GEORGETOWN STEAM PLANT

Interim Action Work Plan

Prepared for
Seattle City Light
P.O. Box 34023
Seattle, WA 98124-4023

Prepared by
Integral Consulting Inc.
411 1st Avenue S.
Suite 550
Seattle, WA 98104

June 2, 2011

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ACRONYMS AND ABBREVIATIONS

Agreed Order	North Boeing Field/Georgetown Steam Plant Agreed Order No. DE 5685
BaP	benzo(a)pyrene
bgs	below ground surface
Boeing	The Boeing Company
BMP	best management practice
City	City of Seattle
COC	chemical of concern
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FTA	fuel tank area
GTSP	Georgetown Steam Plant
HASP	health and safety plan
IAL	interim action level
Integral	Integral Consulting Inc.
KCIA	King County International Airport
KCIW	King County Industrial Waste (program)
LLA	low-lying area
MTCA	Model Toxics Control Act
NAVD88	North American Vertical Datum of 1988
NBF	North Boeing Field
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
SCL	Seattle City Light
SYA	south yard area
TCDD	2,3,7,8-tetrachlorodibenzo-*p*-dioxin
TEQ	toxicity equivalence
TSCA	Toxic Substances Control Act

TPH	total petroleum hydrocarbon
WAC	Washington Administrative Code

1 INTRODUCTION

The Georgetown Steam Plant (GTSP) is a portion of the area addressed by the North Boeing Field/Georgetown Steam Plant Agreed Order No. DE 5685 issued under the Washington State Model Toxics Control Act (MTCA) (RCW 70.105D.050(1)) on July 3, 2008 (the Agreed Order). Potentially liable parties under this order include the City of Seattle (the City), King County, and the Boeing Company (Boeing). The GTSP is owned by the City, and Seattle City Light (SCL) will perform the work at the GTSP.

On June 18, 2010, the Washington State Department of Ecology (Ecology) issued a letter requiring interim actions in 2010 on GTSP to remove sources of polychlorinated biphenyls (PCBs) that may have the potential to migrate offsite, enter Boeing's storm drain system, and recontaminate Slip 4 sediments following its remediation in 2011/2012 (Ecology 2010). This direction was subsequently amended and Ecology has directed removal activities to occur during the 2011 construction season permitting interim actions to occur simultaneously on GTSP and Boeing-leased properties during the regional dry season. This interim action will precede the full remedial investigation and feasibility study process planned for the overall site which includes the GTSP property and North Boeing Field (NBF).

The City's objective is to conduct an interim action that minimizes the need for additional remediation to the largest extent practicable. To this end, soils contaminated with chemicals other than PCBs (i.e., arsenic, total petroleum hydrocarbons [TPH], toxicity equivalents [TEQs] of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin [TCDD], and benzo(a)pyrene [BaP] TEQs) will be addressed simultaneously.

Removal and management of soil with PCB concentrations greater than or equal to 50 mg/kg is regulated by the U.S. Environmental Protection Agency (EPA) under the Toxic Substances Control Act (TSCA). This work will be conducted in accordance with TSCA provisions for risk-based cleanup and disposal of PCB remediation waste [40 CFR § 761.61(c)]. The excavation and management of soils impacted by other chemicals, including PCBs at concentrations less than 50 mg/kg, will be conducted in accordance with MTCA.

This interim action is on a fast-track schedule so that the work can be completed during the dry season. Design parameters in this work plan are conceptual in nature and are subject to modification.

A site characterization work plan (Integral 2010a) was prepared for the GTSP property. Following receipt of Ecology's June 16, 2010, letter, SCL moved forward with the field program and data generation. This work plan is one of three reports being provided by the City to Ecology in preparation for interim remedial actions at the GTSP in 2011. The first document (Integral 2011a) is a technical memorandum that derives chemicals of concern (COCs) and associated interim action cleanup levels (IALs). The second (Integral 2011b) provides a summary of site characterization activities for the entire site and a general interpretation of the extents of detected concentrations. The remainder of this work plan provides brief background information, objectives of the proposed interim action, a summary of the cleanup levels presented in Integral (2011a), technical parameters for the preliminary design, a conceptual scope of the proposed interim action, information on confirmation sampling, health and safety, completion reporting, and project schedule. Figures and preliminary design sketches are also included; however, final construction design documents will be produced and provided to the contractor.

1.1 BACKGROUND

Built in 1906, the Georgetown Steam Plant is a National Historic Landmark that previously produced electricity for a relatively short period of time. The site is located at 6605 13th Avenue South, at the intersection of Greely Street at the north end of King County International Airport (KCIA) (Figure 1-1). Two earlier removal actions were conducted at this site to address PCB-contaminated soil detected in the southwest portion of the GTSP property and along the southern boundary, adjacent to Boeing-leased property. This portion of the site is referred to as the low-lying area (LLA) because surface water historically flowed to this region from portions of the GTSP and offsite areas. The initial removal action was completed in 1985; the second removal action was completed in 2006 (see Figure 3-11 in Integral 2010). Groundwater monitoring that was conducted in 2006/2007 at five locations on GTSP property identified PCBs in groundwater underlying the LLA, but not underlying other portions of the site.

1.2 OBJECTIVES

The primary objective of this interim action is to remove sources of PCBs from the LLA with the potential to migrate offsite and to contaminate Slip 4. The secondary objective of this interim action is to remove or cap site soils contaminated with other chemicals at levels exceeding IALs to minimize the potential need for additional remediation in this part of the GTSP site in the future. The development of IALs is presented in Integral (2011a). The selected interim action is a combination of excavation (with offsite disposal) and capping of contaminated site soils.

1.3 COORDINATION WITH THE BOEING COMPANY

The City and Boeing are working closely to coordinate interim actions at GTSP and the adjacent fence line area on NBF. It is anticipated that the construction work will be conducted using a single prime contractor, to reduce potential coordination complexities due to space, access, and sequencing constraints. The City and Boeing are currently engaged in design coordination activities, and will produce a joint set of construction design documents for the selected remedial contractor later this spring.

2 SITE CONDITIONS

2.1 SITE DESCRIPTION

The GTSP occupies a 2.8-acre parcel at the northern end of NBF in south Seattle (Figure 1-1). King County owns the adjacent property, much of which is leased to Boeing. Surrounding land uses include Boeing's Propulsion and Engineering Lab, the Washington Air National Guard, Washington State Department of Transportation facilities, a King County truck maintenance facility, and KCIA.

The GTSP is on the National Register of Historic Places (No. S264) and currently operates as a museum. Visitors to the museum have access to the outdoor portions of the site. A scale model railroad operates on a portion of the yard to the southeast of the building. Site subareas and features are illustrated in Figure 2-1.

2.2 SITE FEATURES AND TOPOGRAPHY

The majority of the site excluding the power house is covered by a grass lawn. Primary site features are the power house located in the northern portion of the property, a circular concrete water reservoir located near the northwestern corner of the power house, a scale model railroad circuit located southeast of the power house, two small sheds located to the east of the railroad, and a drainage swale that extends along the southern property fence line (Bridgewater 2000). There is also a concrete slab on the north side of the power house where the former Greely Substation was located.

Based on a site survey completed in 2006, the GTSP property generally slopes to the south and southwest. The topography in the upper (northern) approximately two-thirds of the property slopes gently to the south, and then drops more steeply to the LLA that runs along the south property boundary. The LLA forms a broad swale that receives runoff from the northern portion of the site and historically from adjacent offsite areas. The swale slopes to the west, toward the southwest corner of the GTSP property boundary. There is a slight depression in the southwest corner in an area where ponding was observed historically (Integral 2010b).

2.3 GEOLOGY

Generally, site stratigraphy consists of fill underlain by native river deposits. The river deposits are interpreted to consist of dark olive gray, poorly graded sand, silty sand, and silt, with a few instances of inorganic clays. Grain size analyses of native river deposits indicate silt content ranging from 5 to 15 percent. Atterberg limits of samples from varying depths across the site indicate this material is predominantly non-plastic. Generally across the site, the prevalence of poorly graded sands increases with depth. Below 8 ft below ground surface (bgs), these sands are fairly consistent across the LLA down to the deepest boring level of 30 ft bgs. Borings and cone penetrometer tests indicate interbedded, thin (generally less than 1 ft thick) lenses of clayey silts and silty clays, but appear to have limited horizontal extents.

The fill material, which is generally interpreted to occur at or above the water table, is highly variable in color and composition and occurs at a wide range of depths and thicknesses across the site. Fill consists of debris (trash, brick, wood, and coal), silty gravels, inorganic silts, silty sands, fine sands, and occasional poorly graded gravels. Reddish, yellowish, or white silty sand and gravel consisting of crushed, granular, and/or pulverized brick or slag was observed in the northwestern portion of the south yard area (SYA). Fill containing this material was observed across the former fuel tank area (FTA) and LLA. Coal was often observed co-located with the brick fragments, noted in boring logs as black organic soil with grain size ranging from silt to coarse sand. Occasionally, the coal is found in layers with no other debris. These deposits are most common in the central and eastern portions of the SYA and LLA, in the vicinity of the former coal conveyor, and appear to have limited horizontal and vertical extents.

Wood debris (twigs and small sticks) was found in thin layers at a depth of 12–14 ft bgs in eight boreholes in the LLA and at a similar elevation in one FTA boring. The presence and variability of these laterally discontinuous deposits are consistent with a streamside depositional environment and are likely an indicator of the original Duwamish River channel before it was straightened in the early 1900s. The presence of wood debris at deeper depths in some boreholes likely indicates a historical progression of stream advancement and deposition prior to the early 1900s.

In the wet season (November through April), groundwater elevations at GTSP have been observed to range between 11 and 10 ft relative to the North American Vertical Datum of 1988 (NAVD88) (Figure 2-2). This corresponds to depths of approximately 8 to 3 ft bgs. In the summer dry season (May through October), when construction of this interim action is slated to occur, groundwater has been observed to range from approximately 10 to 8 ft NAVD88 (Figure 2-3) (approximately 9 to 5 ft bgs).

A more complete discussion of site characterization fieldwork observations, physical testing results, and presentation of stratigraphic cross sections can be found in the site characterization data report (Integral 2011b).

3 PROPOSED INTERIM ACTION

3.1 INTERIM ACTION LEVELS AND BOUNDARIES

A detailed screening of site characterization data, derivation of chemicals of concern, and associated IALs for this removal action are presented in the *GTSP Technical Memorandum on Data Screening* (Integral 2011a), which has been submitted under separate cover. A summary of the COCs and IALs is shown in Table 3-1 of this work plan.

The data screening memo presents figures illustrating the distribution of COCs in soil samples collected across the site, compared to respective IALs. Interim action boundaries have been delineated to encompass soils with exceedances of IALs, for each of the COCs. Total PCBs and TPH are the most prevalent COCs and, in general, are primarily responsible for driving the delineation of the removal boundary. In accordance with the terms of the April 28, 2010, settlement agreement between the City, Boeing, and King County, the extents of remediation on City property extend to the property and/or lease boundaries. The proposed interim action boundaries are shown on Figure 3-1. Further rationale behind their proposed configuration is explained in the sections below.

Additional samples not presented in Integral (2011a) were collected in May 2011 to support remedy design and as confirmation samples for portions of the site (see Section 4). Based on the results, the proposed excavation footprint in the LLA and FTA may be adjusted, if needed. Other samples provided data for design of stormwater basins. Sampling and analytical methods followed Integral (2010).

3.2 CONCEPTUAL INTERIM ACTION PLAN

A combination of soil excavation (with offsite disposal) and capping is the proposed remedy to address soils contaminated with PCBs, TPH, dioxins/furans (TCDD), carcinogenic PAHs (BaP), and arsenic at the GTSP. Soil within designated areas will be excavated, temporarily stockpiled (as needed), and loaded into haul trucks and/or roll-off containers for disposal at an appropriate landfill facility. It is anticipated that the soil can be characterized for waste disposal on the basis of existing data. In the event that verification sampling of excavated materials is required by the disposal facility, then sampling of stockpiled material may be required.

Certified clean fill materials will be imported to backfill the excavated areas, and the site re-graded to facilitate onsite retention and infiltration of stormwater, reducing offsite drainage to the extent practicable. In a portion of the site, some soils with COCs exceeding direct contact exposure pathway IALs will be left in place. This material will be addressed in conjunction with site regrading work. Surface soils will be stripped and will be covered with geotextile to provide separation and stabilization of the excavated subgrade. The site will be brought to final grade with a minimum 1.5-ft thickness of clean fill to provide a permeable cap for soils exceeding direct contact IALs at depth, followed by compost or topsoil, as needed for establishment of vegetative cover (e.g., grass). Institutional controls (e.g., deed restrictions, monitoring, maintenance, and controlled use) will be implemented to ensure protectiveness of direct contact exposure. The conceptual footprints of proposed excavation and site restoration activities are illustrated on Figures 3-1 and 3-2, respectively. Figure 3-3 provides conceptual cross section schematics in two key areas of the site.

Site access and haul routes are currently under development, in coordination between the City, Boeing, and King County. Figure 3-4 shows the two alternative paths being considered. Trucks leaving the site may travel either direction on Ellis Avenue South for access to East Marginal Way and Airport Way South.

Due to the fast-track schedule, this work plan is limited to a conceptual level of detail. Final design details and specifications will be prepared for incorporation into the construction design documents developed for the selected remediation contractor. The following sections discuss details pertinent to discrete subareas of the site.

3.2.1 Low-Lying and South Yard Areas

In the LLA, an area with groundwater impacted by PCBs has been identified, as indicated by the dashed yellow line on Figure 3-1. Within this area, soils with PCBs exceeding 0.5 mg/kg will be removed. The corresponding excavations will be completed to elevations ranging between 5.5 and 7.5 ft NAVD88 (up to 2.5 ft below the seasonal groundwater surface). Outside of the impacted groundwater area, nearly all soils with detected total PCB concentrations exceeding 1 mg/kg will be removed. The combined footprint and side-slopes of the proposed excavation encompass the southwest corner of the LLA and extend into portions of the SYA. In accomplishing the soil removal for PCBs in this area, soils with TPH exceeding the TPH IAL of 2,000 mg/kg will also be removed. A large proportion of soil with arsenic exceeding its IAL of 20 mg/kg will also be removed as part of this action. Some soil with concentrations of PCBs and arsenic exceeding the direct contact exposure pathway IAL will remain following excavation work. This material will be capped with clean import material, as part of the site restoration activities described in Section 3.5. Institutional controls (e.g., monitoring, maintenance, and controlled use) will be implemented to ensure protection for direct contact exposure pathways. There is an elevated concentration of TCDD at depth at boring location SYASB01, located near the middle of the SYA. This sample falls within the footprint of the proposed site restoration work, and will also be addressed by capping with clean cover. Similarly, there is an isolated exceedance of the BaP IAL directly south of the power plant at boring location SYASB09. This exceedance is located near the soil surface and impacted soils will be removed as part of site restoration activities and replaced by clean fill.

3.2.1.1 Management of Soil with PCB Concentrations of 50 mg/kg or Greater

Soils containing PCBs at concentrations exceeding 50 mg/kg have been delineated in three discrete portions of the LLA (Figure 3-1). Along the western lease boundary between NBF and GTSP, two areas with PCBs equal to or greater than 50 mg/kg will be excavated to 10 ft NAVD88. The material in these areas is entirely within the soil vadose zone. Along the southern lease boundary, there is a small area where soils with PCBs greater than 50 mg/kg extend slightly deeper (planned excavation extends to 7 ft NAVD88) and into the saturated soil zone. Remediation of soils with PCBs equal to or greater than 50 mg/kg will be conducted in accordance with TSCA risk-based cleanup and disposal procedures [40 CFR § 761.61(c)]. The volume of this material will be pre-determined *in situ* (preliminarily estimated to be less than 200 cubic yards) and work will be conducted such that soils with total PCB concentrations equal to or greater than 50 mg/kg will be segregated and placed in separate stockpiles, or direct loaded to designated trucks, for disposal in a TSCA-waste landfill such as the Chemical Waste RCRA/TSCA Subtitle C Facility near Arlington, Oregon. All equipment that comes into contact with soil designated as TSCA remediation waste will be decontaminated using solvent soap washing techniques and/or wipe sampled in accordance with the decontamination procedures required under 40 CFR § 761.79 or will alternatively be discarded as TSCA remediation waste.

3.2.1.2 Management of Soil with PCB Concentrations Less Than 50 mg/kg

Soil containing PCBs at concentrations less than 50 mg/kg and other COCs exceeding the IALs will be managed separately from soil containing PCBs at concentrations greater than 50 mg/kg.

Soil containing PCBs at concentrations less than 50 mg/kg are planned to be transported to a transfer station for subsequent disposal in a facility permitted, licensed, or registered to manage municipal solid waste subject to 40 CFR Part 258 or non-municipal non-hazardous waste subject to 40 CFR §§257.5 through 257.30, as applicable. Candidate facilities are anticipated to include Columbia Ridge Landfill in Arlington, Oregon, and Roosevelt Regional Landfill near Roosevelt, Washington.

3.2.2 Fuel Tank Area

The soil removal boundary in the FTA encompasses soils with TPH concentrations exceeding 3,000 mg/kg. An additional design criterion in this area is removal of soils containing free petroleum product. The footprint of soil removal is presented on Figure 3-1. Excavation depths range from 7 to 2 ft NAVD88 (up to 6 ft below seasonal groundwater surface). The extents of removal are limited by the proximity of the historic GTSP power plant building and an electric transformer pad, as described below.

Soil excavated from this area is anticipated to be acceptable for management as nonhazardous waste. Free product will be separated from construction wastewater and managed according to applicable state and federal regulations.

3.3 UTILITIES AND OTHER EXCAVATION CONSTRAINTS

3.3.1 Fuel Tank Area

Within and adjacent to the FTA, there is an electric transformer station, power lines, storm drains, and possibly a former water intake line. The transformer and power lines are currently in service. The excavation in this area will be offset to protect the transformer and its concrete pad and the associated power pole. It is possible that the power pole may require temporary de-energizing or relocation to facilitate shoring work. This issue will be resolved in ongoing design coordination activities. The storm drain lines in this area provide drainage for power plant roof drains and were installed as part of recent Georgetown Flume remediation work. The portions of this storm drain pipe intersecting the planned excavation prism will be removed and replaced as part of site restoration activities. There is one associated manhole structure that will likely require removal and reinstallation. The current condition of the former water intake pipeline is unknown. It is believed to have been abandoned, but further details regarding whether it was removed or abandoned in-place are not available. Provisions for removing a portion of the pipe (should it be encountered) and replugging exposed ends will be incorporated into the construction design documents provided to the contractor.

Removal of TPH-impacted soils in the FTA is additionally constrained by proximity to the historic power plant building. Shoring and dewatering will be required to accomplish relatively deep excavation depths in this area (12 to 15 ft bgs). The excavation will be offset from the foundation of the power plant building in order to reduce risk of it being undermined by excavation and affected by vibration. Design details are under development and will be included in the construction design documents.

3.3.2 Low-Lying Area

An 8-in. water line, part of a fire suppression network on NBF, has been identified to cross the LLA and terminate at a fire hydrant on KCIA property. It is anticipated that a shut-off valve will be installed on NBF as part of Boeing's site preparation activities. This will allow temporary removal of the portion of the pipe intersecting the proposed excavation prism. Temporary provisions for providing fire suppression coverage for the GTSP power plant will be determined as part of engineering design activities and coordination.

In the southeast corner of the LLA, the property line is located 5–6 ft to the inside of the blast fence between GTSP and KCIA. As described above, the property line delineates the extent of excavation work. Any construction in this area will be protective of the blast fence structure, which is to be left in place.

Additional utilities are known to exist on NBF, adjacent to planned excavations on GTSP. It is understood that Boeing is also in the process of developing a relocation plan for potentially affected utilities (e.g., natural gas and high pressure air) and that relocation work will be completed ahead of interim action construction activities, which are currently expected to occur simultaneously on the GTSP and Boeing-leased property.

3.4 SHORING AND DEWATERING

General soil and groundwater conditions include about 3–6 ft of fill overlying natural deposits primarily of fine to medium sand with varying amounts of non-plastic silt. Grain size analyses of natural soils indicate silt contents ranging from 5 percent to a high of 15 percent. Groundwater in the LLA ranges from about 8.5 to 9 ft NAVD88. With an excavation to an elevation of 5.5 ft NAVD88, there is 2.5 ft of water anticipated at the bottom of the removal area. In the FTA, the proposed excavation target ranges from 2 to 7 ft NAVD88 and up to 6 ft below the dry season water surface elevation in this area. The configurations of shoring and dewatering systems are interdependent and must be jointly designed.

The soil to be excavated is generally loose fine to medium sand to silty sand and is considered to be sensitive to groundwater pressure head and susceptible to strength loss during excavation. Sheet piles are proposed for shoring in the deeper excavations that extend below the groundwater table. The shoring will serve to stabilize the loose sandy soils adjacent to the targeted excavations, while also reducing the flow of groundwater into the excavations. Sheet pile installation does result in ground vibrations and ground settlement near the piles. Typical experience indicates that settlement is a maximum at the piles and decreases with distance away from the pile to nearly imperceptible around 15 ft away from the pile. Settlement due to ground vibrations in very loose soil can occur at greater distances away from the piling operations. Some interior pumping and dewatering is anticipated to facilitate excavation. However, a dry bottom surface is not considered practical, and excavation below water should be expected.

Wastewater generated by excavation dewatering, and gravity dewatering of stockpiled soils, will be collected, treated, and discharged to the sanitary sewer. It is anticipated that the treatment system will consist of an oil/water separator, a settling tank, a particulate filter to reduce suspended solids, and a granular activated carbon filter to reduce chemical contaminants to below allowable limits, as regulated by the King County Industrial Waste (KCIW) program in compliance with the Clean Water Act and the General Pretreatment Regulations (40 CFR Part 403). A Construction Dewatering Request form will be submitted to KCIW. Once the discharge permit has been approved, treated effluent will be discharged following the required sampling and analysis. Per the guidelines for dry season (May through October) discharges, the treated effluent discharge rate will not exceed the capacity of the available side sewer connection (estimated at 50 gpm). Using conservative assumptions of hydrogeologic conditions, the volume of water storage required for this project is preliminarily estimated to range between 40,000 and 60,000 gallons. Storage requirements will be further considered during design and influenced by weather, work schedule, and whether batch processing, or continuous-flow treatment systems are implemented.

3.5 SITE RESTORATION

Following excavation activities, and as part of backfilling work, the site will be regraded to improve onsite stormwater retention and infiltration. As part of this work, any portions of the FTA, SYA, and LLA that were not actively remediated will be stripped of existing surface soils to depths ranging from approximately 1 to 3 ft bgs. The exposed surface will be covered by a geotextile separation layer, prior to backfilling with clean import material to proposed grades. A minimum thickness of 1.5 ft clean import material, underlain by geotextile, will be installed across all areas where deeper soil contamination remains in place. This cover, together with institutional controls, will serve to protect direct exposure pathways from residual contamination.

A design for this work is currently under development; however, it is anticipated the site will be gently sloped (approximate 1 percent grades) to infiltration basins located along the southern and western sides of the current LLA. These basins will be separated from adjacent NBF and KCIA properties by berms, designed with sufficient freeboard to contain, at a minimum, a 100-year return interval design storm. The berms will additionally serve to limit run-on to the site. Preliminary plan and cross sections of this work are provided on Figures 3-2 and 3-3.

3.6 SOURCE CONTROL

Source control is the process of stopping or reducing the migration of known or suspected contamination from one area that could potentially contaminate or recontaminate another area. Source control for this interim action involves both efforts to ensure that contamination remaining on the site does not migrate offsite or to other areas of the site and efforts to ensure that offsite contaminants do not migrate and contaminate clean material brought onto the site.

3.6.1 Prevention of Offsite Contaminant Migration

3.6.1.1 Construction Activities

Prior to construction, a stormwater pollution prevention plan will be prepared to address all anticipated stormwater issues. The plan will include best management practices (BMPs) that will minimize stormwater entering an open excavation and that will prevent stormwater flow from resulting in offsite releases or contact with contaminated materials. Example BMPs include covering of stockpiled materials, catch basin filters, and silt fences.

It is anticipated that excavations will require dewatering to facilitate construction. All collected stormwater and/or groundwater will be treated onsite and discharged to a sanitary sewer as described in Section 3.4.

Construction will occur during the dry season and dust is likely to be generated from vehicular and heavy equipment activity. BMPs will be implemented by the contractor to suppress dust and prevent airborne releases, or tracking from the site. Example BMPs include routine watering of dry, exposed soils and vehicle/truck washes.

3.6.1.2 Groundwater

Removing the known PCB contamination in the subsurface soil of the LLA will reduce the likelihood of contaminants leaching into the groundwater. Post-remediation groundwater monitoring will identify any trends of groundwater contaminant concentrations in excess of cleanup levels. If groundwater contaminant concentrations become a concern after this interim action is completed, additional corrective measures will be reviewed.

3.6.1.3 Stormwater

The objective of the proposed site restoration work discussed in Section 3.5 will be to minimize offsite flow of stormwater and maximize onsite retention and infiltration of runoff from GTSP.

3.6.2 Potential Recontamination Pathways and Control

3.6.2.1 Stormwater

Historically, stormwater has been observed to flow onto the GTSP property during heavy rain events. This stormwater flow can potentially carry contaminated particulate matter that remains on the GTSP property, particularly due to ponding and settling in the southwest corner. Under the proposed site restoration plan, stormwater flow onto GTSP will be minimized through regrading of site topography.

3.6.2.2 Soil and Groundwater

The contractor will be required to implement BMPs to prevent recontamination of GTSP soils from soil stockpiling, dewatering, and loading activities. Dewatering is expected to temporarily change groundwater gradients, and pose potential for spreading contamination in groundwater. The work will be sequenced to minimize the spread of contamination to soils left in place and clean backfill materials. For example, areas with the highest levels of contamination will be excavated first (e.g., the FTA where free product has been observed in soils and the portions of the LLA containing concentrations of PCBs greater than 50 mg/kg). In addition, the use of sheet pile shoring for excavations below the groundwater table will assist in reducing flow of groundwater and associated spread of contamination.

As noted previously, construction activities at GTSP and NBF are currently planned to occur concurrently and in a coordinated fashion to substantially reduce the possibility of contaminants from one property moving to the other. Once the final excavation areas and depths across both properties are determined, the City will determine whether additional controls are needed to prevent recontamination of GTSP soils and groundwater. Sheet piling can be used to prevent soil and groundwater contaminants in adjacent offsite areas from migrating onto the remediated GTSP property. Permeable barriers with adsorbent activated carbon would also serve to prevent contaminants from flowing onsite or offsite without any appreciable restriction of groundwater flow. Decisions about potential source control actions will be finalized before implementation of this interim action.

3.7 PERMITS, APPROVALS, AND NOTIFICATION

In addition to Ecology and EPA (TSCA office) review and approval of this proposed interim action, other local, state, and federal approvals, notification, or permits that apply to the interim action include the following:

- Chapter 197-11 WAC. A State Environmental Policy Act (SEPA) checklist will be prepared and submitted for review.
- The design team is preparing a project-specific Stormwater Pollution Prevention Plan to be implemented by the selected remediation contractor. This plan will describe how stormwater management during interim action construction activities will comply with substantive requirements of Ecology's Construction Stormwater General Permit and the City of Seattle Grading Permit.
- 14 CFR §77.13. Federal Aviation Administration (FAA) form 7460-1 notifying the FAA of construction activities within federal approach/departure surfaces will be submitted a minimum of 30 days prior to commencement of construction.
- KCIW Program. A construction dewatering request form will be filed with KCIW a minimum of 30 days prior to commencement of construction for approval of construction wastewater discharge.

4 COMPLIANCE MONITORING

Compliance monitoring will be accomplished under TSCA guidelines for soils with PCB concentrations equal to or greater than 50 mg/kg and under MTCA for soils with PCB concentrations less than 50 mg/kg and for other COCs that exceed IALs. A portion of the compliance monitoring in areas with PCBs and TPH will be conducted prior to construction for the following reasons:

1. Sampling of vertical sidewalls in the FTA will not be possible due to the use of vertical shoring supports.
2. Sampling below the water table in the LLA and FTA will not be representative of actual site conditions due to construction-related disturbance (the soil is expected to have a soupy consistence despite water management controls).
3. Better definition of soils with PCBs exceeding 50 mg/kg prior to construction will facilitate the division of excavated soils into different stockpiles for disposal.
4. Preconstruction monitoring will minimize or prevent construction delays due to testing during construction.
5. Preconstruction monitoring will further inform the design process.

Additional compliance monitoring will be conducted during construction along accessible, dry excavation slopes. In addition, specific existing samples have been identified as providing compliance data. Thus, the compliance data set for soil will consist of existing data (Integral 2011a,b), new data collected in May 2011 (Figure 4-1, Tables 4-1 and 4-2), and new data collected during construction (Figure 4-1, Tables 4-1).

4.1 COMPLIANCE SAMPLING UNDER TSCA

As noted in Section 1, removal of soils with PCB concentrations equal to or greater than 50 mg/kg is being conducted under the risk-based procedures for the cleanup and disposal of PCB remediation waste [40 CFR § 761.61(c)]. Soils regulated under TSCA are located immediately adjacent to Boeing-leased property. As noted in Section 3, preconstruction compliance (i.e., verification) sampling was performed in May 2011 to ensure that all soil with PCBs exceeding 50 mg/kg will be removed and managed appropriately. During construction, additional compliance samples will be collected in accessible areas above the water table. The sampling design for samples collected during construction includes approximately 25-ft or smaller centers covering the excavation sloped sidewalls in accessible, dry areas without existing data.

Compliance soil samples collected during excavation will be collected from the exposed slope. Soil samples will be collected using a clean, stainless-steel spoon or similar hand tool and placed into 8-ounce glass sample jars, labeled, and stored on ice. A complete record of all significant field activities will be maintained. All recordkeeping will conform to 40 CFR § 761.61(a)(9) and 40 C.F.R § 761.125(c)(5). Documentation will include field logbooks, field sampling forms, photographs, sample labels, chain-of-custody forms, and project and data management file copies. Field logbooks will be used to record pertinent interim action soil removal activities. Confirmation sample locations will be photo-documented with a digital camera, with some identification of the sample location in the photograph. Sample possession and handling will be documented so that the sample is traceable from the time of sample collection, to the laboratory, and through data analysis.

4.2 COMPLIANCE MONITORING UNDER MTCA

MTCA defines three types of compliance monitoring (WAC 173-340-410(1)):

- **Protection monitoring—**confirms that human health and the environment are adequately protected during construction
- **Performance monitoring—**confirms that the IALs have been achieved
- **Confirmational monitoring—**confirms the long-term protectiveness of the interim action.

Protection monitoring will be performed visually during construction to ensure that dust and surface water are contained during remedy implementation. Performance soil sampling will include samples collected in 2010, in May 2011, and during construction as discussed in Section 4.2.1. A post-remedial confirmational groundwater monitoring program will also be conducted, as described in Section 4.2.2. Sample documentation and handling procedures are summarized briefly in Section 4.3.

4.2.1 Performance Monitoring

Performance monitoring will be conducted in the areas where soils are being removed to address non-TSCA PCB contamination, TPH contamination, and in one area metals contamination. Performance samples will target the sloped excavation sidewalls. As for the compliance sampling approach for TSCA soils, the performance sample data set will include samples collected in 2010, in May 2011, and during construction (Figure 4-1, Tables 4-1 and 4-2). In general, the new performance sampling locations sampled in May 2010 were selected to better define areas with soil exceeding PCB concentrations of 50 mg/kg (discussed in Section 4.1) and to obtain data in areas that will not be accessible during construction either because of shoring or because the location is below the water table. The sampling design for samples collected during construction includes approximately 25-ft or smaller centers covering the excavation sloped sidewalls in accessible, dry areas without existing data. Performance soil samples collected during the excavation will be collected from the exposed slope.

Performance soil sample results may be compared directly to the IALs or may be evaluated using a statistical approach consistent with WAC 173-340-740(7)(d). A minimum of 11 samples is required for a statistical approach. If it is determined that statistical analyses are appropriate, they will be conducted consistent with WAC 173-340-740(7)(d): the upper 95 percent confidence limit on the mean concentration may not exceed the IAL; fewer than 10 percent of the samples in the compliance data set may exceed the IAL; and the maximum result in the compliance data set may not be more than two times the IAL. The data set will be assumed to be normal unless distribution testing determines that it is not. If the data set is not normal, it will be assumed to be lognormal unless distribution testing determines that it is not. If the data set is not lognormal, nonparametric statistics will be used.

In the event that one of the new performance samples exceeds an IAL, or the evaluation using the statistical approach exceeds the IAL, a decision will be made whether to adjust the excavation footprint to capture the soils exceeding the IAL or to leave the soils in place beneath the cap that will cover the entire site. If the excavation prism is modified, additional performance monitoring samples may be collected during construction to update the soil performance data set and document remaining site conditions.

In the LLA, existing and planned performance sample locations for non-TSCA PCBs and TPH were selected to verify the proposed depth and lateral extent of the excavations and to document conditions remaining on site at the conclusion of remediation. The criterion for additional excavation to remove TPH-impacted soil will be performance sample results that exceed 2,000 mg/kg. The criterion for additional excavation of non-TSCA PCB-impacted soil will be performance sample results that exceed 0.5 mg/kg within the groundwater-impacted area or 1 mg/kg outside the groundwater-impacted area. Soils containing TPH in excess of 2,000 mg/kg are contained within the PCB excavation prism, so remediation for PCBs is expected to address TPH. Performance samples in the LLA in the vicinity of the TPH plume will be analyzed for TPH. In the event that excavation activities are terminated (e.g., due to practical constraints related to excavation depth) and the performance data set is out of compliance with the IAL, the performance sample data set will document COC concentrations remaining on site. The performance sample data set for the LLA is expected to consist of 12 samples, including both existing and planned samples, in the area subject to the 0.5 mg/kg IAL and 27 samples in the area subject to the 1 mg/kg IAL.

In the FTA, proposed performance soil samples for TPH were selected to verify the lateral and vertical extent of the proposed excavation prism. The criterion for additional excavation will be a performance sample TPH result exceeding 3,000 mg/kg. Because the steam plant building is situated on the northeast corner of the excavation, it may not be possible to achieve the IAL in that area. If this is the case, the performance samples collected in the vicinity of the building will document the TPH concentrations remaining on site. It is our understanding that Boeing plans to sample near the FTA; those data will be used to confirm the excavation depth along the FTA fence line. The performance sample data set for the FTA is expected to consist of eight or more samples, including both existing and planned samples.

A performance sample will be collected during construction along the western fence line in the area where several metals exceeded IALs to assess whether metals are elevated near the lateral extent of the excavation. If metals IALs are exceeded, no additional excavation will be performed and the exceedance(s) will be documented in the interim action completion report.

An archived sample collected from the base of the planned BaP TEQ excavation during the 2010 sampling event was analyzed to further delineate the depth of excavation in that area. No additional performance monitoring is proposed in areas of the south yard where the surface layer of soil will be removed to allow for stormwater control. In these areas, the soil surface will be clean fill overlying geotextile fabric. Existing data in the south yard will be used to document concentrations of COCs below the geotextile fabric. Future testing could be performed in this area if there is a reason to believe contaminants at depth require remediation or if a future construction activity is expected to disturb potentially contaminated soils.

4.2.2 Confirmational Monitoring

A groundwater monitoring plan will be submitted to Ecology for review after interim action construction is substantially complete.

4.3 SAMPLE COLLECTION, DOCUMENTATION, AND HANDLING

Field activities for the soil sample collection and handling will be conducted consistent with Integral (2010a). Performance (verification) soil samples collected during construction will be collected from the sloped excavation sidewall using a clean, stainless-steel spoon or similar hand tool. Soil samples will be placed into 8-ounce glass sample jars, labeled, and stored on ice.

Additional information about sample containers, preservation, and holding times can be found in Table 4-3. Information about analytical methods is provided in Table 4-4. Data quality objectives are provided in Table 4-5. As discussed previously, the chemicals for which performance soil samples will be analyzed are summarized in Table 4-2.

Quality control samples will include field split samples and equipment rinsate blanks. One field split will be sampled per 20 stations. Soil will be homogenized in a stainless steel bowl before being placed into separate, split sample containers. Field splits for TPH-gasoline range will be collected immediately after the sample intervals have been determined and placed into the appropriate containers without homogenization. Rinsate blanks will also be collected from non-dedicated soil sampling equipment at a rate of one per 20 samples.

A complete record of all significant field activities will be maintained. Documentation will include field logbooks, field sampling forms, photographs, sample labels, chain-of-custody forms, and project and data management file copies. Field logbooks will be used to record pertinent interim action soil removal activities. Performance (verification) sample locations will be photo-documented with a digital camera, with some identification of the sample location in the photograph. Sample possession and handling will be documented so that the sample is traceable from the time of sample collection, to the laboratory, and through data analysis.

5 HEALTH AND SAFETY

The interim action will be conducted according to WAC 173-340-810, the Occupational Safety and Health Act of 1970 (29 USC § 651 et seq.), the Washington Industrial Safety and Health Action (Chapter 49.17 Revised Code of Washington), and relevant regulations. A health and safety plan (HASP) is provided in Integral (2010) and will be followed for pre-construction sampling. It will be amended to address additional health and safety issues for Integral staff during construction. The contractor will also prepare a HASP for its operations prior to commencement of the interim action.

6 REPORTING

After the completion of the excavation activities, an interim action completion report will be prepared documenting the implementation of this work plan. The completion report will address the following items:

- Description of excavation activities and observations
- Date and time excavation activities were completed
- Final excavation locations, depth of excavation, and amount of soil removed
- Tables and figures summarizing compliance sampling results
- Laboratory data reports
- Waste disposal manifests.

7 SCHEDULE

The interim action is anticipated to be conducted in July through early October 2011 following regulatory approval, and the receipt of required permits, including EPA review/approval of the TSCA portion of this work plan for cleanup of PCB remediation waste and Ecology approval of this work plan as an interim action under the Agreed Order. Excavation activities are anticipated to require approximately 2 months to complete. All performance (verification) soil samples will be submitted to the laboratory on a requested 48-hour turnaround to expedite the excavation process, and minimize the amount of time excavations are required to be kept open. The interim action completion report will be submitted to Ecology 60 days after the receipt of as-built information from the contractor.

8 REFERENCES

Bridgewater. 2000. Preliminary assessment for the Seattle City Light Georgetown Steam Plant, Georgetown Steam Plant, Seattle, WA. Bridgewater Group. December 18.

Ecology. 2010. Interim Action – Schedule for Removal of Contaminated Soils at the Georgetown Steam Plant. North Boeing field/Georgetown Steam Plant Agreed Order No. DE5685. Letter from Mark Edens to Bill Devereaux. Washington State Department of Ecology, Bellevue, WA.

Edens, M. 2011. Personal communication (e-mail to J. Goldberg, City of Seattle, Seattle, WA, dated February 24, 2011, regarding TSCA coordination). Washington State Department of Ecology, Bellevue, WA.

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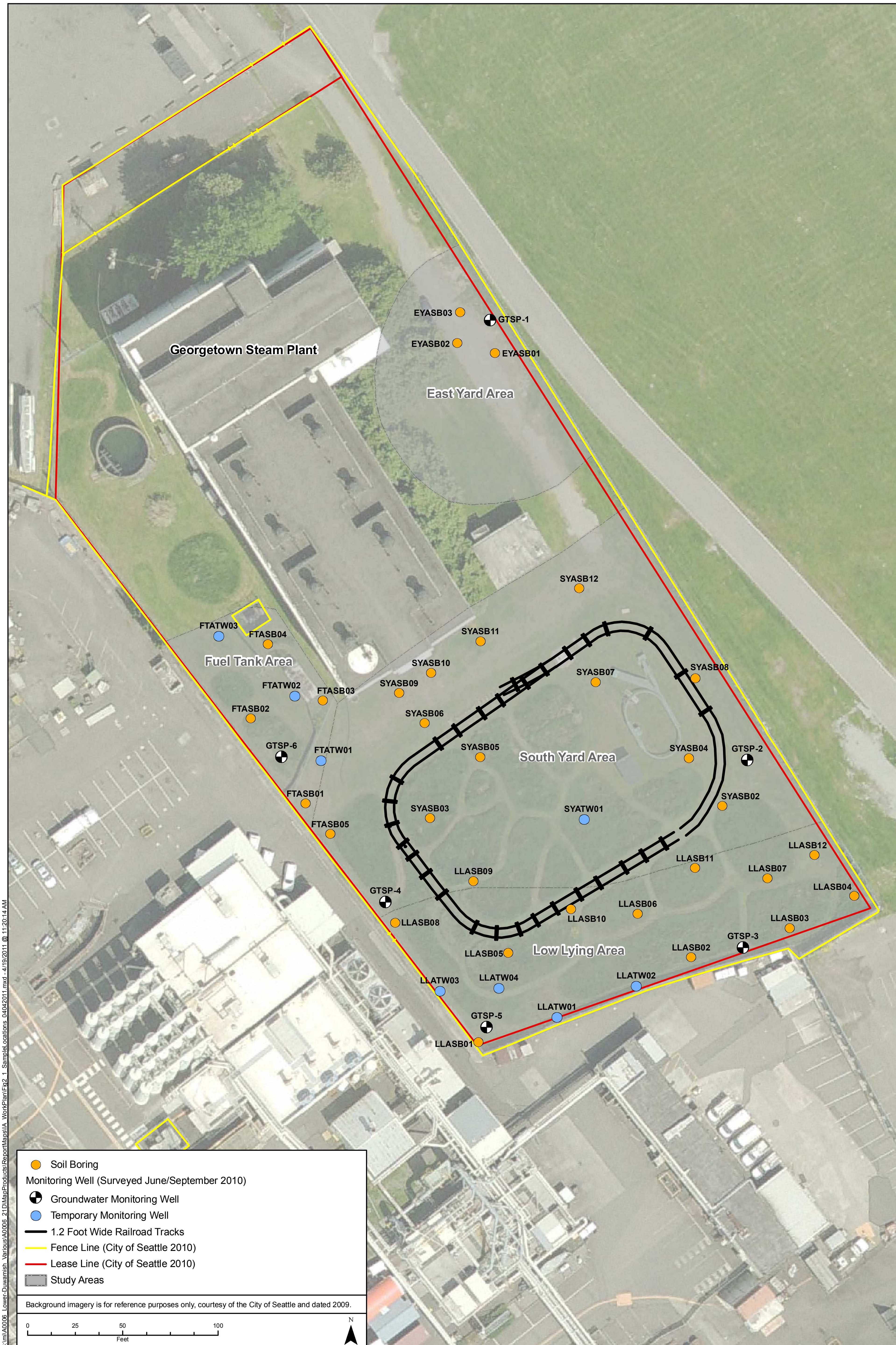
Integral. 2011a. Georgetown Steam Plant Interim Action: technical memorandum on data screening. March 25. Integral Consulting Inc., Seattle, WA.

Integral. 2011b. Georgetown Steam Plant, 2010 Site Characterization Data Report. April 1. Integral Consulting Inc., Seattle, WA.

FIGURES

Figure 1-1.
Georgetown Steam Plant Vicinity Map
Georgetown Steam Plant Site



S:\mi\A0006_Lower-Duwamish_Various\A0006_21D\MapProducts\ReportMaps\IA_WorkPlan\Fig2_1_SampleLocations_04042011.mxd - 4/19/2011 @ 11:20:14 AM

Figure 2-1.
Georgetown Steam Plant Site Layout
Georgetown Steam Plant Site

S:\mi\A0006 Lower-Duwamish Various\A0006 21D\MapProducts\ReportMaps\IA WorkPlan\Fig2 2 GWelevFeb07 04082011.mxd - 4/19/2011 @ 11:22:40 AM

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Figure 2-2.
Groundwater Elevation on February 28, 2007
Georgetown Steam Plant Site

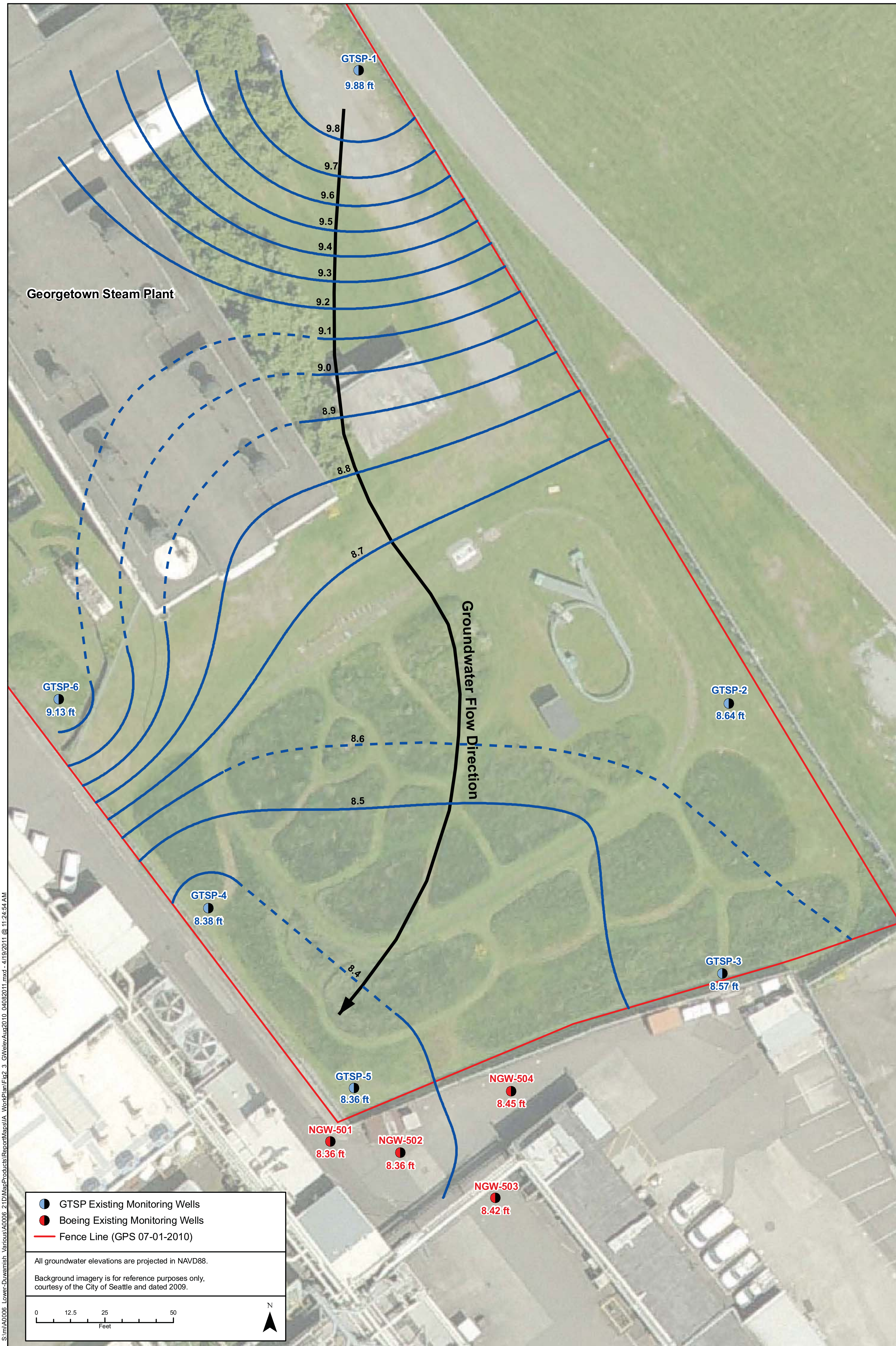

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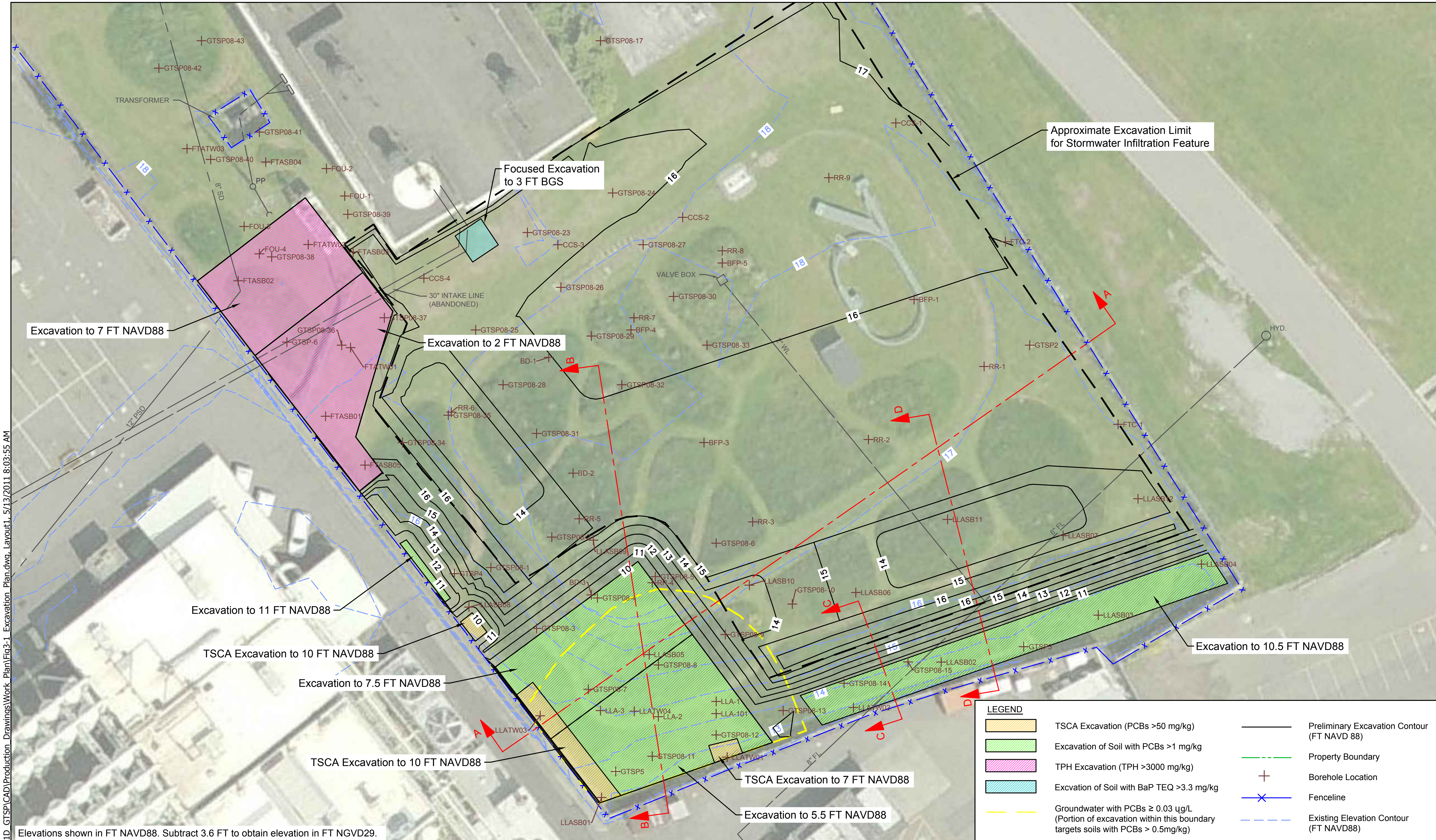
Figure 2-3.
Second Quarter 2010 Groundwater Elevation (August 30)
Georgetown Steam Plant Site



0 15 30 Feet

N

Figure 3-1.
Preliminary Excavation Plan
Georgetown Steam Plant Site

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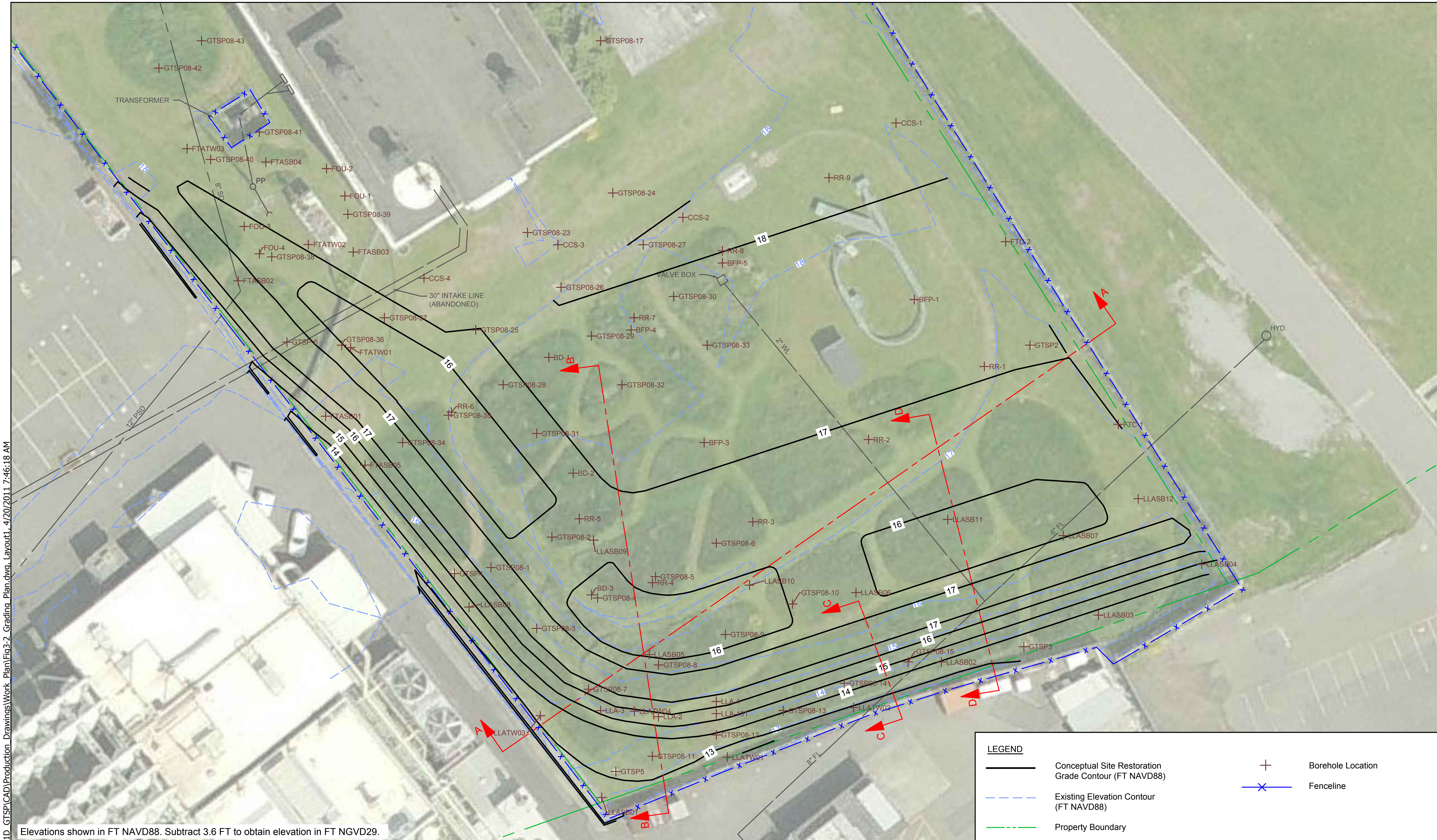

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0 15 30 Feet

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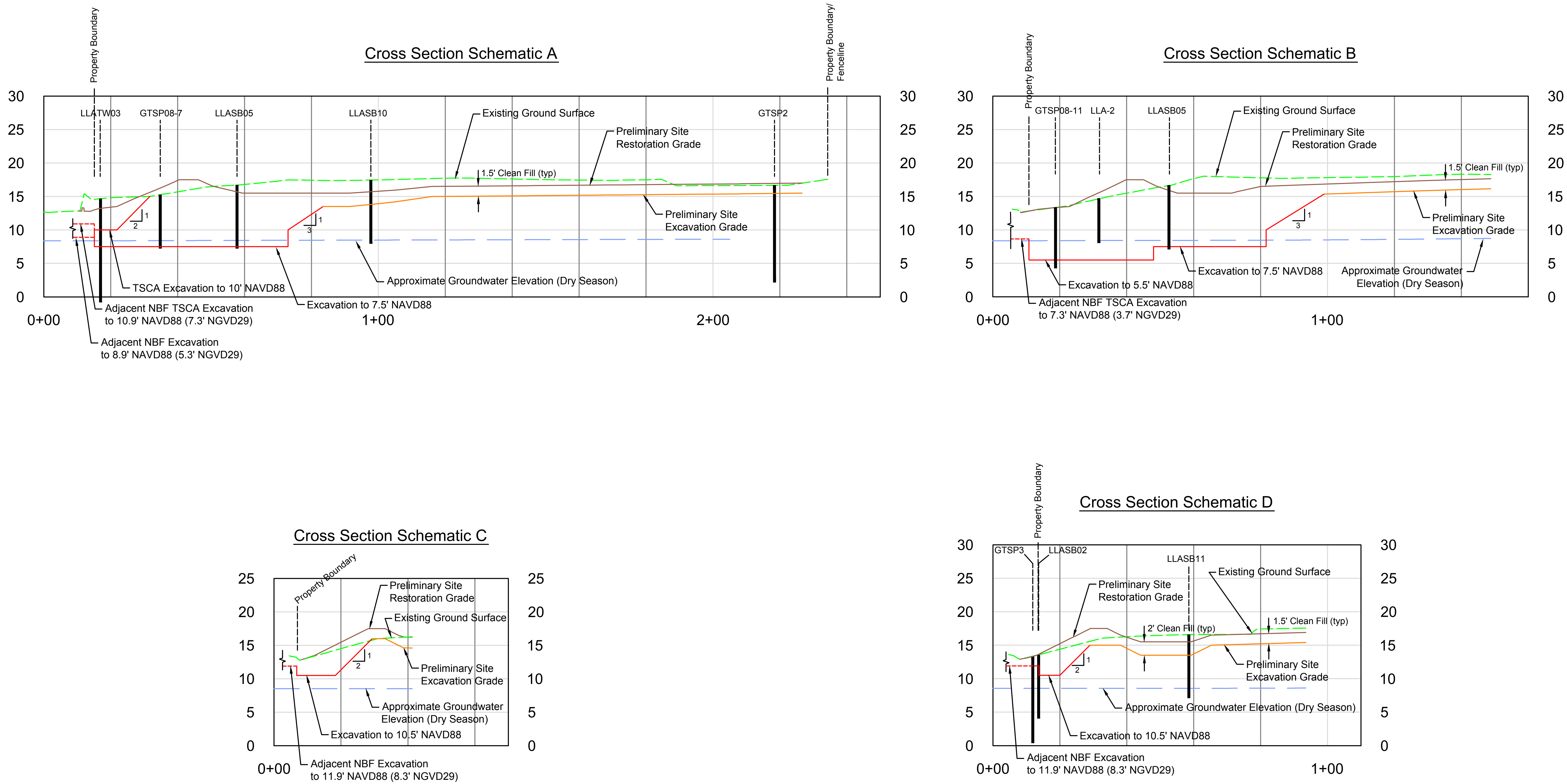
Figure 3-2.
Preliminary Site Restoration Grading Plan
Georgetown Steam Plant Site



Elevations shown in FT NAVD88. Subtract 3.6 FT to obtain elevation in FT NGVD29.

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0 15 30 Feet

2x Vertical Exaggeration

Figure 3-3.
Preliminary Excavation and Final Grading Section Schematics
Georgetown Steam Plant Site

P:\Projects\A000621D_GTSP\CAD\Production_Drawings\Work_Plan\Fig3-3_Cross_Sections.dwg, Sections, 5/12/2011 2:38:52 PM

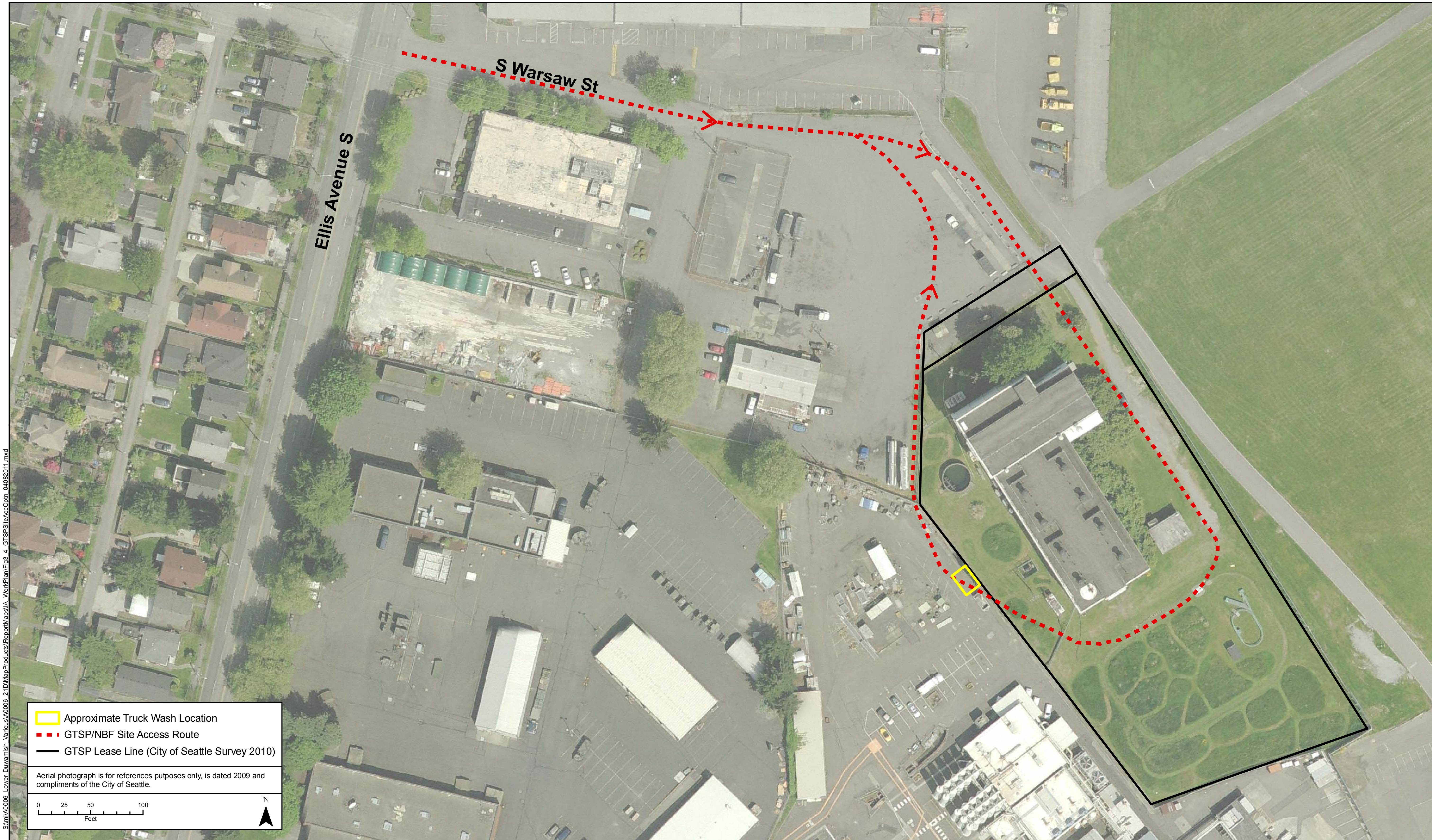

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Figure 3-4.
GTSP Site Access Route
Georgetown Steam Plant Site

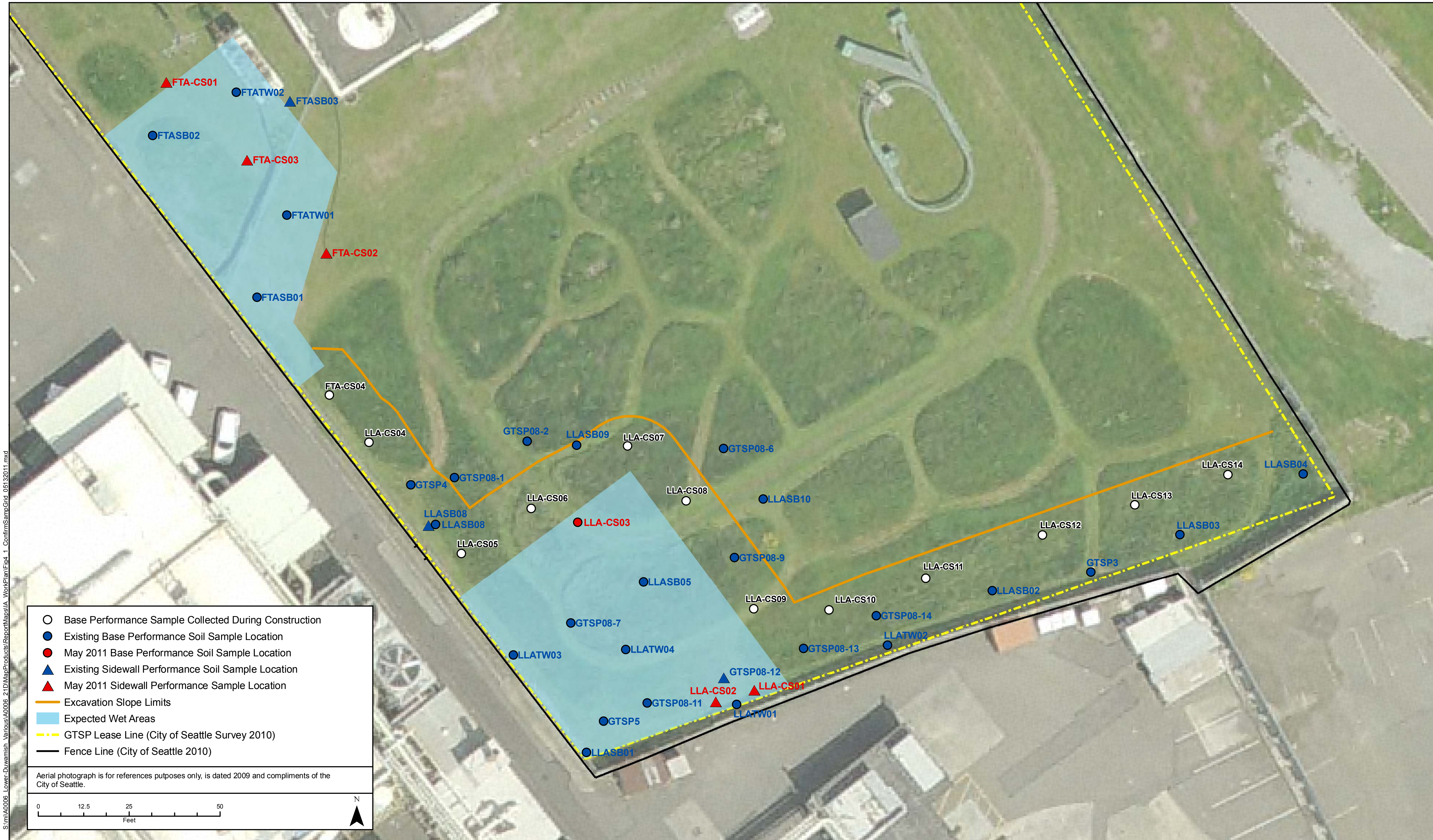

Figure 4-1
Compliance Sampling Plan
Georgetown Steam Plant Site

TABLES

Table 3-1. Interim Action Levels for Soil and Groundwater Chemicals of Concern

	Soil		Groundwater	
Chemical of Concern	IAL (mg/kg)	Basis	IAL (µg/L)	Basis
TCDD TEQ	TBD[a]	Awaiting results of Ecology urban background study	--	
Arsenic	20	Area-wide background	1.2	Natural background in surface water
Copper	550	Terrestrial ecological evaluation		
Lead	220	Terrestrial ecological evaluation		
Nickel	38	Leaching pathway	8.2	Protection of marine receptors in surface water
Zinc	570	Terrestrial ecological evaluation		
BaP TEQ	3.3	Typical urban concentrations	--	
PCBs	0.5 in groundwater-impacted area	Empirical leaching threshold	0.03	PQL
	1 in remainder of site	Direct contact with soil (TSCA)	--	
TPH	3,000 in fuel tank area	Method B direct contact	--	
	2,000 in remainder of site	Method B direct contact		
	Remove free product	Residual saturation limitation		

Notes:

[a] The IAL for dioxins/furans will be established following completion of an ongoing Washington State Department of Ecology study to measure soil dioxin concentrations in Seattle residential neighborhoods. This study will generate data that can be used to determine area background, which may affect determination of the IAL.

-- = not a chemical of concern for this medium or in this site area
BaP = benzo(a)pyrene
IAL = interim action level
PCB = polychlorinated biphenyl
PQL = practical quantitation limit
TBD = to be determined
TCDD = tetrachlorodibenzo-*p*-dioxin
TEQ = toxicity equivalent
TPH = total petroleum hydrocarbon

Table 4-1. Performance Soil Sample Locations

Borehole ID	Location	Excavation Depth (ft NAVD88)	Applicable Samples	Notes	PCB Analysis	TPH Analysis	Metals Analysis
Existing Sample Locations in Low Lying Area							
GTSP08-7	Flat base	7.5	Lowest sample depth 6-8 ft bgs = 9.3-7.3 ft NAVD88	Overlaps excavation/base, applicable because lowest depth meets IAL	X		
LLASB05	Flat base	7.5	Lowest sample depth 8-9.5 ft bgs = 8.6-7.1 ft NAVD88	Overlaps excavation/base, applicable because lowest depth meets IAL for PCBs; archived sample will be analyzed for TPH	X	Archived	
LLATW03	Flat base	10 (TSCA)	Samples with upper depth ≥ 5 ft bgs (≤ 9.8 ft NAVD88)		X	X	
	Flat base	7.5 (non-TSCA)	Samples with upper depth ≥ 6.5 ft bgs (≤ 8.3 ft NAVD88)	6.5-8 ft bgs sample overlaps non-TSCA excavation/base, applicable because it meets IAL	X	X	
GTSP08-11	Flat base	5.5	Lowest sample depth 7-9 ft bgs = 6.5-4.5 ft NAVD88	Overlaps excavation/base, applicable because lowest depth meets IAL	X		
GTSP5	Flat base	5.5	Samples with upper depth ≥ 8 ft bgs (≤ 5.5 ft NAVD88)		X	X	
LLATW04	Flat base	5.5	Samples with upper depth ≥ 9.5 ft bgs (≤ 5.5 ft NAVD88)		X		
LLASB01	Flat base	10 (TSCA)	Samples with upper depth ≥ 3.5 ft bgs (≤ 9.8 ft NAVD88)		X	X	
	Flat base	5.5 (non-TSCA)	Samples with upper depth ≥ 8 ft bgs (≤ 5.3 ft NAVD88)		X		
LLATW01	Flat base	7 (TSCA)	Samples with upper depth ≥ 5 ft bgs (≤ 7.5 ft NAVD88)	5-6.5 ft bgs sample overlaps TSCA excavation/base, applicable because it meets IAL	X	X	
	Flat base	5.5 (non-TSCA)	Samples with upper depth ≥ 6.5 ft bgs (≤ 6.0 ft NAVD88)	6.5-8 ft bgs sample overlaps non-TSCA excavation/base, applicable because it meets IAL	X	X	
GTSP08-12	Sidewall (TSCA)	7	Sample depth 6-8 ft bgs = 7.5-5.5 ft NAVD88	~3 ft from excavation area; overlaps excavation sidewall/below excavation, applicable because it meets IAL	X		

Table 4-1. Performance Soil Sample Locations

Borehole ID	Location	Excavation Depth (ft NAVD88)	Applicable Samples	Notes	PCB Analysis	TPH Analysis	Metals Analysis
GTSP08-2	Sloped base	~15	Sample depth 3-5 ft bgs = 14.9-12.9 ft NAVD88		X		
LLASB09	Sloped base	~12	Samples with upper depth ≥ 5 ft bgs (≥ 12.8 ft NAVD88)	5-6.5 ft bgs sample overlaps excavation/base and is slightly >1 mg/kg; 6.5-8 ft bgs sample is approximately 0.5 mg/kg	X	X	
GTSP08-6	Sloped base	~15.5	Sample depth 5-6 ft bgs = 12.9-11.9 ft NAVD88	Sample is below excavation base but meets IAL	X		
LLASB10	Sloped base	~15.5	Samples with upper depth ≥ 2 ft bgs (≤ 15.0 ft NAVD88)		X	X	
GTSP08-9	Sloped base	~8	Lowest sample depth 7-9 ft bgs = 9.5-7.5 ft NAVD88	Overlaps excavation/base, applicable because lowest depth meets IAL	X		
GTSP08-13	Sloped base	~8.5	Sample depths 3-5 ft bgs and 7-9 ft bgs = 10.8-8.8 ft NAVD88 and 6.8-4.8 ft NAVD88	Lowest sample is below excavation base, but both samples meet IAL	X		
LLASB08	Sloped base (non-TSCA)	~11.5	Samples with upper depth ≥3.5 ft bgs (≥ 11.9 ft NAVD88)		X	X	
	Sidewall (TSCA)	10	Samples with lower depth ≤ 5 ft bgs (≥ 10.3 ft NAVD88)	Elevated PCB concentrations at surface, but will be removed	X	X	
GTSP4	Sloped base	~12.5	Samples with upper depth ≥ 4.5 ft bgs (≥ 11.0 ft NAVD88)	Uppermost sample is below excavation base, but all samples meet IAL	X		
GTSP08-1	Sloped base	~16	Sample depth 3-5 ft bgs = 13.2-11.2 ft NAVD88	Sample is below excavation base but meets IAL	X		
GTSP08-14	Base	10.5	Sample depth 6-8 ft bgs = 8.1-6.1 ft NAVD88	Sample is below excavation base but meets IAL	X		
LLATW02	Base	10.5	Samples with upper depth ≤ 2 ft bgs (≥ 10.9 ft NAVD88)	Overlaps excavation/base, applicable because lowest depth meets IAL	X	X	
LLASB02	Base	10.5	Samples with upper depth ≤ 2 ft bgs (≥ 11.7 ft NAVD88)	2-3.5 ft bgs sample overlaps excavation/base, applicable because it meets IAL	X	X	

Table 4-1. Performance Soil Sample Locations

Borehole ID	Location	Excavation Depth (ft NAVD88)	Applicable Samples	Notes	PCB Analysis	TPH Analysis	Metals Analysis
GTSP3	Base	10.5	Sample depths 0-3 ft bgs and 4-6 ft bgs = 13.4-10.4 ft NAVD88 and 9.4-7.4 ft NAVD88	0-3 ft bgs sample slightly overlaps excavation/base and is >1 mg/kg; 4-6 ft bgs sample is below excavation base, but sample meets IAL	X		
LLASB03	Base	10.5	Samples with upper depth ≤ 2 ft bgs (≥ 11.3 ft NAVD88)	2-3.5 ft bgs sample overlaps excavation/base, applicable because it meets IAL	X	X	
LLASB04	Base	10.5	Samples with upper depth ≤ 3.5 ft bgs (≥ 10.7 ft NAVD88)		X	X	
Planned Sample Locations in Low Lying Area							
LLA-CS01	Sidewall		Mid-point along east boundary of 7 ft NAVD88 TSCA excavation	Details in Table 4-2	X	X	
LLA-CS02	Sidewall		Mid-point along west boundary of 7 ft NAVD88 TSCA excavation	Details in Table 4-2	X	X	
LLA-CS03	Base		Mid-point near northwest boundary of 7.5 ft NAVD88 non-TSCA excavation	Details in Table 4-2	X	X	
LLA-CS04, -CS05, -CS10, -CS11, -CS12, -CS13, -CS14	Base	excavation slope surface		Collected during construction, TPH not expected in these areas based on existing data	X		
LLA-CS06, -CS07, -CS08, -CS09	Base	excavation slope surface		Collected during construction, near TPH plume in LLA	X	X	
Existing Sample Locations in Fuel Tank Area							
FTASB02	Base	7	Lowest sample depth 9.5-11 ft bgs = 8.0-6.5 ft NAVD88	Overlaps excavation/base, applicable because it meets IAL		X	
FTATW02	Base	7	Lowest sample depth 9.5-11 ft bgs = 8.1-6.6 ft NAVD88	Overlaps excavation/base, applicable because it meets IAL		X	

Table 4-1. Performance Soil Sample Locations

Borehole ID	Location	Excavation Depth (ft NAVD88)	Applicable Samples	Notes	PCB Analysis	TPH Analysis	Metals Analysis
FTASB01	Base	2	Lowest sample depth 14-15.5 ft bgs = 2.9-1.4 ft NAVD88	Overlaps excavation/base, applicable because it meets IAL		X	
FTATW01	Base	2	Sample depths 14-15.5 ft bgs and 17-18.5 ft bgs = 3.3-1.8 ft and 0.3–1.2 ft NAVD88	14-15.5 ft bgs sample overlaps excavation/base, applicable because it meets IAL; 17-18.5 ft bgs sample is below excavation base, but sample meets IAL		X	
FTASB03	Sidewall	7	Sample depths 0-0.5 ft, 6.5-8 ft, 8-9.5, 9.5-11 ft bgs = 17.3-16.8 ft, 10.8-9.3 ft, 9.3-7.8 ft, 7.8-6.3 ft NAVD88			X	
Planned Sample Locations in Fuel Tank Area							
FTA-CS01	Sidewall		Mid-point along northwest boundary	Details in Table 4-2		X	
FTA-CS02	Sidewall		Mid-point along east boundary	Details in Table 4-2		X	
FTA-CS03	Sidewall		Mid-point along boundary delineating 2 and 7 ft NAVD88 excavations	Details in Table 4-2		X	
FTA-CS04	Base	excavation slope surface		Collected during construction, TPH not expected at this location based on results from FTASB05			X

Notes:

bgs = below ground surface

IAL = interim action level

NAVD88 = North American Vertical Datum of 1988

PCB = polychlorinated biphenyl

TPH = total petroleum hydrocarbon

TSCA = Toxic Substances Control Act

X = sample to be tested for this analyte

Table 4-2. Performance Soil Sample Testing for Samples Collected in May 2011

Station	Depth (ft bgs)	TPH	PCBs	Preliminary Depth of Excavation (ft bgs)	Nearby PCBs > IAL (ft bgs)	Nearby TPH > IAL (ft bgs)	Notes
FTA-CS01	0–0.5						North sidewall for FTA excavation
	0.5–2.0						
	2.0–3.5						
	3.5-5.0						
	5.0–6.5						
	6.5–8.0	A					
	8.0–9.5	X				FTASB02, FTATW02	Depth unbounded at both locations
	9.5–11.0	X		10.5			
	11.0–12.5	X					
	12.5-14	A					
	14-15.5	A					
FTA-CS02	0–0.5						Southeast sidewall for FTA excavation
	0.5–2						
	2–3.5						
	3.5–5						
	5–6.5	X					
	6.5–8	A				FTASB01, FTATW01	
	8–9.5	X				FTASB01, FTATW01	
	9.5–11	A				FTASB01, FTATW01	
	11–12.5	X				FTATW01	
	12.5–14	A				FTATW01	Depth unbounded at FTATW01
	14-15.5	X		15			
	15.5-17	X					
	17-18.5	A					
	18.5-20	A					
FTA-CS03	0–0.5						Sidewall sample for boundary delineating 2 ft and 7 ft NAVD88 excavations
	0.5–2						
	2–3.5						
	3.5–5						
	5–6.5						
	6.5–8	A					
	8–9.5	X				GTSP6	
	9.5–11	A		10.5		FTATW01, GTSP6	Excavation to 10.5 ft bgs to north of sample location
	11–12.5	X				FTATW01, GTSP6	
	12.5–14	A				FTATW01	Depth unbounded at FTATW01
	14-15.5	X		15.5			Excavation to 15.5 ft bgs to south of sample location
	15.5-17	X					
	17-18.5	A					
	18.5-20	A					
LLA-CS01	0–0.5				LLATW01		Side-wall sample for TSCA material at 3.5-5 ft bgs
	0.5–2						
	2–3.5		A				

Table 4-2. Performance Soil Sample Testing for Samples Collected in May 2011

Station	Depth (ft bgs)	TPH	PCBs	Preliminary Depth of Excavation (ft bgs)	Nearby PCBs > IAL (ft bgs)	Nearby TPH > IAL (ft bgs)	Notes
	3.5–5		A		LLATW01		TSCA material
	5–6.5		X	6	LLATW01		Depth bounded for PCBs above IAL
	6.5-8		X				
	8-9.5		A				
	9.5-11		A				
LLA-CS02	0–0.5				LLATW01		Side-wall sample for TSCA material at 3.5-5 ft bgs
	0.5–2						
	2–3.5		A				
	3.5–5		A		LLATW01		TSCA material
	5–6.5		X	6	LLATW01		Depth bounded for PCBs above IAL
	6.5-8		X				
	8-9.5		A				
	9.5-11		A				
LLA-CS03	0–0.5						Base sample for PCBs and TPH
	0.5–2						
	2–3.5				LLASB05		
	3.5–5				LLASB05		
	5–6.5				LLASB05, LLASB09		
	6.5–8	A	A		LIASB05	LLASB05	
	8–9.5	X	X	9.5	LLASB05		Depth bounded for both PCBs and TPH
	9.5–11	X	X				
	11–12.5	A	A				
	12.5–14	A	A				

Notes

Field splits and field blanks (equipment rinsate samples) will be collected at a frequency of 1 per 20 field samples.
Sample total is dependent on field observations, screening, and the number of samples exceeding screening levels.
Sample locations may be adjusted dependent on field observations.
Analytical methods shown in Table 4-4.

A = archived sample
ft bgs = feet below ground surface
IAL = interim action level
NAVD88 = North American vertical datum 1988
PCBs = total polychlorinated biphenyls
TPH = total petroleum hydrocarbons
TSCA = Toxic Substances Control Act
X = analyzed sample

Table 4-3. Soil Sample Containers, Preservation, Holding Times, and Sample Volume Requirements

	Containers[a]				Archive	
Analysis	Type	Size	Preservation	Holding Time	Holding Time[b]	Sample Size
Field Screening						
(PID/FID + sheen test)	Plastic bag	1 oz	NA	NA	NA	1 g
Geotechnical Testing						
Grain size	Plastic bag	1 gallon	4±2ºC	6 months	NA	300 g
Chemical Testing						
TPH - gasoline range	EPA 5035 sample kit[c]		No headspace, 4±2ºC	14 days	NA	5 g
TPH - diesel- and oil-range	WMG	8 oz	4±2ºC	14 days/40 days[d]	1 year	20 g
PCB Aroclors			4±2ºC	14 days/40 days[d]	1 year	30 g
As, Cu, Pb, Ni, Zn	WMG	4 oz	4±2ºC	6 months[e]	2 years	10 g
Archive only						
Multiple	WMG	16 oz	-20ºC	NA	1-2 years	NA

Notes:

[a] Size and number of containers may be modified by analytical laboratory.
[b] Selected samples will be archived (frozen, -20 C) after sample collection. Archive holding time depends on method of analysis.
[c] Encore type containers as indicated for field preservation of volatiles as per EPA Method 5035.
[d] Holding time is 14 days to extraction and extracts must be analyzed within 40 days from extraction.
[e] Metals (except mercury) may be held at -20ºC for 2 years (PSEP 1986).

As = arsenic
Cu = copper
Pb = lead
NA = not applicable
Ni = nickel
PID/FID = photoionization detection/flame ionization detection
PCB -= polychlorinated biphenyl
TPH = total petroleum hydrocarbons
WMG = wide mouth jar
Zn = zinc

Table 4-4. Soil Analytical Methods

		Sample Preparation		Quantitative Analysis	
Analytes	Laboratory	Protocol	Procedure	Protocol	Procedure
Geotechnical Testing					
Grain size	ARI	NA	--	ASTM D422-63	Sieve and hydrometer
Petroleum Hydrocarbons					
Gasoline-range hydrocarbons	ARI	EPA SW846-5035/NW-TPHGx	Field preserved Purge and trap	NWTPH-Gx (Ecology 1997)	GC/FID
Diesel- and oil-range hydrocarbons	ARI	NWTPH-Dx (Ecology 1997)	Solvent extraction Silica gel cleanup (as needed)	NWTPH-Dx (Ecology 1997)	GC/FID
PCB Aroclors	ARI	EPA SW846-3540C / 3550C	Soxhlet / Sonication	EPA SW846-8082	Dual column GC/ECD
		EPA SW846-3665A	Sulfuric acid cleanup [a]		
		EPA SW846-3630C	Silica Gel Cleanup [a]		
		EPA SW846-3660B	Sulfur cleanup (mod to use mercury) [a]		
Metals					
As, Cu, Pb, Ni, Zn	ARI	EPA SW846-3050	Strong acid digestion	EPA SW846-6010	ICP/AES

Notes:

ARI = Analytical Resources, Incorporated

As = arsenic
Cu = copper
GC/ECD = gas chromatography/electron-capture detector
GC/FID = gas chromatography/flame-ionization detector
ICP/AES = inductively coupled plasma/atomic emission spectrometry
Pb = lead
Ni = nickel
Zn = zinc

[a] Cleanup procedures will be performed as necessary to achieve the method reporting limits and method detection limits consistent with the IALs listed in Table 4-1.

ASTM. 2009. Annual book of ASTM standards. Volume 04.08. American Society for Testing and Materials, Philadelphia, PA.

Ecology. 1997. Analytical Methods for Petroleum Hydrocarbons. ECY 97-602. Washington State Department of Ecology Toxics Cleanup Program and the Ecology Environmental Laboratory, Olympia, WA.

EPA SW-846: USEPA. 2008. SW-846 On-line, Test Methods for Evaluating Solid Waste - Physical/Chemical Methods. U.S. Environmental Protection Agency. http://www.epa.gov/epaoswer/hazwaste/test/main.htm. (Accessed December 28, 2009).

Table 4-5. Soil Data Quality Objectives

Analysis	Units	Laboratory MDL	Laboratory MRL	Precision (RPD)	Bias (%)	Completeness (%)
Geotechnical Testing						
Grain size	percent	NA	0.1	± 20	NA	95
Petroleum hydrocarbons						
Gasoline-range hydrocarbons (toluene - naphthalene)	mg/kg - dry wt.	2.39	5	± 40	74 - 124	95
Diesel-range hydrocarbons (nC12-nC24)	mg/kg - dry wt.	0.297	5	± 40	55 -104	95
Oil-range hydrocarbons (nC24-nC38)	mg/kg - dry wt.	0.694	10	± 40	NA	95
PCB Aroclors						
Aroclor 1016	µg/kg - dry wt.	24.4	100	± 40	30-160	95
Aroclor 1221	µg/kg - dry wt.	NA	100	± 40	30-160	95
Aroclor 1232	µg/kg - dry wt.	NA	100	± 40	30-160	95
Aroclor 1242	µg/kg - dry wt.	NA	100	± 40	30-160	95
Aroclor 1248	µg/kg - dry wt.	NA	100	± 40	30-160	95
Aroclor 1254	µg/kg - dry wt.	NA	100	± 40	30-160	95
Aroclor 1260	µg/kg - dry wt.	30.3	100	± 40	30-160	95
Aroclor 1262	µg/kg - dry wt.	NA	100	± 40	30-160	95
Aroclor 1268	µg/kg - dry wt.	NA	100	± 40	30-160	95
Metals						
Arsenic	mg/kg - dry wt.	0.198	5.0	± 20	75 - 125	95
Copper	mg/kg - dry wt.	0.063	0.2	± 20	75 - 125	95
Lead	mg/kg - dry wt.	0.307	2.0	± 20	75 - 125	95
Nickel	mg/kg - dry wt.	0.245	1.0	± 20	75 - 125	95
Zinc	mg/kg - dry wt.	0.61	1.0	± 20	75 - 125	95

Notes:

Control limits and method detection limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the limits shown in this table.

MDL = method detection limit
MRL = method reporting limit
RPD = relative percent difference
NA = not applicable