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Long Term Groundwater Monitoring Plan South Tacoma Field Former UST Site

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Prepared for

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List of Acronyms and Abbreviations

bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylene
COC	chemicals of concern
Ecology	Washington State Department of Ecology
EIM	Electronic Information Management
EPA	Environmental Protection Agency
IDW	Investigation derived waste
mg/kg	milligrams per kilogram
Monitoring Plan	Long Term Groundwater Monitoring Plan
MTCA	Model Toxics Control Act
MW	monitoring well
QA/QC	quality assurance/quality control
RC	Restrictive Covenant
SI/AA	Supplemental Investigation and Alternatives Analyses
Site	South Tacoma Field former Underground Storage Tank site
STF	South Tacoma Field
TPH	total petroleum hydrocarbons
UST	underground storage tank
VCP	Voluntary Cleanup Program

Section 1: Introduction

This document presents the Long Term Groundwater Monitoring Plan (Monitoring Plan) for the South Tacoma Field former Underground Storage Tank (UST) site (Site) located northeast of the terminus of Burlington Way in the southwestern section of the City of Tacoma, Washington. Investigation and cleanup activities have been conducted at the Site under the Washington State Department of Ecology's (Ecology) Voluntary Cleanup Program (VCP) (VCP No. SW0168). The Monitoring Plan is required as part of the Restrictive Covenant (RC) proposed for soil and groundwater at the Site.

1.1 Purpose and Objectives

The purpose of long term groundwater monitoring at the Site is to evaluate potential changes to groundwater quality in the vicinity of the former UST as the result of historic releases of petroleum hydrocarbons to soil and groundwater. Extensive soil removal activities were conducted following discovery and removal of the UST in 1999; however, residual hydrocarbons remain in soil below a depth of 15 feet. Groundwater has been monitored in the vicinity for over 12 years, with no appreciable changes in groundwater quality. One groundwater monitoring well in the source area continues to show concentrations of total petroleum hydrocarbons (TPH) slightly in excess of Model Toxics Control Act (MTCA) cleanup levels. Occasional exceedances of MTCA cleanup levels have been observed in groundwater from two downgradient wells; however, no exceedances have been reported in groundwater from these wells since 2004. Residual soil contamination is expected to remain an ongoing source of TPH in groundwater; however, groundwater quality has been relatively consistent for over 12 years.

The characteristics of the groundwater aquifer beneath the site are favorable to natural attenuation and exceedances to MTCA cleanup levels have been limited to the one well in the source area. The existing monitoring well network will allow observation of potentially changing groundwater conditions. A monitoring schedule of once annually for three years (which will result in nearly 15 years of annual data), followed by every 18 months is proposed, with monitoring events occurring in late summer and late winter, on a rotating, every other year basis. The 18 month frequency will allow monitoring during two different seasons, one when the City's groundwater wells may be operational and one when groundwater levels may be higher due to seasonal rainfall.

Long term monitoring will continue until cleanup levels are consistently achieved, or until Ecology approves discontinuation based on additional information that may become available.

Section 2: Background

The South Tacoma Field (STF) Superfund Site (STF Superfund Site) is an approximately 300-acre former industrial property that is located in the southwestern section of the City of Tacoma. The STF Superfund Site was remediated in 1998/1999 under the purview of the U. S. Environmental Protection Agency (EPA). Once covered with industrial structures, the STF Superfund Site is now a mostly open field of grass with a few commercial facilities. The STF UST Site is located approximately 850 feet north-northeast of the end of Burlington Way. The STF Superfund Site location map and STF features map (including the location of the former UST) are included as Figures 1 and 2, respectively. Figure 3 provides the location of the former UST, the limits of the prior excavation, and the existing monitoring well network. Table 1 provides monitoring well location and elevation information.

2.1 Investigation, Remediation, and Monitoring History

The former UST was discovered in August 1998 during excavation activities for other remedial actions associated with the STF Superfund Site. The UST had a volume of approximately 9,000 gallons and was partially filled with water and residual petroleum hydrocarbons. Soil containing petroleum hydrocarbons was also encountered in the UST vicinity. The UST was removed, and petroleum-containing soil was excavated to the maximum extent practicable in two stages. An area measuring approximately 150 feet by 120 feet was excavated to a depth of approximately 12 to 14 feet below ground surface (bgs), and an additional area of soil staining was excavated to the maximum depth possible until soil stability issues prevented additional excavation. This depth was approximately 24 feet bgs (referenced as the “floor” in sampling records), and the deepest point of excavation was near the water table, at approximately 38 feet bgs. Due to excavation instability, it was not possible to remove all of the petroleum hydrocarbon-containing soil.

During excavation, approximately 8,000 cubic yards of soil were removed. Of this amount, approximately 3,000 cubic yards contained concentrations of TPH above the MTCA cleanup level of 2000 milligrams per kilogram (mg/kg) for unrestricted land uses and was disposed offsite. The remaining 5,000 cubic yards did not contain elevated concentrations of TPH and was used as part of the backfill for the excavation. In the post-excavation soil samples, diesel- and gasoline-range petroleum hydrocarbon compounds were detected at maximum concentrations of 26,000 mg/kg diesel fuel, 2,500 mg/kg oil, and 960 mg/kg gasoline. The most elevated levels were present from the northern floor and sidewalls of the excavation, from depths between 22 and 28 feet bgs.

The following summarizes investigative activities following UST removal activities at the Site:

- Soil boring and monitoring well sampling - additional site characterization was performed in June and July 2000, including advancing 12 hollow stem auger borings, collection of reconnaissance groundwater samples, construction of five groundwater monitoring wells and collecting groundwater samples from the wells. Findings of the 2000 site characterization were documented in the *Soil and Groundwater Characterization Report, South Tacoma Field Site Former UST Area* (Kennedy/Jenks Consultants 2001).

- Supplemental Investigation and Alternatives Analysis (SI/AA) – A supplemental investigation and remedial alternative analysis was performed in 2009 and 2010 following a Work Plan reviewed by Ecology. In summary, the scope of the supplemental investigation included installation of additional soil borings and soil sampling to better access the vertical and lateral extent of residual soil contamination, installation and sampling on one additional monitoring well (MW-6) and evaluation of the existing and new data. The alternative analysis followed the MTCA process to develop cleanup standards, as well as to identify and evaluate remedial alternatives utilizing the MTCA threshold and balancing criteria (including a disproportionate cost analysis). The evaluation concluded that it was impractical to remove residual TPH in soil and groundwater at the Site. The results of these investigations are presented in the *Supplemental Investigation and Alternatives Analyses Report, South Tacoma Field Former UST Site* (Kennedy/Jenks Consultants 2011).

- Annual groundwater monitoring - Twelve groundwater sampling events were performed using the five monitoring wells from 1999 through 2008. The results show frequent detections above MTCA Method A groundwater cleanup levels in well MW-1, for TPH as gasoline, as diesel, and occasionally as heavy oil. Benzene, toluene, ethylbenzene, xylene (BTEX) compounds were detected frequently in well MW-1, but did not exceed MTCA cleanup levels. TPH as diesel was detected three times in well MW-2, with one detection exceeding the cleanup level. TPH as diesel was detected eight times in well MW-4, with two detections exceeding the cleanup level. Benzene was detected once in well MW-2, and xylenes once in well MW-3, but neither detection exceeded the cleanup level. There have been no detections of any petroleum hydrocarbons in MW-2 or MW-4 since 2006 and heavy oil has not been detected in MW-1 since 2008. The results of these analyses are summarized in the *Supplemental Investigation and Alternatives Analyses Report* referenced above.

Section 3: Constituents of Concern and Point of Compliance

This section presents a summary of the constituents of concern (COC) in groundwater, cleanup levels, and conditional points of compliance.

3.1 Constituents of Concern

TPH (gasoline, diesel, and heavy oil) are the COCs at the site. Low levels of petroleum related constituents have historically been detected but at concentrations below MTCA cleanup levels.

3.2 Groundwater Cleanup Levels

MTCA Method A groundwater cleanup levels for TPH include:

TPH-Gx: 0.8 mg/L (1.0 mg/L if benzene is not present)

TPH-Dx: 0.5 mg/L

TPH-oil: 0.5 mg/L

The SI/AA demonstrated that active remediation of residual TPH in soil and groundwater is impractical. Since residual TPH is present above MTCA cleanup levels in both soil and groundwater, a combination of use restrictions and monitoring will be employed to address residual TPH at the site. These measures will be described in the restrictive covenant for the Site.

Typically, the point of compliance with cleanup levels is throughout the site. However, a conditional point of compliance can be established if cleanup to cleanup levels throughout the site are impractical. Based on investigations and ongoing monitoring of the site over the past 12 years, it is clear that site conditions are stable and that TPH is not expected to migrate beyond the current monitoring well network at concentrations above MTCA cleanup levels. Ongoing monitoring will provide a mechanism to evaluate potential changes to site conditions.

3.3 Conditional Points of Compliance

The conditional point of compliance is the point where cleanup levels established for the site are to be achieved. The proposed conditional point of compliance for this Site are the boundaries of the Pierce County tax parcel (Parcel No. 0220131132) where the Site is located. This parcel is a smaller parcel within the overall BNSF property and STF site. The existing groundwater monitoring well network can serve to monitor changes in groundwater quality and are within the tax parcel.

3.4 Contingency

Upon receipt of analytical data for each long term groundwater monitoring event, the data will be evaluated against the cleanup level. If the TPH concentrations exceed the cleanup level in any of the wells located outside the source area (i.e., MW-2 through MW-6), the monitoring well from which that sample was collected will be re-sampled for re-analysis of TPH. If the result of the

sample collected during the re-sample event indicates that the TPH concentrations exceed the cleanup level, an evaluation of potential further action will be conducted. Further action may include collection of reconnaissance level groundwater samples in the downgradient direction from the existing wells and/or installation of additional monitoring wells at or near the tax parcel boundary. If groundwater samples from the wells outside of the source area (i.e. other than MW-1) show concentrations of TPH above MTCA cleanup levels, Ecology will be consulted to discuss potential actions.

Section 4: Groundwater Monitoring Activities

Groundwater samples will be collected as part of the long term groundwater monitoring program described in this section.

4.1 Field Methods

This section presents the methods for obtaining depth-to-water measurements and for obtaining groundwater samples for laboratory analysis. Table 2 summarizes the field methods and analytical parameters.

4.1.1 Water Levels

Prior to groundwater sample collection activities, the depth to water will be measured in each of the groundwater monitoring wells to evaluate the groundwater flow direction and gradient.

4.1.2 Groundwater Sample Collection Methods

Groundwater samples will be collected from all existing monitoring wells (MW-1 through MW-6) using a bladder or peristaltic pump applying low-flow sampling techniques to reduce the turbidity in the groundwater samples as much as possible. Groundwater field parameters of pH, electrical conductivity, temperature, dissolved oxygen, and redox potential will be measured with a flow-through cell and documented in field notes. The groundwater sample from each well will be collected after these field parameters have stabilized. Non-dedicated field equipment will be decontaminated prior to sampling each monitoring well. Upon collection, the groundwater samples will be labeled and placed in an insulated cooler chilled with ice for transport to an Ecology accredited laboratory under proper chain-of-custody procedures for analysis.

4.2 Groundwater Laboratory Analysis

Groundwater samples from each well will be analyzed for diesel and oil range hydrocarbons using the NWTPH-Dx Method, with acid/silica gel cleanup, and for gasoline range hydrocarbons using the NWTPH-Gx Method.

For quality assurance/quality control (QA/QC) purposes, a field duplicate sample will be collected during each long term groundwater monitoring event. The duplicate will be submitted to the analytical laboratory for analysis of TPH.

4.3 Investigation-Derived Waste

Purge water and decontamination fluids from each monitoring event will be temporarily placed in 55-gallon drums pending analytical results. Each drum will be labeled with the project name, contents, date, and sampling location and stored at a secured area within the STF site. The groundwater sample analyses from the monitoring wells will be used to characterize the drummed wastes. The Investigation Derived Waste (IDW) will be disposed of at an appropriate treatment/disposal facility.

Section 5: Reporting

Following completion of the fieldwork and receipt of laboratory analytical data for each monitoring event, Kennedy/Jenks Consultants will prepare a groundwater monitoring report for submittal to Ecology. The report will include a summary of field activities, tabulated results, and a Site map showing the locations of each monitoring well. Analytical data will also be entered into Ecology's electronic information management (EIM) database.

References

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Washington State Department of Ecology 2001. Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC. Ecology Publication No. 94-06, Revised November 2007.

Tables

Table 1
Monitoring Well Location Data
South Tacoma Field Former UST Site
Tacoma, Washington

Well Designation	Well Location[a]		Well Elevation (feet MSL)[b]	Measuring Point Description
	Easting	Northing		
MW-1	E 349488.8	N 211204.8	252.33	North; top of PVC[c] casing
MW-2	E 349462.0	N 211203.2	252.34	North; top of PVC casing
MW-3	E 349495.4	N 211229.9	252.66	North; top of PVC casing
MW-4	E 349512.7	N 211202.4	253.87	North; top of PVC casing
MW-5	E 349488.7	N 211149.9	253.23	North; top of PVC casing
MW-6	E 349472.0	N 211220.0	251.99	North; top of PVC casing
MW-6R[d]	E 349472.0	N 211220.0	252.27	North; top of PVC casing

Notes:

(a) NAD-1983 State Plane Washington South FIPS 4602 US Feet
(b) Feet above mean sea level (MSL)
(c) Polyvinyl chloride (PVC)
(d) Replacement well overdrilled over location of original well MW-6

TABLE 2

ANALYTICAL METHODS, SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES
Former Underground Storage Tank Area, South Tacoma Field

Analyte	Analytical Method	Container	Preservative	Holding Time
Diesel/Oil	NWTPH-Dx[(a)] with acid/silica gel cleanup	2 - 500 ml[(b)] amber glass	1 M HCl[(c)], 4 ^{o}C[(d)]	14 days
Gasoline	NWTPH-Gx[(e)]	2 - 40 ml VOA[(f)] vials	1 M HCl, 4 ^{o}C	14 days

Notes:

(a) NWTPH-Dx = Northwest Total Petroleum Hydrocarbons Diesel-extended.

(b) ml = milliliter.

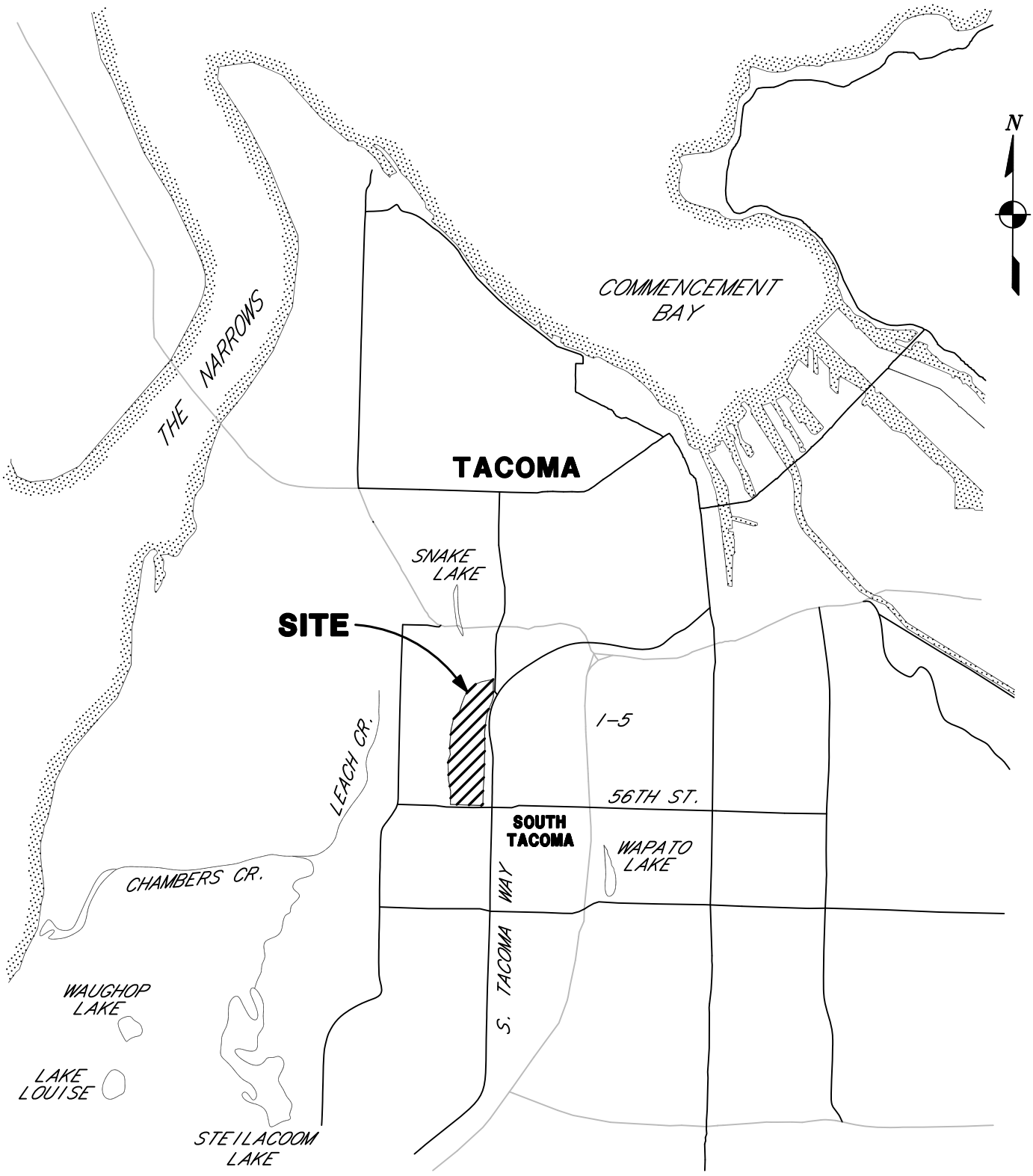
(c) HCL = 1 molar hydrochloric acid

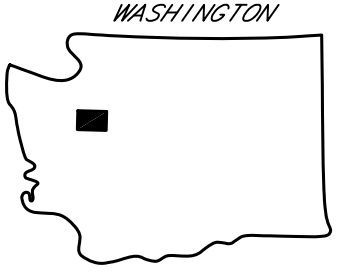
(d) ^{o}C = degrees Celcius.

(e) NWTPH-Gx = Total Petroleum Hydrocarbons Gasoline-extended.

(f) VOA = volatile organics analysis.

Figures





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SO. TACOMA FIELD
TACOMA, WASHINGTON

SOUTH TACOMA FIELD (STF) LOCATION MAP
FORMER UST SITE

006013.03\FIG-01

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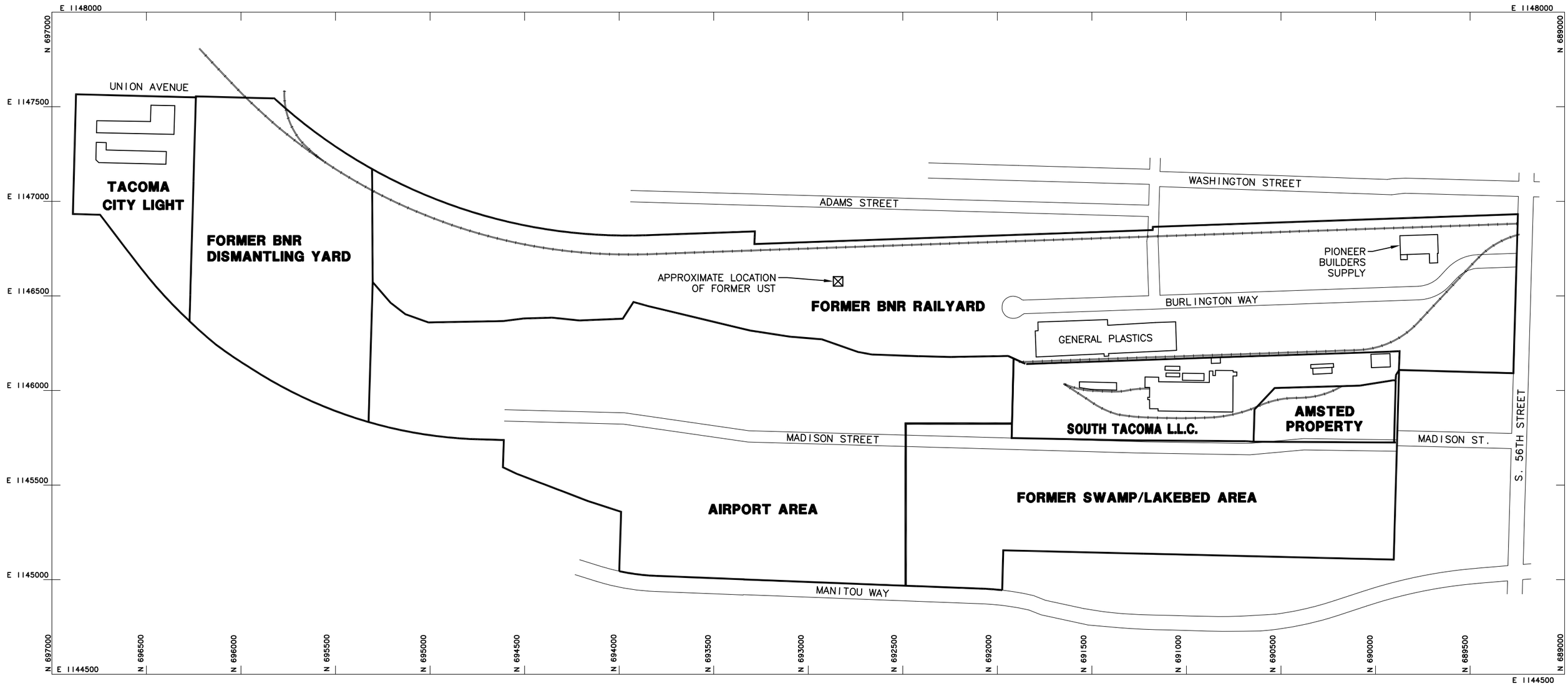
FIGURE 1



N

250 125 0 250 500 750

SCALE IN FEET

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SO. TACOMA FIELD
TACOMA, WASHINGTON

SOUTH TACOMA FIELD (STF) FEATURES
FORMER UST SITE

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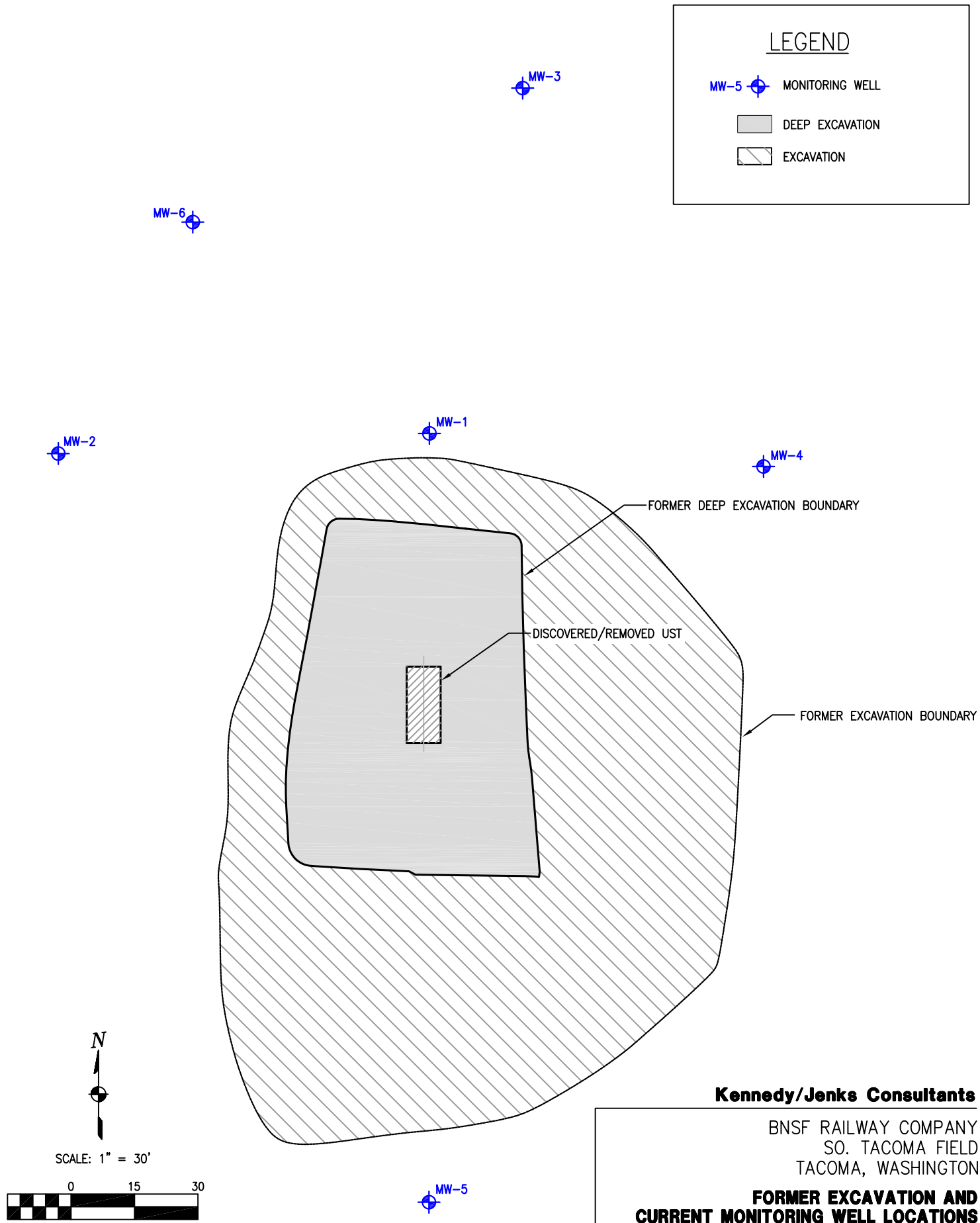
FIGURE 2



SOURCE: EARTH TECH;1548UST DWG, 4-1-99

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TACOMA, WASHINGTON

FORMER EXCAVATION AND CURRENT MONITORING WELL LOCATIONS FORMER UST SITE

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FIGURE 3