GeoEngineers

TRANSMITTAL

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To: Sheri Zimny
City of Olympia
PO Box 1967
Olympia, Washington 98507

Date: 9/3/2009

File: 00415-049-04

Email: szimny@ci.olympia.wa.us

Regarding: 318 State Avenue NE, Olympia, Washington Project No. CH39

We are sending attached via

☐ Courier ☑ Email ☐ FTP ☐ Hand ☐ Other ☐ Overnight ☐ SharePoint ☐ UPS ☐ US Mail

Copies	Date	Description
	9/3/2009	Sampling and Analysis Plan

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Remarks: Please call if you have questions.

Copy To: Department of Ecology

Signed: _____

Nick Rohrbach
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SAMPLING AND ANALYSIS PLAN
318 STATE AVENUE NE PROPERTY
OLYMPIA, WASHINGTON

SEPTEMBER 3, 2009

FOR
CITY OF OLYMPIA

GeoEngineers

File No. 0415-049-04

Sampling and Analysis Plan
File No. 0415-049-04

September 3, 2009

Prepared for:

City of Olympia
P.O. Box 1967
Olympia, Washington 98507-1967

Attention: Sheri Zimny

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SAMPLING AND ANALYSIS PLAN
318 STATE AVENUE NE PROPERTY
OLYMPIA, WASHINGTON
FOR
CITY OF OLYMPIA

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) describes procedures for confirmation soil sample collection and analysis during cleanup activities at the 318 State Avenue NE Property (Property) in Olympia, Washington (Figure 1). Confirmation sampling is being performed to verify that soil with concentrations greater than cleanup levels (CUL) have been removed from the property. This SAP also includes a Quality Assurance Project Plan (QAPP) that identifies quality assurance/quality control (QA/QC) procedures to be implemented during sampling activities and laboratory analyses.

Detailed descriptions of the field sampling procedures, data collection and laboratory analyses are provided in this SAP. Field conditions may make it necessary to modify sampling procedures. Any variations or modifications to sampling procedures will be coordinated with the GeoEngineers' Project Manager (Nick Rohrbach) and Associate-in-Charge (Iain Wingard). Variations or modifications implemented and the reason for the modification will be documented.

2.0 SITE BACKGROUND

The Property is located at 318 State Avenue NE in downtown Olympia, Washington. Former commercial and industrial activities at the Property have included foundry operations, machine shops, automotive repair and maintenance, automotive/truck storage and testing laboratories. The City of Olympia (City) acquired the property from the Washington State Department of Transportation (WSDOT) in 2008. A remedial investigation (RI) and additional groundwater and soil sampling have been prepared to support the redevelopment of the Property for mixed use purposes.

Chemicals of concern (COCs) exceeding Washington State Department of Ecology's (Ecology's) Model Toxics Control Act (MTCA) cleanup levels (CULs) observed in soil at the Property consist of arsenic, lead, trichloroethene (TCE), benzene and carcinogenic polycyclic aromatic hydrocarbons (cPAHs). The COCs are generally present on the eastern portion of the subject Property where past site activities included foundry operations and materials testing laboratory operations. Lead and benzene in soil are also present in one location on the western portion of the site. The contaminants are present in silty fine to medium sand fill and silty sand native soil at depths between the ground surface and approximately 9 feet below ground surface (bgs). The soil also contains debris such as foundry waste, metal, bricks and wood. Shallow unconfined groundwater is present at a depth of approximately 4 to 6 feet bgs and the general direction of groundwater flow is to the northeast.

The cleanup action selected for the Property includes excavation of two contaminated soil zones (CSZ 1 and CSZ 2). The purpose of the excavations is to remove soil containing COCs at concentrations greater than MTCA CULs, and dispose of the soil at an off-site permitted landfill. Upon excavation, confirmation soil samples are to be collected to ensure that the cleanup objectives have been met. This SAP provides the procedures for the confirmation soil sample collection. After soil removal, the excavated areas are to be backfilled with clean material. Monitored natural attenuation of groundwater is planned following the cleanup. A separate SAP will be prepared for groundwater sampling activities to monitor natural attenuation.

3.0 SAMPLING METHODOLOGY

3.1 CONTAMINATED SOIL ZONE 1

As portions of the excavation in CSZ 1 are completed, sidewall and bottom confirmation samples will be collected, and samples will be analyzed by an accredited laboratory. Proposed sampling locations are shown on Figure 2. Actual sampling locations may be adjusted based on observations in the field that could include visual indications of contamination or the presence of potential contaminant transport mechanisms. Sidewall samples will be collected at an elevation approximately equal to the elevation where COCs exceeded CULs in soil samples collected adjacent to sidewall sample area as part of the RI. The approximate number of samples anticipated to be submitted for analysis includes 9 sidewall samples and 10 bottom samples. This equates to an analytical frequency of approximately 1 sidewall sample per 50 linear feet of sidewall, and 1 bottom sample per 1,200 square feet of bottom (i.e., approximate 35-foot sample spacing). All samples from CSZ 1 will be submitted for metals (i.e., arsenic and lead) by Environmental Protection Agency (EPA) 6010 or 6020, chlorinated solvents and benzene by EPA Method 8260. Sidewall and bottom samples from the east half of the excavation will also be analyzed for cPAHs by EPA Method 8270 (Figure 2).

If the sidewall and bottom confirmation samples are below the cleanup levels, no further excavation will be performed. If sidewall or bottom confirmation sample analytical results exceed the cleanup levels, additional excavation will be conducted in the area of the exceedances(s), up to the Property boundary. Following each additional excavation, an additional confirmation sample or samples as appropriate will be collected from the extended excavation to confirm attainment of the proposed cleanup levels. This process will be repeated until the cleanup levels are attained in the sidewalls and excavation bottoms.

3.2 CONTAMINATED SOIL ZONE 2

After the excavation for CSZ 2 is completed, sidewall and bottom confirmation samples will be collected and analyzed for lead by EPA Method 6010 or 6020 and benzene by EPA Method 8260. Samples will be submitted on a 5-day turn-around time to facilitate cleanup activities. One confirmation sample will be collected from each of four sidewalls of the excavation, and one sample will be collected from the bottom of the excavation. The sidewall samples will be collected at approximately 3 feet to 3.5 feet bgs as this is the depth where lead exceeded the CUL in soil. The confirmatory process for CSZ 2 will then proceed generally as described for CSZ 1.

3.3 SAMPLING-DERIVED WASTE

Incidental waste generated during sampling activities includes items such as gloves, plastic sheeting, paper towels and similar expended and discarded field supplies. These materials are considered de minimis and will be disposed of in a local trash receptacle.

4.0 QUALITY ASSURANCE PROJECT PLAN

4.1 GENERAL

The Quality Assurance Project Plan (QAPP) serves as the primary guide for the integration of QA and QC functions into monitoring activities. The QAPP presents the objectives, procedures, organization, functional activities and specific QA and QC activities designed to achieve data quality goals established for the project. This QAPP is based on guidelines specified in Washington Administrative Code (WAC) Chapter 173-340-820, the EPA's Contract Laboratory Program National Functional Guidelines for

Organic Data Review (EPA, 2008), and the EPA's Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA, 2002).

Throughout the project, environmental measurements will be conducted to produce data that are scientifically valid, of known and acceptable quality, and meet established objectives. QA/QC procedures will be implemented so that precision, accuracy, representativeness, completeness and comparability (PARCC) of data generated meet the specified data quality objectives.

4.2 PROJECT ORGANIZATION AND RESPONSIBILITY

Descriptions of the responsibilities, lines of authority and communication for the key positions for QA and QC are provided below. The project organization facilitates the efficient performance of project work, allows for an independent quality review and permits resolution of any QA issues before submittal.

4.3 PROJECT LEADERSHIP AND MANAGEMENT

The Project Manager's duties consist of providing concise technical work statements for project tasks, selecting project team members, determining subcontractor participation, establishing budgets and schedules, adhering to budgets and schedules, providing technical oversight, and providing overall production and review of project deliverables. Nick Rohrbach is the Project Manager for activities at the Property. The Associate–in-Charge is responsible to the City of Olympia for fulfilling contractual and administrative control of the project. Iain Wingard is the Associate-in Charge.

4.4 FIELD COORDINATOR

The Field Coordinator is responsible for the daily management of activities in the field. Specific responsibilities include the following:

- Develops schedules and allocates resources for field tasks.
- Coordinates data collection activities to be consistent with information requirements.
- Collects field data and submits samples to laboratory.
- Assures that data are correctly and completely reported.
- Implements field sampling in accordance with SAP requirements.
- Schedules sample delivery to the analytical laboratory.
- Assures that appropriate sampling, testing and measurement procedures are followed.
- Participates in QA corrective actions as required.

The Field Coordinator for activities at the Property is Garrett Leque.

4.5 QUALITY ASSURANCE LEADER

The GeoEngineers' project Quality Assurance Leader is under the direction of Iain Wingard, who is responsible for the project's overall QA. The project QA Leader is responsible for coordinating QA/QC activities as they relate to the acquisition of field data. The QA Leader has the following responsibilities:

- Serves as the official contact for laboratory data QA concerns.
- Responds to laboratory data, QA needs, resolves issues and answers requests for guidance and assistance.

- Reviews the implementation of the QAPP and the adequacy of the data generated from a quality perspective.
- Maintains the authority to implement corrective actions as necessary.
- Reviews and approves the laboratory QA Plan.
- Evaluates the laboratory's final QA report for any condition that adversely impacts data generation.
- Ensures that appropriate sampling, testing and analysis procedures are followed and that correct quality control checks are implemented.
- Monitors laboratory compliance with data quality requirements.

The QA Leader for activities at the Property is Garrett Leque.

4.6 LABORATORY MANAGEMENT

The Laboratory's QA Coordinator administers the Laboratory QA Plan and is responsible for QC. Specific responsibilities of this position include:

- Ensures implementation of the QA Plan.
- Serves as the laboratory point of contact.
- Activates corrective action for out-of-control events.
- Issues the final QA/QC report.
- Administers QA sample analysis.
- Complies with the specifications established in the project plans as related to laboratory services.
- Participates in QA audits and compliance inspections.

The chemical analytical laboratory QA Coordinator will be determined by the laboratory (Test America, Tacoma, Washington).

4.7 HEALTH AND SAFETY

A site-specific Health and Safety Plan (HASP) will be used during monitoring activities. The Field Coordinator will be responsible for implementing the HASP during sampling activities. The Project Manager will discuss health and safety issues with the subcontractors on a routine basis during the completion of field activities.

The Field Coordinator will conduct a tailgate safety meeting the morning before beginning field activities. The Field Coordinator will terminate any work activities that do not comply with the HASP.

5.0 DATA QUALITY OBJECTIVES

The QA objective for technical data is to collect environmental monitoring data of known, acceptable and reportable quality. The QA objectives established for the project are:

- Implement the procedures outlined herein for field sampling, sample custody, equipment operation and calibration, laboratory analysis, and data reporting that will facilitate consistency and thoroughness of data generated.

- Achieve the acceptable level of confidence and quality required so that data generated are scientifically valid and of known and documented quality. This will be performed by establishing criteria for PARCC and by testing data against these criteria.

The sampling design, field procedures, laboratory procedures, and QC procedures are set up to provide high-quality data for use in this project. Specific data quality factors that may affect data usability include quantitative factors (precision, bias, accuracy, completeness and reporting limits) and qualitative factors (representativeness and comparability).

5.1 ANALYTES OF CONCERN

The analytes of concern for soil at the Property for confirmation sampling include metals, chlorinated solvents, benzene and cPAHs. The individual analytes of concern are presented in Table 1.

5.2 DETECTION LIMITS

Analytical methods have quantitative limitations at a given statistical level of confidence that are often expressed as the method detection limit (MDL). Individual instruments often can detect but not accurately quantify compounds at concentrations lower than the MDL, referred to as the instrument detection limit (IDL). Although results reported near the MDL or IDL provide insight to site conditions, quality assurance dictates that analytical methods achieve a consistently reliable level of detection known as the practical quantitation limit (PQL) or reporting limit (RL). The contract laboratory will provide numerical results for all analytes and report them as detected above the RL or undetected at the RL.

Achieving a stated detection limit for a given analyte is helpful in providing statistically useful data. Intended data uses, such as comparison to numerical criteria or risk assessments, typically dictate specific project target reporting limits (TRLs) necessary to fulfill stated objectives. For this project, the TRLs are values that are less than MTCA Method A CULs for the analytes of concern (MTCA Method B CULs are the TRLs for some solvents for which there is no MTCA Method A CUL established). The TRL for the analytes of concern are shown in Table 1. These TRLs were obtained from Test America, Tacoma, Washington. The analytical methods and processes selected will provide RLs less than the TRLs under ideal conditions. Therefore, the TRLs shown in Table 1 are considered targets because several factors may influence final RLs. Data users must be aware that high non-detect values, although correctly reported, can bias statistical summaries. Careful interpretation is required to correctly characterize site conditions.

5.3 PRECISION

Precision is the measure of mutual agreement among replicate or duplicate measurements of an analyte from the same sample and applies to field duplicate or split samples, replicate analyses, and duplicate spiked environmental samples (matrix spike duplicates) and laboratory control duplicates. The closer the measured values are to each other, the more precise the measurement process. Precision error may affect data usefulness. Good precision is indicative of relative consistency and comparability between different samples. Precision will be expressed as the relative percent difference (RPD) for spike sample comparisons and field duplicate comparisons. This value is calculated by:

$$RPD = 100[(Xs - Xd)/(Xs + Xd)]/2, \quad \text{where}$$

RPD = relative percent difference

Xs = sample analytical result

Xd = duplicate sample analytical result

The RPD will be calculated for appropriate sample sets and compared to the applicable criteria. Precision can also be expressed as the percent difference (%D) between replicate analyses. Persons performing the evaluation must review one or more pertinent documents (USEPA, 2002; USEPA, 2008) that address criteria exceedances and courses of action. The relative percent difference goal for this effort is 50 percent in analyses, unless the duplicate sample concentrations are less than 5 times the reporting limit.

5.4 ACCURACY

Accuracy is a measure of bias in the analytic process. The closer the measurement value is to the true value, the greater the accuracy. This measure is defined as the difference between the reported value versus the actual value and is often measured with the addition of a known compound to a sample. The amount of known compound reported in the sample, or percent recovery, assists in determining the performance of the analytical system in correctly quantifying the compounds of interest. Since most environmental data collected represent one point spatially and temporally rather than an average of values, accuracy plays a greater role than precision in assessing the results. In general, if the percent recovery is low, non-detect results may indicate that compounds of interest are not present when in fact these compounds are present. Detected compounds may be biased low or reported at a value less than actual environmental conditions. The reverse is true when recoveries are high. Non-detect values are considered accurate while detected results may be higher than the true value.

Accuracy will be expressed as the percent recovery of a surrogate compound (also known as "system monitoring compound"), a matrix spike result, or from a standard reference material where:

$$PR = 100(Xss - Xs)/T, \quad \text{where}$$

PR = percent recovery

Xss = spike sample analytical result

Xs = sample analytical result

T = known spike concentration

Persons performing the evaluation must review one or more pertinent documents (USEPA, October 2002; USEPA, 2008) that address criteria exceedances and courses of action. Accuracy criteria for surrogate spikes, matrix spikes and laboratory control spikes are found in Table 2.

5.5 REPRESENTATIVENESS, COMPLETENESS AND COMPARABILITY

Representativeness expresses the degree to which data accurately and precisely represent the actual site conditions. The determination of the representativeness of the data will be performed by completing the following:

- Comparing actual sampling procedures to those delineated within this SAP and QAPP.
- Comparing analytical results of field duplicates to determine the variations in the analytical results.
- Invalidating nonrepresentative data or identifying data to be classified as questionable or qualitative. Only representative data will be used in subsequent data reduction, validation and reporting activities.

Completeness establishes whether a sufficient amount of valid measurements were obtained to meet project objectives. The number of samples and results expected establishes the comparative basis for completeness. Completeness goals are 90 percent useable data for samples/analyses planned. If the completeness goal is not achieved an evaluation will be made to determine if the data are adequate to meet study objectives.

Comparability expresses the confidence with which one set of data can be compared to another. Although numeric goals do not exist for comparability, a statement on comparability will be prepared to determine overall usefulness of data sets, following the determination of both precision and accuracy.

5.6 HOLDING TIMES

Holding times are defined as the time between sample collection and extraction, sample collection and analysis, or sample extraction and analysis. Some analytical methods specify a holding time for analysis only. The holding times for the COCs are shown in Table 3.

5.7 BLANKS

According to the *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, 2008), "The purpose of laboratory (or field) blank analysis is to determine the existence and magnitude of contamination resulting from laboratory (or field) activities. The criteria for evaluation of blanks apply to any blank associated with the samples (e.g., method blanks, instrument blanks, trip blanks, and equipment blanks)." Trip blanks are placed with samples during shipment; method blanks are created during sample preparation and follow samples throughout the analysis process.

Analytical results for blanks will be interpreted in general accordance with *National Functional Guidelines for Organic Data Review* and professional judgment. Blanks are discussed further in Section 9.

6.0 SAMPLE COLLECTION, HANDLING AND CUSTODY

6.1 SAMPLING EQUIPMENT DECONTAMINATION

Reusable sampling equipment that comes in contact with soil will be decontaminated before each use. Decontamination procedures for this equipment will consist of the following: 1) wash with non-phosphate detergent solution (Alconox and distilled water), 2) rinse with distilled water, and 3) second distilled water rinse. Field personnel will limit cross-contamination by changing gloves between sampling events or more frequently as needed. Wash water used to decontaminate the sampling equipment is expected to be de minimis and will be disposed of in the general area of sample collection.

6.2 SAMPLE CONTAINERS AND LABELING

The Field Coordinator will implement the field protocols to manage field sample collection, handling and documentation. Samples obtained will be placed in appropriate laboratory-prepared containers. Sample containers and preservatives are listed in Table 3.

Sample containers will be labeled with the following information at the time of collection:

- project number,
- sample name, and
- date and time of collection.

Confirmation samples will be named according to the following example:

C-02-091509-1-3-3.5,

Where:

"C-02" indicates confirmation sample location 2,

"091509" indicates September 15, 2009,

"1" indicates it is the first sample from location 2 (in the event that further excavation and re-sampling is required), and

"3-3.5" indicates the sample was collected in the interval of 3 to 3.5 feet bgs.

The sample collection activities will be noted on field logs. The Field Coordinator will monitor consistency between the SAP, sample containers/labels, field logs and the chain of custody.

6.3 SAMPLE STORAGE

Samples will be placed in coolers with "blue ice" or double-bagged "wet ice" immediately after they are collected. The objective of the cold storage will be to attain a sample temperature of 4 degrees Celsius. Holding times will not be exceeded.

6.4 SAMPLE SHIPMENT

The samples will be transported and delivered to the analytical laboratory in coolers. Field personnel will transport and hand-deliver samples to the laboratory or to a laboratory courier for analysis. All analyses for this project are anticipated to be performed using a Test America Tacoma, and sample shipping is not anticipated.

6.5 CHAIN-OF-CUSTODY RECORDS

Field personnel are responsible for the security of samples from the time the samples are collected until the samples have been received by the laboratory or courier. A chain-of-custody form will be completed for samples being shipped to the laboratory. Information to be included on the chain-of-custody form includes:

- Project name and number.

- Sample identification numbers.
- Date and time of sampling.
- Sample matrix and number of containers from each sampling point, including preservatives used.
- Analyses to be performed and/or samples to be archived.
- Names of sampling personnel and transfer of custody acknowledgment spaces.

The original chain-of-custody record will be signed by the field sampler and bear a unique tracking number. Field personnel shall retain carbon copies of all chain-of-custodies that are prepared. The original and remaining copies of the chain-of-custody records will accompany the samples during transit by the field sampler or courier to the laboratory.

6.6 LABORATORY CUSTODY PROCEDURES

The laboratory will follow their standard operating procedures (SOPs) to document sample handling from time of receipt (sample log-in) to reporting. Documentation will include at a minimum, the analysts name or initial, and the time and date of analysis.

6.7 FIELD DOCUMENTATION

Field documentation provides important information about potential problems or special circumstances surrounding sample collection. Field personnel will maintain daily field logs while on site. The field logs will be prepared on field report forms. Entries in the field logs and associated sample documentation forms will be made in pencil on Rite-in-the-Rain logs, or waterproof ink on standard paper, and corrections will consist of line-out deletions that are initialed and dated. Individual logs will become part of the project files.

At a minimum, the following information will be recorded during the collection of each sample:

- Sample location and description
- Sampler's name(s)
- Date and time of sample collection
- Type of sample
- Type of sampling equipment used
- Field instrument readings as appropriate
- Field observations and details that are pertinent to the integrity/condition of the samples (e.g., weather conditions, performance of the sampling equipment, sample depth control, etc.)
- Sample preservation

In addition to the sampling information, the following specific information also will be recorded in the field log for each day of sampling:

- Names of team members
- Time of Property arrival/departure

- Other personnel present at the Property as appropriate
- Summary of pertinent meetings or discussions with regulatory agency
- Deviations from sampling plans, site safety plans and QAPP procedures
- Changes in personnel and responsibilities with reasons for the changes
- Levels of safety protection
- Calibration readings for any equipment used and equipment model and serial number

The handling, use and maintenance of field logs are the field coordinator's responsibilities.

7.0 CALIBRATION PROCEDURES

7.1 FIELD INSTRUMENTATION

Equipment and instrumentation calibration facilitates accurate and reliable field measurements. Field and laboratory equipment used on the project will be calibrated and adjusted in general accordance with the manufacturer's recommendations. Methods and intervals of calibration and maintenance will be based on the type of equipment, stability characteristics, required accuracy, intended use and environmental conditions. The basic calibration frequencies are described below.

7.2 LABORATORY INSTRUMENTATION

For analytical chemistry, calibration procedures will be performed in general accordance with the methods cited and laboratory standard operating procedures. Calibration documentation will be retained at the laboratory and readily available for a period of six months.

8.0 DATA REPORTING AND LABORATORY DELIVERABLES

The laboratory will report data in formatted hardcopy and digital form. Analytical laboratory measurements will be recorded in standard formats that display, at a minimum, the field sample identification, the laboratory identification, reporting units, qualifiers, analytical method, analyte tested, analytical result, extraction and analysis dates, and detection limit (RL only). Each sample delivery group will be accompanied by sample receipt forms and a case narrative identifying data quality issues. Laboratory electronic data deliverables (EDD) will be established by GeoEngineers, Inc., with the contract laboratory. Final results will be sent to the Project Manager.

9.0 INTERNAL QUALITY CONTROL

Table 4 summarizes the types and frequency of Quality Control samples to be collected monitoring, including both field QC and Laboratory QC samples.

9.1 FIELD QUALITY CONTROL

Field QC samples serve as a control and check mechanism to monitor the consistency of sampling methods.

9.1.1 Field Duplicates

In addition to replicate analyses performed in the laboratory, field duplicates also serve as measures for precision. This tests both the precision and consistency of laboratory analytical procedures and methods, and the consistency of the sampling techniques used by field personnel.

At least two field duplicate soil samples will be collected from CSZ 1 and at least one field duplicated soil sample will be collected from CSZ 2 and analyzed for the analytes measured in the parent sample. At least one duplicate analysis will be performed for each analyte tested.

9.1.2 Trip Blanks

A minimum of three trip blanks will be analyzed during the cleanup. Two of the trip blanks will be included in coolers containing samples from CSZ 1, and one trip blank will be included in a cooler containing samples from CSZ 2. The trip blank samples will be analyzed for chlorinated solvents and benzene. If solvents or benzene are detected in trip blanks, additional trip blanks may be used.

9.2 LABORATORY QUALITY CONTROL

Laboratory quality control procedures will be evaluated through a formal data quality review process. The analytical laboratory will follow standard method procedures that include specified QC monitoring requirements. These requirements will vary by method but generally include:

- Method blanks
- Internal standards
- Calibrations
- Matrix spike/matrix spike duplicates (MS/MSD)
- Laboratory control spikes/spike duplicates (LCS/LCSD)
- Laboratory replicates or duplicates
- Surrogate spikes

9.2.1 Laboratory Blanks

Laboratory procedures employ the use of several types of blanks but the most commonly used blank for QA/QC assessments are method blanks. Method blanks are laboratory QC samples that consist of either a soil-like material having undergone a contaminant destruction process or HPLC water. Method blanks are extracted and analyzed with each batch of environmental samples undergoing analysis. Method blanks are particularly useful during volatiles analysis since VOCs can be transported in the laboratory through the vapor phase. If a substance is found in the method blank then one (or more) of the following occurred:

- Measurement apparatus or containers were not properly cleaned and contained contaminants.
- Reagents used in the process were contaminated with a substance(s) of interest.
- Contaminated analytical equipment was not properly cleaned.
- Volatile substances in the air with high solubility or affinities toward the sample matrix contaminated the samples during preparation or analysis.

It is difficult to determine which of the above scenarios occurred if blank contamination occurs. However, it is assumed that the conditions that affected the blanks also likely affected the project samples. Given method blank results, validation rules assist in determining which substances in samples are considered "real," and which ones are attributable to the analytical process. Furthermore, the guidelines state, ". . . there may be instances where little or no contamination was present in the

associated blank, but qualification of the sample is deemed necessary. Contamination introduced through dilution water is one example."

9.2.2 Calibrations

Several types of calibrations are used, depending on the method, to determine whether the methodology is "in control" by verifying the linearity of the calibration curve and to assure that the sample results reflect accurate and precise measurements. The main calibrations used are initial calibrations, daily calibrations and continuing calibration verification.

9.2.3 Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD samples are used to assess influences or interferences caused by the physical or chemical properties of the sample itself. MS/MSD data is reviewed in combination with other QC monitoring data to determine matrix effects. In some cases, matrix affects cannot be determined due to dilution and/or high levels of related substances in the sample. A matrix spike is evaluated by spiking a known amount of one or more of the target analytes ideally at a concentration of 5 to 10 times higher than the sample result. A percent recovery is calculated by subtracting the sample result from the spike result, dividing by the spiked amount, and multiplying by 100.

The samples for the MS and MSD analyses should be collected from a sampling location that is believed to exhibit low-level contamination. A sample from an area of low-level contamination is needed because the objective of MS/MSD analyses is to determine the presence of matrix interferences, which can best be achieved with low levels of contaminants. Additional sample volume will be collected for these analyses. This MS/MSD sample will be a composite to achieve a level of representativeness and reproducibility in the data.

9.2.4 Laboratory Control Spikes/Laboratory Control Spike Duplicates (LCS/LCSD)

Also known as blanks spikes, LCS samples are similar to MS samples in that a known amount of one or more of the target analytes are spiked into a prepared media and a percent recovery of the spiked substances are calculated. The primary difference between a MS and LCS is that the LCS spike media is considered "clean" or contaminant free. For example, HPLC water is typically used for LCS water analyses. The purpose of an LCS is to help assess the overall accuracy and precision of the analytical process including sample preparation, instrument performance, and analyst performance. LCS data must be reviewed in context with other controls to determine if out-of-control events occur.

9.2.5 Laboratory Replicates/Duplicates

Laboratories often utilize MS/MSDs, LCS/LCSDs and/or replicates to assess precision. Replicates are a second analysis of a field-collected environmental sample. Replicates can be split at varying stages of the sample preparation and analysis process, but most commonly occur as a second analysis on the extracted media.

9.2.6 Surrogate Spikes

The purposes of using a surrogate are to verify the accuracy of the instrument being used and extraction procedures. Surrogates are substances similar to, but not one of, the target analytes. A known concentration of surrogate is added to the sample and passed through the instrument, noting the surrogate recovery. Each surrogate used has an acceptable range of percent recovery. If a surrogate recovery is low, sample results may be biased low and depending on the recovery value, a possibility of false

negatives may exist. Conversely, when recoveries are above the specified range of acceptance a possibility of false positives exist, although non-detected results are considered accurate.

10.0 DATA REDUCTION AND ASSESSMENT PROCEDURES

10.1 DATA REDUCTION

Data reduction involves the conversion or transcription of field and analytical data to a useable format. The laboratory personnel will reduce the analytical data for review by the QA Leader and Project Manager.

10.2 FIELD MEASUREMENT EVALUATION

Field data will be reviewed at the end of each day by following the QC checks outlined below and procedures in the SAP. Field data documentation will be checked against the applicable criteria as follows:

- Sample collection information
- Field instrumentation and calibration
- Sample collection protocol
- Sample containers, preservation and volume
- Field QC samples collected at the frequency specified
- Sample documentation and chain of custody protocols
- Sample delivery

Cooler receipt forms and sample condition forms provided by the laboratory will be reviewed for out-of-control incidents. The final report will contain what effects, if any, an incident has on data quality. Sample collection information will be reviewed for correctness before inclusion in a final report.

10.3 FIELD QUALITY CONTROL EVALUATION

A field QC evaluation will be conducted by reviewing field logs and daily reports, discussing field activities with staff, and reviewing field QC samples (trip blanks and field duplicates). Trip blanks will be evaluated using the same criteria as method blanks.

10.4 LABORATORY DATA QUALITY CONTROL EVALUATION

The laboratory data assessment will consist of a formal review of the following QC parameters:

- Holding times
- Method blanks
- Matrix spike/matrix spike duplicates
- Laboratory control spikes/laboratory control spike duplicates
- Surrogate spikes
- Replicates

In addition to these QC mechanisms, other documentation such as cooler receipt forms and case narratives will be reviewed to fully evaluate laboratory QA/QC.

10.5 CORRECTIVE ACTION

Any deviation from the established criteria will be documented, and the data will be qualified, as appropriate. If significant quality assurance problems are encountered, appropriate corrective action as determined by GeoEngineers' Project Manager, GeoEngineers' Associate/Principle and/or the analytical laboratory will be implemented as appropriate.

11.0 REFERENCES

Model Toxics Control Act (MTCA) Cleanup Regulations, *Washington Administrative Code, Chapter 173-340.* Washington State Department of Ecology.

USEPA. 2008. Contract Laboratory Program National Functional Guidelines for Organic Data Review.

USEPA. 2002. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.

TABLE 1
SOIL CLEANUP LEVELS AND TARGET REPORTING LIMITS
318 STATE AVENUE NE
OLYMPIA, WASHINGTON

Chemical of Concern	Soil Cleanup Level[1]	Target Reporting Limit
Metals (mg/kg)		
Arsenic	20	1.5
Lead	250	3
Solvents (µg/kg)		
Benzene	30	16
Tetrachloroethene	50	20
Trichloroethene	30	16
Vinyl chloride	670	8
Methylene Chloride	20	40
Chloromethane	77,000	400
Bromomethane	110,000	140
Chloroethane	Not Established	400
Trichlorofluoromethane	24,000,000	40
1,1-Dichloroethene	Not Established	20
trans-1,2-Dichloroethene	1,600,000	40
1,1-Dichloroethane	16,000,000	40
cis-1,2-Dichloroethene	800,000	40
Chloroform	160,000	40
1,1,1-Trichloroethane	2,000	40
Carbon tetrachloride	7,700	20
1,2-Dichloroethane	11,000	40
1,2-Dichloropropane	15,000	12
Bromodichloromethane	16,000	40
cis-1,3-Dichloropropene	5,600	16
trans-1,3-Dichloropropene	5,600	16
1,1,2-Trichloroethane	18,000	12
Dibromochloromethane	12,000	40
Chlorobenzene	1,600,000	40
Bromoform	130,000	40
1,1,2,2-Tetrachloroethane	5,000	10
1,3-Dichlorobenzene	Not Established	40
1,4-Dichlorobenzene	42,000	40
1,2-Dichlorobenzene	7,200,000	40
cPAHs (µg/kg)		
Benzo[a]anthracene	Not Established	25
Chrysene	Not Established	25
Benzo[a]pyrene	100	30
Indeno[1,2,3-cd]pyrene	Not Established	40
Dibenz(a,h)anthracene	Not Established	40
Benzo[b]fluoranthene	Not Established	20
Benzo[k]fluoranthene	Not Established	25

Notes:

[1] Model Toxics Control Act (MTCA) Method A Cleanup Levels (CULs). Where MTCA Method A CULs are not available, MTCA Method B CULs are used.

mg/kg = Milligrams per kilogram

µg/kg = Micrograms per kilogram

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons

Shaded values indicate the Target Reporting Limit is greater than the Cleanup Level.

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TABLE 2
MEASUREMENT QUALITY OBJECTIVES
318 STATE AVENUE NE
OLYMPIA, WASHINGTON

Laboratory Analysis	Reference Method	Check Standard (LCS) %R Limits[1]	Matrix Spike (MS) %R Limits[1]	Surrogate Standards (SS) %R Limits [2]	MS Duplicate Samples or Lab Duplicate RPD Limits[3]	Field Duplicate Samples RPD Limits[3]
Metals	EPA 6010	80%-120%	75%-125%	NA	≤35%	≤50%
Solvents and Benzene	EPA 8260	70%-130%	70%-130%	70%-130%	≤30%	≤30%
cPAHs	EPA 8270	70%-130%	70%-130%	70%-130%	≤30%	≤30%

Notes:

Method numbers refer to EPA SW-846 Analytical Methods or Washington State Department of Ecology (Ecology) recommended analytical methods.

[1] Recovery ranges are goals. Actual percent recovery limits are based on laboratory control limits. Limits will vary for individual analytes and may be outside of the limits shown.

[2] Surrogate standard limits are approximate.

[3] RPD control limits are only applicable if the concentrations are greater than 5 times the method reporting limit (MRL). For results less than 5 times the MRL, the difference between the sample and duplicate must be less than 2X the MRL for soils and 1X the MRL for waters.

LCS = Laboratory Control Sample

%R = Percent Recovery

RPD = Relative Percent Difference

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons

NA = Not Applicable

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TABLE 3
TEST METHODS, SAMPLE CONTAINERS, PRESERVATION AND HOLDING TIME[1]
318 STATE AVENUE NE
OLYMPIA, WASHINGTON

Laboratory Analysis	Method	Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times
Metals	EPA 6010	125 grams	8 oz glass jar	Cool to 4 C	180 days
Solvents and Benzene	EPA 8260	7 grams	2 Methanol-Preserved 40mL VOA Vials	Methanol, Cool to 4 C	14 days
cPAHs	EPA 8270	125 grams	8 oz glass jar	Cool to 4 C	14 days

Notes:

[1] Holding Times are based on elapsed time from date of collection

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons

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TABLE 4
QUALITY CONTROL SAMPLES TYPE AND FREQUENCY
318 STATE AVENUE NE
OLYMPIA, WASHINGTON

Laboratory Analysis	Field Quality Control		Laboratory Quality Control			
	Field Duplicates	Trip Blanks	Method Blanks	LCS	MS / MSD	Lab Duplicates
Metals	3	NA	1/batch	1/batch	1 MS/batch	1/batch
Solvents and Benzene	3	Minimum 3 during cleanup	1/batch	1/batch	1 MS/batch	1/batch
cPAHs	2	NA	1/batch	1/batch	1 MS/batch	1/batch

Notes:

An analytical set or batch is defined as a group of samples taken through a preparation procedure and sharing a method blank, LCS, and MS/ MSD (or MS and laboratory duplicate).

No more than 20 field samples can be contained in one batch.

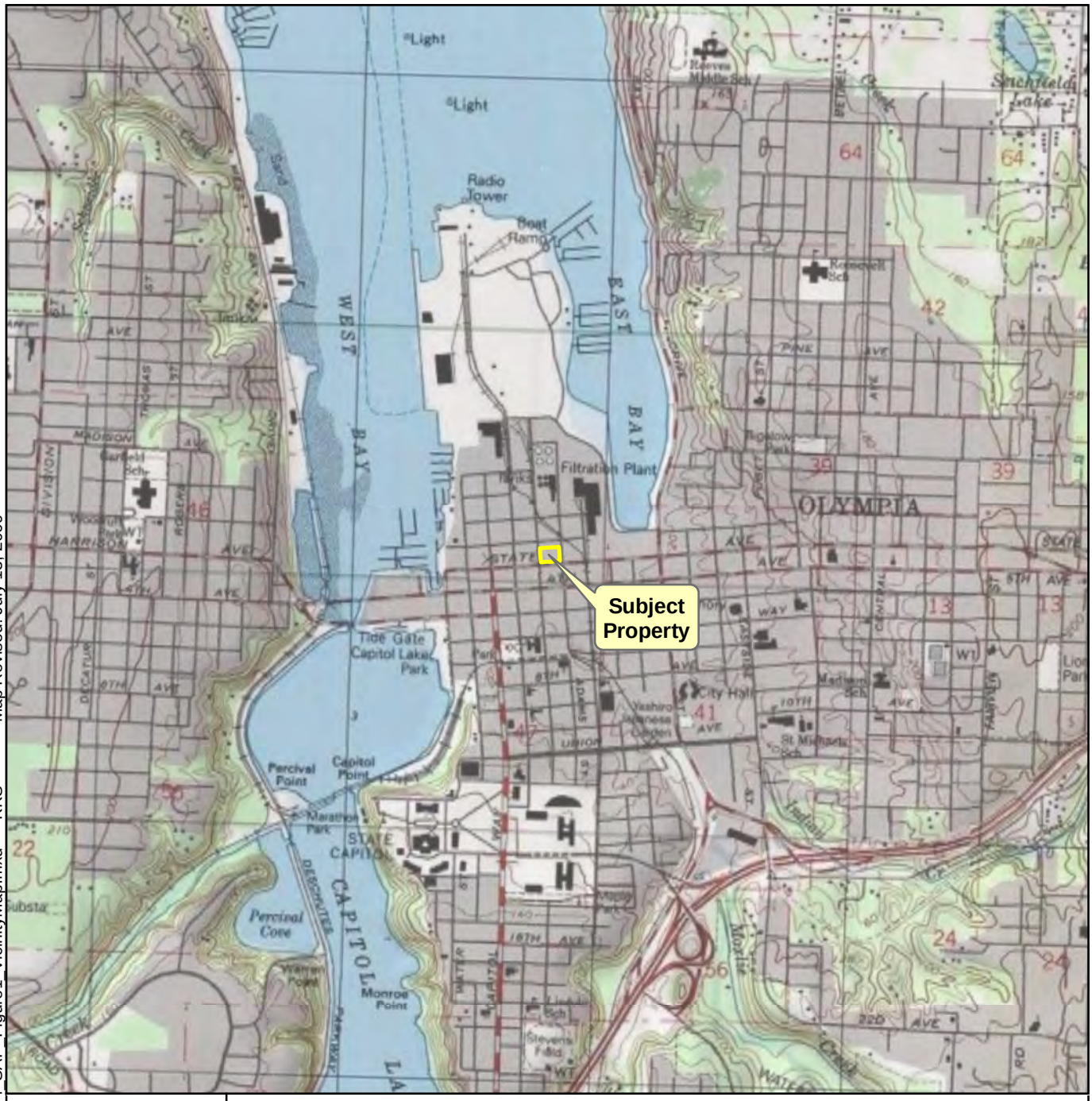
LCS = Laboratory control sample

MS = Matrix spike sample

MSD = Matrix spike duplicate sample

NA = Not applicable

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons



Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: 2008 Shaded Relief from ESRI, 2008 Topographic Maps from National Geographic Society
Projection: NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet
Datum: D_North_American_1983

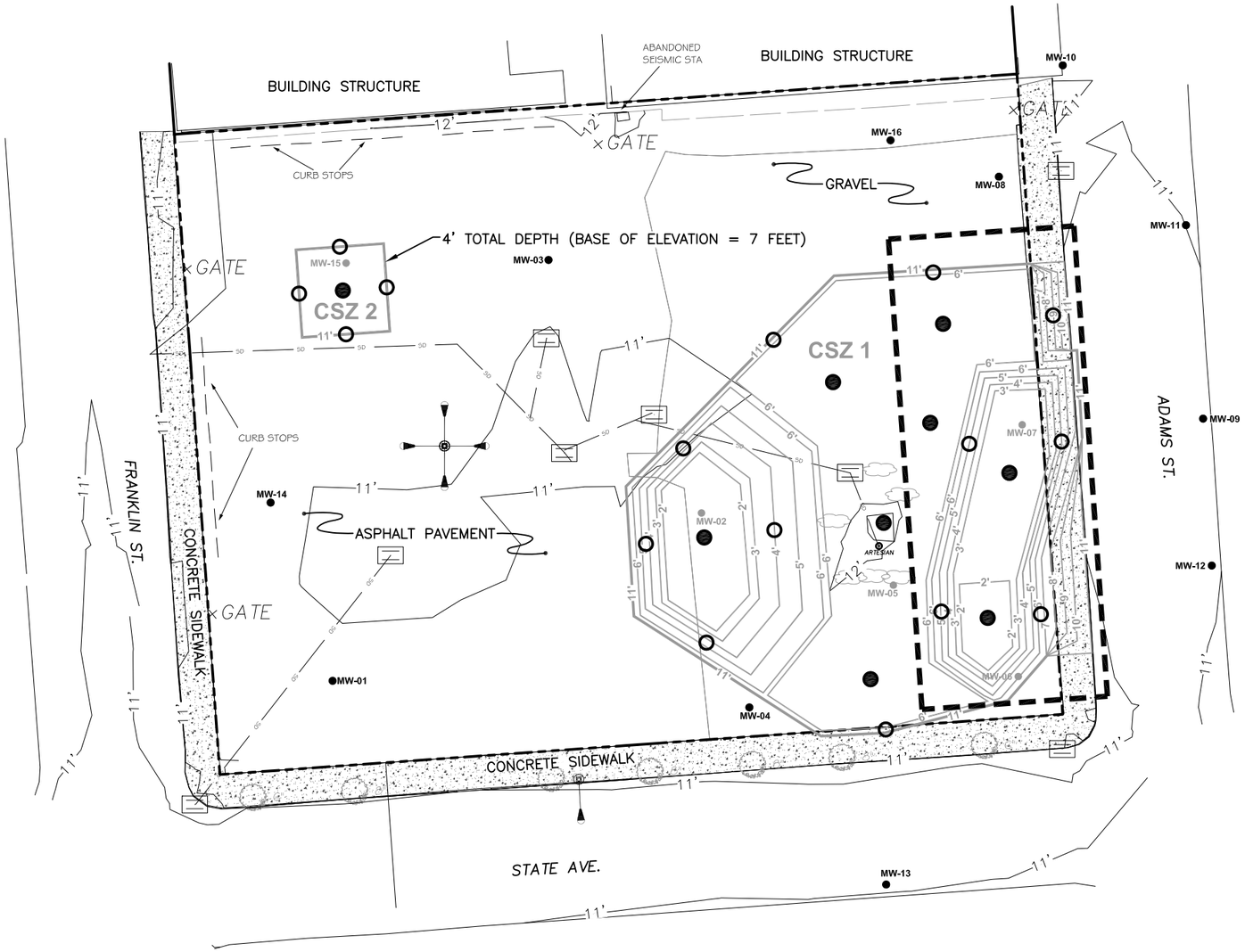
Vicinity Map

318 State Avenue NE
Olympia, Washington

GeoEngineers

Figure 1

Office: TAC Path: \P:\0\0415049\GIS\MXDs\041504904_SAP_Figure1_VicinityMap.mxd KKS Map Revised: July 13, 2009



Legend

- MW-01 ● GeoEngineers Monitoring Well Location and Designation (March and October 2008) (2" ID PVC) Wells to Remain and be Protected from Damage by Remedial Excavation Activities
- MW-02 ● GeoEngineers Monitoring Well Location and Designation (March and October 2008) (2" ID PVC) Wells to be Decommissioned per WAC 173-160-381 Prior to Remedial Excavation Activities
- Sidewall Sample and Approximate Location
- Bottom Sample and Approximate Location
- Limits of Samples to be Submitted for cPAH Analysis
- 11' Existing Topographic Elevation Contour
- 6' Proposed Contour
- 11' Vertical Sidewall 3 to 4 feet in Depth
- CSZ 1 Contaminated Soil Zone
- ARTESIAN Existing Decommissioned Artesian Well Casing
- Catch Basin
- Bush
- Tree
- Street Light
- SD Storm Line
- Property Line

40 0 40
Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Horizontal Datum = NAD83 Washington State Planes, South Zone, US Foot. Vertical Datum = NGVD 29 MSL.

Reference: Drawing provided by City of Olympia.

Confirmation Sampling Locations

318 State Avenue NE
Olympia, Washington

GeoEngineers | Figure 2