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide field personnel with the information needed to collect and document soil samples from excavations and test pits for chemical analysis to ensure consistent and representative sampling.

1.2 APPLICATION

The step-by-step guidelines provided in this SOP are to be followed by the field personnel collecting soil samples from excavations and test pits.

1.3 EQUIPMENT

The following equipment is necessary to properly collect soil samples from an excavation or test pit:

- A field x-ray fluorescence device (XRF) to monitor and record soil performance sample readings.
- Applicable soil sampling equipment (e.g., stainless steel spoons and hand trowels, pre-cleaned sample containers, Teflon tape, stainless steel mixing bowl).
- Materials necessary to provide required documentation (e.g., sample labels, Field Report forms, Log of Test Pit forms, Chain of Custody forms).
- Personal protective equipment (PPE) as described in the site-specific Health and Safety Plan.
- Applicable sampling-support equipment (e.g., sample coolers, ice/blue ice, bubble wrap, clear tape, duct tape, heavy resealable plastic bags, razor knives, garbage bags, paper towels, distilled water, nitrile gloves, plastic sheeting for the sample table).

1.4 PROCEDURES

The following soil sampling procedures have been developed for use during excavation at a site. The specific equipment used will be recorded on the Soil Sample Data form and on the Field Report form. For excavations less than 4 feet below ground surface (bgs), soil samples will be collected using hand tools. For excavations greater than 4 feet bgs, soil samples will be collected using a backhoe bucket.

1.4.1 Setup

The setup instructions below are to be followed at the excavation site:

- Suit up in appropriate PPE as described in the site-specific Health and Safety Plan.
- Set up a temporary table adjacent to the drill rig to log and collect soil samples from soil cores as they are recovered during drilling. Lay plastic sheeting on the table to keep the logging/sampling surface clean and prevent potential cross-contamination between samples. Designate clean areas for decontaminated sampling equipment and pre-cleaned soil sample containers.
- Check all sampling locations to confirm that all known utilities and product/other lines have been clearly marked. If necessary, perform exploratory hand-digging to a depth of 4 to 5 feet bgs to clear the location.
- Set up a temporary work area adjacent to the excavation site. Designate clean areas for decontaminated sampling equipment and pre-cleaned soil sample containers.
- Set up 5-gallon buckets for decontaminating soil sampling equipment between soil samples.
- Calibrate the XRF in accordance with EPA Method 6200 (Exhibit A) to monitor headspace for selected soil samples. Record the reading on the Soil Sample Data form.
- Record in the Soil Sample Data form the location of each sample collected in the excavation.
- Upon completion of the excavation, measure the limits of the excavation from an on-site permanent datum.

1.4.2 Sample Collection

The instructions below are to be followed for soil sample collection:

- Don a clean pair of nitrile sampling gloves for each soil sample collected and for decontamination of the sampling equipment. Using clean gloves for each activity avoids the potential for cross-contamination.
- Decontaminate the stainless steel spoon and bowl before sampling. Decontaminate all non-dedicated sampling equipment between uses. Generally it is not necessary to decontaminate the backhoe bucket if the soil samples are collected from freshly excavated soil in the center of the backhoe bucket rather than from soil in direct contact with the backhoe bucket or teeth.
- Collect the soil sample from the excavation or the backhoe bucket using the stainless steel spoon and bowl.
- Briefly examine the soil sample visually for obvious signs of contamination, and take XRF readings as described in Exhibit B.

- Immediately transfer the soil sample to a pre-cleaned sample container(s) using a decontaminated stainless steel spoon. Fill the container(s) completely to the top to minimize headspace, and seal each with a Teflon lid. Label each sample container and place into a sample cooler. Record sample information on a Chain of Custody form, Soil Sample Data form, and Field Report form.
- Use the Soil Sample Data form to record the location, date, sample identification, depth and time of sample collection, observation of staining (yes/no), odor (yes/no), sheen (yes/no), and any pertinent comments. Record the excavation grid or test pit from which the sample was collected as described in the Compliance Monitoring and Sampling and Analysis Plan, or that the sample was collected from the base of the test pit.
- Retain a portion of the sample to measure using the XRF as described in Exhibit B and record the XRF units on the Soil Sample Data form.
- Use the Log of Test Pit form to record the lithology of the test pit from the ground surface to the total depth of the excavated test pit. Note the location and depth of any utilities present in the test pit, including piping diameters and material types. Note depth to water, if present, including any seepage observed. Note whether sidewalls of the test pit are stable or readily cave (estimation of soil density).
- Use a camera to create a photographic log of each test pit.
- Upon completion of a test pit, measure its dimensions and determine its location relative to an on-site permanent datum. Precisely plot the test pit location and dimensions on a scaled site plan.
- Discard excess soil in a drum or soil stockpile.
- Decontaminate the soil sampling equipment and don a clean pair of sampling gloves before collecting the next soil sample.

1.5 DOCUMENTATION

Document soil sampling activities on the Log of Test Pit form, the Soil Sample Data form, the Chain of Custody form, and the detailed Field Report form.

1.6 REFERENCES

U.S. Department of Energy. 1990. *Quality Control Requirements for Field Methods*, DOE/HWP-69/RI. July.

U.S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operation Methods*. EPA/540/P-87/001a. August.

EXHIBIT A
METHOD 6200—FIELD PORTABLE X-RAY FLUORESCENCE SPECTROMETRY FOR THE DETERMINATION OF ELEMENTAL CONCENTRATIONS IN SOIL AND SEDIMENT

STANDARD OPERATING PROCEDURES
Sound Battery
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

METHOD 6200

FIELD PORTABLE X-RAY FLUORESCENCE SPECTROMETRY FOR THE DETERMINATION OF ELEMENTAL CONCENTRATIONS IN SOIL AND SEDIMENT

SW-846 is not intended to be an analytical training manual. Therefore, method procedures are written based on the assumption that they will be performed by analysts who are formally trained in at least the basic principles of chemical analysis and in the use of the subject technology.

In addition, SW-846 methods, with the exception of required method use for the analysis of method-defined parameters, are intended to be guidance methods which contain general information on how to perform an analytical procedure or technique which a laboratory can use as a basic starting point for generating its own detailed Standard Operating Procedure (SOP), either for its own general use or for a specific project application. The performance data included in this method are for guidance purposes only, and are not intended to be and must not be used as absolute QC acceptance criteria for purposes of laboratory accreditation.

1.0 SCOPE AND APPLICATION

1.1 This method is applicable to the in situ and intrusive analysis of the 26 analytes listed below for soil and sediment samples. Some common elements are not listed in this method because they are considered "light" elements that cannot be detected by field portable x-ray fluorescence (FPXRF). These light elements are: lithium, beryllium, sodium, magnesium, aluminum, silicon, and phosphorus. Most of the analytes listed below are of environmental concern, while a few others have interference effects or change the elemental composition of the matrix, affecting quantitation of the analytes of interest. Generally elements of atomic number 16 or greater can be detected and quantitated by FPXRF. The following RCRA analytes have been determined by this method:

Analytes	CAS Registry No.
Antimony (Sb)	7440-36-0
Arsenic (As)	7440-38-0
Barium (Ba)	7440-39-3
Cadmium (Cd)	7440-43-9
Chromium (Cr)	7440-47-3
Cobalt (Co)	7440-48-4
Copper (Cu)	7440-50-8
Lead (Pb)	7439-92-1
Mercury (Hg)	7439-97-6
Nickel (Ni)	7440-02-0
Selenium (Se)	7782-49-2
Silver (Ag)	7440-22-4
Thallium (Tl)	7440-28-0
Tin (Sn)	7440-31-5

Analytes	CAS Registry No.
Vanadium (V)	7440-62-2
Zinc (Zn)	7440-66-6

In addition, the following non-RCRA analytes have been determined by this method:

Analytes	CAS Registry No.
Calcium (Ca)	7440-70-2
Iron (Fe)	7439-89-6
Manganese (Mn)	7439-96-5
Molybdenum (Mo)	7439-93-7
Potassium (K)	7440-09-7
Rubidium (Rb)	7440-17-7
Strontium (Sr)	7440-24-6
Thorium (Th)	7440-29-1
Titanium (Ti)	7440-32-6
Zirconium (Zr)	7440-67-7

1.2 This method is a screening method to be used with confirmatory analysis using other techniques (e.g., flame atomic absorption spectrometry (FLAA), graphite furnance atomic absorption spectrometry (GFAA), inductively coupled plasma-atomic emission spectrometry, (ICP-AES), or inductively coupled plasma-mass spectrometry, (ICP-MS)). This method’s main strength is that it is a rapid field screening procedure. The method's lower limits of detection are typically above the toxicity characteristic regulatory level for most RCRA analytes. However, when the obtainable values for precision, accuracy, and laboratory-established sensitivity of this method meet project-specific data quality objectives (DQOs), FPXRF is a fast, powerful, cost effective technology for site characterization.

1.3 The method sensitivity or lower limit of detection depends on several factors, including the analyte of interest, the type of detector used, the type of excitation source, the strength of the excitation source, count times used to irradiate the sample, physical matrix effects, chemical matrix effects, and interelement spectral interferences. Example lower limits of detection for analytes of interest in environmental applications are shown in Table 1. These limits apply to a clean spiked matrix of quartz sand (silicon dioxide) free of interelement spectral interferences using long (100 -600 second) count times. These sensitivity values are given for guidance only and may not always be achievable, since they will vary depending on the sample matrix, which instrument is used, and operating conditions. A discussion of performance-based sensitivity is presented in Sec. 9.6.

1.4 Analysts should consult the disclaimer statement at the front of the manual and the information in Chapter Two for guidance on the intended flexibility in the choice of methods, apparatus, materials, reagents, and supplies, and on the responsibilities of the analyst for demonstrating that the techniques employed are appropriate for the analytes of interest, in the matrix of interest, and at the levels of concern.

In addition, analysts and data users are advised that, except where explicitly specified in a regulation, the use of SW-846 methods is *not* mandatory in response to Federal testing requirements. The information contained in this method is provided by EPA as guidance to be used by the analyst and the regulated community in making judgments necessary to generate results that meet the data quality objectives for the intended application.

1.5 Use of this method is restricted to use by, or under supervision of, personnel appropriately experienced and trained in the use and operation of an XRF instrument. Each analyst must demonstrate the ability to generate acceptable results with this method.

2.0 SUMMARY OF METHOD

2.1 The FPXRF technologies described in this method use either sealed radioisotope sources or x-ray tubes to irradiate samples with x-rays. When a sample is irradiated with x-rays, the source x-rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source x-rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of x-rays characteristic of the given atom. The emission of x-rays, in this manner, is termed x-ray fluorescence.

Three electron shells are generally involved in emission of x-rays during FPXRF analysis of environmental samples. The three electron shells include the K, L, and M shells. A typical emission pattern, also called an emission spectrum, for a given metal has multiple intensity peaks generated from the emission of K, L, or M shell electrons. The most commonly measured x-ray emissions are from the K and L shells; only metals with an atomic number greater than 57 have measurable M shell emissions.

Each characteristic x-ray line is defined with the letter K, L, or M, which signifies which shell had the original vacancy and by a subscript alpha (α), beta (β), or gamma (γ) etc., which indicates the higher shell from which electrons fell to fill the vacancy and produce the x-ray. For example, a K_α line is produced by a vacancy in the K shell filled by an L shell electron, whereas a K_β line is produced by a vacancy in the K shell filled by an M shell electron. The K_α transition is on average 6 to 7 times more probable than the K_β transition; therefore, the K_α line is approximately 7 times more intense than the K_β line for a given element, making the K_α line the choice for quantitation purposes.

The K lines for a given element are the most energetic lines and are the preferred lines for analysis. For a given atom, the x-rays emitted from L transitions are always less energetic than those emitted from K transitions. Unlike the K lines, the main L emission lines (L_α and L_β) for an element are of nearly equal intensity. The choice of one or the other depends on what interfering element lines might be present. The L emission lines are useful for analyses involving elements of atomic number (Z) 58 (cerium) through 92 (uranium).

An x-ray source can excite characteristic x-rays from an element only if the source energy is greater than the absorption edge energy for the particular line group of the element, that is, the K absorption edge, L absorption edge, or M absorption edge energy. The absorption edge energy is somewhat greater than the corresponding line energy. Actually, the K absorption edge energy is approximately the sum of the K, L, and M line energies of the particular element, and the L absorption edge energy is approximately the sum of the L and M line energies. FPXRF is more sensitive to an element with an absorption edge energy close to but less than the excitation energy of the source. For example, when using a cadmium-109 source, which has an excitation energy of 22.1 kiloelectron volts (keV), FPXRF would exhibit better sensitivity for zirconium which has a K line energy of 15.77 keV than to chromium, which has a K line energy of 5.41 keV.

2.2 Under this method, inorganic analytes of interest are identified and quantitated using a field portable energy-dispersive x-ray fluorescence spectrometer. Radiation from one or more radioisotope sources or an electrically excited x-ray tube is used to generate characteristic x-ray emissions from elements in a sample. Up to three sources may be used to irradiate a sample. Each source emits a specific set of primary x-rays that excite a corresponding range of elements in a sample. When more than one source can excite the element of interest, the source is selected according to its excitation efficiency for the element of interest.

For measurement, the sample is positioned in front of the probe window. This can be done in two manners using FPXRF instruments, specifically, in situ or intrusive. If operated in the in situ mode, the probe window is placed in direct contact with the soil surface to be analyzed. When an FPXRF instrument is operated in the intrusive mode, a soil or sediment sample must be collected, prepared, and placed in a sample cup. The sample cup is then placed on top of the window inside a protective cover for analysis.

Sample analysis is then initiated by exposing the sample to primary radiation from the source. Fluorescent and backscattered x-rays from the sample enter through the detector window and are converted into electric pulses in the detector. The detector in FPXRF instruments is usually either a solid-state detector or a gas-filled proportional counter. Within the detector, energies of the characteristic x-rays are converted into a train of electric pulses, the amplitudes of which are linearly proportional to the energy of the x-rays. An electronic multichannel analyzer (MCA) measures the pulse amplitudes, which is the basis of qualitative x-ray analysis. The number of counts at a given energy per unit of time is representative of the element concentration in a sample and is the basis for quantitative analysis. Most FPXRF instruments are menu-driven from software built into the units or from personal computers (PC).

The measurement time of each source is user-selectable. Shorter source measurement times (30 seconds) are generally used for initial screening and hot spot delineation, and longer measurement times (up to 300 seconds) are typically used to meet higher precision and accuracy requirements.

FPXRF instruments can be calibrated using the following methods: internally using fundamental parameters determined by the manufacturer, empirically based on site-specific calibration standards (SSCS), or based on Compton peak ratios. The Compton peak is produced by backscattering of the source radiation. Some FPXRF instruments can be calibrated using multiple methods.

3.0 DEFINITIONS

3.1 FPXRF -- Field portable x-ray fluorescence.

3.2 MCA -- Multichannel analyzer for measuring pulse amplitude.

3.3 SSCS -- Site-specific calibration standards.

3.4 FP -- Fundamental parameter.

3.5 ROI -- Region of interest.

3.6 SRM -- Standard reference material; a standard containing certified amounts of metals in soil or sediment.

3.7 eV -- Electron volt; a unit of energy equivalent to the amount of energy gained by an electron passing through a potential difference of one volt.

3.8 Refer to Chapter One, Chapter Three, and the manufacturer's instructions for other definitions that may be relevant to this procedure.

4.0 INTERFERENCES

4.1 The total method error for FPXRF analysis is defined as the square root of the sum of squares of both instrument precision and user- or application-related error. Generally, instrument precision is the least significant source of error in FPXRF analysis. User- or application-related error is generally more significant and varies with each site and method used. Some sources of interference can be minimized or controlled by the instrument operator, but others cannot. Common sources of user- or application-related error are discussed below.

4.2 Physical matrix effects result from variations in the physical character of the sample. These variations may include such parameters as particle size, uniformity, homogeneity, and surface condition. For example, if any analyte exists in the form of very fine particles in a coarser-grained matrix, the analyte’s concentration measured by the FPXRF will vary depending on how fine particles are distributed within the coarser-grained matrix. If the fine particles "settle" to the bottom of the sample cup (i.e., against the cup window), the analyte concentration measurement will be higher than if the fine particles are not mixed in well and stay on top of the coarser-grained particles in the sample cup. One way to reduce such error is to grind and sieve all soil samples to a uniform particle size thus reducing sample-to-sample particle size variability. Homogeneity is always a concern when dealing with soil samples. Every effort should be made to thoroughly mix and homogenize soil samples before analysis. Field studies have shown heterogeneity of the sample generally has the largest impact on comparability with confirmatory samples.

4.3 Moisture content may affect the accuracy of analysis of soil and sediment sample analyses. When the moisture content is between 5 and 20 percent, the overall error from moisture may be minimal. However, moisture content may be a major source of error when analyzing samples of surface soil or sediment that are saturated with water. This error can be minimized by drying the samples in a convection or toaster oven. Microwave drying is not recommended because field studies have shown that microwave drying can increase variability between FPXRF data and confirmatory analysis and because metal fragments in the sample can cause arcing to occur in a microwave.

4.4 Inconsistent positioning of samples in front of the probe window is a potential source of error because the x-ray signal decreases as the distance from the radioactive source increases. This error is minimized by maintaining the same distance between the window and each sample. For the best results, the window of the probe should be in direct contact with the sample, which means that the sample should be flat and smooth to provide a good contact surface.

4.5 Chemical matrix effects result from differences in the concentrations of interfering elements. These effects occur as either spectral interferences (peak overlaps) or as x-ray absorption and enhancement phenomena. Both effects are common in soils contaminated with heavy metals. As examples of absorption and enhancement effects; iron (Fe) tends to absorb copper (Cu) x-rays, reducing the intensity of the Cu measured by the detector, while chromium (Cr) will be enhanced at the expense of Fe because the absorption edge of Cr is slightly lower in energy than the fluorescent peak of iron. The effects can be corrected mathematically through the use of fundamental parameter (FP) coefficients. The effects also can be compensated for using SSCS, which contain all the elements present on site that can interfere with one another.

4.6 When present in a sample, certain x-ray lines from different elements can be very close in energy and, therefore, can cause interference by producing a severely overlapped spectrum. The degree to which a detector can resolve the two different peaks depends on the energy resolution of the detector. If the energy difference between the two peaks in electron volts is less than the resolution of the detector in electron volts, then the detector will not be able to fully resolve the peaks.

The most common spectrum overlaps involve the K_β line of element Z-1 with the K_α line of element Z. This is called the K_α/K_β interference. Because the $K_\alpha:K_\beta$ intensity ratio for a given element usually is about 7:1, the interfering element, Z-1, must be present at large concentrations to cause a problem. Two examples of this type of spectral interference involve the presence of large concentrations of vanadium (V) when attempting to measure Cr or the presence of large concentrations of Fe when attempting to measure cobalt (Co). The V K_α and K_β energies are 4.95 and 5.43 keV, respectively, and the Cr K_α energy is 5.41 keV. The Fe K_α and K_β energies are 6.40 and 7.06 keV, respectively, and the Co K_α energy is 6.92 keV. The difference between the V K_β and Cr K_α energies is 20 eV, and the difference between the Fe K_β and the Co K_α energies is 140 eV. The resolution of the highest-resolution detectors in FPXRF instruments is 170 eV. Therefore, large amounts of V and Fe will interfere with quantitation of Cr or Co, respectively. The presence of Fe is a frequent problem because it is often found in soils at tens of thousands of parts per million (ppm).

4.7 Other interferences can arise from K/L, K/M, and L/M line overlaps, although these overlaps are less common. Examples of such overlap involve arsenic (As) K_α/lead (Pb) L_α and sulfur (S) K_α/Pb M_α. In the As/Pb case, Pb can be measured from the Pb L_β line, and As can be measured from either the As K_α or the As K_β line; in this way the interference can be corrected. If the As K_β line is used, sensitivity will be decreased by a factor of two to five times because it is a less intense line than the As K_α line. If the As K_α line is used in the presence of Pb, mathematical corrections within the instrument software can be used to subtract out the Pb interference. However, because of the limits of mathematical corrections, As concentrations cannot be efficiently calculated for samples with Pb:As ratios of 10:1 or more. This high ratio of Pb to As may result in reporting of a "nondetect" or a "less than" value (e.g., <300 ppm) for As, regardless of the actual concentration present.

No instrument can fully compensate for this interference. It is important for an operator to understand this limitation of FPXRF instruments and consult with the manufacturer of the FPXRF instrument to evaluate options to minimize this limitation. The operator's decision will be based on action levels for metals in soil established for the site, matrix effects, capabilities of the instrument, data quality objectives, and the ratio of lead to arsenic known to be present at the site. If a site is encountered that contains lead at concentrations greater than ten times the concentration of arsenic it is advisable that all critical soil samples be sent off site for confirmatory analysis using other techniques (e.g., flame atomic absorption spectrometry (FLAA), graphite furnance atomic absorption spectrometry (GFAA), inductively coupled plasma-atomic emission spectrometry, (ICP-AES), or inductively coupled plasma-mass spectrometry, (ICP-MS)).

4.8 If SSCS are used to calibrate an FPXRF instrument, the samples collected must be representative of the site under investigation. Representative soil sampling ensures that a sample or group of samples accurately reflects the concentrations of the contaminants of concern at a given time and location. Analytical results for representative samples reflect variations in the presence and concentration ranges of contaminants throughout a site. Variables affecting sample representativeness include differences in soil type, contaminant concentration variability, sample collection and preparation variability, and analytical variability, all of which should be minimized as much as possible.

4.9 Soil physical and chemical effects may be corrected using SSCS that have been analyzed by inductively coupled plasma (ICP) or atomic absorption (AA) methods. However, a major source of error can be introduced if these samples are not representative of the site or if the analytical error is large. Another concern is the type of digestion procedure used to prepare the soil samples for the reference analysis. Analytical results for the confirmatory method will vary depending on whether a partial digestion procedure, such as Method 3050, or a total digestion procedure, such as Method 3052, is used. It is known that depending on the nature of the soil or sediment, Method 3050 will achieve differing extraction efficiencies for different analytes of interest. The confirmatory method should meet the project-specific data quality objectives (DQOs).

XRF measures the total concentration of an element; therefore, to achieve the greatest comparability of this method with the reference method (reduced bias), a total digestion procedure should be used for sample preparation. However, in the study used to generate the performance data for this method (see Table 8), the confirmatory method used was Method 3050, and the FPXRF data compared very well with regression correlation coefficients (r often exceeding 0.95, except for barium and chromium). The critical factor is that the digestion procedure and analytical reference method used should meet the DQOs of the project and match the method used for confirmation analysis.

4.10 Ambient temperature changes can affect the gain of the amplifiers producing instrument drift. Gain or drift is primarily a function of the electronics (amplifier or preamplifier) and not the detector as most instrument detectors are cooled to a constant temperature. Most FPXRF instruments have a built-in automatic gain control. If the automatic gain control is allowed to make periodic adjustments, the instrument will compensate for the influence of temperature changes on its energy scale. If the FPXRF instrument has an automatic gain control function, the operator will not have to adjust the instrument's gain unless an error message appears. If an error message appears, the operator should follow the manufacturer's procedures for troubleshooting the problem. Often, this involves performing a new energy calibration. The performance of an energy calibration check to assess drift is a quality control measure discussed in Sec. 9.2.

If the operator is instructed by the manufacturer to manually conduct a gain check because of increasing or decreasing ambient temperature, it is standard to perform a gain check after every 10 to 20 sample measurements or once an hour whichever is more frequent. It is also suggested that a gain check be performed if the temperature fluctuates more than 10° F. The operator should follow the manufacturer's recommendations for gain check frequency.

5.0 SAFETY

5.1 This method does not address all safety issues associated with its use. The user is responsible for maintaining a safe work environment and a current awareness file of OSHA regulations regarding the safe handling of the chemicals listed in this method. A reference file of material safety data sheets (MSDSs) should be available to all personnel involved in these analyses.

NOTE: No MSDS applies directly to the radiation-producing instrument because that is covered under the Nuclear Regulatory Commission (NRC) or applicable state regulations.

5.2 Proper training for the safe operation of the instrument and radiation training should be completed by the analyst prior to analysis. Radiation safety for each specific instrument can be found in the operator's manual. Protective shielding should never be removed by the analyst or any personnel other than the manufacturer. The analyst should be aware of the local state and national regulations that pertain to the use of radiation-producing equipment and radioactive materials with which compliance is required. There should be a person appointed within the organization that is solely responsible for properly instructing all personnel, maintaining inspection records, and monitoring x-ray equipment at regular intervals.

Licenses for radioactive materials are of two types, specifically: (1) a general license which is usually initiated by the manufacturer for receiving, acquiring, owning, possessing, using, and transferring radioactive material incorporated in a device or equipment, and (2) a specific license which is issued to named persons for the operation of radioactive instruments as required by local, state, or federal agencies. A copy of the radioactive material license (for specific licenses only) and leak tests should be present with the instrument at all times and available to local and national authorities upon request.

X-ray tubes do not require radioactive material licenses or leak tests, but do require approvals and licenses which vary from state to state. In addition, fail-safe x-ray warning lights should be illuminated whenever an x-ray tube is energized. Provisions listed above concerning radiation safety regulations, shielding, training, and responsible personnel apply to x-ray tubes just as to radioactive sources. In addition, a log of the times and operating conditions should be kept whenever an x-ray tube is energized. An additional hazard present with x-ray tubes is the danger of electric shock from the high voltage supply, however, if the tube is properly positioned within the instrument, this is only a negligible risk. Any instrument (x-ray tube or radioisotope based) is capable of delivering an electric shock from the basic circuitry when the system is inappropriately opened.

5.3 Radiation monitoring equipment should be used with the handling and operation of the instrument. The operator and the surrounding environment should be monitored continually for analyst exposure to radiation. Thermal luminescent detectors (TLD) in the form of badges and rings are used to monitor operator radiation exposure. The TLDs or badges should be worn in the area of maximum exposure. The maximum permissible whole-body dose from occupational exposure is 5 Roentgen Equivalent Man (REM) per year. Possible exposure pathways for radiation to enter the body are ingestion, inhaling, and absorption. The best precaution to prevent radiation exposure is distance and shielding.

6.0 EQUIPMENT AND SUPPLIES

The mention of trade names or commercial products in this manual is for illustrative purposes only, and does not constitute an EPA endorsement or exclusive recommendation for use. The products and instrument settings cited in SW-846 methods represent those products and settings used during method development or subsequently evaluated by the Agency. Glassware, reagents, supplies, equipment, and settings other than those listed in this manual may be employed provided that method performance appropriate for the intended application has been demonstrated and documented.

6.1 FPXRF spectrometer -- An FPXRF spectrometer consists of four major components: (1) a source that provides x-rays; (2) a sample presentation device; (3) a detector that converts x-ray-generated photons emitted from the sample into measurable electronic signals; and (4) a data processing unit that contains an emission or fluorescence energy analyzer, such as an MCA, that processes the signals into an x-ray energy spectrum from which elemental concentrations in the sample may be calculated, and a data display and storage system. These components and additional, optional items, are discussed below.

6.1.1 Excitation sources -- FPXRF instruments use either a sealed radioisotope source or an x-ray tube to provide the excitation source. Many FPXRF instruments use sealed radioisotope sources to produce x-rays in order to irradiate samples. The FPXRF instrument may contain between one and three radioisotope sources. Common radioisotope sources used for analysis for metals in soils are iron Fe-55 (^{55}Fe), cadmium Cd-109 (^{109}Cd), americium Am-241 (^{241}Am), and curium Cm-244 (^{244}Cm). These sources may be contained in a probe along with a window and the detector; the probe may be connected to a data reduction and handling system by means of a flexible cable. Alternatively, the sources, window, and detector may be included in the same unit as the data reduction and handling system.

The relative strength of the radioisotope sources is measured in units of millicuries (mCi). All other components of the FPXRF system being equal, the stronger the source, the greater the sensitivity and precision of a given instrument. Radioisotope sources undergo constant decay. In fact, it is this decay process that emits the primary x-rays used to excite samples for FPXRF analysis. The decay of radioisotopes is measured in "half-lives." The half-life of a radioisotope is defined as the length of time required to reduce the radioisotopes strength or activity by half. Developers of FPXRF technologies recommend source replacement at regular intervals based on the source's half-life. This is due to the ever increasing time required for the analysis rather than a decrease in instrument performance. The characteristic x-rays emitted from each of the different sources have energies capable of exciting a certain range of analytes in a sample. Table 2 summarizes the characteristics of four common radioisotope sources.

X-ray tubes have higher radiation output, no intrinsic lifetime limit, produce constant output over their lifetime, and do not have the disposal problems of radioactive sources but are just now appearing in FPXRF instruments. An electrically-excited x-ray tube operates by bombarding an anode with electrons accelerated by a high voltage. The electrons gain an energy in electron volts equal to the accelerating voltage and can excite atomic transitions in the anode, which then produces characteristic x-rays. These characteristic x-rays are emitted through a window which contains the vacuum necessary for the electron acceleration. An important difference between x-ray tubes and radioactive sources is that the electrons which bombard the anode also produce a continuum of x-rays across a broad range of energies in addition to the characteristic x-rays. This continuum is weak compared to the characteristic x-rays but can provide substantial excitation since it covers a broad energy range. It has the undesired property of producing background in the spectrum near the analyte x-ray lines when it is scattered by the sample. For this reason a filter is often used between the x-ray tube and the sample to suppress the continuum radiation while passing the characteristic x-rays from the anode. This filter is sometimes incorporated into the window of the x-ray tube. The choice of accelerating voltage is governed both by the anode material, since the electrons must have sufficient energy to excite the anode, which requires a voltage greater than the absorption edge of the anode material and by the instrument's ability to cool the x-ray tube. The anode is most efficiently excited by voltages 2 to 2.5 times the edge energy (most x-rays per unit power to the tube), although voltages as low as 1.5 times the absorption edge energy will work. The characteristic x-rays emitted by the anode are capable of exciting a range of elements in the sample just as with a radioactive source. Table 3 gives the recommended operating voltages and the sample elements excited for some common anodes.

6.1.2 Sample presentation device -- FPXRF instruments can be operated in two modes: in situ and intrusive. If operated in the in situ mode, the probe window is placed in direct contact with the soil surface to be analyzed. When an FPXRF instrument is operated in the intrusive mode, a soil or sediment sample must be collected, prepared, and placed in a sample cup. For FPXRF instruments operated in the intrusive mode, the probe may be rotated so that the window faces either upward or downward. A protective sample cover is placed over the window, and the sample cup is placed on top of the window inside the protective sample cover for analysis.

6.1.3 Detectors -- The detectors in the FPXRF instruments can be either solid-state detectors or gas-filled, proportional counter detectors. Common solid-state detectors include mercuric iodide (HgI_2), silicon pin diode and lithium-drifted silicon Si(Li). The HgI_2 detector is operated at a moderately subambient temperature controlled by a low power thermoelectric cooler. The silicon pin diode detector also is cooled via the thermoelectric Peltier effect. The Si(Li) detector must be cooled to at least -90 °C either with liquid nitrogen or by thermoelectric cooling via the Peltier effect. Instruments with a Si(Li) detector have an internal liquid nitrogen dewar with a capacity of 0.5 to 1.0 L. Proportional counter detectors are rugged and lightweight, which are important features of a field portable detector. However, the resolution of a proportional counter detector is not as good as that of a solid-state detector. The energy resolution of a detector for characteristic x-rays is usually expressed in terms of full width at half-maximum (FWHM) height of the manganese K_α peak at 5.89 keV. The typical resolutions of the above mentioned detectors are as follows: HgI_2-270 eV; silicon pin diode-250 eV; Si(Li)–170 eV; and gas-filled, proportional counter-750 eV.

During operation of a solid-state detector, an x-ray photon strikes a biased, solid-state crystal and loses energy in the crystal by producing electron-hole pairs. The electric charge produced is collected and provides a current pulse that is directly proportional to the energy of the x-ray photon absorbed by the crystal of the detector. A gas-filled, proportional counter detector is an ionization chamber filled with a mixture of noble and other gases. An x-ray photon entering the chamber ionizes the gas atoms. The electric charge produced is collected and provides an electric signal that is directly proportional to the energy of the x-ray photon absorbed by the gas in the detector.

6.1.4 Data processing units -- The key component in the data processing unit of an FPXRF instrument is the MCA. The MCA receives pulses from the detector and sorts them by their amplitudes (energy level). The MCA counts pulses per second to determine the height of the peak in a spectrum, which is indicative of the target analyte's concentration. The spectrum of element peaks are built on the MCA. The MCAs in FPXRF instruments have from 256 to 2,048 channels. The concentrations of target analytes are usually shown in ppm on a liquid crystal display (LCD) in the instrument. FPXRF instruments can store both spectra and from 3,000 to 5,000 sets of numerical analytical results. Most FPXRF instruments are menu-driven from software built into the units or from PCs. Once the data–storage memory of an FPXRF unit is full or at any other time, data can be downloaded by means of an RS-232 port and cable to a PC.

6.2 Spare battery and battery charger.

6.3 Polyethylene sample cups -- 31 to 40 mm in diameter with collar, or equivalent (appropriate for FPXRF instrument).

6.4 X-ray window film -- Mylar^{TM}, Kapton^{TM}, Spectrolene^{TM}, polypropylene, or equivalent; 2.5 to 6.0 µm thick.

6.5 Mortar and pestle -- Glass, agate, or aluminum oxide; for grinding soil and sediment samples.

6.6 Containers -- Glass or plastic to store samples.

6.7 Sieves -- 60-mesh (0.25 mm), stainless-steel, Nylon, or equivalent for preparing soil and sediment samples.

6.8 Trowels -- For smoothing soil surfaces and collecting soil samples.

6.9 Plastic bags -- Used for collection and homogenization of soil samples.

6.10 Drying oven -- Standard convection or toaster oven, for soil and sediment samples that require drying.

7.0 REAGENTS AND STANDARDS

7.1 Reagent grade chemicals must be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 Pure element standards -- Each pure, single-element standard is intended to produce strong characteristic x-ray peaks of the element of interest only. Other elements present must not contribute to the fluorescence spectrum. A set of pure element standards for commonly sought analytes is supplied by the instrument manufacturer, if designated for the instrument; not all instruments require the pure element standards. The standards are used to set the region of interest (ROI) for each element. They also can be used as energy calibration and resolution check samples.

7.3 Site-specific calibration standards -- Instruments that employ fundamental parameters (FP) or similar mathematical models in minimizing matrix effects may not require SSCS. If the FP calibration model is to be optimized or if empirical calibration is necessary, then SSCSs must be collected, prepared, and analyzed.

7.3.1 The SSCS must be representative of the matrix to be analyzed by FPXRF. These samples must be well homogenized. A minimum of 10 samples spanning the concentration ranges of the analytes of interest and of the interfering elements must be obtained from the site. A sample size of 4 to 8 ounces is recommended, and standard glass sampling jars should be used.

7.3.2 Each sample should be oven-dried for 2 to 4 hr at a temperature of less than 150 °C. If mercury is to be analyzed, a separate sample portion should be dried at ambient temperature as heating may volatilize the mercury. When the sample is dry, all large, organic debris and nonrepresentative material, such as twigs, leaves, roots, insects, asphalt, and rock should be removed. The sample should be homogenized (see Sec. 7.3.3) and then a representative portion ground with a mortar and pestle or other mechanical means, prior to passing through a 60-mesh sieve. Only the coarse rock fraction should remain on the screen.

7.3.3 The sample should be homogenized by using a riffle splitter or by placing 150 to 200 g of the dried, sieved sample on a piece of kraft or butcher paper about 1.5 by 1.5 feet in size. Each corner of the paper should be lifted alternately, rolling the soil over on itself and toward the opposite corner. The soil should be rolled on itself 20 times. Approximately 5 g of the sample should then be removed and placed in a sample cup for FPXRF analysis. The rest of the prepared sample should be sent off site for ICP or AA analysis. The method use for confirmatory analysis should meet the data quality objectives of the project.

7.4 Blank samples -- The blank samples should be from a "clean" quartz or silicon dioxide matrix that is free of any analytes at concentrations above the established lower limit of detection. These samples are used to monitor for cross-contamination and laboratory-induced contaminants or interferences.

7.5 Standard reference materials -- Standard reference materials (SRMs) are standards containing certified amounts of metals in soil or sediment. These standards are used for accuracy and performance checks of FPXRF analyses. SRMs can be obtained from the National Institute of Standards and Technology (NIST), the U.S. Geological Survey (USGS), the Canadian National Research Council, and the national bureau of standards in foreign nations. Pertinent NIST SRMs for FPXRF analysis include 2704, Buffalo River Sediment; 2709, San Joaquin Soil; and 2710 and 2711, Montana Soil. These SRMs contain soil or sediment from actual sites that has been analyzed using independent inorganic analytical methods by many different laboratories. When these SRMs are unavailable, alternate standards may be used (e.g., NIST 2702).

8.0 SAMPLE COLLECTION, PRESERVATION, AND STORAGE

Sample handling and preservation procedures used in FPXRF analyses should follow the guidelines in Chapter Three, "Inorganic Analytes."

9.0 QUALITY CONTROL

9.1 Follow the manufacturer’s instructions for the quality control procedures specific to use of the testing product. Refer to Chapter One for additional guidance on quality assurance (QA) and quality control (QC) protocols. Any effort involving the collection of analytical data should include development of a structured and systematic planning document, such as a Quality Assurance Project Plan (QAPP) or a Sampling and Analysis Plan (SAP), which translates project objectives and specifications into directions for those that will implement the project and assess the results.

9.2 Energy calibration check -- To determine whether an FPXRF instrument is operating within resolution and stability tolerances, an energy calibration check should be run. The energy calibration check determines whether the characteristic x-ray lines are shifting, which would indicate drift within the instrument. As discussed in Sec. 4.10, this check also serves as a gain check in the event that ambient temperatures are fluctuating greatly (more than 10 °F).

9.2.1 The energy calibration check should be run at a frequency consistent with manufacturer's recommendations. Generally, this would be at the beginning of each working day, after the batteries are changed or the instrument is shut off, at the end of each working day, and at any other time when the instrument operator believes that drift is occurring during analysis. A pure element such as iron, manganese, copper, or lead is often used for the energy calibration check. A manufacturer-recommended count time per source should be used for the check.

9.2.2 The instrument manufacturer's manual specifies the channel or kiloelectron volt level at which a pure element peak should appear and the expected intensity of the peak. The intensity and channel number of the pure element as measured using the source should be checked and compared to the manufacturer's recommendation. If the energy calibration check does not meet the manufacturer's criteria, then the pure element sample should be repositioned and reanalyzed. If the criteria are still not met, then an energy calibration should be performed as described in the manufacturer's manual. With some FPXRF instruments, once a spectrum is acquired from the energy calibration check, the peak can be optimized and realigned to the manufacturer's specifications using their software.

9.3 Blank samples -- Two types of blank samples should be analyzed for FPXRF analysis, specifically, instrument blanks and method blanks.

9.3.1 An instrument blank is used to verify that no contamination exists in the spectrometer or on the probe window. The instrument blank can be silicon dioxide, a polytetraflurorethylene (PTFE) block, a quartz block, "clean" sand, or lithium carbonate. This instrument blank should be analyzed on each working day before and after analyses are conducted and once per every twenty samples. An instrument blank should also be analyzed whenever contamination is suspected by the analyst. The frequency of analysis will vary with the data quality objectives of the project. A manufacturer-recommended count time per source should be used for the blank analysis. No element concentrations above the established lower limit of detection should be found in the instrument blank. If concentrations exceed these limits, then the probe window and the check sample should be checked for contamination. If contamination is not a problem, then the instrument must be "zeroed" by following the manufacturer's instructions.

9.3.2 A method blank is used to monitor for laboratory-induced contaminants or interferences. The method blank can be "clean" silica sand or lithium carbonate that undergoes the same preparation procedure as the samples. A method blank must be analyzed at least daily. The frequency of analysis will depend on the data quality objectives of the project. If the method blank does not contain the target analyte at a level that interferes with the project-specific data quality objectives then the method blank would be considered acceptable. In the absence of project-specific data quality objectives, if the blank is less than the lowest level of detection or less than 10% of the lowest sample concentration for the analyte, whichever is greater, then the method blank would be considered acceptable. If the method blank cannot be considered acceptable, the cause of the problem must be identified, and all samples analyzed with the method blank must be reanalyzed.

9.4 Calibration verification checks -- A calibration verification check sample is used to check the accuracy of the instrument and to assess the stability and consistency of the analysis for the analytes of interest. A check sample should be analyzed at the beginning of each working day, during active sample analyses, and at the end of each working day. The frequency of calibration checks during active analysis will depend on the data quality objectives of the project. The check sample should be a well characterized soil sample from the site that is representative of site samples in terms of particle size and degree of homogeneity and that contains contaminants at concentrations near the action levels. If a site-specific sample is not available, then an NIST or other SRM that contains the analytes of interest can be used to verify the accuracy of the instrument. The measured value for each target analyte should be within ±20 percent (%D) of the true value for the calibration verification check to be acceptable. If a measured value falls outside this range, then the check sample should be reanalyzed. If the value continues to fall outside the acceptance range, the instrument should be recalibrated, and the batch of samples analyzed before the unacceptable calibration verification check must be reanalyzed.

9.5 Precision measurements -- The precision of the method is monitored by analyzing a sample with low, moderate, or high concentrations of target analytes. The frequency of precision measurements will depend on the data quality objectives for the data. A minimum of one precision sample should be run per day. Each precision sample should be analyzed 7 times in replicate. It is recommended that precision measurements be obtained for samples with varying concentration ranges to assess the effect of concentration on method precision. Determining method precision for analytes at concentrations near the site action levels can be extremely important if the FPXRF results are to be used in an enforcement action; therefore, selection of at least one sample with target analyte concentrations at or near the site action levels or levels of concern is recommended. A precision sample is analyzed by the instrument for the same field analysis time as used for other project samples. The relative standard deviation (RSD) of the sample mean is used to assess method precision. For FPXRF data to be considered adequately precise, the RSD should not be greater than 20 percent with the exception of chromium. RSD values for chromium should not be greater than 30 percent. If both in situ and intrusive analytical techniques are used during the course of one day, it is recommended that separate precision calculations be performed for each analysis type.

The equation for calculating RSD is as follows:

$$\text{RSD} = (\text{SD}/\text{Mean Concentration}) \times 100$$

where:

RSD = Relative standard deviation for the precision measurement for the analyte
SD = Standard deviation of the concentration for the analyte
Mean concentration = Mean concentration for the analyte

The precision or reproducibility of a measurement will improve with increasing count time, however, increasing the count time by a factor of 4 will provide only 2 times better precision, so there is a point of diminishing return. Increasing the count time also improves the sensitivity, but decreases sample throughput.

9.6 The lower limits of detection should be established from actual measured performance based on spike recoveries in the matrix of concern or from acceptable method performance on a certified reference material of the appropriate matrix and within the appropriate calibration range for the application. This is considered the best estimate of the true method sensitivity as opposed to a statistical determination based on the standard deviation of replicate analyses of a low-concentration sample. While the statistical approach demonstrates the potential data variability for a given sample matrix at one point in time, it does not represent what can be detected or most importantly the lowest concentration that can be calibrated. For this reason the sensitivity should be established as the lowest point of detection based on acceptable target analyte recovery in the desired sample matrix.

9.7 Confirmatory samples -- The comparability of the FPXRF analysis is determined by submitting FPXRF-analyzed samples for analysis at a laboratory. The method of confirmatory analysis must meet the project and XRF measurement data quality objectives. The confirmatory samples must be splits of the well homogenized sample material. In some cases the prepared sample cups can be submitted. A minimum of 1 sample for each 20 FPXRF-analyzed samples should be submitted for confirmatory analysis. This frequency will depend on project-specific data quality objectives. The confirmatory analyses can also be used to verify the quality of the FPXRF data. The confirmatory samples should be selected from the lower, middle, and upper range of concentrations measured by the FPXRF. They should also include samples with analyte concentrations at or near the site action levels. The results of the confirmatory analysis and FPXRF analyses should be evaluated with a least squares linear regression analysis. If the measured concentrations span more than one order of magnitude, the data should be log-transformed to standardize variance which is proportional to the magnitude of measurement. The correlation coefficient (r) for the results should be 0.7 or greater for the FPXRF data to be considered screening level data. If the r is 0.9 or greater and inferential statistics indicate the FPXRF data and the confirmatory data are statistically equivalent at a 99 percent confidence level, the data could potentially meet definitive level data criteria.

10.0 CALIBRATION AND STANDARDIZATION

10.1 Instrument calibration -- Instrument calibration procedures vary among FPXRF instruments. Users of this method should follow the calibration procedures outlined in the operator's manual for each specific FPXRF instrument. Generally, however, three types of calibration procedures exist for FPXRF instruments, namely: FP calibration, empirical calibration, and the Compton peak ratio or normalization method. These three types of calibration are discussed below.

10.2 Fundamental parameters calibration -- FP calibration procedures are extremely variable. An FP calibration provides the analyst with a "standardless" calibration. The advantages of FP calibrations over empirical calibrations include the following:

- No previously collected site-specific samples are necessary, although site-specific samples with confirmed and validated analytical results for all elements present could be used.

- Cost is reduced because fewer confirmatory laboratory results or calibration standards are necessary.

However, the analyst should be aware of the limitations imposed on FP calibration by particle size and matrix effects. These limitations can be minimized by adhering to the preparation procedure described in Sec. 7.3. The two FP calibration processes discussed below are based on an effective energy FP routine and a back scatter with FP (BFP) routine. Each FPXRF FP calibration process is based on a different iterative algorithmic method. The calibration procedure for each routine is explained in detail in the manufacturer's user manual for each FPXRF instrument; in addition, training courses are offered for each instrument.

10.2.1 Effective energy FP calibration -- The effective energy FP calibration is performed by the manufacturer before an instrument is sent to the analyst. Although SSCS can be used, the calibration relies on pure element standards or SRMs such as those obtained from NIST for the FP calibration. The effective energy routine relies on the spectrometer response to pure elements and FP iterative algorithms to compensate for various matrix effects.

Alpha coefficients are calculated using a variation of the Sherman equation, which calculates theoretical intensities from the measurement of pure element samples. These coefficients indicate the quantitative effect of each matrix element on an analyte's measured x-ray intensity. Next, the Lachance Traill algorithm is solved as a set of simultaneous equations based on the theoretical intensities. The alpha coefficients are then downloaded into the specific instrument.

The working effective energy FP calibration curve must be verified before sample analysis begins on each working day, after every 20 samples are analyzed, and at the end of sampling. This verification is performed by analyzing either an NIST SRM or an SSCS that is representative of the site-specific samples. This SRM or SSCS serves as a calibration check. A manufacturer-recommended count time per source should be used for the calibration check. The analyst must then adjust the y-intercept and slope of the calibration curve to best fit the known concentrations of target analytes in the SRM or SSCS.

A percent difference (%D) is then calculated for each target analyte. The %D should be within ±20 percent of the certified value for each analyte. If the %D falls outside this acceptance range, then the calibration curve should be adjusted by varying the slope of the line or the y-intercept value for the analyte. The SRM or SSCS is reanalyzed until the %D falls within ±20 percent. The group of 20 samples analyzed before an out-of-control calibration check should be reanalyzed.

The equation to calibrate %D is as follows:

$$\%D = ((C_s - C_k) / C_k) \times 100$$

where:

$\%D$ = Percent difference
C_k = Certified concentration of standard sample
C_s = Measured concentration of standard sample

10.2.2 BFP calibration -- BFP calibration relies on the ability of the liquid nitrogen-cooled, Si(Li) solid-state detector to separate the coherent (Compton) and incoherent (Rayleigh) backscatter peaks of primary radiation. These peak intensities are known to be a function of sample composition, and the ratio of the Compton to Rayleigh peak is a function of the mass absorption of the sample. The calibration procedure is explained in detail in the instrument manufacturer's manual. Following is a general description of the BFP calibration procedure.

The concentrations of all detected and quantified elements are entered into the computer software system. Certified element results for an NIST SRM or confirmed and validated results for an SSCS can be used. In addition, the concentrations of oxygen and silicon must be entered; these two concentrations are not found in standard metals analyses. The manufacturer provides silicon and oxygen concentrations for typical soil types. Pure element standards are then analyzed using a manufacturer-recommended count time per source. The results are used to calculate correction factors in order to adjust for spectrum overlap of elements.

The working BFP calibration curve must be verified before sample analysis begins on each working day, after every 20 samples are analyzed, and at the end of the analysis. This verification is performed by analyzing either an NIST SRM or an SSCS that is representative of the site-specific samples. This SRM or SSCS serves as a calibration check. The standard sample is analyzed using a manufacturer-recommended count time per source to check the calibration curve. The analyst must then adjust the y-intercept and slope of the calibration curve to best fit the known concentrations of target analytes in the SRM or SSCS.

A %D is then calculated for each target analyte. The %D should fall within ±20 percent of the certified value for each analyte. If the %D falls outside this acceptance range, then the calibration curve should be adjusted by varying the slope of the line the y-intercept value for the analyte. The standard sample is reanalyzed until the %D falls within ±20 percent. The group of 20 samples analyzed before an out-of-control calibration check should be reanalyzed.

10.3 Empirical calibration -- An empirical calibration can be performed with SSCS, site-typical standards, or standards prepared from metal oxides. A discussion of SSCS is included in Sec. 7.3; if no previously characterized samples exist for a specific site, site-typical standards can be used. Site-typical standards may be selected from commercially available characterized soils or from SSCS prepared for another site. The site-typical standards should closely approximate the site's soil matrix with respect to particle size distribution, mineralogy, and contaminant analytes. If neither SSCS nor site-typical standards are available, it is possible to make gravimetric standards by adding metal oxides to a "clean" sand or silicon dioxide matrix that simulates soil. Metal oxides can be purchased from various chemical vendors. If standards are made on site, a balance capable of weighing items to at least two decimal places is necessary. Concentrated ICP or AA standard solutions can also be used to make standards. These solutions are available in concentrations of 10,000 parts per million, thus only small volumes have to be added to the soil.

An empirical calibration using SSCS involves analysis of SSCS by the FPXRF instrument and by a conventional analytical method such as ICP or AA. A total acid digestion procedure should be used by the laboratory for sample preparation. Generally, a minimum of 10 and a maximum of 30 well characterized SSCS, site-typical standards, or prepared metal oxide standards are necessary to perform an adequate empirical calibration. The exact number of standards depends on the number of analytes of interest and interfering elements. Theoretically, an empirical calibration with SSCS should provide the most accurate data for a site because the calibration compensates for site-specific matrix effects.

The first step in an empirical calibration is to analyze the pure element standards for the elements of interest. This enables the instrument to set channel limits for each element for spectral deconvolution. Next the SSCS, site-typical standards, or prepared metal oxide standards are analyzed using a count time of 200 seconds per source or a count time recommended by the manufacturer. This will produce a spectrum and net intensity of each analyte in each standard. The analyte concentrations for each standard are then entered into the instrument software; these concentrations are those obtained from the laboratory, the certified results, or the gravimetrically determined concentrations of the prepared standards. This gives the instrument analyte values to regress against corresponding intensities during the modeling stage. The regression equation correlates the concentrations of an analyte with its net intensity.

The calibration equation is developed using a least squares fit regression analysis. After the regression terms to be used in the equation are defined, a mathematical equation can be developed to calculate the analyte concentration in an unknown sample. In some FPXRF instruments, the software of the instrument calculates the regression equation. The software uses calculated intercept and slope values to form a multiterm equation. In conjunction with the software in the instrument, the operator can adjust the multiterm equation to minimize interelement interferences and optimize the intensity calibration curve.

It is possible to define up to six linear or nonlinear terms in the regression equation. Terms can be added and deleted to optimize the equation. The goal is to produce an equation with the smallest regression error and the highest correlation coefficient. These values are automatically computed by the software as the regression terms are added, deleted, or modified. It is also possible to delete data points from the regression line if these points are significant outliers or if they are heavily weighing the data. Once the regression equation has been selected for an analyte, the equation can be entered into the software for quantitation of analytes in subsequent samples. For an empirical calibration to be acceptable, the regression equation for a specific analyte should have a correlation coefficient of 0.98 or greater or meet the DQOs of the project.

In an empirical calibration, one must apply the DQOs of the project and ascertain critical or action levels for the analytes of interest. It is within these concentration ranges or around these action levels that the FPXRF instrument should be calibrated most accurately. It may not be possible to develop a good regression equation over several orders of analyte concentration.

10.4 Compton normalization method -- The Compton normalization method is based on analysis of a single, certified standard and normalization for the Compton peak. The Compton peak is produced from incoherent backscattering of x-ray radiation from the excitation source and is present in the spectrum of every sample. The Compton peak intensity changes with differing matrices. Generally, matrices dominated by lighter elements produce a larger Compton peak, and those dominated by heavier elements produce a smaller Compton peak. Normalizing to the Compton peak can reduce problems with varying matrix effects among samples. Compton normalization is similar to the use of internal standards in organics analysis. The Compton normalization method may not be effective when analyte concentrations exceed a few percent.

The certified standard used for this type of calibration could be an NIST SRM such as 2710 or 2711. The SRM must be a matrix similar to the samples and must contain the analytes of interests at concentrations near those expected in the samples. First, a response factor has to be determined for each analyte. This factor is calculated by dividing the net peak intensity by the analyte concentration. The net peak intensity is gross intensity corrected for baseline reading. Concentrations of analytes in samples are then determined by multiplying the baseline corrected analyte signal intensity by the normalization factor and by the response factor. The normalization factor is the quotient of the baseline corrected Compton K_α peak intensity of the SRM divided by that of the samples. Depending on the FPXRF instrument used, these calculations may be done manually or by the instrument software.

11.0 PROCEDURE

11.1 Operation of the various FPXRF instruments will vary according to the manufacturers' protocols. Before operating any FPXRF instrument, one should consult the manufacturer's manual. Most manufacturers recommend that their instruments be allowed to warm up for 15 to 30 minutes before analysis of samples. This will help alleviate drift or energy calibration problems later during analysis.

11.2 Each FPXRF instrument should be operated according to the manufacturer's recommendations. There are two modes in which FPXRF instruments can be operated: in situ and intrusive. The in situ mode involves analysis of an undisturbed soil sediment or sample. Intrusive analysis involves collection and preparation of a soil or sediment sample before analysis. Some FPXRF instruments can operate in both modes of analysis, while others are designed to operate in only one mode. The two modes of analysis are discussed below.

11.3 For in situ analysis, remove any large or nonrepresentative debris from the soil surface before analysis. This debris includes rocks, pebbles, leaves, vegetation, roots, and concrete. Also, the soil surface must be as smooth as possible so that the probe window will have good contact with the surface. This may require some leveling of the surface with a stainless-steel trowel. During the study conducted to provide example performance data for this method, this modest amount of sample preparation was found to take less than 5 min per sample location. The last requirement is that the soil or sediment not be saturated with water. Manufacturers state that their FPXRF instruments will perform adequately for soils with moisture contents of 5 to 20 percent but will not perform well for saturated soils, especially if ponded water exists on the surface. Another recommended technique for in situ analysis is to tamp the soil to increase soil density and compactness for better repeatability and representativeness. This condition is especially important for heavy element analysis, such as barium. Source count times for in situ analysis usually range from 30 to 120 seconds, but source count times will vary among instruments and depending on the desired method sensitivity. Due to the heterogeneous nature of the soil sample, in situ analysis can provide only “screening” type data.

11.4 For intrusive analysis of surface or sediment, it is recommended that a sample be collected from a 4- by 4-inch square that is 1 inch deep. This will produce a soil sample of approximately 375 g or 250 cm^3, which is enough soil to fill an 8-ounce jar. However, the exact dimensions and sample depth should take into consideration the heterogeneous deposition of contaminants and will ultimately depend on the desired project-specific data quality objectives. The sample should be homogenized, dried, and ground before analysis. The sample can be homogenized before or after drying. The homogenization technique to be used after drying is discussed in Sec. 4.2. If the sample is homogenized before drying, it should be thoroughly mixed in a beaker or similar container, or if the sample is moist and has a high clay content, it can be kneaded in a plastic bag. One way to monitor homogenization when the sample is kneaded in a plastic bag is to add sodium fluorescein dye to the sample. After the moist sample has been homogenized, it is examined under an ultraviolet light to assess the distribution of sodium fluorescein throughout the sample. If the fluorescent dye is evenly distributed in the sample, homogenization is considered complete; if the dye is not evenly distributed, mixing should continue until the sample has been thoroughly homogenized. During the study conducted to provide data for this method, the time necessary for homogenization procedure using the fluorescein dye ranged from 3 to 5 min per sample. As demonstrated in Secs. 13.5 and 13.7, homogenization has the greatest impact on the reduction of sampling variability. It produces little or no contamination. Often, the direct analysis through the plastic bag is possible without the more labor intensive steps of drying, grinding, and sieving given in Secs. 11.5 and 11.6. Of course, to achieve the best data quality possible all four steps should be followed.

11.5 Once the soil or sediment sample has been homogenized, it should be dried. This can be accomplished with a toaster oven or convection oven. A small aliquot of the sample (20 to 50 g) is placed in a suitable container for drying. The sample should be dried for 2 to 4 hr in the convection or toaster oven at a temperature not greater than 150 °C. Samples may also be air dried under ambient temperature conditions using a 10- to 20-g portion. Regardless of what drying mechanism is used, the drying process is considered complete when a constant sample weight can be obtained. Care should be taken to avoid sample cross-contamination and these measures can be evaluated by including an appropriate method blank sample along with any sample preparation process.

CAUTION: Microwave drying is not a recommended procedure. Field studies have shown that microwave drying can increase variability between the FPXRF data and confirmatory analysis. High levels of metals in a sample can cause arcing in the microwave oven, and sometimes slag forms in the sample. Microwave oven drying can also melt plastic containers used to hold the sample.

11.6 The homogenized dried sample material should be ground with a mortar and pestle and passed through a 60-mesh sieve to achieve a uniform particle size. Sample grinding should continue until at least 90 percent of the original sample passes through the sieve. The grinding step normally takes an average of 10 min per sample. An aliquot of the sieved sample should then be placed in a 31.0-mm polyethylene sample cup (or equivalent) for analysis. The sample cup should be one-half to three-quarters full at a minimum. The sample cup should be covered with a 2.5 µm Mylar (or equivalent) film for analysis. The rest of the soil sample should be placed in a jar, labeled, and archived for possible confirmation analysis. All equipment including the mortar, pestle, and sieves must be thoroughly cleaned so that any cross-contamination is below the established lower limit of detection of the procedure or DQOs of the analysis. If all recommended sample preparation steps are followed, there is a high probability the desired laboratory data quality may be obtained.

12.0 DATA ANALYSIS AND CALCULATIONS

Most FPXRF instruments have software capable of storing all analytical results and spectra. The results are displayed in ppm and can be downloaded to a personal computer, which can be used to provide a hard copy printout. Individual measurements that are smaller than three times their associated SD should not be used for quantitation. See the manufacturer’s instructions regarding data analysis and calculations.

13.0 METHOD PERFORMANCE

13.1 Performance data and related information are provided in SW-846 methods only as examples and guidance. The data do not represent required performance criteria for users of the methods. Instead, performance criteria should be developed on a project-specific basis, and the laboratory should establish in-house QC performance criteria for the application of this method. These performance data are not intended to be and must not be used as absolute QC acceptance criteria for purposes of laboratory accreditation.

13.2 The sections to follow discuss three performance evaluation factors; namely, precision, accuracy, and comparability. The example data presented in Tables 4 through 8 were generated from results obtained from six FPXRF instruments (see Sec. 13.3). The soil samples analyzed by the six FPXRF instruments were collected from two sites in the United States. The soil samples contained several of the target analytes at concentrations ranging from "nondetect" to tens of thousands of mg/kg. These data are provided for guidance purposes only.

13.3 The six FPXRF instruments included the TN 9000 and TN Lead Analyzer manufactured by TN Spectrace; the X-MET 920 with a SiLi detector and X-MET 920 with a gas-filled proportional detector manufactured by Metorex, Inc.; the XL Spectrum Analyzer manufactured by Niton; and the MAP Spectrum Analyzer manufactured by Scitec. The TN 9000 and TN Lead Analyzer both have a HgI_2 detector. The TN 9000 utilized an Fe-55, Cd-109, and Am-241 source. The TN Lead Analyzer had only a Cd-109 source. The X-Met 920 with the SiLi detector had a Cd-109 and Am-241 source. The X-MET 920 with the gas-filled proportional detector had only a Cd-109 source. The XL Spectrum Analyzer utilized a silicon pin-diode detector and a Cd-109 source. The MAP Spectrum Analyzer utilized a solid-state silicon detector and a Cd-109 source.

13.4 All example data presented in Tables 4 through 8 were generated using the following calibrations and source count times. The TN 9000 and TN Lead Analyzer were calibrated using fundamental parameters using NIST SRM 2710 as a calibration check sample. The TN 9000 was operated using 100, 60, and 60 second count times for the Cd-109, Fe-55, and Am-241 sources, respectively. The TN Lead analyzer was operated using a 60 second count time for the Cd-109 source. The X-MET 920 with the Si(Li) detector was calibrated using fundamental parameters and one well characterized site-specific soil standard as a calibration check. It used 140 and 100 second count times for the Cd-109 and Am-241 sources, respectively. The X-MET 920 with the gas-filled proportional detector was calibrated empirically using between 10 and 20 well characterized site-specific soil standards. It used 120 second times for the Cd-109 source. The XL Spectrum Analyzer utilized NIST SRM 2710 for calibration and the Compton peak normalization procedure for quantitation based on 60 second count times for the Cd-109 source. The MAP Spectrum Analyzer was internally calibrated by the manufacturer. The calibration was checked using a well-characterized site-specific soil standard. It used 240 second times for the Cd-109 source.

13.5 Precision measurements -- The example precision data are presented in Table 4. These data are provided for guidance purposes only. Each of the six FPXRF instruments performed 10 replicate measurements on 12 soil samples that had analyte concentrations ranging from "nondetects" to thousands of mg/kg. Each of the 12 soil samples underwent 4 different preparation techniques from in situ (no preparation) to dried and ground in a sample cup. Therefore, there were 48 precision data points for five of the instruments and 24 precision points for the MAP Spectrum Analyzer. The replicate measurements were taken using the source count times discussed at the beginning of this section.

For each detectable analyte in each precision sample a mean concentration, standard deviation, and RSD was calculated for each analyte. The data presented in Table 4 is an average RSD for the precision samples that had analyte concentrations at 5 to 10 times the lower limit of detection for that analyte for each instrument. Some analytes such as mercury, selenium, silver, and thorium were not detected in any of the precision samples so these analytes are not listed in Table 4. Some analytes such as cadmium, nickel, and tin were only detected at concentrations near the lower limit of detection so that an RSD value calculated at 5 to 10 times this limit was not possible.

One FPXRF instrument collected replicate measurements on an additional nine soil samples to provide a better assessment of the effect of sample preparation on precision. Table 5 shows these results. These data are provided for guidance purposes only. The additional nine soil samples were comprised of three from each texture and had analyte concentrations ranging from near the lower limit of detection for the FPXRF analyzer to thousands of mg/kg. The FPXRF analyzer only collected replicate measurements from three of the preparation methods; no measurements were collected from the in situ homogenized samples. The FPXRF analyzer conducted five replicate measurements of the in situ field samples by taking measurements at five different points within the 4-inch by 4-inch sample square. Ten replicate measurements were collected for both the intrusive undried and unground and intrusive dried and ground samples contained in cups. The cups were shaken between each replicate measurement.

Table 5 shows that the precision dramatically improved from the in situ to the intrusive measurements. In general there was a slight improvement in precision when the sample was dried and ground. Two factors caused the precision for the in situ measurements to be poorer. The major factor is soil heterogeneity. By moving the probe within the 4-inch by 4-inch square, measurements of different soil samples were actually taking place within the square. Table 5 illustrates the dominant effect of soil heterogeneity. It overwhelmed instrument precision when the FPXRF analyzer was used in this mode. The second factor that caused the RSD values to be higher for the in situ measurements is the fact that only five instead of ten replicates were taken. A lesser number of measurements caused the standard deviation to be larger which in turn elevated the RSD values.

13.6 Accuracy measurements -- Five of the FPXRF instruments (not including the MAP Spectrum Analyzer) analyzed 18 SRMs using the source count times and calibration methods given at the beginning of this section. The 18 SRMs included 9 soil SRMs, 4 stream or river sediment SRMs, 2 sludge SRMs, and 3 ash SRMs. Each of the SRMs contained known concentrations of certain target analytes. A percent recovery was calculated for each analyte in each SRM for each FPXRF instrument. Table 6 presents a summary of this data. With the exception of cadmium, chromium, and nickel, the values presented in Table 6 were generated from the 13 soil and sediment SRMs only. The 2 sludge and 3 ash SRMs were included for cadmium, chromium, and nickel because of the low or nondetectable concentrations of these three analytes in the soil and sediment SRMs.

Only 12 analytes are presented in Table 6. These are the analytes that are of environmental concern and provided a significant number of detections in the SRMs for an accuracy assessment. No data is presented for the X-MET 920 with the gas-filled proportional detector. This FPXRF instrument was calibrated empirically using site-specific soil samples. The percent recovery values from this instrument were very sporadic and the data did not lend itself to presentation in Table 6.

Table 7 provides a more detailed summary of accuracy data for one particular FPXRF instrument (TN 9000) for the 9 soil SRMs and 4 sediment SRMs. These data are provided for guidance purposes only. Table 7 shows the certified value, measured value, and percent recovery for five analytes. These analytes were chosen because they are of environmental concern and were most prevalently certified for in the SRM and detected by the FPXRF instrument. The first nine SRMs are soil and the last 4 SRMs are sediment. Percent recoveries for the four NIST SRMs were often between 90 and 110 percent for all analytes.

13.7 Comparability -- Comparability refers to the confidence with which one data set can be compared to another. In this case, FPXRF data generated from a large study of six FPXRF instruments was compared to SW-846 Methods 3050 and 6010 which are the standard soil extraction for metals and analysis by inductively coupled plasma. An evaluation of comparability was conducted by using linear regression analysis. Three factors were determined using the linear regression. These factors were the y-intercept, the slope of the line, and the coefficient of determination (r^2).

As part of the comparability assessment, the effects of soil type and preparation methods were studied. Three soil types (textures) and four preparation methods were examined during the study. The preparation methods evaluated the cumulative effect of particle size, moisture, and homogenization on comparability. Due to the large volume of data produced during this study, linear regression data for six analytes from only one FPXRF instrument is presented in Table 8. Similar trends in the data were seen for all instruments. These data are provided for guidance purposes only.

Table 8 shows the regression parameters for the whole data set, broken out by soil type, and by preparation method. These data are provided for guidance purposes only. The soil types are as follows: soil 1--sand; soil 2--loam; and soil 3--silty clay. The preparation methods are as follows: preparation 1--in situ in the field; preparation 2--intrusive, sample collected and homogenized; preparation 3--intrusive, with sample in a sample cup but sample still wet and not ground; and preparation 4–intrusive, with sample dried, ground, passed through a 40-mesh sieve, and placed in sample cup.

For arsenic, copper, lead, and zinc, the comparability to the confirmatory laboratory was excellent with r^2 values ranging from 0.80 to 0.99 for all six FPXRF instruments. The slopes of the regression lines for arsenic, copper, lead, and zinc, were generally between 0.90 and 1.00 indicating the data would need to be corrected very little or not at all to match the confirmatory laboratory data. The r^2 values and slopes of the regression lines for barium and chromium were not as good as for the other for analytes, indicating the data would have to be corrected to match the confirmatory laboratory.

Table 8 demonstrates that there was little effect of soil type on the regression parameters for any of the six analytes. The only exceptions were for barium in soil 1 and copper in soil 3. In both of these cases, however, it is actually a concentration effect and not a soil effect causing the poorer comparability. All barium and copper concentrations in soil 1 and 3, respectively, were less than 350 mg/kg.

Table 8 shows there was a preparation effect on the regression parameters for all six analytes. With the exception of chromium, the regression parameters were primarily improved going from preparation 1 to preparation 2. In this step, the sample was removed from the soil surface, all large debris was removed, and the sample was thoroughly homogenized. The additional two preparation methods did little to improve the regression parameters. This data indicates that homogenization is the most critical factor when comparing the results. It is essential that the sample sent to the confirmatory laboratory match the FPXRF sample as closely as possible.

Sec. 11.0 of this method discusses the time necessary for each of the sample preparation techniques. Based on the data quality objectives for the project, an analyst must decide if it is worth the extra time necessary to dry and grind the sample for small improvements in comparability. Homogenization requires 3 to 5 min. Drying the sample requires one to two hours. Grinding and sieving requires another 10 to 15 min per sample. Lastly, when grinding and sieving is conducted, time has to be allotted to decontaminate the mortars, pestles, and sieves. Drying and grinding the samples and decontamination procedures will often dictate that an extra person be on site so that the analyst can keep up with the sample collection crew. The cost of requiring an extra person on site to prepare samples must be balanced with the gain in data quality and sample throughput.

13.8 The following documents may provide additional guidance and insight on this method and technique:

13.8.1 A. D. Hewitt, "Screening for Metals by X-ray Fluorescence Spectrometry/Response Factor/Compton K_α Peak Normalization Analysis," American Environmental Laboratory, pp 24-32, 1994.

13.8.2 S. Piorek and J. R. Pasmore, "Standardless, In Situ Analysis of Metallic Contaminants in the Natural Environment With a PC-Based, High Resolution Portable X-Ray Analyzer," Third International Symposium on Field Screening Methods for Hazardous Waste and Toxic Chemicals, Las Vegas, Nevada, February 24-26, 1993, Vol 2, pp 1135-1151, 1993.

13.8.3 S. Shefsky, "Sample Handling Strategies for Accurate Lead-in-soil Measurements in the Field and Laboratory," *International Symposium of Field Screening Methods for Hazardous Waste and Toxic Chemicals*, Las Vegas, NV, January 29-31, 1997.

14.0 POLLUTION PREVENTION

14.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity and/or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operation. The EPA has established a preferred hierarchy of environmental management techniques that places pollution prevention as the management option of first choice. Whenever feasible, laboratory personnel should use pollution prevention techniques to address their waste generation. When wastes cannot be feasibly reduced at the source, the Agency recommends recycling as the next best option.

14.2 For information about pollution prevention that may be applicable to laboratories and research institutions consult *Less is Better: Laboratory Chemical Management for Waste Reduction* available from the American Chemical Society's Department of Government Relations and Science Policy, 1155 16th St., N.W. Washington, D.C. 20036, http://www.acs.org.

15.0 WASTE MANAGEMENT

The Environmental Protection Agency requires that laboratory waste management practices be conducted consistent with all applicable rules and regulations. The Agency urges laboratories to protect the air, water, and land by minimizing and controlling all releases from hoods and bench operations, complying with the letter and spirit of any sewer discharge permits and regulations, and by complying with all solid and hazardous waste regulations, particularly the hazardous waste identification rules and land disposal restrictions. For further information on waste management, consult *The Waste Management Manual for Laboratory Personnel* available from the American Chemical Society at the address listed in Sec. 14.2.

16.0 REFERENCES

1. Metorex, X-MET 920 User's Manual.

2. Spectrace Instruments, "Energy Dispersive X-ray Fluorescence Spectrometry: An Introduction," 1994.

3. TN Spectrace, Spectrace 9000 Field Portable/Benchtop XRF Training and Applications Manual.

4. Unpublished SITE data, received from PRC Environment Management, Inc.

17.0 TABLES, DIAGRAMS, FLOWCHARTS, AND VALIDATION DATA

The following pages contain the tables referenced by this method. A flow diagram of the procedure follows the tables.

TABLE 1

EXAMPLE INTERFERENCE FREE LOWER LIMITS OF DETECTION

Analyte	Chemical Abstract Series Number	Lower Limit of Detection in Quartz Sand (milligrams per kilogram)
Antimony (Sb)	7440-36-0	40
Arsenic (As)	7440-38-0	40
Barium (Ba)	7440-39-3	20
Cadmium (Cd)	7440-43-9	100
Calcium (Ca)	7440-70-2	70
Chromium (Cr)	7440-47-3	150
Cobalt (Co)	7440-48-4	60
Copper (Cu)	7440-50-8	50
Iron (Fe)	7439-89-6	60
Lead (Pb)	7439-92-1	20
Manganese (Mn)	7439-96-5	70
Mercury (Hg)	7439-97-6	30
Molybdenum (Mo)	7439-93-7	10
Nickel (Ni)	7440-02-0	50
Potassium (K)	7440-09-7	200
Rubidium (Rb)	7440-17-7	10
Selenium (Se)	7782-49-2	40
Silver (Ag)	7440-22-4	70
Strontium (Sr)	7440-24-6	10
Thallium (Tl)	7440-28-0	20
Thorium (Th)	7440-29-1	10
Tin (Sn)	7440-31-5	60
Titanium (Ti)	7440-32-6	50
Vanadium (V)	7440-62-2	50
Zinc (Zn)	7440-66-6	50
Zirconium (Zr)	7440-67-7	10

Source: Refs. 1, 2, and 3
These data are provided for guidance purposes only.

TABLE 2

SUMMARY OF RADIOISOTOPE SOURCE CHARACTERISTICS

Source	Activity (mCi)	Half-Life (Years)	Excitation Energy (keV)	Elemental Analysis Range	
Fe-55	20-50	2.7	5.9	Sulfur to Chromium	K Lines
				Molybdenum to Barium	L Lines
Cd-109	5-30	1.3	22.1 and 87.9	Calcium to Rhodium	K Lines
				Tantalum to Lead	K Lines
				Barium to Uranium	L Lines
Am-241	5-30	432	26.4 and 59.6	Copper to Thulium	K Lines
				Tungsten to Uranium	L Lines
Cm-244	60-100	17.8	14.2	Titanium to Selenium	K Lines
				Lanthanum to Lead	L Lines

Source: Refs. 1, 2, and 3

TABLE 3

SUMMARY OF X-RAY TUBE SOURCE CHARACTERISTICS

Anode Material	Recommended Voltage Range (kV)	K-alpha Emission (keV)	Elemental Analysis Range	
Cu	18-22	8.04	Potassium to Cobalt	K Lines
			Silver to Gadolinium	L Lines
Mo	40-50	17.4	Cobalt to Yttrium	K Lines
			Europium to Radon	L Lines
Ag	50-65	22.1	Zinc to Technicium	K Lines
			Ytterbium to Neptunium	L Lines

Source: Ref. 4

Notes: The sample elements excited are chosen by taking as the lower limit the same ratio of excitation line energy to element absorption edge as in Table 2 (approximately 0.45) and the requirement that the excitation line energy be above the element absorption edge as the upper limit (L2 edges used for L lines). K-beta excitation lines were ignored.

TABLE 4

EXAMPLE PRECISION VALUES

Analyte	Average Relative Standard Deviation for Each Instrument at 5 to 10 Times the Lower Limit of Detection					
	TN 9000	TN Lead Analyzer	X-MET 920 (SiLi Detector)	X-MET 920 (Gas-Filled Detector)	XL Spectrum Analyzer	MAP Spectrum Analyzer
Antimony	6.54	NR	NR	NR	NR	NR
Arsenic	5.33	4.11	3.23	1.91	12.47	6.68
Barium	4.02	NR	3.31	5.91	NR	NR
Cadmium	29.84[a]	NR	24.80[a]	NR	NR	NR
Calcium	2.16	NR	NR	NR	NR	NR
Chromium	22.25	25.78	22.72	3.91	30.25	NR
Cobalt	33.90	NR	NR	NR	NR	NR
Copper	7.03	9.11	8.49	9.12	12.77	14.86
Iron	1.78	1.67	1.55	NR	2.30	NR
Lead	6.45	5.93	5.05	7.56	6.97	12.16
Manganese	27.04	24.75	NR	NR	NR	NR
Molybdenum	6.95	NR	NR	NR	12.60	NR
Nickel	30.85[a]	NR	24.92[a]	20.92[a]	NA	NR
Potassium	3.90	NR	NR	NR	NR	NR
Rubidium	13.06	NR	NR	NR	32.69[a]	NR
Strontium	4.28	NR	NR	NR	8.86	NR
Tin	24.32[a]	NR	NR	NR	NR	NR
Titanium	4.87	NR	NR	NR	NR	NR
Zinc	7.27	7.48	4.26	2.28	10.95	0.83
Zirconium	3.58	NR	NR	NR	6.49	NR

These data are provided for guidance purposes only.
Source: Ref. 4
[a] These values are biased high because the concentration of these analytes in the soil samples was near the lower limit of detection for that particular FPXRF instrument.
NR Not reported.
NA Not applicable; analyte was reported but was below the established lower limit detection.

TABLE 5

EXAMPLES OF PRECISION AS AFFECTED BY SAMPLE PREPARATION

Analyte	Average Relative Standard Deviation for Each Preparation Method		
	In Situ-Field	Intrusive- Undried and Unground	Intrusive- Dried and Ground
Antimony	30.1	15.0	14.4
Arsenic	22.5	5.36	3.76
Barium	17.3	3.38	2.90
Cadmium[a]	41.2	30.8	28.3
Calcium	17.5	1.68	1.24
Chromium	17.6	28.5	21.9
Cobalt	28.4	31.1	28.4
Copper	26.4	10.2	7.90
Iron	10.3	1.67	1.57
Lead	25.1	8.55	6.03
Manganese	40.5	12.3	13.0
Mercury	ND	ND	ND
Molybdenum	21.6	20.1	19.2
Nickel[a]	29.8	20.4	18.2
Potassium	18.6	3.04	2.57
Rubidium	29.8	16.2	18.9
Selenium	ND	20.2	19.5
Silver[a]	31.9	31.0	29.2
Strontium	15.2	3.38	3.98
Thallium	39.0	16.0	19.5
Thorium	NR	NR	NR
Tin	ND	14.1	15.3
Titanium	13.3	4.15	3.74
Vanadium	NR	NR	NR
Zinc	26.6	13.3	11.1
Zirconium	20.2	5.63	5.18

These data are provided for guidance purposes only.
Source: Ref. 4

[a] These values may be biased high because the concentration of these analytes in the soil samples was near the lower limit of detection.

ND Not detected.
NR Not reported.

TABLE 6

EXAMPLE ACCURACY VALUES

Analyte	Instrument															
	TN 9000				TN Lead Analyzer				X-MET 920 (SiLi Detector)				XL Spectrum Analyzer			
	n	Range of % Rec.	Mean % Rec.	SD	n	Range of % Rec.	Mean % Rec.	SD	n	Range of % Rec.	Mean % Rec	SD	n	Range of % Rec.	Mean % Rec.	SD
Sb	2	100-149	124.3	NA	--	--	--	--	--	--	--	--	--	--	--	--
As	5	68-115	92.8	17.3	5	44-105	83.4	23.2	4	9.7-91	47.7	39.7	5	38-535	189.8	206
Ba	9	98-198	135.3	36.9	--	--	--	--	9	18-848	168.2	262	--	--	--	--
Cd	2	99-129	114.3	NA	--	--	--	--	6	81-202	110.5	45.7	--	--	--	--
Cr	2	99-178	138.4	NA	--	--	--	--	7	22-273	143.1	93.8	3	98-625	279.2	300
Cu	8	61-140	95.0	28.8	6	38-107	79.1	27.0	11	10-210	111.8	72.1	8	95-480	203.0	147
Fe	6	78-155	103.7	26.1	6	89-159	102.3	28.6	6	48-94	80.4	16.2	6	26-187	108.6	52.9
Pb	11	66-138	98.9	19.2	11	68-131	97.4	18.4	12	23-94	72.7	20.9	13	80-234	107.3	39.9
Mn	4	81-104	93.1	9.70	3	92-152	113.1	33.8	--	--	--	--	--	--	--	--
Ni	3	99-122	109.8	12.0	--	--	--	--	--	--	--	--	3	57-123	87.5	33.5
Sr	8	110-178	132.6	23.8	--	--	--	--	--	--	--	--	7	86-209	125.1	39.5
Zn	11	41-130	94.3	24.0	10	81-133	100.0	19.7	12	46-181	106.6	34.7	11	31-199	94.6	42.5

Source: Ref. 4. These data are provided for guidance purposes only.

n:	Number of samples that contained a certified value for the analyte and produced a detectable concentration from the FPXRF instrument.
SD:	Standard deviation; NA: Not applicable; only two data points, therefore, a SD was not calculated.
%Rec.:	Percent recovery.
--	No data.

TABLE 7

EXAMPLE ACCURACY FOR TN 9000[a]

Standard Reference Material	Arsenic			Barium			Copper			Lead			Zinc		
	Cert. Conc.	Meas. Conc.	%Rec.	Cert. Conc.	Meas. Conc.	%Rec.	Cert. Conc.	Meas. Conc.	%Rec.	Cert. Conc.	Meas. Conc.	%Rec.	Cert. Conc.	Meas. Conc.	%Rec.
RTC CRM-021	24.8	ND	NA	586	1135	193.5	4792	2908	60.7	144742	149947	103.6	546	224	40.9
RTC CRM-020	397	429	92.5	22.3	ND	NA	753	583	77.4	5195	3444	66.3	3022	3916	129.6
BCR CRM 143R	--	--	--	--	--	--	131	105	80.5	180	206	114.8	1055	1043	99.0
BCR CRM 141	--	--	--	--	--	--	32.6	ND	NA	29.4	ND	NA	81.3	ND	NA
USGS GXR-2	25.0	ND	NA	2240	2946	131.5	76.0	106	140.2	690	742	107.6	530	596	112.4
USGS GXR-6	330	294	88.9	1300	2581	198.5	66.0	ND	NA	101	80.9	80.1	118	ND	NA
NIST 2711	105	104	99.3	726	801	110.3	114	ND	NA	1162	1172	100.9	350	333	94.9
NIST 2710	626	722	115.4	707	782	110.6	2950	2834	96.1	5532	5420	98.0	6952	6476	93.2
NIST 2709	17.7	ND	NA	968	950	98.1	34.6	ND	NA	18.9	ND	NA	106	98.5	93.0
NIST 2704	23.4	ND	NA	414	443	107.0	98.6	105	106.2	161	167	103.5	438	427	97.4
CNRC PACS-1	211	143	67.7	--	772	NA	452	302	66.9	404	332	82.3	824	611	74.2
SARM-51	--	--	--	335	466	139.1	268	373	139.2	5200	7199	138.4	2200	2676	121.6
SARM-52	--	--	--	410	527	128.5	219	193	88.1	1200	1107	92.2	264	215	81.4

Source: Ref. 4. These data are provided for guidance purposes only.

[a] All concentrations in milligrams per kilogram.

%Rec.: Percent recovery; ND: Not detected; NA: Not applicable.

-- No data.

TABLE 8

EXAMPLE REGRESSION PARAMETERS FOR COMPARABILITY[1]

	Arsenic				**Barium**				**Copper**			
	n	r^2	Int.	Slope	n	r^2	Int.	Slope	n	r^2	Int.	Slope
All Data	824	0.94	1.62	0.94	1255	0.71	60.3	0.54	984	0.93	2.19	0.93
Soil 1	368	0.96	1.41	0.95	393	0.05	42.6	0.11	385	0.94	1.26	0.99
Soil 2	453	0.94	1.51	0.96	462	0.56	30.2	0.66	463	0.92	2.09	0.95
Soil 3	—	—	—	—	400	0.85	44.7	0.59	136	0.46	16.60	0.57
Prep 1	207	0.87	2.69	0.85	312	0.64	53.7	0.55	256	0.87	3.89	0.87
Prep 2	208	0.97	1.38	0.95	315	0.67	64.6	0.52	246	0.96	2.04	0.93
Prep 3	204	0.96	1.20	0.99	315	0.78	64.6	0.53	236	0.97	1.45	0.99
Prep 4	205	0.96	1.45	0.98	313	0.81	58.9	0.55	246	0.96	1.99	0.96

	Lead				**Zinc**				**Chromium**			
	n	r^2	Int.	Slope	n	r^2	Int.	Slope	n	r^2	Int.	Slope
All Data	1205	0.92	1.66	0.95	1103	0.89	1.86	0.95	280	0.70	64.6	0.42
Soil 1	357	0.94	1.41	0.96	329	0.93	1.78	0.93	—	—	—	—
Soil 2	451	0.93	1.62	0.97	423	0.85	2.57	0.90	—	—	—	—
Soil 3	397	0.90	2.40	0.90	351	0.90	1.70	0.98	186	0.66	38.9	0.50
Prep 1	305	0.80	2.88	0.86	286	0.79	3.16	0.87	105	0.80	66.1	0.43
Prep 2	298	0.97	1.41	0.96	272	0.95	1.86	0.93	77	0.51	81.3	0.36
Prep 3	302	0.98	1.26	0.99	274	0.93	1.32	1.00	49	0.73	53.7	0.45
Prep 4	300	0.96	1.38	1.00	271	0.94	1.41	1.01	49	0.75	31.6	0.56

Source: Ref. 4. These data are provided for guidance purposes only.

[1] Log-transformed data

n: Number of data points; r^2: Coefficient of determination; Int.: Y-intercept

— No applicable data

METHOD 6200

FIELD PORTABLE X-RAY FLUORESCENCE SPECTROMETRY FOR THE DETERMINATION OF ELEMENTAL CONCENTRATIONS IN SOIL AND SEDIMENT

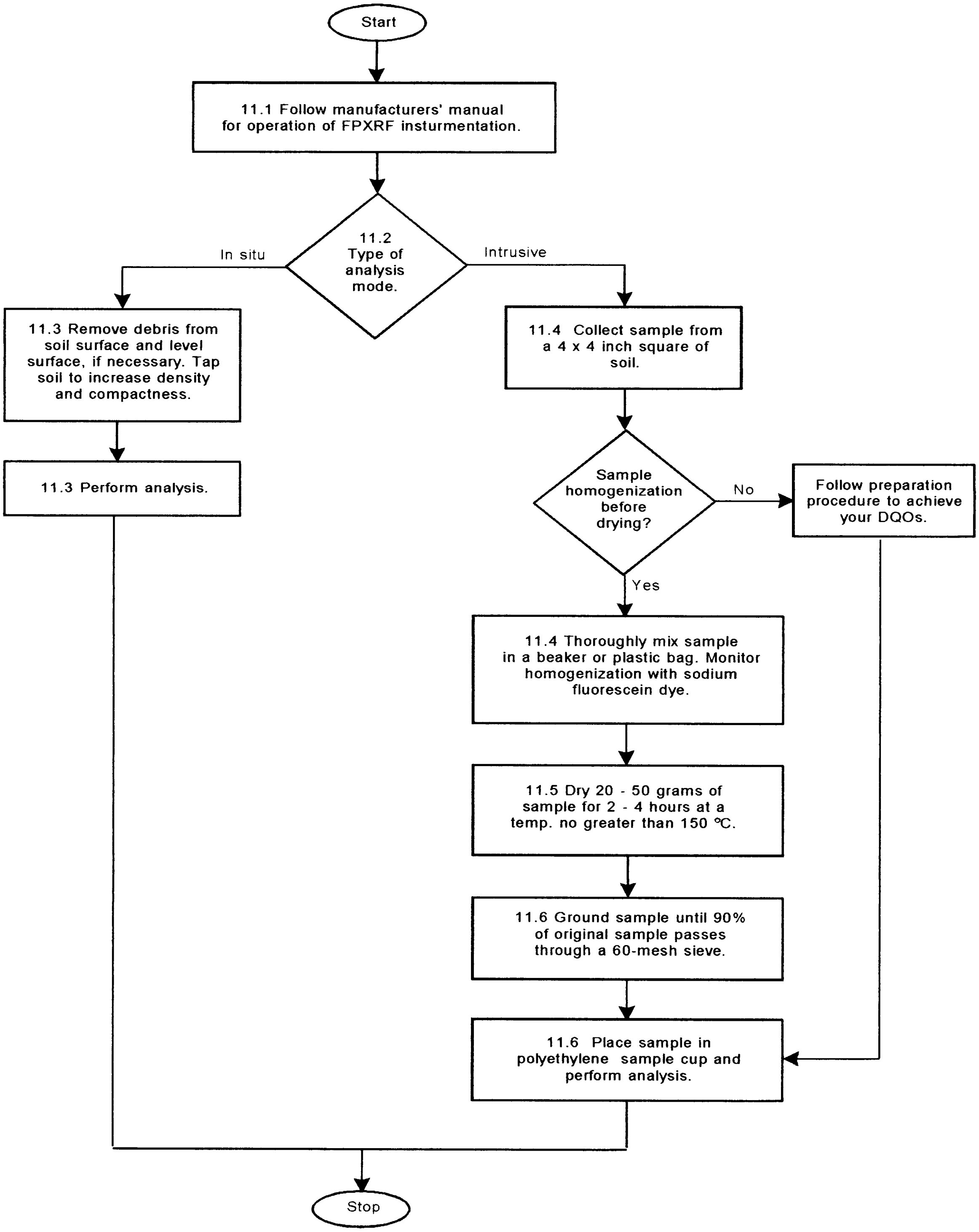

EXHIBIT B
OPERATING PROCEDURE—FIELD X-RAY FLUORESCENCE MEASUREMENT

STANDARD OPERATING PROCEDURES
Sound Battery
2310 East 11th Street
Tacoma, Washington

Farallon PN: 1117-001

Region 4
U.S. Environmental Protection Agency
Science and Ecosystem Support Division
Athens, Georgia

OPERATING PROCEDURE

Title: **Field X-Ray Fluorescence Measurement**

Effective Date: December 20, 2011 | **Number:** SESDPROC-107-R2

Authors

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Revision History

This table shows changes to this controlled document over time. The most recent version is presented in the top row of the table. Previous versions of the document are maintained by the SESD Document Control Coordinator.

History	Effective Date
SESDPROC-107-R2, *Field X-Ray Fluorescence Measurement*, replaces SESDPROC-107-R1 **General:** Corrected any typographical, grammatical and/or editorial errors. **Title Page:** Updated the Enforcement and Investigations Branch Chief to Archie Lee, and the Field Quality Manager to Bobby Lewis. **Revision History:** On the third sentence, replaced Field Quality Manager with Document Control Coordinator. **Section 1.2:** Added the following statement: Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use. **Section 1.3:** Revised the last sentence to reflect that the official copy of this procedure resides on the SESD local area network (LAN), and that the Document Control Coordinator is responsible for ensuring the most recent version of the procedure is placed on the LAN. **Section 1.4:** Deleted references to SOPs for old XRF units and added EPA Method 6200 reference. **Section 1.5.1:** Removed two bullets with material related to the R4 SESD Radiation Monitoring Program and old XRF units. **Section 1.5.2:** References to ILS being the only analyst were removed from the second and third sentences. **Section 1.5.3:** On bullet #4, Soil Moisture, removed reference to the use of microwave ovens for sample drying. **Section 2:** A reference to ILS being the only analyst was removed from the 2nd paragraph, first sentence. In addition, removed references to SOPs for old instruments and replaced with references to EPA Method 6200 throughout the section. **Section 3.1:** Removed references and associated text for old XRF units and replaced with references to Niton® XLt Series instrument. **Section 3.2.2:** Changed method name from “Cup” to “Collected Sample” Measurement.	December 20, 2011

SESDPROC-107-R1, *Field X-Ray Fluorescence Measurement*, replaces SESDPROC-107-R0 **General** Updated referenced procedures due to changes in title names and/or to reflect most recent version. **Title Page** Changed title for Antonio Quinones from Environmental Investigations Branch to Enforcement and Investigations Branch. **Section 1.3** Updated information to reflect that procedure is located on the H: drive of the LAN. **Section 1.4** Alphabetized and revised the referencing style for consistency. **Section 2** Added last paragraph regarding stopping measurements due to environmental conditions.	November 1, 2007
SESDPROC-107-R0, *Field X-Ray Fluorescence*, Original Issue	February 05, 2007

TABLE OF CONTENTS

1 General Information

1.1 Purpose

This document describes general and specific procedures, methods and considerations to be used and observed when conducting field X-ray fluorescence (XRF) measurements of soil and sediment samples.

1.2 Scope/Application

The procedures contained in this document are to be used by field personnel when measuring metals concentrations in soil, sediment or other solids in the field. On the occasion that SESD field personnel determine that any of the procedures described in this procedure cannot be used to obtain metals analyses of the media being sampled, and that another method or XRF instrument must be used to obtain said measurements, the variant instrument and measurement procedure will be documented in the field logbook, along with a description of the circumstances requiring its use. Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.

1.3 Documentation/Verification

This procedure was prepared by persons deemed technically competent by SESD management, based on their knowledge, skills and abilities and has been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the SESD local area network (LAN). The Document Control Coordinator (DCC) is responsible for ensuring the most recent version of the procedure is placed on the LAN and for maintaining records of review conducted prior to its issuance.

1.4 References

SESD Operating Procedure for Equipment Inventory and Management, SESDPROC-108, Most Recent Version

SESD Operating Procedure for Logbooks, SESDPROC-010, Most Recent Version

SESD Operating Procedure for Sediment Sampling, SESDPROC-200, Most Recent Version

SESD Operating Procedure for Soil Sampling, SESDPROC-300, Most Recent Version

United States Environmental Protection Agency (US EPA). Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment, Method 6200, Revision 0, February 2007.

US EPA. 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. Region 4 Science and Ecosystem Support Division (SESD), Athens, GA.

US EPA. Safety, Health and Environmental Management Program Procedures and Policy Manual. Region 4 SESD, Athens, GA, Most Recent Version.

1.5 General Precautions

1.5.1 Safety

Proper safety precautions must be observed when conducting field XRF measurements. Refer to the SESD Safety, Health and Environmental Management Program Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASPs) for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional. When using this procedure, minimize exposure to potential health hazards through the use of protective clothing, eye wear and gloves. The operator should always be aware of the instrument's radioactive source and the direction of its beam of X-rays. The operator should never point the open source at anyone. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate.

1.5.2 Procedural Precautions

All field XRF measurements pertinent to the sampling event are recorded in a bound field record logbook for the event. This record is created and maintained by the analyst providing the field XRF support. After the investigation is complete, the analyst will conduct post-processing of the field measurements and will enter final measurement data in the SESD laboratory information management system and provide the SESD project leader with a copy of the field measurement logbook. All other records and documentation of the investigation should be recorded according to the procedures outlined in the SESD Operating Procedure for Logbooks (SESDPROC-010).

1.5.3 Limitations

There are three main sources of interference in XRF analysis that may impact data quality. They are sample preparation error, spectral interferences and chemical matrix interferences.

- Preparation Error – The accuracy of the analysis is strongly impacted by sample homogenization. The more homogeneous the sample, typically analyzed by the cup method, the more accurate the results. There is no control of this limitation when conducting in situ analysis.

- Spectral Interference – Each element has a signature spectrum of energies and relative intensities. Many elements, however, produce X-rays of similar energy and discerning which element produced a detected X-ray is a factor of the detector's resolution capability and the software's ability to fit all of the data to the relative intensities produced by the various wavelengths.

- Chemical Matrix Interference – This refers to the effect that one element has on another in producing X-rays which reach the detector. Dominant elemental components of a sample, such as silicon in soils, vary in concentration from sample to sample and therefore so does that element's influence on the other elements in the sample.

There are several other limitations that the field investigator must be acutely aware of when conducting field analysis using XRF.

- Soil moisture – Excessive soil moisture biases the results low, i.e., the higher the soil moisture in a particular matrix, the lower the reported concentration relative to the actual concentration. This limitation may be overcome by drying the sample. Without sample drying, XRF measurement results for samples with typical soil moistures within the range of 15% - 25% are routinely reported at values less than laboratory confirmation analysis for the same samples. The actual difference may vary significantly for all samples from a site but the XRF results reported by the instrument are typically on the order of 70% - 80% of the laboratory reported value for samples in this moisture range. This factor should be taken into consideration when making decisions based on XRF results.

- Lack of sensitivity with respect to certain analytes – Due to peak overlaps, some analytes may have problematically high detection limits, i.e., detection limits may be higher than project action levels for certain analytes, limiting its use for rapid field screening for certain elements. One of the most common examples of this phenomenon is the lead/arsenic analyte pair. When lead and arsenic are being analyzed, the peak overlap problem results in detection limits for arsenic that are several times higher than the typical action levels published for this analyte. It commonly is necessary to perform confirmatory analysis in the laboratory to obtain analytical results for arsenic, or other analytes with high detection limits, to obtain data in the range necessary for making regulatory decisions.

2 Operational Checks and Quality Control

All XRF instruments shall be maintained and operated in accordance with the manufacturer's instructions, EPA Method 6200 and the SESD Operating Procedure for Equipment Inventory and Management (SESDPROC-108). Prior to each operational period, the instrument is turned on and is allowed to perform an internal calibration. Following this calibration, a performance check is conducted, using the appropriate National Institute of Standards and Technology (NIST)-traceable standard reference material for the analytes of concern. The value should be within +/- 20% of the stated value of the standard. Following this performance check, an instrument blank sample is analyzed to verify the instrument is not registering false positive results for the analytes of concern. After these checks, the instrument is ready for analysis.

The following operational and quality control requirements also apply to operation of the XRF instrument and must be followed and documented in the field logbook maintained by the analyst:

- During operations, the ambient air temperature will be recorded for each measurement and if the ambient temperature changes by more than 10°F, the instrument will be recalibrated.

- A method blank is analyzed at least once a day to determine if contamination is entering the analytical procedure.

- While the instrument is being used, the reference standards and the blank are run once each hour or every twenty samples, whichever occurs first, and also at the end of the period of operation, prior to turning the instrument off.

- For every twenty samples, or at least once per day, analyze a duplicate using the main sampling technique.

- Once per day, check the instrument’s precision by analyzing one of the site samples at least seven times in replicate.

EPA Method 6200 contains detailed instruction and guidance covering implementation of these procedures and any corrective actions that must be taken based on measured instrument behavior and performance. If at any time during a field investigation, it appears that the environmental conditions could jeopardize the quality of the measurement results, the measurements will be stopped. This will be documented in the field logbook.

3 Field X-Ray Fluorescence (XRF) Measurement Procedures

3.1 General

XRF is the property of a material to emit X-rays, with a characteristic energy, upon being irradiated by X-rays from a known radioisotope source. The emitted X-rays are detected by the particular XRF instrument as they impact a detector, which converts the energy of the emitted X-ray into electric current. The strength of the current is proportional to the energy of the X-ray. An onboard microprocessor counts how often an energy is detected, assigns the energy to a particular element and reports the calculated concentration for the element.

The XRF instrument available for use by SESD field investigators is the Niton® XLt 700 Series Multi-element XRF Spectrum Analyzer. This instrument uses a miniaturized X-ray tube as its source rather than a radioactive isotope for X-ray generation for analysis.

3.2 Mode of Operation

The instrument is typically used in one of two modes, either for taking in situ measurements or for measuring sample material that has been placed in a cup for analysis in the instrument tray. The following is a brief description of these modes of operation.

3.2.1 In Situ Measurement

Prior to taking the in situ measurement, the measurement location is cleared of any significant vegetation, such as large clumps of grass, and is scuffed or otherwise leveled to provide a flat surface on which to place the instrument window. A piece of thin Mylar® film is then placed on the measurement location. This protects the instrument window, preventing it from becoming damaged or contaminated by the media being tested. After the window is pressed to the Mylar® film, the window is opened for a nominal (i.e., programmed) sixty seconds.

Because of the shallow penetration of the X-rays in typical soils, the measured concentrations are representative of the concentrations present at the very surface of the material being measured. If conditions representing concentrations over a greater depth are required by the study data quality objectives (i.e., on the order of three to six inches), the cup method, described in Section 3.2.2, must be used.

3.2.2 Collected Sample Measurement

This method is used to measure concentrations of metals in soil and sediment samples collected from a vertical interval, either as a grab or a composite sample. Typically, soil or sediment samples are collected as if the samples were being collected for routine chemical analyses (SESD Operating Procedure for Soil Sampling (SESDPROC-300) and the SESD Operating Procedure for Sediment

Sampling (SESDPROC-200). After mixing, the media being sampled may be placed in either an 8-ounce glass container or a clean, unused zip-closure plastic bag (or equivalent). The XRF analyst then takes an aliquot from the container and places it in a small plastic cup with a Mylar® covering. The cup containing the sample is then loaded into a tray for analysis by the XRF instrument. Alternatively, if project objectives allow, measurements may be obtained by reading directly through the plastic bag. Window opening time considerations are the same as for the in situ measurement procedures described in Section 3.2.1.

The concentrations reported for the samples analyzed by the cup method are representative of the interval sampled, i.e., if the sampler collected the sample from the interval of 0 to 3 inches below ground surface, the reported concentration, assuming thorough homogenization, will be an average of the concentrations over that interval.

4 Study Design

4.1 General

XRF instruments are typically used for two main purposes. First it may be used to rapidly assess site conditions to support a site reconnaissance. Secondly, it may be used to screen large numbers of soil or sediment samples to minimize the number of samples that are sent to a laboratory to provide detailed site characterization data. These uses are summarized in the following sections.

4.2 Reconnaissance

XRF may be used to obtain in situ measurements at a large number of locations in a short period of time to determine if a site warrants further attention with respect to characterization. When used in concert with GPS, and when observing the limitations described in Section 1.5.3, XRF can reveal, where present, contamination patterns at a site which can form the basis for development of a more detailed study to provide definitive data for site characterization. Conversely, the reconnaissance results may form the basis for a “no further action” decision, providing a very cost effective tool for the decision maker.

4.3 Screening Support for Definitive Level Site Characterization

XRF may be used to supplement laboratory analyses to allow for the collection of large numbers of samples to provide a detailed characterization of a site. A high sample density grid or sampling pattern is created to provide adequate detail to meet the data quality objectives of the study or investigation. This sampling pattern may also involve the collection of significant numbers of subsurface soil samples to characterize any contamination present in the subsurface.

All samples, collected according to procedures found in SESD Operating Procedure for Soil Sampling (SESDPROC-300) and SESD Operating Procedure for Sediment Sampling (SESDPROC-200), are delivered to the XRF analyst on site. The analysis of these samples is conducted according to the method described in Section 3.2.2 of this procedure.

Based on the limiting factors described in Section 1.5.3, a confirmatory analytical scheme can be developed which minimizes the numbers of samples that must undergo laboratory analyses, yet provides definitive level data, with a high degree of confidence, to the project leader and other decision makers. Using the moisture limiting factor, there is usually a high degree of confidence that samples that screen at concentrations less than approximately 70% - 80% of the site action level will actually exceed the action level. Of the samples that screen ***at*** the action level, most all will, with a high degree of confidence, exceed the action level. If a reconnaissance is conducted prior to the full-scale site investigation, in addition to the *in situ* analysis, it is advisable to collect and analyze a small subset of the screened locations to generate site-specific moisture limiting factors. This correlation factor can be used to develop a sampling scheme with more confidence.

Using these relationships, the following scheme may be implemented:

- Ten percent of the samples that screen at concentrations less than approximately 70% - 80% (or other correlation factor developed on actual data) of the site action levels are submitted for confirmation analyses to confirm that concentrations are, in fact, below the site action levels.

- All of the samples that screen at concentrations of 70% - 80% (or other correlation factor developed on actual data) of the action level up to the action level value are submitted for confirmation analyses to confirm that concentrations are, in fact, equal to or greater than the site action levels.

- Ten percent of the samples that screen at concentrations exceeding the action levels are submitted for confirmation analyses to confirm that concentrations are, in fact, greater than the site action levels.