Stage 2 Abatement Plan
NuStar Alamogordo Terminal
Alamogordo, New Mexico

Prepared for:
NuStar Terminals Operations Partnership L.P.

May 28, 2010
1636-00

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Environmental and Geotechnical Consultants

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1.0 Introduction

Ash Creek Associates, Inc. (Ash Creek) prepared this Stage 2 Abatement Plan (Plan) on behalf of NuStar Terminals Operations Partnership L.P. (NuStar) for the NuStar Terminal located in Alamogordo, New Mexico (the Site). A location map for the Site is provided on Figure 1; a Site Plan is provided on Figure 2. The Site is managed under the New Mexico Environment Department (NMED) Groundwater Program. The Plan was prepared in accordance with New Mexico Administrative Code (NMAC) 20.6.2.4106 (D) and (E).

1.1 Scope and Purpose

This Plan is being submitted to provide a summary of site investigation activities and to establish a preferred abatement option and work plan for the remediation of separate and dissolved phase hydrocarbon constituents in groundwater at the Site and vicinity.

1.2 Remediation Work Plan Organization

This Plan includes the following main topics:

- Background – Section 2 presents Site background, operations, physical setting, spill and release history, and previous environmental work. Section 2 is drawn from other reports, which are referenced where appropriate.
- Conceptual Site Model – Section 3 presents the Conceptual Site Model (CSM) for potential risk. This section includes a discussion of the nature and extent of soil and groundwater impacts, a land and water use evaluation and a discussion of potentially complete exposure pathways.
- Stage 2 Abatement Plan – Based on the screening of Site data, abatement options are evaluated and proposed in Section 4. This includes the development of potentially applicable remedial technologies, technology evaluation and selection of a proposed remedial action.
- Proposed Abatement Option – Section 5 describes the proposed abatement option and associated monitoring plan to evaluate the effectiveness of the abatement action.
- Vertical Delineation Plan – Section 6 presents a groundwater gauging and sampling plan to vertically delineate dissolved phase hydrocarbons.

2.0 Background

2.1 Site Location and Description

The Site is located at 6026 Highway 54 South in Alamogordo, New Mexico. The Site covers 17.2 acres and is bounded to the west and south by rural residential lots within the Boles Acres community. Land in the Boles Acres community is predominantly undeveloped, with some agricultural and residential use. The Site is

bounded to the east by Highway 54, railroad tracks, and undeveloped land east of the railroad tracks, and to the north by undeveloped land. The Site is bisected by an east-west-trending, 100-foot-wide, 1.9-acre drainage easement.

2.2 Site Ownership and Contact Information

The Site is currently owned by NuStar. The contact person for this project is:

Joe Aldridge
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2330 North Loop 1604 West
San Antonio, Texas 78248
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The NMED contact is:

Christopher Whitman, Geoscientist
New Mexico Environment Department
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1170 N. Solano Drive, Suite M
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2.3 Operational History and Current Land Use

The Site is a bulk fuel storage and transfer station for jet fuel. The terminal was constructed in 1965 to provide jet fuel to Holloman Air Force Base (Holloman AFB). From 1965 to 1978, the terminal handled gasoline and jet fuel (JP-4); after 1978, the terminal handled exclusively jet fuel (JP-4 from 1978 – 1994, and JP-8 from 1995 to present). Fuel is delivered to the terminal by a below-grade 6-inch transmission pipeline originating near El Paso, Texas. Fuel is stored in aboveground storage tanks (ASTs) at the terminal prior to delivery to Holloman Air Force Base. The fuel is delivered to the Holloman AFB by a 4-inch-diameter below-grade pipeline. Currently, storage capacity at the terminal consists of two 35,000-barrel (bbl) ASTs, two 20,000-bbl ASTs, and one 10,000-bbl AST within a large earthen berm.

2.4 Spill and Release History

Petroleum releases that have occurred at the Site include (Geohydrology Associates, Inc., 1986 and Sullivan Engineering Group, 1992):

- Undocumented small spills during the early years of terminal operations;
- The release of approximately 16,000 gallons of JP-4 fuel on site in 1967 or 1968, following the failure of a buried dresser coupling; and
- An underground pipeline leak at the site in 1982, discovered at a welded joint.

The release locations are not identified in the historical records.

2.5 Previous Environmental Work

Since 1988, assessment and remediation efforts have included installation of 32 on-site monitoring wells and 5 off-site monitoring wells. Table 1 summarizes well construction information and boring logs are provided in Appendix A. Remediation efforts have included a groundwater pump and treat system that was operational for 18 years, and a 3-month pilot test involving a total fluids extraction system. Groundwater monitoring of the monitoring well network has occurred regularly since 2006.

2.5.1 Pump and Treat System

Pursuant to a 1985 Settlement Agreement between New Mexico Water Quality Control Commission (NMWCC) and Standard Transpipe Corporation, five recovery wells and 11 groundwater monitoring wells were installed on the Site in 1986, and a groundwater pump and treat system operated at the Site continuously from 1988 to 2006. During that time, approximately 2,800,000 gallons of groundwater were recovered and treated with this system. The Office of the State Engineer Point of Diversion Summary records indicate that the treatment system's groundwater recovery rate (sum of all operational recovery wells) for the years 2001 through 2006 ranged from 1.7 gallons per minute (gpm) to 3.1 gpm.

The objective of the groundwater pump and treat system was to meet groundwater criteria as outlined in NMWQCC Reg. 3-103 A, B, and C [these standards were adopted later into NMAC 20.6.2.3103 (A)]. Due to ineffectiveness and high cost, the groundwater pump and treat system was shut down on May 23, 2006, with approval of the NMED (CRA, 2009).

2.5.2 Stage 1 Summary

The NMED Groundwater Program transitioned the Site to management under NMAC 20.6.2.4103 in 2006. Pursuant to those regulations, further site characterization was performed, culminating with a Stage 1 Abatement Plan (Conestoga-Rovers & Associates, [CRA], 2009). The Stage 1 Abatement Plan was submitted in November 2009, and approved by NMED in January 2010. Conclusions of the Stage 1 Abatement Plan included:

- Groundwater flow is to the south-southwest at a gradient of approximately 0.008 foot per foot (ft/ft), and appears to be consistent between gauging events;

- Separate phase hydrocarbon (SPH) extent has been delineated, is stable in aerial extent, and limited in mobility and recoverability;
- The dissolved phase plume is sufficiently delineated for the development of the Stage 2 Abatement Plan; and
- The dissolved phase plume appears to be stable and in equilibrium with the current groundwater geochemistry and flow conditions (i.e., migration has not been observed in the last two years of monitoring).

Figure 3 shows the occurrence of SPH in groundwater in August 2007 and November 2009. Figure 4 shows the approximate extent of benzene in groundwater in August 2007 and November 2009.

2.5.3 Groundwater Monitoring Program

A groundwater monitoring program was outlined in the Stage 1 Abatement Plan. Table 2 summarizes that approved groundwater monitoring program. The most recent groundwater monitoring event (May 10-14, 2010) included implementation of the approved program. The domestic water wells (Disinger and Echols) were also sampled as part of that event.

2.5.4 Total Fluids Recovery Pilot Test

During the period October 2008 through January 2009, a pilot test of a total fluids recovery system was performed. The purpose of the pilot test was to evaluate the feasibility of SPH recovery. The scope of the pilot test included installation and operation of two recovery wells (RW-1 and RW-2; Figure 2). The recovery system was equipped with down-hole submersible pneumatic pumps in the recovery wells, an oil/water separator, air stripper, and a 1,000-pound carbon vessel. During the pilot test, approximately 253,700 gallons of groundwater were pumped from RW-1 and RW-2. Of the total fluids recovered, only 10 gallons consisted of SPH (CRA, 2009).

3.0 Conceptual Site Model

The physical and chemical conditions at the Site, including geology, hydrogeology, land and water uses, and nature and extent of the constituents of interest (COI) were evaluated to develop a CSM identifying potentially complete exposure pathways and receptors at and in the vicinity of the Site.

3.1 Physical Setting

A review of published geologic information in combination with previous investigations at the Site and vicinity has provided information on the geologic and hydrogeologic setting of the area. Discussion of the local geology has been developed from previous investigation reports on the Site (Geohydrology Associates, 1986; Sullivan Engineering Group, 1992; CRA, 2005-2009).

3.1.1 Geology

The Site is located near the east edge of the Tularosa Basin. The basin is a broad, north-trending intermountain basin covering an area of 6,540 square miles in south-central New Mexico. The Site is located near the steep, west-facing Sacramento Mountain escarpment on the east side of the basin. Alluvial fans slope westward from the base of the mountain to the basin floor and to alkali flats in the lowlands farther west. The alluvial fans to the west of the Sacramento Mountains are generally poorly sorted and heterogeneous. Particle sizes range from boulders, high on the alluvial fans, to fine sand at the western margin of the alluvial fans. The central part of the basin is occupied by lacustrine clays and evaporates. Some moderately sorted sand lenses occur in the alluvial fans.

The Site falls below the alluvial fans and site lithology is consistent with lacustrine depositions. Environmental investigations at the Site have indicated that most of the shallow sediments (less than 100 feet below ground surface [bgs]) are fine grained and unconsolidated. The predominant soil types are silty clay, sandy clay, and clayey sand. Geologic cross sections are shown on Figure 5. Cross section locations are shown on Figure 2.

3.1.2 Hydrogeology

Depth to groundwater at the Site typically ranges from 70 to 75 feet bgs. The groundwater gradient is approximately 0.008 ft/ft to the south-southwest and has been consistent. Copies of groundwater potentiometric surface maps and groundwater elevations from previous Site investigations are provided in Appendices B and C, respectively.

First encountered groundwater is present in a clayey sand unit. As part of a geohydrologic assessment performed at the Site (GeoHydrology Associates, Inc., 1986), aquifer tests were conducted at 4 wells adjacent to and downgradient of the release area (STP-4W, STP-5W, STP-6W, and STP-7W; Figure 2). From static conditions, wells were pumped for a 24-hour period, and drawdown and recovery were noted to calculate transmissivity values (ranging from 28 square feet per day [ft^2/day] at STP-4W to 150 ft^2/day at STP-7W). Assuming a typical effective porosity of fine textured soil (0.20 for clayey sands [Freeze and Cherry, 1979]), and a groundwater gradient of 0.008 ft/ft, the velocity of groundwater at the Site was estimated to be 13 feet per year in the vicinity of the release area.

Regional hydrogeology indicates that focused recharge areas occur in channels that flow only sporadically upgradient of the Site, and that the Site is not in an area subject to infiltration (USGS, 2007).

3.2 Nature and Extent of Impacted Soil and Groundwater

SPH and dissolved constituents consistent with weathered JP-4 (benzene, toluene, ethylbenzene, and xylenes [BTEX], naphthalene, 1-methylnaphthalene, 2-methylnaphthalene; [Kampbell et al., 2001; Martel, 1987]) have been observed in groundwater at the Site.

3.2.1 Soil

Limited information is available regarding the release area locations and impact on surrounding surface soil. Based upon site investigations performed between 1986 and 2009, it appears that petroleum did not extend off-site during the initial release. The majority of identified soil impacts occur at or below the water table in samples collected at a depth which is seasonally saturated with groundwater. The presence of soil impacts at these locations is associated with dissolved phase petroleum constituents in groundwater.

3.2.2 Groundwater

SPH has been consistently observed in monitoring wells STP-5W, STP-7E, STP-10, and STP-24. During five groundwater gauging events from August 2007 through November 2009, SPH has been intermittently observed in recovery well RW-1 and monitoring well MW-7WE. SPH occurrence in monitoring wells from August 2007 and November 2009 demonstrate that the horizontal extent of SPH is stable to decreasing (see Figure 3).

Dissolved concentrations of petroleum constituents occur primarily in the central and eastern portions of the Site. To screen the extent of hydrocarbon impacted groundwater, TPH-DRO and -GRO analyses have been performed historically (CRA 2005-2009, Ash Creek, 2009). To evaluate groundwater consistent with NMAC 20.6.2.3103(A) standards, BTEX, total naphthalene plus monomethylnaphthalenes, and benzo[a]pyrene analyses have been performed. NMAC standards for BTEX and total naphthalene plus monomethylnaphthalenes have been exceeded; benzo[a]pyrene has not been detected and is not considered a constituent of concern at the Site (Appendix C). Concentrations of dissolved-phase petroleum constituents have been stable to decreasing (see Figure 4).

3.2.3 Data Gap

NMED has requested that vertical delineation of the dissolved-phase hydrocarbons be performed at the Site. A vertical delineation plan utilizing the existing monitoring well network is presented in Section 6. Findings from the vertical delineation study will be incorporated into the second semi-annual 2010 groundwater monitoring report. Findings from the study will be used to further develop the selected abatement option. The screened intervals of adjacent domestic water wells will also be determined as part of this evaluation.

3.4 Land and Water Use

3.4.1 Current and Future Land Use

Current Land Use. The Site is currently used as a bulk terminal, and aviation fuel is stored at the terminal. Access to the Site is restricted and inaccessible to the general public. The Site's south and west property boundaries abut rural residential lots within the Boles Acres community. Land use in the community includes undeveloped land, agricultural, and residential uses. The Site is bounded to the east by Highway 54 and a railroad track east of the highway, and to the north by undeveloped land.

Anticipated Future Land Use. The Site is likely to remain in use as a bulk petroleum terminal for the foreseeable future. With the exception of the Boles Acres residential community, the surrounding land use is likely to remain undeveloped.

3.4.2 Ground and Surface Water Use

Two private domestic water supply wells are south of the Site in the Boles Acres community (Disinger and Echols water wells; Figure 2). The Disinger water well is located 300 feet south of the Site and its total depth is 150 feet. The Echols property is currently vacant and the water well is damaged and inactive. The Boles Acres Water Association provides water to other residents of the Boles Acres Community. The source of the municipal water supply consists of four groundwater wells in the Boles Acres Community. The well closest to the Site is 1,600 feet north (upgradient), and the closest downgradient well is 3,000 feet south of the Site. According to New Mexico Office of the State Engineer, the wells are 200 feet and 300 feet total depth, respectively.

3.5 Analysis of Exposure Pathways and Potential Risk

Exposure pathways have been evaluated for both current and potential future on-Site and off-Site receptors. On-site receptors include commercial workers and excavation (utility) workers. Off-site receptors include current and potential future residents at the Boles Acres community.

Potential exposure pathways are:

- Direct contact with soil;
- Soil leaching to groundwater;
- Constituents in subsurface soil to human receptors via inhalation of vapors or particulates;
- Direct contact with groundwater; and
- Ingestion of groundwater.

The following describes each of these pathways and identifies the potentially complete pathways.

Direct Contact with Surface and Subsurface Soil. The Site is part of an active bulk terminal. The release areas are within the Site and are within a secured, fenced area of the terminal to which only Site workers have access. Releases did not extend off-site during the initial release, and therefore, there are no off-site impacts to surface soil.

On-Site workers (with the exception of excavation workers) will not contact subsurface soil and this is not a complete pathway. In the vicinity of the initial release, there is a potential for exposure of utility (excavation) workers to subsurface soils but on-site excavation activities are rare and standard operating procedures (SOPs) at the terminal limit potential exposure. Site workers are aware of the potential for encountering impacted soils at the site and are required to wear personal protective equipment (PPE) which significantly reduces the potential for direct contact with Site soils. Additionally, Site workers are trained in the appropriate handling of petroleum products. Based on these protective measures, the potential presence of residual hydrocarbons in surface soil is not anticipated to present an unacceptable risk to on-Site excavation workers. Impacted subsurface soil in the smear zone (<65 feet bgs) is below reasonable excavation depths and does not present an unacceptable risk to on-site excavation workers.

As stated in Section 3.2, off-Site soil was not identified as impacted based on PID monitoring, with the exception of soil in the smear zone. The observed soil impact was due to soil contact with impacted groundwater migrating from the Site and occurs at depths of at least 65 feet bgs. Thus, contact with off-Site soil is not considered a complete exposure pathway.

Soil Leaching to Groundwater. Based on regional hydrology, the Site is not in an area subject to infiltration (USGS, 2007); residual hydrocarbons in soil do not represent an ongoing source to groundwater.

Volatilization to Indoor Air. A terminal office building is located on the northern portion of the Site. The terminal office building is currently used by occupational workers and is evaluated as a potentially complete pathway for vapor intrusion from impacted soil and groundwater. Impacted groundwater at a depth of 70 feet is not expected to pose a vapor intrusion threat to receptors. Limited surface soil data suggests no surface soil impacts in the immediate vicinity of the office building. Based on this evaluation there is no unacceptable risk from COI volatilizing to indoor air on-Site or in the Site vicinity.

Direct Contact with Groundwater. Given that first encountered groundwater at the site occurs at 70 feet bgs, on- and off-Site excavation workers will not be exposed to groundwater during subsurface work.

Ingestion of Groundwater. Two domestic use wells are located in the vicinity of the Site. The domestic use wells are located approximately 300 and 450 feet south of the Site boundary (Figure 2). With a groundwater velocity at the Site of 13 feet per year, Site groundwater would take approximately 23 years to travel that distance. Potential constituents in groundwater would likely naturally attenuate to below residential screening levels over the time period required to reach the currently existing groundwater wells.

Monitoring wells STP-21, STP-22, STP-25 and STP-26 are non-detect for dissolved phase constituents and are located between the Site and domestic use wells. Further, the total depths of the domestic water wells are 150 to 175 feet, and would not likely be impacted. A more detailed characterization of the nature and extent of vertically impacted groundwater will be addressed in the vertical delineation report. As outlined in Section 3.2, the extent of SPH and dissolved phase constituents in groundwater are stable to decreasing.

The vertical extent of dissolved phase constituents in groundwater is unknown. The Boles Acres residential community is currently zoned for residential use, and in addition to the two existing domestic wells, there is the potential for new potable water wells to be installed in that area. Therefore, off-Site ingestion of groundwater is considered a potentially complete pathway for future residential receptors. The vertical delineation plan (Section 6) outlines the approach to define the vertical extent of impacted groundwater. The plan will also evaluate the existing domestic groundwater wells in the Boles Acres residential community to evaluate this exposure pathway.

4.0 Abatement Standards and Evaluation of Options

The following sections describe the evaluation of abatement options that were selected based on their protectiveness, implementability, cost, and community acceptance. The abatement option that best meets the selection criteria is proposed as the recommended abatement option. Following the recommendation, a work plan is included to describe the implementation of the proposed technology.

4.1 Abatement Standards

Remediation efforts to date (18-year pump and treat system and pilot test of the total fluids extraction system) were intended to meet groundwater abatement standards consistent with NMAC 20.6.2.3103(A). Those remedial options have proven to be cost prohibitive, ineffective, and result in long timeframes to compliance. These interim action efforts have demonstrated that it is technically impractical to achieve the groundwater abatement standards at the Site. Therefore, contingent upon results of the vertical delineation plan (Section 6), alternative groundwater abatement standards will be developed as provided for in NMAC 20.6.2.4103(F). Specific groundwater abatement standards are not proposed herein.

4.2 Abatement Options

Table 3 provides an initial screening and evaluation of technologies for groundwater. Technologies remaining after the initial screening include:

- No Action;
- Monitoring; and
- Monitored Natural Attenuation (MNA).

Of the remedial technologies remaining after the technology screening, only MNA specifically addresses cleanup to abatement standards. Therefore, the two potential abatement options for further evaluation:

- No action; and
- MNA.

4.3 Evaluation of Abatement Options

4.3.1 Evaluation Criteria

Abatement options were evaluated based on protectiveness of human health and the environment, cost, implementability, and community acceptance as outlined herein.

- Protectiveness. This criterion considers the overall protectiveness of human health and the environment, including the degree to which existing risks are reduced, time required to reduce risk at the Site and attain cleanup standards, on-site and off-site risks resulting from implementing the abatement option, and improvement of the overall environmental quality.
- Cost. This criterion evaluates cost to implement the abatement option, including the cost of construction, the net present value of any long-term costs, and agency oversight costs that are cost recoverable. Long-term costs include operation and maintenance costs, monitoring costs, and equipment replacement costs. Cost estimates for treatment technologies shall describe pretreatment, analytical, labor, and waste management costs. The design life of the cleanup action shall be estimated and the cost of replacement or repair of major elements shall be included in the cost estimate.
- Implementability: This criterion evaluates the ability to implement the abatement option, including consideration of whether the abatement option is technically achievable, availability of necessary off-site facilities, services and materials, administrative and regulatory requirements, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with existing Site operations and other current or potential remedial actions.
- Community Acceptance. This criterion evaluates community concerns regarding the abatement option and, if applicable, the extent to which the abatement option addresses those concerns. This process includes concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the Site.

4.3.2 No Action

Description. The No Action alternative assumes that no further action is taken at the Site and no monitoring is performed.

Protectiveness. The No Action alternative would achieve the protectiveness requirements on a similar timeframe as MNA. However, without the monitoring associated with MNA, No Action does not provide for protection of human health until abatement standards are achieved.

Cost. This alternative has no cost.

Implementability. Because there is no action, there are no difficulties associated with implementation of this alternative.

Community Acceptance. The No Action Abatement Option would not be accepted by the community because it does not provide for protection of human health.

4.3.3 Monitored Natural Attenuation

Description. MNA uses natural processes to reduce the contaminant concentrations. Performance and detection monitoring are conducted to verify that natural attenuation is occurring. Groundwater samples are collected and analyzed for COI and natural attenuation parameters, and the monitoring data are evaluated to determine if changes in contaminant concentrations are indicative of natural attenuation mechanisms (i.e., decreasing COI concentrations, increasing degradation products) and to assess the potential for meeting the abatement standards. The MNA alternative includes groundwater monitoring until abatement standards are met.

Protectiveness. The MNA Abatement Option does achieve the protectiveness requirements, as monitoring will continue to confirm that the extent of SPH and dissolved-phase constituents continue the stable to decreasing trend. Groundwater gauging and sampling over the past 2 years at the Site has shown that the aerial extent of SPH and dissolved groundwater concentrations are stable to decreasing. Dissolved petroleum constituent concentrations in monitoring wells on the Boles Acres property (STP-21, STP-22, STP-23, STP-25 and STP-26) have been non-detect, and are located upgradient of domestic water use wells. Results obtained from the vertical delineation plan outlined in Section 6 would be incorporated into this abatement option.

It has been demonstrated that there is currently no unacceptable risk to excavation workers in the NuStar tank farm or on off-site properties, so the MNA abatement option would be protective of human health.

Cost. The time needed to achieve abatement standards cannot be determined at this time, and cost cannot be accurately estimated. Pending results of the vertical delineation study, alternative abatement standards will be proposed.

Implementability. The implementation of the MNA alternative would be relatively easy and includes groundwater monitoring using existing groundwater monitoring wells. Continued cooperation from adjacent property owners is required for full implementation.

Community Acceptance. In light of the protectiveness of this abatement option and previous costly, long-term, and ineffective efforts at remediation, the community would likely accept it. As outlined in Section 5.1.4, public notification of the Stage 2 Abatement Plan will invite community comment and provide additional information regarding this abatement option.

5.0 Proposed Abatement Option

5.1 Description of MNA

The MNA abatement option is technically feasible, protective (by eliminating the direct ingestion of groundwater exposure pathway), and cost effective. Site conditions are conducive to natural attenuation processes, and dissolved phase groundwater concentrations suggest that MNA is already occurring at the Site. The extent of SPH and dissolved-phase constituent concentrations has decreased during the past two years at the Site. SPH observed in monitoring wells STP-5W, STP-7E, STP-10, and STP-24 will require continued monitoring. MNA is a protective, cost-effective, and implementable abatement option that is likely to be accepted by the local community.

5.2 Groundwater Monitoring Program

The proposed groundwater monitoring program is based on site history, recent groundwater analytical results at the Site, and monitoring COI per NMAC 20.6.2.3103(A). The proposed groundwater gauging and monitoring program is shown in Table 4, and on Figures 6 and 7. Results from ongoing groundwater monitoring will be used to evaluate the effectiveness of MNA at the Site.

Sampling methodology will be consistent with NMED Position Paper Use of Low-Flow and Other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring (October 21, 2001) and in the Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (EPA/540/5-95/504) document. Investigative and monitoring data for the purpose of analytical testing and evaluation will be done in accordance with the Site quality assurance project plan (QAPP; Appendix D). The QAPP includes a site-specific health and safety plan (HASP) as an appendix.

5.3 Reporting Schedule

A semi-annual groundwater monitoring report will be prepared and submitted to the NMED within 60 days following receipt of the analytical data. The semi-annual report will include a narrative section describing the scope, methods, and results of the groundwater monitoring, data tables, and figures summarizing the potentiometric surface and groundwater analytical data. Spatial trends of dissolved oxygen, oxidation

reduction potential, temperature, pH, soluble iron, nitrate, sulfate, and methane will be evaluated to perform preliminary evaluation of MNA processes. The report will include a brief summary of site activities conducted during that semi-annual period and a description of work anticipated to occur during the following semi-annual period. The reporting scope will also include the reporting of groundwater results to the domestic well owners.

5.4 Groundwater Monitoring Program Review

The selected wells, sampling frequency, and analytical program will be reviewed on an annual basis to ensure that the appropriate scope of monitoring is being performed to meet objectives of the selected abatement option.

5.5 Public Notification

Pursuant to NMAC 20.6.2.4108(B), public notice of the Plan will occur within 30 days of the submission of the plan through publication of a notice in newspapers of general circulation in Otero County, New Mexico. The proposed language for the notification is in Appendix E. NMAC 20.6.2.4108 (B) stipulates that the public notice must be approved by NMED prior to circulation.

6.0 Vertical Delineation Plan

The vertical delineation plan is proposed herein to fulfill the requirement for vertical delineation of impacted groundwater per NMAC 20.6.2.4106(C)(2)(A). Additionally, the vertical delineation plan will evaluate the potential exposure pathway for off-site domestic water supply wells. Results will be used to develop alternative abatement standards and re-evaluate the GWM program as outlined in Section 5.1.3.

6.1 Proposed Monitoring Well Program

The monitoring wells selected for the vertical delineation plan have screen intervals (5 to 10 feet in length) varying from 70 feet bgs to 97 feet bgs (Table 5). Groundwater samples will be collected from each well to evaluate dissolved phase trends with depth and estimate the vertical extent of dissolved phase constituents. The analytical program will target the most soluable COI at the site to obtain a conservative estimate of the dissolved phase vertical extent.

Well Gauging and Sampling. The proposed groundwater gauging and sampling will consist of:

- Depth-to-groundwater measurement and well gauging for the presence of separate phase hydrocarbons (SPH) in 12 monitoring wells (Figure 8);
- Groundwater samples will be collected at 10 monitoring well locations and analyzed for BTEX, naphthalene, 1-methylnaphthane, and 2-methylnaphthalene (Figure 9). Prior to sampling, these wells will be overpurged.

Investigative and monitoring data for the purpose of analytical testing and evaluation will be done in accordance with the Site quality assurance project plan (QAPP; Appendix D). Sampling methodology will be consistent with NMED Position Paper Use of Low-Flow and Other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring (October 21, 2001) and in the Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (EPA/540/5-95/504) document.

6.2 Domestic Water Well Evaluation

A water well search will be performed to further evaluate the potentially complete direct groundwater ingestion exposure pathway. Screened intervals of existing downgradient domestic water wells will be evaluated to determine if they access the same hydrologic unit as impacted groundwater on the Site. Findings from these investigations will be used to develop alternative abatement standards for the Site as provided for in NMAC 20.6.2.4103(F).

6.3 Reporting and Schedule

Reporting will include sample results from the vertical delineation groundwater sampling program and results of the domestic water well evaluation. A report will be submitted to the NMED within 60 days following receipt of the analytical data.

7.0 References

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Table 1
Well Construction Summary
NuStar Alamogordo Terminal
Alamogordo, New Mexico

Well ID	Top of Casing Elevation (feet MSL)[1]	Total Depth (feet bgs)	Top of Screen Interval (feet)	Bottom of Screen Interval (feet)
EID 1A	4127.02	76.9	74	84
EID 1B	4125.77	82.6	72	82
EID 1 BS	4125.45	76.94	NA	NA
EID 1C	4123.9	97.27	NA	NA
EID 1D	4124.65	80	NA	NA
EID 4	4125.86	89.5	73	83
STP 1	4125.15	99.5	NA	NA
STP 4N	4124.45	106.1	73	83
STP 4S E	4123.8	88.54	89	94
STP 4S W	4123.79	95.04	82	87
STP 5W	4122.69	98.15	70	80
STP 5E E	4122.03	99.35	92	97
STP 5E W	4121.97	87.92	82	87
STP 6E	4125.19	103.32	73	78
STP 6W E	4124.46	94.8	82	87
STP 6W W	4124.41	88.05	88	93
STP 7E	4123.47	101.62	70	75
STP 7W E	4122.45	85	82	87
STP 7W W	4122.45	91.3	87	92
STP 8	4126.03	100.5	73.5	78.5
STP 9	4124.04	104.6	70	75
STP 10	4121.75	105	73	78
STP 13	4119.05	94	73	78
STP 15	4114.14	92.08	73	78
STP 16	4126.05	90.05	68	88
STP 17	4125.27	89.8	68	88
STP 18	4124.08	90.18	68.5	88.5
STP 19	4126.22	89.98	68	88
STP 20	4123.16	90.02	68	88
STP 21	4122.11	90.2	68	88
STP 22	4123.16	90.12	68	88
STP 23	4121.88	90.12	68	88
STP 24	4127.92	89.53	65	85
RW1	4131.63	102.84	60	100
RW2	4131.73	102.5	59	99
STP-25	4126.80	85.00	65	85
STP-26	4125.95	85.00	65	85
Disinger Domestic Well	--	--	--	--
Echols Domestic Well	--	--	--	--

Notes:
1. -- = unknown

Table 2
Approved Groundwater Monitoring Program
NuStar Alamogordo Terminal
Alamogordo, New Mexico

Well ID	Top of Casing Elevation (feet MSL)[1]	Gauging	TPH-GRO/DRO	BTEX	PAHs	Dissolved Lead
EID 1A	4127.02	X	X	X		X
EID 1B	4125.77	X				
EID 1 BS	4125.45	X				
EID 1C	4123.9	X				
EID 1D	4124.65	X	X	X		X
EID 4	4125.86	X				
STP 1	4125.15	X				
STP 4N	4124.45	X				
STP 4S E	4123.8	X				
STP 4S W	4123.79	X				
STP 5W	4122.69	X				
STP 5E E	4122.03	X				
STP 5E W	4121.97	X				
STP 6E	4125.19	X				
STP 6W E	4124.46	X				
STP 6W W	4124.41	X				
STP 7E	4123.47	X				
STP 7W E	4122.45	X				
STP 7W W	4122.45	X				
STP 8	4126.03	X	X	X	X	
STP 9	4124.04	X	X	X	X	
STP 10	4121.75	X				
STP 13	4119.05	X	X	X		
STP 15	4114.14	X	X	X		
STP 16	4126.05	X	X	X		
STP 17	4125.27	X	X	X		
STP 18	4124.08	X	X	X	X	
STP 19	4126.22	X	X	X		
STP 20	4123.16	X	X	X	X	
STP 21	4122.11	X	X	X		
STP 22	4123.16	X	X	X	X	
STP 23	4121.88	X	X	X		
STP 24	4127.92	X				
RW1	4131.63	X				
RW2	4131.73	X				
STP-25	4126.8	X	X	X		
STP-26	4125.95	X	X	X		
Disinger Domestic Well	--	X	X	X	X	
Echols Domestic Well	--	X	X	X	X	

Notes:
1. TPH - DRO = Total petroleum hydrocarbons, diesel range organics by EPA Method 8015
2. TPH - GRO = Total petroleum hydrocarbons, diesel range organics by EPA Method 8015
3. BTEX = benzene, ethylbenzene, and xylenes by EPA Method 8260B
4. PAHs = Polycyclic aromatic hydrocarbons by EPA Method 8270C
5. Lead = Dissolved Lead by EPA Method 6010B (Field filtered)
6. -- = Not Measured

Table 3
Initial Screening and Evaluation of Technologies for Groundwater
NuStar Alamogordo Terminal
Alamogordo, New Mexico

General Response Actions	Technology	Description	Screening Criteria: Effectiveness	Screening Criteria: Implementability	Screening Criteria: Cost	Screening Comments
NO ACTION	None	No Action	Not effective in achieving Abatement Standards.	Easy to implement.	No capital or O&M costs incurred.	Retained as a baseline for comparison.
INSTITUTIONAL CONTROLS	Groundwater Use Restrictions	Restrict use of shallow groundwater within impacted areas.	Effective at preventing direct contact, but is not effective at preventing migration. Does not address contaminant reduction.	May require deed restrictions to prevent off-site and on-site groundwater use. No planned use of on-site groundwater.	Low costs associated with implementing restrictions (off-site deed restrictions could require compensation).	Not applicable since off-site domestic groundwater wells are not impacted. Results from the vertical delineation study will be utilized to further evaluate potential impacts to off-site wells.
	Monitoring	Laboratory analyses of groundwater samples.	Effective for documenting site conditions to evaluate migration and current site risks. Does not address contaminant reduction.	Easy to implement. On-site and off-site monitoring wells already exist.	Low to moderate costs for monitoring.	Applicable to document site conditions and effectiveness of any treatment.
ENGINEERING CONTROLS	Control of Building HVAC System	Use HVAC system to maintain positive pressure in buildings.	May be effective in preventing migration of volatile contaminants from shallow groundwater into indoor air as long as a pressure differential is maintained between building and subsurface soil. Does not address contaminant reduction. Generally used in conjunction with other engineering controls.	Can be easy to implement in buildings with existing HVAC systems. Not applicable to most of impacted area (outdoor dock space).	Low costs associated with implementing these controls. Operational costs include additional heating of outdoor air.	Not applicable since volatilization from groundwater is an incomplete pathway.
	Vapor Barriers	Installation of low-permeable barriers beneath buildings to prevent vapor intrusion.	Effective in preventing migration of volatile contaminants from shallow groundwater into indoor air. Does not address contaminant reduction.	Easy to implement for new building construction. Some protection from existing slab-on-grade construction - improvement would require sealing floor from top surface (including removal/replacement of finish floor surface), which may not be compatible with future site use.	Moderate cost for surface application. High cost for sub-floor installation (removal and replacement of slab floor).	Not applicable since volatilization from groundwater is an incomplete pathway.
	Sub-Slab Depressurization or Sub-Floor Venting	Installation of sub-slab or sub-floor venting systems or suction pits to create negative pressures beneath structures to prevent vapor migration to ambient air. Vapors are collected in the suction pit or venting pipes below the building and vented to the outside of the building, either passively or with fans.	Effective in preventing migration of subsurface volatile contaminants from groundwater into ambient air. Does not address contaminant reduction.	Easy to implement for new building construction. Existing buildings could be retrofitted. Materials and construction methods are readily available. Generally most suitable for buildings with slab-on-grade floors.	Moderate costs for retrofitting existing structures - would require cutting slab floor to install vapor pits.	Not applicable since volatilization from groundwater is an incomplete pathway.
	Alternative Water Supply	Develop new water supply in uncontaminated area to provide potable water in the areas of impact.	Effective in preventing use of contaminated groundwater. No contaminant reduction.	Municipal water available. Requires agreements with property owners.	Moderate to low	Not applicable since off-site domestic groundwater wells are not impacted. Results from the vertical delineation study will be utilized to further evaluate potential impacts to off-site wells.
	Wellhead Treatment	Treatment at individual impacted water supply wells with use of *Ex-Situ* Physical/Chemical/Thermal treatment technology.	Effective in reducing contaminant concentrations in groundwater prior to use. Does not address risks associated with vapor intrusion.	Easy to implement. Treatment units are readily available. Requires ongoing testing and system maintenance to remain effective.	Low to high capital costs and O&M costs, depending on treatment technology. Moderately low costs for small residential carbon vessel systems.	Municipal water supply is available for residents downgradient of Facility.
CONTAINMENT	Vertical Barrier	Installation of vertical barriers (e.g., sheet piling, soil-bentonite slurry wall, grout, etc.) to prevent migration of groundwater contamination.	Effective at preventing lateral migration. Requires keying into underlying confining unit. Hydraulic control often necessary as supplemental measure to achieve containment. Cannot prevent downward migration.	Difficult to implement, particularly given depth to groundwater. Site lacks suitable confining unit at reasonable depth. Some site contaminants have specific gravity greater than 1 (sinkers). Specialized equipment required for construction.	High capital costs, low to moderate O&M.	Not practical for deep groundwater, would need to extend below deepest potential impact to prevent lateral migration beneath barrier.
	Pumping / Hydraulic Containment	Extraction well(s) with submersible pumps to lower the water table and create hydraulic gradients that direct contaminant migration into the extraction well. Extracted groundwater would require treatment before discharge (see *Ex-Situ* Physical/Chemical/ Thermal Treatment).	Previous interim actions have demonstrated that pumping in site clayey soils not practicable.	Existing monitoring wells could be utilized, although new wells likely needed to achieve full capture of plume. Discharge of treated water would need to be permitted.	Moderate to high capital costs. New extraction wells may be required. Moderate to high O&M costs.	Interim actions have demonstrated pumping not practicable.

Please refer to note at end of table.

Table 3
Initial Screening and Evaluation of Technologies for Groundwater
NuStar Alamogordo Terminal
Alamogordo, New Mexico

General Response Actions	Technology	Description	Screening Criteria: Effectiveness	Screening Criteria: Implementability	Screening Criteria: Cost	Screening Comments
REMOVAL/DISCHARGE	Pumping (Pump & Treat)	Extraction well(s) with submersible pumps to remove contaminated groundwater with goal of plume reduction and aquifer restoration. Treatment of extracted groundwater likely required before discharge (see *Ex-Situ* Physical/Chemical/ Thermal Treatment).	Previous interim actions have demonstrated that pumping in site clayey soils not practicable.	Existing monitoring wells could be utilized, although new wells likely needed to achieve objectives of plume reduction/aquifer restoration. Discharge of treated water would need to be permitted.	Moderate to high capital costs, if new extraction wells required. Moderate to high O&M costs.	Interim actions have demonstrated pumping not practicable.
	Subsurface Drains	Trench or horizontal boring filled with porous media - gravity drains to sump/pump. Treatment of extracted groundwater likely required before discharge (see Ex-Situ Physical/Chemical/Thermal Treatment).	Effective for shallow groundwater at preventing contaminant migration. Not effective for impacted deeper groundwater. May also be used in conjunction with other technologies.	Not practical to install at groundwater depths.	Moderate to high capital and O&M costs.	Not retained since groundwater depth greater than appropriate for subsurface drains.
	Discharge to Sewer / Surface Water	Discharge of water (which may require treatment) into surface water, storm sewer, or sanitary sewer.	Effective for disposal of extracted groundwater. Treatment of water may be necessary prior to disposal.	No surface water discharges available at the site. Sanitary sewer may not have adequate capacity, depending on extraction flow rate. Storm sewer only available at Lombard street (approximately 750 feet from site).	Moderate cost to connect to storm sewer. Low to moderate disposal costs depending upon permit fees and monthly usage fees.	Not retained because technologies involving groundwater extraction are not appropriate technologies for site conditions.
	Discharge to Reinjection Wells	Discharge of water (which may require treatment) into aquifer by reinjection wells.	Moderate effectiveness, depending upon whether injection wells can be adequately located to prevent plume spreading.	Underground injection control permit required for reinjection. Property access required for suitable injection locations.	Moderate to high capital and O&M costs for reinjection wells.	Not retained because technologies involving groundwater extraction are not appropriate technologies for site conditions.
	Reuse	Reuse of treated water for non-potable use such as irrigation or wetland enhancement.	Effective for treated, extracted groundwater.	A suitable use would need to be identified that can accommodate a steady flow rate in all seasons and within reasonable proximity.	Low to high costs depending upon storage and pumping requirements, and length of discharge piping.	Not retained because technologies involving groundwater extraction are not appropriate technologies for site conditions.
EX-SITU PHYSICAL/ CHEMICAL/ THERMAL TREATMENT	Adsorption	Concentrating solutes on the surface of a sorbent material, such as activated carbon, to remove the solute from the bulk liquid.	Highly effective at removing many organic compounds from extracted water stream. Enhanced media required to improve MTBE removal efficiency.	Applicable for treatment of site contaminants in extracted water. Treatment equipment is readily available.	Moderate capital and O&M costs.	Not retained because technologies involving groundwater extraction are not appropriate technologies for site conditions.
	Air Stripping	Volatile organics are partitioned from extracted groundwater by increasing surface area exposed to air.	Highly effective at removing many volatile organic compounds from extracted water stream. May require treatment of vapor effluent.	Applicable for treatment of site contaminants in extracted water. Treatment equipment is readily available. Requires air emission testing and modeling to determine if offgas treatment is required.	Low to moderate capital and O&M costs. Higher costs if offgas treatment needed.	Not retained because technologies involving groundwater extraction are not appropriate technologies for site conditions.
	Separation/ Reverse Osmosis	Extracted groundwater is forced through a selectively permeable membrane under pressure. Water is allowed to pass through the membrane while contaminants are trapped.	Highly effective at removing many contaminants from the extracted water stream.	Applicable for treatment of site contaminants in extracted water. Treatment equipment is readily available.	High capital and O&M costs.	Not retained because technologies involving groundwater extraction are not appropriate technologies for site conditions.
	Ultraviolet (UV) Oxidation	Ultraviolet radiation is used to destroy organic contaminants as water flows through treatment cell.	Effective at removing many organic contaminants from the extracted water stream.	Applicable for treatment of site contaminants in extracted water. Treatment equipment is readily available.	High capital and O&M costs.	Not retained because technologies involving groundwater extraction are not appropriate technologies for site conditions.
	Sprinkler Irrigation	Contaminated water is distributed through a pressurized sprinkler irrigation system (generally onto a highly porous media), allowing transfer of VOCs from aqueous phase to vapor phase.	Effective at removing many organic contaminants from the extracted water stream. Simpler system than more aggressive treatment technologies (such as air stripping).	Applicable for treatment of site contaminants in extracted water, but requires significant treatment system area.	Low to moderate capital and O&M costs.	Not retained because technologies involving groundwater extraction are not appropriate technologies for site conditions.
	Ion Exchange	Ion exchange removes ions from the aqueous phase by exchange with counter ions on the exchange medium.	Effective for treatment of inorganic contaminants.	Treatment equipment is readily available.	Moderate to high capital and O&M costs.	Not compatible with site contaminants.
	Precipitation/ Coagulation/ Flocculation	This process transforms dissolved contaminants into an insoluble solid, facilitating the contaminant's subsequent removal from the liquid phase by sedimentation or filtration.	Effective for treatment of inorganic contaminants.	Treatment equipment is readily available.	Moderate to high capital and O&M costs.	Not compatible with site contaminants.

Please refer to note at end of table.

Table 3
Initial Screening and Evaluation of Technologies for Groundwater
NuStar Alamogordo Terminal
Alamogordo, New Mexico

General Response Actions	Technology	Description	Screening Criteria: Effectiveness	Screening Criteria: Implementability	Screening Criteria: Cost	Screening Comments
EX-SITU BIOLOGICAL TREATMENT	Bioreactors / Trickling Filter	Contaminants in extracted groundwater are put into contact with microorganisms in attached or suspended growth biological reactors.	Effective at removing many organic contaminants from the extracted water stream. May be less effective during cold weather. May not reach treatment goals without followup polishing treatment.	Difficult to maintain effectiveness with variable operating parameters (i.e., influent concentrations, ambient concentrations). Requires significant area for reactors. Would require significant maintenance.	Moderate capital costs and moderate to high O&M costs	Not retained because technologies involving groundwater extraction are not appropriate technologies for site conditions.
	Constructed Wetlands	Utilizes natural geochemical and biological processes inherent in an artificial wetland ecosystem to remove contaminants from extracted groundwater.	Highly effective at removing many organic and inorganic contaminants from the extracted water stream.	Requires large land area to implement. May introduce attractive nuisance hazard for local wildlife.	Moderate to high capital costs. Low O&M costs.	Not retained because technologies involving groundwater extraction are not appropriate technologies for site conditions.
IN-SITU BIOLOGICAL TREATMENT	Enhanced Bioremediation (Bioaugmentation, Biostimulation)	Adding nutrients, electron acceptor, or other amendments to enhance bioremediation. Addition of specific microbial cultures can be included if indigenous species not suitable for complete degradation of COIs.	Effective with addition of suitable amendments. Strategic placement of amendments can be effective in conjunction with other technologies. Treating source-area concentrations (SPH) requires significantly longer time to complete.	Site conditions (fine textured soils) may prevent practical application of bioremediation substrates.	Low to moderate costs depending on number of injection events required.	Residual SPH exists in groundwater so this technology would not significantly reduce cleanup timeframe. Relative to MNA
	Monitored Natural Attenuation	Using natural processes to reduce contaminant concentrations to acceptable levels. Process is closely monitored to verify exposures are acceptable prior to concentrations reaching acceptable levels.	May be effective, especially in areas of low concentrations (near plume boundaries), but is dependant upon site conditions. Not effective for source areas; other technologies will likely be required.	Easy to implement. Monitoring wells already exist. Likely will require significant timeframe to reach cleanup goals.	Low costs for monitoring.	Applicable technology for portions of plume with low contaminant concentrations. Source areas will require long time frame.
	Phytoremediation	Phytoremediation is a process that uses plants to remove, transfer, stabilize, and destroy contaminants.	Can be effective at removing a variety of organic and inorganic compounds from contaminated groundwater through plant uptake.	Requires significant land area suitable for large plants. Contamination must be accessible to plant root zones.	Moderate implementation cost.	Not compatible with site conditions or deep contamination.
IN-SITU PHYSICAL/ CHEMICAL/ THERMAL TREATMENT	Aeration / Air Sparging	Increasing the contact between water and air to enhance volatilization. Air sparging involves injecting air into saturated matrices.	Effective for volatile contamination. May require shallow vapor extraction to prevent uncontrolled vapor migration.	Equipment and technology for air sparging are readily available. Vapor mitigation would likely be required. Most effective in areas of high concentrations. Likely not practical for site conditions (fine textured soil).	Moderate capital and O&M costs for air sparging. High capital and O&M costs with addition of SVE system to control vapors.	Vapor collection less feasible due to depth to groundwater. Not suitable for low-concentration extent of plume. Significant cost associated with high-concentration area. Not compatible with site conditions.
	Multi-Phase Extraction (MPE)	MPE provides simultaneous extraction of soil vapor, contaminated groundwater, and LNAPL using single vacuum pump, multiple in-well pumps, or bioslurping.	Effective for source removal at site with moderate to low soil permeability. Pilot testing would be needed. Site investigations indicated that site lithology is amenable to this technology. May require vapor effluent treatment.	Equipment and technology for MPE are readily available. Treatment of recovered soil vapors and groundwater would be required prior to discharge. Not compatible with depth to groundwater.	Moderate to high capital and O&M costs. Higher costs if vapor treatment needed.	Not compatible with site conditions or deep contamination. Not compatible with site conditions.
	Steam Flushing/ Steam Stripping	Steam is injected into the contaminated aquifer to vaporize less volatile organics.	Used in conjunction with vapor recovery. May be effective for increasing usability of SVE for low-volatility compounds.	Equipment and technology are readily available. Treatment of recovered vapors would likely be required. Likely not practical for site conditions (fine textured soil).	High capital costs.	Not retained since not beneficial to removal of site COIs.
	Chemical Oxidation	Chemically converts hazardous contaminants to less toxic compounds. Effective in destroying organic contaminants (including LNAPL) and oxidizing inorganic contaminants to less toxic/less mobile forms. Can include oxidant chemicals such as peroxides, permanganates, or ozone.	Effective in destroying organic contaminants (including free product) and oxidizing inorganic contaminants to less toxic/less mobile forms. Difficult to provide adequate coverage in subsurface. May cause settling in organic soils. Most applicable to source-area concentrations or NAPLs.	Equipment and vendors are readily available. Less efficient at addressing diffuse concentrations of site COIs. Likely not practical for site conditions (fine textured soil).	High implementation costs (potentially requiring multiple applications).	Not retained since inefficient for diffuse contaminant plume. Low hydraulic conductivity and depth to groundwater would limit effectiveness and increase cost.
	Passive/Reactive Treatment Walls	Barriers placed across groundwater movement that allows passage of water while facilitating degradation or removal of contaminants.	Can be effective in the remediation of VOC contamination. May not be suitable for source area remediation. Not cost-effective for very wide or deep plumes.	Difficult to implement given depth to contaminated aquifer. Site lacks suitable confining unit. Specialized equipment required for construction.	High costs for installation. Moderate costs for performance and compliance monitoring, and periodic maintenance.	Not applicable to site conditions (depth to groundwater and SPH). No confining layer at a depth that is within the vertical limits of trenching equipment. Not cost-effective for estimated extent of plume.

Note:
1. Shading indicates technologies that have been eliminated from consideration.

Table 4
Proposed Groundwater Monitoring Program
NuStar Alamogordo Terminal
Alamogordo, New Mexico

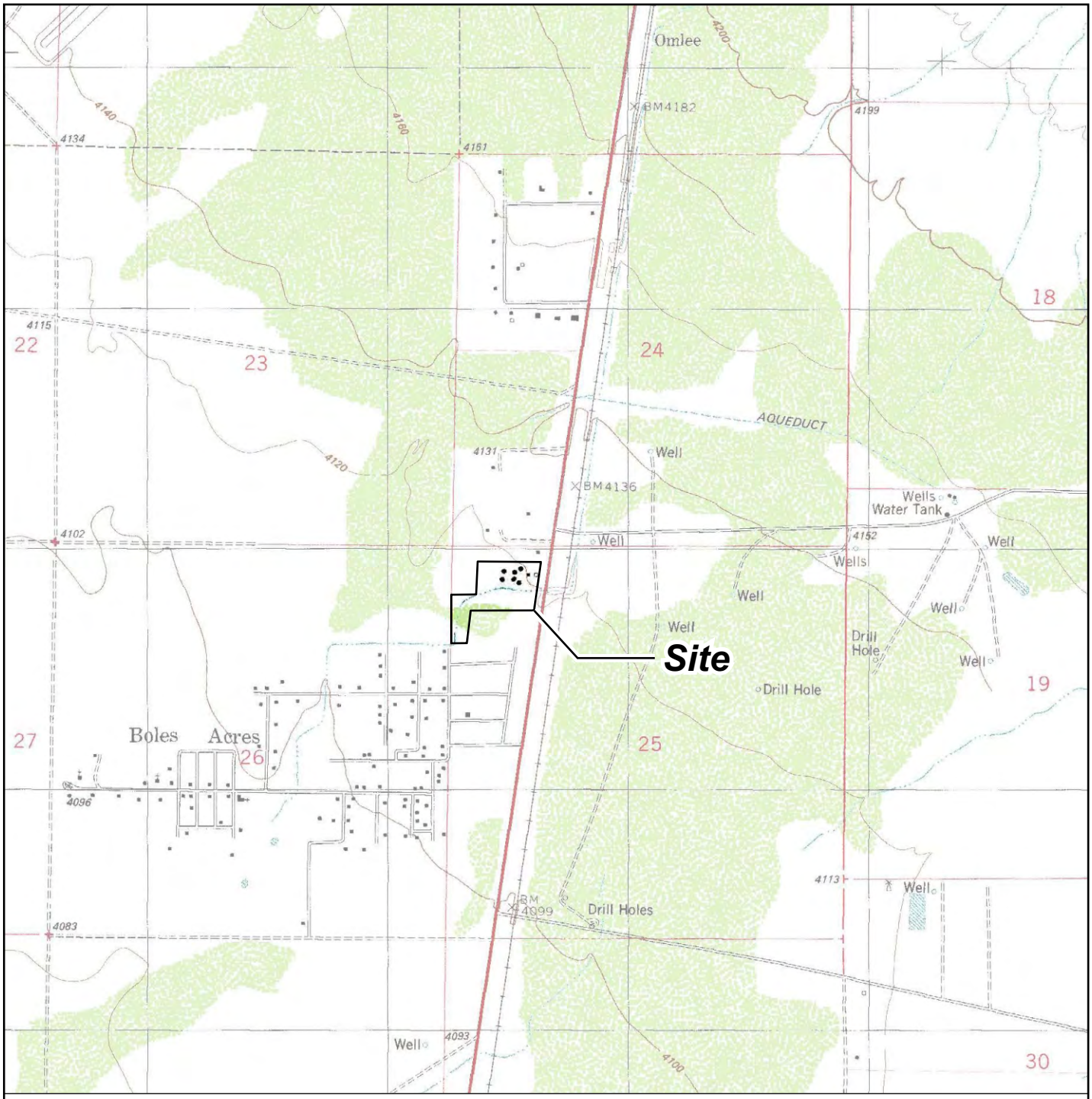
Well ID	Top of Casing Elevation (feet MSL)[1]	Gauging	BTEX	Naphthalene, 1-methylnaphthalene, and 2- methylnaphthalene	Soluble Fe, Nitrate, Sulfate, and Methane	Dissolved Lead
EID 1A	4127.02	S	S	S		A
EID 1B	4125.77	S				
EID 1 BS	4125.45	S				
EID 1C	4123.9	S				
EID 1D	4124.65	S	S	S		A
EID 4	4125.86	S				
STP 1	4125.15	S				
STP 4N	4124.45	S				
STP 4S E	4123.8	S				
STP 4S W	4123.79	S				
STP 5W	4122.69	S				
STP 5E E	4122.03	S				
STP 5E W	4121.97	S				
STP 6E	4125.19	S				
STP 6W E	4124.46	S				
STP 6W W	4124.41	S				
STP 7E	4123.47	S				
STP 7W E	4122.45	S				
STP 7W W	4122.45	S				
STP 8	4126.03	S	S	S		
STP 9	4124.04	S	S	S		
STP 10	4121.75	S				
STP 13	4119.05	S	S	S		
STP 15	4114.14	S	S	S	S	
STP 16	4126.05	S	S	S		
STP 17	4125.27	S	S	S		
STP 18	4124.08	S	S	S		
STP 19	4126.22	S	S	S		
STP 20	4123.16	S	S	S	S	
STP 21	4122.11	S	S	S	S	
STP 22	4123.16	S	S	S		
STP 23	4121.88	S	S	S		
STP 24	4127.92	S				
RW1	4131.63	S				
RW2	4131.73	S				
STP-25	4126.80	S	S	S		
STP-26	4125.95	S	S	S		
Disinger Domestic Well	--		A	A		
Echols Domestic Well	--		A	A		

Notes:
1. S = PerformedSemi-Annually
2. A = Performed Annually
3. BTEX = benzene, ethylbenzene, and xylenes by EPA Method 8260B
4. Soluble iron, Nitrate, Sulfate, and Methane
5. Total Naphthalene plus monomethylnaphthalenes by EPA Method 8260B
6. Lead = Dissolved Lead by EPA Method 6010B (Field filtered)
7. -- = unknown

Table 5
Proposed Vertical Delineation Groundwater Program
Almagordo Terminal
Almagordo, New Mexico

Well ID	Total Depth (feet bgs)	Screen interval		Gauge	BTEX	Total naphthalene plus monomethylnaphthalenes
		Top of Screen interval	Bottom of Screen Interval			
STP 4N	106.1	73	83	X	X	X
STP 4S E	88.54	89	94	X	X	X
STP 4S W	95.04	82	87	X	X	X
STP 5W	98.15	70	80	X	X	X
STP 5E E	99.35	92	97	X	X	X
STP 5E W	87.92	82	87	X	X	X
STP 6E	103.32	73	78	X	X	X
STP 6W E	94.8	82	87	X	X	X
STP 6W W	88.05	88	93	X	X	X
STP 7E	101.62	70	75	X		
STP 7W E	85	82	87	X		
STP 7W W	91.3	87	92	X	X	X

Notes:
1. BTEX = benzene, ethylbenzene, and xylenes by EPA Method 8260B
2. Total naphthalene plus monomethylnaphthalenes by EPA Method 8260B
3. Lead = Dissolved Lead by EPA Method 6010B (Field filtered)



Note: Base map prepared from USGS 7.5-minute quadrangle of Alamogordo South, NM, dated 1981.

0 2,000 4,000

Approximate Scale in Feet

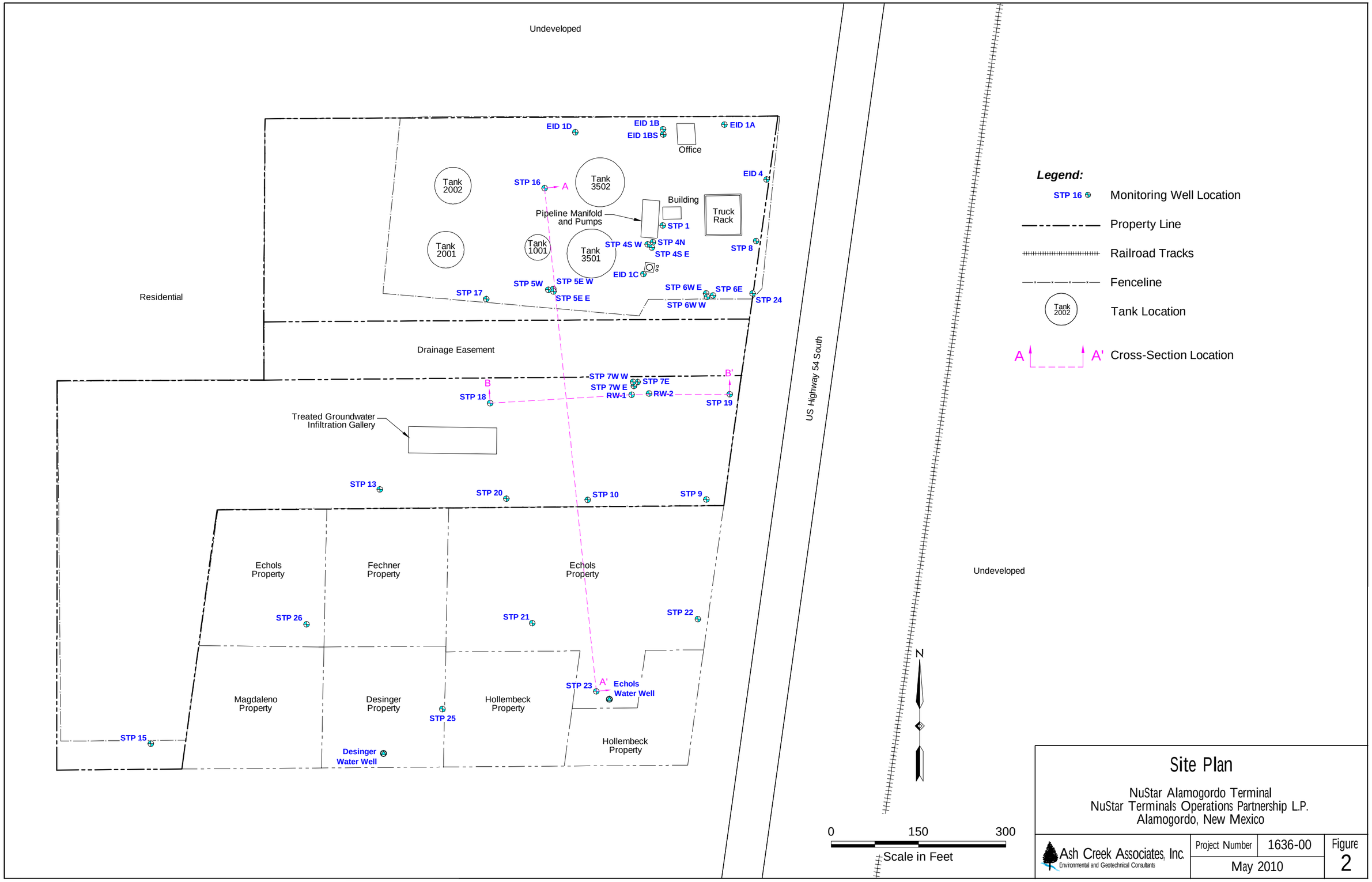
New Mexico

N

Site Location Map

NuStar Alamogordo Terminal
NuStar Terminals Operations Partnership L.P.
Alamogordo, New Mexico

Ash Creek Associates, Inc. Environmental and Geotechnical Consultants	Project Number 1636-00	Figure
	May 2010	1

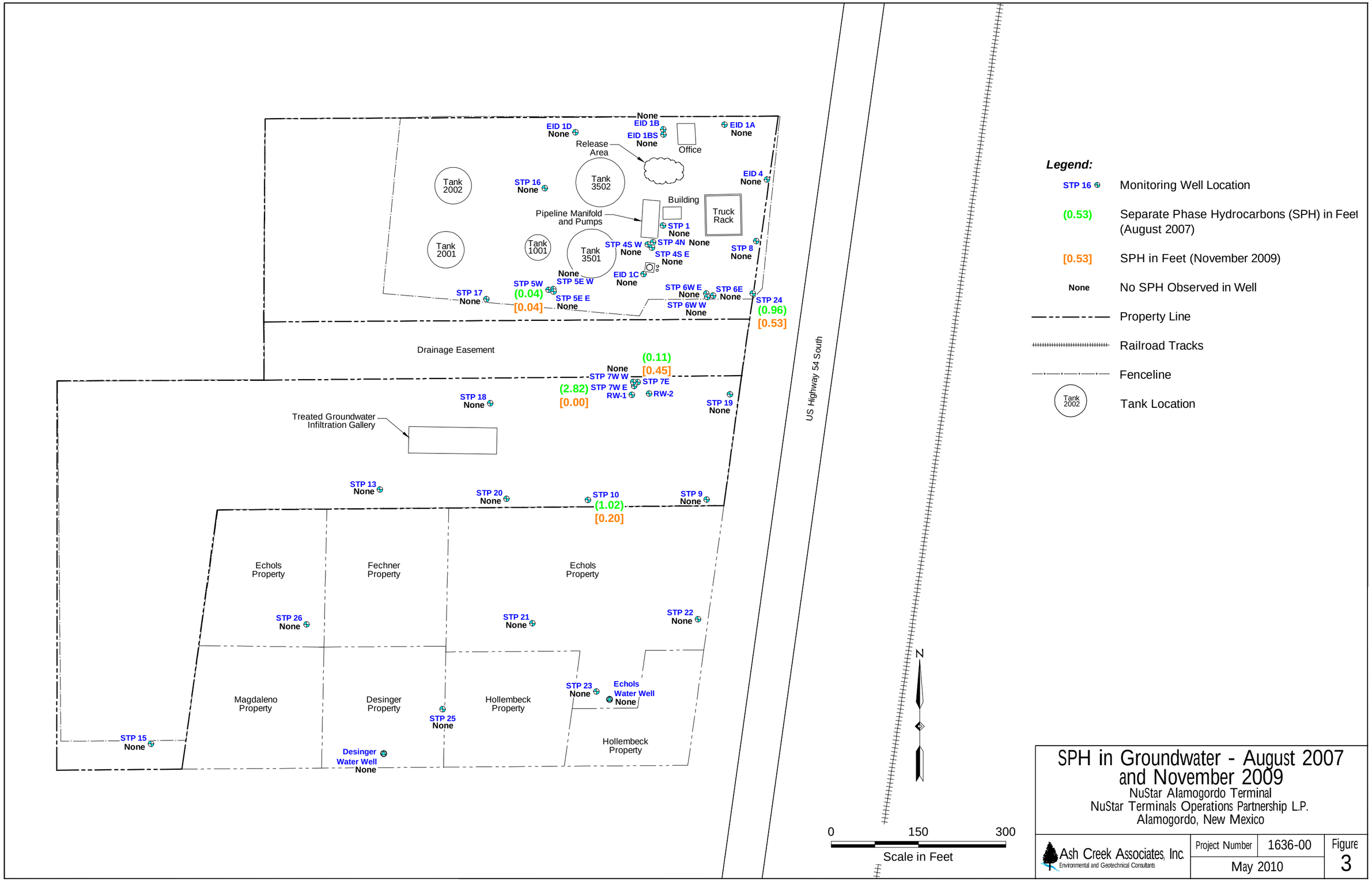


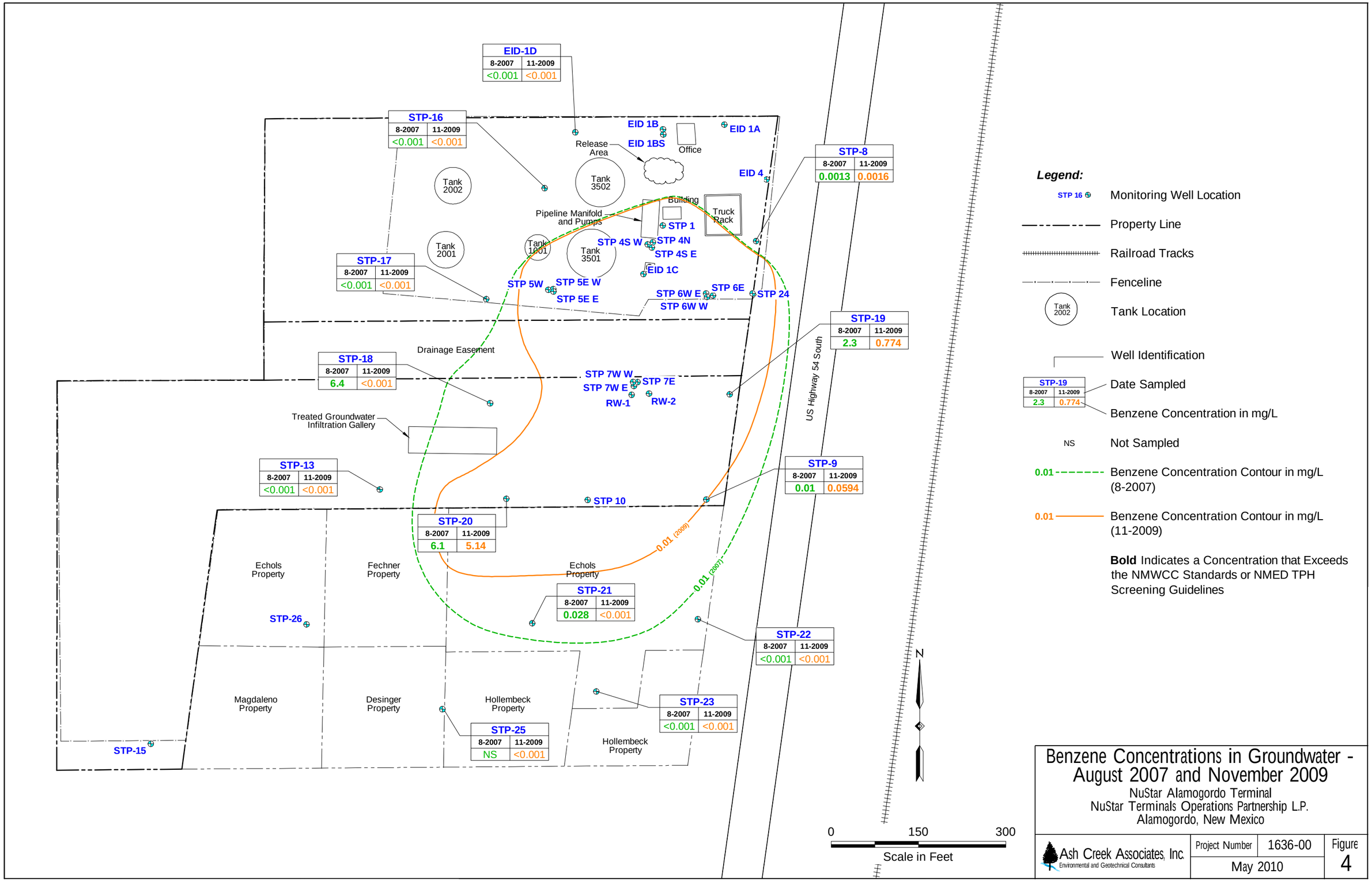
Site Plan

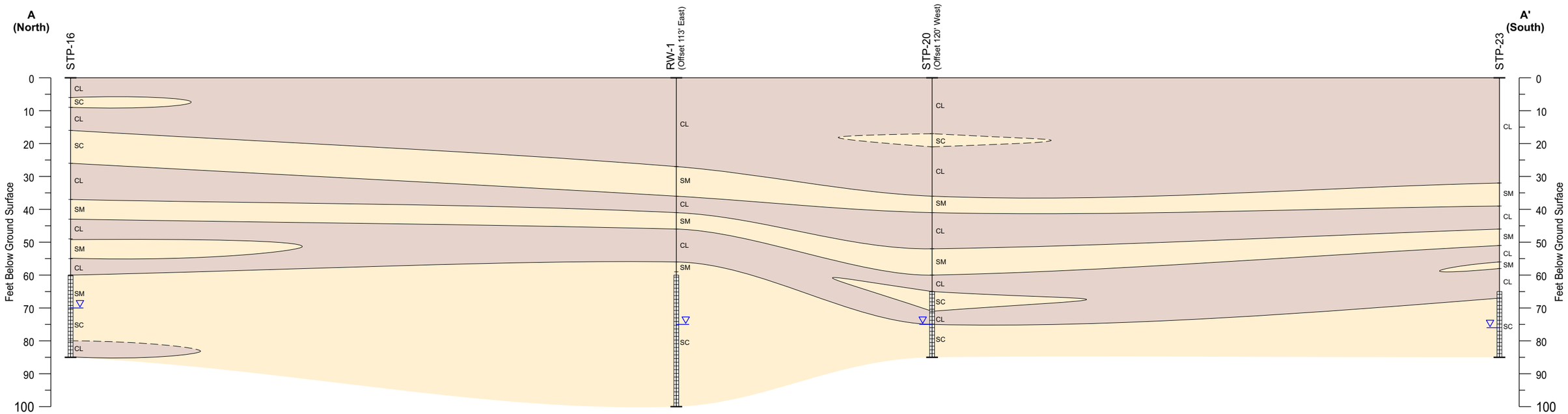
NuStar Alamogordo Terminal
NuStar Terminals Operations Partnership L.P.
Alamogordo, New Mexico

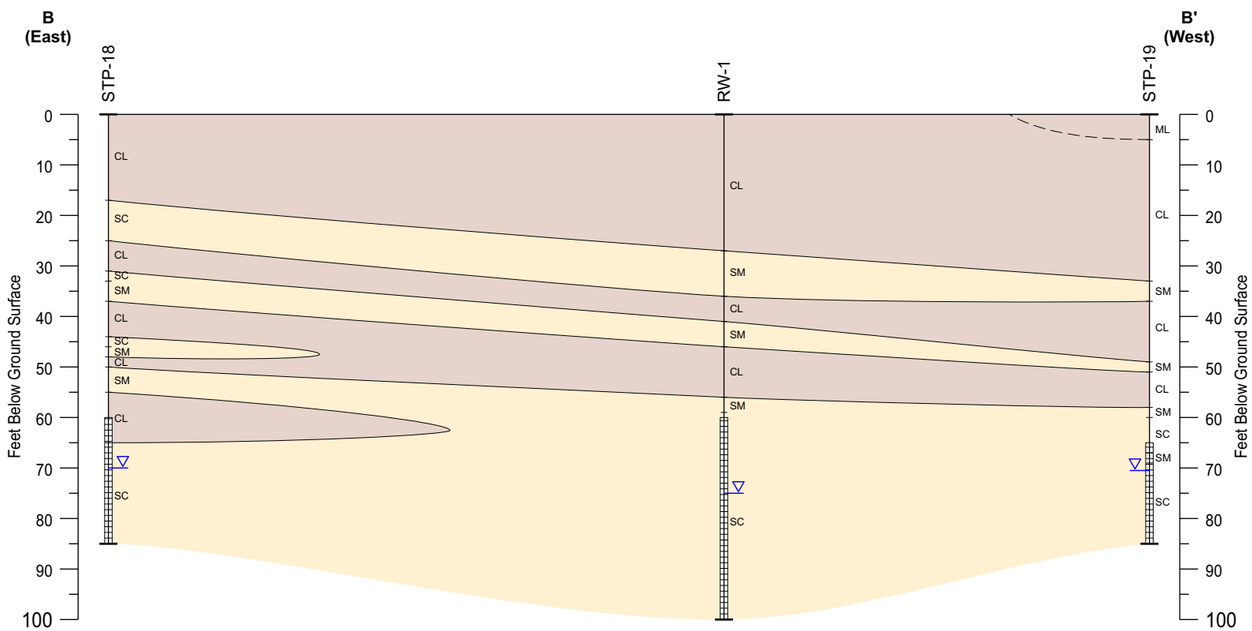
Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

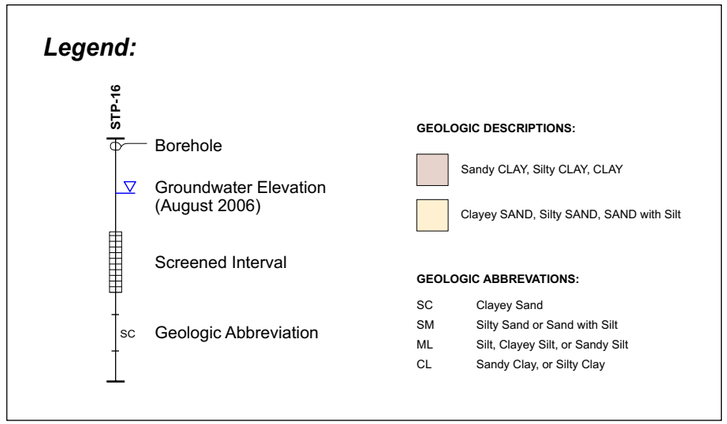
Project Number	1636-00	Figure
May 2010		2


None
EID 1B
EID 1D
None
EID 1BS
None
EID 1A
None
Release Area
Office
Tank 2002
STP 16
None
Tank 3502
EID 4
None
Building
Truck Rack
Pipeline Manifold and Pumps
STP 1
None
Tank 2001
Tank 1001
Tank 3501
STP 4S W
None
STP 4N
None
STP 4S E
None
STP 8
None
None
STP 5E W
EID 1C
None
STP 5W
(0.04)
[0.04]
STP 5E E
None
STP 17
None
STP 6W E
None
STP 6E
None
STP 6W W
None
STP 24
(0.96)
[0.53]
Drainage Easement
(0.11)
[0.45]
None
STP 7W W
STP 7E
(2.82)
[0.00]
STP 7W E
RW-1
RW-2
STP 18
None
STP 19
None
Treated Groundwater Infiltration Gallery
US Highway 54 South
STP 13
None
STP 20
None
STP 10
(1.02)
[0.20]
STP 9
None
Echols Property
Fechner Property
Echols Property
STP 26
None
STP 21
None
STP 22
None
Magdaleno Property
Desinger Property
Hollembeck Property
STP 23
None
Echols Water Well
None
STP 25
None
Hollembeck Property
STP 15
None
Desinger Water Well
None
N
0
150
300
Scale in Feet
Legend:
STP 16
Monitoring Well Location
(0.53)
Separate Phase Hydrocarbons (SPH) in Feet (August 2007)
[0.53]
SPH in Feet (November 2009)
None
No SPH Observed in Well
Property Line
Railroad Tracks
Fenceline
Tank 2002
Tank Location
SPH in Groundwater - August 2007 and November 2009
NuStar Alamogordo Terminal
NuStar Terminals Operations Partnership L.P.
Alamogordo, New Mexico
Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants
Project Number
1636-00
May 2010
Figure
3


EID-1D
8-2007 11-2009
<0.001 <0.001
STP-16
8-2007 11-2009
<0.001 <0.001
EID 1B
EID 1A
EID 1BS
Release Area
Office
Tank 3502
Tank 2002
EID 4
STP-8
8-2007 11-2009
0.0013 0.0016
Building
Truck Rack
Pipeline Manifold and Pumps
STP 1
STP 4S W
STP 4N
STP 4S E
Tank 1001
Tank 3501
Tank 2001
EID 1C
STP-17
8-2007 11-2009
<0.001 <0.001
STP 5W
STP 5E W
STP 5E E
STP 6W E
STP 6E
STP 24
STP 6W W
STP-19
8-2007 11-2009
2.3 0.774
Drainage Easement
STP-18
8-2007 11-2009
6.4 <0.001
STP 7W W
STP 7E
STP 7W E
RW-1
RW-2
US Highway 54 South
Treated Groundwater Infiltration Gallery
STP-13
8-2007 11-2009
<0.001 <0.001
STP-9
8-2007 11-2009
0.01 0.0594
STP 10
STP-20
8-2007 11-2009
6.1 5.14
0.01 (2009)
0.01 (2007)
Echols Property
Fechner Property
Echols Property
STP-21
8-2007 11-2009
0.028 <0.001
STP-26
STP-22
8-2007 11-2009
<0.001 <0.001
Magdaleno Property
Desinger Property
Hollembeck Property
STP-23
8-2007 11-2009
<0.001 <0.001
STP-25
8-2007 11-2009
NS <0.001
Hollembeck Property
STP-15
N
0 150 300
Scale in Feet
Legend:
STP 16 Monitoring Well Location
Property Line
Railroad Tracks
Fenceline
Tank 2002 Tank Location
Well Identification
STP-19
8-2007 11-2009
2.3 0.774
Date Sampled
Benzene Concentration in mg/L
NS Not Sampled
0.01 Benzene Concentration Contour in mg/L (8-2007)
0.01 Benzene Concentration Contour in mg/L (11-2009)
Bold Indicates a Concentration that Exceeds the NMWCC Standards or NMED TPH Screening Guidelines
Benzene Concentrations in Groundwater - August 2007 and November 2009
NuStar Alamogordo Terminal
NuStar Terminals Operations Partnership L.P.
Alamogordo, New Mexico
Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants
Project Number 1636-00
May 2010
Figure 4







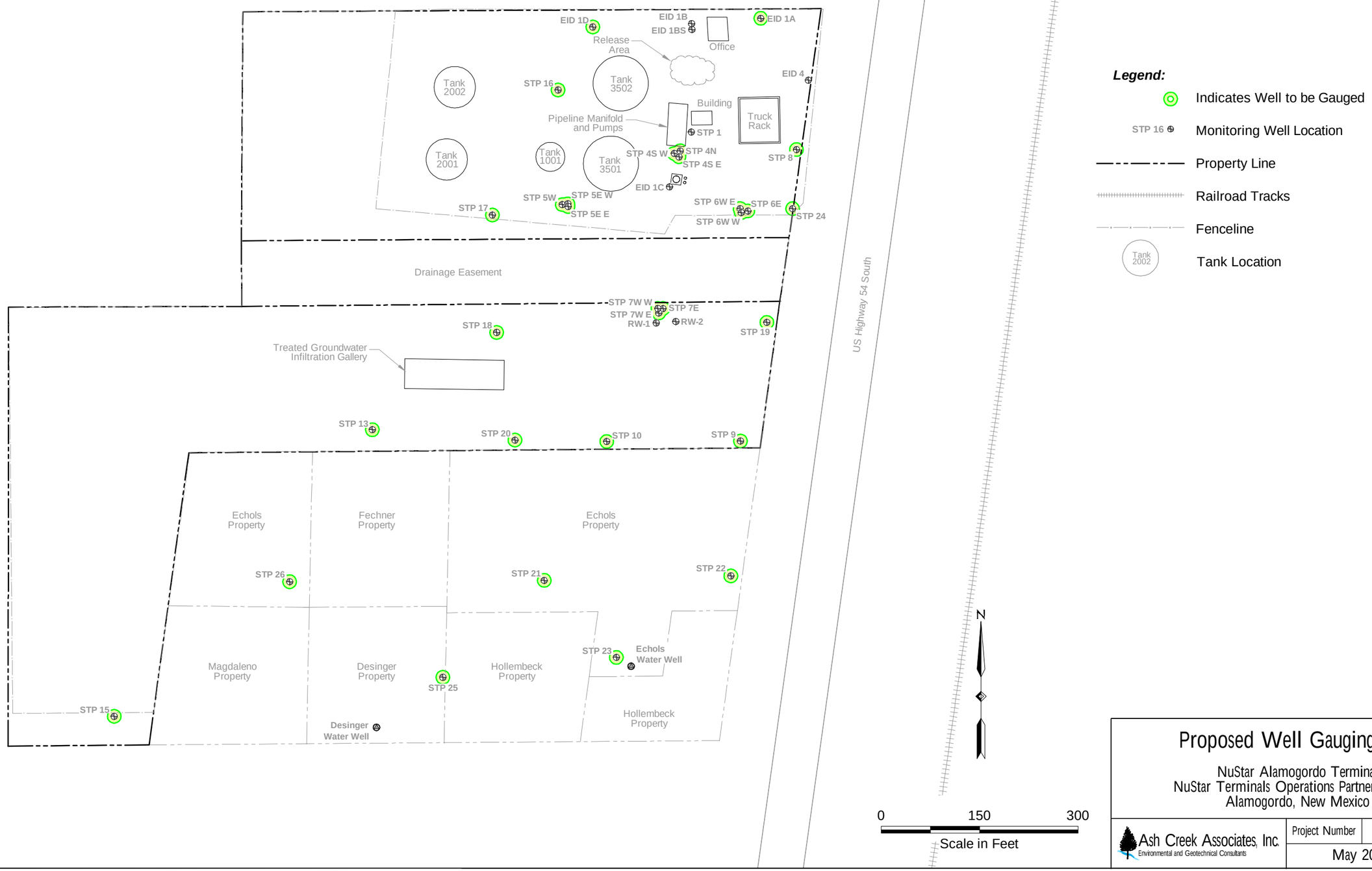
Approximate Horizontal Scale in Feet
0 60 120
0 30 60
Approximate Vertical Scale in Feet
Vertical Exaggeration x 2

Geologic Cross-Sections A-A' and B-B'

NuStar Alamogordo Terminal
NuStar Terminals Operations Partnership L.P.
Alamogordo, New Mexico

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1636-00	Figure
May 2010		5

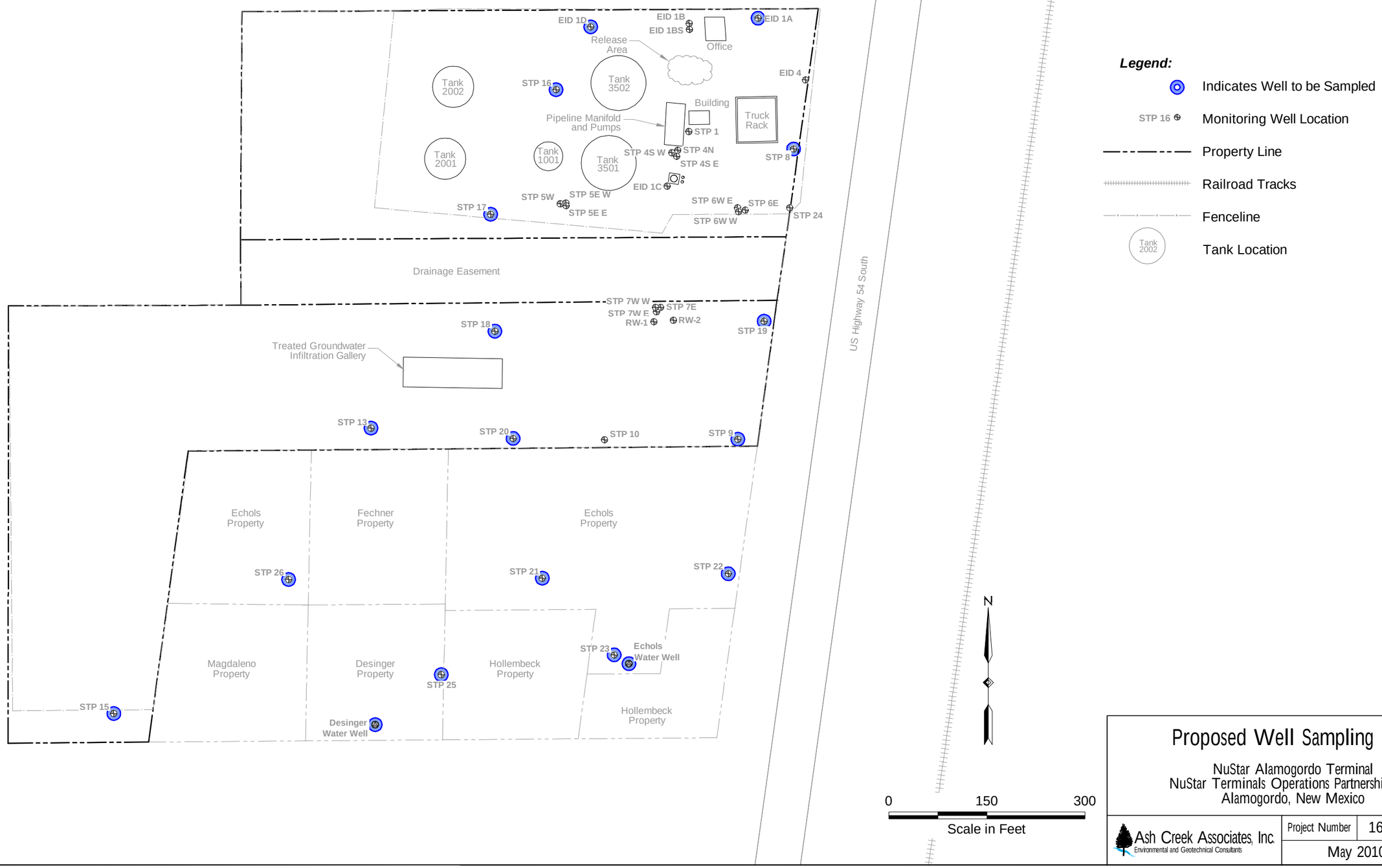


Proposed Well Gauging Plan

NuStar Alamogordo Terminal
NuStar Terminals Operations Partnership L.P.
Alamogordo, New Mexico

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1636-00	Figure
May 2010		6



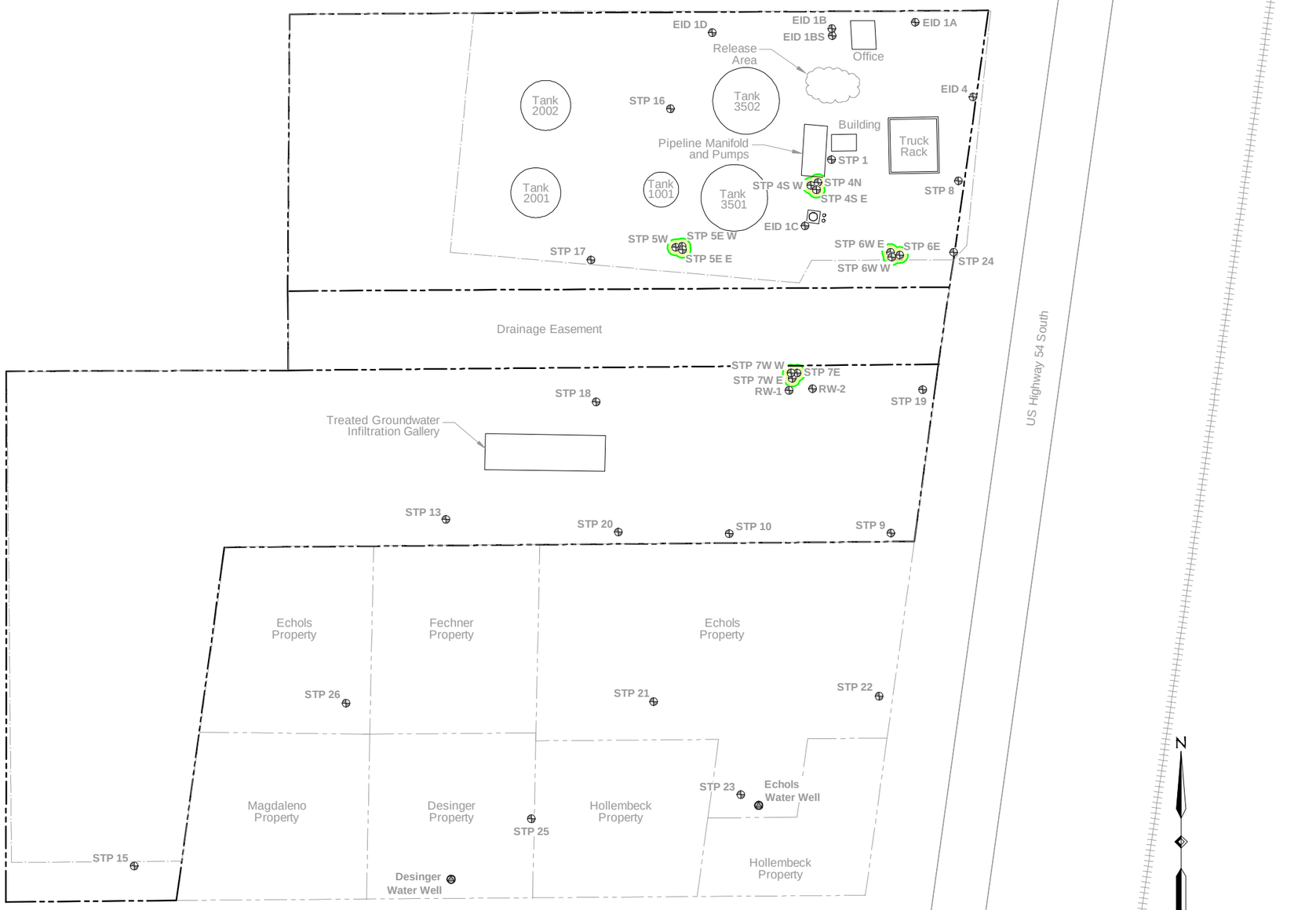
Proposed Well Sampling Plan

NuStar Alamogordo Terminal
NuStar Terminals Operations Partnership L.P.
Alamogordo, New Mexico

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1636-00	Figure
May 2010		7

DRAFT



Legend:

- Indicates Well to be Gauged
- STP 16 — Monitoring Well Location
- Property Line
- Railroad Tracks
- Fenceline
- Tank 2002 — Tank Location

N

0 150 300

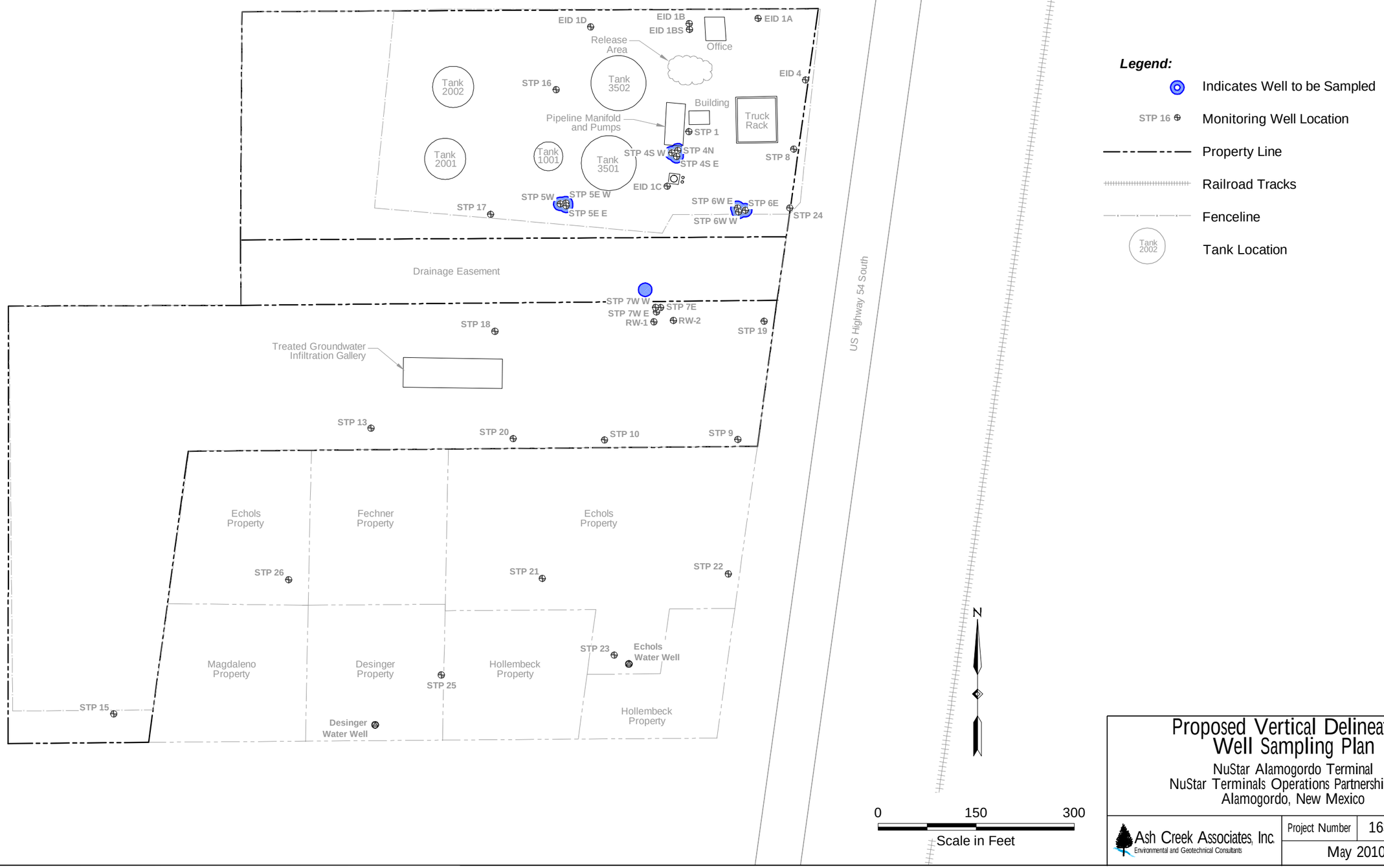
Scale in Feet

Proposed Vertical Delineation Gauging Plan

NuStar Alamogordo Terminal
NuStar Logistics L.P.
Alamogordo, New Mexico

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1636-00	Figure
May 2010		8



Proposed Vertical Delineation Well Sampling Plan

NuStar Alamogordo Terminal
NuStar Terminals Operations Partnership L.P.
Alamogordo, New Mexico

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1636-00	Figure
May 2010		9

Appendix A

Soil Boring Logs and Monitoring Well Construction Logs

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Standard Transpipe Corporation Owner's Well No. STP 4 N

Street or Post Office Address P. O. Box 109

City and State Alamogordo, New Mexico 88310

Well was drilled under Permit No. _____ and is located in the:

a. _____ ¼ NE ¼ NW ¼ NW ¼ of Section 25 Township 17 S. Range 9 E. N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____

Subdivision, recorded in Otero County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Braziel Drilling Company License No. WD-601

Address P. O. Box 180, La Luz, New Mexico 88337

Drilling Began _____ Completed 4/1986 Type tools air rotary Size of hole 7 7/8 in.

Elevation of land surface or _____ at well is 4127.65 ft. Total depth of well 100 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 69.49 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
84	100	16	Sand with clay	2

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
5			0	73	73			
5							73	83
5			83	100	17			

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by:

_____

State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad _____ FWL _____ FSL _____

File No. _____ Use _____ Location No. _____

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Standard Transpipe Corporation Owner's Well No. STP 5W
Street or Post Office Address P. O. Box 109
City and State Alamogordo, New Mexico 88310

Well was drilled under Permit No. _____ and is located in the:

a. ____ ¼ NE ¼ NW ¼ NW ¼ of Section 25 Township 17 S. Range 9 E. N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in Otero County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Braziel Drilling Company License No. WD-601

Address P. O. Box 180, La Luz, New Mexico 88337

Drilling Began _____ Completed 4/1986 Type tools air rotary Size of hole 7 7/8 in.

Elevation of land surface or _____ at well is 4126.02 ft. Total depth of well 100 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 70.36 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
70	100	30	Clayey sand and gravel	5

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
5			0	70	70			
5							70	80
5			80	100	20			

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by:

_____
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad _____ FWL _____ FSL _____

File No. _____ Use _____ Location No. _____

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Standard Transpipe Corporation Owner's Well No. STP 6 E
Street or Post Office Address P. O. Box 109
City and State Alamogordo, New Mexico 88310

Well was drilled under Permit No. _____ and is located in the:

a. ____ ¼ NE ¼ NW ¼ NW ¼ of Section 25 Township 17 S. Range 9 E. N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in Otero County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Braziel Drilling Company License No. WD-601
Address P. O. Box 180, La Luz, New Mexico 88337

Drilling Began _____ Completed 4/1986 Type tools air rotary Size of hole 7 7/8 in.

Elevation of land surface or _____ at well is 4128.12 ft. Total depth of well 98 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 70.83 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
60	85	25	Fine to coarse sand	5

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
5			0	73	73			
5							73	78
5			78	98	20			

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by:

_____
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad _____ FWL _____ FSL _____

File No. _____ Use _____ Location No.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Standard Transpipe Corporation Owner's Well No. STP 7 E
Street or Post Office Address P. O. Box 109
City and State Alamogordo, New Mexico 88310

Well was drilled under Permit No. _____ and is located in the:

a. ____ ¼ NE ¼ NW ¼ NW ¼ of Section 25 Township 17 S. Range 9 E. N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in Otero County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Braziel Drilling Company License No. WD-601
Address P. O. Box 180, La Luz, New Mexico 88337

Drilling Began _____ Completed 4/1986 Type tools air rotary Size of hole 7 7/8 in.

Elevation of land surface or _____ at well is 4126.30 ft. Total depth of well 100 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 71.57 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
70	87	17	Coarse gravelly sand	10

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
4			0	70	70			
4							70	75
4			75	100	25			

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by:

_____
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad _____ FWL _____ FSL _____

File No. _____ Use _____ Location No. _____

5

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Standard Transpipe Corporation Owner's Well No. STP 9

Street or Post Office Address P. O. Box 109

City and State Alamogordo, New Mexico 88310

Well was drilled under Permit No. _____ and is located in the:

a. ____ ¼ SE ¼ NW ¼ NW ¼ of Section 25 Township 17 S. Range 9 E. N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____ Subdivision, recorded in Otero County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Braziel Drilling Company License No. WD-601

Address P. O. Box 180, La Luz, New Mexico 88337

Drilling Began _____ Completed 4/1986 Type tools air rotary Size of hole 7 7/8 in.

Elevation of land surface or _____ at well is 4126.38 ft. Total depth of well 100 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 73.17 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
68	82	14	Sand	5

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
4			0	70	70			
4							70	75
4			75	95	20			

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by:

_____

State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad _____ FWL _____ FSL _____

File No. _____ Use _____ Location No.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Standard Transpipe Corporation Owner's Well No. STP 10

Street or Post Office Address P. O. Box 109

City and State Alamogordo, New Mexico 88310

Well was drilled under Permit No. _____ and is located in the:

a. ____ ¼ SE ¼ NW ¼ NW ¼ of Section 25 Township 17 S. Range 9 E. N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____

Subdivision, recorded in Otero County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Braziel Drilling Company License No. WD-601

Address P. O. Box 180, La Luz, New Mexico 88337

Drilling Began _____ Completed 4/1986 Type tools air rotary Size of hole 7 7/8 in.

Elevation of land surface or _____ at well is 4124.74 ft. Total depth of well 100 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 72.35 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
70	78	8	Poorly sorted sand	3

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
4			0	73	73			
4							73	78
4			78	98	20			

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by:

_____

State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad _____ FWL _____ FSL _____

File No. _____ Use _____ Location No. _____

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Standard Transpipe Corporation Owner's Well No. STP 11

Street or Post Office Address P. O. Box 109

City and State Alamogordo, New Mexico 88310

Well was drilled under Permit No. _____ and is located in the:

a. ____ ¼ NE ¼ SW ¼ NW ¼ of Section 25 Township 17 S. Range 9 E. N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____ Subdivision, recorded in Otero County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Braziel Drilling Company License No. WD-601

Address P. O. Box 180, La Luz, New Mexico 88337

Drilling Began _____ Completed 4/1986 Type tools air rotary Size of hole 7 7/8 in.

Elevation of land surface or _____ at well is 4120.53 ft. Total depth of well 94 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 75.23 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
60	100	40	Clayey silt	2

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
4			0	74	74			
4							74	84
4			84	94	10			

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by:

_____

State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad _____ FWL _____ FSL _____

File No. _____ Use _____ Location No. _____

MONITORING WELL CONSTRUCTION DETAIL

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP,

No. STP-16

File No.: 042597
Date: 7/30/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

Top of Casing Elevation: 4126.05

Surface Completion: ft

Stick Up:

ground surface

Surface Seal: Grout

Well Casing

Annulus Backfill Type: Grout

Top of Seal at 60 ft

Bottom of Seal at 63 ft

Seal Type: 3/8 Chips

Top of Screen at 65 ft

Pack Type:
Sand, size 20/40
Gravel
Natural

Depth to Groundwater (TOC) 68 ft

Bottom of screen at 85 ft

Total Well Depth (TOC) 87 ft

Note: All dimensions are below ground surface (bgs) except where noted.

Screen Type: ☑ slotted ☐ perforated other:

Screen Material: ☐ stainless steel ☑ PVC other:

Screen Length: 20' Screen Diameter: 2" Screen Slot Size: 0.010"

Well Casing Material: Schedule 40 PVC Well Casing Diameter: 2"

Development - Method: Pump Hole Diameter: 7 7/8"

Duration/Volume: 10 gallons

MONITORING WELL CONSTRUCTION DETAIL

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP,

No. STP-17

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

Top of Casing Elevation: 4125.27

Surface Completion: ft

Stick Up: ft

ground surface

Surface Seal: Grout

Well Casing

Annulus Backfill Type: Grout

Top of Seal at 60 ft

Bottom of Seal at 63 ft

Seal Type: 3/8 Chips

Top of Screen at 65 ft

Pack Type:
Sand, size 20/40
Gravel
Natural

Depth to Groundwater (TOC) -

Bottom of screen at 85 ft

Total Well Depth (TOC) 87 ft

Note: All dimensions are below ground surface (bgs) except where noted.

Screen Type: ☑ slotted ☐ perforated other:

Screen Material: ☐ stainless steel ☑ PVC other:

Screen Length: 20' Screen Diameter: 2" Screen Slot Size: 0.010"

Well Casing Material: Schedule 40 PVC Well Casing Diameter: 2"

Development - Method: Pump Hole Diameter: 7 7/8"

Duration/Volume: 9 gallons

MONITORING WELL CONSTRUCTION DETAIL

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP,

No. STP-18

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

Top of Casing Elevation: 4124.08

Surface Completion: ft

Stick Up: ft

ground surface

Surface Seal: Grout

Well Casing

Annulus Backfill Type: Grout

Top of Seal at 60 ft

Bottom of Seal at 63 ft

Seal Type: 3/8 Chips

Top of Screen at 65.5 ft

Pack Type:
Sand, size 20/40
Gravel
Natural

Depth to Groundwater (TOC) -

Bottom of screen at 85.5 ft

Total Well Depth (TOC) 86 ft

Note: All dimensions are below ground surface (bgs) except where noted.

Screen Type: ☑ slotted ☐ perforated other:

Screen Material: ☐ stainless steel ☑ PVC other:

Screen Length: 20' Screen Diameter: 2" Screen Slot Size: 0.010"

Well Casing Material: Schedule 40 PVC Well Casing Diameter: 2"

Development - Method: Pump Hole Diameter: 7 7/8"

Duration/Volume: 10 gallons

MONITORING WELL CONSTRUCTION DETAIL

Project: ALAMOGORDO TERMINAL

No. STP-19

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP,

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

Top of Casing Elevation: 4126.22

Surface Completion: ft

Stick Up: ft

ground surface

Surface Seal: Grout

Well Casing

Annulus Backfill Type: Grout

Top of Seal at 59 ft

Bottom of Seal at 62.5 ft

Seal Type: 3/8 Chips

Top of Screen at 65 ft

Pack Type:
Sand, size 20/40
Gravel
Natural

Depth to Groundwater (TOC) 71 ft

Bottom of screen at 85 ft

Total Well Depth (TOC) 86 ft

Note: All dimensions are below ground surface (bgs) except where noted.

Screen Type: ☑ slotted ☐ perforated other:

Screen Material: ☐ stainless steel ☑ PVC other:

Screen Length: 20' Screen Diameter: 2" Screen Slot Size: 0.010"

Well Casing Material: Schedule 40 PVC Well Casing Diameter: 2"

Development - Method: Pump Hole Diameter: 7 7/8"

Duration/Volume: 10 gallons

MONITORING WELL CONSTRUCTION DETAIL

Project: ALAMOGORDO TERMINAL

No. STP-20

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP,

File No.: 042597
Date: 8/1/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

Top of Casing Elevation: 4123.16

Surface Completion: ft

Stick Up: ft

ground surface

Surface Seal: Grout

Well Casing

Annulus Backfill Type: Grout

Top of Seal at 59 ft

Bottom of Seal at 63 ft

Seal Type: 3/8 Chips

Top of Screen at 65 ft

Pack Type:
Sand, size 20/40
Gravel
Natural

Depth to Groundwater (TOC) -

Bottom of screen at 85 ft

Total Well Depth (TOC) 86 ft

Note: All dimensions are below ground surface (bgs) except where noted.

Screen Type: ☑ slotted ☐ perforated other:

Screen Material: ☐ stainless steel ☑ PVC other:

Screen Length: 20' Screen Diameter: 2" Screen Slot Size: 0.010"

Well Casing Material: Schedule 40 PVC Well Casing Diameter: 2"

Development - Method: Pump Hole Diameter: 7 7/8"

Duration/Volume: 8 gallons

MONITORING WELL CONSTRUCTION DETAIL

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP,

No. STP-21

File No.: 042597
Date: 8/3/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

Top of Casing Elevation: 4122.11

Surface Completion: ft

Stick Up: ft

ground surface

Surface Seal: Grout

Well Casing

Annulus Backfill Type: Grout

Top of Seal at 60 ft

Bottom of Seal at 63 ft

Seal Type: 3/8 Chips

Top of Screen at 65 ft

Pack Type:
Sand, size 20/40
Gravel
Natural

Depth to Groundwater (TOC) -

Bottom of screen at 85 ft

Total Well Depth (TOC) 86 ft

Note: All dimensions are below ground surface (bgs) except where noted.

Screen Type: ☑ slotted ☐ perforated other:

Screen Material: ☐ stainless steel ☑ PVC other:

Screen Length: 20' Screen Diameter: 2" Screen Slot Size: 0.010"

Well Casing Material: Schedule 40 PVC Well Casing Diameter: 2"

Development - Method: Pump Hole Diameter: 7 7/8"

Duration/Volume: 10 gallons

MONITORING WELL CONSTRUCTION DETAIL

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP,

No. STP-22

File No.: 042597
Date: 8/1/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

Top of Casing Elevation: 4123.16

Surface Completion: ft

Stick Up: ft

ground surface

Surface Seal: Grout

Well Casing

Annulus Backfill Type: Grout

Top of Seal at 59.5 ft

Bottom of Seal at 62.5 ft

Seal Type: 3/8 Chips

Top of Screen at 65 ft

Pack Type:
Sand, size 20/40
Gravel
Natural

Depth to Groundwater (TOC) 72.5 ft

Bottom of screen at 85 ft

Total Well Depth (TOC) 85.5 ft

Note: All dimensions are below ground surface (bgs) except where noted.

Screen Type: ☑ slotted ☐ perforated other:

Screen Material: ☐ stainless steel ☑ PVC other:

Screen Length: 20' Screen Diameter: 2" Screen Slot Size: 0.010"

Well Casing Material: Schedule 40 PVC Well Casing Diameter: 2"

Development - Method: Pump Hole Diameter: 7 7/8"

Duration/Volume: 10 gallons, clear discharge

MONITORING WELL CONSTRUCTION DETAIL

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP,

No. STP-23

File No.: 042597
Date: 8/3/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

Top of Casing Elevation: 4121.88

Surface Completion: ft

Stick Up: ft

ground surface

Surface Seal: Grout

Well Casing

Annulus Backfill Type: Grout

Top of Seal at 60 ft

Bottom of Seal at 63 ft

Seal Type: 3/8 Chips

Top of Screen at 65 ft

Pack Type:
Sand, size 20/40
Gravel
Natural

Depth to Groundwater (TOC) -

Bottom of screen at 85 ft

Total Well Depth (TOC) 86 ft

Note: All dimensions are below ground surface (bgs) except where noted.

Screen Type: ☑ slotted ☐ perforated other:

Screen Material: ☐ stainless steel ☑ PVC other:

Screen Length: 20' Screen Diameter: 2" Screen Slot Size: 0.010"

Well Casing Material: Schedule 40 PVC Well Casing Diameter: 2"

Development - Method: Pump Hole Diameter: 7 7/8"

Duration/Volume: 10 gallons

MONITORING WELL CONSTRUCTION DETAIL

Project: ALAMOGORDO TERMINAL

No. STP-24

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP,

File No.: 042597
Date: 8/2/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

Top of Casing Elevation: 4127.92

Surface Completion: ft

Stick Up: ft

ground surface

Surface Seal: Grout

Well Casing

Annulus Backfill Type: Grout

Top of Seal at 60 ft

Bottom of Seal at 63 ft

Seal Type: 3/8 Chips

Top of Screen at 65 ft

Pack Type:
Sand, size 20/40
Gravel
Natural

Depth to Groundwater (TOC) -

Bottom of screen at 85 ft

Total Well Depth (TOC) 86 ft

Note: All dimensions are below ground surface (bgs) except where noted.

Screen Type: ☑ slotted ☐ perforated other:

Screen Material: ☐ stainless steel ☑ PVC other:

Screen Length: 20' Screen Diameter: 2" Screen Slot Size: 0.010"

Well Casing Material: Schedule 40 PVC Well Casing Diameter: 2"

Development - Method: Not Developed Hole Diameter: 7 7/8"

Duration/Volume: PSH in well

MONITORING WELL CONSTRUCTION DETAIL

Project: ALAMOGORDO TERMINAL

No. RW-1

Client: NUSTAR TERMINALS OPERATIONS PARTNERSHIP, L.P.

File No.: 042597
Date: 5/28/2008
Drilling Co.: WHITE DRILLING
Supervisor: JOE BLACKBURN
Type Rig: AIR ROTARY
Logged by: JAMES ORNELAS

Top of Casing Elevation: _____

Surface Completion: 6"X6" Steal Vault

Stick Up: 2.84 ft

ground surface

Surface Seal: Concrete

Well Casing

Annulus Backfill Type: Bentonite

Top of Seal at _____ ft

Bottom of Seal at 57 ft

Seal Type: Bentonite

Top of Screen at 60 ft

Pack Type:
Sand, size 20/40
Gravel
Natural

Depth to Groundwater (TOC) -

Bottom of screen at 100 ft

Total Well Depth (TOC) 100 ft

Note: All dimensions are below ground surface (bgs) except where noted.

Screen Type: ☑ slotted ☐ perforated other: Certalock

Screen Material: ☐ stainless steel ☑ PVC other: _____

Screen Length: 40' Screen Diameter: 4" Screen Slot Size: 0.020"

Well Casing Material: Schedule 40 PVC Well Casing Diameter: 4"

Development - Method: 15' bailer Hole Diameter: 7 7/8"

Duration/Volume: ~100 gallons

MONITORING WELL CONSTRUCTION DETAIL

Project: ALAMOGORDO TERMINAL

No. RW-2

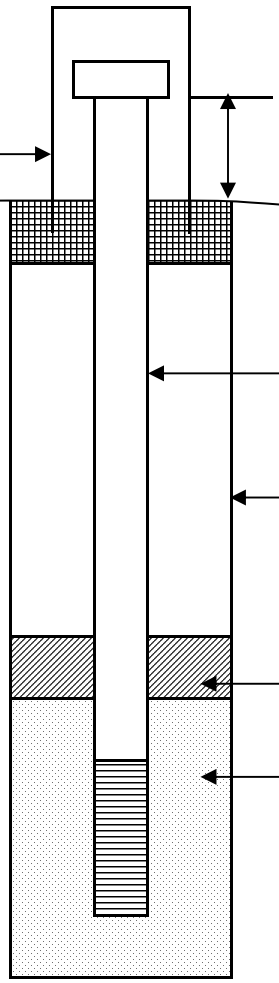
Client: NUSTAR TERMINALS OPERATIONS PARTNERSHIP, L.P.

File No.: 042597
Date: 5/28/2008
Drilling Co.: WHITE DRILLING
Supervisor: JOE BLACKBURN
Type Rig: AIR ROTARY
Logged by: JAMES ORNELAS

Top of Casing Elevation: _____

Surface Completion: 6"X6" Steal Vault

ground surface



Stick Up: 2.84 ft

Surface Seal: Concrete

Well Casing

Annulus Backfill Type: Bentonite

Top of Seal at _____ ft

Bottom of Seal at 56 ft

Seal Type: Bentonite

Top of Screen at 59 ft

Pack Type:
Sand, size 20/40
Gravel
Natural

Depth to Groundwater (TOC) -

Bottom of screen at 99 ft

Total Well Depth (TOC) 100 ft

Note: All dimensions are below ground surface (bgs) except where noted.

Screen Type: ☑ slotted ☐ perforated other: Certalock

Screen Material: ☐ stainless steel ☑ PVC other: _____

Screen Length: 40' Screen Diameter: 4" Screen Slot Size: 0.020"

Well Casing Material: Schedule 40 PVC Well Casing Diameter: 4"

Development - Method: 15' bailer Hole Diameter: 7 7/8"

Duration/Volume: ~120 gallons

STP 4N

Section 6. LOG OF [illegible]E

Depth in Feet From	To	Thickness in Feet	Color and Type of Material Encountered
0	28	28	Clay, brown, sandy
28	51	23	Sand, brown, clean, few clay stringers
51	55	4	Clay, reddish-brown, silty
55	80	25	Sand, poor samples
80	84	4	Clay, brown
84	100	16	Sand, poor samples

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Drilling Agent

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form [illegible]

STP 5W

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	40	40	Clay, grayish tan, some gravel
40	60	20	Clay, tan, sandy
60	100	40	Clay, tan, soft

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Drilled Agent

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible and

STP 6E

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	27	27	Clay, buff
27	85	58	Sand, brown, fine, some clay stringers
85	98	13	Sand, brown, coarse, gravelly

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Drilling Agent

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is

STP 7E

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	28	28	Clay, brown
28	40	12	Sand, brown, fine
40	52	12	Clay, brown, sandy
52	91	39	Sand, brown, medium, hard, gravelly
91	100	9	Clay, brown, sandy

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

DRILL Agent

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is

STP 9

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	29	29	Clay, reddish brown, sandy
29	42	13	Sand, brown, fine
42	48	6	Clay, brown, silty
48	82	34	Sand, brown, fine to medium, hard streaks
82	88	6	Clay, brown, sandy
88	95	7	Sand, fine to medium
95	100	5	Clay, brown, sandy

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller Agent

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible

STP 10

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	20	20	Clay, brown, silty
20	48	20	Sand, buff, fine to medium
48	54	6	Clay, buff, sandy
54	96	42	Sand, brown, coarse, gravelly
96	100	4	Clay, red, sandy

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

By [illegible] Agent

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is

STP 11

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	3	3	Silt, reddish brown, clayey
3	15	12	Caliche, buff, soft
15	60	45	Clay, brown, silty
60	100	40	Clay and silt, brown, sand in lower part

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Drill Agent

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible [illegible]

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-16

File No.: 042597
Date: 7/30/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	0-4' Post hole refusal 4-85' Air Rotary Start Time: 1230 Finish Time: 1600
										(CL) Clay: dry, hard with silt, light brown
					0		5			
										(SC) Sand: very fine, with clay and silt; brown (10YR 4/2)
					0		10			(CL) Sandy Clay: very fine sand; reddish brown (5YR 4/4)
					0		15			
										(SC) Clayey Sand: very fine sand,; brown (5YR 4/4)
					0		20			
					0		25			
										(CL) Silty Clay: reddish brown (5YR 4/4)
					0		30			
					0		35			
										(CL) Sandy Clay: brown, (10YR 5/4)
										(SM) Sand: with silt, brown (10YR 6/6)
					0		40			

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-16

File No.: 042597
Date: 7/30/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA					BORING DATA
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(SM) Sand: with silt and discontinuous strings of clay, brown (10YR 6/6)
					0		45			(CL) Silty Clay: moist, soft, reddish brown (5YR 4/4)
					0		50			(CL) Sandy Clay: very fine sand; reddish brown (5YR 4/4)
										(SM) Sand: with silt, brown (10YR 6/6)
					0		55			(CL) Silty Clay: reddish brown (5YR 4/4)
					0		60			(SM) Sand: with silt, brown (10YR 6/6)
					0		65			- more clayey, moist
					0		70			(SC) Clayey Sand: brown (10YR 6/6)
					0		75			
					0		80			

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

Water Level after 14 hrs

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-16

File No.: 042597
Date: 7/30/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(CL) Sandy Clay: brown (10YR 5/4)
					0		85			Total Depth of Well

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-17

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	0-4' Post hole refusal 4-85' Air Rotary Start Time: 0800 Finish Time: 1040
										(ML) Silt: fill material for dyke, light brown
										(CL) Silty Clay: dry, hard, reddish brown (5YR 4/4)
					0		5			-with gravel to 1/4"
					0		10			-more moisture
					0		15			(SC) Sandy Clay: very fine sand, bits of limestone and caliche in cuttings, light brown (5YR 5/6)
					0		20			
										(CL) Sandy Clay: very fine sand, light brown (10YR 5/4)
					0		25			(CL) Silty Clay: light brown (5YR 5/6)
					0		30			-bits of limestone in cuttings
					0		35			-thin beds of limestone and sandstone to 40'
					0		40			

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-17

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(CL) Silty Clay: soft, moist, light brown (5YR 5/6)
					0		45			-with very fine sand (5YR 4/4)
					0		50			
										(SM) Silty Sand: fine sand, loose, light brown (10YR 6/6)
					0		55			
										(CL) Silty Clay: reddish brown (5YR 4/4)
					0		60			
										(SM) Silty Sand: fine sand, loose, light brown (10YR 6/6)
					0		65			
										(SC) Clayey Sand: moist, light brown (5YR 5/6)
					0		70			
					0		75			
					0		80			

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-17

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	0-4' Post hole refusal 4-85' Air Rotary Start Time: 0800 Finish Time: 1040
										(SC) Clayey Sand: wet, light brown (5YR 5/6)
					0		85			Total Depth of Well

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

No. STP-18

Client: SUPPORT TERMINALS
OPERATING PARTNERSHIP, L.P.

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	0-3' Post hole refusal 3-85' Air Rotary Start Time: 1630 Finish Time: 1840
										(CL) Silty Clay: dry, hard, brown (5YR 4/4)
					0		5			-bits of caliche in cuttings
					0		10			
					0		15			
										(SC) Clayey Sand: very fine sand, brown (10YR 5/4)
					0		20			
					0		25			(CL) Silty Clay: brown (5YR 5/6)
					0		30			
										(SC) Clayey Sand: moist, brown (10YR 6/6)
										(SM) Silty Sand: brown (10 YR 6/6)
					0		35			
										(CL) Silty Clay: brown (5YR 4/4)
					0		40			

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

No. STP-18

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA					BORING DATA
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(CL) Sandy Clay: very fine sand, soft, moist, light brown (5YR 5/6)
					0		45			(SC) Clayey Sand: light brown (10YR 6/6)
										(SM) Silty Sand: light brown (10YR 6/6)
										(CL) Silty Clay: brown (5YR 4/4)
					0		50			(SM) Silty Sand, light brown (10 YR 6/6) - bits of sandstone in cuttings
					4.5		55			(CL) Sandy Clay: fine sand, moist, brown (5YR 4/4)
										(CL) Silty Clay: moist, brown (5YR 4/4)
					3.0		60			
					3.2		65			(SC) Clayey Sand: wet, brown (5YR 5/6)
					3.0		70	▼		
					7.0		75			
					5.0		80			

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

▼ Water Level After 1 day

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-18

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(SC) Clayey Sand: wet, brown (5YR 5/6)
					0		85			Total Depth of Well

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

No. STP-19

Client: SUPPORT TERMINALS
OPERATING PARTNERSHIP, L.P.

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	0-4' Post hole refusal 4-85' Air Rotary Start Time: 1200 Finish Time: 1405
										(ML) Silt: light brown
										(CL) Silty Clay: dry, hard, dark brown
					0		5			
					0		10			-(10 YR 5/4)
					0		15			-(5YR 4/4)
					0		20			-bits of limestone
					0		25			-more sand, fine sand
					0		30			(MH) Silt: with clay, light brown (10 YR 5/4) - bits of caliche
					0		35			(SM) Silty Sand: light brown (10 YR 6/6)
					0		40			(CL) Silty Clay: slightly moist, brown (5YR 4/4)

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

No. STP-19

Client: SUPPORT TERMINALS
OPERATING PARTNERSHIP, L.P.

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(CL) Silty Clay: slightly moist, brown (5YR 4/4)
					0		45			
					0		50			(SM) Silty Sand, light brown (10 YR 6/6)
										(CL) Silty Clay: brown (5YR 4/4)
					4.5		55			
										(SM) Silty Sand: light brown (10 YR 6/6)
					3.0		60			(SC) Clayey Sand: light brown 6YR 6/4)
					3.2		65			
										(SM) Silty Sand: light brown (10 YR 6/6)
										(SC) Clayey Sand: wet, light brown (10YR 6/6)
					3.0		70	▼		
					7.0		75			-(10YR 5/4)
					5.0		80			

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

Water Level After 1 day

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-19

File No.: 042597
Date: 7/31/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(SC) Clayey Sand: wet, light brown (10YR 5/4)
					5.2		85			Total Depth of Well

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

No. STP-20

Client: SUPPORT TERMINALS
OPERATING PARTNERSHIP, L.P.

File No.: 042597
Date: 8/1/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	0-3' Post hole refusal 3-85' Air Rotary Start Time: 0820 Finish Time: 1030
										(CL) Silty Clay: dry, hard, brown (5YR 4/4)
					0		5			-bits of caliche and some limestone in cuttings
					0		10			-with caliche in cuttings
					0		15			
										(SC) Clayey Sand: brown (10YR 6/6)
					0		20			(CL) Silty Clay, brown (10YR 5/4)
					0		25			-(5YR 4/4)
					0		30			-moist, soft, bits of limestone in cuttings (10YR 6/6)
					0		35			(SM) Silty Sand: fine sand, loose, brown (10YR 6/6)
					0		40			

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

No. STP-20

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

File No.: 042597
Date: 8/1/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(SM) Silty Sand: fine sand, loose, brown (10YR 6/6)
										(CL) Silty Clay, brown (5YR 4/4)
					0		45			
					0		50			
										(SM) Silty Sand: loose, brown (10YR 6/6)
										(CL) Silty Clay: brown (5YR 4/4)
					1.0		55			
										(SM) Silty Sand: granular, brown (10 YR 6/6)
					3.0		60			
										(CL) Sandy Clay: moist, brown (5YR 5/6)
					1.5		65			
										(SC) Clayey Sand: wet, brown (10YR 6/6)
					2.0		70			
										(CL) Silty Clay: stained black, slight odor, grayish black (N2)
										-driller noted odor at well when drilling
					65.2		75			
										(SC) Clayey Sand: brown (10YR 6/6)
					158.0		80			

Grab Sample

Analyzed Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

File No.: 042597

Date: 8/1/2007

No. STP-20

Drilling Co.: UNIVERSAL DRILLING COMPANY

Supervisor: KEITH BARGE

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

Type Rig: AIR ROTARY

Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(SC) Clayey Sand: brown (10YR 6/6)
					116		85			Total Depth of Well

Grab Sample

Analyzed Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-21

File No.: 042597
Date: 8/2/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	Start Time: 1320 Finish Time: 1510
										(CL) Silty Clay: dry, hard, brown (5YR 4/4) - some caliche
					0		5			-bits of caliche in cuttings
					0		10			
					0		15			
					0		20			
					0		25			(SC) Clayey Sand: brown (10YR 5/4)
					0		30			(CL) Silty Clay: brown (5YR 4/4)
					0		35			(SC) Clayey Sand: light brown (10YR 6/6) - bits of sandstone in cuttings
					0		40			(SM) Silty Sand: granular, light brown (10YR 6/6) - bits of sandstone in cuttings

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-21

File No.: 042597
Date: 8/2/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(CL) Silty Clay: brown (5YR 4/4)
					0		45			
										(SM) Silty Sand: granular, light brown (5YR 5/6)
										(SC) Clayey Sand: fine sand, light brown (5YR 5/6)
					0		50			
										(SM) Silty Sand: granular, light brown (10YR 6/6)
					0		55			
										(CL) Sandy Clay: fine sand, soft, light brown (10YR 6/6)
					0		60			
					0		65			(SC) Clayey Sand: moist, soft, light brown (10YR 6/6)
					4.0		70			-odor noted at well head during drilling
					180		75			
					68		80			

Grab Sample

Analyzed Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS
OPERATING PARTNERSHIP, L.P.

No. STP-21

File No.: 042597
Date: 8/2/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(SC) Clayey Sand: moist, soft, light brown (10YR 6/6)
					0		85			Total Depth of Well

Grab Sample

Analyzed Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-22

File No.: 042597
Date: 8/1/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	0-3' Post hole refusal 3-85' Air Rotary Start Time: 1300 Finish Time: 1640
										(CL) Silty Clay: dry, hard, brown (5YR 4/4)
					0		5			-more silt, caliche in cuttings
					0		10			-more moist
					0		15			(SC) Clayey Sand: light brown (10YR 6/6)
					0		20			(SM) Silty Sand: granular, light brown
										(CL) Silty Clay: brown (5YR 4/4)
					0		25			
					0		30			(SM) Silty Sand: granular, light brown (10YR 6/6)
										(SC) Clayey Sand: light brown (10YR 6/6)
					0		35			
										(CL) Silty Clay: brown (5YR 4/4)
					0		40			

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

No. STP-22

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

File No.: 042597
Date: 8/1/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA					BORING DATA
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(CL) Silty Clay: brown (5YR 4/4)
										(SM) Silty Sand: fine sand, granular, light brown (10YR 6/6)
					0		45			
										(CL) Sandy Clay: fine sand, light brown (10YR 6/6)
										(CL) Silty Clay, brown (5YR 4/4)
					0		50			- more moist
					0		55			
					0		60			
										(SM) Silty Sand: granular, light brown (10YR 6/6)
					0		65			(SC) Clayey Sand: moist, brown (5YR 5/6)
					0		70			
					0.8		75			(CL) Sandy Clay: moist, reddish brown (5YR 4/4)
					0		80			

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

Water Level after 1 day

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

No. STP-22

Client: SUPPORT TERMINALS
OPERATING PARTNERSHIP, L.P.

File No.: 042597
Date: 8/1/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(CL) Sandy Clay: moist, reddish brown (5YR 4/4)
					1.2		85			Total Depth of Well

Grab Sample

Analyzed Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-23

File No.: 042597
Date: 8/3/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	Start Time: 1050 Finish Time: 1250
										(CL) Silty Clay: brown (5YR 4/4)
										-dry, hard
					0		5			-some caliche in cuttings
					0		10			
					0		15			
					0		20			
										(CL) Sandy Clay: fine sand, light brown (10YR 5/4)
					0		25			
										(CL) Silty Clay: brown (5YR 4/4)
					0		30			
										(SM) Silty Sand: bits of limestone in cuttings, caliche, light brown (10YR 6/6)
					0		35			
					0		40			(CL) Silty Clay: brown (5YR 4/4)

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-23

File No.: 042597
Date: 8/3/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA					BORING DATA
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(CL) Silty Clay: brown (5YR 4/4)
										(CL) Sandy Clay: light brown (10YR 6/6)
					0		45			
										(SM) Silty Sand: fine sand, granular, light brown (10YR 6/6)
					0		50			
										(CL) Silty Clay: brown (5YR 4/4)
					0		55			
										(SM) Silty Sand: fine sand, granular, light brown (10YR 6/6)
										(CL) Silty Clay: brown (5YR 4/4)
					0		60			
										(CL) Sandy Clay: moist, light brown (5YR 5/6)
					0		65			
										(SC) Clayey Sand: moist, light brown (10YR 6/6)
					0		70			
					0.8		75			
					1.7		80			

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-23

File No.: 042597
Date: 8/3/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(SC) Clayey Sand: moist, light brown (10YR 6/6)
					1.2		85			Total Depth of Well

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

Client: SUPPORT TERMINALS OPERATING PARTNERSHIP, L.P.

No. STP-24

File No.: 042597
Date: 8/2/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	0-4' - Post hole digger 4-5' - Hand Probe 5-85' Air Rotary Start Time: 0800 Finish Time: 1030
										(CL) Silty Clay: brown (5YR 4/4) fill material
					0		5			-light brown (10YR 6/6)
					0		10			- (5YR 5/6)
					0		15			(SC) Clayey Sand: fine sand, moist, soft, gravel and caliche in cuttings, light brown (5YR 5/6)
					0		20			
					0		25			
										(CL) Silty Clay: brown (5YR 4/4)
					0		30			
										(SC) Clayey Sand: fine sand, light brown (10YR 6/6)
										(SM) Silty Sand: granular, light brown (10YR 6/6)
					0		35			
					0		40			(SC) Sandy Clay: soft, moist, light brown (5YR 5/6)

Grab Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

No. STP-24

Client: SUPPORT TERMINALS
OPERATING PARTNERSHIP, L.P.

File No.: 042597
Date: 8/2/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(SC) Sandy Clay: soft, moist light brown (5YR 5/6)
					0		45			
					0		50			(CL) Silty Clay: brown (5YR 4/4)
					0		55			
										(SM Silty Sand: fine sand, granular, brown (10YR 6/6)
					0		60			(SC) Clayey Sand: moist, light brown (5YR 5/6)
					0		65			
					1.3		70			
					1.2		75			-wet, hydrocarbon odor at hole
					4.4		80			

Grab Sample

Analyzed Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

No. STP-24

Client: SUPPORT TERMINALS
OPERATING PARTNERSHIP, L.P.

File No.: 042597
Date: 8/2/2007
Drilling Co.: UNIVERSAL DRILLING COMPANY
Supervisor: KEITH BARGE
Type Rig: AIR ROTARY
Logged by: DANNY FITZGERALD

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(SC) Clayey Sand: moist, light brown (5YR 5/6)
					20.0		85			Total Depth of Well

Grab Sample

Analyzed Sample

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

File No.: 042597

Date: 5/28/2008

No. RW-1

Drilling Co.: WHITE DRILLING

Supervisor: JOE BLACKBURN

Client: NUSTAR TERMINALS
OPERATIONS PARTNERSHIP, L.P.

Type Rig: AIR ROTARY

Logged by: JAMES ORNELAS

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA					BORING DATA
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	0-4' - Post hole digger 4-5' - Hand Probe 5-100' Air Rotary Start Time: 1315 Finish Time: 1415
										(ML) Silt: light brown
										(CL) Silty Clay: dry, hard, dark brown
							5			
										- some caliche
							10			
										- (5YR 4/4)
							15			
										(CL) Sandy Clay: dry, fine sand
							20			
							25			
										(CL) Clay: dry, hard, dark brown
										(ML) Silt with clay: light brown (10YR 5/4) - some caliche
							30			(SM) Silty Sand: light brown (10YR 6/6)
							35			
										(CL) Silty Clay: slightly moist, brown (5YR 4/4)
							40			

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

File No.: 042597

Date: 5/25/2008

No. RW-1

Drilling Co.: WHITE DRILLING

Supervisor: JOE BLACKBURN

Client: NUSTAR TERMINALS
OPERATIONS PARTNERSHIP, L.P.

Type Rig: AIR ROTARY

Logged by: JAMES ORNELAS

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(CL) Silty Clay: slightly moist, brown (5YR 4/4), dry
										(SM) Silty Sand: light brown (10YR 6/6), dry
							45			
										(CL) Silty Clay: brown (5YR 4/4), dry
							50			
							55			
										(SM) Silty Sand: light brown (10YR 6/6), dry
							60			(SC) Clayey Sand: light brown (6YR 6/4)
							65			
										(SM) Silty Sand: light brown (10YR 6/6)
							70			
										(SC) Clayey Sand: wet, light brown (10YR 6/6)
							75			
							80			

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

File No.: 042597

Date: 5/25/2008

No. RW-1

Drilling Co.: WHITE DRILLING

Supervisor: JOE BLACKBURN

Client: NUSTAR TERMINALS
OPERATIONS PARTNERSHIP, L.P.

Type Rig: AIR ROTARY

Logged by: JAMES ORNELAS

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(SC) Clayey Sand: light brown (10YR 5/4)
							85			
							90			
							95			
							100			Total Depth of Well

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

No. RW-2

Client: NUSTAR TERMINALS
OPERATIONS PARTNERSHIP, L.P.

File No.: 042597
Date: 5/28/2008
Drilling Co.: WHITE DRILLING
Supervisor: JOE BLACKBURN
Type Rig: AIR ROTARY
Logged by: JAMES ORNELAS

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA					BORING DATA
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	0-4' - Post hole digger 4-5' - Hand Probe 5-100' Air Rotary Start Time: 0800 Finish Time: 1000
										(ML) Silt: light brown
										(CL) Silty Clay: dry, hard, dark brown
							5			
										- some caliche
							10			
										- (5YR 4/4)
							15			
										(CL) Sandy Clay: dry, fine sand
							20			
							25			
										(CL) Clay: dry, hard, dark brown
										(ML) Silt with clay: light brown (10YR 5/4) - some caliche
							30			(SM) Silty Sand: light brown (10YR 6/6)
							35			
										(CL) Silty Clay: slightly moist, brown (5YR 4/4)
							40			

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

File No.: 042597

Date: 5/25/2008

No. RW-2

Drilling Co.: WHITE DRILLING

Supervisor: JOE BLACKBURN

Client: NUSTAR TERMINALS
OPERATIONS PARTNERSHIP, L.P.

Type Rig: AIR ROTARY

Logged by: JAMES ORNELAS

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(CL) Silty Clay: slightly moist, brown (5YR 4/4), dry
										(SM) Silty Sand: light brown (10YR 6/6), dry
							45			
										(CL) Silty Clay: brown (5YR 4/4), dry
							50			
							55			
										(SM) Silty Sand: light brown (10YR 6/6), dry
							60			(SC) Clayey Sand: light brown (6YR 6/4)
							65			
										(SM) Silty Sand: light brown (10YR 6/6)
							70			
										(SC) Clayey Sand: wet, light brown (10YR 6/6)
							75			
							80			

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

SOIL BORING LOG

Project: ALAMOGORDO TERMINAL

File No.: 042597

Date: 5/25/2008

No. RW-2

Drilling Co.: WHITE DRILLING

Supervisor: JOE BLACKBURN

Client: NUSTAR TERMINALS
OPERATIONS PARTNERSHIP, L.P.

Type Rig: AIR ROTARY

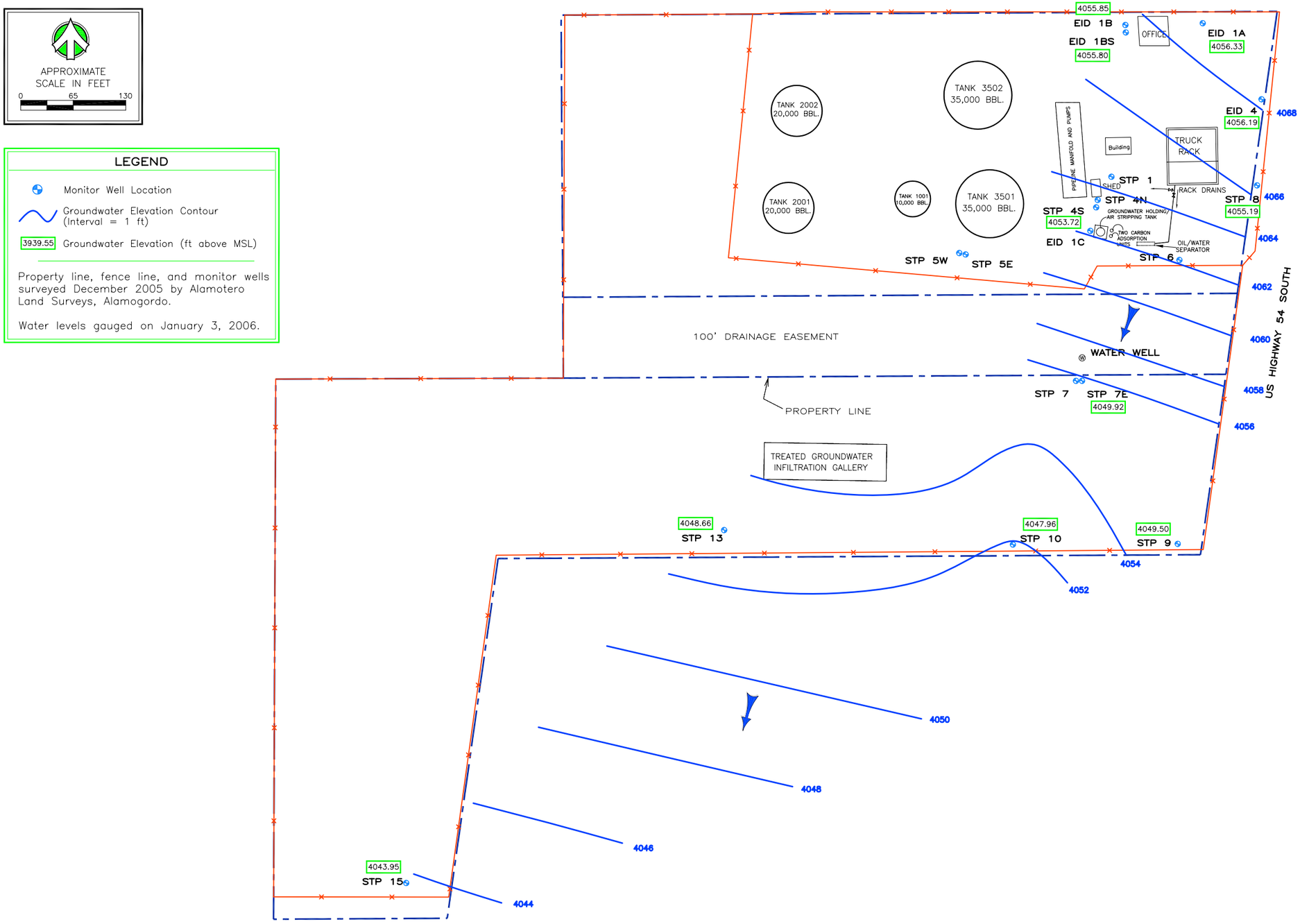
Logged by: JAMES ORNELAS

LABORATORY TEST DATA (Results Reported in mg/kg)					FIELD DATA				BORING DATA	
Benzene	Toluene	Ethyl-benzene	Xylenes	Total TPH (C6-C35)	Photo-Ionization Detection Reading (ppm)	Sampling	Depth (feet)	Water Level	Screen Interval	
										(SC) Clayey Sand: light brown (10YR 5/4)
							85			
							90			
							95			
							100			Total Depth of Well

Stratification is Inferred And May Not be Exact.
Soil Classification Based on Visual-Manual Procedure

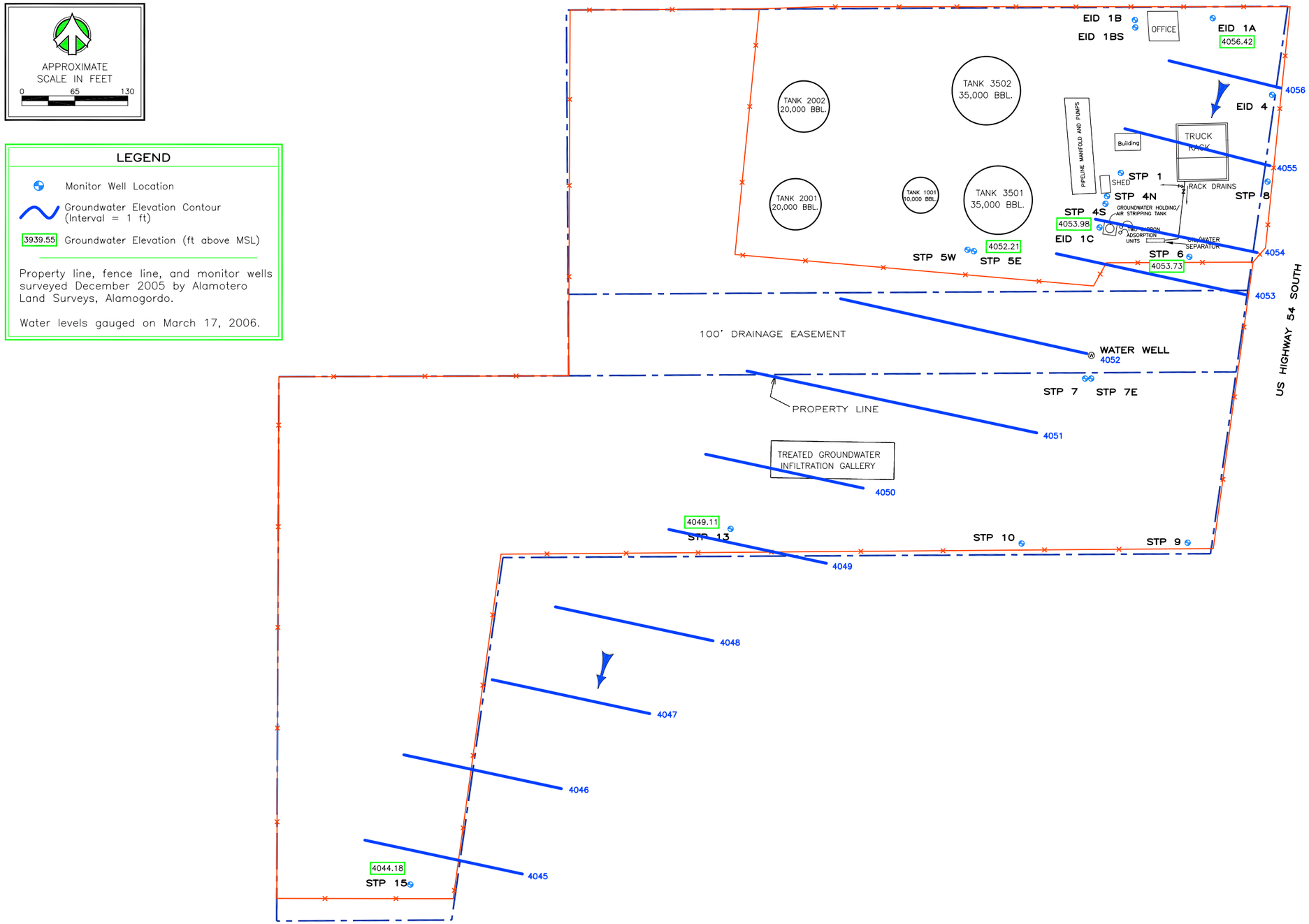
Appendix B

Historical Potentiometric Surface Maps



042597 SLR 012306

POTENTIOMETRIC SURFACE MAP	JOB No. 042597
ALAMOGORDO TERMINAL ST SERVICES	FIGURE 3



042597 2Q06 SLR 041706

POTENTIOMETRIC SURFACE MAP

ALAMOGORDO TERMINAL
ST SERVICES

JOB No. 042597

FIGURE 3

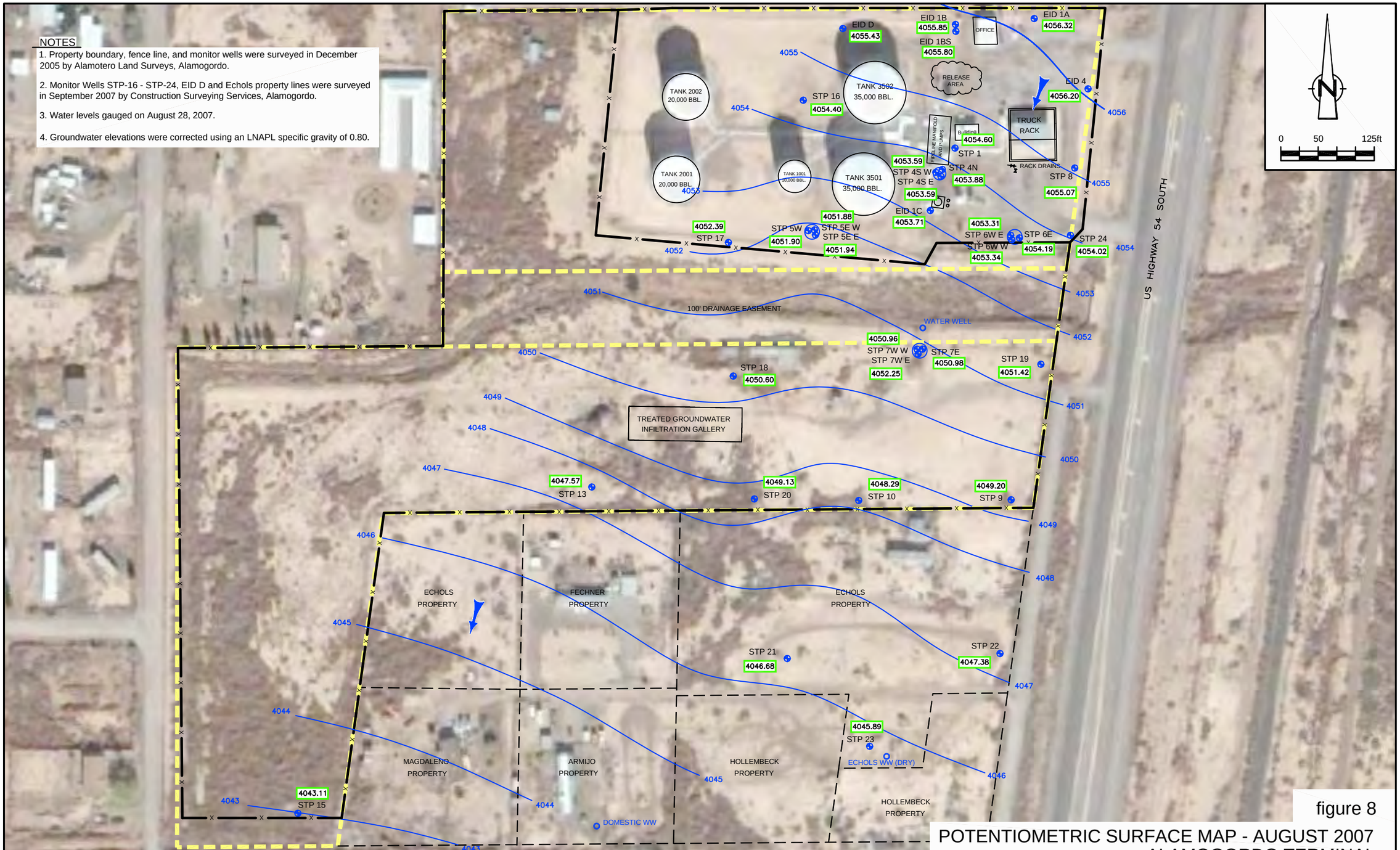
NOTES

1. Property boundary, fence line, and monitor wells were surveyed in December 2005 by Alamotero Land Surveys, Alamogordo.

2. Monitor Wells STP-16 - STP-24, EID D and Echols property lines were surveyed in September 2007 by Construction Surveying Services, Alamogordo.

3. Water levels gauged on August 28, 2007.

4. Groundwater elevations were corrected using an LNAPL specific gravity of 0.80.



LEGEND

- Monitor Well Location
- Groundwater Elevation Contour (Interval = 1 ft)
- 3939.55 Groundwater Elevation (ft above MSL)
- Groundwater Flow Direction

figure 8

POTENTIOMETRIC SURFACE MAP - AUGUST 2007
ALAMOGORDO TERMINAL
ALAMOGORDO, NEW MEXICO
Support Terminals Operating Partnership, L.P.

042597-07(001)GN-MD007 JAN 25/2008

figure 3

GROUNDWATER GRADIENT MAP - OCTOBER 2008
ALAMOGORDO TERMINAL
ALAMOGORDO, NEW MEXICO
NuStar Terminals Operations Partnership L.P.

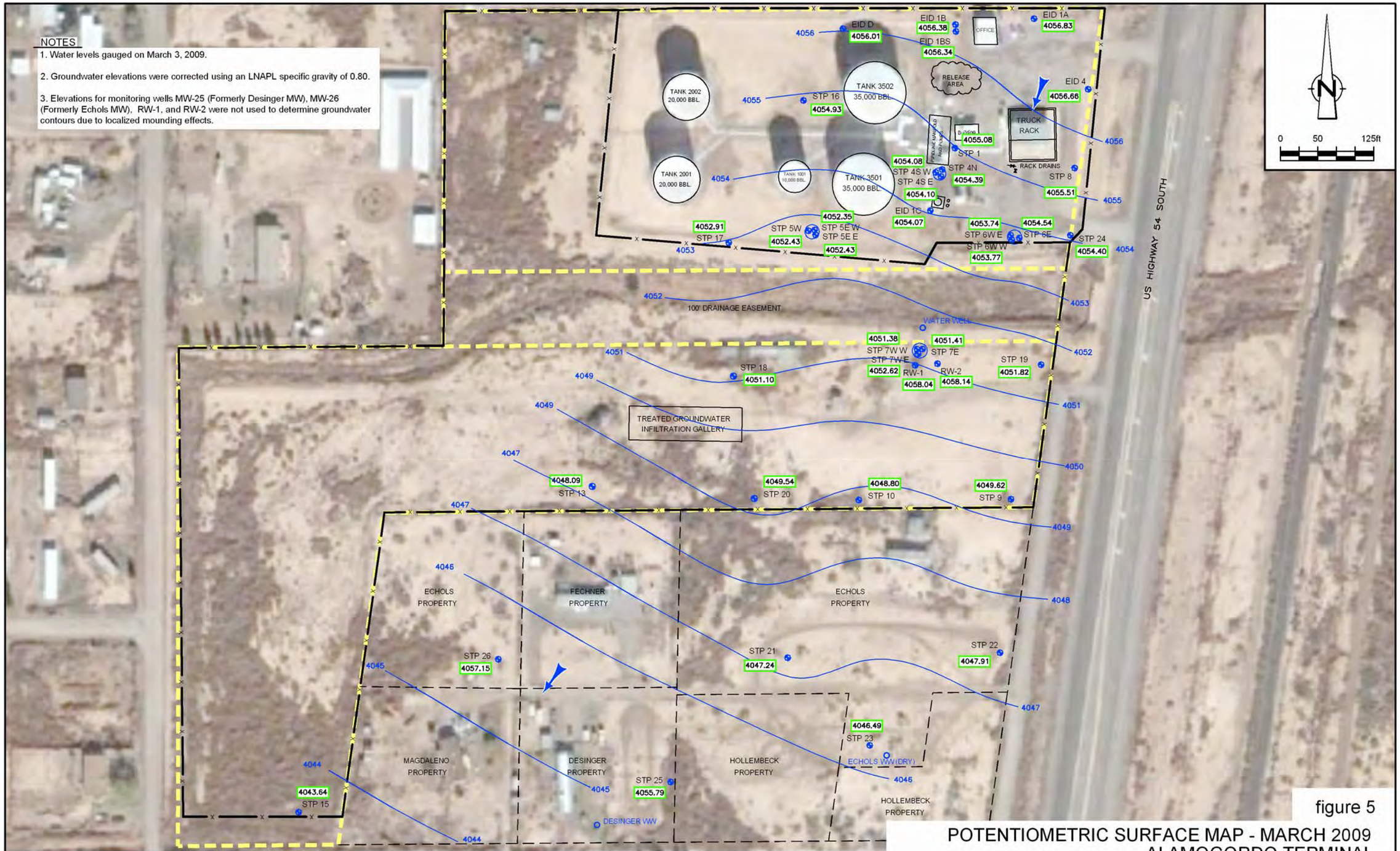
042597-08(008)GN-MD003 JAN 16/2009

NOTES

1. Water levels gauged on March 3, 2009.

2. Groundwater elevations were corrected using an LNAPL specific gravity of 0.80.

3. Elevations for monitoring wells MW-25 (Formerly Desinger MW), MW-26 (Formerly Echols MW), RW-1, and RW-2 were not used to determine groundwater contours due to localized mounding effects.



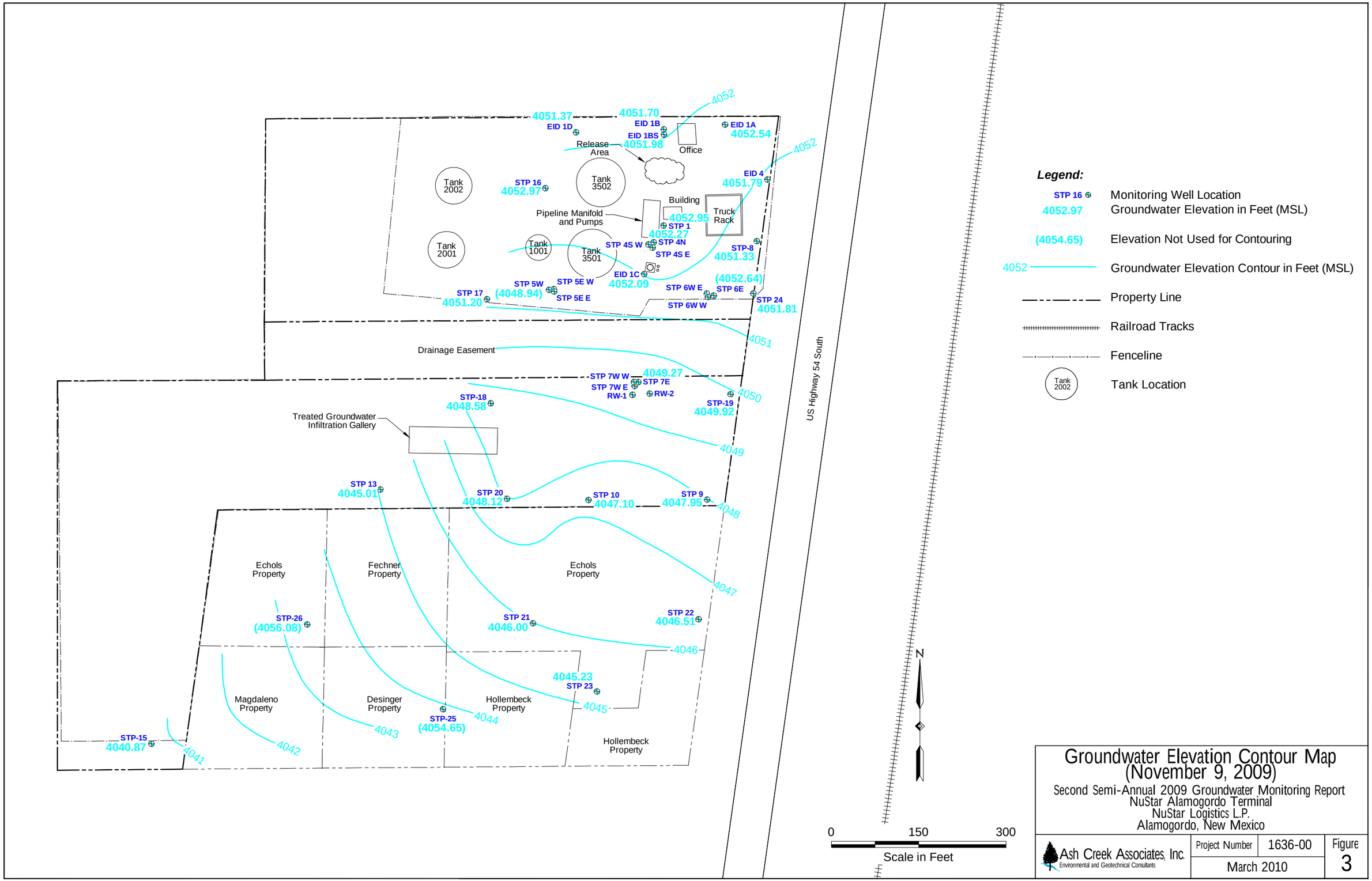
LEGEND

- Monitor Well Location
- Property Boundary
- Fence Line
- 3939.55 Groundwater Elevation (ft above MSL)
- Groundwater Flow Direction
- Groundwater Elevation Contour (Interval = 1 ft)

figure 5

POTENTIOMETRIC SURFACE MAP - MARCH 2009
ALAMOGORDO TERMINAL
ALAMOGORDO, NEW MEXICO
NuStar Terminals Operations Partnership L.P.

042597-08(007)GN-MD004B SEP 10/2009



Groundwater Elevation Contour Map (November 9, 2009)

Second Semi-Annual 2009 Groundwater Monitoring Report
NuStar Alamogordo Terminal
NuStar Logistics L.P.
Alamogordo, New Mexico

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1636-00	Figure
March 2010		3

Appendix C

Historical Groundwater Monitoring Tables

Table C- 1
Historical Groundwater Elevation and Product Thickness Data
NuStar Alamogordo Terminal
Alamogordo, New Mexico

Well ID	Measurement Date	Top of Casing Elevation (feet MSL)[1]	Top of Screen Interval (feet)	Bottom of Screen Interval (feet)	Depth to Groundwater (feet)	Depth to Product (feet)	Product Thickness (feet)	Groundwater Elevation (feet MSL)
EID 1A	10/3/2005	4127.02	74	84	70.78	--	--	4056.24
	1/3/2006				70.69	--	--	4056.33
	3/17/2006				70.60	--	--	4056.42
	5/9/2006				70.91	--	--	4056.11
	8/28/2007				70.70	--	--	4056.32
	9/8/2008				71.57	--	--	4055.45
	10/29/2008				71.32	--	--	4055.70
	3/3/2009				70.19	--	--	4056.83
	11/9/2009				74.48	--	--	4052.54
EID 1B	10/3/2005	4125.77	72	82	69.97	--	--	4055.80
	1/3/2006				69.92	--	--	4055.85
	8/28/2007				69.92	--	--	4055.85
	9/8/2008				70.77	--	--	4055.00
	3/3/2009				69.39	--	--	4056.38
	11/9/2009				74.07	--	--	4051.70
EID 1 BS	1/3/2006	4125.45	NA	NA	69.65	--	--	4055.80
	8/28/2007				69.65	--	--	4055.80
	9/8/2008				--	--	--	--
	3/3/2009				69.11	--	--	4056.34
	11/9/2009				71.47	--	--	4051.98
EID 1C	1/3/2006	4123.9	NA	NA	69.59	--	--	4054.31
	8/28/2007				70.19	--	--	4053.71
	9/8/2008				71.02	--	--	4052.88
	3/3/2009				69.83	--	--	4054.07
	11/9/2009				71.81	--	--	4052.09
EID 1D	8/28/2007	4124.65	NA	NA	69.22	--	--	4055.43
	9/8/2008				69.89	--	--	4054.76
	3/3/2009				68.64	--	--	4056.01
	11/9/2009				73.28	--	--	4051.37
EID 4	10/3/2005	4125.86	73	83	69.76	--	--	4056.10
	1/3/2006				69.67	--	--	4056.19
	8/28/2007				69.66	--	--	4056.20
	9/8/2008				70.59	--	--	4055.27
	3/3/2009				69.20	--	--	4056.66
	11/9/2009				74.07	--	--	4051.79
STP 1	1/3/2006	4125.15	NA	NA	70.43	--	--	4054.72
	8/28/2007				70.55	--	--	4054.60
	9/8/2008				71.32	--	--	4053.83
	3/3/2009				70.07	--	--	4055.08
	11/9/2009				72.20	--	--	4052.95
STP 4N	8/28/2007	4124.45	73	83	70.58	70.57	0.01	4053.87
	9/8/2008				71.24	--	--	4053.21
	3/3/2009				70.06	--	--	4054.39
	11/9/2009				72.18	--	--	4052.27
STP 4S E	10/3/2005	4123.8	89	94	70.12	--	--	4053.68
	1/3/2006				70.08	--	--	4053.72
	3/17/2006				69.82	--	--	4053.98
	5/9/2006				70.36	--	--	4053.44
	8/28/2007				70.21	--	--	4053.59
	9/8/2008				70.91	--	--	4052.89
	3/3/2009				69.70	--	--	4054.10
	11/9/2009				71.78	--	--	4052.02
STP 4S W	10/3/2005	4123.79	82	87	70.01	--	--	4053.78
	5/9/2006				70.36			4053.43
	8/28/2007				70.20	--	--	4053.59
	9/8/2008				70.89	--	--	4052.90
	3/3/2009				69.71	--	--	4054.08
	11/9/2009				71.80	--	--	4051.99
STP 5W	1/3/2006	4122.69	70	80	70.65	--	--	--
	8/28/2007				70.82	70.78	0.04	4051.90
	9/8/2008				71.47	71.45	0.02	4051.24
	3/3/2009				70.30	70.25	0.05	4052.43
	11/9/2009				73.75	73.71	0.04	4048.97
STP 5E E	10/3/2005	4122.03	92	97	69.88	--	--	4052.15
	3/17/2006				69.82	--	--	4052.21
	5/9/2006				70.57	--	--	4051.46
	8/28/2007				70.09	--	--	4051.94
	9/8/2008				70.75	--	--	4051.28
	3/3/2009				69.60	--	--	4052.43
	11/9/2009				73.69	--	--	4048.34
STP 5E W	10/3/2005	4121.97	82	87	69.88	--	--	4052.09
	5/9/2006				71.07	--	--	4050.90
	8/28/2007				70.09	--	--	4051.88
	9/8/2008				70.76	--	--	4051.21
	3/3/2009				69.62	--	--	4052.35
	11/9/2009				73.67	--	--	4048.30
STP 6E	8/28/2007	4125.19	73	78	71.00	--	--	4054.19
	9/8/2008				71.88	--	--	4053.31
	3/3/2009				70.65	--	--	4054.54
	11/9/2009				72.73	--	--	4052.64

Please refer to notes at end of table.

Table C- 1
Historical Groundwater Elevation and Product Thickness Data
NuStar Alamogordo Terminal
Alamogordo, New Mexico

Well ID	Measurement Date	Top of Casing Elevation (feet MSL)[1]	Top of Screen Interval (feet)	Bottom of Screen Interval (feet)	Depth to Groundwater (feet)	Depth to Product (feet)	Product Thickness (feet)	Groundwater Elevation (feet MSL)
STP 6W E	10/3/2005	4124.46	82	87	71.03	--	--	4053.43
	3/17/2006				70.23	--	--	4054.23
	5/9/2006				71.23	--	--	4053.23
	8/28/2007				71.15	--	--	4053.31
	9/8/2008				71.98	--	--	4052.48
	3/3/2009				70.72	--	--	4053.74
	11/9/2009				72.80	--	--	4051.66
STP 6W W	10/3/2005	4124.41	88	93	70.93	--	--	4053.48
	5/9/2006				71.15	--	--	4053.26
	8/28/2007				71.01	--	--	4053.40
	9/8/2008				71.91	--	--	4052.50
	3/3/2009				70.64	--	--	4053.77
	11/9/2009				72.74	--	--	4051.67
STP 7E	1/3/2006	4123.47	70	75	73.61	73.54	0.07	4049.92
	8/28/2007				72.58	72.47	0.11	4050.98
	9/8/2008				73.32	73.22	0.10	4050.23
	3/3/2009				72.41	71.97	0.44	4051.41
	11/9/2009				74.20	73.75	0.45	4049.63
STP 7W E	10/3/2005	4122.45	82	87	73.6	70.75	2.85	4052.50
	8/28/2007				73.82	71.00	2.82	4050.89
	9/8/2008				74.68	71.78	2.90	4050.09
	3/3/2009				73.58	70.63	2.95	4051.23
	11/9/2009				73.04	--	--	4049.41
STP 7W W	10/3/2005	4122.45	87	92	71.27	--	--	4051.18
	8/28/2007				71.49	--	--	4050.96
	9/8/2008				72.25	--	--	4050.20
	3/3/2009				71.07	--	--	4051.38
	11/9/2009				72.61	--	--	4049.84
STP 8	8/28/2007	4126.03	73.5	78.5	70.96	--	--	4055.07
	9/8/2008				71.86	--	--	4054.17
	3/3/2009				70.52	--	--	4055.51
	11/9/2009				74.70	--	--	4051.33
STP 9	1/3/2006	4124.04	70	75	74.56	74.54	0.02	4049.50
	8/28/2007				74.84	--	--	4049.20
	9/8/2008				75.67	--	--	4048.37
	3/3/2009				74.42	--	--	4049.62
	11/9/2009				76.09	--	--	4047.95
STP 10	1/3/2006	4121.75	73	78	75.84	73.31	2.53	4047.93
	8/28/2007				74.28	73.26	1.02	4048.29
	9/8/2008				74.97	72.96	2.01	4048.39
	10/7/2008				74.93	73.92	1.01	4047.63
	10/29/2008				75.11	74.05	1.06	4047.49
	3/3/2009				73.87	72.72	1.15	4048.80
	11/9/2009				74.65	74.45	0.20	4047.26
STP 13	10/3/2005	4119.05	73	78	70.70	--	--	4048.35
	1/3/2006				70.39	--	--	4048.66
	3/17/2006				69.94	--	--	4049.11
	5/9/2006				70.02	--	--	4049.03
	8/28/2007				71.48	--	--	4047.57
	9/8/2008				72.02	--	--	4047.03
	10/29/2008				71.85	--	--	4047.20
	3/3/2009				70.96	--	--	4048.09
	11/9/2009				74.04	--	--	4045.01
STP 15	10/3/2005	4114.14	73	78	70.64	--	--	4043.49
	1/3/2006				70.18	--	--	4043.95
	3/17/2006				69.95	--	--	4044.18
	5/9/2006				70.34	--	--	4043.79
	8/28/2007				71.02	--	--	4043.12
	9/8/2008				71.53	--	--	4042.61
	10/29/2008				71.16	--	--	4042.97
	3/3/2009				70.49	--	--	4043.65
	11/9/2009				73.27	--	--	4040.87
STP 16	8/28/2007	4126.05	68	88	71.65	--	--	4054.40
	9/8/2008				72.32	--	--	4053.73
	3/3/2009				71.12	--	--	4054.93
	11/9/2009				73.08	--	--	4052.97
STP 17	8/28/2007	4125.27	68	88	72.90	--	--	4052.37
	9/8/2008				73.51	--	--	4051.76
	3/3/2009				72.36	--	--	4052.91
	11/9/2009				74.07	--	--	4051.20
STP 18	8/28/2007	4124.08	68.5	88.5	73.48	--	--	4050.60
	9/8/2008				74.11	--	--	4049.97
	10/7/2008				74.01	--	--	4050.07
	10/29/2008				74.02	--	--	4050.07
	3/3/2009				72.98	--	--	4051.10
	11/9/2009				74.50	--	--	4049.58
STP 19	8/28/2007	4126.22	68	88	74.80	--	--	4051.42
	9/8/2008				75.65	--	--	4050.57
	10/7/2008				75.72	--	--	4050.50
	10/29/2008				75.90	--	--	4050.32
	3/3/2009				74.4	--	--	4051.82
	11/9/2009				76.30	--	--	4049.92

Please refer to notes at end of table.

Table C- 1
Historical Groundwater Elevation and Product Thickness Data
NuStar Alamogordo Terminal
Alamogordo, New Mexico

Well ID	Measurement Date	Top of Casing Elevation (feet MSL)[1]	Top of Screen Interval (feet)	Bottom of Screen Interval (feet)	Depth to Groundwater (feet)	Depth to Product (feet)	Product Thickness (feet)	Groundwater Elevation (feet MSL)
STP 20	8/28/2007	4123.16	68	88	74.03	--	--	4049.13
	9/8/2008				74.78	--	--	4048.38
	10/7/2008				74.70	--	--	4048.46
	10/29/2008				74.71	--	--	4048.45
	3/3/2009				73.62	--	--	4049.54
	11/9/2009				75.04	--	--	4048.12
STP 21	8/28/2007	4122.11	68	88	75.43	--	--	4046.68
	9/8/2008				76.05	--	--	4046.06
	3/3/2009				74.87	--	--	4047.24
	11/9/2009				76.11	--	--	4046.00
STP 22	8/28/2007	4123.16	68	88	75.78	--	--	4047.38
	9/8/2008				76.47	--	--	4046.69
	3/3/2009				75.25	--	--	4047.91
	11/9/2009				76.65	--	--	4046.51
STP 23	8/28/2007	4121.88	68	88	75.99	--	--	4045.89
	9/8/2008				76.06	--	--	4045.82
	3/3/2009				75.39	--	--	4046.49
	11/9/2009				76.65	--	--	4045.23
STP 24	8/28/2007	4127.92	65	85	74.67	73.71	0.96	4054.02
	9/8/2008				75.48	74.69	0.79	4053.07
	3/3/2009				73.78	73.46	0.32	4054.40
	11/9/2009				76.11	75.58	0.53	4052.23
RW1	8/28/2007	4131.63	60	100	--	--	--	--
	6/18/2008				75.79	75.30	0.49	4055.84
	3/3/2009				73.59	Odor	--	4058.04
	11/9/2009				75.46	73.75	1.71	4057.54
RW2	8/28/2007	4131.73	59	99	--	--	--	--
	10/7/2008				74.99	74.89	--	4056.74
	10/29/2008				76.43	76.10	0.33	4055.56
	3/3/2009				73.59	Odor	--	4058.14
	11/9/2009				75.50	--	--	4056.23
STP-25 (Disinger MW)	8/28/2007	4126.80	65	85	--	--	--	--
	10/29/2008				72.03	--	--	4054.77
	3/3/2009				71.01	--	--	4055.79
	11/9/2009				72.15	--	--	4054.65
STP-26 (Echols MW)	8/28/2007	4125.95	65	85	--	--	--	--
	10/29/2008				72.03	--	--	4053.92
	3/3/2009				68.80	--	--	4057.15
	11/9/2009				69.87	--	--	4056.08

Notes:
1. NA = Not available.
2. feet MSL = Feet relative to mean sea level.
3. -- = No product or not applicable.
4. Elevation was corrected in wells with the presence of measurable separate-phase petroleum hydrocarbons using the following equation and assuming a specific gravity for gasoline product of 0.8 gram per cubic centimeter (Merck 1989):

$$h_w = \frac{p_g h_g}{p_w}$$

water-level elevation = top of casing elevation + $[h_w - d_w]$

where:

h_w = groundwater level elevation
d_w = depth to groundwater measuring point
p_g = density of separate-phase hydrocarbons
p_w = density of water
h_g = product thickness

Reference: Merck Index 1989, An Encyclopedia of Chemicals, Drugs and Biologicals, Merck and Company, Rahway, New Jersey.

Table C- 2
Historical roundwater Analytical Data – TPH, VOCs, PAHs, and lead
NuStar Alamogordo Terminal
Alamogordo, New Mexico

Sample Location	Sample Date	TPHg	TPHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	PAHs: Total Naphth + Mononaph.	benzo-a-pyrene	Dissolved Lead
		Concentrations in mg/L (ppm)								
EID 1A	1/4/2006	--	--	<0.001	<0.001	<0.001	<0.001	--	--	--
	9/6/2007	<0.029	0.074	<0.001	<0.001 J	<0.001	<0.003	<0.0096	<0.0096	--
	9/11/2008	<0.029	0.051	<0.00039	<0.00039	0.00088 J	<0.0012	--	--	0.0056
	9/11/08 DUP	<0.029	0.075	<0.00039	<0.00039	<0.00042	<0.0012	--	--	0.0037
	3/4/2009	<0.06	0.469 J	<0.0002	<0.0003	<0.0006	<0.0006	--	--	0.687
EID 1B	1/4/2006	--	--	<0.001	<0.001	<0.001	<0.001	--	--	--
	8/30/2007	<0.1	<0.048	<0.001	<0.001	<0.001	<0.003	<0.0096	<0.0096	--
	9/9/2008	<0.029	0.016 J	<0.00039	<0.00039	<0.00042	<0.0012	--	--	--
EID 1 BS	9/6/2007	<0.029	<0.033	<0.001	<0.001 J	<0.001	<0.003	<0.0096	<0.0096	--
EID 1C	1/4/2006	--	--	0.00872	<0.005	0.0441	0.0198	--	--	--
	9/5/2007	0.51	0.12	0.0044	<0.001	0.026	0.0065	0.0027	<0.0096	--
EID 1D	8/30/2007	<0.029	<0.024	<0.00039	<0.00039	<0.00042	<0.003	<0.001	<0.0011	--
	9/9/2008	<0.029	0.022 J	<0.00039	0.00048 J	<0.00042	<0.0012	--	--	0.012
	3/4/2009	<0.06	0.210 J	<0.0002	<0.0003	<0.0006	<0.0006	--	--	0.000609 J
	3/4/2009 DUP	<0.06	0.212 J	<0.0002	<0.0003	<0.0006	0.000710 J	--	--	0.000330 J
	11/10/2009	<0.1	0.111	<0.001	<0.002	<0.001	<0.002	--	--	--
	11/10/2009 DUP	<0.1	0.11	<0.001	<0.002	<0.001	<0.002	--	--	--
EID 4	1/4/2006	--	--	<0.001	<0.001	<0.001	<0.001	--	--	--
	8/30/2007	<0.1	<0.048	<0.001	<0.001	<0.001	<0.003	<0.0096	<0.0096	--
	9/9/2008	<0.029	0.015 J	<0.00039	<0.00039	<0.00042	<0.0012	--	--	--
STP 1	1/4/2006	--	--	1.14	<0.01	0.0472	<0.01	--	--	--
	8/30/2007	16	0.45	0.069	0.0067	0.0026	0.018	<0.0096	<0.0096	--
STP 4S E	9/5/2007	59	0.56	23	<1.0	0.69	<3.0	0.026	<0.0096	--
STP 4S W	9/5/2007	0.35	0.53	0.036	<0.001	0.0006	0.00045	<0.0096	<0.0096	--
STP 5W	1/3/2006	--	--	7.02	2.18	2.03	2.194	--	--	--
STP 5E E	9/6/2007	12	1.2	0.58	2	0.46	1.1	0.024	<0.0096	--
STP 5E W	9/5/2007	<0.1	<0.048	<0.001	<0.001	<0.001 J	<0.003	<0.0096	<0.0096	--
STP 6E	9/5/2007	5.8	0.67	0.13	<0.02	1	0.36	0.05	<0.0096	--
	9/5/2007 DUP	--	--	0.13	<0.0098	1.1 J	--	--	--	--
STP 6W E	9/5/2007	0.96	0.39	0.24	0.01	0.012	<0.015	0.0013	<0.0096	--
STP 6W W	9/5/2007	12	0.83	1.1	0.036	1.7	1.62	0.079	<0.0096	--
STP 7E	10/3/2005	--	--	6.97	3.1	1.96	2.462	--	--	--
STP 7W W	9/6/2007	0.21	0.37	0.013	0.0029	0.011	0.0134	<0.0096	<0.0096	--
STP 8	1/4/2006	--	--	0.0028	<0.001	0.0101	<0.001	--	--	--
	8/30/2007	0.16	0.12	0.0013	<0.00039	0.0023	<0.003	0.00533	<0.0011	--
	9/10/2008	0.20	0.15	0.0015	0.00086 J	0.0021	<0.0012	0.00022	<0.000081	--
	3/4/2009	0.201	0.365 J	0.00133	0.00212	<0.0006	<0.0006	0.00055	<0.0001	--
	11/11/2009	0.468	0.426	0.0016	<0.002	0.00369	<0.002	0.000742	<0.0001	--
	11/11/2009 DUP	0.467	0.488	0.00171	<0.002	0.00396	<0.002	0.000704	--	--
STP 9	10/3/2005	--	--	<0.001	<0.001	<0.001	<0.001	--	--	--
	1/3/2006	--	--	0.00319	<0.001	0.315	0.114	--	--	--
	9/5/2007	4	0.58	0.01	<0.01	0.55	0.12	0.084	<0.0096	--
	9/5/2007 DUP	--	--	0.01	<0.0039	0.63 J	--	--	--	--
	9/11/2008	3.1	0.29	0.026	<0.002	0.55 E	0.14	0.016	<0.000081	--
	3/5/2009	5.02	1.06	0.0326	0.703	<0.0006	0.189	0.0479	<0.0001	--
	11/11/2009	7.32	1.17	0.0594	<0.002	0.808	0.192	0.0633	<0.00010	--
STP 10	10/3/2005	--	--	1.44	0.563	1.1	1.413	--	--	--
STP 13	1/4/2006	--	--	<0.001	<0.001	<0.001	<0.001	--	--	--
	8/29/2007	<0.029	<0.024	<0.00039	<0.00039	<0.00042	<0.003	<0.001	<0.0011	--
	9/10/2008	<0.029	0.018 J	<0.00039	<0.00039	<0.00042	<0.0012	--	--	--
	3/4/2009	<0.06	<0.200	0.000200 U	<0.0003	<0.0006	<0.0006	--	--	--
	11/11/2009	0.268	<0.1	<0.001	<0.002	<0.001	<0.002	--	--	--
STP 15	10/3/2005	--	--	<0.001	<0.001	<0.001	<0.001	--	--	--
	1/4/2006	--	--	<0.001	<0.001	<0.001	<0.001	--	--	--
	3/17/2006	--	--	<0.001	<0.001	<0.001	<0.001	--	--	--
	5/9/2006	--	--	<0.001	<0.001	<0.001	<0.001	--	--	--
	8/29/2007	<0.029	<0.024	<0.00039	<0.00039	<0.00042	<0.003	<0.001	<0.0011	--
	9/10/2008	<0.029	0.013 J	<0.00039	<0.00039	<0.00042	<0.0012	--	--	--
	10/30/2008	--	--	<0.001	<0.0010	<0.0010	<0.0030	--	--	--
	3/4/2009	<0.06	<0.200	<0.0002	<0.0003	<0.0006	<0.0006	--	--	--
	11/11/2009	<0.1	<0.1	<0.001	<0.002	<0.001	<0.002	--	--	--
STP 16	8/30/2007	<0.029	<0.200	<0.00039	<0.00039	<0.00042	<0.003	<0.001	<0.0011	--
	9/9/2008	<0.029	0.022 J	<0.00039	<0.00039	<0.00042	<0.0012	--	--	--
	3/4/2009	<0.06	<0.200	<0.00020	<0.0003	<0.0006	<0.0006	--	--	--
	11/10/2009	<0.1	<0.1	<0.001	<0.002	<0.001	<0.002	--	--	--
STP 17	8/30/2007	<0.029	<0.200	<0.00039	<0.00039	<0.00042	<0.003	<0.001	<0.0011	--
	9/10/2008	<0.029	0.024 J	<0.00039	<0.00039	<0.00042	<0.0012	--	--	--
	3/4/2009	<0.06	<0.200	<0.0002	<0.0003	<0.0006	<0.0006	--	--	--
	3/4/2009 DUP	<0.06	<0.200	<0.0002	<0.0003	<0.0006	<0.0006	--	--	--
	11/10/2009	<0.1	<0.1	<0.001	<0.002	<0.001	<0.002	--	--	--
STP 18	8/29/2007	0.30	<0.024	6.4	0.0067	0.17	--	0.036	<0.0011	--
	8/29/2007 DUP	0.30	<0.024	--	--	--	--	--		--
	9/11/2008	<0.029	0.012 J	0.0030	0.00095 J	0.00061 J	<0.0012	<0.00096	<0.000081	--
	3/5/2009	<0.06	<0.2	0.00191	<0.0003	<0.0006	0.000630 J	0.097	<0.0001	--
	11/11/2009	<0.1	<0.1	<0.001	<0.002	<0.001	<0.002	--	<0.0001	--

Please refer to notes at end of table.

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Table C- 2
Historical roundwater Analytical Data – TPH, VOCs, PAHs, and lead
NuStar Alamogordo Terminal
Alamogordo, New Mexico

Sample Location	Sample Date	TPHg	TPHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	PAHs: Total Naphth + Mononaph.	benzo-a-pyrene	Dissolved Lead
		Concentrations in mg/L (ppm)								
STP 19	8/29/2007	13	0.51	2.3	0.37	0.86	0.72	0.063	<0.0011	--
	9/11/2008	7.8	0.33	2.0	0.34	0.53	0.4	0.033	<0.000081	--
	3/5/2009	5.7	0.615	1.87	0.495	0.297	0.355	--	--	--
	11/12/2009	3.01	0.349	0.774	0.0551	0.181	0.111	--	--	--
STP 20	8/29/2007	45	1.5	6.1	9.1	1.8	2.24	0.122	<0.0011	--
	9/11/2008	45	1.6	5.8	9.2	2.1	2.5	0.082	<0.000081	--
	3/5/2009	26.9	2.87	5.63	1.79	8.61	2.04	<0.001	<0.0001	--
	11/12/2009	37.6	3.38	5.14	6.49	1.35	1.54	0.0273	<0.0001	--
STP 21	8/29/2007	0.11	<0.024	0.028	0.0057	0.0023	0.0046	<0.001	<0.0011	--
	9/10/2008	0.078 J	0.031 J	0.026	0.00052 J	0.0048	<0.0012	--	--	--
	3/5/2009	<0.06	<0.200	<0.0002	<0.0003	<0.0006	0.000640 J	--	--	--
	11/11/2009	<0.1	<0.1	<0.001	<0.002	<0.001	<0.002	--	--	--
STP 22	8/29/2007	1.8	1.2	<0.00039	<0.00039	0.021	0.0059	0.0345	<0.0011	--
	9/10/2008	0.57	0.46	<0.00039	<0.00039	0.0041	0.0013 J	0.0023 J	<0.000081	--
	3/4/2009	0.954	1.37	<0.0002	0.00182	<0.0006	0.000940 J	0.00153	<0.0001	--
	11/12/2009	1.6	2.07	<0.001	<0.002	<0.001	<0.002	--	<0.0001	--
STP 23	8/29/2007	<0.029	<0.024	<0.00039	<0.00039	<0.00042	<0.003	<0.001	<0.0011	--
	9/10/2008	<0.029	0.019 J	<0.00039	<0.00039	<0.00042	<0.0012	--	--	--
	9/10/2008 DUP	<0.029	0.026 J	<0.00039	<0.00039	<0.00042	<0.0012	--	--	--
	3/4/2009	<0.06	<0.2	<0.0002	<0.0003	<0.0006	<0.0006	--	--	--
	11/11/2009	<0.1	0.112	<0.001	<0.002	<0.001	<0.002	--	--	--
STP-25	10/30/2008	<0.10	0.061	<0.0010	<0.0010	0.00065 J	<0.003	<0.0096	<0.0002	--
(Disinger MW)	11/11/2009	<0.1	<0.1	<0.001	<0.002	<0.001	<0.002	0.000259 J	<0.0001	--
STP-26	10/30/2008	0.037 J	0.12	<0.0010	<0.0010	<0.0010	<0.003	<0.01	<0.0002	--
(Echols MW)	11/11/2009	<0.1	<0.1	<0.001	<0.002	<0.001	<0.002	--	<0.0001	--
NMWQCC Standards		N/A	2.86	0.01	0.75	0.75	0.62	0.03	0.0007	0.05

Notes:
1. Total petroleum hydrocarbons (TPH) as gasoline (TPHg) and diesel (TPHd) were analyzed by Method 8015M.
2. Volatile organic compounds (VOCs) were analyzed by EPA Method 8260.
3. Polycyclic aromatic hydrocarbons (PAHs) were analyzed by EPA Method 8270C.
4. New Mexico Environment Department (NMED) TPH Screening Guidelines, Table 2a. TPH Screening Guidelines for Potable Groundwater (GW-1) for petroleum product jet fuel.
5. New Mexico Water Quality Control Commission (NMWQCC) Standards 20.6.2.3103.A.
6. All results in milligrams per liter (mg/L) parts per million (ppm).
7. J = Result is less than the reporting limit; estimated value.
8. E = Result exceeds calibration range; estimated value.
9. **Bold** indicates that a constituent of concern (COC) was detected.
10. Shading indicates that a detected result exceeded the NMED TPH screening guidelines or the NMWQCC Standard (for VOCs, PAHs, or dissolved lead).

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Appendix D

Quality Assurance Project Plan

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A Site Health and Safety Plan
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C ALS Laboratory Group QA Manual

1.0 Project Description

This Quality Assurance Project Plan (QAPP) summarizes the organization, objectives, quality assurance (QA) and quality control (QC) activities associated with the remediation activities for the NuStar Logistics, L.P. (NuStar) Alamogordo Terminal in Alamogordo, New Mexico (Site). This QAPP is being submitted as an Appendix of the Stage 2 Abatement Plan (Stage 2 Plan) for the Site.

This QAPP describes specific protocols for the sampling, handling and storage, chain-of-custody, and laboratory (and field) analyses. QA/QC procedures will be conducted in accordance with regulatory guidelines, technical standards, and Site-specific project objectives.

2.0 Program Organization and Responsibility

The project management, QA, field, and laboratory personnel are provided in the following subsections.

2.1 General Project Management

Technical Management. Ash Creek Associates, Inc. (Ash Creek) is the primary environmental/technical consultant for the remediation activities at the Site and will have the overall responsibility for monitoring and sampling activities at the Site.

Project Manager: Sam Jackson
Responsible Engineer in Charge: Herb Clough, P.E.
Principal: Amanda Spencer
Health and Safety Officer: Mike Stevens

Ash Creek's Project Manager has the overall responsibility for ensuring that the project meets the requirements outlined by NuStar and the New Mexico Department of the Environment (NMED). Ash Creek's Project Manager will supervise day-to-day activities, including budgets, schedules, staffing, and quality objectives; and under the supervision of the Responsible Engineer in Charge, is responsible for the preparation, quality, and completeness of deliverables.

Regulatory Management. The regulatory contact for the Site is:

Christopher Whitman, Geoscientist
Groundwater Quality Bureau, NMED

2.2 Field Responsibilities

Field Manager. Ash Creek will have the overall responsibility for all phases of monitoring and sampling. Ash Creek will supervise all field activities. The majority of field activities will be conducted by a subcontractor, who will serve as Field Manager, and report directly to the Ash Creek Project Manager. The Field Manager will be responsible for monitoring and sampling activities; collecting environmental documentation; and ensuring chain-of-custody protocols with the analytical laboratory are followed.

Health and Safety Officer. The Health and Safety Officer (HSO) will be responsible for ensuring:

- Project personnel maintain appropriate levels of training, as specified by Occupational Safety and Health Act (OSHA) protocols;
- Health and Safety Plans (HASPs) are prepared and maintained in accordance with OSHA protocols;
- Field operations are conducted using health and safety protocols that are appropriate and protective; and
- Subcontractors have HASPs relative to their respective responsibilities.

The HASP for the Site is included as Appendix A of this QAPP. The HASP details field activities conducted in compliance with NMED and OSHA requirements (29 CFR 1910.120).

Quality Assurance Officer. The Quality Assurance Officer (QAO) responsibilities will include monitoring project QA procedures to ensure compliance with this QAPP.

Ash Creek Quality Assurance Officer: Sam Jackson (or designated alternate)

Laboratory Project Manager. The analytical laboratory will be provided a copy of this QAPP and a statement binding the laboratory to adhere to this QAPP. Any exceptions identified by the laboratory will be reviewed by the Project Manager and/or QAO to assess whether the exception will result in a significant deficiency. If possible, corrective action will be taken.

ALS Laboratory Project Manager: JayLynn Thibault (or designated alternate)

3.0 Data Quality Objectives

To achieve project objectives, data quality objectives (DQOs) have been established to ensure that the data collected are sufficient and of adequate quality for their intended uses. DQOs include both quantitative and qualitative statements that are derived from the outputs of the seven-step DQO process.

The seven-step DQO process includes:

1) State the problem
2) Identify the decision
3) Identify inputs to the decision
4) Define the boundaries of the study
5) Develop a decision rule
6) Specify limits on decision errors
7) Optimize the design for obtaining data

The details of the DQO process for this remediation project are provided below.

The problem is that impacts from chemicals of interest (COI) have been identified in on-site and off-site groundwater.

The decision is to perform groundwater monitoring and sampling in accordance with the selected abatement options for the Site to confirm that the abatement is successful. The monitoring and sampling will continue on a routine basis until groundwater concentrations are below abatement standards for applicable exposure pathways.

The inputs to the decision include data from historical Site assessments as outlined in the Stage 2 Plan.

The spatial boundaries are the sampling locations (i.e., monitoring wells) presented in the Stage 2 Plan. The applicable COI identified in the Stage 2 Plan include separate phase hydrocarbons (SPH) and dissolved constituents benzene, toluene, ethylbenzene, and xylenes (BTEX), naphthalene, 1-methylnaphthalene, and 2- methylnaphthalene. The primary potential exposure pathway to these COI is via direct ingestion of impacted groundwater.

The decision rule is derived from the evaluation of historical investigations and current groundwater conditions at the Site. SPH has been observed in the groundwater on-site and groundwater conditions exceed abatement standards off-site.

The groundwater monitoring program is designed to ensure that the identified problem be solved in a resource-effective manner. The scope of work (SOW) for the abatement activities is provided in the Stage 2 Plan, which is being submitted concurrently with this QAPP.

4.0 Field Sampling Plan (FSP)

The FSP includes, but is not limited to, the following items:

1) Site Background
2) Sampling Objectives
3) Sample Location and Frequency
4) Sample Designation
5) Sampling Equipment and Procedures
6) Sampling Handing Analysis

The Site background, sampling objectives, sample location and frequency, and sample designation are discussed in the Stage 2 Plan. The groundwater monitoring program outlined in the Stage 2 Plan includes the gauging of select on-site and off-site monitoring wells for water levels and the presence of SPH, as well as the sampling of groundwater from select monitoring wells for the COI defined in the DQO section above. The monitoring wells sampled as part of the Vertical Delineation Plan will be developed prior to sampling. The groundwater sampling procedure includes measuring water levels, purging and monitoring geochemical field parameters, and sampling. Field observations and measurements made during groundwater monitoring are recorded on monitoring well sampling forms (included in Appendix B of this QAPP). Field monitoring and sampling procedures are described in the subsections below.

4.1 Groundwater Levels

Water levels in the wells are measured and recorded for the purpose of determining groundwater elevations and gradient. The wells are opened and the water level is allowed to equilibrate before the measurements are taken. Measurements of the depth to water (DTW) are made to the nearest 0.01 foot using an oil/water interface probe.

4.2 Well Development

The well will be set up in a manner such that the volume of water generated can be easily determined and field parameters can be collected. The development activities will be completed to maximize the removal of sediment from the well casing.

Procedures:

- Measure depth to water (DTW) and total depth of the well prior to development and calculate the casing volume.

- Field parameters (temperature, pH, and conductivity) will be measured for each casing volume removed.
- Purge water will be placed in Department of Transportation (DOT) approved drums or high-capacity tank.
- After the removal of eight casing volumes, field parameters will be monitored for stability.

The well will be considered developed after a minimum of 10 casing volumes have been removed, field parameters have stabilized, and purged water is as free of sediment as possible. Field parameters will be considered stable if temperature, pH, and conductivity are within 10% for three consecutive casing volumes. Wells will also be considered developed if the well is pumped dry during the development process. Consult the project-specific SAP for additional parameters and stabilization criteria.

4.3 Purging

After the groundwater levels are measured, each well is purged prior to sampling. Each monitoring well is purged using a low-flow sampling method. While purging the well, the flow rate is managed to maintain a steady water level in the well casing (expected to be between 0.1 to 0.5 liter per minute [L/min]). During purging, the intake will be maintained at the center of the screen. To assess the effectiveness of purging, groundwater field parameters (pH, electrical conductivity, and temperature) are recorded. Field parameters are recorded approximately every five minutes during purging. Purging is considered complete when the water quality parameters are stable for three consecutive measurements.

4.4 Sampling

After the purging of each well is complete, groundwater samples are collected for chemical analyses using the same pump as was used for the well purging. Samples will be collected in sample containers (with preservative, when applicable) provided by the laboratory for the specific analyses that will be completed.

4.5 Sample Management

4.5.1 Sample Containers

Clean sample containers will be provided by the analytical laboratory ready for sample collection, including preservative, if required. Each container will be fully filled, leaving no headspace. Lids will be equipped with Teflon® liners to reduce the loss of volatile compounds.

4.5.2 Sample Storage and Shipment

All samples will be stored in a cooler chilled with ample ice or blue ice until transported to the analytical laboratory. All samples will be delivered to the analytical laboratory within 24 hours of collection. The cooler

lid will be sealed with chain-of-custody seals. Chain-of-custody will be maintained and documented at all times.

4.6 Field and Laboratory Documentation Procedures

The following section describes field and laboratory chain-of-custody documentation procedures for monitoring and sampling activities.

4.6.1 Field Documentation Procedures

Groundwater monitoring and sampling activities will be documented on designated field forms (Appendix B of this QAPP). Any additional field work in support of the Stage 2 Plan will be documented on field note sheets. The field sheet entries will include as much data as possible. All notes will be filed in a secure location at the Ash Creek office and will be electronically scanned and saved to the Ash Creek server. The Ash Creek server is backed-up regularly so that data will not be lost in the event of a power failure. Field notes will contain, at a minimum, the following information:

- Name(s) of Field Staff;
- Site Name and Site Number;
- Task Description;
- Date (Project Start/End);
- Time of Major Events;
- Site Conditions; and
- Weather Conditions.

Additionally, the following items will be documented in the field notebook:

- The names and purpose of any Site visitors;
- Field instrument calibration documentation (time, calibration materials used, calibration confirmation results);
- All measurements made and samples collected (include sample names and duplicate sample names); and
- Photographs (include: photograph number, date/time, direction photographer is facing, and subject of photograph).

All entries will be printed in waterproof, indelible ink and no erasures will be made. If any incorrect entries are made to any field notes or sampling sheets, the information will be crossed-out using a single strike

mark and the correct information will be recorded. The change will be initialed by the note taker when the change(s) is/are made.

4.6.2 Laboratory Chain-of-Custody Procedures and Documentation

A chain-of-custody record will be used to provide necessary documentation of sample possession from the time of collection to the time of receipt by the analytical laboratory. The following sampling and packing procedures will ensure that the samples will arrive at the laboratory with the appropriate chain-of-custody form.

1) All samples will be accompanied by a properly completed chain-of-custody form supplied by the laboratory. When transferring possession of the samples, the individuals relinquishing and receiving the samples will sign and date the form, and note the time on the form.
2) The chain-of-custody form will include the project name; sample IDs; the date and time of collection of each sample; the number of containers; preservation used; and analyses requested.
3) If samples are packaged for shipment to a laboratory, a copy of the chain-of-custody should be submitted in each cooler. Shipping containers will be secured with tape and custody seals prior to shipping.
4) Shipping airbills for samples will be retained as part of the custody documentation. Commercial carriers are not required to sign off on chain-of-custody forms as long as the forms are sealed inside the sample coolers and custody seals remain intact.

The chain-of-custody procedures to be followed by the laboratory are provided in Section 22 of the ALS QA Manual (Appendix C of this QAPP).

4.7 Decontamination Procedures

Decontamination procedures are required for field personnel and for field equipment used during sampling. Decontamination procedures for field personnel will depend on the type of work and Site-specific field conditions known or expected at each site as identified in the project HASP. Sampling equipment decontamination is described in the following subsection.

4.7.1 Equipment Decontamination

To prevent cross-contamination between sampling events, clean, dedicated sampling equipment (e.g., groundwater sampling tubing) is used when possible for each sampling event and is discarded after use. Fresh gloves are worn for each new sampling location.

Sampling equipment (e.g., sampling pumps) will be decontaminated in accordance with the following procedures before each sampling attempt or measurement:

1) Brush equipment with a nylon brush to remove large particulate matter.
2) Rinse with potable tap water.
3) Wash with non-phosphate detergent solution (Liquinox® and potable tap water).
4) Rinse with potable tap water.
5) Rinse with distilled water.

Decontamination water will be disposed of in the oil/water separator (OWS) located at the terminal.

5.0 Measurement and Data Acquisition

5.1 Laboratory Analytical Methods

Appropriate analytical methods were selected based on requirements described in *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, U.S. Environmental Protection Agency (EPA), SW-846, Third Edition, dated November 1986 (with later revisions). Volume 1B of this report documents organic analytical methods.

In accordance with the above-referenced document, groundwater samples will be analyzed for select volatile organic compounds (VOCs) using EPA Method 8260B (VOCs Gas Chromatography/Mass Spectrometry [GC/MS]).

5.2 Calibration Procedures

The following subsection describes calibration procedures for both field instrumentation and laboratory analytical equipment.

5.2.1 Calibration of Field Instruments/Equipment

A calibration program will be implemented to ensure that routine calibration is performed on all field instruments. The calibration of all equipment will be performed in accordance with manufacturer recommendations and the frequency of calibration will vary depending on analyses required. The program will be conducted by the Field Manager. All field personnel will be familiar with all field instruments. In general, all field equipment will be operated according to manufacturers instructions. If field equipment should fail, the Project Manager will be contacted immediately and will either have the malfunction repaired immediately or will provide replacement equipment.

5.2.2 Calibration of Laboratory Instruments

The laboratory will be responsible for the calibration of the GC/MS used for analyses of groundwater samples. The calibration procedures to be followed by the laboratory are provided in their QA Manual

(Appendix C of the QAPP). The manual meets all EPA requirements for analyses being performed by the laboratory.

6.0 Internal Quality Control

6.1 Field QA/QC Samples

Field QA/QC samples are intended to provide control over the collection of environmental measurements and subsequent review, interpretation, and collection of analytical data. The field QA/QC samples that are appropriate to the Stage 2 Plan are summarized in this section, as well as a summary of the frequency at which these samples are required to meet project objectives.

6.1.1 Trip Blanks

Purpose. To detect potential additional sources of contamination related to transportation of the sample.

Preparation. Trip blanks are prepared by the laboratory with laboratory reagent water and are transported to and from the field in sample shipment containers (cooler).

Frequency. One trip blank will be submitted for each shipment of samples

6.1.2 Field Duplicates

Purpose. Field duplicates are collected to determine the overall precision of the monitoring program. Any variability between the field duplicate samples is the sum of the sampling and analytical variability and is the most meaningful measurement of uncertainty of the samples obtained.

Procedure. Field duplicates are collected as independent samples using the same sampling procedures. Samples are handled, preserved, transported, and analyzed using the same protocols.

Frequency. Duplicates should be collected at a minimum frequency of 5 percent. If fewer than 20 samples are collected, then at least one duplicate sample should be collected.

6.2 Laboratory QC Analyses

The laboratory will perform the internal QC checks that are specified by EPA Method 8260. The QC checks include the following: matrix spikes (MS), surrogate spikes, referenced samples, laboratory control samples (LCS), and/or method blanks. Additionally, as specified in the analytical method, laboratory duplicates may be collected on one or more of these lab QC samples in order to verify the precision of the analysis. The frequency of QC samples, the compounds to be used for spikes, and the QC acceptance criteria are described in the EPA method and in the laboratory QA manual provided in Appendix C of this

QAPP. The laboratory will document that both initial and ongoing instrument calibration and analytical QC criteria have been met.

7.0 Data Reduction, Validation, and Reporting

This section describes the reduction, validation, and reporting of field and/or laboratory analytical data.

7.1 Data Reduction

The laboratory will perform the data reduction in accordance with procedures outlined in the ALS QA manual provided in Appendix C of this QAPP. The data reduction will serve to ensure that the actual quantities reported are accurate and qualified as appropriate.

7.2 Data Validation

The laboratory will validate the data in terms of identifying and flagging QC outliers in accordance with the specific analytical method used. The laboratory will also evaluate its internal QC programs, such as spike recoveries, surrogate recoveries, establishing quantitation limits, evaluating precision and accuracy controls, and maintaining records of instrument calibration. The Ash Creek Project Manager will be responsible for reviewing all sample collection procedures and laboratory reports to ensure that the field and laboratory QA/QC requirements established in this QAPP are met.

Field data validation process should evaluate that properly calibrated instruments have been used; that appropriate standard operating procedures (SOPs; in most cases, adhering to equipment manufacturer's operating instructions) have been followed; and that accurate records of field activities have been maintained.

7.3 Data Reporting

Field subcontractors are responsible for reporting field data to Ash Creek. The laboratory is responsible for reporting all analytical data to Ash Creek. Ash Creek is responsible for reporting all data to IDEM once the data validation has been reviewed and approved. The Data Validation Report will document the quality of the data being reported and serves to evaluate the results against the DQOs defined in this QAPP.

The analytical reports will address, at a minimum, the following items:

- Chain-of-custody documentation
- Sample data (to include matrix, field ID number, laboratory ID number, date of sampling, date of extraction, and date of analysis)
- Holding times

- Instrument calibration
- Method detection limits (MDLs)
- Blank analysis:
    - Field (trip and equipment)
    - Method
- Quality control:
    - Accuracy:
        - Spike recovery (matrix, surrogate)
    - Precision:
        - Field duplicates
        - Lab duplicates
- Data use and limitations.

Appendix A

Site Health and Safety Plan

1.0 Introduction

This Health and Safety Plan (HASP) includes both information specific to the NuStar Terminals Operations Partnership, L.P. (NuStar) Alamogordo Terminal in Alamogordo, New Mexico (Site; including Site-specific activities, health hazards, route to hospital, and toxicity information), and the Ash Creek Associates, Inc. (Ash Creek) General Health and Safety Plan (General HASP).

1.1 Emergency Contact Summary

SITE LOCATION	6026 Highway 54 South, Alamogordo, New Mexico
NEAREST HOSPITAL	Gerald Champion Regional Medical Center 2669 North Scenic Drive Alamogordo, NM 88310 (see Figure 1) Telephone 575-439-6100
EMERGENCY RESPONDERS	Police Department ..... 9-1-1 Fire Department..... 9-1-1 Ambulance..... 9-1-1
EMERGENCY CONTACTS	Ash Creek Associates.....(503) 924-4704 National Response Center.....(800) 424-8802 Office of Emergency Response (IDEM).....(888) 233-7745 Poison Control Center.....(800) 222-1222 Chemtrec .....(800) 424-9300

In the event of an emergency, call for help as soon as possible. Give the following information:

- WHERE the emergency is (use cross-streets or landmarks).
- PHONE NUMBER you are calling from.
- WHAT HAPPENED (type of injury).
- HOW MANY persons need help.
- WHAT is being done for the victim(s).
- YOU HANG UP LAST (let the person you called hang up first).

2.0 Corporate Health and Safety Plan

The attached Ash Creek General HASP, together with the included Site-specific information, cover each of the 11 required plan elements as specified in Occupational Safety and Health Act (OSHA) 1910.120, and meets all applicable regulatory requirements. The reader is advised to thoroughly review the entire plan.

3.0 Site-Specific Health and Safety Plan

3.1 Site Location and Description

LOCATION: 6026 Highway 54 South, Alamogordo, New Mexico

LAND USE OF AREA SURROUNDING FACILITY: Residential, vacant

3.2 Site Activity Summary

SITE ACTIVITIES: May include, but not limited to: groundwater monitoring, soil probes, monitoring well installation, soil and groundwater sampling.

PROPOSED DATE OF ACTIVITY: 2010

POTENTIAL SITE CONTAMINANTS: BTEX (benzene, toluene, ethylbenzene, and xylenes), MTBE (methyl-tertiary butyl ether), and Naphthalene

POTENTIAL ROUTES OF ENTRY: Skin contact with impacted soil and groundwater, incidental ingestion of soil and groundwater, inhalation of volatiles

PROTECTIVE MEASURES: Engineering controls, safety glasses, safety boots, hard hat, gloves, protective clothing (including reflective vest), flame retardant garment, as necessary

MONITORING EQUIPMENT: Photoionization detector (PID) with 10.2 eV lamp and olfactory indications

3.3 Chain of Command

The chain of command for Health and Safety in this project involves the following individuals:

CORPORATE HEALTH AND SAFETY (H&S) MANAGER: Mike Stevens, P.E.
PROJECT MANAGER: Amanda Spencer
PROJECT H&S OFFICER: Sam Jackson
FIELD H&S MANAGERS: To be designated

3.4 Hazard Analysis and Applicable Safety Procedures

The following work tasks will be accomplished:

- Gauging and sampling existing monitoring wells

The associated hazards for the above activities that may be anticipated during this project are discussed in detail below.

Much of the terminal property is frequented by heavy machinery, and awareness of the surroundings during sampling is critical. Work areas should be marked with traffic warnings (i.e., cones or barricades) and reflective vests should be worn.

3.4.1 Groundwater Monitoring

Groundwater and soil sampling will occur under the assumption the media is contaminated and appropriate PPE will be required.

3.4.2 Air Monitoring and Action Levels

Air monitoring will be conducted to determine possible hazardous conditions and to confirm the adequacy of PPE. The results of the air monitoring will be used as the basis for specifying PPE and determining the need to upgrade protective measures.

Air monitoring equipment will be calibrated prior to use (where applicable) as specified by the instrument manuals and results will be documented in the instrument log. All equipment will be maintained as specified by the manufacturer or more frequently as required by use conditions, and repair records will be maintained with the instrument log.

PID Monitoring. Air monitoring will be conducted with a PID with 10.2 eV lamp, or equivalent, to measure organic vapor concentration during Site work activities. (The 10.2 eV lamp is specified to allow detection of halogenated compounds.) A background PID measurement will be taken prior to the start of work to quantify levels associated with the ambient air space in the vicinity of the Site. Additional measurements will be taken if other indications of elevated concentrations (i.e., olfactory evidence) are encountered. If PID measurements are elevated relative to the previously measured background levels, then detector tube readings will be collected from the breathing space (described below). If the detector tube readings exceed the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) concentrations, then Site workers exposed to these levels will use air purifying respirators as appropriate. If detector tube readings are below the REL concentrations, then a PID measurement will be collected from the breathing space. If PID measurements are elevated in the breathing zone above background concentrations, then Site workers exposed to these levels will use air-purifying respirators as appropriate. If measured concentrations exceed IDLH concentrations, Site work will cease pending re-evaluation of the situation by the H&S Manager.

LEL Monitoring. Hot work permits (HWPs) are required for any process that may produce an ignition source in a work area in which flammable vapors or gases may be present (i.e., batteries associated with bladder pump). For safe operation of processes involving combustible materials, hazard surveys must be performed before HWPs are issued. These surveys typically involve the use of combustible gas meters, also called lower explosive limit (LEL) meters.

Olfactory. If olfactory senses detect any unfamiliar odor, work will stop until an assessment can be made to determine whether the need exists to upgrade protective measures.

3.5 Chemicals of (COC)

Based on Site information gathered to date, the following chemicals may be present at the Site:

- Jet Fuel;
- BTEX; and
- Naphthalene.

3.5.1 Exposure Informaion

Pertinent toxicological properties of Site COCs are discussed below. This information generally covers potential toxic effects that may occur from relatively significant acute and/or chronic exposures and is not meant to indicate that such effects will occur from the planned Site activities. In general, the chemicals that may be encountered at the Site are not expected to be present at concentrations that could produce significant exposures. The types of planned work activities should also limit potential exposures at the Site. Furthermore, appropriate protective and monitoring equipment will be used, as discussed below, to further minimize any exposures that might occur.

Standards for occupational exposures to Site COCs are included where available. Site exposures are generally expected to be of short duration and well below the level of any of these exposure limits. These standards are presented below:

PEL: Permissible Exposure Limit

TWA: Time-Weighted Average exposure limit for any eight-hour work shift of a 40-hour workweek

STEL: Short-Term Exposure Limit expressed as a 15-minute, time-weighted average and not to be exceeded at any time during a workday

C: Ceiling exposure limit not to be exceeded at any time during a workday

Jet Fuel (JP-4). JP-4 is called a wide-cut fuel because it is produced from a broad distillation temperature range and contains a wide array of carbon chain-lengths, from 4 to 16 carbons long. It was initially developed for broad availability in times of need. The composition of JP-4 is approximately 13% (v/v) aromatic hydrocarbons, 1.0% olefin hydrocarbons, and 86% saturated hydrocarbons. It has a distillation temperature range of 60 to 270 °C.

Aviation fuels consist primarily of hydrocarbon compounds (paraffins, cycloparaffins or naphthenes, aromatics, and olefins) and contains additives that are determined by the specific uses of the fuel. Paraffins and cycloparaffins are the major components. Paraffins have a high hydrogen-to-carbon ratio, with a high heat release per unit of weight and a cleaner burn than other hydrocarbons. Cycloparaffins have a lower hydrogen-to-carbon ratio, which results in less heat released per unit of weight but increases the fuel's density. These components reduce the freezing point of the fuel. Aromatic hydrocarbons are a good energy source but produce smoke when burned; therefore, the maximum levels are restricted (20-25% by volume in JP-4). Finally, olefins are similar to the paraffins but are unsaturated with lower hydrogento- carbon ratios. They are the most reactive of the hydrocarbons and are permitted at only 5% by volume in JP-4. Benzene, present in wide-cut fuels such as JP-4, is an ineffectual contaminant usually present below 0.5%. Nonhydrocarbon compounds such as sulfur and sulfur compounds are also found. Additives such as antioxidants, metal deactivators, fuel system icing inhibitors, corrosion inhibitors, and static dissipator additives are all present in limited quantities in jet fuels in order to improve performance.

Benzene. Benzene exposure can occur by inhalation, percutaneous absorption, ingestion, and skin and eye contact. Like other aliphatic and aromatic hydrocarbons, acute overexposure to benzene can cause central nervous system depression. Headache, dizziness, nausea, convulsions, coma, and death can result from elevated exposures. In some cases, acute exposure has resulted in death due to ventricular fibrillation. The principal chronic hazard associated with benzene exposures is its ability to cause changes in blood cells, including anemias and cell abnormalities. Benzene has been demonstrated to cause leukemia in epidemiological studies, and it is recognized as a human carcinogen by NIOSH and other agencies. The U.S. Environmental Protection Agency (EPA) currently classifies benzene as a Class A, or confirmed, human carcinogen. The current PEL-TWA for benzene is 1 ppm with an STEL of 5 ppm.

Toluene. Toluene exposure can occur by inhalation, percutaneous absorption, ingestion, and skin and eye contact. Toluene can cause eye, respiratory, and skin irritation. Drying and defatting on the skin can occur with prolonged skin contact. The chief symptom of acute exposure to toluene vapor is depression of the central nervous system function. Symptoms include headache, dizziness, drowsiness, in-coordination, and coma. The current PEL-TWA for toluene is 100 ppm with an STEL of 150 ppm.

Ethylbenzene. Ethylbenzene exposure can occur by inhalation, ingestion, and skin and eye contact. Like other aliphatic and aromatic hydrocarbons, acute overexposure to ethylbenzene can cause central nervous system depression. Headache, dizziness, nausea, convulsions, coma, and death can result from elevated exposures. Ethylbenzene also causes skin drying and defatting, and eye and mucous membrane irritation can result from overexposure. The current PEL-TWA for ethylbenzene is 100 ppm with an STEL of 125 ppm.

Xylene. The major route of xylene toxicity is via inhalation of vapor, with percutaneous absorption and ingestion of liquid playing lesser roles. Xylene can cause irritation of the eyes, nose, and throat. Repeated

skin contact may cause drying, defatting, and dermatitis. Acute exposure to vapors via inhalation may cause central nervous system depression, and liver and kidney damage. The current PEL-TWA for xylene is 100 ppm with an STEL of 150 ppm.

Naphthalene. Exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene happens mostly from breathing air contaminated from the burning of wood, tobacco, or fossil fuels, industrial discharges, or moth repellents. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. Naphthalene has caused cancer in animals. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have been found in at least 687, 36, and 412, respectively, of the 1,662 National Priority List sites identified by the EPA. Naphthalene is a white solid that evaporates easily. Fuels such as petroleum and coal contain naphthalene. Naphthalene is also called white tar, and tar camphor, and has been used in mothballs and moth flakes. Burning tobacco or wood produces naphthalene. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Its major consumer use is in moth repellents and toilet deodorant blocks.

3.5.2 Toxicity Information

Pertinent toxicological properties of Site COCs are discussed below. This information generally covers potential toxic effects which may occur from relatively significant acute and/or chronic exposures, and is not meant to indicate that such effects will occur from the planned Site activities. In general, the chemicals which may be encountered at the Site are not expected to be present at concentrations that could produce significant exposures. The types of planned work activities should also limit potential exposures at the Site. Furthermore, appropriate protective and monitoring equipment will be used, as discussed below, to further minimize any exposures that might occur.

Standards for occupational exposures to Site COCs are included where available. Site exposures are generally expected to be of short duration and well below the level of any of these exposure limits. These standards are presented below.

PEL: Permissible Exposure Limit

REL: Recommended Exposure Limit (NIOSH)

IDLH: Immediately Dangerous to Life and Health (NIOSH)

TWA: Time-Weighted Average exposure limit for any eight-hour work shift of a 40-hour workweek

STEL: Short-Term Exposure Limit expressed as a 15-minute, time-weighted average and not to be exceeded at any time during a workday

C: Ceiling exposure limit not to be exceeded at any time during a workday

The following table lists the exposure limits recommended by OSHA and NIOSH for each of the listed compounds. Respiratory protection will be required if measured concentrations in air exceed the minimum of these exposure limits.

Compound	OSHA PEL [ppm]	NIOSH REL [ppm]	IDLH [ppm]
Benzene	1 (average) 5 (short-term)	0.1 (average) 1 (short-term)	500
Toluene	200 (average) 300 (peak)	100 (average) 150 (short-term)	500
Ethylbenzene	100 (average)	100 (average) 125 (short-term)	800
Xylenes	100 (average)	100 (average) 150 (peak)	900
Naphthalene	10 ppm (based on 40-hour workweek)	NA	500

Notes: 1. ppm = Parts per million. 2. NA = Not applicable.

Benzene. Benzene, also known as benzol, is a colorless liquid with a sweet odor. Benzene evaporates into air very quickly and dissolves slightly in water. Benzene is highly flammable. Most people can begin to smell benzene in air at 1.5-4.7 parts of benzene per million parts of air and smell benzene in water at 2 ppm. Most people can begin to taste benzene in water at 0.5-4.5 ppm. Benzene is found in air, water, and soil.

Benzene found in the environment is from both human activities and natural processes. Benzene was first discovered and isolated from coal tar in the 1800s. Today, benzene is made mostly from petroleum sources. Because of its wide use, benzene ranks in the top 20 in production volume for chemicals produced in the United States. Various industries use benzene to make other chemicals, such as styrene (for Styrofoam® and other plastics), cumene (for various resins), and cyclohexane (for nylon and synthetic fibers). Benzene is also used for the manufacturing of some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene, which include volcanoes and forest fires, also contribute to the presence of benzene in the environment. Benzene is also a natural part of crude oil and gasoline and cigarette smoke.

Most people are exposed to a small amount of benzene on a daily basis. You can be exposed to benzene in the outdoor environment, in the workplace, and in the home. Exposure of the general population to benzene is mainly through breathing air that contains benzene. The major sources of benzene exposure are tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions. Vapors (or gases) from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure. Auto exhaust and industrial emissions account for about 20 percent of the total nationwide exposure to benzene. About 50 percent of the entire nationwide exposure to benzene results from smoking tobacco or from exposure to tobacco smoke. The average smoker (32 cigarettes per

day) takes in about 1.8 milligrams (mg) of benzene per day. This is about 10 times the average daily intake of nonsmokers.

Measured levels of benzene in outdoor air have ranged from 0.02 to 34 parts of benzene per billion parts of air (ppb; 1 ppb is 1,000 times less than 1 ppm). People living in cities or industrial areas are generally exposed to higher levels of benzene in air than those living in rural areas. Benzene levels in the home are usually higher than outdoor levels. People living around hazardous waste sites, petroleum refining operations, petrochemical manufacturing sites, or gas stations may be exposed to higher levels of benzene in air.

Benzene can enter your body through your lungs when you breathe contaminated air. It can also enter through your stomach and intestines when you eat food or drink water that contains benzene. Benzene can enter your body through skin contact with benzene-containing products such as gasoline.

When you are exposed to high levels of benzene in air, about half of the benzene you breathe in leaves your body when you breathe out. The other half passes through the lining of your lungs and enters your bloodstream. Animal studies show that benzene taken in by eating or drinking contaminated foods behaves similarly in the body to benzene that enters through the lungs. A small amount will enter your body by passing through your skin and into your bloodstream during skin contact with benzene or benzene-containing products. Once in the bloodstream, benzene travels throughout your body and can be temporarily stored in the bone marrow and fat. Benzene is converted to products, called metabolites, in the liver and bone marrow. Some of the harmful effects of benzene exposure are believed to be caused by these metabolites. Most of the metabolites of benzene leave the body in the urine within 48 hours after exposure.

After exposure to benzene, several factors determine whether harmful health effects will occur and if they do, what the type and severity of these health effects might be. These factors include the amount of benzene to which you are exposed and the length of time of the exposure. Most data involving effects of long-term exposure to benzene are from studies of workers employed in industries that make or use benzene. These workers were exposed to levels of benzene in air far greater than the levels normally encountered by the general population. Current levels of benzene in workplace air are much lower than in the past. Because of this reduction, and the availability of protective equipment such as respirators, fewer workers have symptoms of benzene poisoning.

Brief exposure (5 to 10 minutes) to very high levels of benzene in air (10,000-20,000 ppm) can result in death. Lower levels (700-3,000 ppm) can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. In most cases, people will stop feeling these effects when they stop being exposed and begin to breathe fresh air.

Eating foods or drinking liquids containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, coma, and death. The health effects that may result from eating foods or drinking liquids containing lower levels of benzene are not known. If you spill benzene on your skin, it may cause redness and sores. Benzene in your eyes may cause general irritation and damage to your cornea.

Benzene causes problems in the blood. People who breathe benzene for long periods may experience harmful effects in the tissues that form blood cells, especially the bone marrow. These effects can disrupt normal blood production and cause a decrease in important blood components. A decrease in red blood cells can lead to anemia. Reduction in other components in the blood can cause excessive bleeding. Blood production may return to normal after exposure to benzene stops. Excessive exposure to benzene can be harmful to the immune system, increasing the chance for infection and perhaps lowering the body's defense against cancer.

Benzene can cause cancer of the blood-forming organs. The Department of Health and Human Services (DHHS) has determined that benzene is a known carcinogen. The International Agency for Cancer Research (IARC) has determined that benzene is carcinogenic to humans, and the EPA has determined that benzene is a human carcinogen. Long-term exposure to relatively high levels of benzene in the air can cause cancer of the blood-forming organs. This condition is called leukemia. Exposure to benzene has been associated with development of a particular type of leukemia called acute myeloid leukemia (AML).

Exposure to benzene may be harmful to the reproductive organs. Some women workers who breathed high levels of benzene for many months had irregular menstrual periods. When examined, these women showed a decrease in the size of their ovaries. However, exact exposure levels were unknown, and the studies of these women did not prove that benzene caused these effects. It is not known what effects exposure to benzene might have on the developing fetus in pregnant women or on fertility in men. Studies with pregnant animals show that breathing benzene has harmful effects on the developing fetus. These effects include low birth weight, delayed bone formation, and bone marrow damage.

The health effects that might occur in humans following long-term exposure to food and water contaminated with benzene are not known. In animals, exposure to food or water contaminated with benzene can damage the blood and the immune system and can even cause cancer.

EPA has set the maximum permissible level of benzene in drinking water at 5 ppb. Because benzene can cause leukemia, EPA has set a goal of 0 ppb for benzene in drinking water and in water such as rivers and lakes. EPA estimates that 10 ppb benzene in drinking water that is consumed regularly or exposure to 0.4 ppb benzene in air over a lifetime could cause a risk of one additional cancer case for every 100,000 exposed persons. EPA recommends a maximum permissible level of benzene in water of 200 ppb for short-term exposures (10 days) for children.

EPA requires that the National Response Center be notified following a discharge or spill into the environment of 10 pounds or more of benzene.

OSHA regulates levels of benzene in the workplace. The maximum allowable amount of benzene in workroom air during an eight-hour workday, 40-hour workweek is 1 ppm. Since benzene can cause cancer, NIOSH recommends that all workers likely to be exposed to benzene wear special breathing equipment.

Toluene. Toluene is a clear, colorless liquid with a distinctive smell. It is added to gasoline along with benzene and xylene. Toluene occurs naturally in crude oil and in the tolu tree. It is produced in the process of making gasoline and other fuels from crude oil, in making coke from coal, and as a by-product in the manufacture of styrene. Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes. It is disposed of at hazardous waste sites as used solvent (a substance that can dissolve other substances) or at landfills where it is present in discarded paints, paint thinners, and fingernail polish. You can begin to smell toluene in the air at a concentration of 8 ppm, and taste it in your water at a concentration of 0.04-1 ppm. (One ppm is equivalent to 1 minute in 2 years.)

Toluene can enter your body when you breathe its vapors or eat or drink contaminated food or water. When you work with toluene-containing paints or paint thinners, the toluene can also pass through your skin into your bloodstream. You are exposed to toluene when you breathe air containing toluene. When this occurs the toluene is taken directly into your blood from your lungs. Where you live, work, and travel and what you eat affects your daily exposure to toluene. Factors such as your age, sex, body composition, and health status affect what happens to toluene once it is in your body. After being taken into your body, more than 75 percent of the toluene is removed within 12 hours. It may leave your body unchanged in the air you breathe out or in your urine after some of it has been chemically changed to make it more water soluble. Generally, your body turns toluene into less harmful chemicals such as hippuric acid.

A serious health concern is that toluene may have an effect on your brain. Toluene can cause headaches, confusion, and memory loss. Whether or not toluene does this to you depends on the amount you take in and how long you are exposed. Low-to-moderate, day-after-day exposure in your workplace can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, and loss of appetite. These symptoms usually disappear when exposure is stopped. Researchers do not know if the low levels of toluene you breathe at work will cause any permanent effects on your brain or body after many years. You may experience some hearing loss after long-term daily exposure to toluene in the workplace.

If you are exposed to a large amount of toluene in a short time because you deliberately sniff paint or glue, you will first feel light-headed. If exposure continues, you can become dizzy, sleepy, or unconscious. You

might even die. Toluene causes death by interfering with the way you breathe and the way your heart beats. When exposure is stopped, the sleepiness and dizziness will go away and you will feel normal again.

If you choose to repeatedly breathe in toluene from glue or paint thinners, you may permanently damage your brain. You may also experience problems with your speech, vision, or hearing, have loss of muscle control, loss of memory, poor balance, and decreased mental ability. Some of these changes may be permanent.

Toluene may change the way your kidneys work, but in most cases, the kidneys will return to normal after exposure stops. If you drink alcohol and are exposed to toluene, the combination can affect your liver more than either compound alone. This phenomenon is called synergism. Combinations of toluene and some common medicines like aspirin and acetaminophen may increase the effects of toluene on your hearing.

In animals, the main effect of toluene is on the nervous system. Animals exposed to moderate or high levels of toluene may also show slightly adverse effects in their liver, kidneys, and lungs.

Several studies have shown that unborn animals were harmed when high levels of toluene were breathed in by their mothers. When the mothers were fed high levels of toluene, the unborn animals did not show any structural birth defects, although some effects on behavior were noted. We do not know if toluene would harm your unborn child if you drink water or breathe air containing low levels of toluene, because studies in people are not comprehensive enough to measure this effect. However, if you deliberately breathe in large amounts of toluene during your pregnancy, your baby can have neurological problems and retarded growth and development.

Studies in workers and in animals exposed to toluene indicate that toluene does not cause cancer. IARC and the DHHS have not classified toluene for carcinogenic effects. The EPA has determined that toluene is not classifiable as to its human carcinogenicity.

The federal government has developed regulatory standards and guidelines to protect you from the possible health effects of toluene in the environment. OSHA has set a limit of 100 ppm of toluene for air in the workplace, averaged for an eight-hour exposure per day over a 40-hour work week. The American Conference of Governmental Industrial Hygienists (ACGIH) and NIOSH have recommended that toluene in workplace air not exceed 100 ppm (as an average level over 8 hours).

EPA recommends that drinking water should not contain more than 20 ppm for 1 day, 3 ppm for 10 days, or 1 ppm for lifetime consumption. Any release of more than 1,000 pounds of this chemical to the environment must be reported to the National Response Center.

Xylenes. There are three forms of xylene in which the methyl groups vary on the benzene ring: meta-xylene, ortho-xylene, and para-xylene (m-, o-, and p-xylene). These different forms are referred to as isomers. The term total xylenes refers to all three isomers of xylene (m-, o-, and p-xylene). Mixed xylene is a mixture of the three isomers and usually also contains 6-15 percent ethylbenzene. Xylene is also known as xylol or dimethylbenzene. Xylene is primarily a synthetic chemical. Chemical industries produce xylene from petroleum. Xylene also occurs naturally in petroleum and coal tar and is formed during forest fires. It is a colorless, flammable liquid with a sweet odor.

Xylene is one of the top 30 chemicals produced in the United States in terms of volume. It is used as a solvent (a liquid that can dissolve other substances) in the printing, rubber, and leather industries. Along with other solvents, xylene is also used as a cleaning agent, a thinner for paint, and in varnishes. It is found in small amounts in airplane fuel and gasoline. Xylene is used as a material in the chemical, plastics, and synthetic fiber industries and as an ingredient in the coating of fabrics and papers. Isomers of xylene are used in the manufacture of certain polymers (chemical compounds), such as plastics.

Xylene evaporates and burns easily. Xylene does not mix well with water; however, it does mix with alcohol and many other chemicals. Most people begin to smell xylene in air at 0.08-3.7 ppm and begin to taste it in water at 0.53-1.8 ppm.

Xylene is most likely to enter your body when you breathe xylene vapors. Less often, xylene enters the body through the skin following direct contact. It is rapidly absorbed by your lungs after you breathe air containing it. Exposure to xylene may also take place if you eat or drink xylene-contaminated food or water. The amount of xylene retained ranges from 50 to 75 percent of the amount of xylene that you inhale. Physical exercise increases the amount of xylene absorbed by the lungs. Absorption of xylene after eating food or drinking water containing it is both rapid and complete. Absorption of xylene through the skin also occurs rapidly following direct contact with xylene. Absorption of xylene vapor through the skin is lower than absorption of xylene vapor by the lungs. However, it is not known how much of the xylene is absorbed through the skin. At hazardous waste sites, breathing xylene vapors, drinking well water contaminated with xylene, and direct contact of the skin with xylene are the most likely ways you can be exposed. Xylene passes into the blood soon after entering the body.

In people and laboratory animals, xylene is broken down into other chemicals especially in the liver. This process changes most of the xylene that is breathed in or swallowed into a different form. Once xylene breaks down, the breakdown products rapidly leave the body, mainly in urine, but some unchanged xylene also leaves in the breath from the lungs. One of the breakdown products of xylene, methylbenzaldehyde, is harmful to the lungs of some animals. This chemical has not been found in people exposed to xylene. Small amounts of breakdown products of xylene have appeared in the urine of people as soon as 2 hours after breathing air containing xylene. Usually, most of the xylene that is taken in leaves the body within

18 hours after exposure ends. Storage of xylene in fat or muscle may prolong the time needed for xylene to leave the body.

Short-term exposure of people to high levels of xylene can cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; impaired function of the lungs; delayed response to a visual stimulus; impaired memory; stomach discomfort; and possible changes in the liver and kidneys. Both short- and long-term exposure to high concentrations of xylene can also cause a number of effects on the nervous system, such as headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. People exposed to very high levels of xylene for a short period of time have died. Most of the information on long-term exposure to xylene is from studies of workers employed in industries that make or use xylene. Those workers were exposed to levels of xylene in air far greater than the levels normally encountered by the general population. Many of the effects seen after their exposure to xylene could have been caused by exposure to other chemicals that were in the air with xylene.

Results of studies of animals indicate that large amounts of xylene can cause changes in the liver and harmful effects on the kidneys, lungs, heart, and nervous system. Short-term exposure to very high concentrations of xylene causes death in animals, as well as muscular spasms, incoordination, hearing loss, changes in behavior, changes in organ weights, and changes in enzyme activity. Long-term exposure of animals to low concentrations of xylene has not been well studied.

Information from animal studies is not adequate to determine whether or not xylene causes cancer in humans. Both IARC and EPA have found that there is insufficient information to determine whether or not xylene is carcinogenic and consider xylene not classifiable as to its human carcinogenicity.

Exposure of pregnant women to high levels of xylene may cause harmful effects to the fetus. Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, decreased weight, skeletal changes, and delayed skeletal development. In many instances, these same concentrations also cause damage to the mothers. The higher the exposure and the longer the exposure to xylenes the greater the chance of harmful health effects. Lower concentrations of xylene are not so harmful.

EPA estimates that, for an adult of average weight, exposure to 10 milligrams of xylene per liter (mg/L or ppm) of water each day for a lifetime (70 years) is unlikely to result in harmful noncancerous health effects. For a long-term but less-than-lifetime exposure (about 7 years), 27.3 ppm is estimated to be a level unlikely to result in harmful health effects in an adult.

Exposure to 12 ppm xylene in water for 1 day or to 7.8 ppm of xylene in water for 10 days or longer is unlikely to present a health risk to a small child. EPA has proposed a recommended maximum level of 10 ppm xylene in drinking water.

To protect people from the potential harmful health effects of xylene, EPA regulates xylene in the environment. EPA has set a legally enforceable maximum level of 10 mg/L (equal to 10 ppm) of xylene in water that is delivered to any user of a public water system. OSHA has set an occupational exposure limit of 100 ppm of xylene in air averaged over an eight-hour workday and a 15-minute exposure limit of 150 ppm. These regulations also match recommendations (not legally enforceable) of the ACGIH. NIOSH has recommended an exposure limit (not legally enforceable) of 100 ppm of xylene averaged over a workday up to 10 hours long in a 40-hour workweek. NIOSH has also recommended that exposure to xylene not exceed 150 ppm for longer than 15 minutes. NIOSH has classified xylene exposures of 10,000 ppm as immediately dangerous to life or health.

EPA and the Food and Drug Administration (FDA) specify conditions under which xylene may be used as a part of herbicides, pesticides, or articles used in contact with food. The EPA has a chronic drinking water health advisory of 27.3 ppm for an adult and 7.8 ppm for a 10-kilogram child.

EPA regulations require that a spill of 1,000 pounds or more of xylene or used xylene solvents be reported to the Federal Government National Response Center.

Naphthalene. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This condition is called hemolytic anemia. Some symptoms of hemolytic anemia are fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. Animals sometimes develop cloudiness in their eyes after swallowing high amounts of naphthalene. It is not clear whether this also develops in people. Rats and mice that breathed naphthalene vapors daily for a lifetime developed irritation and inflammation of their nose and lungs. It is unclear if naphthalene causes reproductive effects in animals; most evidence says it does not.

There is no direct evidence in humans that naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene cause cancer. However, cancer from naphthalene exposure has been seen in animal studies. Some female mice that breathed naphthalene vapors daily for a lifetime developed lung tumors. Some male and female rats exposed to naphthalene in a similar manner also developed nose tumors.

Based on the results from animal studies, the DHHS concluded that naphthalene is reasonably anticipated to be a human carcinogen. IARC concluded that naphthalene is possibly carcinogenic to humans. The EPA determined that naphthalene is a possible human carcinogen (Group C) and that the data are inadequate to assess the human carcinogenic potential of 2-methylnaphthalene.

Record of Health and Safety Communication

PROJECT NAME: NUSTAR / ALAMOGORDO TERMINAL

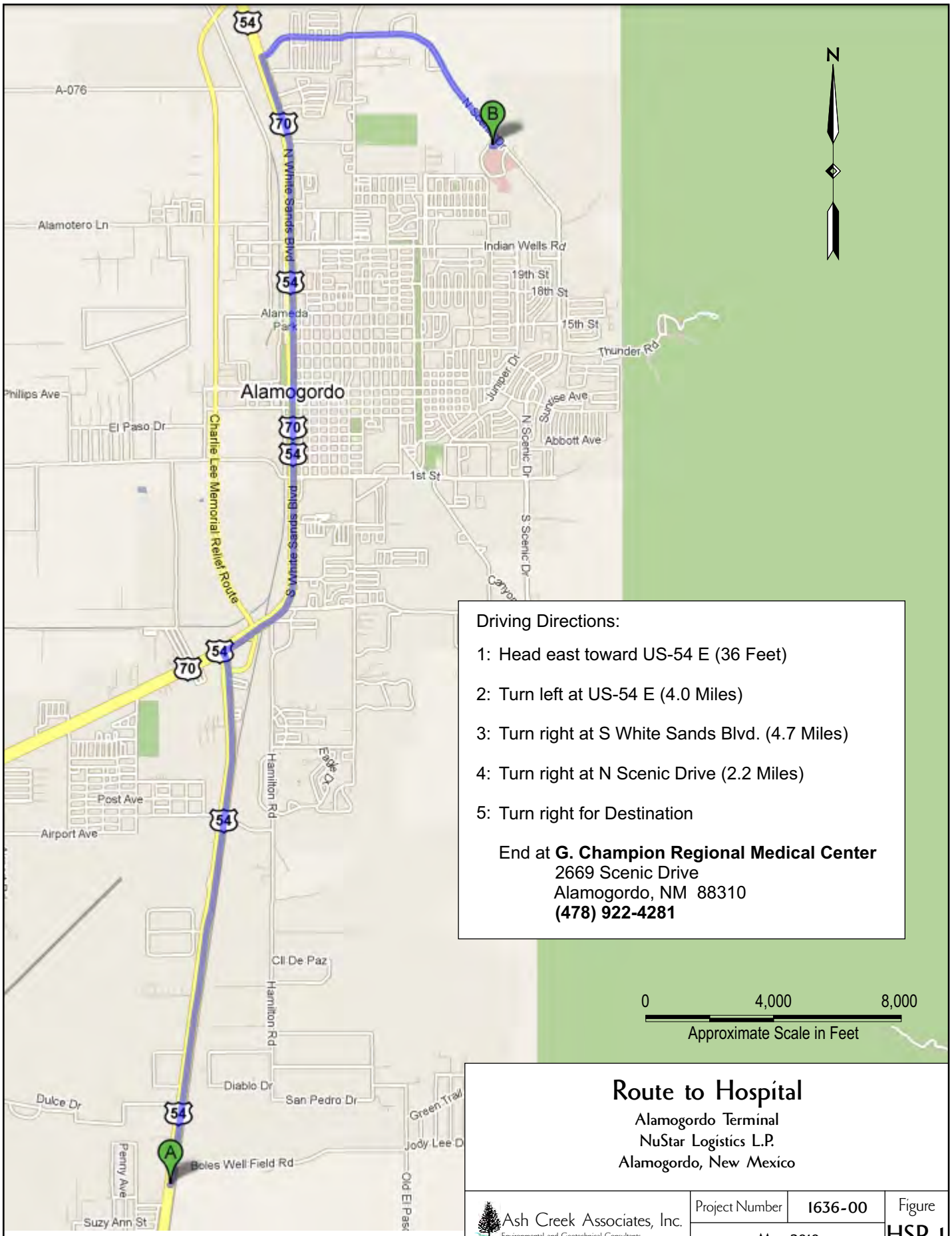
SITE CONTAMINANTS (see Attached): Total petroleum hydrocarbons (TPH); Diesel; Gasoline; Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX); Methyl tertiary-butyl ether (MTBE); and Naphthalene

PPE REQUIREMENTS (check all that apply):

- ☑ Safety Glasses
- ☑ Safety Boots
- ☑ Hard Hat
- ☑ Gloves :
- ☑ Clothing : Safety Vest
- ☐ Respiratory Protection : Have available
- ☑ Other : Flame-Resistant Garment

The following personnel have reviewed a copy of the Summary Information regarding the Site, and the General Health and Safety Plan (and attachments). By signing below, these personnel indicate that they have read the plan, including all referenced information, and that they understand the requirements detailed for this project.

PRINTED NAME	SIGNATURE	COMPANY	DATE



Driving Directions:

1: Head east toward US-54 E (36 Feet)

2: Turn left at US-54 E (4.0 Miles)

3: Turn right at S White Sands Blvd. (4.7 Miles)

4: Turn right at N Scenic Drive (2.2 Miles)

5: Turn right for Destination

End at **G. Champion Regional Medical Center**
2669 Scenic Drive
Alamogordo, NM 88310
(478) 922-4281

Base map prepared from Google - Map data 2009.

Route to Hospital

Alamogordo Terminal
NuStar Logistics L.P.
Alamogordo, New Mexico

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1636-00	Figure
May 2010		HSP-1

Appendix B

Field Forms

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

3015 SW First Avenue
Portland, Oregon 97201-4707
(503) 924-4704 Portland
(360) 567-3977 Vancouver
(503) 943-6357 Fax
www.ashcreekassociates.com

PROJECT NUMBER _____
FIELD REPORT NUMBER _____
PAGE _____ OF _____
DATE _____

PROJECT _____ ARRIVAL TIME _____
LOCATION _____ DEPARTURE TIME _____
CLIENT _____ WEATHER _____
PURPOSE OF OBSERVATIONS _____
ASH CREEK REPRESENTATIVE _____ ASH CREEK PROJECT MANAGER _____
CONTRACTOR _____ PERMIT NO. _____
CONTRACTOR REP. _____ JOB PHONE _____

Our firm's professionals are represented on site solely to observe operations of the contractor identified, to form opinions about the adequacy of those operations, and to report those opinions to our client. The presence and activities of our field representative do not relieve any contractor from its obligation to meet contractual requirements. The contractor retains sole responsibility for site safety and the methods, operations, send sequence of construction. Unless signed by the Ash Creek Associates Project Manager, this report is preliminary. A preliminary report is provided solely as evidence that field observation was performed. Observations and/or conclusions and/or recommendations conveyed in the final report may vary from and shall take precedence over those included in a preliminary report.

BY _____ REVIEWED BY _____

ASH CREEK ASSOCIATES REPRESENTATIVE _____ ASH CREEK ASSOCIATES PROJECT MANAGER _____

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

3015 SW First Avenue
Portland, Oregon 97201-4707
(503) 924-4704 Portland
(360) 567-3977 Vancouver
(503) 943-6357 Fax
www.ashcreekassociates.com

PROJECT NUMBER _____
FIELD REPORT NUMBER _____
PAGE _____ OF _____
DATE _____

BY

REVIEWED BY

ASH CREEK ASSOCIATES REPRESENTATIVE

ASH CREEK ASSOCIATES PROJECT MANAGER

WELL GAGING DATA SHEET

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

		Job Number:	
Client:		Date:	
Project:		Sampler:	
Weather:		Time In/Out:	

WATER LEVEL DATA

Well I.D.	Time	Depth to Free Product (feet)	Depth to Water (feet)	Depth to Well Bottom (feet)	Product Thickness (feet)	Water Column Height (feet)	Notes/Other Remarks

WELL MONITORING DATA SHEET

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Well I.D.		Job Number:	
Client:		Date:	
Project:		Sampler:	
Weather:		Time In/Out:	

WELL DATA

Well Depth:		Well Diameter:		Water Height	
Depth to Water:		Screened Interval:		x Multiplier	
Water Column Length:		Depth to Free Product:		x Casing Volumes	
Purge Volume:		Free Product Thickness:		= Purge Volume	
Water Height Multipliers (gal)	1-inch = 0.041	2-inch = 0.162	4-inch = 0.653	1 gallon = 3.785 liters	

PURGING DATA

Purge Method:		Pump Intake Depth:	Comments
Sampling Method:		Tubing Type:	

Time	Volume Purged (liters)	Cumulative Volume Purged (liters)	DTW (btc)	Purge Rate (L/min)	pH	Temp (^oC)	Cond (μS/cm)	DO (ppm)	ORP (mV)	Turbidity (NTUs)	Clarity/Color Other Remarks
					+/-0.2	+/-0.5° C	+/-5%	+/- 0.5 ppm	+/-20mV	+/-10%	<-- Stabilization Criteria

Clarity: VC = very cloudy, Cl = Cloudy, SC = slightly cloudy, AC = almost clear, C = clear

SAMPLING DATA

Sample ID:		Sampling Flow Rate		Analytical Laboratory:	
Sample Time:		Final Depth to Water:		Did Well Dewater?	

# Containers/Type	Preservative	Analysis/Method	Field Filtered	Filter Size	MS/MSD	Duplicate ID
			yes no			
			yes no			
			yes no			
			yes no			
			yes no			
			yes no			

COMMENTS

DRUM LOG

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

		Job Number:	
Client:		Date:	
Project:		Sampler:	
Weather:		Time In/Out:	

INVENTORY ALL DRUMS ONSITE (INCLUDING EMPTY DRUMS)

Drum Number	Generation Date	Drum Contents	Color of Contents	Integrity of the Drum	Label Type (haz/non-haz/client specific)	Volume at Arrival	Volume at Departure	Location of Drum/Notes/ Other Remarks (i.e., photo taken)

WELL MONITORING DATA SHEET

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Well I.D.		Job Number:	
Client:		Date:	
Project:		Field Rep.	
Weather:		Time In/Out:	

WELL DATA

Well Depth:		Well Diameter:		Water Height	
Depth to Water:		Screened Interval:		x Multiplier	
Water Column Length:		Depth to Free Product:		x Casing Volumes	
Purge Volume:		Free Product Thickness:		= Purge Volume	
Water Height Multipliers (gal)	1-inch = 0.041	2-inch = 0.162	4-inch = 0.653	1 gallon = 3.785 liters	

DEVELOPMENT DATA

Purge Method:		Comments:	

Time	Volume Purged (liters)	Cumulative Volume Purged (liters)	DTW (btc)	Purge Rate (L/min)	pH	Temp (^{o}C)	Cond (μS/cm)	DO (ppm)	ORP (mV)	Turbidity (NTUs)	Clarity/Color Other Remarks
					+/-0.1	+/-1° C	+/-3%	--	--	5 to 10 NTU or no visual improvement	<-- Stabilization Criteria

Clarity: VC = very cloudy, Cl = Cloudy, SC = slightly cloudy, AC = almost clear, C = clear

COMMENTS

VAPOR MONITORING DATA SHEET

Client: _____ Job #: _____

Sampler: _____

Date	Time	Location	PID Reading	Other

Date	Time	Sample Location	Sample ID	Other

Notes: _____

_____

_____

_____

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

CHAIN OF CUSTODY RECORD

Client Name: Ash Creek Associates
Address: 3015 SW First Ave
City/State/Zip: Portland, OR 97201

Telephone Number: 503.924.4704
Fax No.: 503.943.6357

Project Manager:
Project Name:
Project Number:
Sampler Name:

Analytical Lab:
Report To:
Page: 1 **of** 1

Sample ID / Description	Date Sampled	Time Sampled	No. of Containers Shipped	Grab	Composite	Field Filtered	Preservative: Ice	Preservative: HNO_3 (Red Label)	Preservative: HCl (Blue Label)	Preservative: NaOH (Orange Label)	Preservative: H_2SO_4 Plastic (Yellow Label)	Preservative: H_2SO_4 Glass(Yellow Label)	Preservative: None (Black Label)	Preservative: Other (Specify)	Matrix: Groundwater	Matrix: Wastewater	Matrix: Drinking Water	Matrix: Sludge	Matrix: Soil	Matrix: Other (specify):	Analyze For:													**RUSH TAT (Pre-Schedule)**	Standard TAT	Fax Results	Send QC with report

Special Instructions:

Laboratory Comments:
Temperature Upon Receipt:
VOCs Free of Headspace? Y N

Method of Shipment:

Relinquished by: Name/Company	Date	Time	Received by: Name/Company	Date	Time
Relinquished by: Name/Company	Date	Time	Received by: Name/Company	Date	Time
Relinquished by: Name/Company	Date	Time	Received by: Name/Company	Date	Time
Relinquished by: Name/Company	Date	Time	Received by: Name/Company	Date	Time

Appendix C

ALS Laboratory Group QA Manual

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

QUALITY ASSURANCE MANUAL

ALS Laboratory Group

10450 STANCLIFF RD, SUITE 210
Houston, TX 77099
Tel. 281-530-5656
Fax 281-530-5887
www.elabi.com
www.alsglobal.com

Revision 08.0
September 1, 2009

Approved by: _____ Date: 8/6/09
Raj Naran, Laboratory Director

Approved by: _____ Date: 08/06/09
Hoai Van, Technical Director

Approved by: Rebecca Pierrot Date: 8/6/09
Rebecca Pierrot, QA Manager

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3. Introduction and Scope

The purpose of this *Quality Assurance Manual* is to outline the quality system for the laboratory. The *Quality Assurance Manual* defines the policies, procedures, and documentation that assure analytical services continually meet a defined standard of quality that is designed to provide clients with data of known and documented quality and, where applicable, demonstrate regulatory compliance. The *Quality Assurance Manual* sets the standard under which all laboratory operations are performed including the laboratory's organization, objectives, and operating philosophy.

3.1. Scope of Testing

ALS Laboratory Group is a professional analytical services laboratory located in Houston, Texas. ALS Laboratory Group provides analytical services for many matrices, including aqueous, soil, solid waste, and air using analytical protocols defined by EPA Approved Methods. ALS Laboratory Group strives to provide analytical test results that are of the type and quality needed and expected by our customers. Refer to Appendices for a list of methods and the NELAC accreditation status by matrix.

3.2 Table of Contents, References and Appendices

The table of contents is found in Section 2 of this Manual. This *Quality Assurance Manual* uses the references from the 2003 NELAC Standard, Chapter 5, Appendix A.
The following additional sources of method references used at ALS Laboratory Group are:

- USEPA SW-846 *Test Methods for Evaluating Solid Waste*, 3rd Edition, through Updates III and IV, and published new methods from SW-846 (e.g. SW8000C).
- Selected USEPA Approved *Methods, as referenced in the "Methods Update Rule" (MUR),* 40 CFR, Part 136 , Table 1B, changes in the published March 12, 2007.
- APHA, AWWA, and WEF *Standard Methods for the Examination of Water and Wastewater, 19th through 21st Editions, (1995-2005).*
- USEPA Methods published in Appendix A, B and C of 40 CFR, Part 136.
- Selected USEPA Drinking Water methods published by the USEPA Office of Ground Water and Drinking Water
- State approved UST methods for TPH (e.g. TPH by TCEQ1005, Rev 3, June 2001).
- Department of Defense Quality Service Manual, Version 4.1, April 2009
- TCEQ QA Program Plan for the Superfund Program, Revision 6.0, Effective 06/01/09.
- TNI (The NELAC Institute) *Quality Manual* template, Version 2, 2007.

For a complete reference listing, refer to the current revision of SOP HS-QS 014, Appendix A.

3.3 Glossary and Acronyms Used

Quality control terms are generally defined within the section that describes the activity.

- Glossary - Refer to Section 25, Appendix A, for NELAC QA definitions as published in Chapter 1 of the 2003 NELAC Standards
- Acronyms: the following are a list of acronyms used in this document and their definitions

  AA – Accrediting Authority

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ANSI	–	American National Standards Institute
ASQC	–	American Society for Quality Control
ASTM	–	American Society for Testing and Materials
Blk	–	Blank
°C	–	degrees Celsius
cal	–	calibration
CAS	–	Chemical Abstract Service
CCV	–	Continuing calibration verification
COC	–	Chain of custody
DO	–	Dissolved oxygen
DOC	–	Demonstration of Capability
DOD	–	Department of Defense
ELAP	–	Environmental Laboratory Accreditation Program
EPA	–	Environmental Protection Agency
mg/L	–	milligrams per liter
GC/MS	–	gas chromatography/mass spectrometry
Ical	–	initial calibration
ICP-MS	–	inductively coupled plasma-mass spectrometry
ICV	–	Initial calibration verification
lb/in2	–	pound per square inch
LCS	–	Laboratory control sample
LFB	–	Laboratory fortified blank
LOD	-	Limit of detection
LOQ	-	Limit of quantitation
MDL	–	Method detection limit
MQL	–	Method quantitation limit
mg/Kg	–	milligrams per kilogram
mg/L	–	milligrams per liter
MS	–	matrix spike
MSD	–	matrix spike duplicate
NELAC	–	National Environmental Laboratory Accreditation Conference
NELAP	–	National Environmental Laboratory Accreditation Program
NIST	–	National Institute of Standards and Technology
PT	–	Proficiency Test(ing)
PTOB	–	Proficiency Testing Oversight Body
PTPA	–	Proficiency Testing Provider Accreditor
QA	–	Quality Assurance
QC	–	Quality Control
QS	–	*Quality System (Manual)*
QAM	–	Quality Assurance Manager
RL	–	Reporting level
RPD	–	Relative percent difference
RSD	–	Relative standard deviation
SOPs	–	Standard operating procedures
spk	–	spike
std	–	standard
TNI	-	The NELAC institute
ug/L	–	micrograms per liter
UV	–	Ultraviolet
VOC	–	Volatile organic compound
SV	–	Semi-volatile (organic compound)

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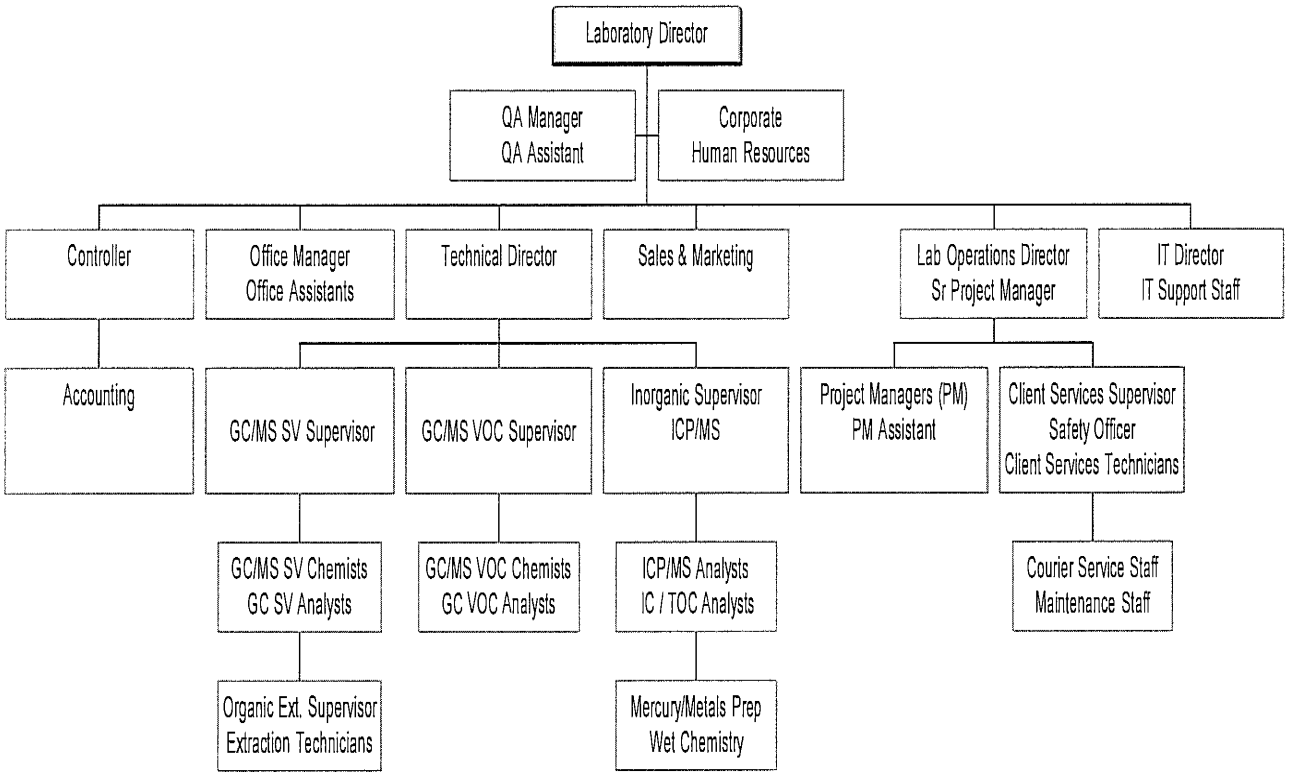
4 Organizational Roles and Responsibilities

The laboratory is a legally identifiable organization. Through application of the policies and procedures outlined in this section, the laboratory assures that it is impartial and that personnel are free from undue commercial, financial, or other undue pressures that might influence their technical judgment. The laboratory is responsible for carrying out testing activities that meet the requirements of the NELAC Standard, the DOD ELAP Standard, and that meet the needs of the client, the regulatory authorities or organizations providing recognition.

4.1 Laboratory Organizational Structure

The organizational structure indicated minimizes the potential for conflicting or undue interests that might influence the technical judgment of analytical personnel. The laboratory is a commercial operation, and a division of a publicly owned corporation, the ALS Laboratory Group. The US tax ID number is available upon request, if applicable. The laboratory operates at 10450 Stancliff Road, Suite 210, Houston, Texas, 77099.

Organizational Chart



4.2 Responsibility and Authority

The Laboratory Management includes the titles of Laboratory Director, Technical Director, Laboratory Operations Director, Quality Assurance Manager, Project Managers and department supervisors. Management has overall responsibility for the technical operations and authority needed to generate the required quality of laboratory operations. Management's commitment to quality and to the Quality System is stated in the Quality Policy (§5.1), which is upheld through the application of related policies and procedures. Management ensures technical competence of personnel operating equipment,

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performing tests, evaluating results, or signing reports, and limits authority to perform laboratory functions to those appropriately trained and/or supervised.

The assignment of responsibilities, authorities, and interrelationships of the personnel who manage, perform, or verify work affecting the quality of environmental tests is found in the job descriptions described in section 4.3

Management bears specific responsibility for maintenance of the Quality System. This includes defining roles and responsibilities to personnel, approving documents, providing required training, providing a procedure for confidential reporting of data integrity issues, and periodically reviewing data, procedures, and documentation. Management ensures that audit findings and corrective actions are completed within required time frames.

Designated alternates are appointed by management during the absence of the Laboratory Director, Technical Director or the Quality Assurance Manager, and always if the absence is more than 15 days. The laboratory must notify the primary Accrediting Agency, in writing, if the absence of the Technical Director exceeds 65 calendar days. Management is responsible for defining the minimal level of education, qualifications, experience, and skills necessary for all positions in the laboratory and assuring that technical staff has demonstrated capabilities in their tasks. These qualifications are identified in section 4.3

4.3 Job Descriptions and Qualifications: Job descriptions are provided for all positions that manage, perform, or verify work affecting data quality

4.3.1 Laboratory Director: responsible for all laboratory activities as the highest level manager. The laboratory director provides administrative, operational, and technical leadership through planning, allocation and management of personnel and resources. Provides resources for implementation of the QA program and reviews and approves the *Quality Assurance Manual*. Requires a BS or BA degree in Science, Engineering or Management, and five years of supervisory experience in environmental laboratory operations. This individual is an approved signatory for all facility policies and procedures.

4.3.2 Technical Director: Day to day supervision of technical laboratory operations is the responsibility of the Technical Director, who assures reliable data through the following activities: monitoring quality control performance, monitoring the validity of generated data to ensure reliable data, corroborating the analysis performed, and certifying demonstrations of capability. The Technical Director certifies that personnel with appropriate educational and/or technical background perform all tests for which the laboratory is accredited; reviews new methods for their applicability to a project, implements new methodology at the facility, and directs, trains and supervises individuals participating in this effort; in the case of the Technical Directors absence, the Laboratory Operations Director or a Technical Supervisor shall maintain these duties. Requires a BS or BA degree in Science, Engineering or Management (with at least 24 college semester credits in chemistry), and five years technical supervisory experience in environmental laboratory operations. This individual is an approved signatory for all facility policies and procedures, as well as training documentation.

4.3.3 Laboratory Operations Director: reports to the Laboratory Director, Supervises the Project Management Group; coordinates client requirements with laboratory capacity and capability, provides technical expertise for efficient and productive laboratory operation;

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provides technical expertise to clients. Requires a BS or BA degree in Science, Engineering or Management, and five years supervisory experience in environmental laboratory operations. This individual is an approved signatory for client reports, as well as all policies and procedures related to Laboratory Operations.

4.3.4 Quality Assurance Manager: the authority and responsibility for implementing, maintaining and improving the quality system; ensures that all personnel understand the quality system, and their contributions to it; facilitates communication throughout the facility regarding the effectiveness of the quality system; has direct access to the Laboratory Director and is independent of operations where the Quality Manager has oversight; is the focal point for the quality system and has oversight of quality control data; evaluates data objectively and performs assessments without managerial influence; arranges for, or conducts, internal audits annually; evaluates the effectiveness of training; and, notifies laboratory management of deficiencies (or opportunities for continuous improvement) and monitors corrective actions; keeps the *Quality Assurance Manual* current; signs the demonstrations of capability; responsible for maintaining QA records such as archived logbooks, PT results, maintaining the laboratories certifications and approvals; facilitates a QA Management System review (SOP HS-QS-017, Management Review); may place a stop work order on any non-compliant work area. The QAM maintains a general knowledge of the analytical test methods performed in the facility. In the case of his absence, the QA Assistant or the Technical Director shall maintain these duties. Requires a BS or BA degree in Science, Engineering or Management, and five years experience in environmental laboratory and two years experience in quality system management. This individual is an approved signatory for all policy and procedural documents within the facility.

4.3.5 Information Technology Manager: reports directly to the Laboratory Director; responsible for maintaining the Laboratory Information Management System (LIMS) and other specific computer software and hardware pertinent to laboratory function; functions include maintaining the computer network, education of analytical staff in the use of scientific software, software development, and implementation, Electronic Data Deliverables (EDDs), data back-up, data archiving, and maintaining electronic data integrity. Requires an associate's degree in Information Systems or Computer Science, and five years experience in computers and network information system hardware and software. This individual is an approved signatory for policy and procedures related to Information Technology.

4.3.6 Project Managers (PM): senior level scientists that interface with both laboratory supervision and the client. Project Managers report to the Laboratory Operations Director; Project Mangers are responsible for ensuring that the analyses performed by the laboratory meet all project, contract, and regulatory-specific requirements. The PM relays the project details, requested by the customer, to the laboratory staff. The PM reviews all sample log-in information; helps direct turnaround time commitments and reviews all final reports. Requires a BS or BA degree in Science, Engineering or Management, and five years experience in environmental laboratory operations. This individual is an approved signatory for client reports.

4.3.7 Safety Officer: responsible for the administration of the laboratory's safety program: designated as the Chemical Hygiene Officer and reports directly to the Laboratory Director; coordinator for the Safety Committee Officer, implements safety policies, supervises new employee safety training, reviews any accidents or incidents, prepares

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prevention plan; monitors hazardous waste disposal, and conducts routine safety inspections. Requires a high school diploma, completion of a 40-hr OSHA Safety training course and two years experience in the environmental laboratory. This individual is an approved signatory for all policies and procedures related to Safety.

4.3.8 Client Services Supervisor: Supervision of the Client Services Group who are responsible for sample receipt and log-in activities; maintaining sample custody, supervising storage and later the disposal of samples; reports to the Laboratory Operations Director; Requires a high school diploma, and two years experience in the environmental laboratory. This individual is an approved signatory for all policies and procedures related to Sample Management and Client Services.

4.3.9 Technical Supervisors: responsible for a technical supervision of technical operation in their area of laboratory responsibility (e.g. Volatiles Supervisor). They report to the Technical Director; are full-time members of the staff and assure reliable data through the following activities: monitoring quality control, corroborating the analysis performed, and provide supervision to staff in training, assuring demonstrations of capability are performed by the departmental staff upon completion of training and then annually; they assist the Technical Director in certifying that personnel with appropriate educational and/or technical background perform all tests for which the laboratory is accredited. Requires a BS or BA degree in Science, Engineering or Management, and five years technical supervisory experience in environmental laboratory operations. Technical Supervisors are approved signatories for policies and procedures for their respective areas. They are also approved signatories on raw data.

4.3.10 Chemists and Technicians: those individuals typically performing the analyses. Chemists and Technicians report directly to the Technical Supervisor of the pertinent work area. Chemists are those individuals with a 4-year college degree, preferably in the sciences. Technicians are required to have a high school diploma and may have some college education. Chemists and technicians are approved signatories for raw data, provided that they have successfully met the requirement for initial or on-going demonstrations of capability.

4.3.11 Equivalent experience (3 years experience per 1 year of formal education) may be substituted in lieu of formal education.

5 Quality Systems

The laboratory's Quality System (QS) is documented in this *Quality Assurance Manual* and associated quality system documents. Together they describe the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of the organization for ensuring quality in its work processes, products, and services.

5.1 Quality Policy

A Quality Policy statement, including objectives and commitments by top management is required in the Quality Assurance Manual. The quality policy is signed and dated, and is issued under the authority of the highest level of laboratory management, which demonstrates management's commitment to integrity, ethics, the quality system and associated standards.

Quality Policy Statement

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The objective of the quality system, and the commitment of management, is to consistently provide our customers with data of known and documented quality that meets their requirements. Our policy is to use good professional practices, to maintain quality, to uphold the highest quality of service, and to comply with the NELAC Standard, and the DOD ELAP Standard. The laboratory ensures that personnel are free from any commercial, financial, and other undue pressures, which might adversely affect the quality of work. This policy is implemented and enforced through the unequivocal commitment of management, at all levels, to the Quality Assurance (QA) principles and practices outlined in this manual. However, the primary responsibility for quality rests with each individual within the laboratory organization. Every laboratory employee must ensure that the generation and reporting of quality analytical data is a fundamental priority. All laboratory employees are required to familiarize themselves with the quality documentation and to implement the policies and procedures in their work. All employees shall be trained annually on ethical principles and procedures surrounding the data that is generated. The laboratory maintains a strict policy of client confidentiality.

5.2 Quality Assurance Manual

The Laboratory Management ensures that the laboratory's policies and objectives for quality are documented by reference or by inclusion in the *Quality Assurance Manual*, and that the *Quality Assurance Manual* is communicated to, understood by, and implemented by all personnel concerned. All employees are required to sign a form, kept on file with their training records, in the QA department, that states that they have read and understood the *Quality Manual*, including the quality policy statement. The *Quality Assurance Manual* is reviewed annually, and maintained current and up-to-date by the *Quality Assurance Manager*.

5.3 Data Integrity System

The Data Integrity System employed by ALS Laboratory Group is an integrated approach designed to ensure the production of defensible and quality data. The overall system consists of a three-tier approach as documented in HS-QS-015, *Data Integrity System*.

System policy is based upon criteria specified by ISO 17025, US EPA, and (if needed) project specific criteria. System programs to support this policy include documentation of procedure (SOPs), employee training, internal/external assessment, and annual management review. Within each system program, critical components of data integrity are employed. These components include defined data quality objectives, data generation procedures, data verification, data validation, and data archival. Prior to final released, validated data are compared to the data quality objectives in order to assure its worthiness.

6 Document Management

This section describes procedures for document management, which includes controlling, distributing, reviewing, and accepting modifications. The purpose of document management is to preclude the use of invalid and/or obsolete documents.

6.1 Types of Documents: The laboratory manages three types of documents: 1) controlled, 2) approved, and 3) obsolete.

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6.1.1 Controlled Documents - A Controlled Document is one that is uniquely identified, issued, tracked, and kept current as part of the quality system. Controlled documents may be internal documents (i.e. SOPs) or external documents (i.e. published methodologies).

6.1.2 Approved Document: an approved document has been reviewed, and either signed and dated, or acknowledged in writing or secure electronic means by the issuing authority(ies). The SOPs are the most common type of reviewed and approved (internal) document.

6.1.3 Obsolete documents: Documents that have been superseded by more recent versions. Original obsolete internal documents (i.e. SOPs) are maintained in archive storage. Copies of such documents may be destroyed.

6.2 Document Approval: All documents that affect the quality of laboratory data are managed appropriate to the scope and depth required. Controlled internal documents will be reviewed and approved for use by the QA Manager, the technical director, the Laboratory Director and the department supervisor, where applicable. Internal documents are reviewed annually to ensure their contents are suitable and in compliance with the current quality systems requirements, and accurately describe current operations. Approved copies of documents (internal and external) are available at all locations where operations are essential to the effective functions of the laboratory.

6.2.1 Approved internal documents: are uniquely identified with 1) date of issue, 2) revision identification, 3) page number, 4) the total number of pages, and 5) the signatures of the issuing authorities.

6.3 Document Master List: A master list of controlled internal documents is maintained that includes distribution, location, and revision dates. A master list of controlled external documents is also maintained that includes title, author, copyright date, and date of publication, and location. The controlled document list is maintained by the QA Department. The controlled document list is updated annually at a minimum.

6.4 Standard Operating Procedures: SOPs are approved internal documents and are used to ensure consistency of application of common procedures. These written procedures describe in detail how to accurately reproduce laboratory processes, and are of two types: 1) test method SOPs, which have specifically required details, and 2) general use SOPs which document the more general organizational procedures and policies. Where equipment manuals or published methods accurately reflect laboratory procedures in detail, a separate SOP may not be required.

6.4.1 SOP Location: The laboratory SOPs for all test methods within its scope, located in the QA Manager's Office. Controlled copies of these documents are located in the respective department performing the test method. Any deviation from a test method SOP must be documented, including both a description of the change made and a technical justification. The deviation from a test method SOP must be reported to the client or be agreed upon as part of client project specification or requirement.

6.4.2 All SOPs are written according to the guidelines of the SOP HS-GEN-001, *Preparation and Management of SOPs*.

7 Review of Requests, Tenders and Contracts

The review of all new work assures that oversight is provided so that requirements are clearly defined, the laboratory has adequate resources and capability, and the test method is applicable to the customer's needs. This process assures that all work will be given adequate attention without shortcuts that may compromise data quality. Contracts for new work may be formal bids, signed documents, verbal, or electronic.

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The Laboratory Project Management Group and the Laboratory Director determine if the laboratory has the necessary accreditation, resources, including schedule, equipment, deliverables, and personnel to meet a work request. Every client is assigned to a designated Project Manager, who informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to the complete the work satisfactorily.

The client is informed of any deviation from a contract including the test method or sample handling processes. All differences between the request and a final contract are resolved and recorded before any work begins. It is necessary that the contract be acceptable to both the laboratory and the client. This review process is repeated when there are amendments to the original contract by the client. The participating laboratory personnel are given copies of the amendments.

Records are maintained for every contract or work request, when appropriate by the project Manager. This includes pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract.

8 Subcontracting of Tests

A *subcontract contract laboratory* is defined as a laboratory external to this laboratory, or at a different location than the address indicated on the front cover of this manual, that performs analyses for this laboratory. When subcontracting analytical services, the project management group must assure work requiring accreditation is placed with an appropriately accredited laboratory or one that meets applicable statutory and regulatory requirements for performing the tests. To assure this, laboratory list of accredited subcontractors is maintained for those fields of testing clients routinely request. Where these requirements are not met, the final report must clearly identify the subcontracted data as non-accredited.

The Project Manager must notify the client of the intent to subcontract the work in writing. When possible, the laboratory gains the approval of the client to subcontract their work prior to implementation, preferably in writing.

The laboratory performing the subcontracted work is identified in the final report. The laboratory assumes responsibility to the client for the subcontractor's work, except in the case where a client or a regulating authority specified which subcontractor is to be used.

9 Purchasing Services and Supplies

The laboratory ensures that purchased supplies and services that affect the quality of environmental tests are of the required or specified quality by using approved suppliers and products. The laboratory has procedures for purchasing, receiving, and storage of supplies that affect the quality of environmental tests are found in SOP HS-QS-001, Chemical Purchase & Receipt; Chemical Preparation, Storage & Tracking. The laboratory test method SOPs in general specify the chemicals and grade required by each.

The Technical Director or a Technical Supervisor is responsible for review and approval of the supplier of services and supplies and approves technical content of purchasing documents prior to ordering.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality by signing packing slips or other supply receipt

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documents. The purchasing documents contain the data that adequately describe the services and/or supplies ordered and shall be maintained on file in the accounting department. The laboratory maintains a list of approved suppliers on the laboratory network in e-LIMS.

10 Service to Client

The laboratory collaborates with clients and/or their representatives in clarifying their requests and in monitoring of the laboratory performance related to their work. Each request is reviewed to determine the nature of the request and the laboratory's ability to comply with the request within the confines of prevailing statutes and/or regulations without risk to the confidentiality of other clients. The laboratory actively seeks client feedback, both positive and negative, to identify areas of improvement within the quality system, testing activities and service to the client

10.1. Client Confidentiality

The laboratory confidentiality policy is to not divulge or release any information to a third party without proper authorization. All electronic data (storage or transmissions) are kept confidential, based on technology and laboratory limits, as required by client or regulation. The procedures for maintaining client confidentiality are found in SOP HS-GEN-04, Client Confidentiality of Electronic Data Transfers.

11 Complaints

The purpose of this section is to assure that customer complaints are addressed and corrected. This includes requests to verify results or analytical data.

The client Project Manager performs any initial documentation and review of a client complaint. Depending upon the nature of the complaint, the Project Manager will also consult with the technical staff and the quality assurance department to assure the issue is addressed and corrected. If it is determined that a complaint is without merit, it is documented, and the client is contacted. If it is determined that the complaint has merit, a corrective action is initiated. See HS-QS-003, Nonconformance Corrective Action Reporting.

12 Control of Non-conforming Work

NON-CONFORMING WORK is work that does not meet acceptance criteria or requirements. Non-conformances can include unacceptable quality control results or departures from standard operating procedures or test methods. Requests for departures from laboratory procedures are approved by Quality Assurance Manager or the Technical Director and documented.

The policy for control of non-conforming work is to identify the non-conformance, determine if it will be permitted, and take appropriate action. All employees have the authority to stop work on samples when any aspect of the process does not conform to laboratory requirements.

The responsibilities and authorities for the management of non-conforming work are detailed in SOP HS-QS-003, Nonconformance Corrective Action Reporting. The procedure for investigating and taking associated corrective actions of non-conforming work are described in this SOP.

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The laboratory evaluates the significance of the nonconforming work, and takes corrective action immediately, when necessary. The client is notified if their data has been impacted. Resumption of work after non-conformance is authorized by the Quality Assurance Manager or the Technical Director.

13 Corrective Action

Corrective action is the action taken to eliminate the cause(s) of a systemic error, defect, or other undesirable situation. Deficiencies cited in external assessments, internal quality audits, data reviews, complaints, or managerial reviews are documented and require corrective action. Corrective actions taken are appropriate for the magnitude of the problem and the degree of risk.

Any of the Technical Staff (e.g. an analyst, supervisor or project manager) may initiate a corrective action when performing a routine data review. All deficiencies are investigated and a corrective action plan developed and implemented if determined necessary. The implementation may be monitored for effectiveness. Corrective action reporting for routine, non-recurring exceedances can be records in logbooks, email, or other informal documents. More serious corrective actions require a more formal corrective action report that is reported to the QA department for monitoring as per SOP HS-QS-003. The QA Manager is responsible for monitoring and recording corrective actions in these cases. Specific corrective action protocols specified in test methods may over-ride general corrective action procedures specified in this manual.

13.1. Selection and Implementation of Corrective Actions: Once an exceedance or nonconformance is noted, the first action is an investigation to determine the root cause. The root cause is investigated to define the condition or event that, if corrected or eliminated, would prevent the recurrence of the noted deficiency. Based on the root cause investigation potential corrective actions, most likely to prevent recurrence of the nonconformance, are identified. Records are maintained of nonconformances requiring corrective action to show that the root cause(s) was investigated, and includes the results of the investigation. This procedure is discussed in further detail in SOP HS-QS-003. Where uncertainty arises regarding the best approach for analysis of the cause of an exceedance that require corrective action, the appropriate personnel (e.g. the Technical Director or a Department Supervisor) will recommend corrective action to be initiated and completed within the agreed upon time frame.

13.2. Monitoring of Corrective Action: Corrective actions are monitored to ensure the successful implementation of changes in laboratory processes as a result of a corrective action plan. Monitoring is executed by the QA Manager, in cooperation with the Department Supervisor. Department supervisors are responsible for monitoring corrective actions associated with routine laboratory activities, including implementation of procedural changes as stated in the appropriate SOP. Serious corrective actions, those related to systematic problems, are monitored by the QA Manager. All monitoring of Corrective Actions is documented through the NCAR database. This procedure is discussed in further detail in SOP HS-QS-003 Nonconformance and Corrective Actions.

13.3. Additional Audits: Additional audits are required when nonconformances or departures cast doubt on the laboratory's compliance with approved policies and procedures, or with standards on which these policies and procedures are based (i.e., NELAC Standard, or DOD ELAP Standard). These audits are conducted as soon as possible according to HS-QS012, Internal Auditing.

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13.4. Technical Corrective Actions: A cause analysis in corrective action investigates the root cause of the problem. Sample data associated with an exceeded quality control are evaluated for the need to be reanalyzed or qualified. Unacceptable quality control results are documented, and if the evaluation requires cause analysis, the cause and solution are recorded. The analyst is responsible for initiating or recommending corrective actions and ensuring that exceedances of quality control acceptance criteria are documented. Analysts routinely implement corrective actions for data with unacceptable QC measures. First level correction may include re-analysis without further assessment. If the test method SOPs addresses the specific actions to take, they are followed. Otherwise, corrective actions start with assessment of the cause of the problem. Area supervisors review corrective action results and suggest improvements, alternative approaches, and procedures where needed. If the data reported are affected adversely by the nonconformance, the client is notified in writing. The discovery of a non-conformance for results that have already been reported to the client must be immediately evaluated for significance of the non-conformance, its acceptability to the client, and determination of the appropriate corrective action.

Where possible, samples are reported only if all quality control measures are acceptable. Where unacceptable quality control measures must be reported, all sample associated with the failing control measures are reported with the appropriate data qualifiers.

13.4. Departures from Approved Procedures: For exceptionally permitting departures from documented policies and procedures, the laboratory allows the release of non-conforming data only with approval by the Technical Director or his designee on a case-by-case basis (e.g. meeting a client specification). Planned departures from procedures or policies do not require audits or investigations. Permitted departures for non-conformances, such as QC exceedances, are fully documented and include the reason for the departure, the affected SOP(s), the impact of the departure on the data, and the data. Refer to SOP HS-GEN-005, Departures from Approved Procedures.

14 Preventative Action

Preventative action is a pro-active process to identify opportunities for improvement, rather than a reaction to the identification of problems or complaints. The process maximizes the quality of service provided by the laboratory.

Opportunities for improvement and potential sources of nonconformances, either technical or concerning the quality system, are proactively identified through various actions including, but not limited to, review of QC data to identify quality trends (SOP HS-QS-004, Control Charts), regularly scheduled staff quality meetings (SOP HS-GEN-006, Resource Review), annual managerial reviews (SOP HS-QS-017, Quality Assurance Management Review), scheduled instrument maintenance (SOP HS-EQ-004, Preventative Maintenance), running a new LIMS system in tandem with the old system to assure at least one working system (SOP HS-IT-002, Computer Software Installation and Maintenance) and other actions taken to prevent problems.

Once potential preventive actions are identified, an action plan is developed, implemented, and monitored to reduce the likelihood of the nonconformance occurrence and to tack advantage of the opportunity for improvement.

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All employees have the authority to recommend preventive action procedures, however management is responsible for implementing and monitoring the effectiveness of preventive actions.

15 Control of Records

Laboratory records are a subset of documents, usually data recordings that include annotations, such as daily refrigerator temperature recordings, raw data entered laboratory logbooks, spreadsheets, analyst notes on a chromatogram, and copies of test reports, etc. Records may be on any form of media, including electronic and hard copy. Records allow for the historical reconstruction of laboratory activities related to sample handling and analysis.

These procedures are described in more detail in Laboratory SOPs HS-QS-11 for Record Archival Procedures and HS-QS-014, Document Control and Laboratory Records. These procedures require that all records, as either hard copy or electronic, be maintained for a period of at least ten (10) years. The records are stored in secure storage to protect them from deterioration or damage and to protect client confidentiality. In the event that the laboratory transfers ownership or goes out of business, records are maintained or transferred according to the clients' instructions. All electronic records are backed-up daily by the IT Department. Access to protected records is limited to laboratory management or their designees to prevent unauthorized access or amendment.

Legal Chain of Custody Records are managed when projects request the use of internal chain of custody procedures as described in SOP HS-SM-001, Sample Log-in Procedures.

16 Audits and Management Review

Audits measure laboratory performance and verify compliance with accreditation/ certification and project requirements. Audits specifically provide management with an on-going assessment of the quality system. They are also instrumental in identifying areas where improvement in the quality system will increase the reliability of data. Audits are of four main types: internal, external, performance, and system.

16.1 Internal Audits – The laboratory periodically conducts internal audits in all areas of the laboratory to ensure that its operations continue to comply with the requirements of the Quality System as well as requirements of the standards on which the Quality System is based.The internal audit reviews laboratory conformance in two areas: quality system procedures and analytical method procedures. A quality system audit reviews general laboratory cleanliness, employee training documentation, support systems, equipment and facilities maintenance and repair records, control charting activities, sample handling and record-keeping practices. Analytical method evaluations include a review of how analysts perform preparation and analysis steps in conformance to approved laboratory standard operating procedures. All areas of the quality system must be conducted annually at a minimum, but any area assessments may be performed monthly or quarterly until all areas are performed. Should an area be found in nonconformance, a corrective action must be designated to the responsible individuals. Upon completion of the corrective action, re-auditing must be performed as verification.

16.1.1 Analytical method audits must be conducted in a manner such that each department is audited at least once annually for at least one analytical method that is routinely performed and is representative of the majority of methods performed by that department. After an

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audit is performed, a report is generated and given to management and each supervisor of the department audited. This report includes the findings and observations and the recommendations for improvement or correction. Time-lines for responses and corrections are provided so they may be addressed in a timely fashion. The supervisors of each area provide responses to any findings with demonstration of corrections as needed.

16.1.2 When an audit finding casts doubt on the effectiveness of the operation or on the correctness or validity of test results, the laboratory shall notify affected clients in writing within seven days.

16.1.3 All investigations that result in findings of inappropriate activity are documented and include any disciplinary actions. Corrective action, and appropriate notifications of clients.

16.2 External Audits - It is the laboratory's policy to cooperate and assist with all external audits, whether performed by a client or an accrediting authority. All external audits are fully documented and tracked to closure. Management ensures that all areas of the laboratory are accessible to auditors as applicable and that appropriate personnel are available to assist in conducting the audit. Any findings related to an external audit follow corrective action procedures. Management ensures that corrective actions are carried out within the timeframe specified by the auditor(s).

16.3 Performance Audits - Performance audits may be Proficiency Test Samples, internal single-blind samples, double-blind samples through a provider or client, or anything that tests the performance of the analyst and method.

16.3.1 NELAC Proficiency Test (PT) samples are scheduled twice annually for each NELAC field of accreditation per matrix. The PT samples tested are purchased from a NELAC approved PT provider. The results assess analyst proficiency when conducting analyses for specific analyte(s) on a matrix specific basis. PT sample management, analysis and reporting of PT sample results are to be conducted in the same manner as real environmental samples utilizing the same staff and methods as used for routine analysis. This requires use of the same procedures, equipment, facilities, and frequency of analysis.

16.3.2 PT sample results are forwarded by QA Manager the PT provider via the provider supplied reporting format (i.e. fax, mail or internet reporting). After closing of a PT study, results are evaluated by the provider and reported directly to the primary NELAC Accrediting Authority (TCEQ) and secondary NELAC Accrediting Authorities when required (e.g. LDEQ), to other non-NELAC State Accrediting Authorities as required, and to the laboratory. All recent results of the PT studies are posted in the laboratory and made available to the staff and interested clients. For those results that deviate from the accepted values, a nonconformance corrective action (NCAR) must be issued to the appropriate departmental supervisor or analyst to investigate and report the findings. The NCAR process typically requires analysis of another PT to verify the adequacy of the corrective action. The QA Department maintains records of the corrective action PT and related documents. The results of PT corrective actions and corrective action PT are reported to the accrediting authority as required by the respective program. Corrective PT studies are sent directly to all respective accrediting authorities

16.4 Management Review - An overall quality system evaluation is performed by the laboratory upper management via an annual management system review. The review includes: suitability of policies and procedures, reports from managerial and supervisory personnel, the outcome of recent internal audits, , corrective and preventative actions, assessments by external bodies, matters

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arising from the previous review; results of participation in proficiency testing, details of any complaints from clients, adequacy of staffing training (for both new and existing staff members),,relevant quality control activities (LCS limits, LOD and LOQ assessments), changes in the volume and type of the work; and future plans and projections for new work.

17 Personnel, Training, and Data Integrity

17.1 Job Descriptions - Job descriptions are described for all positions that manage, perform, or verify work affecting data quality, and are located in this QA Manual, refer to section 4. 3

17.2 Employee Training - Employee training includes the following areas: Ethics and Data Integrity QA training, health and safety training, internal technical training, and analyst demonstration of capability, and external training, as needed. These training requirements are outlined in SOP HS-QS-013, *Employee Training* and in SOP HS-GEN-002. *Laboratory Ethics and Data Integrity Procedures.*

17.2.1 SOP-HS-QS-013 requires all analysts to be trained in the elements of this QA Manual, and that they must sign a method qualification statement that they have read, understand and agree to follow the technical SOPs they perform. They also must perform the required demonstration of capability for the method. This information must be on file in the QA department after completion and it the responsibility of each departmental supervisor that these items are completed and approved.

17.2.2 SOP-HS-QS-013 also indicates the required Quality Assurance SOP training for each department according to work group function and responsibility.

17.2.3 SOP HS-GEN-002, *Laboratory Ethics and Data Integrity Procedures* is required training for all new employees and must be conducted annually for all employees.

17.3 Ethics and Data Integrity – Data integrity and ethics procedures in the laboratory include training, signed, and dated integrity documentation for all laboratory employees, periodic monitoring of data integrity, and documented data integrity procedures.

17.3.1 SOP HS-GEN 002, *Laboratory Ethics and Data Integrity Procedures.* The ethics SOP provides guidance and direction for employee conduct and practices when generating laboratory data and a thorough understanding of what constitutes an improper, unethical or illegal action and consequences of such action. The ethics policy specifically defines employee responsibility and accountability with the following being required of all personnel:

- Laboratory Group employees shall at all times conduct themselves and the business of the Company in an honest and ethical manner.
- ALS Laboratory Group employees shall comply with the terms of the ethics agreement, and as a condition of employment is required to sign the Ethics Agreement.
- The willful act of improper manipulation or falsification of data will not be tolerated and is subject to punitive measures up to and including dismissal and subsequent legal action.
- Observance of unethical behavior shall be immediately reported to a supervisor, a manager, or the QA Manager. Failure to report such activity is considered to be in support of the unethical activity and shall be dealt with in those terms.
- The ethics agreement shall be posted in a common area.

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- Unauthorized release of confidential information about the Company or its customers shall be subject to disciplinary action, up to and including dismissal and subsequent legal action.

17.3.2 Employees are trained to understand that improper or unethical actions are serious matters that can have a very negative effect on the laboratory. The actions can result in any of the following: potential civil or criminal liability for ALS Laboratory Group and employees; cost in time and resources of defending data before auditors; loss of client trust; loss of business and potential fines and imprisonment of employees involved. In order to maintain the integrity and reputation of ALS Laboratory Group, it is most important that all the data released in projects be as factual as possible. **Therefore, misrepresentation of any data by an ALS Laboratory Group employee is not allowed. Any employee who knowingly releases false data values will be subject to disciplinary action, up to an including possible termination of employment and legal action.**

17.3.3 Periodic monitoring of data integrity is performed by the QA department when performing laboratory data audits as part of SOP HS-QS-012, *Internal Audits* or at any time by the QA Department should an inappropriate action be suspected or a lack of proper training be evident.

17.3.4 Documented data integrity procedures are part of training provided in SOP HS-QS-016, *Manual Integration Policy* and SOP HS-QS-009, *Data Reduction, Review and Validation.*

18 Accommodations and Environmental Conditions

The laboratory facilities are designed and organized to facilitate testing of environmental samples. Environmental conditions are monitored to ensure that conditions do not invalidate results or adversely affect the required quality of any measurement.

ALS Laboratory Group, Houston Facility, is conveniently located in southwest Houston at 10450 Stancliff Road. The current facility has 26,000 square feet, in which 17,000 square feet is associated with laboratory work space, sample receiving and storage areas. A list of current equipment in use is found in Appendix C.

Separate work areas, or departments, are designated by application within the facility. The work space is complimented by special air handling and ventilation capabilities, sophisticated central gas supply, sensitive, modern and automated instrumentation, current data management software and computer hardware. The work area for volatile organic analysis has a separate, dedicated HVAC system. In addition, there are separate secure facilities for sample storage, solvent storage, laboratory inventory and hazardous waste management and storage. A floor plan is found in Appendix C.

The laboratory security features provide sample integrity and storage. Access to the facility is limited to the front door and the shipping and receiving door. During working hours, the doors are monitored by personnel. Guests are escorted and monitored when entering the facility. The building is protected by a 24-hour protection electronic security system. Refrigerated sample storage monitoring is performed according to SOP HS-EQ-002, *Thermometer Calibration and Temperature Monitoring.* Separate sample storage areas are maintained for samples requiring volatile organic analysis.

19 Test Methods and Method Validation

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All methods must be validated before they are put into use. Sources of methods employed are based on published methods or on documented performance based method procedures. The following elements of method validation are: Demonstration of Capability, On-going proficiency, Initial Test Method Evaluation, Estimation of Uncertainty and Laboratory-Developed or Non-Standard Method Validation and Control of Data.

19.1 Demonstration of Capability (DOC) is a procedure to establish the ability of the analyst to generate data of acceptable accuracy and precision. This procedure requires the preparation and analysis of a known concentration of each analyte spiked in four separate aliquots of laboratory pure matrix. These samples are carried through the entire preparation and analytical procedure. The resulting recovery and the standard deviation are determined and compared to specified limits. This DOC must be made at any time there is a significant change in instrument type, personnel or test methods. For analytes that do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples. For analytes for which spiking is not an option and for which quality control samples are not readily available, the procedure published in 40 CFR Part 136, Appendix A, test methods, is one way to perform this demonstration. The data for the DOC procedure is evaluated by either the section supervisor or the QA Department. Documentation for analyst DOCs are maintained on the laboratory network and by the QA Department as stored in analyst training records. After successful completion of the DOC or on-going DOCs, NELAC certification statements are prepared and reviewed for approval by the Technical Director and the QA Manager.

19.2 On-going Proficiency-Annual ongoing DOC's are performed when either an analyst repeats the DOC annually or generates acceptable results when analyzing performance evaluation samples. The data for the DOC procedure is evaluated by either the section supervisor or the QA Department.

19.3 Initial Test Method Evaluation – This evaluation involves the determination of the Limit of Detection (LOD), confirmation of the Limit of Quantitation (LOQ), an evaluation of precision and bias, and an evaluation of the selectivity of the method

19.3.1 The Limit of Detection (LOD) defines a range below the LOQ where detections must be reported with the data qualifier "J", indicating the value reported is an estimated value. The LOD is an estimate of the minimum amount of a substance that an analytical process can reliably detect. The LOD is analyte- and matrix-specific and may be laboratory-dependent. No results are reported below the LOD. The LOD may be verified using either an MDL study or detection limit check standard analysis. Further discussion of LOD is found in SOP HS-QS-006 (current revision).

19.3.2 The Limit of Quantitation (LOQ) for an analytical method is established to be no lower than the lowest non-zero calibration standard for the determinative method. The LOQ defines the lower limit for an analyte working range where data may be reported without qualification. On a final analytical report, the LOQ may be labeled as the method quantitation limit (MQL) or practical quantitation limit (PQL). Further discussion of LOQ is found in SOP HS-QS-006 (current revision).

19.3.3 Evaluation of Precision and Bias: Precision and Bias are determined for standard and non-standard methods, where:

- Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance, or range, in either absolute or relative terms.

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- Bias is the systematic error that contributes to the difference between the mean of a significant number of test results and the accepted reference value.
- Precision and bias criteria are based evaluation of control chart limits or based upon approved program limits (e.g. TCEQ QAPP for Superfund control limits). When criteria are not documented, they are determined through the performance of a Demonstration of Capability.
- Precision and bias using non-standard, modified standard or laboratory-developed methods are compared to the criteria established by the client (when requested), the method, or the laboratory.

19.3.4 Evaluation of the Selectivity of the Method – This evaluates selectivity of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. The laboratory evaluates selectivity through procedures defined in the test method SOPs such as use of dual columns, interference checks, and analysis of method required QC samples (e.g. blanks, LCS, etc).

19.4 Estimation of Uncertainty – An Estimation of uncertainty consists of the sum (combining the components) of the uncertainties of the numerous steps of the analytical process, including, but not limited to, sample plan variability, spatial and temporal sample variation, sample heterogeneity, calibration/calibration check variability, extraction variability, and weighing variability. To the degree where the laboratory has a control over these processes, the laboratory estimates uncertainty using the standard deviation calculated from routine quality control samples (e.g. the LCS).

19.5 Laboratory-Developed or Non-Standard Method Validation – All laboratory developed, modified standard methods, or non-standard methods (for which accreditation is sought) require planned method validation as described earlier in Section 19.3.

19.6 Control of Data: All calculations and all relevant data are subject to appropriate checks in a systematic manner are addressed in the following laboratory SOPs:

19.6.1 SOP HS-IT-001, *LIMS Raw Data and Data Integrity*, for the validation of software applications associated with data acquisition, calculation and reporting;

19.6.2 SOP HS-QS-009, *Data Reduction, Review and Validation*, for procedure to insure that reported data are free from transcription and calculation errors and for procedures to address manual calculations,

19.6.3 SOP HS-QS-016, *Manual Integration Policy*, for procedures for manual integrations;

19.6.4 SOP-HS-IT-002, *Computer Software Installation and Maintenance,* assures that computers, user-developed computer software, automated equipment, or microprocessors used for the acquisition, processing, recording, reporting, storage, or retrieval of environmental test data are properly installed and tested to document all computers and related software in use are validated as being adequate for use and

- protected for integrity and confidentiality of data entry or collection, data storage, data transmission and data processing;
- maintained to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of environmental test data; and
- Held secure including the prevention of unauthorized access to, and the unauthorized amendment of, computer records.

20 Equipment

20.1 General Equipment Requirements include the following:

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20.1.1 The laboratory has all the necessary equipment required for the correct performance of the scope of environmental testing presented in this *Quality Manual*.

20.1.2 All equipment and software used for testing and sampling is capable of achieving the accuracy required and complies with the specifications of the environmental test method as specified in the laboratory SOP.

20.1.3 Equipment is operated only by authorized and trained personnel (DOCs, etc, are on file);

20.1.4 SOP HS-EQ-004, Preventative Maintenance, describes laboratory procedures for safe handling, storage, use and planned maintenance of measuring equipment to ensure proper functioning and in order to prevent contamination or deterioration is available to the technical staff approved to operate designated equipment. Table C.2 in Appendix C is a summary of maintenance schedules for laboratory equipment.

20.1.5 Up-to-date instructions on the use and maintenance of equipment (including any relevant manuals provided by the manufacturer of the equipment) are readily available for use by laboratory personnel.

20.1.6 SOP HS-QS–005, *Validation of New Instrumentation and New Methods* requires that all equipment is calibrated or checked before being placed into use to ensure that it meets laboratory specifications and the relevant standard specifications of the application.

20.1.7 SOP HS-IT-003, *IT System Security* ensures that *t*est equipment, including hardware and software, are safeguarded from adjustments which would invalidate the test results by limiting access to the equipment and using password protection where possible.

20.1.8 Equipment that has been subject to overloading, mishandling, given suspect results, or been shown to be defective or outside specifications are: taken out of service, isolated to prevent its use, or clearly labeled as being out of service until it has been shown to function properly. If it is shown that previous tests are affected, then procedures for non-conforming work must be followed.

20.1.9 SOP HS-EQ-004, Preventative Maintenance, also requires each item of equipment and the software used to generate test results be uniquely identified and records of equipment maintenance and software installed be maintained. Maintenance Logbooks are assigned to each instrument for the purpose of documenting maintenance activities. This information includes the following:

- identity of the equipment and its software;
- manufacturer's name, type identification, serial number or other unique identifier;
- checks that equipment complies with specifications of applicable tests;
- current location;
- manufacturer's instructions, if available, or a reference to their location;
- dates, results and copies of reports and certificates of all calibrations, adjustments, acceptance criteria, and the due date of next calibration;
- maintenance plan where appropriate, and maintenance carried out to date; documentation on all routine and non-routine maintenance activities and reference material verifications;
- any damage, malfunction, modification or repair to the equipment;
- date received and date placed into service (if available); and
- Condition when received, if available (new, used, reconditioned).

20.2. Support Equipment Calibration – Various types of support equipment have calibration verification requirements based upon application. Refer to Table C.1 in Appendix C.

20.3. Instrument Calibration Procedures – A summary of calibration procedures by analytical method is found in Appendix E.

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20.3.1. Initial Calibrations – In general, all initial calibrations are according to method requirements described in the Laboratory Method SOP. The SOPs require the use of a second source calibration verification standard, acquired from a different vendor or different lot if the same vender. The calibration type (internal, external) and the calibration model options are in described in the SOPs. The following general rules must be followed for all multi-point initial calibrations:

- Select points from the middle of the curve may not be dropped in order to achieve acceptance criteria.
- If the low or high calibration point is dropped from the curve, the working curve is adjusted and sample results outside the curve are qualified or re-analyzed at dilution.
- Results that are less than the lower calibration standard are considered to have increased uncertainty, and must be reported with a "J" qualifier.
- Results that are greater than the highest calibration must be diluted to fall within the calibration range. If dilution is not possible, the result must be reported with an "E" qualifier and narrated as to its potential usability.
- Sufficient raw data records are retained to allow reconstruction of each initial calibration.

20.3.2. Continuing Calibration Verification, and Frequency – performed according to method requirements. Refer to Tables in Appendix E for established acceptance criteria. The following general rules must be followed for continuing calibration verifications:

- Continuing instrument calibration verification is performed at the beginning, after every ten samples, and end of each analytical batch. Methods employing internal standards require continuing calibration verifications to be analyzed at the beginning of the each analytical batch or as required by the determinative method, whichever is more restrictive.
- Continuing instrument calibration verification is performed whenever it is expected that the analytical system may be out of calibration or might not meet verification acceptance criteria.
- Continuing instrument calibration verification is performed when the time period for calibration or the most recent calibration verification has expired.
- Continuing instrument calibration verification is performed for all analytical systems that have a calibration verification requirement
- Calibration is verified for each compound, element, or other discrete chemical species.
- The calculations and associated statistics for continuing instrument calibration are included or referenced in the test method SOP.
- Sufficient raw data records are retained to allow reconstruction of the continuing instrument calibration verification. Continuing instrument calibration verification records connect the continuing verification date to the initial instrument calibration

20.3.3. Unacceptable Continuing Instrument Calibration Verifications: If routine corrective action for continuing instrument calibration verification fails to produce a subsequent consecutive (immediate) calibration verification within acceptance criteria, then a new calibration is performed or acceptable performance is demonstrated after corrective action with two consecutive calibration verifications.

- For any samples analyzed on a system with an unacceptable calibration, some results may be useable if qualified and under the following conditions:

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- If the acceptance criteria are exceeded high (high bias) and the associated samples are below detection, then those sample results that are non-detects may be reported as non-detects.
- If the acceptance criteria are exceeded low (low bias) and there are samples that exceed the maximum regulatory limit, then those exceeding the regulatory limit may be reported.

20.3.4. Corrective Actions for Calibration, and other method QC – see Appendix E by method.

20.4. Major Equipment List: For a list of test equipment in use, refer to Table C.3 in Appendix C.

21 Measurement Traceability

21.1. Measurement Quality Assurance comes in part from traceability of standards to standard reference materials. To achieve the traceability element of QA, the following are performed:

21.1.1. All equipment used for generation of test results, including equipment for subsidiary measurements, must calibrated prior being put into service and on a continuing basis; and the calibrations must be traceable to certified reference materials, where available, for the preparation of the calibration standard(s); SOP HS-QS-001, *Chemical Purchase & Receipt; Chemical Preparation, Storage & Tracking* describes the laboratory procedures for documenting chemical reference standards purchased for use in the laboratory and procedures for tracking chemical standards prepared for use. Each method SOP describes the purity or reference standard quality required for purchase and preparation of the calibration standards. Method SOP requirements, in general, specify purchasing standards that are traceable to standard reference materials. For standards in use for calibration, second source standards are also acquired, to verify the calibration standards in use. Standard receipt and preparation records are kept in laboratory notebooks to indicate traceability to purchased stocks or neat compounds, date of preparation, expiration date, and preparer's initials. Calibration Standard instructions are described in the applicable method SOPs.

21.1.2. The SOP HS-QS-001 requires the following records be kept for purchased standards:

- assignment of a unique tracking ID,
- standard name,
- manufacturer name or vender name
- certificate of analysis or purity (if available)
- lot ID,
- receipt date,
- Expiration date.
- Standard storage requirements are specified in the method SOPs.

21.1.3. For standards prepared, the SOP HS-QS-001 requires:

- an assignment of a unique tracking ID,
- the tracking IDs of standards or reagents used in the preparation,
- amounts and concentration of standards used,
- the final volume and concentration,
- an assigned expiration data (as per stability of the analyte based on the method,/ manufacturers expiration date, etc) and
- identification of the analyst associated with the preparation,
- standard storage requirements are specified in the method SOPs.

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21.1.4. When traceability of measurements to SI units is not possible or not relevant, evidence for correlation of results through interlaboratory comparisons, proficiency testing, or independent analysis may be provided.

21.1.5. Equipment used for generation of test results are calibrated according to the minimum frequency identified in the laboratory SOP, as specified by the method, the manufacturer, by regulation, or as needed.

21.1.6. Additionally, clients may further verify a required level of uncertainty is achieved by: a review of internal quality control data, provided as requested by a client; and through a use of a third party data validation service, to review the data (as requested by a client).

21.1.7. Reference Material requirements for the Metrology equipment (analytical balances, thermometers, etc.) are identified is SOP HS-EQ-001, *Use and Maintenance of Balances,* and SOP HS-EQ-002, Thermometer Calibration and Temperature Monitoring. Volumetric calibration checks for pipets, etc., are performed according to SOP HS-EQ-003.

- SOP HS-EQ-001 requires the annual analytical balance service and calibration verification using an outside service, and Class 1 weights are used for daily calibration verifications of analytical balance use ranges.
- SOP HS-EQ-002 requires that ASTM Reference thermometers calibrations be verified annually by a NVLAP calibration laboratory. Thermometers in use for various temperature monitoring activities (e.g. storage refrigerators, drying ovens, etc.) are verified for accuracy annually using the ASTM reference thermometers.
- For equipment using thermocouple temperature monitoring devices, annual verifications are performed using an approved vender's traceable reference devices.

22 Sample Handling and Management

22.1. Processes to facilitate and document sample handling and management are found in the following steps:

22.1.1. Provide clients with appropriate sample collection materials to meets sample EPA sample collection guidelines. Materials and information provided are:

- Sample collection containers,
- sample bottle labels,
- preservative information,
- chain of custody forms,
- sample shipping containers,
- directions for collection, as needed
- a trip blank if volatile organics are to be collected
- a shipping cooler temperature blank
- custody seals for the containers and coolers
- sample receipt policy
- additional packing material, as needed
- shipping instructions, etc
- These items are provided to clients from client instructions through project management contact. SOP HS-SM-002, Bottle Orders describes procedures to supply clients with the above sample collection materials.

22.1.2. HS-SM-001, Sample Log-in Procedures – The SOP includes the procedures to perform the following for samples received:

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- Document time of receipt of samples received on client chain of custody and maintain all shipping documents related to sample custody (air-bill, cooler seals, etc)
- inspect chain of custody information against the samples received,
- check for correct containerization, preservation, cooler receipt temperature
- check sample integrity (checks for VOC headspace, broken or missing containers, etc.)
- status of hold time for test requested on samples submitted, alert lab of short hold time samples received
- checks for completeness of sample collection information – date and time of collection, identification of sample collector, sample collection location, and project identification
- check for information regarding which tests are to be assigned for samples submitted
- record information concerning the login process into the lab LIMS to complete a Sample Receipt Checklist (SRC) document, where and inconsistencies or non-conforming issues can be brought to the attention of Project Management.
- The SOP identifies non-conforming areas where immediate client contact must be made to request client instruction for handling samples submitted.
  - samples received outside of temperature requirements
  - VOC samples having headspace issues
  - Missing or broken samples
  - Sample quantity insufficient to perform the tests requested
  - Samples received past the established hold-time requirement
  - Samples collected in inappropriate container
  - Samples preserved incorrectly
  - Sample collection information incomplete (no COC or date of collection, etc).
- After all the inspection steps are completed, samples are logged into the lab LIMS where each sample container is assigned a unique identifier and is assigned the client requested tests
  - The sample LIMS entries include date of collection and receipt to facilitate sample hold time monitoring by assigned test
- After Samples are logged into the lab LIMS, all sample receipt information is transferred to the assigned Project Manager, for review.
- The Final Step is a Project Management review of all sample receipt and login documents, and for the correctness of the test assigned, where
  - The Project Manager makes any required client contact and submits a Work Order Acknowledge (WOA) to the client (via email or fax) to inform the client of all samples received and the associated tests assigned.

22.1.3. Sub-Sample Procedures: The following lab SOPs are utilized when performing subsampling as either the routine approach to handle samples or due to a circumstance where multiple tests are required and a limited number of containers are submitted for testing.

- SOP HS-QS-008, Container Sub-sampling-metals, inorganics, semi-volatile organics,
- SOP HS-QS-010, Container Sub-sampling-volatile organics, SW5035A
- Subsample records are maintained in laboratory sample preparation logbook records

22.1.4. Sub-Contracting Tests to another laboratory: SOP HS-GEN-007, Subcontract Sample Submittal, requires that

- clients are notified in advance when test subcontracting is required
- all samples are shipped under COC to maintain the integrity of the samples

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- the subcontract labs must have the required NELAC accreditation to process the submitted samples when NELAC accredited testing is requested
- final results from subcontracted analyses are identified to the client in the test report

22.1.5. Sample Storage – The laboratory building is operated under a controlled access security system, where entrance requires use of a magnetic key for employees or and when entry access is granted internally, using an electronic door lock release switch system. The building security ensures that only laboratory employees have access to sample storage areas. For the samples received, specific cooler or freezer storage locations are assigned per SOP HS-SM-001, as described in the SOP appendix. Samples for Volatile Organic Testing are segregated in coolers that are separate from general storage (semi-volatiles, metals, etc.). Refrigerator / Freezer sample storage areas are monitored daily for the required storage temperatures (e.g. above 0 to 6°C for water samples) according to SOP HS-EQ-001.

- Samples are stored separately from
  - extracts prepared for testing and
  - test calibration standard storage areas

22.1.6. Sample Disposal – Sample are held in storage for a minimum of 30 days after reporting data to a client, unless directed otherwise. Disposal of samples follow procedures identified in SOP HS-SAF-001, Hazardous and Non-Hazardous Waste Disposal Procedures. The SOP directs the following:

- All Soils are incinerated to comply with USDA Soil import permit requirements
- Neutral, non-hazardous aqueous waste may be disposed into the sanitary sewer system
- Hazardous waste are segregated according to type, stored as per RCRA hazardous storage rule (40 CFR §§260-262)
- The laboratory is Conditionally Exempt Small Quantity Generator (CESQG)
- All Hazardous waste shipments are handled by a RCRA permitted waste transporter
- All Hazardous Waste is only shipped to a RCRA permitted waste disposal facility

23 Quality of Test Results

23.1. The quality of test results are defined by the use, collection, and monitoring of essential quality control elements of the test procedures. Procedures employed to accomplish this are:

23.1.1. Defining acceptance criteria based upon method defined criteria, which may be static (e.g. ±20%) or statistically derived (e.g. ± 3 standard deviations from a mean). Acceptance criteria for the testing procedures are typically defined by the QC sample type (ICV, CCV, LCS, MS, etc.) and are in general based on either defined method criteria or a statistical method.

- Acceptance criteria and frequency for calibration and calibration verifications by method are found in the Appendix E Tables.
- Acceptance criteria and frequency for Laboratory Control Samples (LCS) by method are found in the Appendix G Tables.

23.1.2. Trend Analysis: collection of LCS results by the Laboratory LIMS system enables trend monitoring of a method. SOP HS-QS-004, Control Charting, provides a procedure to monitor trends to ensure the method remains is control. When a method LCS trend is found to be out of control, a corrective action must be initiated.

23.1.3. Participation in semi-annual Proficiency Test studies (per matrix) provided data to assess the validity of the testing procedures employed.

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23.1.4. Replicate tests using the same or different methods.

23.1.5. Retesting of retained samples to confirm analysis

23.1.6. Correlation of results for different characteristics of a sample.

23.1.7. The required use of second source calibration verification standards ensure the quality of reference materials used to prepare calibrations and other quality control samples employed in the testing processes.

23.1.8. All Test and Preparation SOPs define the quality control sample that are required to be used in the test processes, as based on the most restrictive requirements based on analytical methods, regulatory requirements, or internally generated QC criteria. When the most restrictive criteria are not apparent, the mandated method or regulatory criteria is employed. These QC samples include:

- Initial Calibration Standards defined and acceptable calibration models and criteria
- Initial Calibration Verification and Continuing Calibration, criteria & frequency
- Calibration or instrument blanks and criteria
- Method Blanks and criteria to indicate potential contamination
- Laboratory Control Samples
- Duplicate & criteria (whether as sample, LCSD or MSD)
- Interference checks as defined by a method
- Internal / external calibration criteria as per method
- Quality of reagents or solvents use to prepare standards and samples
- Evaluation of method capability through limit of detection evaluation and analyst demonstration of capability – Appendix F Tables indicate current Limits of Detection and Quantitation for the method and analyte by matrix.

23.1.9. Employment of Positive and Negative control for Testing Procedures – The following are procedures are employed as negative or positive: Blanks (negative) Laboratory control sample (positive)

- Blanks (negative)
- Laboratory control sample (positive)

23.1.10. Method Selectivity is assured through:

- absolute and relative retention times in chromatographic analyses;
- two-column confirmation when using non-specific detectors (e.g. dual ECD) ;
- use of acceptance criteria for mass-spectral tuning (found in test method SOPs);
- Utilization of reference cultures (microbiological); and
- use of the correct method according to its scope assessed during method validation.

23.2. Laboratory Quality Control Batch Sample types and typical corrective actions – (see batch definitions in Appendix A). These essential Quality Control components are processed in exactly the same manner as field samples.

23.2.1. Method Blanks (MB) –

- MB is prepared from analyte free water (or other acceptable analyte free matrix)
- Contaminated blanks are identified according to the acceptance limits in the test method SOPs, typical criteria <1/2 LOQ or < LOQ if a common lab contaminant (e.g. methylene chloride for VOC analysis)
- When a blank is determined to be contaminated, the cause must be investigated and measures taken to minimize or eliminate the problem.
- Batch Data that are unaffected by the blank contamination (non-detects or other analytes) are reported unqualified.

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- Batch Sample data that are suspect due to the presence of a contaminated blank are reanalyzed, qualified, or deleted (not reportable).

23.2.2. Laboratory Control Samples (LCS)

- LCS are prepared from analyte free water (or other acceptable analyte free matrix), and spiked with verified and known amounts of analytes for the purpose of establishing precision or bias measurements.
- LCS are analyzed at a frequency mandated by method, regulation, or client request, whichever is more stringent (1 per batch of 20 or less is the practice in the laboratory SOPs as per method).
- LCS data is calculated in percent recovery that allows comparison to established acceptance criteria.
- When the LCS does not meet criteria, the cause must be investigated and measures to correct the problem must be taken.
- For any batch samples analyzed with the unacceptable LCS, some results may be useable if qualified and under the following conditions:
  - If the acceptance criteria are exceeded high (high bias) and the associated samples are below detection, then those sample results that are non-detects may be reported as non-detects.
  - If the acceptance criteria are exceeded low (low bias) and there are samples that exceed the maximum regulatory limit, then those exceeding the regulatory limit may be reported.
- For those batch samples having unusable data, reprocessing and reanalysis is required (after the cause of the LCS failure has been corrected),
- Should re-analysis be an impossibility, any data reported must be qualified and discussed in the data report narrative to the client

23.2.3. Matrix Spikes and Matrix Spike Duplicates - prepared from a portion of client sample, and spiked with verified and known amounts of analytes for the purpose of evaluating the effect of sample matrix on the test measurements.

- The MS are analyzed at a frequency mandated by method, regulation, or client request, whichever is more stringent (1 per batch of 20 or less is the practice in the laboratory SOP as per most method).
- MS are calculated in percent recovery that allows comparison to established acceptance criteria (the LCS criteria is utilized for most methods).
- When the MS does not meet criteria, it evaluated in comparison with the LCS to assess whether there is a matrix effect present. A reproducible duplicate MS (the MSD) would assist the confirmation that a matrix effect is likely present.
- For any batch samples analyzed with the unacceptable MS, like the LCS some results may be useable under the following conditions:
  - If the acceptance criteria are exceeded high (high bias) and the associated samples are below detection, then those sample results that are non-detects may be reported as non-detects.
  - If the acceptance criteria are exceeded low (low bias) and there are samples that exceed the maximum regulatory limit, then those exceeding the regulatory limit may be reported.
- All batch samples associated with a MS outside of criteria are identified for the client or program data usability decisions. The cause of an MS exceedance may be due to many reasons, most often due to an interference present that is not easily removed by a

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practice stated in the method. In these cases, the data is reported with the qualified MS results and noted on a laboratory data review checklist exception report (see § 24).

23.2.4. Duplicates - prepared from a portion of client sample, for the purpose of evaluating method precision.

- The duplicate is analyzed at a frequency mandated by method, regulation, or client request, whichever is more stringent (1 per batch of 20 or less is the practice in the laboratory SOP as per most methods). The duplicate may take the form as a duplicate, a matrix spike duplicate (MSD), or a laboratory control sample duplicate, depending on the availability of additional sample and the type of test method. Typical precision limit for waters is ≤ 20% for the RPD. For soil, the typical precision limit is ≤ 30% for the RPD. Refer to Appendix G tables.

23.2.5. Surrogate Spikes - Surrogates are substances with chemical properties and behaviors similar to the analytes of interest used to assess method performance in individual samples

- Surrogates are added to all samples (in test methods where surrogate use is appropriate) prior to sample preparation or extraction.
- Surrogate recovery results are compared to the acceptance criteria as established in the test method SOP or from program guidance (CLP or DOD) or from laboratory established limits
- For surrogate results outside established criteria, data are evaluated to determine the impact. Corrective actions include reprocessing and reanalysis to determine whether a matrix effect is present, qualifying the data and/or narrating the occurrence on the data review checklist exception report.

23.2.6. Proficiency Test Samples - The laboratory participates in proficiency test (PT) samples studies twice annually. These studies include all applicable fields of proficiency testing and are obtained from an approved proficiency test provider.

- The laboratory does not share PT samples with other laboratories, does not communicate with other laboratories regarding current PT sample results, and does not attempt to obtain the assigned value of any PT sample from the PT provider
- Proficiency Testing (PT) samples are treated as typical samples in the normal production process where possible, including the same preparation, calibration, quality control and acceptance criteria, sequence of analytical steps, number of replicates, and sample log-in. PT samples are not analyzed multiple times unless routine environmental samples are analyzed multiple times.
- The laboratory initiates corrective action procedures for any unacceptable PT result. Additionally, the laboratory must successfully complete two of the most recent three proficiency tests for each field of proficiency testing. In the event that this requirement is not met, the laboratory institutes corrective action procedures, including participation in 2 supplemental PT studies to demonstrate corrective action. Supplemental PT studies are performed at least 15 days apart from each other.
    - For Analyte Group PT studies (i.e., Semivolatile Organics by SW8270), the laboratory must produce acceptable results for 80% of the analytes in the Analyte Group Study. A greater than 20% unacceptable rate for an Analyte Group Study results in a "Fail" score for the entire analytical group. A "not acceptable" result for any analyte on two of the most recent PT studies results in a "Fail" score for that analyte.

23.2.7. Data Review - The laboratory reviews all data generated in the laboratory for compliance with method, laboratory and, where appropriate, client requirements. Procedures for Data

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Reduction, Review and Validation are described in SOP HS-QS-009. The procedure describes all steps to document the review as either hardcopy or as electronic review via use of computer user identification and password security. In general, the procedure include:

- Initial analyst calibration, and applicable batch QC data (method blank, LCS, MS, Duplicate, etc,), including the raw data and calculated data entered into the lab LIMS. Batch QC limits by method are stored in LIMS to facilitate checks for meeting Batch QC acceptance limits by method. The LIMS also contains LOQ and LOD information along with upper calibration limits by method, to facilitate accurate evaluation of detections against the method applicability range for reporting, to ensure required dilutions were performed and reported correctly, when necessary. The initial process includes the use of LIMS QC Checking tools that the analyst and any later peer reviewer can use to evaluate whether reportable client data entered in e-LIMS is correctly referenced (or linked) to the correct supporting QC data. A Data Assessment checklist is prepared during the initial review of the data by the analyst.
- A second peer review is performed by a qualified analyst or supervisor. The same LIMS QC checks are reviewed and include search for the required QC sample types to assure that all supporting QC data are present in e-LIMS for evaluation against the QC acceptance criteria stored in e-LIMS for each test performed. A nominal 10 % of the raw data is reviewed to verify the correct data has been calculated and entered correctly.
- QC exceedances are identified in e-LIMS by the application of the appropriate data qualifying flags. The data qualifying flags may either initiate corrective actions for nonconforming data and/or require supporting comment information to be entered into e-LIMS batch report or entered into the batch data review checklist exception report
- Comments for data flags are maintained in LIMS and into the batch data review checklist exception report for inclusion in the project Case Narrative, as necessary.
- A Final Project Manager review of data performed to review the data for completeness against any client specified requirements, complete a narrative to discuss any anomalies associated with assigned data flags.
- QA Department data review

24 Reporting of Results

Data are reported without qualification if they are greater than the lowest calibration standard, lower than the highest calibration standard, and without compromised sample or method integrity (all supporting QC assessments meet stated requirements per method).

24.1 Test Reports - The report format has been designed to accommodate each type of test performed and to minimize the potential for misunderstanding or misuse. Each test report generated contains the following information:

24.1.1 Report Cover Letter, includes the following client name, address, date of issue for the cover letter, project reference,

- the ALS Laboratory Work Order Number
- report introduction for samples submitted, stating the number of samples received and date(s) of receipt, for the analysis presented in the report

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- the statement like "the analytical data provided relates directly to the samples received at ALS Laboratory Group and for only the analysis requested"
- the statement like "Results are expressed "as received" unless otherwise noted."
- The statement like "QC sample results for this data met EPA or laboratory specifications except as noted in the Case Narrative or as noted with qualifiers in the QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained by ALS Laboratory Group. Samples will be disposed in 30 days unless storage arrangements are made. The total number of pages in this report is 16.
- Signature of the Project Manager (this may be electronic)
- NELAC Accreditation ID (e.g. Texas NELAC Certificate No: T104704231-08D-TX or other applicable state accreditation ID)
- Lab Name as ALS Laboratory Group, full physical address (same as on QA Manual)
- Lab Phone and Fax Number (same as on the QA Manual)
- ALS Laboratory Group world wide web site address

24.1.2 Sample Summary Table

- Client Name
- Project Name
- ALS Laboratory Work Order Number
- Date of issue for the Summary Table
- NELAC Accreditation ID or other applicable state accreditation ID
- Work Order Sample Summary to indicate for each sample received -
  - Lab Sample ID
  - Client Sample ID
  - Date & Time of Sample Collection
  - Date & Time of Sample Receipt
  - Sample Analysis Hold Status (check as either yes or no)

24.1.3 Case Narrative, or client required laboratory data review checklist, if required to further describe any qualified data reported – the narrative references the following:

- Client Name
- Project Name
- ALS Laboratory Work Order Number
- Date of issue for the Narrative Report
- NELAC Accreditation ID or other applicable state accreditation ID
- A discussion of the qualified data reported

24.1.4 Each Analytical Report includes the following information:

- Client Name
- Project Name
- ALS Laboratory Work Order Number
- Date of issue for the Analytical Report
- Client Sample ID
- ALS Laboratory Sample ID
- Date & Time of Sample Collection
- Sample matrix identification
- Analytical Report paginated as "AR page X of Y"
- Identification of each test performed and name of analyte reported for that test
  - Method Reference

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- Analyte Name(s)
- Test Result and unit
- Reporting Limit (aka as LOQ) for analyte
- LOD for analyte if required in client reporting format
- Dilution factor(s) associated with reported result(s)
- Surrogate result and % recovery, if applicable
- Date of test preparation, if applicable
- Date of test analysis
- Initials of Analyst
- Data Qualifiers defined on Analytical Report - ND, J, B, *, S, P, E, H, where
  - ND = not detected at Reporting Limit
  - J = analyte detected below quantitation limits
  - B = analyte detected in the associated method blank
  - * = value exceeds Maximum Contaminant Level
  - S = Spike Recovery outside accepted recovery limits
  - P = Dual column results percent difference > 40%
  - E = Value above quantitation range
  - H = Analyzed outside Hold Time
  - a = accredited by the applicable State Authority (optional)
  - n = accreditation not offered by the State Authority (optional)

24.1.5 QC Batch Report - a report of applicable batch QC samples (method blank, LCS, MS, Duplicate, etc.) by batch ID, test method and matrix

- Client Name
- Project Name
- ALS Laboratory Work Order Number
- Date of issue for the QC Batch Report
- Batch ID, Instrument ID and Method – the following are reported
  - QC sample ID (method blank, LCS, MS, etc.)
  - QC sample PQL (reporting limit)
  - QC sample result (value of a blank, LCS or MS)
  - QC sample reference value (e.g. background sample result for and MS)
  - QC sample dilution factor
  - QC Spike Level (e.g. applicable to LCS, MS, MSD sample types)
  - Calculated % Recovery for LCS or MS, MSD
  - Applicable control limits for LCS or MS & MSD or Duplicate (as RPD)
  - IDs of samples associated with the Batch ID (sequentially assigned by LIMS)
  - Applicable Batch QC data qualifiers - ND, J, B, *, S, P, E, H, O & R
    - ND = not detected at Reporting Limit
    - J = analyte detected below quantitation limits
    - B = analyte detected in the associated method blank
    - * = value exceeds a regulatory limit (e.g. an MCL or client permit value)
    - S = Spike Recovery outside accepted recovery limits
    - P = Dual column results percent difference > 40%
    - E = Value above quantitation range
    - H = Analyzed outside Hold Time
    - O = Referenced analyte is >4 times amount spiked

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- R = RPD outside accepted limits

24.1.6 Chain of Custody documents –see example in SOP HS-SM-001 Appendix

24.1.7 Sample Receipt Checklist – see example in SOP HS-SM-001 Appendix

24.1.8 Subcontractor analytical results are presented, in their entirety, as an attachment to the final report.

24.2 Supplemental Test Report Information

24.2.3 A statement of compliance/non-compliance when requirements of the quality systems are not met, including identification of test results that do not meet NELAC sample acceptance requirements, such as holding time, preservation, etc., are included in the project narrative;

24.2.4 When requested by the client, a statement on the estimated uncertainty of the measurement is included in the project narrative as per SOP HS-QS-019

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APPENDIX A - DEFINITIONS FOR QUALITY SYSTEMS FROM NELAC

The following selected definitions are from published texts in the 2003 NELAC Standard, June 5, 2003.

Acceptance Criteria: specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst: the designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Assessment: the evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Assessment Criteria: the measures established by NELAC and applied in establishing the extent to which an applicant is in conformance with NELAC requirements. (NELAC)

Assessment Team: the group of people authorized to perform the on-site inspection and proficiency testing data evaluation required to establish whether an applicant meets the criteria for NELAP accreditation. (NELAC)

Assessor: one who performs on-site assessments of accrediting authorities and laboratories' capability and capacity for meeting NELAC requirements by examining the records and other physical evidence for each one of the tests for which accreditation has been requested. (NELAC)

Audit: a systematic evaluation to determine the conformance to quantitative *and qualitative* specifications of some operational function or activity. (EPA-QAD)

Batch: environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank: a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. Blanks include:

- Equipment Blank: a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)
- Field Blank: blank prepared in the field by filling a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
- Instrument Blank: a clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

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- Method Blank: a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)
- Reagent Blank: (method reagent blank): a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Blind Sample: a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibration: set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards (VIM:6.11)

- In calibration of support equipment, the values realized by standards are established through the use of Reference Standards that are traceable to the International System of Units (SI).
- In calibration according to test methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has be calibrated or verified to meet specifications.

Calibration Curve: the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method: a defined technical procedure for performing a calibration. (NELAC)

Calibration Standard: a substance or reference material used to calibrate an instrument. (QAMS)

Certified Reference Material (CRM): a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30 - 2.2)

Chain of Custody Form: record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses.
(NELAC)

Confidential Business Information (CBI): information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. NELAC and its representatives agree to safeguard identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation: verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

- Second column confirmation,
- Alternate wavelength,
- Derivatization,
- Mass spectral interpretation
- Alternative detectors or
- Additional cleanup procedures. (NELAC)

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Conformance: an affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Corrective Action: the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Critical Finding: a finding or combination of findings that results in a significant negative effect on data quality or defensibility, if not corrected. (NELAC)

Data Audit: a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency: See Finding and Critical Finding.

Delegate: any environmental official of the States or the Federal government not sitting in the House of Representatives, who is eligible to vote in the House of Delegates. (NELAC)

Demonstration of Capability: a procedure to establish the ability of the analyst to generate acceptable accuracy. (NELAC)

Denial: to refuse to accredit in total or in part a laboratory applying for initial accreditation or resubmission of initial application. (NELAC)

Detection Limit: the lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed. (ASQC)

Federal Water Pollution Control Act (Clean Water Act, CWA): the enabling legislation under 33 U.S.C. 1251 *et seq*., Public Law 92-50086 Stat. 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance. (NELAC)

Field Measurement: The determination of physical, biological, or radiological properties, or chemical constituents; that are measured on-site, close in time and space to the matrices being sampled/measured, following accepted test methods. This testing is performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory

Field of Accreditation: (previously Field of Testing) NELAC's approach to accrediting laboratories by matrix, technology/method and analyte/analyte group. Laboratories requesting accreditation for a matrix-technology/method-analyte/analyte group combination or for an updated/improved method are required to submit only that portion of the accreditation process not previously addressed (see NELAC, section 1.8 ff). (NELAC)

Field of Proficiency Testing: NELAC's approach to offering proficiency testing by matrix, technology, and analyte/analyte group.

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Finding: an assessment conclusion, referenced to a NELAC Standard and supported by objective evidence, that identifies a deviation from a NELAC requirement. **See Critical Finding.**

Holding Times (Maximum Allowable Holding Times): the maximum times that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR Part 136)

Inspection: an activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ASQC E4-1994)

Interim Accreditation: temporary accreditation status for a laboratory that has met all accreditation criteria except for a pending on-site assessment which has been delayed for reasons beyond the control of the laboratory. (NELAC)

Internal Standard: a known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method. (NELAC)

International System of Units (SI): the coherent system of units adopted and recommended by the General Conference on Weights and Measures. (CCGPM) (VIM 1.12)

Laboratory: a body that calibrates and/or tests. (ISO 25)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (NELAC)

Laboratory Duplicate: aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Legal Chain of Custody Protocols: procedures employed to record the possession of samples from the time of sampling until analysis and are performed at the special request of the client. These protocols include the use of a Chain of Custody Form that documents the collection, transport, and receipt of compliance samples by the laboratory. **In addition, these protocols document all handling of the samples within the laborator**y. (NELAC)

Limit of Detection (LOD): an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory-dependent.

Limit of Quantitation (LOQ): The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence

Manager (however named): the individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Matrix: the substrate of a test sample.
Field of Accreditation Matrix: these matrix definitions shall be used when accrediting a laboratory (see Field of Accreditation).

- Drinking Water: any aqueous sample that has been designated a potable or potential potable water source.

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- Non-Potable Water: any aqueous sample excluded from the definition of Drinking Water. Includes surface water, ground water, effluents, water treatment chemicals, and TCLP or other extracts.
- Solid and Chemical Materials: includes soils, sediments, sludges, products and by-products of an industrial process that results in a matrix not previously defined.
- Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- Air and Emissions: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device. (NELAC)

Quality System Matrix: These matrix definitions are an expansion of the field of accreditation matrices and shall be used for purposes of batch and quality control requirements (see Appendix D of Chapter 5). These matrix distinctions shall be used:

- Aqueous: any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
- Drinking Water: any aqueous sample that has been designated a potable or potential potable water source.
- Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.
- Non-aqueous Liquid: any organic liquid with <15% settleable solids.
- Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- Solids: includes soils, sediments, sludges and other matrices with >15% settleable solids.
- Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.
- Air and Emissions: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample): a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of Target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (QAMS)

May: denotes permitted action, but not required action. (NELAC)

Measurement System: a test method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).

Method Detection Limit: the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Must: denotes a requirement that must be met. (Random House College Dictionary)

National Accreditation Database: the publicly accessible database listing the accreditation status of all laboratories participating in NELAP. (NELAC)

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National Institute of Standards and Technology (NIST): an agency of the US Department of Commerce's Technology Administration that is working with EPA, States, NELAC, and other public and commercial entities to establish a system under which private sector companies and interested States can be accredited by NIST to provide NIST-traceable proficiency testing (PT) to those laboratories testing drinking water and wastewater.

National Environmental Laboratory Accreditation Conference (NELAC): a voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP): the overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

National Voluntary Laboratory Accreditation Program (NVLAP): a program administered by NIST that is used by providers of proficiency testing to gain accreditation for all compounds/matrices for which NVLAP accreditation is available, and for which the provider intends to provide NELAP PT samples. (NELAC)

Negative Control: measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

NELAC Standards: the plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference. (NELAC)

NELAP Recognition: the determination by the NELAP Director that an accrediting authority meets the requirements of the NELAP and is authorized to grant NELAP accreditation to laboratories. (NELAC)

Non-governmental Laboratory: any laboratory not meeting the definition of the governmental laboratory. (NELAC)

Performance Audit: the routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Positive Control: measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation: refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Primary Accrediting Authority: the agency or department designated at the Territory, State or Federal level as the recognized authority with responsibility and accountability for granting NELAC accreditation for a specified field of testing. (NELAC)

Procedure: Specified way to carry out an activity or a process. Procedures can be documented or not. (ISO 9000: 2000 and Note1)

Proficiency Testing: a means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC)

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Proficiency Testing Oversight Body/Proficiency Testing Provider Accreditor (PTOB/PTPA): an organization with technical expertise, administrative capacity and financial resources sufficient to implement and operate a national program of PT provider evaluation and oversight that meets the responsibilities and requirements established by NELAC standards. (NELAC)

Proficiency Testing Program: the aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Testing Study Provider: any person, private party, or government entity that meets stringent criteria to produce and distribute NELAC PT samples, evaluate study results against published performance criteria and report the results to the laboratories, primary accrediting authorities, PTOB/PTPA, and NELAP. (NELAC)

Proficiency Test Sample (PT): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Protocol: a detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed. (EPA-QAD)

Quality Assurance: an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance [Project] Plan (QAPP): a formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EPA-QAD)

Quality Control: the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample: a sample used to assess the performance of all or a portion of the measurement system. QC samples may be Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking.

Quality Manual: a document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ASQC E-41994)

Raw Data: any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted. (EPA-QAD)

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Recognition: previously known as reciprocity. The mutual agreement of two or more parties (i.e., States) to accept each other's findings regarding the ability of environmental testing laboratories to meet NELAC standards. (NELAC)

Reference Material: a material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Standard: a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.08)

Replicate Analyses: the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Requirement: denotes a mandatory specification; often designated by the term "shall". (NELAC)

Resource Conservation and Recovery Act (RCRA): the enabling legislation under 42 USC 321 *et seq.* (1976), that gives EPA the authority to control hazardous waste from the "cradle-to-grave", including its generation, transportation, treatment, storage, and disposal. (NELAC)

Revocation: the total or partial withdrawal of a laboratory's accreditation by the accrediting authority. (NELAC)

Safe Drinking Water Act (SDWA): the enabling legislation, 42 USC 300f *et seq.* (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations. (NELAC)

Secondary Accrediting Authority: the Territorial, State or federal agency that grants NELAC accreditation to laboratories, based upon their accreditation by a NELAP-recognized Primary Accrediting Authority. See also **Recognition** and **Primary Accrediting Authorit**y. (NELAC)[1.5.2.3]

Selectivity: (Analytical chemistry) the capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity: the capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Shall: denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)

Should: denotes a guideline or recommendation whenever noncompliance with the specification is permissible. (ANSI)

Spike: a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes. (NELAC)

Standard: the document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

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Standard Operating Procedures (SOPs): a written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standard Method: a test method issued by an organization generally recognized as competent to do so.

Standardized Reference Material (SRM): a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Statistical Minimum Significant Difference (SMSD): the minimum difference between the control and a test concentration that is statistically significant; a measure of test sensitivity or power. The power of a test depends in part on the number of replicates per concentration, the significance level selected, e.g., 0.05, and the type of statistical analysis. If the variability remains constant, the sensitivity of the test increases as the number of replicates is increased. (NELAC)

Supervisor (however named): the individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)

Surrogate: a substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes. (QAMS)

Suspension: temporary removal of a laboratory's accreditation for a defined period of time, which shall not exceed six months, to allow the laboratory time to correct deficiencies or area of non-compliance with the NELAC standards. (NELAC)

Technical Director: individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Technology: a specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Test: a technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method: an adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP or published by a recognized authority. (NELAC)

Test Sensitivity/Power: the minimum significant difference (MSD) between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the selected significance level, and the type of statistical analysis (see Chapter 5, Appendix D, section 2.4.a). (NELAC)

Tolerance Chart: A chart in which the plotted quality control data is assessed via a tolerance level (e.g. ± 10% of a mean) based on the precision level judged acceptable to meet overall quality/data use requirements instead of statistical acceptance criteria (e.g. ± 3 sigma) (applies to radio bioassay laboratories). (ANSI)

Traceability: the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM-6.12)

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United States Environmental Protection Agency (EPA): the federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e., the air, water, and land) upon which human life depends. (US-EPA)

Validation: the confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

Verification: confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

> NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.
> The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell: a well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented.
(NELAC)

Working Range: the difference between the Limit of Quantitation and the upper limit of measurement system calibration.

Sources:
40CFR Part 136
American Society for Quality Control (ASQC),
Definitions of Environmental Quality Assurance Terms, 1996 American National Standards Institute (ANSI), Style Manual for Preparation of Proposed American National Standards, Eighth Edition, March 1991
ANSI/ASQC E4, 1994
International Standards Organization (ISO) Guides 2, 30, 8402
National Institute of Standards and Technology (NIST)
National Environmental Laboratory Accreditation Conference (NELAC), July 1998 Standards
Random House College Dictionary
US EPA Quality Assurance Management Section (QAMS), Glossary of Terms of Quality Assurance Terms, 8/31/92 and 12/6/95
US EPA Quality Assurance Division (QAD)
Webster's New World Dictionary of the American Language

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APPENDIX B – Containers, Preservation and Holding Times

Parameter	Containers [1]	Preservative	Holding Time [2]
Acidity / E305.1	P, G - 250 ml	>0 to 6 ° C	14 days
Alkalinity / SM 2320B – E310.1	P, G - 250 mL	>0 to 6 ° C	14 days
Ammonia as N	P, G – 500 mL	>0 to 6 ° C; H_2SO_4 to pH<2	28 days
Bacterial Tests (Coliform, Total, Fecal and *E. Coli*)	PA, G – 250-ml	Cool <10 ° C; 0.008% $Na_2S_2O_3$ if Cl_2 present	6 hours
Biological Oxygen Demand (BOD)	P, G – 1000 mL	>0 to 6 ° C	48 hours
(Carbonaceous) Biological Oxygen Demand (CBOD)	P, G – 1000 mL	>0 to 6 ° C	48 hours
Bromide	P, G – 500 mL	None required	28 days
(Total Organic) Carbon (TOC) / SW 9060	P, G – 250 mL	>0 to 6 °C; HNO_3 or H_2SO_4 to pH<2	28 days
Chemical Oxygen Demand (COD)	P, G – 500 mL	>0 to 6 ° C; H_2SO_4 to pH<2	28 days
Chloride	P, G – 500 mL	None required	28 days
Color	P, G – 500 mL	>0 to 6 ° C	48 hours
Conductivity (Spec. Conductance)	P, G – 250 mL	>0 to 6 ° C	28 days
(Reactive) Cyanide	P, G – 4 oz wm	None required	14 days
Cyanide (Total and Amenable to Chlorination)	P, G - 1000 mL	>0 to 6 ° C; NaOH to pH>12; 0.6g ascorbic acid	14 days
Cyanide (Total or Reactive) / Soil	P, G – 100 g in 250-ml wm bottle.	>0 to 6 ° C	14 days
Fluoride	P – 250 mL	None required	28 days
Hardness	P, G – 250 mL	HNO_3 or H_2SO_4 to pH<2	6 months
Nitrate as N	P, G – 250 mL	>0 to 6 ° C	48 hours
Nitrate-Nitrite as N	P, G – 250 mL	>0 to 6 ° C; H_2SO_4 to pH<2	28 days
Nitrite as N	P, G – 250 mL	>0 to 6 °C	48 hours
(Total Kjeldahl) Nitrogen	P, G – 250 mL	>0 to 6 ° C; H_2SO_4 to pH<2	28 days
Oil and Grease	G – 1000 mL wm	>0 to 6 ° C; H_2SO_4 to pH<2	28 days
pH (hydrogen ion)	P, G – 250 mL	>0 to 6 ° C	analyze immediately
(Total) Phenols (wet method)	G / amber – 1000 mL	>0 to 6 ° C; H_2SO_4 to pH<2	28 days
(*ortho*-) Phosphate	P, G – 250 mL	Filter immediately; >0 to 6 ° C	48 hours
(Total) Phosphate	P, G – 250 mL	>0 to 6 ° C; H_2SO_4 to pH<2	28 days
Residue (Total Solids)	P, G – 500 mL	>0 to 6 ° C	7 days
Residue (Dissolved Solids) (TDS)	P, G – 500 mL	>0 to 6 ° C	7 days
Residue (Suspended Solids) (TSS)	P, G – 500 mL	>0 to 6 ° C	7 days
Residue (Settleable)	P, G – 1000 mL	>0 to 6 ° C	48 hours
Residue (Total Volatile) (TVS)	P, G – 500 mL	>0 to 6 ° C	7 days
Residue (Volatile Suspended) (TVSS)	P, G – 500 mL	>0 to 6 ° C	7 days
Silica	P – 500 mL	>0 to 6 ° C	28 days
Chromium VI	P, G – 250 mL	>0 to 6 ° C	24 hours
Chromium VI (soil)	P, G – 4 oz wide mouth	>0 to 6 ° C	24 hours

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Parameter	Containers [1]	Preservative	Holding Time [2]
Mercury	P, G – 500 mL	HNO_3 to pH<2	28 days
Mercury (soil)	P, G – 4 oz wm bottle	None	28 days
Metals (except Chromium IV and Hg)	P, G – 1000 mL	HNO_3 to pH<2	6 months
Metals (except CrVI and Hg)/ (soil)	P, G – 50 g in 120 ml bottle	None	6 months
TCLP Mercury	P, G – 1000 mL	>0 to 6 ° C	28 days to extract; 28 days after extraction to analysis
TCLP Metals (except Mercury)	P, G – 1000 mL	>0 to 6 ° C	180 days to extract; 180 days after extraction to analysis
Dioxins (TCDD)	G – 2 x 1L amber	>0 to 6 ° C; 0.008% $Na_2S_2O_3$ if Cl_2 is present	7 days to extract; 40 days after extraction to analysis
Pesticides in Soil (Organochlorine) 8081B	G, 4 oz wide mouth	>0 to 6 °C	7 days to extract; 40 days after extraction to analysis
Pesticides – water (Organochlorine)/8081B	Amber G, 2 x 1L	>0 to 6 °C; adjust pH to 4-5	7 days to extract; 40 days after extraction to analysis
PCBs in Soil SW 8082A	G, 4 oz wide mouth	>0 to 6 ° C	7 days to extract; 40 days after extraction to analysis
PCBs in water SW 8082A / EPA 608	Amber G; 2 x 1L	>0 to 6°C; adjust pH to 4-5	7 days to extract; 40 days after extraction to analysis
(Total) Petroleum Hydrocarbons (TPH) Water – by TX 1005	G – 2 x 40 mL with no headspace	>0 to 6 °C; HCl to pH<2	14 days to extract; 14 days after extraction to analysis
Polynuclear Aromatic Hydrocarbons (PAHs) / (soil)	G, 4 oz wide mouth	>0 to 6 ° C; store in the dark	14 days to extract; 40 days after extraction to analysis
Polynuclear Aromatic Hydrocarbons (PAHs) by 8270 (water)	Amber G; 2 x 1L	>0 to 6 ° C	7 days to extract; 40 days after extraction to analysis
Semi-Volatiles (BNAs) in soil	G, 4 oz wide mouth	>0 to 6 ° C	7 days to extract; 40 days after extraction to analysis
Semi-Volatiles (BNAs)	Amber G, 2 x 1L	>0 to 6 ° C	7 days to extract; 40 days after extraction to analysis
Semi-Volatiles (TCLP)	G, 4 oz wide mouth	>0 to 6 ° C	14 days to TCLP extraction; 7 days from TCLP extraction to BNA extraction; 40 days after BNA extraction to analysis
Total Organic Halogens (TOX) / SW9020	Amber G, 250mL	>0 to 6 ° C; H_2SO_4 to pH<2	28 days
Volatiles (water) SW 8260B	G – 3 x 40 mL with no headspace	>0 to 6 ° C; HCl to pH<2	14 days
Volatiles (TCLP)	G, 2 x 4 oz wide mouth	>0 to 6 ° C	14 days to extract; 14 days after extraction to analysis
Volatiles (low level soil by 5035A, where soil likely contain VOCs < 200 ppb)	Collect sample using approved coring device (EnCore, etc) or field preserve 5 gram sample in pre-tared 40 ml VOA vial, containing 5ml of organic free water, 1g sodium bisulfate & stir bar	>0 to 6 ° C; or freeze[3] samples to –12 to -20 ° C as an alternative to preservation with sodium bisulfate as a means to inhibit biodegradation.	48 hrs to transfer contents of core device to a 40 ml VOA vial , containing 5ml of organic free water, 1g sodium bisulfate & stir bar; analyze transferred sample 14 days from collection
Volatiles (high level soil by 5035A, where soil may contain VOCs >200 ppb)	Collect sample using approved coring device (EnCore, etc) or field preserve samples in pre-tared 60 ml glass bottles	>0 to 6 ° C; or freeze[3] samples to –12 to –20 ° C as an alternative to preservation with methanol as a means to	48 hrs to transfer contents of core device to a 40 ml VOA vial , containing 10 ml of purge and trap grade methanol; analyze methanol

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Parameter	Containers [1]	Preservative	Holding Time [2]
	with methanol	inhibit biodegradation.	preserved sample 14 days from collection
Volatiles (Soil)	G, 2 oz wide mouth	>0 to 6 ° C	14 days
Alpha, Beta, and Radium	P, G – 1000 mL	HNO_3 to pH<2	6 months

[1] (P) polyethylene/plastic; (G) Glass ; (PA) Autoclavable Plastic
[2] Recommended Holding Times from 40CFR136 and/or USEPA SW-846.
[3] Option to freeze core soil must be approved by regulatory agency or QA Project Plan.

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APPENDIX C – Houston Floor Plan and Laboratory Equipment

Floor Plan

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Table C.1 Calibration And Maintenance Schedule – Houston Facility

Instrument	Activity	Frequency	Documentation
pH electrometers	Calibration: 1. pH buffer aliquot are used only once 2. Buffers used for calibration will bracket the pH of the media, reagent, or sample tested.	Before use	Worksheet/log book
pH probe / ISE probes	Maintenance: Use manufacturer's specifications	As needed	Worksheet/log book
Spectrophotometer.	1. Keep cells clean 2. Service contract. Check wavelength settings with color standards	Annually	Post service date on Unit
Refrigerators, Freezers, and BOD incubators	1. Thermometers are immersed in liquid to the appropriate immersion line 2. The thermometers are graduated in increments of 1°C or less	Temperatures are recorded each day in use	Worksheet/log book
DO electrometer	Calibrate as specified in SOP	Before use	Worksheet/log book
DO probe	Maintenance as specify by manufacturer	As needed	Worksheet/log book
CETAC Mercury Analyzer	Check tubing for wear Fill rinse tank with 10% HCl Insert clean drying tube filled with Magnesium Perchlorate Fill reductant bottle with 10% Stannous Chloride	Daily Daily Daily Daily	Worksheet/log book
UV-Vis Spectrophotometer	Clean ambient flow cell Precision check/alignment of flow cell Wavelength verification check	As required As required Semi-annually	Worksheet/log book

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Table C.1 Calibration And Maintenance Schedule – Houston Facility

Instrument	Activity	Frequency	Documentation
ICP/MS	Check pump tubing	Daily	Worksheet/log book
	Check liquid argon supply	Daily	
	Check fluid level in waste container	Daily	
	Check filters	Weekly	
	Clean or replace filters	As required	
	Check torch	Daily	
	Check sample spray chamber for debris	Monthly	
	Clean and align nebulizer	Monthly	
	Check entrance slit for debris	Monthly	
	Change printer ribbon	As required	
	Replace pump tubing	As required	
GC/MS Systems	Ion gauge tube degassing	As required	Worksheet/log book
	Pump oil-level check	Monthly	
	Diffusion Pump oil changing	Annually	
	Analyzer bake-out	As required	
	Analyzer cleaning	As required	
	Resolution adjustment – Tune MSD	As required	
	Auto sampler maintenance	As required	
	Purge and Trap maintenance	As required	
Electron Capture Detector (ECD)	Detector wipe test (Ni-63)	Semi-annually	Worksheet/log book
	Detector cleaning	As required	
Gas Chromatograph	Compare standard response to previous day or since last initial calibration	Daily	Worksheet/log book
	Check carrier gas flow rate in column	Daily via use of known RT	
	Check temp. of detector, inlet,	Daily	

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Table C.1 Calibration And Maintenance Schedule – Houston Facility			
Instrument	**Activity**	**Frequency**	**Documentation**
Gas Chromatograph continued	column oven		
	Septum replacement	As required	
	Glass wool replacement	As required	
	Check system for gas leaks with SNOOP	W/cylinder change as required	
	Check for loose/fray wires and insulation	Monthly	
	Bake injector/column	As required	
	Change/remove sections of guard column	As required	
	Replace connectors/liners	As required	
	Change/replace column(s)	As required	
	Autosampler Maintenance	As required	
Flame Ionization Detector (FID)	Detector cleaning	As required	Worksheet/log book
Photoionization Detector (PID)	Change O-rings	As required	Worksheet/log book
	Clean lamp window	As required	
HPLC / IC units	Change guard columns	As required	Worksheet/log book
	Change lamps	As required	
	Change pump seals	Semi-annually or as required	
	Replace tubing	As required	
	Change fuses in power supply	As required	
	Filter all samples and solvents	Daily	
	Change autosampler rotor/stator	As required	
TOC Analyzer	Check Sample Delivery Tubing	Daily	
	Check Gas and Reagent supplies	Daily	
	Replace Catalyst	As required	

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Table C.1 Calibration And Maintenance Schedule – Houston Facility			
Instrument	**Activity**	**Frequency**	**Documentation**
	IR Detector cleaning	As required	
Balances	Class "S" traceable weight check Clean pan and check if level Field service	Daily, when used Daily At least annually	
Conductivity Meter	0.01 M KCl calibration Conductivity cell cleaning	Daily, when used As required	
Turbidimeter	Check light bulb	Daily, when used	
Deionized/ Water	Check resistance Check deionizer light Monitor for VOA's Replace cartridge & large mixed bed resins	Daily Daily Daily As required	
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required	
Refrigerators/ Freezers	Temperature monitoring Temperature adjustment Defrosting/cleaning	Daily As required As required	
pH/Specific Ion Meter	Calibration/check slope Clean electrode	Daily As required	
BOD Incubator	Temperature monitoring Coil and incubator cleaning	Daily Monthly	

Table C.3 – Houston Lab Item Description	Manufacturer/Model	Condition / Year Installed	Approx. Age-Years
GC with FID (FID #2)	HP 5890A, HP7673 Injector	Used / good – 11/1999	9
GC with FID/FPD (FID #1)	HP 5890A, HP7673A Injector	Used / good – 11/1999	8
GC with FID (FID#3)	HP 5890A Series II, HP7673A Injector	Used / good – 09/2000	8.5
GC with FID (FID #4) / with Headspace Analyzer	HP 5890A Series II / HTA HT280T Headspace Autosampler	Used / good – 02/2001 / Headspace – new - 2007	7 / 2
GC with FID, Dual Thu-put (FID#7 / #8)	Agilent 6890N, Dual Column/FID	New / Excellent – 02/2006	2.5

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Table C.3 – Houston Lab Item Description	Manufacturer/Model	Condition / Year Installed	Approx. Age-Years
GC with FID, Dual Thu-put (FID#10 / #11)	Agilent 6890N, Dual Column/FID	New / Excellent – 02/2006	2.5
GC with FID (FID#6- GRO)	HP 5890 Series II,	Used/ good – 09/2000	8.5
Purge & Trap Conc, for GRO	OI 4560 (for FID #6)	Used/ good – 09/2000	8.5
Purge & Trap Concentrator	OI 4552 Autosampler (for FID 6)	Used/ good – 09/2000	8.5
GC with FID (FID#9- GRO)	Agilent 6890 GC	Used/ good – 09/2006	2.5
Purge & Trap Concentrator	Tekmar 3100 (for FID #9 – GRO)	New / excellent – 04/2004	4
Closed Loop Multi-sampler	OI 4552 Multi-sampler (FID#9)	Used/ good – 09/2000	7.5
GC Dual PID (BTEX 1&2)	HP 5890 Series II	Used/ good – 09/2000	8.5
Purge & Trap Concentrator	Tekmar 3000 (BTEX 1&2)	Used/ good – 09/2000	8.5
Closed Loop Multi-sampler	Varian Archon Sampler (BTEX 1&2)	Used/ good – 09/2000	8.5
GC Dual PID (BTEX 3&4)	HP 5890 Series II	Used / good – 02/2001	8
Closed Loop Multi-sampler	Varian Archon Sampler (BTEX 3&4)	New / excellent – 08/2001	7.5
Purge & Trap	Tekmar 3000	New / excellent – 02/2001	8
GC Dual ECD (ECD 1&2)	HP 5890 Series II, HP7673 Injector	Used / good – 02/2000	9
GC Dual ECD (ECD 3&4)	HP 5890 Series II, HP7673 Injector	Used / good – 07/2000	8.5
GC Dual ECD (ECD 5&6)	HP 5890 Series II, HP7673 Injector	Used / good – 07/2000	8.5
GC Dual ECD (ECD 7&8)	Agilent 6890N, dual micro ECDs, Agilent 7683B Injector	New / excellent – 05/2005	3.5
GC Dual ECD (ECD 9&10)	HP 5890 Series II, HP7673 Injector	Used / good – 05/2007	7
GC/MSD (VOA1)	HP5890 Series II with HP5972A MSD	Used / good – 12/1999	9
Closed Loop Multi-sampler	Varian Archon Multi-sampler (VOA1)	New / excellent – 02/2001	8
Purge & Trap Concentrator	HP Purge and Trap (VOA 1)	Used / good – 12/1999	9
GC/MSD II (VOA2)	Agilent 6890 GC with 5973A MSD	New / excellent – 07/2000	9
Closed Loop Multi-sampler	Varian Archon Multi-sampler (VOA2)	New / excellent – 07/2000	9
Purge & Trap Concentrator	Tekmar Dohrman Velocity (VOA2)	New / excellent – 04/2004	5
GC/MSD II (VOA3)	HP5890 Series II with HP5972A MSD	Used / good – 12/1999	9
Closed Loop Multi-sampler	Varian Archon Multi-sampler (VOA3)	New / excellent – 06/2002	6.5
Purge & Trap Concentrator	Tekmar Dohrmann 3100 (VOA3)	New / excellent – 06/2002	6.5
GC/MSD II (VOA4)	Agilent 6890 GC with 5973 Inert MSD	New / excellent – 04/2004	5
Closed Loop Multi-sampler	Varian Archon Multi-sampler (VOA4)	New / excellent – 04/2004	5
Purge & Trap Concentrator	Tekmar Dohrmann Velocity (VOA4)	New / excellent – 04/2004	5
GC/MSD II (VOA5)	Agilent 6890 GC with 5975 Inert MSD	New / excellent – 03/2005	4
Closed Loop Multi-sampler	Tekmar/Dohrmann SOLATek (VOA5)	New / excellent – 03/2005	4
Purge & Trap Concentrator	Tekmar Dohrmann Velocity (VOA5)	New / excellent – 03/2005	4
GC/MSD II (VOA5)	Agilent 6890 GC with 5975 Inert MSD	New / excellent – 02/2009	<1
Closed Loop Multi-sampler	Varian Archom (VOA5)	New / excellent – 02/2009	<1
Purge & Trap Concentrator	Tekmar Dohrmann Velocity (VOA5)	New / excellent – 02/2009	<1
GC/MSD II (SV2)	Agilent 6890 Plus with 5973 MSD	New / excellent – 07/2000	8.5
GC/MSD III (SV3)	Agilent 6890 Plus with 5973 MSD	New / excellent – 03/2002	7
GC/MSD IV (SV4)	Agilent 6890 Plus with 5973 MSD	New / excellent – 08/2004	4.5
GC/MSD V (SV5)	Agilent 6890 Plus with 5973 MSD	New / excellent – 06/2006	5.5
Soxtec Extraction Unit (1)	Model 2055 (Total Ext. Capacity = 6)	New / good – 6/2002	6.5
Soxtec Extraction Unit (2)	Model 2055 (Total Ext. Capacity = 6)	New / good – 7/2008	<1
HPLC – with UV and Fluorescence detectors	Agilent 1100 Series HPLC, with autosampler	New / excellent – 03/ 2002	7
UV/VIS	Shimadzu UV-2450	New / Excellent – 02/2006	3
Ion Chromatograph	Dionex ICS-3000	New / Excellent – 11/2006	3

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Table C.3 – Houston Lab Item Description	Manufacturer/Model	Condition / Year Installed	Approx. Age-Years
ICP/MS	Agilent 7500 Series ORC	New / excellent – 08/2003	5.5
ICP/MS	Agilent 7500 Series ORCE	New / excellent – 04/2005	4
ICP/MS	Agilent 7500 Series ORCE	New / excellent – 03/2007	3
Mercury Analyzer	CETAC Technologies M-6000A	New / excellent – 01/2000	9
TOC Analyzer (for waters)	OI 1010 TOC Analyzer &Autosampler	New / excellent – 02/2005	4
TOC Analyzer (for soils)	OI TOC Solids Analyzer	New / excellent – 07/2003	5.5
Cyanide Distillation	Environmental Express 10 position	New / excellent – 06/2002	6.5
Ammonia Distillation	Environmental Express 10 position	New / excellent – 06/2003	5.5
Vortex	Fisher Genie 2	New / excellent – 01/2002	7
Stirrer	Labline Multi Magnestir	New / excellent – 01/2000	9
Centrifuge (4)	IES	Used/good – 01/2000	9
Water Bath	Precision	Used/good – 01/2000	9
Nitrogen Evaporator	Organomation N-Evap	Used/good – 01/2001	8
Turbo Vap II (2 units)	Caliper Life Sciences, Turbo Vap II	New / excellent – 03/2006	3
3-D Shaker	Glass-col	New / excellent – 01/2002	7
Multi-tube Vortexer	VWR VX 2500	New / excellent – 01/2002	7
GPC	OI Analytical Autoprep 2000	New / excellent – 06/2002	6.5
Furnace	Thermodyne	New / excellent – 01/2002	7
Furnace	Thermodyne	New / excellent – 07/2008	<1
Sonicator Ultrasonic	Heat System XL	New / excellent – 01/2001	8
Ultrasonic Bath (3)	Branson 2200	Used / good – 12/1999	9
Hot Plate (2)	Corning PC 104	Used / good – 12/1999	9
Hot Block Digesters (2)	Environmental Express	New / excellent – 01/2000 & 07/2001	9 & 8
Hot Block Digesters (2)	Environmental Express	New / excellent – 04/2007	2
Analytical balances (6)	Mettler AE 200 (2), Mettler AE 163(2), Fisher A160, Cahn Micro-balance (1)	Used / good – 01/2000	9
Analytical balance	Ohaus ScoutPro 400g	New / Excelent – 11/2006	2
Analytical balance	Shimadzu UniBlock AUX220	New / Excellent – 02/2006	2
Specific Ion/pH Meter (2)	Fisher Accumet AR-50	New / excellent – 01/2000	9
Specific Ion/pH Meter	Fisher Accumet AR-50	New / excellent – 04/2008	<1
PH Meter	Mettler Toledo SevenEasy	New / Excellent – 11/2006	2
ZHE Extraction Units (9)	Environmental Express	New / excellent – 01/2002	6
Top Loading balance (1)	Mettler 4400	Used / good – 01/2000	8
Top Loading balance (1)	Denver Instruments APX-1502	New / excellent – 05/2003	5
Forced Air Oven	VWR FM 1390	Used / good – 12/1999	9
Drying Oven (2)	VWR Model 1326	New / excellent – 12/2005	3
Full Size Refrigerator/Freezer (3)	Labline Explosion Proof	Used / good – 12/1999	9
13' x 40' Walk-in Refrigerator	Thermo-Kool	New / excellent – 04/2007	2
8' x 10' Walk-in Refrigerator	NorLake	Used / good – 12/1999	9
8' x 10' Walk-in Freezer	NorLake	Used / good – 6/2002	6
Refrigerators (5)	Various	Used / good – 06/2001	8
Freezer (3)	Hussmann/Tappan	Used / good – 12/1999, 4/2002	9 & 7
ELIMS Database	e-LIMS	New / excellent – 7/2004	4
Computer Servers (4)	HP and Compaq	New / excellent – 12/1999	9
Computer Server (Target)	e-Lab Analytical, Inc.	New / excellent – 7/2005	4
SQL Server (eLIMS)	e-Lab Analytical, Inc.	New / excellent – 7/2005	4

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APPENDIX D – ALS Laboratory Group Standard Operating Procedures

SOP Number	Rev. Number	SOP Title – Houston Facility
		General
HS-GEN 001	07	Preparation / Management of Standard Operating Procedures
HS-GEN 002	07	Laboratory Ethics, Accountability and Responsibility
HS-GEN 003	06	Glassware Cleaning
HS-GEN 004	05	Client Confidentiality of Electronic Data Transfers
HS-GEN 005	05	Departures from Approved Procedures
HS-GEN 006	03	Resources Review
HS-GEN 007	04	Subcontract Sample Submittal
HS-GEN 008	04	QC Criteria Development Where No Regulatory Criteria Exist
		Administrative
HS-ADM 003	07	Work Order Reporting
HS-ADM 004	05	Complaint Resolution
		Quality Assurance
HS-QS 001	06	Chemical Purchase/Receipt; Chemical Prep., Storage & Tracking
HS-QS 002	04	Changing Analytical Results/Report Revision
HS-QS 003	06	Nonconformance Corrective Action Reporting
HS-QS 004	07	Control Charting
HS-QS 005	04	Validation of New Instrumentation and New Methods
HS-QS 006	04	Limit of Detection and Limit of Quantitation
HS-QS 007	06	Reagent Water
HS-QS 008	06	Container Sub-sampling - Metals, Inorganics, Semivolatile Organics
HS-QS 009	06	Data Reduction, Review and Validation
HS-QS 010	01	Container Sub-sampling-Volatile Organics, SW5035A
HS-QS 011	05	Records Archival
HS-QS 012	04	Internal Audits
HS-QS 013	05	Employee Training
HS-QS 014	06	Laboratory Records Control Procedures
HS-QS 015	01	Data Integrity System
HS-QS 016	05	Manual Integration Policy
HS-QS 017	02	Quality Assurance Management Review
HS-QS 018	03	Sporadic Marginal Exceedance
HS-QS 019	02	Estimation of Measurement Uncertainty
		Client Services - Sample Management- Safety
HS-SM 001	07	Sample Log-in Procedures
HS-SM 002	05	Bottle Orders
HS-SM 003	03	LIMS Login Procedures
HS-SAF 001	04	Waste Disposal Procedures
		Information Technology
HS-IT 001	04	LIMS Raw Data and Data Integrity

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SOP Number	Rev. Number	SOP Title – Houston Facility
HS-IT 002	03	Computer Software Installation and Maintenance
HS-IT 003	03	LIMS System Security
HS-IT 004	01	Electronic Data Archival and Storage
HS-IT 005	01	Electronic Time Changes
		Equipment
HS-EQ 001	07	Balance Calibration and Use
HS-EQ 002	08	Thermometer Calibration and Temperature Monitoring
HS-EQ 003	06	Lab Volumetric Ware Calibration
HS-EQ 004	05	Preventative Maintenance
		Metals Preparation and Analysis
HS-MET 001	08	Hot Block Metals Digestion - Solids Samples
HS-MET 002	06	Hot Block Metals Digestion - Aqueous Samples
HS-MET 003	07	ICP-MS Analysis – SW6020A – EPA 200.8
HS-MET 004	08	Mercury Analysis for Aqueous Samples – 7470A – EPA 245.2
HS-MET 005	08	Mercury Analysis for Solid Samples – 7471B
		General Chemistry
HS-WC 001	06	Alkalinity Forms by SM 2320B / E310.1
HS-WC 002	06	pH (Aqueous SW9040C – EPA150.1 / soils SW 9045D)
HS-WC 003	07	Total Suspended Solids, TSS- EPA 160.2
HS-WC 004	02	Analysis of Fluoride by ISE Method SM 4500 F B & C
HS-WC 005	03	Free Carbon Dioxide, SM 4500 CO2 D
HS-WC 006	06	Ortho Phosphorus, SM 4500 P / EPA 365.3
HS-WC 007	05	Analysis of Fluoride by ISE Method SW9214
HS-WC 008	06	Chrome VI Analysis, SW 7196A & SM3500-Cr B
HS-WC 009	05	Chrome VI – Preparation of Soils , SW 3060A
HS-WC 010	03	Ferrous Iron, SM 3500 Fe D
HS-WC 011	04	Specific Conductivity, EPA120.1 / SW9050A / SM2510 B
HS-WC 012	07	Total Dissolved Solids, TDS- SM 2540 C
HS-WC 013	06	Total, Fixed and Volatile Solids, Aqueous Samples- SM 2540 B & E
HS-WC 014	06	Percent Solids, Percent Moisture, Soils -
HS-WC 015	04	Total Phosphorus, EPA 365.3
HS-WC 016	03	Settleable Solids, SM 2540 F
HS-WC 017	04	Silica (SiO2), SM 4500 Si D
HS-WC 018	05	Sulfide, Iodometric Method, SM 4500 S^{-2} F
HS-WC 019	03	Sulfite, Iodometric Method, SM 4500 SO_3^{-2} B
HS-WC 020	05	Cyanide, Total SW9010/SW9014 / E335.3 / SM4500 CN C&E
HS-WC 021	04	Total Organic Carbon, Aqueous SM5310C / SW9060A
HS-WC 022	03	Total Organic Carbon, Soils - SW9060 Modified
HS-WC 023	02	Color, SM 2120B
HS-WC 025	03	Chemical Oxygen Demand, Hach 8000
HS-WC 026	03	Ammonia as N, SM 4500-NH3 B / F

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SOP Number	Rev. Number	SOP Title – Houston Facility
HS-WC 027	02	Ammonia as N, by ISE, SM 4500-NH3 B / D
HS-WC 028	03	Residual Chlorine - SM 4500 Cl F
HS-WC 029	03	Total Recoverable Phenols, EPA 420.4 – SW9065
HS-WC 030	01	Turbidity by Nephelometry
HS-WC 031		Nitrite as N, SM 4500-N02 B / EPA 354.1
HS-WC 032	02	Cyanide, Weak Acid Dissociable, SM 4500 CN – I
HS-WC 033	03	Total Kjeldahl Nitrogen, EPA 351.2 / SM 4500-NH3 D
HS-WC 036	03	Oil and Grease, SPE - EPA 1664
HS-WC 037	02	Flash Point by D93-02a / SW1010 Ignitability
HS-WC 040	02	TOC on Solids, Walkley-Black
HS-WC 041	01	Ignitability of Solids, SW1030
HS-WC 042	01	Paint Filter Liquids Test, SW9095B
HS-WS 043	01	Dissolved Qxygen SM4500-O G & EPA360.1
HS-BIO 003	02	BOD and CBOD (EPA 405.1 & SM5210 B)
HS-IC 001	06	Anions by Ion Chromatography, SW-9056A-EPA 300.0
HS-IC 002	02	Perchlorate by Ion Chromatography, EPA 314
		Leachate Preparation Methods
HS-LEACH 001	01	TCEQ 7 Day Leachate Procedure
HS-TCLP 001	06	Toxic Characteristic Leaching Procedure (TCLP) – ZHE
HS-TCLP 002	05	Toxic Characteristic Leaching Procedure (TCLP) – SV/ Metals
HS-SPLP 001	06	Synthetic Characteristic Leaching Procedure (SPLP) – ZHE
HS-SPLP 002	05	Synthetic Characteristic Leach. Procedure (SPLP) – SV/ Metals
		Organic Preparation Methods
HS-EXT 001	09	Separatory Funnel Extraction of Aqueous Samples
HS-EXT 002	09	Automated Soxhlet Extraction of Solids/Soils – SW3541
HS-EXT 003	05	Sep. Funnel Extraction – Herbicides from Waters, SW 8151A
HS-EXT 004	05	Sonication Extraction- Herbicides-Soils, SW8151A
HS-EXT 005	07	Extraction of TPH from Waters and Soil - TX1005
HS-EXT 006	04	Fractionation of TPH from Waters and Soil - TX1006
HS-EXT 008	04	LL Sonication Extraction – DRO - Soils - SW3550C
HS-EXT 009	04	LL Extraction of DRO From Waters - SW3510C
HS-EXT 011	03	GPC Cleanup - SW3640A
HS-EXT 013	02	Salting Out Extraction of Explosives from Waters by SW8330A
HS-EXT 014	03	Extraction of Explosives from Soils by SW8330A
HS-EXT 015	01	Extraction – Derivatization of Formaldehyde – Soils/Waters - SW8315A
HS-EXT 017	01	Massachusetts EPH, extraction – fractionation, water & soil
HS-EXT 020	01	HEM from soils by SW9071B
		GC / HPLC Methods
HS-BTEX 001	06	BTEX Analysis in Solid and Aqueous Samples – SW8021B
HS-GRO 001	03	GRO by Purge & Trap – Soils & Waters – GC/FID – SW8015C

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SOP Number	Rev. Number	SOP Title – Houston Facility
HS-GRO 002	01	Massachusetts VPH
HS-GCFID 001	07	TCEQ 1005 -Total Petroleum Hydrocarbons
HS-GCFID 003	05	Low Level DRO, ORO by GC/FID SW-8015C
HS-GCFID 005	03	Nonhalogenated Organics by Dir. Inj GCFID - 8015 Modified
HS-GCFID 006	03	Fractionation Analysis of TPH by TCEQ 1006
HS-GCFID 009	01	Massachusetts EPH
HS-GCFID 010	01	RSK-175, Headspace Analysis, Methane, Ethane, Ethene
HS-GCECD 001	07	Organochlorine Pesticides by GC/ECD – 8081B – EPA 608
HS-GCECD 002	08	Polychlorinated Biphenyls (PCBs) by GC/ECD – 8082A – EPA 608
HS-GCECD 003	06	Herbicides by GC/ECD - 8151A
HS-GCECD 004	03	EDB and DBCP by GC/ECD - 8011 / EPA 504.1
HS-HPLC 002	02	Acrylamide by SW 8316
HS-HPLC 003	03	Analysis of Explosives by SW8330A
HS-HPLC 004	01	Formaldehyde by SW8315A
		GC/MS Methods
HS-MSSV 001	09.1	Semivolatile Organic Compounds by GC/MS by 8270D – EPA 625
HS-MSSV 003	04	Low Level SV Organic Compounds by GC/MS - 8270D Modified
HS-MSV 001	09.1	Volatile Organics Compounds by GC/MS 8260C – EPA 624
		Miscellaneous SOP for State Specific Programs
HS-LaDNR 001	03	Sample Preparation
HS-LaDNR 002	03	Cation Exchange Capacity - Exchangeable Cations - ESP
HS-LaDNR 003	03	Saturated Paste - Saturation Point of Soils - LA DNR 29B
HS-LaDNR 004	02	True Total Barium - LA DNR 29B
HS-LaDNR 005	02	Leachate Test of Soil - LA DNR 29B
HS-LaDNR 006	02	Oil and Grease from 7 Day Leachate Test of Soil - LA DNR 29B
HS-LaDNR 007	01	Oil and Grease from Soil - LA DNR 29B
HS-LaDNR 008	01	LaDNR l:1 Aqueous Extract
HS-LaDNR 009	01	LaDNR Soil pH
HS-LaDNR 010	01	LaDNR Electrical Conductivity

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Table E.1.1 Calibration Summary & QC Procedures - Colorimetric Methods (SW 7196, etc), Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial multipoint calibration (minimum 5 standards and a blank).	initial calibration prior to sample analysis.	Correlation coefficient >0.995 for linear regression.	Correct problem then repeat initial calibration.
Second-source calibration check standard.	Once per initial calibration, prior to sample analysis.	Analyte within ±10% of expected value.	Correct problem then repeat initial calibration.
Calibration verification.	After every 15 samples and at the end of the analysis sequence.	The analyte within ±10% of expected value.	Correct problem then repeat ICAL or CCV and reanalyze all samples since last successful CCV.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Once per analyst.	QC acceptance criteria, Table G.1.1	Recalculate results; locate and fix system problem and rerun demonstration for analytes that did not meet criteria.
Method blank.	One per prep batch.	No analyte detected Above ½ LOQ. or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem then reprep and analyze method blank and all samples in the affected batch.
LCS for the analyte.	One LCS per prep batch.	QC acceptance criteria, Table G.1.1	Correct problem then reprep and analyze the LCS and all samples in the affected prep batch.
MS/MSD.	One MS/MSD per every 20 field samples per matrix.	QC acceptance criteria, Table G.1.1; RPD ≤ 20%	Describe in Laboratory Review Checklist.
LOD study.	Once per 12 month period.	LODs established shall be < 1/2 the LOQs in Table F.1	None.

Table E.1.2 Calibration Summary and QC Procedures for EPA Method 300.0 / SW9056A – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Minimum five-point initial calibration for all analytes.	Initial calibration prior to sample analysis.	Calibration factor or Linear least squares regression - r ≥ 0.995	Correct problem then repeat initial calibration.
Second-source (ICV) calibration verification, all analytes.	Once per five-point initial calibration.	All analytes within ± 10% of expected value.	Correct problem then repeat initial calibration.
Retention time window verified for each analyte.	Each initial calibration	Verify RT ± 3 times standard deviation for each analyte average retention time over 8 to 24 hr period after ICAL. CCVs must fall within the RT window	Correct problem then reanalyze all samples analyzed since the last retention time check.

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Table E.1.2 Calibration Summary and QC Procedures for EPA Method 300.0 / SW9056A – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Calibration verification (CCV and CCB)	CCV and CCB after every 10 injections and at the end of the analysis sequence.	All analytes within ± 10% of expected value for CCV; no analytes in CCB above 2-3 times the LOD.	Correct problem, repeat calibration verification and reanalyze all samples since last successful calibration verification.
Demonstration of ability to generate acceptable accuracy and precision using four replicate LCS.	Annually, Once per analyst.	LCS recovery ± 10% of expected value.	Recalculate results; locate and fix problem with system, then rerun demonstration for those analytes not meeting criteria.
Method blank.	One per analytical batch of 10 (E300.0) or 20 (SW9056A) or less.	No analytes detected above the LOQ or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem, and then re-analyze method blank and all samples processed with the contaminated blank.
LCS for all analytes.	One LCS per analytical batch of 10 (E300) or 20 (SW9056A) field samples.	Recovery ± 10% of expected value).	Correct problem, and then re-analyze the LCS and all samples in the affected analytical batch.
MS	One MS per every 10 (E300) or every 20 (SW9056A) field samples per matrix.	Advisory acceptance recovery ± 20% of expected value	Describe in Laboratory Review Checklist.
Duplicate or MSD	One duplicate (or MSD) per every 10 (E300) or every 20 (SW9056A) field samples per matrix.	RPD <20%	Describe in Laboratory Review Checklist.
LOD Study	Once per 12 month period	Detection limits established shall be ≤ ½ the LOQs	

Table E.1.3 Calibration Summary & QC Procedures - Ion Selective Electrode (e. g. SM 4500-NH3 D) Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Minimum five-point initial calibration for the ISE analyte.	Upon initial instrument set-up, major maintenance (e.g. new ISE probe installation) or each time a CCV fails to meet criteria.	Slope in range of 55 to 59 mV	Correct problem then repeat initial calibration.
Second-source (ICV) calibration verification, all analytes.	Once per initial calibration curve	All analytes within ± 10% of expected value.	Correct problem then repeat initial calibration.
Calibration verification (CCV and CCB)	CCV and CCB after every 10 injections and at the end of the analysis sequence.	All analytes within ± 10% of expected value for CCV; no analytes in CCB above the times the LOQ.	Correct problem, repeat CCV and reanalyze all affected samples since last successful CCV.

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Table E.1.3 Calibration Summary & QC Procedures - Ion Selective Electrode (e. g. SM 4500-NH3 D) Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Demonstration of ability to generate acceptable accuracy and precision using four replicate LCS.	Annually, Once per analyst.	LCS recovery ± 10% of expected value.	Recalculate results; locate and fix problem with system, then rerun demonstration for those analytes not meeting criteria.
Method blank.	One per analytical batch of 10 (E300.0) or 20 (SW9056A) or less.	No analytes detected above the LOQ or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem, and then re-analyze method blank and all samples processed with the contaminated blank.
LCS for all analytes.	One LCS per analytical batch of 10 (E300) or 20 (SW9056A) field samples.	Recovery ± 10% of expected value).	Correct problem, and then re-analyze the LCS and all samples in the affected analytical batch.
MS	One MS per every 10 (E300) or every 20 (SW9056A) field samples per matrix.	Advisory acceptance recovery ± 20% of expected value	Describe in Laboratory Review Checklist.
Duplicate or MSD	One duplicate (or MSD) per every 10 (E300) or every 20 (SW9056A) field samples per matrix.	RPD <20%	Describe in Laboratory Review Checklist.
LOD Study	Once per 12 month period	Detection limits established shall be ≤ ½ the LOQs	

Table E.2.1 - Summary of Calibration and QC Procedures for ICP/MS Methods SW6020A and 200.8 Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
MS tuning sample.	Prior to initial calibration	Tune requirements for both EPA 200.8 and SW6020A must be met (see §11.3 of SOP MET-003, current revision)	Retune instrument then reanalyze tuning solution.
Initial calibration (minimum 4 standards and a blank).	Daily initial calibration prior to sample analysis.	r > 0.998.	N/A.
Initial Calibration verification (second source).	Daily after initial calibration	All analytes within ±10% of expected value.	Correct problem and repeat initial calibration.
Low Level ICV (LLICV).	Daily, after ICV	All analytes should within ±30% of expected value.	Rinse system again , and repeat LLICV
Calibration blank (ICB and CCB).	Run the ICB after the ICV (Before analyzing samples) and run a CCB after each CCV, The CCV is run every 10 samples and at end of the analysis sequence.	Assess analytes detected >LOQ (or MQL).	If any >MQL, Correct problem then re-analyze the CCB and any affected previous samples having detections >MQL.

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Table E.2.1 - Summary of Calibration and QC Procedures for ICP/MS Methods SW6020A and 200.8 Houston Facility

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Calibration verification (Instrument Check Standard).	Before beginning a sample run, after every 10 samples and at the end of the analysis sequence.	All analyte(s) within ±10% of expected value.	Correct problem then repeat ICAL or CCV and reanalyze all samples since last successful CCV.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Once per analyst.	6020A: QC acceptance criteria, Recovery within 80-120% of expected results. 200.8: QC acceptance criteria, Recovery within 85-115% of expected results.	Recalculate results; locate and fix system problem and rerun demonstration for analytes that did not meet criteria.
Method blank.	One per preparation batch.	No analytes detected > ½ LOQ; for common lab contaminants (Ca, Na, Mg, Fe, Al, Zn) - ≥ LOQ ; or > 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem reprep and analyze method blank and all samples processed with the contaminated blank.
Interference check solutions (ICS-A and ICS-AB).	At the beginning and end of an analytical run or twice during a 12-hour period, whichever is more frequent.	ICS-A: All non-spiked analytes < ½ LOQ; within ±20% of true value. ICS-AB: Within ±20% of true value.	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all affected samples.
LCS for the analyte.	One LCS per prep batch.	6020A: QC acceptance criteria, Recovery within 80-120% of expected results. 200.8: QC acceptance criteria, Recovery within 85-115% of expected results.	Correct problem, reprep and analyze the LCS and all samples in affected prep batch.
Dilution test (6020A only).	Each preparatory batch.	1:4 dilution must agree within ±10% of the original determination for analytes present at concentrations > 50x concentration of the LOQ.	Perform post digestion spike addition for failed analytes.
Post digestion spike addition (6020A only).	When dilution test fails.	Recovery within 75-125% of expected results.	Dilute the sample; reanalyze post digestion spike addition.
MS/MSD	SW6020A:One MS/MSD per every 20 field samples per matrix; 200.8: One MS per every 10 field samples per matrix	SW6020A: QC advisory acceptance criteria, 75-1255% of expected results ; 200.8: QC advisory acceptance criteria, recovery within 70-130% of expected results	Describe in Laboratory Review Checklist.
Internal Standards (ISs).	Every sample.	For 6020A: See Table 21.3 – Sample IS intensity >70% of intensity of IS in the ICAL blank. For 200.8: Sample IS intensity within 60-125% of intensity of IS in the ICAL blank. CCBs and CCVs must meet 80-120%.	Perform corrective action as described in Method SW6020A, Section 8.3.

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Table E.2.1 - Summary of Calibration and QC Procedures for ICP/MS Methods SW6020A and 200.8 Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
LOD study.	MDL Study performed annually. Limits are checked quarterly through Detection Limit Check Study (DCS)	LODs established shall be ≤1/2 the LOQs in Table F.2.1	None.

Table E.2.2 - Calibration & QC Procedures – Mercury SW7470A/EPA 245.1 & SW7471B - Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial multipoint calibration (minimum 5 standards and a blank).	Daily initial calibration prior to sample analysis.	Correlation coefficient >0.995 for linear regression.	Correct problem then repeat initial calibration.
Instrument Performance Check (ICP = ICCV, for EPA 245.1 only)	Daily after initial calibration prior to sample analysis (same source as ICAL)	The analyte within ±5% of expected value (EPA 245.1 only).	Correct problem then repeat initial calibration.
Second-source Initial Calibration Verification standard.	Once per initial daily multipoint calibration.	Analyte within ±10% of expected value.	Correct problem then repeat initial calibration.
Calibration blank.	Once per initial daily multipoint calibration.	No analyte detected > ½ LOQ.	Correct problem then reanalyze calibration blank and all samples associated with blank.
Continuing Calibration verification (CCV).	After every 10 samples and at the end of the analysis sequence.	The analyte within ±10% of expected value.	Correct problem then repeat calibration and reanalyze all samples since last successful calibration.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Once per analyst.	QC acceptance criteria, within ±15% of expected value.	Recalculate results; locate and fix system problem and rerun demonstration for those analytes not meeting criteria.
Method blank.	One per prep batch of 20 or less.	No analytes detected > ½ LOQ or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank.
LCS for the analyte.	One LCS per prep batch of 20 or less.	QC acceptance criteria, within ±15% of expected value.	Correct problem then reprep and analyze the LCS and all samples in the affected prep batch.
MS/MSD.	One MS/MSD per every 20 project samples per matrix.	QC acceptance criteria, within ±15% of expected (7470A & 7471B); ,within ±30% of expected (for EPA 245.1)	Describe in Laboratory Review Checklist.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Initially once per analyst, then annually thereafter.	QC acceptance criteria, within ±15% of expected value.	Recalculate results; locate and fix system problem and rerun demonstration for analytes not meeting criteria.

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LOD (MDL) study.	Once per 12 month period.	LODs established shall be ≤1/2 LOQs in Table F.2.2	None.

Table E.3.1 - Calibration and QC Procedures for TPH by Method TX 1005 – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Five-point initial calibration for all analytes.	Initial calibration prior to sample analysis.	Linear – RSD for all analytes ß20% or Linear – least squares regression R > 0.995; or	Correct problem then repeat initial calibration.
Second-source calibration verification (ICV).	Once per five-point initial calibration.	All analytes within ≤25% of expected value.	Correct problem then repeat initial calibration.
Calibration verification (CCV).	Daily, before sample analysis, after every 20 samples and at the end of the analysis sequence.	All analytes within ≤25% of expected value.	Correct problem, repeat CCV or ICAL and reanalyze all samples since last successful CCV.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Once per analyst.	QC acceptance criteria, Table G.4.	Recalculate results; locate and fix system problem and rerun demonstration for analytes not meeting criteria.
Method blank.	One per prep batch.	No TPH detected ≥ LOQ or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank.
LCS	One LCS per prep batch, LCS includes all analytes.	QC acceptance criteria, Table G.4.	Correct problem, then re-prep and analyze the LCS and all samples in the affected prep batch.
Surrogate spike	Every sample, spiked sample, standard, and method blank.	QC acceptance criteria, Table G.4.	Method 8000C, Section 9.6 Requirements. Describe in Laboratory Review Checklist.
MS/MSD	One MS/MSD per every 20 samples per matrix.	QC acceptance criteria, Table G.4.	Describe in Laboratory Review Checklist.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Initially once per analyst, then annually thereafter.	QC acceptance criteria, Table G.5.	Recalculate results; locate and fix system problem and rerun demonstration for analytes not meeting criteria.
LOD study.	Once per 12 month period.	LODs established shall be ≤ 1/2 LOQs in Table F.3.	None.

Table E.3.2 - Calibration and QC Procedures for TPH & Misc. Analytes, Method 8015D – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Five-point initial calibration for all analytes.	Initial calibration prior to sample analysis.	Linear – RSD for all analytes ß20% or Linear – least squares regression R > 0.995; or	Correct problem then repeat initial calibration.

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Table E.3.2 - Calibration and QC Procedures for TPH & Misc. Analytes, Method 8015D – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Second-source calibration verification (ICV).	Once per five-point initial calibration.	All analytes within ≤20% of expected value.	Correct problem then repeat initial calibration.
Calibration verification (CCV).	Daily, before sample analysis, after every 20 samples and at the end of the analysis sequence.	All analytes within ≤20% of expected value.	Correct problem, repeat CCV or ICAL and reanalyze all samples since last successful CCV.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Once per analyst.	QC acceptance criteria, Table G.4.	Recalculate results; locate and fix system problem and rerun demonstration for analytes not meeting criteria.
Method blank.	One per prep batch.	No analytes detected ≥ LOQ for TPH or ≥ ½ LOQ for Misc. Analytes or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank.
LCS	One LCS per prep batch, LCS includes all analytes.	QC acceptance criteria, Table G.3.2	Correct problem, then re-prep and analyze the LCS and all samples in the affected prep batch.
Surrogate spike	Every sample, spiked sample, standard, and method blank.	QC acceptance criteria, Table G.3.2	Method 8000C, Section 9.6 Requirements. Describe in Laboratory Review Checklist.
MS/MSD	One MS/MSD per every 20 project samples per matrix.	QC acceptance criteria, Table G.3.2	Describe in Laboratory Review Checklist.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Initially once per analyst, then annually thereafter.	QC acceptance criteria, Table G.3.2	Recalculate results; locate and fix system problem and rerun demonstration for analytes not meeting criteria.
LOD study.	Once per 12 month period.	LODs established shall be ≤ 1/2 LOQs in Table F.3.	None.

Table E.4 - Calibration and QC Procedures for Method SW 8011 / EPA504.1 – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Minimum of five-points to generate initial calibration curve	Initial calibration prior to sample analysis.	Linear – mean RSD for all analytes(peaks) <20%; or Linear – least squares regression, r > 0.995; or Non-linear – COD >0.99 (6 points must be used for 2nd order).	Correct problem, then repeat initial calibration.
Second-source Calib. Verification (ICV)	Once per initial calibration.	Agree within ± 3**0** % of expected value (same as the LCS).	Correct problem then repeat initial calibration.

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Table E.4 - Calibration and QC Procedures for Method SW 8011 / EPA504.1 – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Calibration verification (CCV)	Daily, before sample analysis, after every 20 samples and at the end of the analysis sequence.	All analytes within ±30% of expected value.	Correct problem, then repeat CCV. If second CCV fails, repeat ICAL. Reanalyze all samples since last successful calibration verification.
Retention time window set +/- 0.07 minutes from the average RT.	Each initial calibration and calibration verifications.	RT windows are set at +/- 0.07 minutes from the ICAL mean RT. 72 hr RT Study after the ICAL must be within window. Absolute RTs are updated with each CCV to compensate for minor shifts in absolute RT.	Correct problem then reanalyze all samples analyzed since the last retention time check.
Method blank.	One per preparation batch.	No analytes detected >1/2 LOQ or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problems then re-prep and analyze method blank and all samples processed with the contaminated blank.
LCS	One LCS per preparation batch.	QC acceptance criteria, Table G.4.1 for 8011; Table G.4.2 for 504.1	Correct problem then re-extract and analyze the LCS and all samples in the affected analytical batch.
MS/MSD	One MS/MSD per every 20 project samples per matrix.	QC acceptance criteria, Table G.4.1 for 8011; Table G.4.3 for 504.1	Describe in Laboratory Review Checklist.
Second Column Confirmation	Every sample and QC sample, 100% for all positive results	Detected results 5X above the LOQ should differ no more than 40%.	Inspect chromatography for co-elutions and narrate as necessary when due to sample matrix.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Once per analyst.	QC acceptance criteria, Table G.4.1 for 8011; Table G.4.2 for 504.1	Recalculate results; locate and fix problem with system, then rerun demonstration for those analytes not meeting criteria.

Table E.5 Calibration and QC Procedures for BTEX by Method SW8021B / EPA 602 – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Five-point initial calibration for all analytes.	Initial calibration prior to sample analysis.	Linear – RSD for all analytes <20% or Linear – least squares regression r > 0.995; or Non-linear – COD > 0.990 (6 points shall be used for second order). [Note: use of grand mean not allowed.]	Correct problem then repeat initial calibration.
Second-source (ICV) calibration verification.	Once per five-point initial calibration.	All analytes within ±20% of expected value.	Correct problem then repeat initial calibration.

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Table E.5 Calibration and QC Procedures for BTEX by Method SW8021B / EPA 602 – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Calibration verification (CCV).	Daily, before sample analysis, after every 20 samples and at the end of the analysis sequence.	All analytes within ±20 of expected value	Correct problem then repeat ICAL or CCV and reanalyze all samples since last successful CCV.
Method blank.	One per prep batch.	No analytes detected < ½ LOQ or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank.
LCS	LCS for all analytes.	One LCS per prep batch, Table G.5.	Correct problem then reprep and analyze the LCS and all samples in the affected prep batch.
Surrogate spike	Every sample, spiked sample, standard, and method blank.	QC acceptance criteria, Table G.5.	Method 8000C, Section 9.6 Requirements. Describe in Lab Review Checklist.
MS/MSD	One MS/MSD per every 20 project samples per matrix.	QC acceptance criteria, Table G.5.	Describe in Laboratory Review Checklist.
Second-column confirmation.	100% for all positive results.	Same as for initial or primary column analysis.	Same as for initial or primary column analysis.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Initially once per analyst, then annually thereafter.	QC acceptance criteria, Table G.5.	Recalculate results; locate and fix system problem and rerun demonstration for analytes not meeting criteria.
LOD study.	Once per 12 month period.	Detection limits established shall be ≤1/2 LOQs in Table F.5.	None.

Table E.6 Summary of Calibration and QC Procedures for Method SW8081B – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Five-point initial calibration for all analytes.	Initial calibration prior to sample analysis.	Linear – avg. RSD for all analytes <20% RSD or Linear – least squares regression; r > 0.995; or Non-linear – COD >0.990 (6 or more points must be used for second order). [Note: grand mean not allowed.]	Correct problem then repeat initial calibration.
Second-source (ICV) calibration verification For all analytes.	Once per five-point initial calibration.	All analytes within ±15% of expected value.	Correct problem then repeat initial calibration.
Retention time window verified for each analyte.	Each initial calibration	Verify ± 3 times standard deviation for each analyte retention time from 72-hour study.	Correct problem then reanalyze all samples analyzed since the last retention time check.

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Table E.6 Summary of Calibration and QC Procedures for Method SW8081B – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Calibration verification (CCV).	Daily, before sample analysis , after every 20 samples and at the end of the analysis sequence.	All analytes within ±15% of expected value.	Correct problem then repeat CCV or ICAL and reanalyze all samples since last successful CCV.
Breakdown check (Endrin and DDT).	Daily prior to analysis of samples.	Degradation <15%.	Take corrective action prior to calibration. Repeat breakdown check.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Once per analyst.	QC acceptance criteria, Table G.6.	Recalculate results; locate and fix system problem and rerun demonstration for analytes not meeting criteria.
Method blank.	One per prep batch.	No analytes detected >1/2 LOQ or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank.
LCS for all analytes.	One LCS per prep batch.	QC acceptance criteria, Tables G.6, G.14.	Correct problem then reprep and analyze the LCS and all samples in the affected prep batch.
Surrogate spike.	Every sample, spiked sample, standard, and method blank.	QC acceptance criteria, Table G.6.	Method 8000C, Section 9.6 Requirements. Describe in Laboratory Review Checklist.
MS/MSD.	One MS/MSD per every 20 project samples per matrix.	QC acceptance criteria, Tables G.6	Describe in Laboratory Review Checklist.
Second-column confirmation (excluding Toxaphene & chlordane).	100% for all positive results.	Same as for initial or primary column analysis.	Same as for initial or primary column analysis.
LOD study.	Once per 12 month period.	LODs established shall be ≤ 1/2 LOQs in Table F.6.	None

Table E.7 - Summary of Calibration and QC Procedures – Method SW8082A – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Minimum five-point initial calibration (ICAL) for Aroclor 1016/1260 mix. Single point calibration for other Aroclors, for pattern recognition and calibration factor.	Initial calibration prior to sample analysis.	Calibration Factor – RSD for all analytes (peaks) <20% or Linear – least squares regression r > 0.995; or Non-linear regression – (COD) r^2 > 0.99 (6 points must be used for 2nd order). [Note: use of grand mean not allowed.]	Correct problem then repeat initial calibration.

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Table E.7 - Summary of Calibration and QC Procedures – Method SW8082A – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Second-source calibration verification (ICV) for PCB 1016/1260 mix.	Once per initial calibration .	Mix within ±15% of expected value.	Correct problem then repeat initial calibration.
Absolute RT position established for each analyte and surrogate	Set once with each ICAL and set at the beginning of each (12-hr) shift with CCV.	Position shall be set using the ICAL midpoint standard, or set with the value of CCV that is run at beginning of each (12-hr) shift.	N/A
RT window verification for each analyte and surrogate. RT window set +/- 0.07 minutes from the absolute RT for Aroclor 1016/1260 mix.	Each calibration verification (ICV and CCVs).	All analytes and surrogates in ICV & CCV must fall within the RT windows	Correct problem then reanalyze CCV and all samples analyzed since the last acceptable RT verification. If CCV fails RT verification again, redo ICAL & reset RT widow & position.
Calibration verification (CCV) for PCB 1016/1260 mix.	Daily, before sample analysis, after every 20 samples and at the end of the analysis sequence.	All analytes within ±15% of expected value.	Correct problem, repeat ICAL or CCV and reanalyze all affected samples since last successful CCV.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Once per analyst.	QC acceptance criteria, Table G.7.	Recalculate results; locate and fix system problem and rerun demonstration for analytes not meeting criteria.
Method blank.	One per prep batch.	No analytes detected >1/2 LOQ or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank.
LCS (1016/1260 mix).	One LCS per prep batch.	QC acceptance criteria, Tables G.7	Correct problem then reprep and analyze the LCS and all samples in affected prep batch.
Surrogate spike.	Every sample, spiked sample, standard, and method blank.	QC acceptance criteria, Table G.7.	Method 8000C, Section 9.6 Requirements. Describe in Laboratory Review Checklist.
MS/MSD (1016/1260 mix).	One MS/MSD per every 20 samples per matrix.	QC acceptance criteria, Tables G.7	Describe in Laboratory Review Checklist.
LOD study.	Once per 12 month period.	Detection limits established shall be $\leq$ 1/2 the LOQs in table F.7.	None.

Table E.8 Summary of Calibration and QC Procedures for Method SW8151A – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Five-point initial calibration (ICAL) for all analytes.	Initial calibration prior to sample analysis.	Linear – RSD for all analytes >20%D or Linear – least squares regression r > 0.995; or Non-linear – COD > 0.990 (6 points shall be used for second order, 7 points shall be used for third order). [Note: use of grand mean not allowed.]	Correct problem then repeat initial calibration.

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Table E.8 Summary of Calibration and QC Procedures for Method SW8151A – Houston Facility

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Second-source calibration verification (ICV).	Once per five-point initial calibration.	All analytes within ±20% of expected value.	Correct problem then repeat initial calibration.
Retention time (RT) window verified for each analyte.	Each initial calibration	Verify ± 3 times standard deviation for each analyte retention time from 72-hour study.	Correct problem then re-analyze all samples analyzed since the last RT check.
Calibration verification (CCV).	Daily, before sample analysis, after every 20 samples and at the end of the analysis sequence.	All analytes within ±20% of expected value.	Correct problem then repeat CCV (or ICAL) and reanalyze all samples since last successful CCV.
Method blank.	One per prep batch.	No analytes detected >1/2 LOQ or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank.
LCS for all analytes.	One LCS per prep batch.	QC acceptance criteria, Tables G.8	Correct problem then reprep and analyze the LCS and all samples in affected prep batch.
Surrogate spike.	Every sample, spiked sample, standard, and method blank.	QC acceptance criteria, Table G.8.	Method 8000C, Section 9.6 Requirements. Describe in Laboratory Review Checklist.
MS/MSD.	One MS/MSD per every 20 project samples per matrix.	QC acceptance criteria, Tables G.8.	Describe in Laboratory Review Checklist.
Second-column confirmation.	100% for all positive results.	Same as for initial or primary column analysis.	Same as for initial or primary column analysis.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Once per analyst.	QC acceptance criteria, Table G.8.	Recalculate results; locate and fix system problem and rerun demonstration for analytes not meeting criteria.
LOD study.	Once per 12 month period.	Detection limits established shall be ≤ 1/2 LOQs in Table F.8.	None.

Table E.9 Calibration and QC Procedures for Method SW8260C & EPA 624 – Houston Facility

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Minimally use five-point initial calibration (ICAL) for all analytes, use six points if second order curve fit to be used .	Initial calibration prior to sample analysis.	Average RRF : see Table in SOP; RSD for Target analytes <20%; or option below: Option 1 linear – least squares regression r > 0.995. Option 2 non-linear – r^2 > 0.99 (must use 6 points at minimum). [Note: grand mean not allowed.]	Correct problem then repeat initial calibration.

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Table E.9 Calibration and QC Procedures for Method SW8260C & EPA 624 – Houston Facility

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Second-source (ICV) calibration verification.	Once per five-point initial calibration.	8260C- Analytes within ±30% of expected value, poor purging VOCs ±40%. 624 – Analytes within ±20% of expected value, poor purging VOCs ±25% (Acrolein, Acrylonitrile, ketones)	Correct problem then repeat initial calibration.
Relative Retention Time evaluated for each analyte in ICAL.	Each ICAL standard	Relative retention time (RRT) of the analyte within ± 0.06 RRT units of the RRT of the ICAL midpoint.	Correct problem then re-run ICAL.
Calibration verification (CCV).	Daily, before sample analysis and every 12 hours of analysis time for 80260C.	8260C – CCV min RRF- Table in SOP; RSDs : < 20% Diff. (when using RFs) or drift (when using linear 1st order or non-linear 2nd order fit). 624 – All analytes within ±20 % D (or ±20 %Drift).	Correct problem then repeat ICAL
Calibration verification (CCV) Internal Standards.	With every calibration verification	Retention time ±30 seconds from retention time of the mid-point std. In the ICAL. EICP area within –50% to +100% of ICAL mid-point std.	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.
Internal Standards – samples and QC samples.	All samples and QC samples except the CCV	Retention time ±30 seconds from retention time of the CCV. EICP area within –50% to +100% of CCV.	Reanalyze sample to confirm IS failure due to matrix, and describe in lab review checklist.
Demonstrate ability to generate acceptable accuracy and precision using four LCS analyses.	Once per analyst.	QC acceptance criteria, Table G.9.	Recalculate results; locate and fix system problem and rerun demonstration for those analytes not meeting criteria.
Method blank.	One per preparation batch.	No analytes detected >½ LOQ; no common lab contaminants detected >LOQ or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem, then re-analyze method blank and all samples processed with contaminated blank.
LCS for all analytes.	One LCS per preparation batch.	QC acceptance criteria, Table G.9 and G.14	Correct problem, then re-analyze the LCS and all samples in the affected batch.
MS/MSD.	One MS/MSD per every 20 project samples per matrix.	QC acceptance criteria for % Recovery - Table G.9; 20% RPD limit for waters; 30% PRD Limit for Soils	Describe in Laboratory Review Checklist.
Check of mass spectral ion intensities using BFB	Prior to ICAL and each 12hr CCV	Refer to criteria listed in the method description	Retune instrument and verify.
Surrogate spike.	Every sample, spiked sample, standard, and method blank.	QC acceptance criteria, Table G.9.	Method 8000C, Section 9.6 Requirements. Describe in Lab Review Checklist.

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Table E.9 Calibration and QC Procedures for Method SW8260C & EPA 624 – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
MDL study.	Once per 12 month period.	Detection limits established shall be < 1/2 the LOQs in Table F.9	None.

Table E.10 - Calibration and QC Procedures for Method SW8270D & EPA 625 - Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Check of mass spectral ion intensities using DFTPP.	Prior to Init. Calib. And 12hr Cont. Calibration verification (CCV).	Refer to criteria listed in the method description	Retune instrument and verify.
Minimum Five-point initial calibration for all analytes; use six points if second order curve fit is used.	Initial calibration prior to sample analysis.	Evaluate for best curve fit model, Avg Response Factors (avg RF) and each level RF should meet min RF requirements in SOP and %RSDs for each: ≤20% or one option below: linear curve fit, r > 0.995; or when non-linear (quadratic) where r^2 > 0.990 and 6 points shall be used (2nd order). [Note: use of grand mean not allowed.]	Correct problem then repeat initial calibration.
Second-source (ICV) calibration verification.	Once per each initial calibration curve.	Analytes within ±30% of expected value.	Correct problem then rerun ICV. If ICV fails again, correct problem and repeat initial calibration.
Continuing Calibration Verification (CCV).	Daily, before sample analysis and every 12 hours of analysis time.	CCV RF should meet RF requirements in Table in SOP All compounds should meet ≤ 20% difference (if using RFs) or ≤ 20% drift (if using linear or non-linear calibration).	Correct problem then rerun CCV. If CCV fails again, repeat initial calibration.
CCV Internal Standards.	Immediately after or during data acquisition of calibration check standard (CCV).	Retention time ±30 seconds from RT of the mid-point standard in the ICAL. EICP area within –50% to +100% of ICAL mid-point standard.	Check mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system malfunctioned.
Internal Standards – samples and QC samples.	All samples and QC samples except the CCV	Retention time ±30 seconds from retention time of the daily CCV standard. EICP area within –50% to +100% of the daily CCV.	Reanalyze sample to confirm IS failure due to matrix, and describe in lab review checklist.
Method blank.	One per preparation batch.	No analytes detected ≥ ½ MQL; no common lab contaminants (e.g. phthalates) detected ¹ MQL or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem, then re-analyze method blank and all samples processed with the contaminated blank.

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Table E.10 - Calibration and QC Procedures for Method SW8270D & EPA 625 - Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
LCS for all analytes.	One LCS per preparation batch.	QC acceptance criteria, Table G.10 & G.14 for 8270 ; Table G.11 & G.14 for 625	Correct problem, then re-analyze the LCS and all samples in the affected preparation batch.
MS/MSD.	One MS/MSD per every 20 project samples per matrix.	QC advisory criteria, Table G.10 for 8270D Table G.11 for 625	Describe in Laboratory Review Checklist. For matrix evaluation. If MS results are outside LCS limits, evaluate if source of difference is due to matrix effect or lab error.
Surrogate spike.	All field samples and QC samples.	QC acceptance criteria, Table G.10 for 8270D Table G.11 for 625	Method 8000C, Section 9.6 Requirements. Describe in Laboratory Review Checklist.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS analyses.	Once per analyst.	QC acceptance criteria, Table G.10 for 8270D and Table G.11 for 625	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria.
MDL/LOD study.	MDL once annually.	Detection limits established should ≤ 1/3 the LOQ in Table F.10 for 8270D and Table F.11 for EPA 625	None.

Table E.11 - Summary of Calibration and QC Procedures for Method EPA 608			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Five-point initial calibrations for pesticides and separate PCB 1016/1260 mix.	Initial calibration prior to sample analysis.	Calibration Factors – mean RSD for all analytes <10% or Linear – least squares regression R > 0.995.	Correct problem then repeat initial calibration.
Second-source calibration verification for pesticides and PCB 1016/1260 mix.	Once per five-point initial calibration.	Mix within ±15% of expected value.	Correct problem then repeat initial calibration.
Calibration verification (CCV) for pesticides and PCB 1016/1260 mix.	After every 20 samples and at the end of the analysis sequence.	All analytes within ±15% of expected value.	Correct problem then repeat CCV (or ICAL) and reanalyze all samples since last successful CCV.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Once per analyst.	QC acceptance criteria, Tables G.6 & G7.	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria.
Method blank.	One per prep batch.	No analytes detected > ½ LOQ or .> 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank.

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Table E.11 - Summary of Calibration and QC Procedures for Method EPA 608			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
LCS (for pesticides and separate 1016/1260 mix).	One LCS per prep batch.	QC acceptance criteria, Table G.6 & G 7	Correct problem then reprep and analyze the LCS and all samples in the affected prep batch.
Surrogate spike.	Every sample, spiked sample, standard, and method blank.	QC acceptance criteria, Table G. 6 & G.7	Confirm failure if necessary. If chromatography indicates matrix cause, re-analysis may not be necessary. Describe in Lab Data Review Checklist.
MS/MSD (1016/1260 mix).	One MS/MSD per every 20 project samples per matrix.	QC acceptance criteria, Table G.6 & G.7	Describe in Laboratory Review Checklist.
LOD.MDL study.	Once per 12 month period.	Detection limits established shall be ≤ 1/2 LOQs in table F.6 & F.7.	None.

Table E.12- Calibration and QC Procedures for Explosives SW8330A – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Five-point initial calibration for all analytes.	Initial calibration prior to sample analysis.	Linear – mean RSD for all analytes <20%; or Linear – 1sf order fit, R > 0.995; or Non-linear – COD > 0.99 (6 points required for 2nd order).	Correct problem then repeat initial calibration.
Second-source calibration verification (ICV)	Once per five-point initial calibration.	All analytes within ±25% of expected value (±30% for Tetryl).	Correct problem then repeat initial calibration.
Continuing Calibration verification (CCV).	After every 20 samples and at the end of the analysis sequence.	All analytes within ±20% of expected value.	Correct problem then repeat CCV (or ICAL) and reanalyze all samples since last successful CCV.
Retention Time (RT) Window verification	At instrument setup and after major maintenance (e.g. column change)	Verify RT widow with 72 hour study (use CCV data from three days)	N/A
Method blank.	One per preparation batch.	No analytes detected > ½ MQL or > 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem, then re-prepare and analyze method blank and all samples processed with the contaminated blank.
LCS	LCS for all analytes. One LCS per preparation batch.	QC acceptance criteria, Table G.12. LCSD RPD < 30%	Correct problem, then re-prepare and analyze LCS and all samples processed with the LCS.
MS/MSD	One MS/MSD per preparation batch (20 or less samples per matrix).	QC acceptance criteria, Table G.12. MS/MSD RPD <50% for waters and soils.	Describe in Laboratory Review Checklist.

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Table E.12- Calibration and QC Procedures for Explosives SW8330A – Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Detection 2nd Column Confirmations	Each detection	Results agree within 40 %.	Evaluate any > 40 % for co-elutions
Analyst demonstrate ability to generate acceptable accuracy / precision - four LCS.	Once per analyst.	QC acceptance criteria, Table G.12	Recalculate results; locate and fix problem with system and then rerun demonstration.
LOD/MDL study.	Once per 12 month period.	MDLs established shall be < 1/3 the LOQ in Tables F.12	None.

Table E.13.1 Calibration and QC Procedures for SW 8315A & SW8316 - Houston Facility			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Five-point initial calibration for all analytes.	Initial calibration prior to sample analysis.	CF – mean RSD for all analytes <20%; or Linear – 1sf ordert, R > 0.995; or Non-linear – COD > 0.99 (6 points required for 2nd order).	Correct problem then repeat initial calibration.
Second-source calibration verification (ICV)	Once per five-point initial calibration.	All analytes within ±20% of expected value.	Correct problem then repeat initial calibration.
Continuing Calibration verification (CCV).	After every 20 samples and at the end of the analysis sequence.	All analytes within ±20% of expected value.	Correct problem then repeat CCV (or ICAL) and reanalyze all samples since last successful CCV.
Retention Time (RT) Window verification	At instrument setup and after major maintenance (e.g. column change)	Verify RT widow with 72 hour study (use CCV data from three days)	N/A
Method blank.	One per preparation batch.	No analytes detected > ½ MQL or > 5% of regulatory limit or >5% of target analyte detected in a sample.	Correct problem, then re-prepare and analyze method blank and all samples processed with the contaminated blank.
LCS	LCS for all analytes. One LCS per preparation batch.	QC acceptance criteria, Table G.13. LCSD RPD < 20% (waters) LCSD RPD < 30% (soil)	Correct problem, then re-prepare and analyze LCS and all samples processed with the LCS.
MS/MSD	One MS/MSD per preparation batch (20 or less samples per matrix).	QC acceptance criteria, Table G.13. MS/MSD/RPD	Describe in Laboratory Review Checklist.
Analyst demonstrate ability to generate acceptable accuracy / precision - four LCS.	Once per analyst.	QC acceptance criteria, Table G.13	Recalculate results; locate and fix problem with system and then rerun demonstration.

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Table E14 - Summary of Calibration and QC Procedures for RSK – 175			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Minimum of five-points for initial calibration for all analytes.	Initial calibration (ICAL) prior to sample analysis.	Linear – mean RSD for all analytes <25%; or Linear – least squares regression, R > 0.995; or Non-linear – COD > 0.99 (6 points shall be used for second order).	Correct problem then repeat initial calibration.
Second-source (ICV) calibration verification.	Once per each initial calibration curve.	All analytes within ±25% of expected value.	Correct problem then repeat initial calibration.
Calibration verification.	Daily, before sample analysis, after every 20 samples and at the end of the analysis sequence.	All analytes within ±25% of expected value.	Correct problem, then repeat ICAL verification and reanalyze all samples since last successful calibration verification.
Method blank.	One per preparation batch.	Any analytes detected must be < 1/2 LOQ.	Correct problem, then re-prepare and analyze method blank and all affected samples processed with the contaminated blank.
LCS/LCSD	LCS for all analytes, one LCS per preparation batch.	Recovery: ±25% of expected value; LCSD RPD <30%.	Correct problem then re-analyze the LCS and all samples in the affected batch.
MS/MSD	One MS/MSD per every 20 project samples.	Recovery: ±30% of expected value; MSD RPD <30%.	Describe in Laboratory Review Checklist.
Duplicate (for sample, or as MSD, or as LCSD).	One duplicate per every 20-project samples.	Duplicate RPD <30%.	Describe in Laboratory Review Checklist.
Analyst demonstrate ability to generate acceptable accuracy and precision using four replicate LCS.	Once per analyst initially and annually thereafter.	QC acceptance criteria for LCS Recovery : ±25%, RPD <30%.	Recalculate results; locate and fix problem with system and then rerun demonstration and meet criteria.

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Table F.1 - Wet Chemistry LODs and LOQs – Houston Facility					
Analyte / method- water matrix * NELAC accredited	LOD mg/L	LOQ mg/L	Analyte / method– solid/soil matrix * NELAC accredited	LOD mg/Kg	LOQ mg/Kg
pH / E150.1*/ SW9040C * (standard units)	-	± 0.05	pH / SW9045D * (standard units)	-	± 0.05
pH SM4500H+ B * (standard units)	-	± 0.05			
Specific Conductance (umhos/cm) / EPA 120.0 / SW 9050A*	1.0	1.0	Specific Conductance / 120.0 / 9050*	0.5	1.0
Total Dissolved Solids EPA160.2* /SM2540C*	5	10			
Total Suspended Solids - EPA 160.1*/ SM 2540D*	2	2			
Total Solids – EPA 160.3* / SM2540B*	5	10			
Volatile Solids - SM 2540 G	5	10			
Percent Moisture (as % weight)	-	0.01	Percent Moisture (as % Weight)	-	0.01
Total Alkalinity / SM 2320B / EPA 310.1*	2	5			
Ammonia as N – SM4500 NH3-B-F*	0.008	0.025			
Ammonia as N – SM4500 NH3-D */ E350.3*	0.2	0.2	Ammonia as N – SM4500 NH3-D	10	10
Fluoride – SM4500 F B & C / EPA 340.2	0.1	0.1			
Fluoride – SW 9214 *	0.1	0.1			
Chrome VI by SW 7196* / SM3500 Cr B	0.004	0.01	Chrome VI by SW 7196* / SW3060A (prep)	0.7	2
Ferrous Iron by SM 3500-Fe D	0.02	0.05			
Chloride by EPA 300 */ SW9056A*	0.01	0.5	Chloride by EPA 300* / SW9056A*	0.1	5
Fluoride by EPA 300* / SW9056A*	0.01	0.1	Fluoride by EPA 300 */ SW9056A*	0.1	1
Sulfate by EPA 300* / SW9056A*	0.01	0.5	Sulfate by EPA 300* / SW9056A*	0.1	5
o-Phosphorous (P) by EPA 300* / SW9056A*	0.03	0.1	o-Phosphorous (P) - EPA300*/SW9056A*	0.3	1
Nitrate as N - E300 */ SW9056A*	0.03	0.1	Nitrate as N - E300* / SW9056A*	0.3	1
Nitrite as N – E300* / SW9056A*	0.03	0.1	Nitrite as N – E300* / SW9056A*	0.3	1
Bromide – E300* / SW9056A*	0.03	0.1	Bromide – E300* / SW9056A*	0.3	1
Nitrite as N - SM4500-NO2 B * / E354.1*	0.003	0.01			
Total Kjeldahl Nitrogen, E351.2 / SM4500 NH3 D	1.0	1.0			
o-Phosphorous (as P) E365.3* / SM4500 P *	0.006	0.025			
Total Phosphorous (as P) E365.3* / SM4500 P*	0.02	0.05			
Total Cyanide – SW 9010C / 9014 * / E335.3*	0.004	0.02	Total Cyanide - SW9010C / 9014*	0.6	2.0
Total Cyanide – SM 4500 CN C* & E *	0.004	0.02			
Cyanide, Weak Acid Dissociable– SM4500CN I	0.005	0.02			
Sulfide by SM4500-S^{2-} F * / EPA 376.1*	0.5	1			
Sulfite by SM4500-$S0_3^{2-}$ B * (Iodometric)	1.2	5			
Total Organic Carbon – SM5310C / E415.1* / SW 9060A*	0.1	0.5	Total Organic Carbon – 9060A Mod * (as %Wt - dry)	0.02 %	0.06 %
			Total Organic Carbon –Walkley-Black * (as %Wt - dry)	0.02 %	0.02 %
Chemical Oxygen Demand – Hach 8000 *	4	15			
BOD, 5-day – SM 5210 B* / E405.1 *	2	2			
Carbonaceous BOD – SM 5210 B * / E405.1	2	2			
Phenolics, Total Recoverable – E420.1* / SW9065*	0.02	0.05	Phenolics, Total Recoverable – SW9065*	1	2.5
Oil and Grease, 1664 *	0.6	2	O & G (HEM), SW9071B	33	33

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Table F.1 - Wet Chemistry LODs and LOQs – Houston Facility					
Analyte / method- water matrix * NELAC accredited	LOD mg/L	LOQ mg/L	Analyte / method– solid/soil matrix * NELAC accredited	LOD mg/Kg	LOQ mg/Kg
Chlorine, Total Residual - SSM4500CL F *	0.1	0.1			
Hardness (As CaCO3) SM2340 B *	2	2	True Total Barium (LaDNR)	50	50
Silica, Dissolved (as SiO2) - SM4500-SiD *	0.02	0.1			
Color, Pt-Co units - SM2120B / EPA 110.2	5	5			
Turbidity – EPA 180.1	0.1	0.1			

Table F.2.1 - Metals by ICP/MS – SW 6020A – EPA 200.8 - Houston Facility LODs and LOQs - Houston Facility							
Analyte – Water Matrix * NELAC accredited	Isotope	LOD µg/L	LOQ µg/L	Analyte - Soil Matrix * NELAC accredited	Isotope	LOD mg/Kg	MQL mg/Kg
Aluminum*	27	3.7	10	Aluminum*	27	0.2	1
Antimony*	121	0.5	5	Antimony*	121	0.25	0.5
Arsenic*	75	0.9	5	Arsenic*	75	0.06	0.5
Barium*	135	0.7	5	Barium*	135	0.08	0.5
Beryllium*	9	0.3	2	Beryllium*	9	0.05	0.5
Boron*	11	15	20	Boron*	11	1.5	2.5
Cadmium*	111	0.6	2	Cadmium*	111	0.04	0.5
Calcium*	44	50	500	Calcium*	44	10	50
Chromium*	53	0.6	5	Chromium*	53	0.05	0.5
Cobalt*	59	0.5	5	Cobalt*	59	0.17	0.5
Copper*	65	0.5	5	Copper*	65	0.14	0.5
Iron*	56	36	200	Iron*	56	4	50
Potassium*	39	100	500	Potassium*	39	3.6	50
Lead*	207	0.4	5	Lead*	207	0.05	0.5
Magnesium*	24	39	500	Magnesium*	24	3.3	50
Manganese*	55	0.8	5	Manganese*	55	0.07	0.5
Molybdenum*	95	0.6	5	Molybdenum*	95	0.05	0.5
Sodium*	23	100	200	Sodium*	23	4	50
Nickel*	60	1.4	5	Nickel*	60	0.06	0.5
Selenium*	82	2.5	5	Selenium*	82	0.25	0.5
Tin*	118	0.6	5	Tin*	118	0.14	1.0
Strontium*	88	0.5	5	Strontium*	88	0.06	0.5
Silver*	109	0.7	5	Silver*	109	0.04	0.5
Titanium*	47	1.2	5	Titanium*	47	0.13	1.0
Thallium*	203	0.8	2	Thallium*	203	0.07	0.5
Vanadium*	51	0.7	5	Vanadium*	51	0.07	0.5
Zinc*	66	2.5	5	Zinc*	66	0.25	0.5

Table F.2.2 - Mercury by Cold Vapor - LODs and LOQs - Houston Facility					
Analyte / method- water matrix * NELAC accredited EPA 254.1 – SW7470A	LOD µg/L	LOQ µg/L	Analyte / method– solid/soil matrix * NELAC accredited SW7471B	LOD µg/Kg	LOQ µg/Kg
Mercury, Total*	0.042	0.2	Mercury, Total*	1.4	13.3

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Table F.3.1 - TPH Methods - Current LODs and LOQs - Houston Facility					
Analyte – water matrix * NELAC accredited	LOD mg/L	LOQ mg/L	Analyte - solid/soil matrix * NELAC accredited	LOD mg/Kg	LOQ mg/Kg
Total Petroleum Hydrocarbon / TX 1005 *	0.2	0.5	Total Petroleum Hydrocarbon / TX 1005*	16	50
nC6-nC12 / TX 1005 *	0.2	0.5	nC6-nC12 / TX 1005 *	16	50
>nC12 to nC28 / TX 1005*	0.2	0.5	>nC12 to nC28 / TX 1005*	16	50
>nC28 to nC35 / TX 1005*	0.2	0.5	>nC28 to nC35 / TX 1005*	16	50
TX 1006 – Fractionated Hydrocarbons	-	-	TX 1006 - Fractionated Hydrocarbons	-	-
Aliphatics nC6 / TX 1006	-	1	Aliphatics nC6	-	10
Aliphatics >nC6 to nC8	-	1	Aliphatics >nC6 to nC8	-	10
Aliphatics >nC8 to nC10	-	1	Aliphatics >nC8 to nC10	-	10
Aliphatics >nC10 to nC12	-	1	Aliphatics >nC10 to nC12	-	10
Aliphatics >nC12 to nC16	-	1	Aliphatics >nC12 to nC16	-	10
Aliphatics >nC16 to nC21	-	1	Aliphatics >nC16 to nC21	-	10
Aliphatics >nC21 to nC35	-	1	Aliphatics >nC21 to nC35	-	10
Total Aliphatic Fraction	-	5	Total Aliphatic Fraction	-	50
Aromatics >nC7 to nC8	-	1	Aromatics >nC7 to nC8	-	10
Aromatics >nC8 to nC10	-	1	Aromatics >nC8 to nC10	-	10
Aromatics >nC10 to nC12	-	1	Aromatics >nC10 to nC12	-	10
Aromatics >nC12 to nC16	-	1	Aromatics >nC12 to nC16	-	10
Aromatics >nC16 to nC21	-	1	Aromatics >nC16 to nC21	-	10
Aromatics >nC21 to nC35	-	1	Aromatics >nC21 to nC35	-	10
Total Aromatic Fraction	-	5	Total Aromatic Fraction	-	50
8015C– Gasoline Range (P&T - C6-C10)*	0.02	0.05	8015C Gasoline Range (P &T C6-C10)*	0.02	0.05
8015C_ Diesel Range (>C10-C28)*	0.02	0.05	8015C - Diesel Range (>C10-C28)*	0.5	1.7
8015C – Oil Range (>C28)	0.02	0.1	8015C - Oil Range (>C28)	0.5	3.4

Table F.3.2 - Non-halogenated Organics by 8015D - LODs and LOQs - Houston Facility					
Analyte – water matrix * NELAC accredited	LOD mg/L	LOQ mg/L	Analyte - solid/soil matrix * NELAC accredited	LOD mg/Kg	LOQ mg/Kg
Ethylene Glycol*	1	1	Ethylene Glycol*	1	1
1-Propanol *	1	1	1-Propanol *	1	1
2-Propanol *	1	1	2-Propanol *	1	1
Isobutanol *	1	1	Isobutanol *	1	1
Propylene glycol *	10	10	Propylene glycol *	10	10
Ethanol *	1	1	Ethanol *	1	1
Methanol*	1	1	Methanol*	1	1

Table F.3.3 - Dissolved Gases by RSK-175 ***** - LODs and LOQs - Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - water matrix * NELAC accredited	LOD µg/L	LOQ µg/L
Ethane *	0.2	1	Ethene *	0.2	1
Methane *	0.1	0.5	Isobutane*	1	1
Propane*	1	1	n-Butane*	1	1

Table F.4 - SW8011* – EPA 504.1 LODs and LOQs – Houston Facility					
Analyte – water matrix	LOD	LOQ	Analyte – water matrix	LOD	LOQ
* NELAC accredited	µg/L	µg/L	* NELAC accredited	µg/L	µg/L
1,2-Dibromoethane (EDB)*	0.01	0.02	1,2,3-Trichloropropane (1,2,3-TCP)*	0.01	0.02

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Table F.4 - SW8011* – EPA 504.1 LODs and LOQs – Houston Facility					
Analyte – water matrix	LOD	LOQ	Analyte – water matrix	LOD	LOQ
* NELAC accredited	µg/L	µg/L	* NELAC accredited	µg/L	µg/L
1,2-Dibromo-3-chloropropane (DBCP)*	0.01	0.02			

Table F.5 - BTEX by 8021 - LODs and LOQs - Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg
Benzene*	0.2	1	Benzene*	0.2	1
Ethylbenzene *	0.3	1	Ethylbenzene*	0.3	1
Toluene*	0.4	1	Toluene*	0.4	1
m,p-Xylene*	0.5	2	m,p-Xylene*	0.7	2
p-Xylene*	0.5	1	o-Xylene*	0.7	1
Xylenes, Total*	0.5	3	Xylenes, Total*	0.7	3
Methyl tert-butyl ether*	1.3	5	Methyl tert-butyl ether*	1.3	5

Table F.6 - SW 8081B LODs and LOQs – Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg
4,4'-DDD*	0.01	0.1	4,4'-DDD*	0.5	3.3
4,4'-DDE*	0.01	0.1	4,4'-DDE*	0.5	3.3
4,4'-DDT*	0.01	0.1	4,4'-DDT*	0.5	3.3
Aldrin*	0.01	0.05	Aldrin *	0.3	1.7
Alpha-BHC*	0.01	0.05	Alpha-BHC*	0.3	1.7
Beta-BHC*	0.01	0.05	Beta-BHC*	0.3	1.7
Delta-BHC*	0.01	0.05	Delta-BHC*	0.2	1.7
Chlordane, Technical*	0.12	0.5	Chlordane, Technical*	1.2	17
Alpha-Chlordane *	0.01	0.05	Alpha-Chlordane*	0.2	1.7
Gamma-Chlordane*	0.01	0.05	Gamma-Chlordane*	0.2	1.7
Dieldrin*	0.01	0.1	Dieldrin*	0.5	3.3
Endosulfan I*	0.01	0.05	Endosulfan I*	0.3	1.7
Endosulfan II*	0.01	0.1	Endosulfan II*	0.6	3.3
Endosulfan sulfate*	0.01	0.1	Endosulfan sulfate*	0.6	3.3
Endrin*	0.01	0.1	Endrin*	0.6	3.3
Endrin aldehyde*	0.01	0.1	Endrin aldehyde*	0.6	3.3
Endrin ketone*	0.01	0.1	Endrin ketone*	0.6	3.3
Gamma-BHC (Lindane)*	0.01	0.05	gamma-BHC (Lindane)*	0.2	1.7
Heptachlor*	0.01	0.05	Heptachlor *	0.3	1.7
Heptachlor epoxide*	0.01	0.05	Heptachlor epoxide*	0.3	1.7
Methoxychlor*	0.09	0.5	Methoxychlor*	3.4	17
Toxaphene*	0.13	0.5	Toxaphene*	3.8	17
Hexachlorobenzene *	0.01	0.05	Hexachlorobenzene	0.2	1.7
Mirex *	0.012	0.05	Mirex *	0.2	1.7

Table F.7 - SW 8082A - PCBs - LODs and LOQs - Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg

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Table F.7 - SW 8082A - PCBs - LODs and LOQs - Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg
Aroclor 1016*	0.2	0.5	Aroclor 1016*	2.4	17
Aroclor 1221*	0.2	0.5	Aroclor 1221*	2.4	17
Aroclor 1232*	0.2	0.5	Aroclor 1232*	2.4	17
Aroclor 1242*	0.2	0.5	Aroclor 1242*	2.4	17
Aroclor 1248*	0.2	0.5	Aroclor 1248*	2.4	17
Aroclor 1254*	0.2	0.5	Aroclor 1254*	2.4	17
Aroclor 1260*	0.2	0.5	Aroclor 1260*	1.8	17

Table F.8 - SW 8151A LODs and LOQs - Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg
2,4,5-T*	0.05	0.1	2,4,5-T*	0.6	3.3
2,4,5-TP (Silvex)*	0.02	0.1	2,4,5-TP (Silvex)*	0.5	3.3
2,4-D*	0.08	0.2	2,4-D*	1.0	6.6
2,4-DB*	0.07	0.2	2,4-DB*	1.7	6.6
Dalapon*	0.05	0.1	Dalapon*	1.6	3.3
Dicamba*	0.05	0.1	Dicamba*	1.5	3.3
Dichlorprop*	0.07	0.2	Dichlorprop*	3.0	6.6
Dinoseb*	0.03	0.1	Dinoseb*	0.5	3.3
MCPA*	3	20	MCPA*	150	333
MCPP*	7	20	MCPP*	140	333

Table F.9.1 – SW8260C – Current LODs and LOQs, 5 ml purge – Houston Facility					
Analyte – water matrix 5 ml purge volume * NELAC Accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix based on 5 g dry weight sample * NELAC Accredited	LOD µg/Kg	LOQ µg/Kg
1,1,1,2-Tetrachloroethane *	0.5	5	1,1,1,2-Tetrachloroethane *	0.5	5
1,1,1-Trichloroethane *	0.5	5	1,1,1-Trichloroethane *	0.5	5
1,1,2,2-Tetrachloroethane *	0.5	5	1,1,2,2-Tetrachloroethane *	0.5	5
1,1,2-Trichlor-1,2,2-trifluoroethane *	0.6	5	1,1,2-Trichlor-1,2,2-trifluoroethane *	0.5	5
1,1,2-Trichloroethane *	0.5	5	1,1,2-Trichloroethane *	0.5	5
1,1-Dichloroethane *	0.5	5	1,1-Dichloroethane *	0.5	5
1,1-Dichloroethene *	0.5	5	1,1-Dichloroethene *	0.5	5
1,1-Dichloropropene *	0.5	5	1,1-Dichloropropene *	0.5	5
1,2,3-Trichlorobenzene *	0.5	5	1,2,3-Trichlorobenzene *	0.5	5
1,2,3-Trichloropropane *	0.7	5	1,2,3-Trichloropropane *	0.5	5
1,2,3-Trimethylbenzene	0.5	5	1,2,3-Trimethylbenzene	0.5	5
1,2,4-Trichlorobenzene *	0.5	5	1,2,4-Trichlorobenzene *	0.6	5
1,2,4-Trimethylbenzene *	0.5	5	1,2,4-Trimethylbenzene *	0.5	5
1,2-Dibromo-3-chloropropane *	1	5	1,2-Dibromo-3-chloropropane *	0.9	5
1,2-Dibromoethane *	0.5	5	1,2-Dibromoethane *	0.5	5
1,2-Dichlorobenzene *	0.5	5	1,2-Dichlorobenzene *	0.5	5
1,2-Dichloroethane *	0.5	5	1,2-Dichloroethane *	0.5	5
1,2-Dichloropropane *	0.5	5	1,2-Dichloropropane *	0.5	5
1,3,5-Trimethylbenzene *	0.5	5	1,3,5-Trimethylbenzene *	0.5	5
1,3-Butadiene	0.5	5	1,3-Butadiene	5	5

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Table F.9.1 – SW8260C – Current LODs and LOQs, 5 ml purge – Houston Facility					
Analyte – water matrix 5 ml purge volume * NELAC Accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix based on 5 g dry weight sample * NELAC Accredited	LOD µg/Kg	LOQ µg/Kg
1,3-Dichlorobenzene *	0.5	5	1,3-Dichlorobenzene *	0.5	5
1,3-Dichloropropane *	0.5	5	1,3-Dichloropropane *	0.5	5
1,4-Dichlorobenzene *	0.5	5	1,4-Dichlorobenzene *	0.5	5
1,4-Dioxane *	50	100	1,4-Dioxane *	20	100
1-Chlorohexane *	0.8	5	1-Chlorohexane *	0.6	5
1-Propanol *	100	100	1-Propanol *	20	100
2,2-Dichloropropane *	0.5	5	2,2-Dichloropropane *	0.5	5
2-Butanone *	1	10	2-Butanone *	1.4	10
2-Chloro-1,3-butadiene *	1.1	5	2-Chloro-1,3-butadiene *	5	5
2-Chloroethyl vinyl ether *	1	10	2-Chloroethyl vinyl ether *	1	5
2-Chlorotoluene *	0.5	5	2-Chlorotoluene *	0.5	5
2-Hexanone *	1	10	2-Hexanone *	1	10
2-Methylnaphthalene *	5	5	2-Methylnaphthalene *	0.7	5
2-Pentanone *	1	10	2-Pentanone *	10	10
4-Chlorotoluene *	0.5	5	4-Chlorotoluene *	0.5	5
4-Isopropyltoluene *	0.5	5	4-Isopropyltoluene *	0.5	5
4-Methyl-2-pentanone *	1	10	4-Methyl-2-pentanone *	1	10
Acetaldehyde	3.2	10	Acetaldehyde	7	10
Acetone *	1	10	Acetone *	2	20
Acetonitrile *	7	50	Acetonitrile *	10	50
Acrolein *	2	20	Acrolein *	2	20
Acrylonitrile *	1	10	Acrylonitrile *	1	20
Allyl alcohol *	100	100	Allyl alcohol	100	100
Allyl Chloride *	1	10	Allyl Chloride *	1	10
Amyl Alcohol	10	100	Amyl Alcohol	10	100
Benzene *	0.5	5	Benzene *	0.5	5
Benzyl Chloride *	0.5	5	Benzyl Chloride *	0.5	5
Bromobenzene *	0.5	5	Bromobenzene *	0.5	5
Bromochloromethane *	0.5	5	Bromochloromethane *	0.5	5
Bromodichloromethane *	0.5	5	Bromodichloromethane *	0.5	5
Bromoform *	0.5	5	Bromoform *	0.5	5
Bromomethane *	0.9	5	Bromomethane *	1	10
Butyl methacrylate	5	5	Butyl methacrylate	0.5	5
Carbon disulfide *	1	10	Carbon disulfide *	1	10
Carbon tetrachloride *	0.5	5	Carbon tetrachloride *	0.5	5
Chlorobenzene *	0.5	5	Chlorobenzene *	0.5	5
Chloroethane *	0.5	5	Chloroethane *	1	10
Chloroform *	0.5	5	Chloroform *	0.5	5
Chloromethane *	0.5	5	Chloromethane *	1	10
cis-1,2-Dichloroethene *	0.5	5	cis-1,2-Dichloroethene *	0.5	5
cis-1,3-Dichloropropene *	0.5	5	cis-1,3-Dichloropropene *	0.5	5
Cyclohexane	0.6	5	Cyclohexane	5	5
Dibromochloromethane *	0.5	5	Dibromochloromethane *	0.5	5
Dibromomethane *	0.5	5	Dibromomethane *	0.5	5
Dichlorodifluoromethane *	0.5	5	Dichlorodifluoromethane *	0.5	5
Diethyl Ether *	1.2	5	Diethyl Ether *	0.5	5

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Table F.9.1 – SW8260C – Current LODs and LOQs, 5 ml purge – Houston Facility					
Analyte – water matrix 5 ml purge volume * NELAC Accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix based on 5 g dry weight sample * NELAC Accredited	LOD µg/Kg	LOQ µg/Kg
Diisopropyl ether *	0.5	5	Diisopropyl ether	0.5	10
Epichlorohydrin *	2.5	20	Epichlorohydrin *	1	20
Ethanol *	100	100	Ethanol *	2.4	100
Ethyl acetate *	0.5	5	Ethyl acetate *	100	10
Ethyl acrylate	0.5	5	Ethyl acrylate	10	5
Ethyl Methacrylate *	1.3	5	Ethyl Methacrylate *	0.6	5
Ethyl tert-Butyl Ether (ETBE) *	5	5	Ethyl tert-Butyl Ether (ETBE)	0.5	5
Ethylbenzene *	0.5	5	Ethylbenzene *	0.5	5
Ethylene oxide	2.3	10	Ethylene oxide *	3.5	10
Hexachlorobutadiene *	0.8	5	Hexachlorobutadiene *	1	5
Iodomethane *	1.1	10	Iodomethane *	1	10
Isobutyl alcohol *	26	100	Isobutyl alcohol *	20	100
Isopropyl alcohol *	21	100	Isopropyl alcohol *	14	100
Isopropylbenzene *	0.5	5	Isopropylbenzene *	0.5	5
M,p-Xylene *	1	10	m,p-Xylene *	1	10
Methacrylonitrile *	0.5	5	Methacrylonitrile *	1.7	5
Methyl acetate *	0.5	5	Methyl acetate *	0.5	5
Methyl acrylate *	5	5	Methyl acrylate *	0.5	5
Methyl methacrylate	0.5	5	Methyl methacrylate	0.5	5
Methyl tert-butyl ether *	0.5	5	Methyl tert-butyl ether	0.5	5
Methylcyclohexane *	0.8	5	Methylcyclohexane *	0.5	5
Methylene chloride *	0.5	10	Methylene chloride *	1	10
Naphthalene *	0.5	5	Naphthalene *	5	5
n-Butyl acetate	0.7	5	n-Butyl acetate	0.5	5
n-Butyl acrylate	0.5	5	n-Butyl acrylate	14	5
n-Butyl alcohol *	100	100	n-Butyl alcohol	0.5	100
n-Butylbenzene *	0.6	5	n-Butylbenzene *	0.5	5
n-Hexane	0.8	5	n-Hexane	0.5	5
n-Propylbenzene *	0.5	5	n-Propylbenzene *	5	5
o-Xylene *	0.5	5	o-Xylene *	5	5
Pentachloroethane *	5	5	Pentachloroethane *	3.5	5
Propionitrile *	9	50	Propionitrile *	0.5	50
Propylene oxide	1	10	Propylene oxide	0.5	10
sec-Butylbenzene *	0.5	5	Sec-Butylbenzene *	0.5	5
Styrene *	0.5	5	Styrene *	10	5
Tert-Amyl Methyl Ether *	5	5	Tert-Amyl Methyl Ether	0.5	5
Tert-Butyl Alcohol *	13	100	Tert-Butyl Alcohol *	0.5	100
tert-Butylbenzene *	0.6	5	Tert-Butylbenzene *	0.6	5
Tetrachloroethene *	0.6	5	Tetrachloroethene *	0.7	5
Tetrahydrofuran	0.6	5	Tetrahydrofuran	0.5	5
Toluene *	0.5	5	Toluene *	0.5	5
trans-1,2-Dichloroethene *	0.5	5	Trans-1,2-Dichloroethene *	0.5	5
trans-1,3-Dichloropropene *	0.5	5	Trans-1,3-Dichloropropene *	5	5
trans-1,4-Dichloro-2-butene *	0.8	5	Trans-1,4-Dichloro-2-butene *	0.5	5
Trichloroethene *	0.5	5	Trichloroethene *	0.5	5
Trichlorofluoromethane *	0.5	5	Trichlorofluoromethane *	1	5

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Table F.9.1 – SW8260C – Current LODs and LOQs, 5 ml purge – Houston Facility					
Analyte – water matrix 5 ml purge volume * NELAC Accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix based on 5 g dry weight sample * NELAC Accredited	LOD µg/Kg	LOQ µg/Kg
Vinyl acetate *	1	10	Vinyl acetate *	0.5	10
Vinyl chloride *	0.5	2	Vinyl chloride *	1	2
Xylenes, Total *	1	15	Xylenes, Total *	1.5	15

Table F.9.2 - SW8260C Low Level Waters - Houston Facility					
Analyte - water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L
1,1,1,2-Tetrachloroethane*	0.2	1	Carbon tetrachloride*	0.2	1
1,1,1-Trichloroethane*	0.1	1	Chlorobenzene*	0.1	1
1,1,2,2-Tetrachloroethane*	0.2	1	Chloroethane*	0.3	1
1,1,2-Trichlor-1,2,2-trifluoroethane *	0.1	1	Chloroform*	0.1	1
1,1,2-Trichloroethane*	0.1	1	Chloromethane*	0.2	1
1,1-Dichloroethane*	0.2	1	cis-1,2-Dichloroethene	0.2	1
1,1-Dichloroethene*	0.2	1	cis-1,3-Dichloropropene*	0.1	1
1,1-Dichloropropene*	0.2	1	Cyclohexane	0.1	1
1,2,3-Trichlorobenzene*	0.2	1	Dibromochloromethane*	0.1	1
1,2,3-Trichloropropane	0.1	1	Dibromomethane*	0.2	1
1,2,4-Trichlorobenzene*	0.1	1	Dichlorodifluoromethane*	0.5	1
1,2,4-Trimethylbenzene*	0.1	1	Dicyclopentadiene	0.1	1
1,2-Dibromo-3-chloropropane *	0.1	1	Ethyl acrylate	0.1	1
1,2-Dibromoethane*	0.1	1	Ethylbenzene*	0.2	1
1,2-Dichlorobenzene*	0.1	1	Ethyl methacrylate *	0.1	1
1,2-Dichloroethane*	0.1	1	Hexachlorobutadiene*	0.4	1
1,2-Dichloropropane*	0.1	1	Iodomethane*	0.4	2
1,3,5-Trimethylbenzene*	0.1	1	Isopropylbenzene*	0.1	1
1,3-Dichlorobenzene*	0.1	1	m,p-Xylene*	0.2	2
1,3-Dichloropropane *	0.1	1	Methacrylonitrile *	0.2	2
1,4-Dichlorobenzene*	0.1	1	Methyl acetate *	0.1	1
1,4-Dioxane*	20	20	Methyl acrylate *	0.1	1
1-Chlorohexane*	0.2	1	Methyl methacrylate *	0.1	1
2,2-Dichloropropane*	0.1	1	Methyl tert-butyl ether*	0.2	1
2-Butanone*	0.4	2	Methylcyclohexane *	0.2	1
2-Chloro-1,3-butadiene	0.1	2	Methylene chloride*	0.1	2
2-Chloroethyl vinyl ether*	0.2	2	n-Butylbenzene*	0.1	1
2-Chlorotoluene*	0.2	1	n-Hexane	0.2	1
2-Hexanone*	0.2	2	n-Propylbenzene*	0.1	1
2-Methylnaphthalene	0.2	1	Naphthalene*	0.1	1
4-Chlorotoluene*	0.1	1	o-Xylene*	0.1	1
4-Isopropyltoluene*	0.1	1	Propylene oxide	0.9	2
4-Methyl-2-pentanone*	0.2	2	sec-Butylbenzene*	0.1	1
4-Vinyl-1-cyclohexene	0.1	1	Styrene*	0.1	1
Acetone*	1	2	tert-Butylbenzene*	0.1	1
Acetonitrile*	3.7	10	Tetrachloroethene*	0.3	1
Acrolein*	0.5	2	Toluene*	0.1	1

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Table F.9.2 - SW8260C Low Level Waters - Houston Facility					
Analyte - water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L
Acrylonitrile*	0.7	2	trans-1,2-Dichloroethene*	0.3	1
Benzene*	0.1	1	trans-1,3-Dichloropropene*	0.1	1
Bromobenzene*	0.1	1	Trans-1,4-Dichloro-2-butene	0.3	1
Bromochloromethane*	0.2	1	Trichloroethene*	0.1	1
Bromodichloromethane*	0.2	1	Trichlorofluoromethane*	0.2	1
Bromoform*	0.3	2	Vinyl acetate*	0.7	1
Bromomethane*	0.3	2	Vinyl chloride*	0.4	1
Carbon disulfide*	0.2	1	Xylenes, Total *	0.3	3

Table F.9.3 - EPA 624 - Houston Facility					
Analyte - water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L
1,1,1-Trichloroethane*	0.5	5	Chlorobenzene*	0.5	5
1,1,2,2-Tetrachloroethane*	0.5	5	Chloroethane*	1	5
1,1,2-Trichloroethane*	0.8	5	Chloroform*	0.5	5
1,1-Dichloroethane*	0.5	5	Chloromethane*	1	5
1,1-Dichloroethene*	0.8	5	cis-1,2-Dichloroethene *	0.6	5
1,2-Dichlorobenzene*	0.5	5	cis-1,3-Dichloropropene*	0.5	5
1,2-Dichloroethane*	0.5	5	Dibromochloromethane*	0.6	5
1,2-Dichloropropane*	0.7	5	Ethylbenzene*	0.5	5
1,3-Dichlorobenzene*	0.5	5	m,p-Xylene*	1	5
1,4-Dichlorobenzene*	0.5	5	Methylene chloride*	1.4	5
2-Butanone*	1	10	Methyl tert-butyl ether*		
2-Chloroethyl vinyl ether*	0.8	10	o-Xylene*	0.6	5
Acetone*	1	10	Tetrachloroethene*	0.6	5
Acrolein*	2	20	Toluene*	0.5	5
Acrylonitrile*	3	20	trans-1,2-Dichloroethene*	0.5	5
Benzene*	0.5	5	trans-1,3-Dichloropropene*	0.5	5
Bromodichloromethane*	0.5	5	Trichloroethene*	0.7	5
Bromoform*	0.8	5	Trichlorofluoromethane*	0.5	5
Bromomethane*	1	5	Vinyl chloride*	1	5
Carbon tetrachloride*	0.5	5	Xylenes, Total *	1.5	15

Table F.10.1 - SW8270D - LODs and LOQs – Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg
1,1'-Biphenyl *	0.50	10	1,1'-Biphenyl *	30	167
1,2,4,5-Tetrachlorobenzene*	1.20	5	1,2,4,5-Tetrachlorobenzene*	30	167
1,2,4-Trichlorobenzene*	0.80	5	1,2,4-Trichlorobenzene*	30	167
1,2-Dichlorobenzene*	0.90	5	1,2-Dichlorobenzene*	30	167
1,2-Dinitrobenzene *	1.90	5	1,2-Dinitrobenzene *	68	167
1,2-Diphenylhydrazine*	0.80	5	1,2-Diphenylhydrazine*	40	167
1,3-Dichlorobenzene*	1.10	5	1,3-Dichlorobenzene*	30	167
1,3-Dinitrobenzene	1.60	5	1,3-Dinitrobenzene*	46	167
1,4-Dichlorobenzene*	1.10	5	1,4-Dichlorobenzene*	32	167

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Table F.10.1 - SW8270D - LODs and LOQs – Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg
1,4-Dinitrobenzene *	1.50	5	1,4-Dinitrobenzene *	48	167
1,4-Dioxane	2.70	5	1,4-Dioxane	47	167
1,4-Naphthoquinone *	0.90	5	1,4-Naphthoquinone *	37	167
1- Chloronaphthalene*	0.50	5	1-Chloronaphthalene*	170	167
1-Methylnaphthalene	0.70	5	1-Methylnaphthalene	30	167
2,3,4,6-Tetrachlorophenol*	1.60	5	2,3,4,6-Tetrachlorophenol*	47	167
2,4,5-Trichlorophenol*	0.90	5	2,4,5-Trichlorophenol*	56	167
2,4,6-Trichlorophenol*	1.40	5	2,4,6-Trichlorophenol*	31	167
2,4-Dichlorophenol*	1.50	5	2,4-Dichlorophenol*	36	167
2,4-Dimethylphenol*	1.90	5	2,4-Dimethylphenol*	37	167
2,4-Dinitrophenol*	1.40	5	2,4-Dinitrophenol*	64	167
2,4-Dinitrotoluene*	1.00	5	2,4-Dinitrotoluene*	61	167
2,6-Dichlorophenol*	1.30	5	2,6-Dichlorophenol*	54	167
2,6-Dimethylphenol	0.70	5	2,6-Dimethylphenol	41	167
2,6-Dinitrotoluene*	1.10	5	2,6-Dinitrotoluene*	31	167
2-Chloronaphthalene*	1.10	5	2-Chloronaphthalene*	35	167
2-Chlorophenol*	1.10	5	2-Chlorophenol*	58	167
2-Methylnaphthalene*	0.90	5	2-Methylnaphthalene*	30	167
2-Methylphenol*	1.00	5	2-Methylphenol*	36	167
2-Nitroaniline*	1.40	5	2-Nitroaniline*	38	167
2-Nitrophenol*	1.20	5	2-Nitrophenol*	61	167
3 & 4-Methylphenol*	1.00	5	3 & 4-Methylphenol*	64	167
3,3´-Dichlorobenzidine*	0.90	5	3,3´-Dichlorobenzidine*	30	167
3-Methylcholanthrene *	1.20	5	3-Methylcholanthrene *	30	167
3-Nitroaniline*	1.40	5	3-Nitroaniline*	30	167
4,6-Dinitro-2-methylphenol *	0.90	5	4,6-Dinitro-2-methylphenol *	68	167
4-Bromophenyl phenyl ether*	1.20	5	4-Bromophenyl phenyl ether*	42	167
4-Bromopyrazole	2.10	5	4-Bromopyrazole	76	167
4-Chloro-3-methylphenol*	0.80	5	4-Chloro-3-methylphenol*	60	167
4-Chloroaniline*	0.80	5	4-Chloroaniline*	31	167
4-Chlorophenyl phenyl ether*	1.00	5	4-Chlorophenyl phenyl ether*	30	167
4-Nitroaniline*	1.60	5	4-Nitroaniline*	41	167
4-Nitrophenol*	1.90	5	4-Nitrophenol*	61	167
4-Nitroquinoline-1-oxide	2.00	5	4-Nitroquinoline-1-oxide	88	167
7,12-Dimethylbenz(a)anthracene*	0.90	5	7,12-Dimethylbenz(a)anthracene*	37	167
Acenaphthene*	0.90	5	Acenaphthene*	30	167
Acenaphthylene*	0.50	5	Acenaphthylene*	30	167
Acetophenone *	0.90	5	Acetophenone*	30	167
Aniline*	0.70	5	Aniline*	30	167
Anthracene*	0.60	5	Anthracene*	30	167
Aramite*	1.60	5	Aramite*	61	167
Atrazine*	1.00	5	Atrazine*	46	167
Azobenzene*	1.00	5	Azobenzene*	30	167
Benz(a)anthracene*	0.50	5	Benz(a)anthracene*	30	167
Benzaldehyde	1.30	5	Benzaldehyde	43	167
Benzidine*	5.00	5	Benzidine*	167	167

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Table F.10.1 - SW8270D - LODs and LOQs – Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg
Benzo(a)pyrene*	0.60	5	Benzo(a)pyrene*	30	167
Benzo(b)fluoranthene*	0.70	5	Benzo(b)fluoranthene*	30	167
Benzo(g,h,i)perylene*	0.50	5	Benzo(g,h,i)perylene*	30	167
Benzo(k)fluoranthene*	0.90	5	Benzo(k)fluoranthene*	30	167
Benzoic acid*	5.00	5	Benzoic acid*	33	167
Benzyl alcohol*	0.60	5	Benzyl alcohol*	36	167
Bis(2-chloroethoxy)methane*	0.50	5	Bis(2-chloroethoxy)methane*	30	167
Bis(2-chloroethyl)ether*	1.00	5	Bis(2-chloroethyl)ether*	34	167
Bis(2-chloroisopropyl)ether*	0.60	5	Bis(2-chloroisopropyl)ether*	30	167
Bis(2-ethylhexyl)phthalate*	3.30	5	Bis(2-ethylhexyl)phthalate*	30	167
Butyl benzyl phthalate *	0.70	5	Butyl benzyl phthalate *	30	167
Caprolactam*	5.00	5	Caprolactam*	51	167
Carbazole *	0.50	5	Carbazole *	30	167
Chlorobenzilate*	1.20	5	Chlorobenzilate*	32	167
Chlorothalonil	0.90	5	Chlorothalonil	55	167
Chrysene*	0.80	5	Chrysene*	30	167
Dacthal	0.90	5	Dacthal	36	167
Di-n-butyl phthalate*	0.50	5	Di-n-butyl phthalate*	30	167
Di-n-octyl phthalate*	0.60	5	Di-n-octyl phthalate*	30	167
Dibenz(a,h)anthracene *	0.80	5	Dibenz(a,h)anthracene*	30	167
Dibenz(a,j)acridine *	1.10	5	Dibenz(a,j)acridine *	30	167
Dibenzofuran *	0.70	5	Dibenzofuran*	30	167
Diethyl phthalate*	0.50	5	Diethyl phthalate*	30	167
Dimethyl phthalate*	0.50	5	Dimethyl phthalate*	30	167
Diphenylamine*	0.70	5	Diphenylamine*	30	167
Ethyl methacrylate	1.00	5	Ethyl methacrylate	30	167
Ethyl methanesulfonate*	0.80	5	Ethyl methanesulfonate*	32	167
Fluoranthene*	0.50	5	Fluoranthene*	30	167
Fluorene*	0.60	5	Fluorene*	30	167
Hexachlorobenzene*	1.10	5	Hexachlorobenzene*	32	167
Hexachlorobutadiene*	1.10	5	Hexachlorobutadiene*	34	167
Hexachlorocyclopentadiene*	2.30	5	Hexachlorocyclopentadiene*	41	167
Hexachloroethane*	1.00	5	Hexachloroethane*	39	167
Hexachloropropene *	2.50	5	Hexachloropropene *	30	167
Indeno(1,2,3-cd)pyrene*	1.30	5	Indeno(1,2,3-cd)pyrene*	30	167
Isodrin*	1.30	5	Isodrin*	50	167
Isophorone*	0.60	5	Isophorone*	30	167
Isophthalonitrile	0.50	5	Isophthalonitrile	30	167
Isosafrole *	0.80	5	Isosafrole*	35	167
Kepone *	5.00	5	Kepone *	167	167
Methapyrilene *	1.40	5	Methapyrilene *	30	167
Methyl methanesulfonate*	1.20	5	Methyl methanesulfonate*	37	167
N-Nitrosodiethylamine *	0.80	5	N-Nitrosodiethylamine *	47	167
N-Nitroso-di-n-butylamine *	0.90	5	N-Nitroso-di-n-butylamine *	44	167
N-Nitrosodi-n-propylamine*	0.90	5	N-Nitrosodi-n-propylamine*	30	167
N-Nitrosodimethylamine*	0.80	5	N-Nitrosodimethylamine*	46	167

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Table F.10.1 - SW8270D - LODs and LOQs – Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg
N-Nitrosomethylethylamine *	0.80	5	N-Nitrosomethylethylamine *	56	167
N-Nitrosodiphenylamine*	0.70	5	N-Nitrosodiphenylamine*	30	167
N-Nitrosomorpholine *	1.10	5	N-Nitrosomorpholine *	84	167
N-Nitrosopiperidine *	1.10	5	N-Nitrosopiperidine *	38	167
N-Nitrosopyrrolidine *	1.10	5	N-Nitrosopyrrolidine *	41	167
Naphthalene*	0.60	5	Naphthalene*	30	167
Nitrobenzene*	0.80	5	Nitrobenzene*	33	167
Pentachlorobenzene*	1.40	5	Pentachlorobenzene*	36	167
Pentachloroethane	2.20	5	Pentachloroethane	53	167
Pentachloronitrobenzene*	3.10	5	Pentachloronitrobenzene*	59	167
Pentachlorophenol*	1.60	5	Pentachlorophenol*	70	167
Phenacetin*	0.50	5	Phenacetin*	30	167
Phenanthrene*	0.50	5	Phenanthrene*	30	167
Phenol*	0.50	5	Phenol*	30	167
Pronamide*	1.20	5	Pronamide*	30	167
Pyrazole	1.30	5	Pyrazole	61	167
Pyrene*	0.50	5	Pyrene*	30	167
Pyridine*	2.00	5	Pyridine*	30	167
Quinazoline	0.80	5	Quinazoline	30	167
Quinoline *	0.60	5	Quinoline *	30	167
Safrole*	1.20	5	Safrole *	36	167
Sym-Trinitrobenzene *	1.70	5	Sym-Trinitrobenzene *	167	167

Table F.10.2 - SW8270D – Low Level Method – Houston Facility					
Analyte – water matrix * NELAC accredited	MDL µg/L	MQL µg/L	Analyte - solid/soil matrix * NELAC accredited	MDL µg/Kg	MQL µg/Kg
1,1´-Biphenyl *	0.10	0.2	1,1'-Biphenyl *	2.9	6.6
1,2,4-Trichlorobenzene *	0.12	0.2	1,2,4-Trichlorobenzene *	3.9	6.6
1,2-Dichlorobenzene *	0.13	0.2	1,2-Dichlorobenzene *	3.3	6.6
1,2-Diphenylhydrazine *	0.10	0.2	1,2-Diphenylhydrazine *	2.2	6.6
1,3-Dichlorobenzene *	0.14	0.2	1,3-Dichlorobenzene *	3.7	6.6
1,4-Dichlorobenzene *	0.12	0.2	1,4-Dichlorobenzene *	3.6	6.6
1-Methylnaphthalene	0.09	0.2	1-Methylnaphthalene	2.3	6.6
2,4,5-Trichlorophenol *	0.09	0.2	2,4,5-Trichlorophenol *	2.8	6.6
2,4,6-Trichlorophenol *	0.07	0.2	2,4,6-Trichlorophenol*	3.3	6.6
2,4-Dichlorophenol *	0.08	0.2	2,4-Dichlorophenol *	2.2	6.6
2,4-Dimethylphenol *	0.08	0.2	2,4-Dimethylphenol *	3.3	6.6
2,4-Dinitrophenol *	0.08	1.0	2,4-Dinitrophenol *	3.3	33
2,4-Dinitrotoluene *	0.09	0.2	2,4-Dinitrotoluene *	3.3	6.6
2,6-Dinitrotoluene *	0.07	0.2	2,6-Dinitrotoluene *	3.2	6.6
2-Chloronaphthalene *	0.10	0.2	2-Chloronaphthalene *	4.1	6.6
2-Chlorophenol *	0.08	0.2	2-Chlorophenol *	3.2	6.6
2-Methylnaphthalene *	0.07	0.2	2-Methylnaphthalene *	2.7	6.6
2-Methylphenol *	0.08	0.2	2-Methylphenol *	2.9	6.6
2-Nitroaniline *	0.10	0.2	2-Nitroaniline *	3.3	6.6

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Table F.10.2 - SW8270D – Low Level Method – Houston Facility					
Analyte – water matrix * NELAC accredited	MDL µg/L	MQL µg/L	Analyte - solid/soil matrix * NELAC accredited	MDL µg/Kg	MQL µg/Kg
2-Nitrophenol *	0.07	0.2	2-Nitrophenol *	4.6	6.6
3&4-Methylphenol *	0.10	0.2	3 & 4-Methylphenol *	2.8	6.6
3,3'-Dichlorobenzidine *	0.07	0.2	3,3´-Dichlorobenzidine *	3.1	6.6
3-Nitroaniline *	0.08	0.2	3-Nitroaniline *	2.6	6.6
4,6-Dinitro-2-methylphenol *	0.08	0.2	4,6-Dinitro-2-methylphenol *	3.3	6.6
4-Bromophenyl phenyl ether *	0.09	0.2	4-Bromophenyl phenyl ether *	3.3	6.6
4-Chloro-3-methylphenol *	0.10	0.2	4-Chloro-3-methylphenol *	3.3	6.6
4-Chloroaniline *	0.07	0.2	4-Chloroaniline *	2.2	6.6
4-Chlorophenyl phenyl ether *	0.08	0.2	4-Chlorophenyl phenyl ether *	2.2	6.6
4-Nitroaniline *	0.07	0.2	4-Nitroaniline *	3.3	6.6
4-Nitrophenol *	0.07	1.0	4-Nitrophenol *	3.8	33
Acenaphthene*	0.09	0.2	Acenaphthene*	2.2	6.6
Acenaphthylene*	0.07	0.2	Acenaphthylene*	2.2	6.6
Acetophenone *	0.10	0.2	Acetophenone *	2.4	6.6
Aniline *	0.10	0.2	Aniline -	2.2	6.6
Anthracene*	0.07	0.2	Anthracene*	2.2	6.6
Atrazine *	0.08	0.2	Atrazine *	3.3	6.6
Benz(a)anthracene*	0.07	0.2	Benz(a)anthracene*	2.8	6.6
Benzaldehyde	0.12	0.2	Benzaldehyde	4.6	6.6
Benzidine *	0.10	0.2	Benzidine *	6.6	6.6
Benzo(a)pyrene*	0.08	0.2	Benzo(a)pyrene*	2.3	6.6
Benzo(b)fluoranthene*	0.09	0.2	Benzo(b)fluoranthene*	3.3	6.6
Benzo(g,h,i)perylene*	0.09	0.2	Benzo(g,h,i)perylene*	2.9	6.6
Benzo(k)fluoranthene*	0.10	0.2	Benzo(k)fluoranthene*	3.3	6.6
Benzoic acid *	0.14	0.2	Benzoic acid *	6.6	6.6
Benzyl alcohol *	0.09	0.2	Benzyl alcohol *	3.1	6.6
Bis(2-chloroethoxy) methane *	0.09	0.2	Bis(2-chloroethoxy)methane *	2.4	6.6
Bis(2-chloroethyl) ether *	0.07	0.2	Bis(2-chloroethyl)ether *	2.8	6.6
Bis(2-chloroisopropyl) ether *	0.07	0.2	Bis(2-chloroisopropyl)ether *	2.7	6.6
Bis(2-ethylhexyl)phthalate *	0.20	0.2	Bis(2-ethylhexyl)phthalate *	6.6	6.6
Butyl benzyl phthalate *	0.10	0.2	Butyl benzyl phthalate *	2.5	6.6
Caprolactam *	0.08	0.2	Caprolactam *	2.4	6.6
Carbazole *	0.07	0.2	Carbazole *	2.2	6.6
Chrysene*	0.07	0.2	Chrysene*	2.9	6.6
Di-n-butylphthalate *	0.07	0.2	Di-n-butyl phthalate *	2.5	6.6
Di-n-octylphthalate *	0.09	0.2	Di-n-octyl phthalate *	2.9	6.6
Dibenz(a,h)anthracene*	0.08	0.2	Dibenz(a,h)anthracene*	2.2	6.6
Dibenzofuran *	0.08	0.2	Dibenzofuran *	2.2	6.6
Diethylphthalate *	0.07	0.2	Diethyl phthalate *	3.3	6.6
Dimethylphthalate *	0.10	0.2	Dimethyl phthalate*	2.4	6.6
Diphenylamine *	0.09	0.2	Diphenylamine *	2.2	6.6
Fluoranthene*	0.07	0.2	Fluoranthene*	2.2	6.6
Fluorene*	0.07	0.2	Fluorene*	2.2	6.6
Hexachlorobenzene *	0.10	0.2	Hexachlorobenzene *	2.6	6.6
Hexachlorobutadiene *	0.15	0.2	Hexachlorobutadiene *	4.4	6.6

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Table F.10.2 - SW8270D – Low Level Method – Houston Facility					
Analyte – water matrix * NELAC accredited	MDL µg/L	MQL µg/L	Analyte - solid/soil matrix * NELAC accredited	MDL µg/Kg	MQL µg/Kg
Hexachlorocyclopentadiene *	0.08	0.2	Hexachlorocyclopentadiene *	3.6	6.6
Hexachloroethane *	0.17	0.2	Hexachloroethane *	3.9	6.6
Indeno(1,2,3-cd)pyrene*	0.10	0.2	Indeno(1,2,3-cd)pyrene*	3.5	6.6
Isophorone *	0.07	0.2	Isophorone *	3.0	6.6
Naphthalene*	0.10	0.2	Naphthalene*	3.3	6.6
Nitrobenzene *	0.09	0.2	Nitrobenzene *	3.3	6.6
N-Nitrosodi-n-propylamine *	0.10	0.2	N-Nitrosodi-n-propylamine *	4.0	6.6
N-Nitrosodimethylamine *	0.10	0.2	N-Nitrosodimethylamine *	4.1	6.6
N-Nitrosodiphenylamine *	0.09	0.2	N-Nitrosodiphenylamine *	2.2	6.6
Pentachlorophenol *	0.08	0.2	Pentachlorophenol *	2.8	6.6
Phenanthrene*	0.07	0.2	Phenanthrene*	3.0	6.6
Phenol *	0.07	0.2	Phenol *	3.3	6.6
Pyrene*	0.07	0.2	Pyrene*	2.2	6.6
Pyridine *	0.08	1	Pyridine *	3.3	6.6
Quinoline *	0.08	0.2	Quinoline *	2.2	6.6

Table F.11 - EPA 625 - LODs and LOQs - Houston Facility					
Analyte – water matrix	LOD	LOQ	Analyte – water matrix	LOD	LOQ
* NELAC accredited	µg/L	µg/L	* NELAC accredited	µg/L	µg/L
1,2,4-Trichlorobenzene*	0.9	5	Bis(2-chloroethoxy)methane*	0.8	5
1,2-Dichlorobenzene*	0.7	5	Bis(2-chloroethyl)ether*	0.8	5
1,2-Diphenylhydrazine	1.0	5	Bis(2-chloroisopropyl)ether*	0.8	5
1,3-Dichlorobenzene*	0.8	5	Bis(2-ethylhexyl)phthalate*	1.2	5
1,4-Dichlorobenzene*	0.7	5	Butyl benzyl phthalate*	0.8	5
2,4,5-Trichlorophenol*	1.3	9	Chrysene*	1.0	5
2,4,6-Trichlorophenol*	1.6	5	Di-n-butyl phthalate*	0.7	5
2,4-Dichlorophenol*	1.6	5	Di-n-octyl phthalate*	0.6	5
2,4-Dimethylphenol*	1.5	5	Dibenz(a,h)anthracene*	0.6	5
2,4-Dinitrophenol*	1.6	5	Diethyl phthalate*	0.8	5
2,4-Dinitrotoluene*	0.9	5	Dimethyl phthalate*	0.9	5
2,6-Dinitrotoluene*	1.0	5	Fluoranthene*	0.6	5
2-Chloronaphthalene*	0.9	5	Fluorene*	0.8	5
2-Chlorophenol*	1.8	5	Hexachlorobenzene*	0.6	5
2-Nitrophenol*	1.3	5	Hexachlorobutadiene*	0.9	5
3,3´-Dichlorobenzidine*	0.7	5	Hexachlorocyclopentadiene*	0.6	5
4,6-Dinitro-2-methylphenol	1.0	5	Hexachloroethane*	1.4	5
4-Bromophenyl phenyl ether*	0.9	5	Indeno(1,2,3-cd)pyrene*	0.6	5
4-Chloro-3-methylphenol*	1.1	5	Isophorone*	0.9	5
4-Chlorophenyl phenyl ether*	0.9	5	N-Nitrosodi-n-propylamine*	1.0	5
4-Nitrophenol*	1.0	5	N-Nitrosodimethylamine*	0.9	5
Acenaphthene*	0.8	5	N-Nitrosodiphenylamine*	0.7	5
Acenaphthylene*	0.7	5	Naphthalene*	0.8	5
Anthracene*	0.7	5	Nitrobenzene*	0.8	5
Benzidine*	5.0	5	Pentachlorobenzene*	0.8	5
Benz(a)anthracene*	0.6	5	Pentachlorophenol*	1.5	5

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Table F.11 - EPA 625 - LODs and LOQs - Houston Facility					
Analyte – water matrix	LOD	LOQ	Analyte – water matrix	LOD	LOQ
* NELAC accredited	µg/L	µg/L	* NELAC accredited	µg/L	µg/L
Benzo(a)pyrene*	0.7	5	Phenanthrene*	0.7	5
Benzo(b)fluoranthene*	0.8	5	Phenol*	1.5	5
Benzo(g,h,i)perylene*	0.9	5	Pyrene*	0.9	5
Benzo(k)fluoranthene*	0.6	5			

Table F.12 - SW 8330A LODs and LOQs - Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg
HMX*	0.10	0.45	HMX*	40	250
RDX*	0.10	0.45	RDX*	40	250
1,3,5-Trinitrobenzene*	0.10	0.45	1,3,5-Trinitrobenzene*	80	250
1,3-Dinitrobenzene*	0.10	0.45	1,3-Dinitrobenzene*	40	250
Tetryl*	0.10	0.45	Tetryl*	74	500
Nitrobenzene*	0.10	0.45	Nitrobenzene*	40	250
2,4,6-Trinitrotoluene*	0.10	0.45	2,4,6-Trinitrotoluene*	40	250
4-Amino-2,6-dinitrotoluene*	0.10	0.45	4-Amino-2,6-dinitrotoluene*	40	250
2-Amino-4, 6-dinitrotoluene*	0.10	0.45	2-Amino-4, 6-dinitrotoluene*	40	250
2,4-Dinitrotoluene*	0.10	0.45	2,4-Dinitrotoluene*	40	250
2,6-Dinitrotoluene*	0.10	0.45	2,6-Dinitrotoluene*	40	250
2-Nitrotoluene*	0.10	0.45	2-Nitrotoluene*	40	250
3-Nitrotoluene*	0.10	0.45	3-Nitrotoluene*	40	250
4-Nitrotoluene*	0.10	0.45	4-Nitrotoluene*	40	250

Table F.13.1 - Formaldehyde by SW 8315A - LOD and LOQ - Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg
Formaldehyde *	1	5	Formaldehyde *	100	100

Table F.13.2 - Formaldehyde by SW 8316 - LOD and LOQ - Houston Facility					
Analyte – water matrix * NELAC accredited	LOD µg/L	LOQ µg/L	Analyte - solid/soil matrix * NELAC accredited	LOD µg/Kg	LOQ µg/Kg
Acrylamide *	0.24	1.0	Acrylamide *	0.24	1.0

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Appendix G – Method Acceptance Criteria for LCS

Table G.1 - Wet Chemistry - LCS Recovery Limits – Houston Facility

Analyte - Water Matrix	SPK mg/L	Low	High	RPD	Analyte - Soil Matrix	SPK mg/Kg	Low	High	RPD
PH / E150.2/SW9040 (standard units)	-	90	110	20	pH / E150.2/SW9045 (standard units)	50	78	122	30
Specific Conductance / E120.0 SW9050 (umhos/cm)	-	85	115	20					
Total Dissolved Solids / EPA160.2/ SM 2540C	1000	85	115	20					
Total Suspended Solids / EPA 160.1 / SM 2540D	100	72	115	20					
Total Solids / EPA 160.3	1000	80	120	20					
Total Alkalinity / SM2320B/E 310.1	1000	85	115	20					
Chrome VI - SW 7196A – SM3500	0.25	86	117	15	Chrome VI by SW 7196	25	81	115	25
Ferrous Iron by SM 3500-Fe D	0.25	85	115	20					
Ammonia as N - SM4500 NH3-D	10	80	120	20					
Ammonia as N - SM4500 NH3-B-F	0.2	80	120	20					
T. Kjeldahl Nitrogen – SM4500	10	80	120	20					
Fluoride by SM 4500 F BC (ISE)	4	80	120	20					
Fluoride by SW 9214 (ISE)	4	80	120	20					
Bromide by EPA 300 / SW9056A	4	90	110	20	Bromide by EPA 300 / SW9056A	40	90	110	20
Chloride by EPA 300 / SW9056A	20	90	110	20	Chloride by EPA 300 / SW9056A	200	90	110	20
Fluoride by EPA 300 / SW9056A	4	90	110	20	Fluoride by EPA 300 / SW9056A	40	90	110	20
Sulfate by EPA 300 / SW9056A	20	90	110	20	Sulfate by EPA 300 / SW9056A	200	90	110	20
Nitrate as N - E300 / SW9056A	4	90	110	20	Nitrate as N - E300 / SW9056A	40	90	110	20
Nitrite as N – E300 / SW9056A	4	90	110	20	Nitrite as N – E300 / SW9056A	40	90	110	20
O-Phosphorous (P) E300/SW9056A	4	90	110	20	O-Phosphorous (P) E300/SW9056A	40	90	110	20
Ortho Phosphorous (P) E365.3	0.25	85	115	20					
Total Phosphorous (P) E365.3	0.25	85	115	20					
Total Organic Carbon - E415.1/ SW9060A / SM5310C	10	80	120	20	Total Organic Carbon – SW 9060A M for soil	0.6 %wt	80	120	20
Chemical Oxygen Demand – Hach	100	80	120	20					
Biochemical Oxygen Demand - E405.1 / SM5210B	198	85	115	20					
Phenolics, Tot Recoverable – SW9065 - E420.1	0.5	80	120	20	Phenolics, Tot Recoverable SW9065	25	80	120	20
Perchlorate - E314.0 (unit = µg/L)	25	85	115	20					
Total Cyanide - SW9010/9014	0.10	80	120	20	Total Cyanide - SW9010/9014	5.0	80	120	30
Total Cyanide – SM 4500CN E	0.10	80	120	20					
Oil &Grease, EPA 1664A	40	80	120	20	Oil &Grease, EPA1664A/SW9071B	2670	80	120	20

Table G.3.1 - TPH LCS Recovery Limits - Houston

Analyte – Water Matrix	SPK mg/L	Low	High	RPD	Analyte – Soil Matrix	SPK mg/Kg	Low	High	RPD
NC6-nC12 / TX1005	25	75	125	20	NC6-nC12 / TX1005	250	75	125	30
>nC12 to nC28 / TX1005	25	75	125	20	>nC12 to nC28 / TX1005	250	75	125	30
Total Petroleum Hydrocarbons	50	75	125	20	Total Petroleum Hydrocarbons	500	75	125	30
2-Fluorobiphenyl (Surr) TX1005	5	70	130	20	2-Fluorobiphenyl (Surr) TX1005	50	70	130	30
Trifluorotoluene (Surr) TX1005	5	70	130	20	Trifluorotoluene (Surr) TX1005	50	70	130	30
TPH (TX1006)	50	60	140	20	TPH (TX1006)	500	60	140	30

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Table G.3.1 - TPH LCS Recovery Limits - Houston

Analyte – Water Matrix	SPK mg/L	Low	High	RPD	Analyte – Soil Matrix	SPK mg/Kg	Low	High	RPD
Gasoline Range (Purgeable) by SW8015C	1.0	70	130	20	Gasoline Range (Purgeable) by SW8015C	1.0	70	130	30
Diesel Range by SW8015C	1.0	70	130	20	Diesel Range by SW8015C	33	70	130	30
Oil Range by SW8015C	1.0	70	130	20	Oil Range by SW8015C	33	70	130	30

Table G.3.2 - Nonhalogenated Organics by 8015C - LCS Recovery Limits – Houston Facility

Analyte – Water Matrix	SPK mg/L	Low	High	RPD	Analyte – Soil Matrix	SPK mg/Kg	Low	High	RPD
Ethylene Glycol	100	70	130	20	Ethylene Glycol	100	70	130	30
1-Propanol	10	70	130	20	1-Propanol	10	70	130	30
2-Propanol	10	70	130	20	2-Propanol	10	70	130	30
Isobutanol	10	70	130	20	Isobutanol	10	70	130	30
Propylene glycol	100	70	130	20	Propylene glycol	100	70	130	30
Ethanol	10	70	130	20	Ethanol	10	70	130	30
Methanol	10	70	130	20	Methanol	10	70	130	30

Table G.3.3 - - Dissolved Gases by Headspace Analysis of waters, RSK-175.
LCS Recovery Limits – Houston Facility

Analyte – Water Matrix	SPK µg/L	Low	High	RPD	Analyte – Water Matrix	SPK µg/L	Low	High	RPD
Ethane	18.0	75	125	20	Methane	9.62	75	125	20
Ethene	16.8	75	125	20					

Table G.4.1 - SW 8011 LCS Recovery Limits – Houston Facility

Analyte - Water Matrix	SPK µg/L	Low	High	RPD	Analyte - Water Matrix	SPK µg/L	Low	High	RPD
1,2-Dibromoethane	0.25	60	140	20	1,2-Dibromo-3-chloropropane	0.25	60	140	20
1,2,3-Trichloropropane	0.25	60	140	20					

Table G.4.2 - EPA 504.1 LCS Recovery Limits – Houston Facility

Analyte - Water Matrix	SPK µg/L	Low	High	RPD	Analyte - Water Matrix	SPK µg/L	Low	High	RPD
1,2-Dibromoethane	0.25	70	130	20	1,2-Dibromo-3-chloropropane	0.25	70	130	20
1,2,3-Trichloropropane	0.25	70	130	20					

Table G.4.3 - EPA 504.1 MS Recovery Limits – Houston Facility

Analyte - Water Matrix	SPK µg/L	Low	High	RPD	Analyte - Water Matrix	SPK µg/L	Low	High	RPD
1,2-Dibromoethane	0.25	65	135	20	1,2-Dibromo-3-chloropropane	0.25	65	135	20
1,2,3-Trichloropropane	0.25	65	135	20					

Table G.5 - BTEX by SW 8021B LCS Recovery Limits – Houston Facility

Analyte – Water Matrix	SPK µg/L	Low	High	RPD	Analyte - Soil Matrix	SPK µg/Kg	Low	High	RPD
Benzene	20	77	126	20	Benzene	20	74	129	30
Ethylbenzene	20	76	125	20	Ethylbenzene	20	73	127	30
Toluene	20	80	124	20	Toluene	20	75	128	30
M,p-Xylene	40	79	124	20	m,p-Xylene	40	74	127	30
o-Xylene	20	79	124	20	p-Xylene	20	74	127	30
Xylenes, Total	60	79	124	20	Xylenes, Total	60	74	127	30

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Table G.5 - BTEX by SW 8021B LCS Recovery Limits – Houston Facility									
Analyte – Water Matrix	SPK µg/L	Low	High	RPD	Analyte - Soil Matrix	SPK µg/Kg	Low	High	RPD
Methyl tert-butyl ether	100	75	128	20	Methyl tert-butyl ether	100	73	128	30
4-BFB (Surr)	30	77	129	20	4-BFB (Surr)	30	75	131	30
Trifluorotoluene (Surr)	30	75	130	20	Trifluorotoluene (Surr)	30	73	130	30

Table G.6 - SW 8081B LCS Recovery Limits – Houston Facility									
Analyte – Water Matrix	SPK µg/L	Low	High	RPD	Analyte - Soil Matrix	SPK µg/Kg	Low	High	RPD
4,4'-DDD	0.5	53	144	30	4,4'-DDD	16.7	53	138	30
4,4'-DDE	0.5	55	144	30	4,4'-DDE	16.7	57	136	30
4,4'-DDT	0.5	53	149	30	4,4'-DDT	16.7	53	139	30
Aldrin	0.25	47	141	30	Aldrin	8.33	52	130	30
Alpha-BHC	0.25	51	141	30	Alpha-BHC	8.33	52	130	30
Beta-BHC	0.25	58	144	30	Beta-BHC	8.33	62	130	30
Delta-BHC	0.25	48	146	30	Delta-BHC	8.33	41	137	30
Dieldrin	0.5	56	144	30	Dieldrin	16.7	54	138	30
Endosulfan I	0.25	55	141	30	Endosulfan I	8.33	55	132	30
Endosulfan II	0.5	57	144	30	Endosulfan II	16.7	59	134	30
Endosulfan sulfate	0.5	58	145	30	Endosulfan sulfate	16.7	54	141	30
Endrin	0.5	60	163	30	Endrin	16.7	60	157	30
Endrin aldehyde	0.5	59	158	30	Endrin aldehyde	16.7	56	146	30
Endrin ketone	0.5	59	154	30	Endrin ketone	16.7	56	153	30
Gamma-BHC (Lindane)	0.25	53	142	30	Gamma-BHC (Lindane)	8.33	52	133	30
Heptachlor	0.25	51	144	30	Heptachlor	8.33	54	134	30
Heptachlor epoxide	0.25	55	142	30	Heptachlor epoxide	8.33	58	130	30
Methoxychlor	0.25	59	150	30	Methoxychlor	16.7	60	140	30
Alpha-Chlordane	0.25	55	141	30	Alpha-Chlordane	8.33	55	132	30
Gamma-Chlordane	0.25	55	137	30	Gamma-Chlordane	8.33	60	129	30
Mirex	0.5	50	150	30	Mirex	16.7	50	150	30
Hexachlorobenzene	0.5	50	150	30	Hexachlorobenzene	16.7	50	150	30
Decachlorobiphenyl (Surr)	0.2	61	154	30	Decachlorobiphenyl (Surr)	6.67	66	150	30
Tetrachloro-m-xylene (Surr)	0.2	60	144	30	Tetrachloro-m-xylene (Surr)	6.67	63	135	30

Table G.7 - SW 8082A LCS Recovery Limits - Houston Facility									
Analyte - Water Matrix	SPK µg/L	Low	High	RPD	Analyte - Soil Matrix	SPK µg/Kg	Low	High	RPD
Aroclor 1016	5	54	138	30	Aroclor 1016	167	53	135	30
Aroclor 1260	5	57	136	30	Aroclor 1260	167	54	137	30
Decachlorobiphenyl (Surr)	0.2	54	140	30	Decachlorobiphenyl (Surr)	6.67	54	143	30
Tetrachloro-m-xylene (Surr)	0.2	53	137	30	Tetrachloro-m-xylene (Surr)	6.67	55	137	30

Table G.8 - SW 8151A LCS Recovery Limits,- Houston Facility									
Analyte - Water Matrix	SPK µg/L	Low	High	RPD	Analyte - Soil Matrix	SPK	Low	High	RPD
2,4,5-T	0.25	46	127	20	2,4,5-T	0.5	41	149	30
2,4,5-TP (Silvex)	0.25	54	145	20	2,4,5-TP (Silvex)	0.5	54	142	30
2,4-D	0.25	31	120	20	2,4-D	0.5	31	120	30
2,4-DB	0.25	43	147	20	2,4-DB	0.5	55	147	30
Dalapon	0.25	28	153	20	Dalapon	0.5	49	144	30
Dicamba	0.25	39	122	20	Dicamba	0.5	41	132	30

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Table G.8 - SW 8151A LCS Recovery Limits,- Houston Facility									
Analyte - Water Matrix	SPK µg/L	Low	High	RPD	Analyte - Soil Matrix	SPK	Low	High	RPD
Dichlorprop	0.25	53	128	20	Dichlorprop	0.5	53	124	30
Dinoseb	0.25	41	128	20	Dinoseb	0.5	41	135	30
MCPA	25	43	126	20	MCPA	50	37	131	30
MCPP	25	43	128	20	MCPP	50	39	131	30
DCAA (Surr)	0.50	43	130	20	DCAA (Surr)	0.5	47	135	30

Table G.9.1 - SW8260C LCS Recovery Limits - Houston Facility									
Analyte – Water Matrix	SPK µg/L	Low	High	RPD	Analyte – Soil Matrix	SPK µg/Kg	Low	High	RPD
1,1,1,2-Tetrachloroethane	50	78	120	20	1,1,1,2-Tetrachloroethane	50	80	120	30
1,1,1-Trichloroethane	50	80	122	20	1,1,1-Trichloroethane	50	80	127	30
1,1,2,2-Tetrachloroethane	50	75	120	20	1,1,2,2-Tetrachloroethane	50	72	124	30
1,1,2-Trichlor-1,2,2-trifluoroethane	50	75	125	20	1,1,2-Trichlor-1,2,2-trifluoroethane	50	79	129	30
1,1,2-Trichloroethane	50	80	120	20	1,1,2-Trichloroethane	50	77	120	30
1,1-Dichloroethane	50	76	120	20	1,1-Dichloroethane	50	78	124	30
1,1-Dichloroethene	50	76	120	20	1,1-Dichloroethene	50	80	124	30
1,1-Dichloropropene	50	75	120	20	1,1-Dichloropropene	50	77	122	30
1,2,3-Trichlorobenzene	50	76	120	20	1,2,3-Trichlorobenzene	50	74	126	30
1,2,3-Trichloropropane	50	76	120	20	1,2,3-Trichloropropane	50	72	123	30
1,2,3-Trimethylbenzene	50	80	120	20	1,2,3-Trimethylbenzene	50	80	120	30
1,2,4-Trichlorobenzene	50	80	120	20	1,2,4-Trichlorobenzene	50	75	127	30
1,2,4-Trimethylbenzene	50	75	120	20	1,2,4-Trimethylbenzene	50	80	121	30
1,2-Dibromo-3-chloropropane	50	75	124	20	1,2-Dibromo-3-chloropropane	50	68	131	30
1,2-Dibromoethane	50	80	120	20	1,2-Dibromoethane	50	80	120	30
1,2-Dichlorobenzene	50	80	120	20	1,2-Dichlorobenzene	50	78	120	30
1,2-Dichloroethane	50	78	120	20	1,2-Dichloroethane	50	75	121	30
1,2-Dichloropropane	50	80	120	20	1,2-Dichloropropane	50	79	121	30
1,3,5-Trimethylbenzene	50	80	120	20	1,3,5-Trimethylbenzene	50	80	123	30
1,3-Butadiene	50	71	127	20	1,3-Butadiene	50	75	127	30
1,3-Dichlorobenzene	50	80	120	20	1,3-Dichlorobenzene	50	79	120	30
1,3-Dichloropropane	50	80	120	20	1,3-Dichloropropane	50	78	120	30
1,4-Dichlorobenzene	50	80	120	20	1,4-Dichlorobenzene	50	78	120	30
1,4-Dioxane	1000	45	160	20	1,4-Dioxane	1000	61	137	30
1-Chlorohexane	50	73	120	20	1-Chlorohexane	50	80	125	30
1-Propanol	1000	54	151	20	1-Propanol	50	60	140	30
2,2-Dichloropropane	50	80	125	20	2,2-Dichloropropane	50	79	128	30
2-Butanone	100	70	130	20	2-Butanone	100	68	127	30
2-Chloro-1,3-butadiene	50	74	122	20	2-Chloro-1,3-butadiene	50	63	136	30
2-Chloroethyl vinyl ether	100	75	121	20	2-Chloroethyl vinyl ether	100	74	128	30
2-Chlorotoluene	50	80	120	20	2-Chlorotoluene	50	80	120	30
2-Hexanone	100	74	132	20	2-Hexanone	100	70	131	30
2-Methylnaphthalene	50	60	140	20	2-Methylnaphthalene	50	60	140	30
4-Chlorotoluene	50	80	120	20	4-Chlorotoluene	50	79	120	30
4-Isopropyltoluene	50	80	120	20	4-Isopropyltoluene	50	80	123	30
4-Methyl-2-pentanone	100	72	130	20	4-Methyl-2-pentanone	100	71	130	30
Acetaldehyde	200	60	130	20	Acetaldehyde	200	58	137	30
Acetone	100	65	138	20	Acetone	100	63	138	30
Acetonitrile	100	64	133	20	Acetonitrile	500	62	131	30

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Table G.9.1 - SW8260C LCS Recovery Limits - Houston Facility

Analyte – Water Matrix	SPK µg/L	Low	High	RPD	Analyte – Soil Matrix	SPK µg/Kg	Low	High	RPD
Acrolein	100	64	145	20	Acrolein	100	56	143	30
Acrylonitrile	100	70	130	20	Acrylonitrile	100	67	130	30
Allyl Chloride	50	50	149	20	Allyl Chloride	50	71	131	30
Benzene	50	80	120	20	Benzene	50	79	121	30
Benzyl Chloride	50	69	120	20	Benzyl Chloride	50	63	133	30
Bromobenzene	50	80	120	20	Bromobenzene	50	80	120	30
Bromochloromethane	50	80	120	20	Bromochloromethane	50	80	120	30
Bromodichloromethane	50	80	120	20	Bromodichloromethane	50	80	121	30
Bromoform	50	79	120	20	Bromoform	50	74	126	30
Bromomethane	50	70	133	20	Bromomethane	50	69	125	30
Butyl methcrylate	50	70	130	20	Butyl methacrylate	50	70	130	30
Carbon disulfide	100	77	123	20	Carbon disulfide	100	75	128	30
Carbon tetrachloride	50	76	122	20	Carbon tetrachloride	50	76	130	30
Chlorobenzene	50	80	120	20	Chlorobenzene	50	80	120	30
Chloroethane	50	69	129	20	Chloroethane	50	73	128	30
Chloroform	50	80	120	20	Chloroform	50	77	122	30
Chloromethane	50	67	125	20	Chloromethane	50	64	129	30
Cis-1,2-Dichloroethene	50	80	120	20	cis-1,2-Dichloroethene	50	78	122	30
Cis-1,3-Dichloropropene	50	80	120	20	cis-1,3-Dichloropropene	50	80	123	30
Cyclohexane	50	70	126	20	Cyclohexane	50	75	129	30
Dibromochloromethane	50	80	120	20	Dibromochloromethane	50	80	122	30
Dibromomethane	50	80	120	20	Dibromomethane	50	74	120	30
Dichlorodifluoromethane	50	62	123	20	Dichlorodifluoromethane	50	57	133	30
Diethyl Ether	50	75	129	20	Diethyl Ether	50	78	121	30
Diisopropyl ether	50	75	121	20	Diisopropyl ether	50	74	124	30
Epichlorohydrin	200	68	131	20	Epichlorohydrin	200	55	132	30
Ethyl acrylate	50	70	128	20	Ethyl acrylate	50	76	125	30
Ethyl methacrylate	50	78	123	20	Ethyl methacrylate	50	62	137	30
Ethylbenzene	50	80	120	20	Ethylbenzene	50	80	120	30
Hexachlorobutadiene	50	72	123	20	Hexachlorobutadiene	50	74	132	30
Iodomethane	100	70	126	20	Iodomethane	100	70	130	30
Isobutyl alcohol	1000	49	150	20	Isobutyl alcohol	1000	57	144	30
Isoprene	50	71	126	20	Isoprene	50	79	128	30
Isopropyl alcohol	1000	51	150	20	Isopropyl alcohol	1000	51	145	30
Isopropylbenzene	50	80	120	20	Isopropylbenzene	50	80	123	30
M,p-Xylene	100	80	120	20	m,p-Xylene	100	80	120	30
Methacrylonitrile	50	71	129	20	Methacrylonitrile	50	57	137	30
Methyl acetate	50	68	132	20	Methyl acetate	50	64	129	30
Methyl methacrylate	50	75	124	20	Methyl methacrylate	50	73	123	30
Methyl tert-butyl ether	50	80	122	20	Methyl tert-butyl ether	50	75	124	30
Methylcyclohexane	50	75	122	20	Methylcyclohexane	50	76	129	30
Methylene chloride	50	78	120	20	Methylene chloride	50	68	127	30
n-Butyl acetate	50	57	150	20	n-Butyl acetate	50	59	142	30
n-Butyl acrylate	50	73	125	20	n-Butyl acrylate	50	69	130	30
n-Butylbenzene	50	77	120	20	n-Butylbenzene	50	78	128	30
n-Heptane	50	67	127	20	n-Heptane	50	76	122	30
n-Hexane	50	68	129	20	n-Hexane	50	76	132	30
n-Propylbenzene	50	80	120	20	n-Propylbenzene	50	79	124	30
Naphthalene	50	74	127	20	Naphthalene	50	71	132	30

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Table G.9.1 - SW8260C LCS Recovery Limits - Houston Facility

Analyte – Water Matrix	SPK µg/L	Low	High	RPD	Analyte – Soil Matrix	SPK µg/Kg	Low	High	RPD
o-Xylene	50	80	120	20	o-Xylene	50	80	121	30
Propylene oxide	100	60	131	20	Propylene oxide	100	56	142	30
Sec-Butylbenzene	50	79	120	20	sec-Butylbenzene	50	80	125	30
Styrene	50	80	120	20	Styrene	50	80	123	30
Tert-butyl alcohol	1000	57	146	20	Tert-butyl alcohol	1000	58	139	30
Tert-Butylbenzene	50	80	120	20	tert-Butylbenzene	50	80	122	30
Tetrachloroethene	50	80	120	20	Tetrachloroethene	50	80	123	30
Toluene	50	80	120	20	Toluene	50	79	120	30
Trans-1,2-Dichloroethene	50	80	122	20	Trans-1,2-Dichloroethene	50	78	124	30
Trans-1,3-Dichloropropene	50	80	120	20	Trans-1,3-Dichloropropene	50	80	122	30
Trans-1,4-Dichloro-2-butene	50	75	120	20	Trans-1,4-Dichloro-2-butene	50	64	130	30
Trichloroethene	50	80	120	20	Trichloroethene	50	80	120	30
Trichlorofluoromethane	50	70	129	20	Trichlorofluoromethane	50	77	132	30
Vinyl acetate	100	71	129	20	Vinyl acetate	100	61	140	30
Vinyl chloride	50	67	129	20	Vinyl chloride	50	71	129	30
Xylenes, Total	150	80	120	20	Xylenes, Total	150	80	120	30
1,2-Dichloroethane-d4	50	70	125	20	1,2-Dichloroethane-d4	50	70	128	30
4-Bromofluorobenzene	50	72	125	20	4-Bromofluorobenzene	50	73	126	30
Dibromofluoromethane	50	71	125	20	Dibromofluoromethane	50	71	128	30
Toluene-d8	50	75	125	20	Toluene-d8	50	73	127	30

Table G.9.2 - SW8260C Low Level Water - LCS Recovery - Limits Houston Facility

Analyte – Low Water Matrix	SPK µg/L	Low	High	RPD	Analyte – Low Water Matrix	SPK µg/L	Low	High	RPD
1,1,1,2-Tetrachloroethane	10	80	120	20	Chlorobenzene	10	80	120	20
1,1,1-Trichloroethane	10	80	120	20	Chloroethane	10	80	120	20
1,1,2,2-Tetrachloroethane	10	74	123	20	Chloroform	10	80	120	20
1,1,2-Trichlor-1,2,2-trifluoroethane	10	76	120	20	Chloromethane	10	72	127	20
1,1,2-Trichloroethane	10	80	120	20	Cis-1,2-Dichloroethene	10	80	120	20
1,1-Dichloroethane	10	80	120	20	Cis-1,3-Dichloropropene	10	79	120	20
1,1-Dichloroethene	10	80	120	20	Cyclohexane	10	75	125	20
1,1-Dichloropropene	10	80	120	20	Dibromochloromethane	10	74	120	20
1,2,3-Trichlorobenzene	10	79	120	20	Dibromomethane	10	80	120	20
1,2,3-Trichloropropane	10	70	126	20	Dichlorodifluoromethane	10	72	125	20
1,2,3-Trimethylbenzene	10	80	120	20	Dicyclopentadiene	10	80	120	20
1,2,4-Trichlorobenzene	10	77	120	20	Ethyl acrylate	10	75	125	20
1,2,4-Trimethylbenzene	10	80	120	20	Ethylbenzene	10	80	120	20
1,2-Dibromo-3-chloropropane	10	68	120	20	Ethyl methacrylate	10	59	139	20
1,2-Dibromoethane	10	80	120	20	Hexachlorobutadiene	10	77	122	20
1,2-Dichlorobenzene	10	80	120	20	Iodomethane	20	58	130	20
1,2-Dichloroethene, Total	10	80	120	20	Isopropylbenzene	10	80	120	20
1,2-Dichloroethane	10	79	120	20	m,p-Xylene	20	80	123	20
1,2-Dichloropropane	10	80	120	20	Methacrylonitrile	10	75	126	20
1,3,5-Trimethylbenzene	10	80	120	20	Methyl acetate	10	76	122	20
1,3-Dichlorobenzene	10	80	120	20	Methyl methacrylate	10	73	139	20
1,3-Dichloropropane	10	80	120	20	Methyl tert-butyl ether	10	79	120	20
1,4-Dichlorobenzene	10	80	120	20	Methylcyclohexane	10	79	123	20
1,4-Dioxane	200	60	154	20	Methylene chloride	10	75	125	20
1-Chlorohexane	10	77	120	20	n-Butylbenzene	10	80	120	20

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Table G.9.2 - SW8260C Low Level Water - LCS Recovery - Limits Houston Facility

Analyte – Low Water Matrix	SPK µg/L	Low	High	RPD	Analyte – Low Water Matrix	SPK µg/L	Low	High	RPD
2,2-Dichloropropane	10	77	121	20	n-Hexane	10	75	125	20
2-Butanone	20	70	130	20	n-Propylbenzene	10	80	120	20
2-Chloroethyl vinyl ether	20	75	120	20	Naphthalene	10	74	125	20
2-Chlorotoluene	10	80	120	20	o-Xylene	10	80	120	20
2-Hexanone	20	66	131	20	Sec-Butylbenzene	10	80	120	20
4-Chlorotoluene	10	80	120	20	Styrene	10	78	122	20
4-Isopropyltoluene	10	80	120	20	Tert-Butylbenzene	10	80	120	20
4-Methyl-2-pentanone	20	67	132	20	Tetrachloroethene	10	80	120	20
Acetone	20	65	135	20	Toluene	10	80	121	20
Acetonitrile	20	70	135	20	Trans-1,2-Dichloroethene	10	80	120	20
Acrolein	20	70	130	20	Trans-1,3-Dichloropropene	10	76	120	20
Acrylonitrile	20	70	130	20	Trichloroethene	10	80	120	20
Benzene	10	80	120	20	Trichlorofluoromethane	10	79	120	20
Bromobenzene	10	80	120	20	Vinyl acetate	20	63	139	20
Bromochloromethane	10	80	120	20	Vinyl chloride	10	75	125	20
Bromodichloromethane	10	80	120	20	Xylenes, Total	30	80	124	20
Bromoform	10	70	120	20	1,2-Dichloroethane-d4	10	71	125	20
Bromomethane	10	63	139	20	4-Bromofluorobenzene	10	70	125	20
Butyl acrylate	10	68	130	20	Dibromofluoromethane	10	74	125	20
Carbon disulfide	20	80	120	20	Toluene-d8	10	78	123	20
Carbon tetrachloride	10	79	120	20					

Table G.9.3 - EPA 624 LCS Recovery Limits - Houston Facility

Analyte – Water Matrix	SPK µg/L	Low	High	RPD	Analyte - Water Matrix	SPK µg/L	Low	High	RPD
1,1,1-Trichloroethane	20	80	133	20	Chloroethane	20	78	125	20
1,1,2,2-Tetrachloroethane	20	73	133	20	Chloroform	20	79	127	20
1,1,2-Trichloroethane	20	80	132	20	Chloromethane	20	70	133	20
1,1-Dichloroethane	20	76	131	20	cis-1,2-Dichloroethene	20	74	129	20
1,1-Dichloroethene	20	77	124	20	cis-1,3-Dichloropropene	20	74	129	20
1,2-Dichlorobenzene	20	79	131	20	Dibromochloromethane	20	75	133	20
1,2-Dichloroethane	20	79	126	20	Ethylbenzene	20	75	137	20
1,2-Dichloropropane	20	77	132	20	m,p-Xylene	20	70	130	20
1,3-Dichlorobenzene	20	77	130	20	Methyl tert-butyl ether	20	70	130	20
1,4-Dichlorobenzene	20	74	125	20	Methylene chloride	20	80	126	20
2-Butanone	40	70	130	20	o-Xylene	20	70	130	20
2-Chloroethyl vinyl ether	40	57	120	20	Tetrachloroethene	20	80	132	20
Acetone	40	65	140	20	Toluene	20	77	134	20
Acrolein	40	60	120	20	Trans-1,2-Dichloroethene	20	80	130	20
Acrylonitrile	100	60	120	20	Trans-1,3-Dichloropropene	20	76	128	20
Benzene	20	75	134	20	Trichloroethene	20	80	132	20
Bromodichloromethane	20	80	131	20	Trichlorofluoromethane	20	80	120	20
Bromoform	20	65	135	20	Vinyl chloride	20	70	125	20
Bromomethane	20	65	135	20	1,2-Dichloroethane-d4 (Surr)	20	65	138	20
Carbon tetrachloride	20	78	129	20	4-BFB (Surr)	20	77	121	20
Chlorobenzene	20	80	126	20	Toluene-d8 (Surr)	20	80	123	20

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Table G.10.1 - Method 8270D LCS Recovery Limits - Houston Facility

Analyte - 8270 Water	SPK µg/L	Low	High	RPD	Analyte - 8270 Soil	SPK µg/Kg	Low	High	RPD
1,1´-Biphenyl	50	50	120	20	1,1´-Biphenyl	1667	55	120	30
1,2,4,5-Tetrachlorobenzene	50	50	120	20	1,2,4,5-Tetrachlorobenzene	1667	55	120	30
1,2,4-Trichlorobenzene	50	50	120	20	1,2,4-Trichlorobenzene	1667	55	120	30
1,2-Dichlorobenzene	50	50	120	20	1,2-Dichlorobenzene	1667	55	120	30
1,2-Dinitrobenzene	50	50	120	20	1,2-Dinitrobenzene	1667	40	130	30
1,2-Diphenylhydrazine	50	55	120	20	1,2-Diphenylhydrazine	1667	55	120	30
1,3-Dichlorobenzene	50	50	120	20	1,3-Dichlorobenzene	1667	55	120	30
1,3-Dinitrobenzene	50	55	120	22	1,3-Dinitrobenzene	1667	55	120	30
1,4-Dichlorobenzene	50	55	120	20	1,4-Dichlorobenzene	1667	55	120	30
1,4-Dinitrobenzene	50	55	120	20	1,4-Dinitrobenzene	1667	40	130	30
1,4-Dioxane	50	10	120	20	1,4-Dioxane	1667	15	120	30
1,4-Naphthoquinone	50	55	120	20	1,4-Naphthoquinone	1667	55	120	30
1-Chloronaphthalene	50	40	130	20	1-Chloronaphthalene	1667	50	125	30
1-Methylnaphthalene	50	55	120	20	1-Methylnaphthalene	1667	55	120	30
2,3,4,6-Tetrachlorophenol	50	55	120	20	2,3,4,6-Tetrachlorophenol	1667	55	120	30
2,4,5-Trichlorophenol	100	50	120	20	2,4,5-Trichlorophenol	3333	55	120	30
2,4,6-Trichlorophenol	100	50	120	20	2,4,6-Trichlorophenol	3333	55	120	30
2,4-Dichlorophenol	100	50	120	20	2,4-Dichlorophenol	3333	55	120	30
2,4-Dimethylphenol	100	50	120	20	2,4-Dimethylphenol	3333	55	125	30
2,4-Dinitrophenol	100	40	120	20	2,4-Dinitrophenol	3333	40	125	30
2,4-Dinitrotoluene	50	50	120	20	2,4-Dinitrotoluene	1667	55	125	30
2,6-Dichlorophenol	100	50	120	20	2,6-Dichlorophenol	1667	55	120	30
2,6-Dimethylphenol	50	50	120	20	2,6-Dimethylphenol	1667	55	120	30
2,6-Dinitrotoluene	50	55	120	20	2,6-Dinitrotoluene	1667	55	120	30
2-Chloronaphthalene	50	55	135	20	2-Chloronaphthalene	1667	55	145	30
2-Chlorophenol	100	50	120	20	2-Chlorophenol	3333	55	120	30
2-Chloroquinoxaline	50	55	120	20	2-Chloroquinoxaline	1667	55	120	30
2-Methylnaphthalene	50	55	120	20	2-Methylnaphthalene	1667	55	120	30
2-Methylphenol	100	50	120	20	2-Methylphenol	3333	55	120	30
2-Nitroaniline	50	55	120	20	2-Nitroaniline	1667	55	130	30
2-Nitrophenol	100	55	120	20	2-Nitrophenol	3333	55	120	30
3&4-Methylphenol	150	55	120	20	3&4-Methylphenol	5000	55	120	30
3,3´-Dichlorobenzidine	50	30	120	20	3,3´-Dichlorobenzidine	1667	32	125	30
3-Methylcholanthrene	50	50	120	20	3-Methylcholanthrene	1667	55	125	30
3-Nitroaniline	50	40	120	20	3-Nitroaniline	1667	43	120	30
4,6-Dinitro-2-methylphenol	100	50	120	20	4,6-Dinitro-2-methylphenol	3333	50	130	30
4-Bromophenyl phenyl ether	50	55	120	20	4-Bromophenyl phenyl ether	1667	55	120	30
4-Bromopyrazole	100	40	120	20	4-Bromopyrazole	3333	50	125	30
4-Chloro-3-methylphenol	100	50	120	20	4-Chloro-3-methylphenol	3333	55	120	30
4-Chloroaniline	50	30	120	20	4-Chloroaniline	1667	30	120	30
4-Chlorophenyl phenyl ether	50	55	120	20	4-Chlorophenyl phenyl ether	1667	55	120	30
4-Nitroaniline	50	50	120	20	4-Nitroaniline	1667	55	120	30
4-Nitrophenol	100	45	120	20	4-Nitrophenol	3333	50	130	30
4-Nitroquinoline-1-oxide	50	50	130	20	4-Nitroquinoline-1-oxide	1667	50	150	30
7,12-Dimethylbenz(a)anthracene	50	45	120	20	7,12-Dimethylbenz(a)anthracene	1667	55	120	30
Acenaphthene	50	55	120	20	Acenaphthene	1667	55	120	30
Acenaphthylene	50	55	120	20	Acenaphthylene	1667	55	120	30
Acetophenone	50	40	120	20	Acetophenone	1667	54	120	30
Aniline	50	30	120	20	Aniline	1667	25	120	30

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Table G.10.1 - Method 8270D LCS Recovery Limits - Houston Facility

Analyte - 8270 Water	SPK µg/L	Low	High	RPD	Analyte - 8270 Soil	SPK µg/Kg	Low	High	RPD
Anthracene	50	55	120	20	Anthracene	1667	55	120	30
Aramite	50	50	120	20	Aramite	1667	55	142	30
Atrazine	50	50	120	20	Atrazine	1667	55	127	30
Azobenzene	50	50	130	20	Azobenzene	1667	55	120	30
Benz(a)anthracene	50	55	120	20	Benz(a)anthracene	1667	55	125	30
Benzaldehyde	50	45	120	20	Benzaldehyde	1667	20	132	30
Benzidine	50	10	120	20	Benzidine	1667	10	120	30
Benzo(a)pyrene	50	55	120	20	Benzo(a)pyrene	1667	55	120	30
Benzo(b)fluoranthene	50	55	120	20	Benzo(b)fluoranthene	1667	55	125	30
Benzo(g,h,i)perylene	50	55	120	20	Benzo(g,h,i)perylene	1667	55	120	30
Benzo(k)fluoranthene	50	55	120	20	Benzo(k)fluoranthene	1667	55	130	30
Benzoic acid	50	20	120	20	Benzoic acid	1667	15	130	30
Benzyl alcohol	50	50	120	20	Benzyl alcohol	1667	55	120	30
Bis(2-chloroethoxy) methane	50	55	120	20	Bis(2-chloroethoxy) methane	1667	55	120	30
Bis(2-chloroethyl)ether	50	50	120	20	Bis(2-chloroethyl)ether	1667	55	120	30
Bis(2-chloroisopropyl)ether	50	50	120	20	Bis(2-chloroisopropyl)ether	1667	55	120	30
Bis(2-ethylhexyl)phthalate	50	50	120	20	Bis(2-ethylhexyl)phthalate	1667	55	125	30
Butyl benzyl phthalate	50	50	120	20	Butyl benzyl phthalate	1667	55	125	30
Caprolactam	50	30	120	20	Caprolactam	1667	55	140	30
Carbazole	50	55	120	20	Carbazole	1667	55	120	30
Chlorobenzilate	50	55	120	20	Chlorobenzilate	1667	55	120	30
Chlorothalonil	50	55	120	20	Chlorothalonil	1667	55	140	30
Chrysene	50	55	120	20	Chrysene	1667	55	125	30
Dacthal	50	55	120	20	Dacthal	1667	55	125	30
Di-n-butyl phthalate	50	55	120	20	Di-n-butyl phthalate	1667	55	125	30
Di-n-octyl phthalate	50	50	120	20	Di-n-octyl phthalate	1667	55	130	30
Diallate	50	55	120	20	Diallate	1667	50	140	30
Dibenz(a,h)anthracene	50	55	120	20	Dibenz(a,h)anthracene	1667	55	120	30
Dibenz(a,j)acridine	50	55	120	20	Dibenz(a,j)acridine	1667	40	130	30
Dibenzofuran	50	55	120	20	Dibenzofuran	1667	55	120	30
Diethyl phthalate	50	55	120	20	Diethyl phthalate	1667	55	120	30
Dimethyl phthalate	50	55	120	20	Dimethyl phthalate	1667	55	120	30
Diphenyl ether	50	55	120	20	Diphenyl ether	1667	55	120	30
Diphenylamine	50	55	120	20	Diphenylamine	1667	55	120	30
Ethyl methacrylate	50	45	120	20	Ethyl methacrylate	1667	35	120	30
Ethyl methanesulfonate	50	50	120	20	Ethyl methanesulfonate	1667	55	120	30
Fluoranthene	50	55	120	20	Fluoranthene	1667	55	125	30
Fluorene	50	55	120	20	Fluorene	1667	55	120	30
Hexachlorobenzene	50	55	120	20	Hexachlorobenzene	1667	55	120	30
Hexachlorobutadiene	50	55	120	20	Hexachlorobutadiene	1667	55	120	30
Hexachlorocyclopentadiene	50	50	120	20	Hexachlorocyclopentadiene	1667	50	120	30
Hexachloroethane	50	55	120	20	Hexachloroethane	1667	55	120	30
Hexachloropropene	50	55	120	20	Hexachloropropene	1337	55	120	30
Indeno(1,2,3-cd)pyrene	50	55	120	20	Indeno(1,2,3-cd)pyrene	1667	55	125	30
Isodrin	50	55	120	20	Isodrin	1667	55	120	30
Isophorone	50	55	120	20	Isophorone	1667	55	120	30
Isophthalonitrile	50	55	120	20	Isophthalonitrile	1667	50	120	30
Isosafrole	50	55	120	20	Isosafrole	1667	45	140	30
Kepone	50	15	140	20	Kepone	1667	20	120	30

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Table G.10.1 - Method 8270D LCS Recovery Limits - Houston Facility

Analyte - 8270 Water	SPK µg/L	Low	High	RPD	Analyte - 8270 Soil	SPK µg/Kg	Low	High	RPD
Methapyrilene	50	40	130	20	Methapyrilene	1667	40	130	30
Methyl methanesulfonate	50	50	120	20	Methyl methanesulfonate	1667	55	120	30
N-Nitrosodiethylamine	50	40	130	20	N-Nitrosodiethylamine	1667	40	130	30
N-Nitroso-di-n-butylamine	50	40	130	20	N-Nitroso-di-n-butylamine	1667	40	130	30
N-Nitrosodi-n-propylamine	50	50	120	20	N-Nitrosodi-n-propylamine	1667	55	120	30
N-Nitrosodimethylamine	50	45	120	20	N-Nitrosodimethylamine	1667	45	120	30
N-Nitrosomethylethylamine	50	40	130	20	N-Nitrosomethylethylamine	1667	40	130	30
N-Nitrosodiphenylamine	50	55	120	20	N-Nitrosodiphenylamine	1667	55	120	30
N-Nitrosomorpholine	50	40	130	20	N-Nitrosomorpholine	1667	40	130	30
N-Nitrosopiperidine	50	40	130	20	N-Nitrosopiperidine	1667	40	130	30
N-Nitrosopyrrolidine	50	40	130	20	N-Nitrosopyrrolidine	1667	40	130	30
Naphthalene	50	55	120	20	Naphthalene	1667	55	120	30
Nitrobenzene	50	55	120	20	Nitrobenzene	1667	55	120	30
Pentachlorobenzene	50	55	120	20	Pentachlorobenzene	1667	55	120	30
Pentachloroethane	50	50	120	20	Pentachloroethane	1667	55	120	30
Pentachloronitrobenzene	50	50	120	20	Pentachloronitrobenzene	1667	55	140	30
Pentachlorophenol	100	55	120	20	Pentachlorophenol	3333	50	135	30
Phenacetin	50	55	120	20	Phenacetin	1667	55	125	30
Phenanthrene	50	55	120	20	Phenanthrene	1667	55	120	30
Phenol	100	50	120	20	Phenol	3333	50	120	30
Pronamide	50	55	120	20	Pronamide	1667	55	122	30
Pyrazole	100	35	120	20	Pyrazole	1667	40	125	30
Pyrene	50	55	120	20	Pyrene	1667	55	125	30
Pyridine	50	35	120	20	Pyridine	1667	30	120	30
Quinazoline	50	55	120	20	Quinazoline	1667	55	135	30
Quinoline	50	55	120	20	Quinoline	1667	55	130	30
Safrole	50	55	120	20	Safrole	1667	55	120	30
Sym-Trinitrobenzene	58	55	120	20	Sym-Trinitrobenzene	1667	60	160	30
2,4,6-Tribromophenol	100	42	124	20	2,4,6-Tribromophenol	3333	36	126	30
2-Fluorobiphenyl	100	48	120	20	2-Fluorobiphenyl	3333	43	125	30
2-Fluorophenol	100	20	120	20	2-Fluorophenol	3333	37	125	30
4-Terphenyl-d14	100	51	135	20	4-Terphenyl-d14	3333	32	125	30
Nitrobenzene-d5	100	41	120	20	Nitrobenzene-d5	3333	37	125	30
Phenol-d6	100	20	120	20	Phenol-d6	3333	40	125	30

Table G.10.2 - Method 8270D Low Level LCS Recovery Limits – Houston Facility

Analyte - 8270 Water	SPK µg/L	Low	High	RPD	Analyte - 8270 Soil	SPK µg/Kg	Low	High	RPD
1,1´-Biphenyl	5	45	125	20	1,1´-Biphenyl	166.7	50	120	30
1,2,4-Trichlorobenzene	5	45	120	20	1,2,4-Trichlorobenzene	166.7	50	120	30
1,2-Dichlorobenzene	5	45	120	20	1,2-Dichlorobenzene	166.7	50	120	30
1,2-Diphenylhydrazine	5	39	127	20	1,2-Diphenylhydrazine	166.7	50	135	30
1,3-Dichlorobenzene	5	45	120	20	1,3-Dichlorobenzene	166.7	50	120	30
1,4-Dichlorobenzene	5	40	120	20	1,4-Dichlorobenzene	166.7	50	120	30
1-Methylnaphthalene	5	45	120	20	1-Methylnaphthalene	166.7	50	120	30
2,4,5-Trichlorophenol	5	46	120	20	2,4,5-Trichlorophenol	166.7	45	127	30
2,4,6-Trichlorophenol	5	42	120	20	2,4,6-Trichlorophenol	166.7	45	130	30
2,4-Dichlorophenol	5	49	120	20	2,4-Dichlorophenol	166.7	45	125	30
2,4-Dimethylphenol	5	35	120	20	2,4-Dimethylphenol	166.7	45	120	30

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Table G.10.2 - Method 8270D Low Level LCS Recovery Limits – Houston Facility

Analyte - 8270 Water	SPK µg/L	Low	High	RPD	Analyte - 8270 Soil	SPK µg/Kg	Low	High	RPD
2,4-Dinitrophenol	5	15	120	20	2,4-Dinitrophenol	166.7	10	126	30
2,4-Dinitrotoluene	5	50	122	20	2,4-Dinitrotoluene	166.7	50	130	30
2,6-Dinitrotoluene	5	50	120	20	2,6-Dinitrotoluene	166.7	50	125	30
2-Chloronaphthalene	5	50	120	20	2-Chloronaphthalene	166.7	50	145	30
2-Chlorophenol	5	50	120	20	2-Chlorophenol	166.7	45	120	30
2-Methylnaphthalene	5	50	120	20	2-Methylnaphthalene	166.7	50	120	30
2-Methylphenol	5	45	120	20	2-Methylphenol	166.7	45	120	30
2-Nitroaniline	5	28	139	20	2-Nitroaniline	166.7	45	138	30
2-Nitrophenol	5	40	120	20	2-Nitrophenol	166.7	45	125	30
3&4-Methylphenol	5	35	120	20	3&4-Methylphenol	166.7	45	120	30
3,3´-Dichlorobenzidine	5	15	120	20	3,3´-Dichlorobenzidine	166.7	15	120	30
3-Nitroaniline	5	30	120	20	3-Nitroaniline	166.7	40	120	30
4,6-Dinitro-2-methylphenol	5	25	121	20	4,6-Dinitro-2-methylphenol	166.7	15	135	30
4-Bromophenyl phenyl ether	5	45	120	20	4-Bromophenyl phenyl ether	166.7	50	125	30
4-Chloro-3-methylphenol	5	47	120	20	4-Chloro-3-methylphenol	166.7	45	130	30
4-Chloroaniline	5	20	120	20	4-Chloroaniline	166.7	20	120	30
4-Chlorophenyl phenyl ether	5	50	120	20	4-Chlorophenyl phenyl ether	166.7	50	120	30
4-Nitroaniline	5	30	133	20	4-Nitroaniline	166.7	50	127	30
4-Nitrophenol	5	30	130	20	4-Nitrophenol	166.7	40	147	30
Acenaphthene	5	45	120	20	Acenaphthene	166.7	50	120	30
Acenaphthylene	5	47	120	20	Acenaphthylene	166.7	50	120	30
Acetophenone	5	40	120	20	Acetophenone	166.7	50	120	30
Aniline	5	10	120	20	Aniline	166.7	10	135	30
Anthracene	5	45	120	20	Anthracene	166.7	50	123	30
Atrazine	5	40	130	20	Atrazine	166.7	29	148	30
Benz(a)anthracene	5	40	120	20	Benz(a)anthracene	166.7	50	131	30
Benzaldehyde	5	35	130	20	Benzaldehyde	166.7	45	120	30
Benzidine	5	10	120	20	Benzidine	166.7	10	120	30
Benzo(a)pyrene	5	45	120	20	Benzo(a)pyrene	166.7	50	130	30
Benzo(b)fluoranthene	5	50	120	20	Benzo(b)fluoranthene	166.7	50	137	30
Benzo(g,h,i)perylene	5	42	127	20	Benzo(g,h,i)perylene	166.7	50	130	30
Benzo(k)fluoranthene	5	45	127	20	Benzo(k)fluoranthene	166.7	50	143	30
Benzoic acid	5	10	110	20	Benzoic acid	166.7	10	120	30
Benzyl alcohol	5	35	122	20	Benzyl alcohol	166.7	40	143	30
Bis(2-chloroethoxy) methane	5	45	120	20	Bis(2-chloroethoxy) methane	166.7	50	120	30
Bis(2-chloroethyl)ether	5	37	121	20	Bis(2-chloroethyl)ether	166.7	45	127	30
Bis(2-chloroisopropyl)ether	5	40	120	20	Bis(2-chloroisopropyl)ether	166.7	50	120	30
Bis(2-ethylhexyl)phthalate	5	40	139	20	Bis(2-ethylhexyl)phthalate	166.7	21	148	30
Butyl benzyl phthalate	5	47	123	20	Butyl benzyl phthalate	166.7	50	136	30
Caprolactam	5	35	134	20	Caprolactam	166.7	50	135	30
Carbazole	5	42	128	20	Carbazole	166.7	50	143	30
Chrysene	5	43	120	20	Chrysene	166.7	50	130	30
Di-n-butyl phthalate	5	45	123	20	Di-n-butyl phthalate	166.7	50	140	30
Di-n-octyl phthalate	5	45	129	20	Di-n-octyl phthalate	166.7	50	140	30
Dibenz(a,h)anthracene	5	45	120	20	Dibenz(a,h)anthracene	166.7	50	130	30
Dibenzofuran	5	50	120	20	Dibenzofuran	166.7	50	125	30
Diethyl phthalate	5	41	120	20	Diethyl phthalate	166.7	50	125	30
Dimethyl phthalate	5	40	122	20	Dimethyl phthalate	166.7	50	125	30
Diphenylamine	5	45	120	20	Diphenylamine	166.7	45	132	30

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Table G.10.2 - Method 8270D Low Level LCS Recovery Limits – Houston Facility

Analyte - 8270 Water	SPK µg/L	Low	High	RPD	Analyte - 8270 Soil	SPK µg/Kg	Low	High	RPD
Fluoranthene	5	45	125	20	Fluoranthene	166.7	50	131	30
Fluorene	5	49	120	20	Fluorene	166.7	50	125	30
Hexachlorobenzene	5	48	120	20	Hexachlorobenzene	166.7	50	124	30
Hexachlorobutadiene	5	40	120	20	Hexachlorobutadiene	166.7	50	125	30
Hexachlorocyclopentadiene	5	34	136	20	Hexachlorocyclopentadiene	166.7	45	135	30
Hexachloroethane	5	40	120	20	Hexachloroethane	166.7	45	125	30
Indeno(1,2,3-cd)pyrene	5	41	128	20	Indeno(1,2,3-cd)pyrene	166.7	45	139	30
Isophorone	5	40	121	20	Isophorone	166.7	45	130	30
N-Nitrosodi-n-propylamine	5	30	140	20	N-Nitrosodi-n-propylamine	166.7	45	120	30
N-Nitrosodimethylamine	5	40	120	20	N-Nitrosodimethylamine	166.7	20	140	30
N-Nitrosodiphenylamine	5	40	125	20	N-Nitrosodiphenylamine	166.7	50	130	30
Naphthalene	5	45	120	20	Naphthalene	166.7	50	125	30
Nitrobenzene	5	44	120	20	Nitrobenzene	166.7	50	125	30
Pentachlorophenol	5	19	121	20	Pentachlorophenol	166.7	23	136	30
Phenanthrene	5	45	121	20	Phenanthrene	166.7	50	125	30
Phenol	5	20	124	20	Phenol	166.7	45	130	30
Pyrene	5	40	130	20	Pyrene	166.7	45	130	30
Pyridine	5	15	130	20	Pyridine	166.7	15	120	30
Quinoline	5	45	120	20	Quinoline	166.7	45	130	30
2,4,6-Tribromophenol	5	34	129	20	2,4,6-Tribromophenol	166.7	36	126	30
2-Fluorobiphenyl	5	40	125	20	2-Fluorobiphenyl	166.7	43	125	30
2-Fluorophenol	5	20	120	20	2-Fluorophenol	166.7	37	125	30
4-Terphenyl-d14	5	40	135	20	4-Terphenyl-d14	166.7	32	125	30
Nitrobenzene-d5	5	41	120	20	Nitrobenzene-d5	166.7	37	125	30
Phenol-d6	5	20	120	20	Phenol-d6	166.7	40	125	30

Table G.11 - Method 625 LCS Recovery Limits, Houston Facility

Analyte - 625 Water	SPK µg/L	Low	High	RPD	Analyte - 625 Water	SPK µg/L	Low	High	RPD
1,2,4-Trichlorobenzene	100	54	120	20	Benzyl alcohol	100	49	120	20
1,2-Dichlorobenzene	100	49	120	20	Bis(2-chloroethoxy) methane	100	54	120	20
1,2-Diphenylhydrazine	100	55	134	20	Bis(2-chloroethyl)ether	100	55	120	20
1,3-Dichlorobenzene	100	55	120	20	Bis(2-chloroisopropyl)ether	100	48	120	20
1,4-Dichlorobenzene	100	55	120	20	Bis(2-ethylhexyl)phthalate	100	50	120	20
2,4,5-Trichlorophenol	100	52	120	20	Butyl benzyl phthalate	100	51	120	20
2,4,6-Trichlorophenol	100	55	120	20	Carbazole	100	55	120	20
2,4-Dichlorophenol	100	53	120	20	Chrysene	100	52	120	20
2,4-Dimethylphenol	100	53	120	20	Di-n-butyl phthalate	100	54	120	20
2,4-Dinitrophenol	100	47	120	20	Di-n-octyl phthalate	100	49	120	20
2,4-Dinitrotoluene	100	55	120	20	Dibenz(a,h)anthracene	100	55	120	20
2,6-Dinitrotoluene	100	55	120	20	Dibenzofuran	100	55	120	20
2-Chloronaphthalene	100	55	125	20	Diethyl phthalate	100	55	120	20
2-Chlorophenol	100	54	120	20	Dimethyl phthalate	100	55	120	20
2-Methylnaphthalene	100	46	120	20	Diphenylamine	100	52	120	20
2-Methylphenol	100	53	120	20	Fluoranthene	100	55	120	20
2-Nitroaniline	100	53	123	20	Fluorene	100	55	120	20
2-Nitrophenol	100	53	120	20	Hexachlorobenzene	100	54	120	20
3&4-Methylphenol	100	48	120	20	Hexachlorobutadiene	100	51	120	20
3,3´-Dichlorobenzidine	100	25	120	20	Hexachlorocyclopentadiene	100	48	120	20

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Table G.11 - Method 625 LCS Recovery Limits, Houston Facility

Analyte - 625 Water	SPK µg/L	Low	High	RPD	Analyte - 625 Water	SPK µg/L	Low	High	RPD
3-Nitroaniline	100	26	120	20	Hexachloroethane	100	54	120	20
4,6-Dinitro-2-methylphenol	100	51	121	20	Indeno(1,2,3-cd)pyrene	100	51	120	20
4-Bromophenyl phenyl ether	100	49	120	20	Isophorone	100	55	120	20
4-Chloro-3-methylphenol	100	51	120	20	N-Nitrosodi-n-propylamine	100	55	120	20
4-Chloroaniline	100	21	120	20	N-Nitrosodimethylamine	100	42	120	20
4-Chlorophenyl phenyl ether	100	56	120	20	N-Nitrosodiphenylamine	100	52	120	20
4-Nitroaniline	100	47	120	20	Naphthalene	100	55	120	20
4-Nitrophenol	100	26	133	20	Nitrobenzene	100	40	124	20
Acenaphthene	100	55	120	20	Pentachlorophenol	100	45	125	20
Acenaphthylene	100	55	120	20	Phenanthrene	100	55	120	20
Anthracene	100	55	120	20	Phenol	100	38	120	20
Benz(a)anthracene	100	53	120	20	Pyrene	50	54	120	20
Benzidine	100	10	120	20	2,4,6-Tribromophenol	100	42	124	20
Benzo(a)pyrene	100	55	120	20	2-Fluorobiphenyl	100	48	120	20
Benzo(b)fluoranthene	100	54	120	20	2-Fluorophenol	100	20	120	20
Benzo(g,h,i)perylene	100	55	120	20	4-Terphenyl-d14	100	51	135	20
Benzo(k)fluoranthene	100	50	120	20	Nitrobenzene-d5	100	41	120	20
Benzoic acid	100	24	131	20	Phenol-d6	100	20	120	20

Table G.12 - SW 8330B LCS Recovery Limits – Houston Facility

Analyte – Water Matrix	SPK µg/L	Low	High	RPD	Analyte – Soil Matrix	SPK µg/Kg	Low	High	RPD
HMX	3.25	60	120	20	HMX	2500	60	125	30
RDX	3.25	50	120	20	RDX	2500	60	130	30
1,3,5-Trinitrobenzene	3.25	60	125	20	1,3,5-Trinitrobenzene	2500	60	125	30
1,3-Dinitrobenzene	3.25	55	120	20	1,3-Dinitrobenzene	2500	60	125	30
Tetryl	3.25	45	140	20	Tetryl	2500	45	140	30
Nitrobenzene	3.25	55	120	20	Nitrobenzene	2500	60	120	30
2,4,6-Trinitrotoluene	3.25	60	130	20	2,4,6-Trinitrotoluene	2500	60	130	30
4-Amino-2,6-dinitrotoluene	3.25	55	120	20	4-Amino-2,6-dinitrotoluene	2500	60	125	30
2-Amino-4, 6-dinitrotoluene	3.25	55	120	20	2-Amino-4, 6-dinitrotoluene	2500	60	125	30
2,4-Dinitrotoluene	3.25	60	120	20	2,4-Dinitrotoluene	2500	60	125	30
2,6-Dinitrotoluene	3.25	60	125	20	2,6-Dinitrotoluene	2500	60	120	30
2-Nitrotoluene	3.25	55	125	20	2-Nitrotoluene	2500	60	125	30
3-Nitrotoluene	3.25	55	120	20	3-Nitrotoluene	2500	60	120	30
4-Nitrotoluene	3.25	55	120	20	4-Nitrotoluene	2500	60	125	30
1,2-DNB (Surr)	3.25	55	140	20	1,2-DNB (Surr)	2500	50	150	30

Table G.13.1 - SW 8315A LCS Recovery Limits - Houston Facility

Analyte – Water Matrix	SPK µg/L	Low	High	RPD	Analyte – Soil Matrix	SPK µg/Kg	Low	High	RPD
Formaldehyde	50	60	120	20	Formaldehyde	1000	70	130	30

Table G.13.2 - SW 8316 LCS Recovery Limits – Houston Facility

Analyte – Water Matrix	SPK µg/L	Low	High	RPD	Analyte – Soil Matrix	SPK µg/Kg	Low	High	RPD
Acrylamide	25	60	120	20	Acrylamide	25	60	120	30

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TABLE G. 14 - NUMBER OF ALLOWABLE SPORADIC MARGINAL EXCEEDANCES	
Number of analytes	Sporadic Marginal Exceedances Allowed
0-11	0
11-30	1
31-50	2
51-70	3
71-90	4
>90	5

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Appendix E

Public Notification

Notice is hereby given that on May 21, 2010, NuStar Logistics, L.P., 2330 North Loop 1604 West, San Antonio, TX 78248 proposed a Stage 2 Abatement action at their Alamogordo Facility, located at 6026 Highway 54 South, Alamogordo, New Mexico. Groundwater at the Facility is impacted with separate and dissolved phase hydrocarbons. The proposed abatement action includes monitored natural attenuation and an institutional control to limit domestic water well installation adjacent to the Facility. A final determination will be made by the New Mexico Environment Department in accordance with New Mexico Administrative Code (NMAC) 20.6.2.4103. A copy of the abatement plan can be viewed by the public at the New Mexico Environment Department main office or at their office in Las Cruces. Written comments on the abatement plan, and requests for a public meeting or hearing that include the reasons why a meeting or hearing should be held, will be accepted for consideration if sent to the secretary within sixty (60) days after the determination of administrative completeness.

For further information, interested parties may contact:

Christopher Whitman

NM Environment Dept.

Ground Water Quality Bureau

1170 N. Solano Drive, Suite M

Las Cruces, NM 88001

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