October 1, 2015

New York State Department of Environmental Conservation – Region 7
615 Erie Boulevard West
Syracuse, New York 13204
Attn: Mr. Richard Brazell, P.E.

RE: Cold Springs Terminal Mutual Defense Group
Remedial Action Work Plan
Cold Springs Terminal
Hillside Drive
Lysander, Onondaga County, New York
NYSDEC Spill #89-04923

Dear Mr. Brazell

Groundwater & Environmental Services, Inc., (GES) of North Syracuse, New York, is pleased to submit this Remedial Action Work Plan (RAWP) on behalf of the Cold Springs Terminal Mutual Defense Group (the Group). This RAWP was prepared in accordance with Section 5.3 of DER-10 Technical Guidance for Site Investigation and Remediation.

GES and the Group are available to discuss this document and the work proposed within at your convenience at either the NYSDEC Syracuse or Albany offices. Please feel free to contact the undersigned at (800) 220-3069, extension 4051, if you have any questions or comments.

Sincerely,
Groundwater & Environmental Services, Inc.



Devin T. Shay
Principal Hydrogeologist

Attachments

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REMEDIAL ACTION WORK PLAN

COLD SPRINGS TERMINAL
Lysander, New York
NYSDEC Spills Incident #89-04923
October 1, 2015

Prepared for:
Cold Springs Terminal Mutual Defense Group
Hillside Road
Lysander, New York

Prepared by: _____
Devin T. Shay
Principal Hydrogeologist

Prepared by: _____ for
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ABBREVIATIONS AND ACRONYMS

AST	Above-ground Storage Tanks
Aztech	Aztech Technologies, Inc.
CAMP	Community Air Monitoring Plan
^{o}C	Celsius degrees
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
CSTMDG	Cold Springs Terminal Mutual Defense Group
DER-10	NYSDEC Technical Guidance for Site Investigation and Remediation
DO	Dissolved Oxygen
ELAP	Environmental Laboratory Approval Program
EPA	Environmental Protection Agency
GPM	Gallon per minute
GES	Groundwater & Environmental Services, Inc.
HASP	Health and Safety Plan
HDPE	High density polyethylene
in. Hg	Inches of mercury
ITRC	Interstate Technology & Regulatory Council
LIF	Laser-induced Fluorescence
lb/hr	Pounds per hour
LGAC	Liquid-phase granular activated carbon
LNAPL	Light Non-aqueous Phase Liquid
NEC	National Electric Code
ORP	Oxidation reduction potential
OSHA	Occupational Safety and Health Administration
PVC	Polyvinyl chloride
mg/L	milligrams per liter
mS/cm	millisiemens per centimeter
mV	millivolts
MNA	Monitored Natural Attenuation
MPE	Multi-phase Extraction
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	Operation and Maintenance
PBS	Petroleum Bulk Storage
PID	Photoionization detector
PTSR	Pilot Test Summary Report
QAPP	Quality Assurance Project Plan
ROI	Radius of Influence

ABBREVIATIONS AND ACRONYMS

RAOs	Remedial Action Objectives
RAWP	Remedial Action Work Plan
SCGs	Standards, Criteria and Guidance
SMP	Site Management Plan
STARS	Spill Technology and Remediation Series
SSIWP	Supplemental Site Investigation Work Plan
SCFM	Standard cubic feet per minute
SVE	Soil Vapor Extraction
SU	Standard Units for pH
TPH	Total Petroleum Hydrocarbons
UFPO	Underground Facilities Protection Organization
UVOST®	Ultra-violet Optical Screening Tool
µg/L	micrograms per liter
VEGE	Vacuum Enhanced Groundwater Extraction
VOCs	Volatile organic compounds

1.0 INTRODUCTION

1.1 Plan Overview and Objectives

Groundwater & Environmental Services, Inc., on behalf of the Cold Springs Terminal Mutual Defense Group, has prepared this RAWP for the Cold Springs Terminal properties located on Hillside Road in Lysander, New York (the "Site"). This RAWP presents a detailed description of the selected environmental remedy for the Site that will best address existing LNAPL. It is anticipated that improvement will also be seen in the dissolved-phase hydrocarbon concentrations as a result of system operation. The Site includes three (3) adjacent former Petroleum Bulk Storage (PBS) facilities referred to as the Northern Terminal, the Southwestern Terminal and the Southeastern Terminal. The former terminals are located on the north side of the Seneca River. Separate phase LNAPL and dissolved and sorbed petroleum hydrocarbons are present in the subsurface at the Site. The impacts are the result of highly degraded gasoline, middle distillates and fuel oil present in the subsurface which are attributed to multiple releases resulting from historical terminal operations.

This document proposes a two (2) part environmental remedy for the Site, which includes the implementation of a focused active remedial measure followed by post-remediation monitoring of residual and dissolved phase impacts. This approach is designed to address any remaining recoverable LNAPL present in the subsurface to the extent practicable and minimize the potential for residual LNAPL to migrate. GES recommends that, as a first phase to the proposed remedy, a VEGE system is installed and operated at discrete locations on the Site where recoverable LNAPL exceeds recoverability thresholds and can be practically recovered. This technology was selected based on a recent pilot test and data gathered during environmental investigation activities documented by AECOM in the *Pilot Test Summary Report*, submitted to the NYSDEC on September 30, 2014 (AECOM, 2014).

The second phase of the proposed remedy will consist of monitoring the distribution of the post-active remediation residual LNAPL and groundwater quality to confirm hydrocarbon plume stability.

The selected remedy provides for the protection of public health and the environment consistent with the intended future use of the Site properties and its intent is to meet with ITRC environmental standards and guidance for LNAPL remediation (ITRC, 2009). The proposed remediation and monitoring activities outlined in this RAWP are submitted pursuant to the guidelines of the NYSDEC and applicable DER-10 SCGs. Administrative controls, which may include restricted site access and/or a deed restriction, may be recommended as deemed necessary by the NYSDEC.

1.2 Regulatory Oversight

The NYSDEC Spill Incident Database indicates that the current open spill number on record for the Site is #89-04923. The project is currently managed under that spill number by staff from NYSDEC Region 7 in Syracuse, New York.

1.3 Document Organization

The goal of the RAWP is to briefly summarize the available information regarding the nature and extent of contaminants present at the Site and to present the proposed remedy to address the remaining contaminants of concern.

The key components of the RAWP include:

- Summary of subsurface and local hydrogeological conditions
- Summary of LNAPL distribution and characteristics
- Remedial pilot testing results summary
- Remedial system final design basis, general installation specifications, and proposed O&M plan
- Performance monitoring criteria for the selected remedy
- Post-remediation monitoring activities

Due to the extensive amount of historic data and correspondence regarding the Site, information utilized in preparation of this RAWP is referenced in the body of the document, and the full list of the referenced former submittals is included in **Appendix A**. In addition, pertinent information utilized in preparation of this RAWP was obtained from the PTSR completed by AECOM and submitted to the NYSDEC in September 2014. The PTSR is included in **Appendix B**.

Section 1.0 provides the objectives of the RAWP and a summary of the regulatory oversight and procedural guidelines governing remediation of the Site.

Section 2.0 describes of the geographic location of the Site, briefly presents the environmental activities that have been completed at the location, and provides a summary of physiographic site attributes.

Section 3.0 references pertinent information included in the PTSR that was utilized to develop the RAWP including existing geologic and hydrogeologic conditions, the LNAPL CSM and data acquired during the MPE and VEGE pilot testing completed on the Site by AECOM.

Section 4.0 identifies the RAOs for the Site, determined in accordance with the DER-10. The RAOs are based on the results of the environmental investigation activities and CSM presented in the PTSR completed by AECOM and submitted to the NYSDEC in September, 2014 (AECOM, 2014).

Section 5.0 defines the proposed remedial strategy for the Site, describes the proposed actions required to implement the targeted VEGE remediation and recommends a post-remediation monitoring strategy to evaluate LNAPL trends when active remediation is completed.

Section 6.0 describes the proposed waste disposal procedures to be followed during system installation, operation of the remediation system, and post-remediation monitoring activities.

Section 7.0 describes the implementation and reporting schedule for system operation, system monitoring and post-remediation monitoring activities.

1.4 Site Operational Procedures

Any personnel performing environmental investigation and construction related activities on site and all associated subcontractors and vendors who enter the Site must work under a site specific HASP. The HASP must include emergency phone numbers, site maps, hospital routes, descriptions of tasks to be performed, and descriptions of the standard health and safety procedures that will be utilized during these activities. All personnel and subcontractors that may come in contact with impacted materials, who complete work activities at the Site as described in this RAWP, must be trained and certified in accordance with OSHA CFR 1910.120.

Level D personal protection equipment, at a minimum, must be utilized during all environmental investigation and construction related activities completed on the Site. This level of protection includes steel-toed boots, safety glasses, hard hats, appropriate work gloves, and hearing protection, at a minimum. Appropriate hand protection, including Kevlar liners, leather, and/or nitrile gloves, will be worn when conducting drilling related activities, handling soils, and completing groundwater monitoring and sampling activities.

An UFPO subsurface utility mark-out must be completed at the Site before beginning any subsurface work. Prior to beginning intrusive activities, the public utility mark-outs and any on-site private utility mark-outs completed by Site personnel must be reviewed.

2.0 SITE SETTING AND BACKGROUND

2.1 Site Description

The Cold Springs Terminal site includes three (3) former (inactive) PBS facilities located adjacent to one another along Hillside Road in the Town of Lysander, Onondaga County, New York. The Site encompasses a total area of approximately six (6) acres and is located on the north shore of the Seneca River, approximately 1.25 miles north of Onondaga Lake. The location of the Site may be referenced on the Site Location Map provided on **Figure 1**. The Seneca River comprises the southern boundary of the Site. The Cold Springs Cemetery is located adjacent to the western boundary of the Site. Privately owned residences are present further to the west. Privately owned wooded land and residences are also present to the north and east of the Site.

The Northern Terminal consists of approximately 2.75 acres and is located on the north side of Hillside Road. The majority of the former terminal infrastructure has been demolished on this property. Only secondary containment berms and the concrete footprints of former ASTs remain on the property. The Southwestern Terminal, which is approximately 1.75 acres in size, and the Southeastern Terminal, encompassing 1.6 acres, are located south of Hillside Road to the southwest and southeast of the Northern Terminal, respectively. Portions of the former terminal infrastructure, including ASTs, loading racks, piping, canopies, utility buildings, trailers and storage sheds remain present on both the Southwestern and Southeastern Terminal properties. The layout of three (3) facilities and existing site features may be referenced on the Site Map provided as **Figure 2**.

2.2 Site History

The three (3) terminals comprising the Site began operating as PBS facilities as early as 1934 (Aztech, 2007). In general, the facilities handled gasoline, middle distillates (Jet-A fuel, kerosene, and diesel) and fuel oil. Environmental activities were initiated at the Site in 1989 after a release of an unspecified volume of gasoline was reported to the NYSDEC (Spill #89-04923) on August 17, 1989. However, additional spills have been documented on the terminal properties by other sources throughout their operating histories (Aztech, 2007). Separate phase, dissolved and sorbed petroleum hydrocarbons have been identified on the Site as a result of several environmental investigations completed by various consultants. A detailed summary of the environmental activities completed on the Site from 1989 through 2007 may be referenced in correspondence completed by Aztech (Aztech, 2007).

Historical LNAPL recovery efforts completed from 1990 through 2005 reportedly collected approximately 3,200 gallons of LNAPL from the Site using hand bailing methods (AECOM, 2012). Pilot testing of both groundwater pumping and SVE technologies was completed on the Site by Aztech during 2005. The extraction wells incorporated into the system were mainly located on the southern portion of the Northern Terminal property (adjacent to Hillside Road), in the northeast corner of the Southwestern Terminal property and adjacent to the canopy on the Southeastern Terminal property. An SVE system with automated LNAPL recovery pumps was subsequently put into operation in January 2006. The SVE system remained operational through

September 2008 at which time it experienced mechanical failure (Aztech, 2009). The SVE system was rebuilt and put back into operation in 2009. Operation of the remediation system was suspended indefinitely in 2011 due to limited mass recovery and funding issues (Aztech, 2011). However, the SVE system operated by Aztech reportedly collected 208 gallons of LNAPL (as liquid) and the reported equivalent of 9,385 gallons of LNAPL (by vapor extraction) from the Site between January 2006 and October 2008 (Aztech, 2009). The relatively limited historical LNAPL mass recovery rates, in relation to the areal extent of the LNAPL mass, were attributed to "the restricted fluid permeability of the Site stratigraphy" (AECOM, 2012).

In 2012, the *Supplemental Site Investigation Work Plan,* updated to address NYSDEC comments, was completed by AECOM and submitted to the NYSDEC on behalf of the CSTMDG. The SSIWP included the proposed environmental investigation and planned pilot testing activities to be completed to aid in the development of a CSM and an environmental remedy for the Site. Soil boring activities, soil and groundwater sampling, liquid level gauging, cone penetrometer testing and UVOST® investigations were completed as part the site investigation activities. In addition, pilot testing of both MPE and VEGE technologies was completed on the Site using existing wells to evaluate the applicability of these technologies as potential remedies for the location. The PTSR submitted to the NYSDEC in September 2014 provides the results of the investigation and pilot testing activities (Appendix B).

3.0 EXISTING SITE CONDITIONS AND PILOT TESTING RESULTS

The CSTMDG previously retained AECOM to complete a detailed investigation and summary of the geology and hydrogeology of the Site, a thorough LNAPL characterization study, and a pilot test of VEGE and MPE technologies. A summary of the results of these efforts has not been duplicated in this document; rather the AECOM report has been included in its entirety as **Appendix B**. The reader is directed to this document to gain an understanding of the complexities of the interaction of the site hydrogeology and LNAPL mass, and the challenges these complexities represent to the proposed remediation efforts.

3.1 Site Geology and Hydrogeology

A detailed presentation of the geology on the Site may be referenced in Section 2.4 and of the PTSR. A discussion of the hydrogeologic conditions on the Site and the groundwater elevation data collected from the Site during a comprehensive fluid level gauging event completed at the Site on July 11, 2013 may be referenced in Section 2.5 of the PTSR (**Appendix B**).

3.2 LNAPL Conceptual Site Model

To facilitate understanding of LNAPL conditions and potential remediation, a Conceptual Site Model was developed by AECOM (2014) which assessed the chemical and physical properties of the LNAPL found at the site and its lateral and vertical distribution.

The LNAPL present on the Site is the result of multiple releases during historical terminal operations conducted at the Site since 1934 (Aztech, 2007). Forensic evaluations of the LNAPL present on the Site, completed in conjunction with historical environmental investigations, have determined that the LNAPL present in the subsurface consists of degraded gasoline, middle distillates (Jet-A fuel, kerosene, and diesel) and fuel oil (Zymax, 2009). Weathering of LNAPL, which includes processes such as dissolution, volatilization, and biodegradation, has changed the chemical composition and physical characteristics of the liquid. A detailed discussion of the current chemical and physical properties of the LNAPL present on the Site may be referenced in Section 2.6.2 of the PTSR (**Appendix B**).

The horizontal and vertical extent of the LNAPL present on the Site was evaluated by AECOM during site investigation activities conducted during 2014. Both UVOST® and fluid gauging methods were used to evaluate LNAPL in the subsurface on the Site. A detailed description of the results of these investigation activities may be referenced in Section 2.6.3 and Section 2.6.4 of the PTSR (**Appendix B**). The location of the UVOST investigation locations may be referenced on **Figure 3**. A representation of the total LIF response observed during the UVOST® investigation are provided on **Figure 4**.

The LNAPL distribution generated from the comprehensive fluid level gauging event completed on the Site by AECOM in July of 2013 is provided as **Figure 5**. A depiction of the specific volume distribution of LNAPL in the subsurface, determined from the data presented in the PTSR, is provided as **Figure 6**.

Bail down testing results, fluid gauging data and laboratory analytical results of the physical properties of the LNAPL from the Site indicate that the mobility and recoverability of the material are low when compared to industry standards (AECOM, 2014). A detailed summary of the mobility, migration and recoverability characteristics of the material is provided in Section 2.6.5 of the PTSR (**Appendix B**).

3.3 2014 Pilot Testing Activities

AECOM conducted MPE and VEGE pilot testing in June of 2014 to evaluate the feasibility of these technologies to address LNAPL remaining in the subsurface. A detailed presentation of the pilot testing activities performed on the Site may be referenced in Section 2.7 of the PTSR provided in **Appendix B**. A summary of the findings of the MPE and VEGE pilot testing are presented in Section 2.8 of the PTSR.

The pilot testing indicated significant variability in LNAPL transmissivity and recoverability in response to varying geologic conditions at the site. These geologic controls on LNAPL mobility and recoverability were identified in the LNAPL CSM and are a key consideration in the implementation of the proposed remedy. See **Appendix B** for a detailed discussion of site conditions and findings of field pilot testing.

4.0 REMEDIAL GOALS

4.1 Remedial Action Objectives

The primary objective of this RAWP is to present a detailed description of the most viable remedial alternative to meet specific remedial goals for the Site based on the type, distribution and concentrations of petroleum hydrocarbon impact present. The development of Remedial Action Objectives (RAOs) is integral to the overall remedial alternatives development and evaluation process. RAOs are identified to provide the basis for developing and selecting the appropriate remedial alternative in the context of achieving site conditions that are protective of public health and the environment. Site-specific RAOs were identified in accordance with the procedures described in 6 NYCRR Part 375 and the DER-10 guidance document, last amended on May 3, 2010, as issued by NYSDEC. In accordance with the DER-10 (Chapter 4, Section 1, Part C), "generic RAOs were identified, as applicable to the contaminants identified by the RI".

The site-specific RAOs presented in this RAWP were identified based on an evaluation of the results of historical environmental investigations, pilot testing and remedial activities completed on the Site. The type of contaminated media present on the Site, the distribution of contaminants present, and contaminant concentrations were reported in the PTSR submitted by AECOM to the NYSDEC in September 2014 (**Appendix B**). The CSM for the Site, presented in the PTSR, indicates that a LNAPL mass approximately 114,500 square feet in area is present in the subsurface on the Site. Based on historic fluid gauging results, the horizontal extent of LNAPL has been determined to be stable. Most of the LNAPL present in the subsurface exists in the residual phase. However, a small portion of the LNAPL present has been determined to be mobile. The CSM also indicated that contaminant impacts to both soil and groundwater are present on the Site. A detailed summary of the distribution and concentration of the contaminants present may be referenced in the PTSR (AECOM, 2014) included as **Appendix B**.

The RAOs established for the Site were identified in the interest of protecting public health and the environment based on contaminant-specific SCGs per the DER-10. Potential exposure pathways for existing contaminants and the current, intended and reasonably anticipated future use of the Site and its surroundings were considered during the determination of applicable SCGs. Action-specific SCGs, which include considerations for impacts to public health and the environment during remedy implementation, were evaluated during the RAO identification process.

SITE-SPECIFIC REMEDIAL ACTION OBJECTIVES SUMMARY		
Media	**Constituent(s) of Concern**	**Remedial Action Objectives**
Groundwater	Petroleum Hydrocarbons	<u>RAOs for Public Health Protection:</u> • Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards. • Prevent contact with, or inhalation of volatiles above applicable standards, from contaminated groundwater. <u>RAOs for Environmental Protection:</u> • Restore groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable. • Prevent the discharge of contaminants to surface water. • Remove the source of ground or surface water contamination through removal or treatment.
Soil	Petroleum Hydrocarbons	<u>RAOs for Public Health Protection:</u> • Prevent ingestion/direct contact with soil exhibiting concentrations above applicable standards. • Prevent inhalation of or exposure from contaminants volatilizing at concentrations above applicable standards from soil. <u>RAOs for Environmental Protection:</u> • Prevent migration of contaminants that would result in groundwater or surface water contamination. • Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.
Surface Water	Petroleum Hydrocarbons	<u>RAOs for Public Health Protection:</u> • Prevent ingestion of water impacted by contaminants above applicable standards. • Prevent contact or inhalation of contaminants above applicable standards from impacted water bodies. • Prevent surface water contamination which may result in fish advisories. <u>RAOs for Environmental Protection:</u> • Surface water quality is to meet ambient water quality criteria for the contaminant of concern. • Prevent impacts to biota from ingestion/direct contact with surface water causing toxicity and impacts from bioaccumulation through the marine or aquatic food chain.
Sediment	Petroleum Hydrocarbons	<u>RAOs for Public Health Protection:</u> • Prevent direct contact with sediments contaminated at levels above applicable standards. • Prevent surface water contamination which may results in fish advisories. <u>RAOs for Environmental Protection:</u> • Prevent releases of contaminants from sediment that would results in surface water levels in excess of ambient water quality criteria.
Soil Vapor	Petroleum Hydrocarbons	<u>RAOs for Public Health Protection:</u> • Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at the Site.

4.2 Groundwater

Impacted groundwater is present on the Site. The PTSR (AECOM, 2014), which is included as **Appendix B**, provides a summary of the results of the most recent groundwater analytical data collected from the Site. The referenced results were compiled as the result of a groundwater investigation completed by Aztech Technologies, Inc. during 2009. The PTSR indicated that total concentrations of VOCs "ranged from non-detectable levels to a maximum of 56,100 µg/L; MTBE was detected at a maximum concentration of 170 µg/L and ethanol was detected at a maximum concentration of 24,000 µg/L." The area of the groundwater impacts is similar to the extent of measured LNAPL."

4.2.1 RAOs for Public Health Protection

The first listed RAO for public health protection regarding groundwater at the Site is to prevent ingestion of groundwater with contaminant levels exceeding drinking water standards. Groundwater at the Site or in the area is not currently used as a potable water source, therefore, this RAO is not considered applicable to the Site. Additional deed restrictions regarding groundwater use limitations and/or permits may be warranted or required at the discretion of appropriate agencies (NYSDEC and NYSDOH).

The second listed RAO for public health protection regarding groundwater at the Site is to prevent contact with, or inhalation of volatiles, from contaminated groundwater. Trespasser casual exposure to contaminants from contact or inhalation of groundwater-sourced volatiles is currently limited by the presence of fencing around the Site, existing surfaces (asphalt and secondary containment) across the majority of the Site, and limited access to the Site due to the presence of the Seneca River along the southern property boundary. The groundwater elevation data collected on July 11, 2013 from monitoring wells location across the Site indicated that the depth to groundwater ranged from eight (8) feet to ten (10) feet below grade. This depth range minimizes the likelihood of casual exposure to groundwater on the Site. However, any remedial actions/technologies for groundwater must address the following RAO: prevent direct contact (i.e. incidental ingestion, inhalation and dermal contact) with contaminated groundwater above the acceptable risk levels for human receptors. There is a potential for exposure to impacted groundwater via direct contact or inhalation of volatiles by environmental or construction workers. All workers entering the site will need to be trained according to OSHA CFR 1910.120. These exposure pathways may be mitigated via the use personal protective equipment and the application engineering controls during remedial or construction related activities completed on the Site.

4.2.2 RAOs for Environmental Protection

The first listed RAO for environmental protection regarding groundwater is to restore the groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable. The goal of any proposed remedial action must mitigate impacts to groundwater to the extent practicable. The remedial technology selected for the Site must address, to the extent practicable, the RAO to restore groundwater at the Site to pre-release conditions.

The second listed RAO for environmental protection regarding groundwater at the Site is to prevent the discharge of contaminants to existing surface water bodies. The potential exists for impacted groundwater to reach the shoreline of the Seneca River, which is located down gradient of impacted areas. However, the existing data available for the Site indicates that the area of groundwater impacts on the Site is "similar to the extent of the measured LNAPL" (AECOM, 2014). There currently is no indication that LNAPL has migrated to the Seneca River. However, the selected remedial technology must address this RAO to ensure that the implementation and application of the technology limits the potential for impacted groundwater to discharge into the Seneca River.

Any selected remedy for the Site must address the goal of reducing the volume of potential source material to groundwater and surface water impacts. The remedial technology selected for the Site must address, to the extent practicable, the RAO to minimize the source of groundwater and/or surface water contamination to pre-release conditions or to the most practicable extent.

4.3 Soil

Impacts to soil are present on the Site. The PTSR (AECOM, 2014), included as **Appendix B**, provides a summary of the results of the UVOST® investigation conducted during environmental investigation activities to evaluate LNAPL impacts to soil. Impacted soil was found to extend from west of the pump station on the Southwestern Terminal property to the wooded area located east of the Southeastern Terminal property. Impacted soil was also present on the southern portion of the Northern Terminal property adjacent to Hillside Road. LNAPL was observed to be present in soil from the ground surface to an average depth of approximately 15 feet below grade (AECOM, 2014). Selected soil samples were also analyzed for TPH. The PTSR indicated total petroleum hydrocarbon concentrations in soil ranged from 31.5 to 5,910 micrograms per gram (µg/g), with an average value of 2,470 µg/g (AECOM, 2014).

4.3.1 RAOs for Public Health Protection

The first listed RAO for public health protection regarding soil at the Site is to prevent ingestion and/or direct contact with soil that exhibits impact above applicable NYSDEC standards. Trespasser casual exposure to contaminants from contact with soil that demonstrates impacts above applicable standards is currently limited by the presence of fencing around the Site, existing surfaces (asphalt and secondary containment) across the majority of the Site, and limited access to the Site due to the presence of the Seneca River along the southern property boundary. Additional deed restrictions regarding the future use limitations and/or permits may be warranted or required at the discretion of appropriate agencies (NYSDEC and NYSDOH). However, the potential for direct contact with contaminated soils above the acceptable risk levels for human receptors must be mitigated during the implementation of any selected remedy by environmental workers at the Site. All workers entering the site will need to be trained according to OSHA CFR 1910.120. These exposure pathways may be mitigated via the use of personal protective equipment and the application of engineering controls during remedial or construction related activities.

The second listed RAO for public health protection regarding soil at the Site is to prevent exposure to contaminants volatilizing from contaminants in soil above acceptable risk levels. Again, casual exposure to contaminants above acceptable risk levels due to the inhalation of volatiles above acceptable risk levels is limited by the presence of fencing around the Site, impermeable surfaces (asphalt and secondary containment) across the majority of the Site, and limited access to the Site due to the presence of the Seneca River along the southern property boundary. However, the potential for inhalation of volatile contaminants above the acceptable risk levels for human receptors must be mitigated during the implementation of any selected remedy at the Site. These exposure pathways may be mitigated via the use of personal protective equipment and the application of engineering controls during remedial or construction related activities. A CAMP may be developed and implemented if the remediation efforts involve subsurface work that uncovers impacted soil.

4.3.2 RAOs for Environmental Protection

The first listed RAO for environmental protection regarding soil is to prevent the migration of contaminants from soil that would result in groundwater or surface water contamination. Impacted soil is present on the Site. The potential exists for LNAPL or impacted groundwater from soil to reach the shoreline of the Seneca River, which is located down gradient of impacted areas. The existing data available for the Site indicates that area of the Site where impacted soil has been detected is comparable to the extent of the measurable and impacted groundwater (AECOM, 2014). As previously stated in Section 4.2.2, groundwater impacts on the Site are "similar to the extent of the measured LNAPL" (AECOM, 2014). There currently is no indication that LNAPL has migrated to the Seneca River. The LNAPL present on the Site is considered the source of impacts to both soil and groundwater. Any selected remedy for the Site will mitigate the migration of LNAPL and groundwater in soil and address the potential source of groundwater impacts limiting the potential for groundwater transported contaminant migration.

The second listed RAO for environmental protection regarding soil is to prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts form bioaccumulation through the terrestrial food chain. There are currently no ecological resources present on the Site and the intended future use for the Site is industrial. This RAO is not considered applicable to the Site.

4.4 Surface Water and Sediment

Impacts to surface water and sediment have not been identified on or proximal to the Site. These facts indicate that the hydrogeologic conditions preclude migration to the river and prevent discharge. There is currently no indication that impacted groundwater has migrated toward the river. In addition, fluid gauging data indicates that the LNAPL plume is stable. The RAOs for public health and environmental protection due to existing impacts to surface water and sediment are not considered applicable to the Site.

4.5 Soil Vapor

The first listed RAO for public health protection regarding soil vapors on the Site is to mitigate

impacts to public health resulting from soil vapor intrusion into buildings above applicable standards or acceptable risk levels. There are currently no occupied structures present on the Site. Therefore, the RAO for public health protection due to soil vapor intrusion is not considered applicable to the Site. However, any selected remedial actions/technologies applied to the Site must mitigate the potential for soil vapor intrusion into site buildings. Any building or structure built or temporarily staged on the Site could potentially become an exposure pathway to environmental workers due to soil vapor intrusion. In such an instance, the potential for exposure to volatile contaminants exists via direct inhalation of volatiles by environmental or construction workers. These exposure pathways may be mitigated via the use personal protective equipment and the application engineering controls during remedial or construction related activities completed on the Site.

4.6 Summary of RAOs

The RAOs identified for the Site in accordance with the procedures and guidelines described in 6 NYCRR Part 375 and the DER-10 were identified based on an evaluation of the results of historical environmental investigations, pilot testing and remedial activities completed on the Site. The type of contaminated media present on the Site, the distribution of contaminants present, and contaminant concentrations were reported in the PTSR submitted by AECOM to the NYSDEC in September 2014.

The following site-specific RAOs were identified in the interest of protecting public health and the environment based on contaminant-specific SCGs per the DER-10.

- Remove to the extent practical and feasible the source of groundwater or surface water contamination in order to mitigate the migration of the source of contaminants
- Restore the groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable.

Action-specific SCGs, which include considerations for impacts to public health and the environment during remedy implementation, were also evaluated during the RAO identification process. The RAOs identified as a result of consideration for action-specific SCGs may be mitigated via the use of personal protective equipment and the application of engineering controls during remedial or construction related activities. The RAOs include preventing human exposure (contact, ingestion, inhalation, etc.) to and migration of impacted soil and groundwater during installation, operation and/or monitoring of the selected remedial technology. These RAOs must be proactively met during the implementation and application of any selected environmental remedy for the Site.

5.0 PROPOSED REMEDIAL ACTIONS

5.1 Remediation Goals

The primary objective of this RAWP is to present a detailed description of the most viable remedial alternative that will meet specific remediation goals for the Site while addressing the site-specific RAOs. The goal of the selected remedy should mitigate potential impacts to public health and the environment to the extent practicable. Based on these criteria and the site-specific RAOs for the Site GES has identified the following remedial goals for the Site:

- Recover mobile phase LNAPL in the areas most favorable to recovery, to the extent practicable;
- Decrease the mobile fraction of the LNAPL body; increase the area of the LNAPL at residual saturation;
- Decrease the LNAPL transmissivity in the limited area where this value falls above the ITRC criterion for recoverability;
- Advance the physical weathering of the LNAPL mass, thereby increasing LNAPL viscosity;
- Reduce the volatile fraction of the LNAPL in the remediation areas, thereby increasing LNAPL viscosity; and,
- Support conditions for biodegradation as a side effect of active remediation.

5.2 Remediation Considerations

GES conducted a comprehensive review of the historical environmental data available for the Site and the recent pilot test results (AECOM, 2014) to evaluate potential remedial technologies and determine the remedial technology that is best suited to address the existing impacts present at the location. Data summarized on **Figures 4**, **5**, and **6** that displays the factors affecting the extent of the recoverable LNAPL was used to guide the selection of the appropriate technology and where that technology will be applied. The selection of the most suitable technology to meet the remediation goals for the Site was based on the following characteristics of the Site and the nature of the remaining LNAPL impacts:

- The subsurface soil distribution is heterogeneous in nature, consisting of interbedded silt, clay, sands and minor gravel layers and lenses that are often discontinuous.
- Interbedded silt and sands are commonly present at the elevation of the air/LNAPL/water interface (water table).
- Silt and clay layers are present below the average elevation of the water table in some locations.
- Seasonal changes in the level of the Seneca River influence hydraulic conditions in the southern portion of the Site. This effect is influenced largely by the sediment types and varieties across the Site.
- LNAPL present in the subsurface is characterized as gasoline and middle distillates from

multiple releases that have undergone substantial physical/chemical weathering.

- Physical weathering and historic remediation activities have left little recoverable LNAPL; the material present is not mobile or demonstrates very low mobility with limited recoverability using typical remedial techniques.

5.3 Remedy Selection

GES conducted a comprehensive review of the historical environmental data available for the Site and the recent pilot test results (AECOM, 2014) to evaluate potential remedial technologies and determine the remedial technology GES has determined that a two (2) part remedy, which includes the implementation of a focused active remediation followed by post-remediation monitoring of any residual LNAPL and dissolved phase impacts, is the best remedial approach for the Site, considering the goals stated above. The proposed remediation and monitoring activities are submitted pursuant applicable DER-10 standards, criteria and guidance. GES proposes the installation of a VEGE system in targeted areas of the Site where the largest amount of potentially recoverable LNAPL exists. Regular monitoring of the VEGE system will be completed to evaluate the system effectiveness and optimize recovery, as needed, to ensure it is operating at maximum efficiency. The selected technology is designed to effectively reduce the LNAPL source, maintain the stability of the LNAPL and dissolved phase hydrocarbon concentrations in the subsurface.

The second part of the remedy, MNA, will consist of monitoring the post-active remediation LNAPL distribution and VOCs concentrations in groundwater to confirm that natural attenuation is occurring. The goal of this portion of the proposed remedy is to monitor the attenuation rates of any hydrocarbon impacts remaining on the Site after active remediation is completed and ensure any remaining impacts will not impact potential receptors.

The CSTMDG, in consultation with the NYSDEC, may review the possibility of establishing administrative controls for the Site, based on the results of active remediation, to ensure the long-term management of any residual hydrocarbon impacts remaining. Administrative controls may include restricted site access and/or a deed restriction, to further minimize potential risks of impacts to public health or the environment as a possible contingency. Any administrative controls established for the Site will be put into place in accordance with NYSDEC requirements and in coordination with the current property owners. A SMP may be developed and put into place, if necessary, to ensure long-term management of any Institutional and Engineering Controls that are required for the Site. The SMP may include detailed descriptions of the required monitoring activities, inspection schedules, reporting activities and required certifications for professional participants in the SMP.

5.4 Pre-Remediation Well Maintenance and Groundwater Monitoring

Groundwater monitoring of selected monitoring wells located across the Site will be conducted prior to implementing the remedial action. A total of 29 wells located on the Northern, Southwestern and Southeastern Terminal properties will be evaluated. A list of the wells included in the proposed pre-remediation groundwater monitoring and sampling event is provided

on **Table 1**. The wells were selected for pre-remediation monitoring (and subsequent system performance monitoring) based on their location relative to the proposed remediation activities and their reported screened intervals.

5.4.1 Well Integrity Inspection and Maintenance

The existing monitoring wells that were selected for pre-remediation monitoring (and subsequent system performance monitoring) were installed for the purposes of historical environmental investigation and/or remediation-related activities. The monitoring wells vary in age and condition. Prior to implementation of pre-remediation monitoring, each of the monitoring wells included in the proposed pre-remediation groundwater monitoring and system performance monitoring activities will be inspected to ensure that surface water and/or other contaminants are unable to enter the well. Each well will be visually inspected to ensure it is accurately labeled. Each of the wells will be evaluated to determine the condition of the well casing, the condition of the surrounding protective casing, the integrity of the visible surface seals with the ground surface and the condition and fit of the well cap. Any visible damage or deterioration observed will be repaired. Well pads that appear to have changed in elevation due to ground heaving will be repaired and resurveyed. Locks on well caps will be inspected and broken, damaged and/or missing well locks will be replaced. Each of the wells will be evaluated using an interface probe to determine the observed depth to the bottom of the well relative to the constructed depth of the well as reported on historical well construction summaries. Wells that demonstrate an accumulation of silt at the base will be redeveloped.

5.4.2 Pre-Remediation Groundwater Monitoring

The locations of the wells that will be included in the monitoring event are depicted in red on the Site Map provided as **Figure 7**. The wells will be gauged with an interface probe and the depth to water and LNAPL thickness (if present) will be recorded. Any LNAPL bailed during the monitoring events will be stored in an on-site storage tanks and quantified prior to disposal. The groundwater quality in each well will then be evaluated using a multi-parameter water quality meter. The selected parameters of temperature (^{o}C), pH (SU), conductivity (mS/cm), DO (mg/L) and ORP (mV) will be recorded to evaluate MNA indicators on the Site. Groundwater samples will be collected from each of the well locations in accordance with DER-10 guidelines. Individual wells will be purged of three (3) well volumes and subsequently sampled using disposable bailers. Samples will be analyzed for NYSDEC STARS-listed VOCs. In addition, collected samples will be analyzed for selected MNA indicator including: nitrate/nitrite, sulfate, dissolved methane, alkalinity, dissolved ferrous iron, dissolved manganese, and carbon dioxide. Chain-of-custody documentation will be maintained for all collected samples. Collected groundwater samples will be sent to a NYSDOH ELAP certified laboratory, for analysis. A QAPP will be developed which defines the objectives of the sampling and remediation activities completed on the Site and presents the procedures that will be utilized to meet site-specific data quality goals in accordance with DER-10 guidelines.

5.5 VEGE System Design - Basis of Design

5.5.1 Pilot Testing Results

AECOM completed a MPE and VEGE pilot tests at the Site in 2014 (the pilot test). Four (4) existing monitoring wells, S-5, A-16, S-3, and S-15, were used as extraction wells during the pilot test. The pilot test at well S-5 was implemented as a MPE test using a drop tube placed in the well; AECOM concluded that the results were inconclusive for this test because the monitoring points were not within the influence of the test well. The other three (3) tests were implemented at monitoring wells A-16, S-3, and S-15 using VEGE with submersible pumps. During each of the VEGE tests, vacuum was applied in three (3) steps beginning with 5 in. Hg, increasing to 8 in. Hg, and concluding at 13 in. Hg. In general, the groundwater recovery rate increased as the applied vacuum was increased. The induced vapor flow rates during the VEGE pilot tests ranged from 21 to 36 SCFM for each of the test wells. The estimated ROI for the three (3) VEGE tests ranged from a low of 18 feet to a maximum of 38 feet. At the maximum applied vacuum step (13 in. Hg), the estimated ROI was reported as less than 38 feet (A-16), 32 feet (S-3), and 22 feet (S-15). AECOM noted in the pilot test report that directional anomalies (anisotropy) were observed in the test data, primarily due to the documented heterogeneity of the site soils. Other data quality issues were noted due to the inefficiency of the wells utilized for testing due to their overall age, potential degree of fouling, and uncertainty related to their construction. For these reasons, a factor of conservancy has been applied to the SVE ROI as explained below.

Data collected during the 2014 AECOM pilot test are used as the design basis to establish engineering parameters for the VEGE system, including the required vapor flow rate, wellhead vacuum, well spacing, and anticipated ROI. Groundwater recovery rates obtained during the pilot test and aquifer parameters determined during previous site investigations were used to model the capture zone of the full-scale VEGE system and form the design basis for the groundwater extraction and treatment system. The analysis of the available data and the rationale for the design basis are presented in the following section.

5.5.2 Overview

Vacuum enhanced groundwater extraction is implemented by using a vacuum blower to extract soil vapors and a pneumatic or electric submersible pump to remove LNAPL (if present) and groundwater from the extraction well, which is constructed appropriately to accommodate both types of extraction. The vacuum blower removes hydrocarbons from the unsaturated soil matrix. The removal of groundwater from the subsurface dewaters the area adjacent to the extraction well which creates a cone of depression. The lowered groundwater elevation near the extraction well exposes more soil to the SVE process thereby removing hydrocarbon impacts from the dewatered soils. The application of vacuum draws air through the subsurface soil matrix so that the hydrocarbons present in the unsaturated soil are volatilized and removed. The applied vacuum also increases the piezometric head which increases the rate of groundwater recovery. Emission control methodologies are employed to treat the recovered vapors, as necessary, to meet air emission requirements. Dissolved phase hydrocarbons in extracted groundwater are treated by

groundwater treatment equipment within the system, in order to meet discharge permitting requirements.

5.5.3 Basis of Design

The proposed extraction system has been designed based on the relationship between pore volume exchange rate, ROI, extraction well flow rate, and extraction well vacuum. The pore volume exchange rate determines the minimum air flow rate required to achieve design goals. When air is extracted from a SVE well, the resulting pore air velocities are highest near the well. The pore air velocity decreases exponentially with distance from the extraction well as a result of both the increased soil volume, and leakage of air from the surface into the soil pores. The pore air velocity at each distance from the extraction well can be converted into a pore volume exchange rate. The pore volume exchange rate represents the number of times the air within a unit volume of soil pores is removed over a period of time. At a specified pore volume exchange rate, the ROI is established based on the achievable flow rate and vacuum parameters. Typical SVE systems operate at one (1) to two (2) pore volume exchanges per day – two (2) pore volume exchanges per day were used as the basis for the VEGE system design.

For the purposes of this design, it is assumed that the subsurface airflow characteristics in the pilot study test areas are similar to the larger areas of the site where remediation will be implemented.

5.5.4 Vacuum Extraction Design Parameters

The vacuum extraction portion of the VEGE system has been designed to meet the following parameters:

1. Vapor Flow Rate and Applied Vacuum: The design vapor flow rate for each VEGE well is 30 SCFM per well at an applied vacuum of 13 in. Hg. During the pilot test, the vapor flow rate at the maximum applied vacuum of 13 in. Hg was reported to be between 29 and 36 SCFM. This maximum flow and vacuum combination also induced the greatest vacuum influence in the vadose zone.

2. ROI: The VEGE well network is based upon an ROI of 25 feet at an applied vacuum of 13 in. Hg and a vapor flow rate of 30 SCFM per well. A ROI of 25 feet was used: 1) to account for subsurface heterogeneities; 2) to account for surface leakage due to no surface seal and/or the poor condition of the existing asphalt; and, 3) to account for the interference of adjacent vapor extraction wells.

3. Well Spacing and Number of Wells: Based on the SVE ROI, 40 wells spaced on approximate 50-foot center (25-foot ROI with overlap between points) are required to cover the treatment area (**Figure 8**).

4. Air Flow Capacity of Vapor Extraction System: The VEGE system is designed with a total air flow capacity of 1200 SCFM and a wellhead vacuum of 13 in. Hg. This is based on each

extraction well operating at the design flowrate of 30 SCFM and the wellhead vacuum of 13 in. Hg. The equipment and piping network design will have to account for friction losses between the blower inlet and the extraction wells to ensure the minimum vacuum of 13 in. Hg is available at each wellhead.

5. Well Screen Intervals: The VEGE system is designed to remove LNAPL from the areas adjacent to the extraction wells via volatilization and fluid pumping. The vertical arrangement of the well screens was selected to allow for optimum mass removal based on available data including historical LNAPL and water table elevations, soil analytical data, field VOC screening data as collected with a PID, geologic descriptions, and LIF/ UVOST® data. Screen intervals for each extraction well are presented in **Table 2** and generally range from six (6) feet to a maximum of 22 feet below grade. The final screen interval for each extraction well will be confirmed by the on-site geologist during well installation based on geology, PID readings, and other conditions.

5.5.5 Groundwater Extraction Design Parameters

The groundwater extraction portion of the VEGE system has been designed to meet the following parameters:

Groundwater Pumping Rate: An evaluation of the existing subsurface characteristics and the available pilot testing data indicates that a pumping rate of one (1) gpm from each of the 40 VEGE wells will create a capture zone that encompasses all of the treatment area. This will produce a total flow rate of up to 40 gpm with each extraction well pumping at design capacity. An evaluation of the existing subsurface characteristics and the available pilot testing data indicates that the steady-state pumping rate will be approximately 10 gpm once target groundwater elevations are achieved. The groundwater treatment system will be designed for a maximum flow rate of 50 gpm to handle the higher initial pumping rate expected when the system is first started.

Groundwater Recovery: Each VEGE extraction well will be fitted with an automated submersible, pneumatic pump.

System Flexibility/Optimization: Due to the heterogeneities of the site soils, the VEGE system and the associated piping manifold have been designed to allow for flexible operation and adjustments. The system operation can be configured using the manifold valves to distribute system flow capacity into any combination of wells simultaneously, as conditions warrant. As the system is optimized, the VEGE system resources can be focused on specific areas of the site, as needed, to maximize treatment. As treatment progresses, those areas which have achieved stated remedial objectives can eventually be taken offline, and the system resources can then be refocused in other areas as appropriate.

5.5.6 VEGE System Design

The proposed VEGE system will consist of 40 permanent extraction wells and associated remediation equipment. The VEGE wells will be connected to the remediation system

components with either below grade piping or winterized above-grade piping. The decision to use above grade versus below grade piping will be made based on site features and logistics in the final design phase.

The proposed system includes a rotary lobe blower, air/liquid separator, oil/water separator, flow equalization tank, bag filters, LGAC, water transfer pumps, an air stripper and an electric catalytic oxidizer with a vacuum blower. Each of the water treatment system components will be rated for a minimum of 50 gpm. LNAPL will be stored in a secondarily contained tank for characterization and off-site disposal. The water stream will be filtered by bag filters and then treated using an air stripper and LGAC prior to discharge to the river. The vapor treatment system will be rated for a minimum of 1200 SCFM.

A compound for the remediation system equipment will be placed near the canopy on the Southeast terminal. The system will be fully automated and designed to operate continuously without daily operator oversight. Each extraction well will be fitted with a total fluids submersible, pneumatic pump. Each pump will include internal controls to automatically activate the pump when fluids are present and will be top-loading for optimum LNAPL recovery. A rotary screw air compressor will be required to provide sufficient compressed air for the 40 pumps.

Laboratory and field data collected during the AECOM pilot test were used to estimate the air discharge rate and evaluate if air treatment is required. The initial vapor phase mass removal rate is expected to be 0.056 lb/hr per well, or a total mass removal rate of 2.2 lb/hr for all 40 wells operating simultaneously. The extracted vapors will initially be treated using an appropriately sized catalytic oxidizer, and then discharged through a 30-foot tall stack..

Water generated by the VEGE system will be treated using an appropriately sized air stripper, followed by two (2) LGAC units piped in series. The air stripper will be designed for a maximum flow rate of 50 gpm. The LGAC vessels will be designed for a maximum flow rate of 50 gpm with a hydraulic loading rate of five (5) gpm per square foot and an empty bed contact time of 15 minutes. These conditions will require vessels with a 4-foot diameter and a minimum 5-foot hydraulic freeboard above the water level (assuming two (2) units in series). Commercially available LGAC units with these dimensions contain 2,000 pounds of granular activated carbon each.

The electrical service will be rated to provide adequate power for the VEGE system equipment and all ancillary components such as heaters, lighting, and controls. The final design of the electrical service will be completed once the equipment has been specified and selected.

The following strategies will be incorporated into the VEGE system to maximize the efficiency of the system:

- Individual system piping lines will be run to each extraction well rather than connecting the wells to a common extraction header. This will allow for maximum flow control and operational flexibility at each location.

- The vapor extraction conveyance piping will be sloped toward the extraction wells (where achievable) to allow gravity to drain the lines. This will minimize water in the extraction piping which will maximize vapor extraction flow rates while also reducing maintenance associated with condensate management.
- Above-grade piping will be minimized and where necessary will be fitted with heat trace cable to ensure year round operation during freezing/potentially freezing conditions.

5.6 VEGE System

5.6.1 Design and Installation of VEGE Wells

The AECOM pilot study noted that using the existing monitoring wells as VEGE extraction wells was problematic, and, short circuiting and poor well condition likely reduced the vacuum influence observed. GES recommends installing new wells designed for use as VEGE extraction wells to avoid these problems and to improve the effectiveness of the remedial activities. Consistent with the pilot test results, GES has determined that a VEGE system that includes new extraction wells operating at 30 SCFM and an applied vacuum of 13 in. Hg can be expected to produce a 25 foot ROI.

GES proposes the installation of 40 new recovery wells on the Southwestern and Southeastern Terminal properties. The Proposed VEGE Well Location Map is provided as **Figure 8**. Targeted well locations were selected based on the current site characteristics, the existing LNAPL footprint, determined by the most recent gauging data available for the Site (July 2013) and the maximum UVOST® response locations (AECOM, 2014). The well spacing was determined using the conservative 25 foot ROI. There is an expectation that there will be overlapping influence within individual networks during system operation. As previously stated, the VEGE wells will be connected to the remediation system components with either below grade piping or winterized above-grade piping. Well construction diagrams for both well types are provided on **Figure 9**. A network of 11 wells is proposed for installation in the central portion of the Southwestern Terminal property to the south of the loading rack. On the Southeastern Terminal property, a network of 15 recovery wells is proposed which will extend from the north of the loading rack adjacent to Hillside Road to the southwest towards the canopy in the southwest corner of the property. Another smaller network of four (4) extraction wells is proposed for installation on the eastern side of the Southeastern Terminal property adjacent to the retaining wall. Ten (10) extraction wells are proposed to be installed between the Northern Terminal property and Hillside Road. Extraction well coverage is sufficient with locations proposed around the existing terminal infrastructure; no demolition or removal of existing infrastructure is necessary.

Historical LNAPL and water table elevations were evaluated to determine the vertical location of the VEGE well screen intervals. The highest LNAPL/water table elevations were recorded approximately five (5) feet below grade. In order to maintain enough available well screen during high water table conditions to operate the VEGE system, and to accommodate a proper well seal, the top of screen will be set between six (6) and seven (7) feet below grade, depending on location. The lowest LNAPL/water table elevations can extend down to approximately 16 feet

below grade. An evaluation of the existing subsurface characteristics and the available pilot testing data indicate that pumping groundwater two (2) feet below the static water table elevation will generate a capture zone that encompasses the remediation zone. The extraction wells must be deep enough to allow for the required drawdown plus the additional depth to accommodate the submersible pumps. The bottom of the VEGE wells will extend to a maximum of 22 feet below grade, depending on location. The bottom three (3) feet of each well may be installed as a sump with solid casing rather than well screen.

The proposed VEGE well construction details are presented in **Table 2**. However, the extraction wells screened interval may be modified based on field conditions encountered during installation, including subsurface conditions, PID readings, and observations of hydrocarbon impact by the geologist. Soil borings advanced at each of the proposed well locations will be sampled using continuous split-spoon samplers. Collected samples will be characterized by qualified personnel and the soil properties, including soil moisture content, grain-size, visual presence of hydrocarbon impacts, and field PID readings will be documented. At each proposed extraction well location, an evaluation of the existing subsurface conditions will be completed and the total well depth and screened interval will be determined. Wells will be installed across the saturated sand zone and soil impacts, whenever possible. Well screens will typically consist of at least 10-foot lengths of 4-inch diameter, 0.010-inch slot, continuously wrapped, schedule 40 PVC. Well risers will consist of schedule 40 PVC which extends to the ground surface. Solid PVC casing may be installed as a sump in the bottom three (3) feet of the wells, depending on conditions. The annular space at each well location will be sand packed from the bottom of the soil boring to approximately one (1) foot above the top of the well screen. A bentonite seal with a minimum thickness of one (1) foot will be inserted on top of the sand pack. Cement/bentonite grout will be installed into the remaining annular space to approximately four (4) feet below grade to provide a proper seal in wells that will be connected to the system with subsurface piping. Sand pack will then be placed in the annular space from the top of the grout seal to approximately 0.5-feet below grade. At locations where above ground piping may be utilized, the grout seal may be extended to within one (1) foot of ground surface. Well risers will be housed in flush-mount access vaults installed at the ground surface to provide access to recovery wells during system maintenance and monitoring activities. Soil cuttings and groundwater generated during VEGE well installation activities will be temporarily staged on the Site for disposal at a client-approved disposal facility.

5.6.2 Remediation System Installation

The VEGE remediation system will be housed in a heated, vented and insulated enclosure on the Site. Each of the proposed extraction wells will be connected to individual system piping lines extending to the remediation system enclosure where they will be connected to a common network manifold. Above-grade piping will consist of individual 2-inch diameter schedule 80 PVC vapor recovery lines and 1-inch HDPE groundwater recovery lines. The compressed air line will be constructed of 1-inch or 2-inch steel pipe and a flexible air hose. Subsurface piping will consist of 2-inch schedule 40 PVC vapor recovery lines, 1-inch schedule 40 groundwater recovery lines, and 2-inch or smaller diameter compressed air lines. Any buried conveyance

piping will be pressure tested before backfilling to ensure proper pipe integrity.

A survey of the new system extraction wells, above-ground and subsurface piping, selected system components and the system shed will be completed by a licensed New York surveyor when construction is completed. An updated Site map which incorporates all system -related survey data will be generated for the Site.

5.6.3 Soil Vapor Extraction Equipment

The soil vapor extraction system will consist of a vacuum blower to remove vapors from the subsurface using networks of both underground and above-ground piping which are attached to a network of 40 extraction wells. The vapor extraction system will include a vapor/liquid separator to remove condensation from the extraction process. If necessary, the knockout tank will be fitted with a pump to transfer liquids to the groundwater treatment system. The system will include a manual dilution air valve, flow control valve, vacuum gauges, temperature gauge, and sampling ports to facilitate operation and system optimization. The blower will have an inlet particulate filter and vacuum relief valve to prevent damage.

An integrated control system will be provided to ensure safe, automated operation of the system. All SVE piping and equipment will be grounded and bonded. Details of the SVE system are presented on **Figures 10** and **11**.

Extracted vapors will initially be treated using a catalytic oxidizer. Sampling ports will be provided to allow performance monitoring at the influent and effluent sides of the catalytic oxidizer.

5.6.4 Groundwater / LNAPL Pumping

Pneumatic, total-fluids, submersible pumps will be installed in each of the 40 recovery wells to draw down the water table. Compressed air will be provided by a rotary screw air compressor located in the treatment enclosure. An air dryer will be included to remove moisture from the compressed air; particle and oil filters will be included to ensure air quality is suitable for the pneumatic pumps..

An evaluation of the existing subsurface characteristics and the available pilot testing data indicates that steady-state pumping conditions will require a groundwater recovery rate of one (1) gpm per well. The initial pumping rate should be higher to allow the extraction wells to be dewatered in a reasonable period of time.

5.6.5 Recovered Groundwater Treatment Equipment

Total fluids, consisting of LNAPL and groundwater will be pumped to the treatment system. A representative process flow diagram for the LNAPL and groundwater recovery portion of the proposed VEGE system is depicted on **Figure 12**. LNAPL will be separated from groundwater using an oil/water separator. Separated LNAPL will flow via gravity to an AST that will have

secondary containment. Separated water will be pumped to an equalization tank and then through bag filters to remove suspended solids. Filtered water will be treated with an air stripper followed by two (2) 2,000-pound liquid-phase granular activated carbon adsorbers piped in series. A heat-traced and insulated outfall pipe will be built to convey treated water to a constructed outfall at the Seneca River. All water treatment equipment and the outfall will be rated for 50 gpm to ensure the system can operate at the maximum anticipated flow rate.

5.6.6 Automation and Control System

The VEGE remediation system will include a control system that automates and integrates the operation of the equipment. The control system will include:

- Groundwater pump operations;
- SVE blower operation;
- Catalytic oxidizer operation;
- Transfer pump operation;
- Safety alarms to disable the system; and
- Telemetry for 24 hour system monitoring.

The telemetry unit will be capable of remote data communication and alarm notification.

The control system will provide automatic and both on site and remote (via telemetry) manual shut-off controls to protect the remedial system components and prevent the release of liquids or vapors. System fault controls include:

- Vapor/liquid separator high liquid level alarm;
- SVE blower high vacuum alarm;
- SVE blower high temperature alarm;
- Oil/water separator high liquid level alarm;
- LNAPL holding tank high liquid level alarm;
- Equalization tank high liquid level alarm;
- Air stripper high liquid level alarm;
- Floor sump high liquid level alarm; and,
- Manual emergency shut off within the system shed.

The system control panel will be designed to meet the appropriate NEC requirements. The equipment enclosure will, at a minimum, be classified as Class I, Division 2 in accordance with NEC requirements because of the oil/water separator and the vapor extraction equipment. The final area classification will be determined in consultation with the equipment vendors as the system design is finalized.

5.7 System Operation, Maintenance, and Project Reporting

The system operation and maintenance will be completed in accordance with the system requirements and per NYSDEC guidelines. The NYSDEC will be notified of site visits and

system installation activities prior to beginning work on the Site. Routine system monitoring visits are generally not included in this notification process.

5.7.1 Maintenance and Monitoring

During the initial system start-up period, the remedial system will be monitored frequently to ensure that the equipment is operating at maximum efficiency and in compliance with NYSDEC requirements. System monitoring may include daily or biweekly system checks, and will likely continue for up to a three (3) month period. GES recommends that maintenance visits to the Site be conducted at a minimum of once per week for the first month of operation, or until the system is optimized to the level that represents maximum vapor phase recovery rate that can be effectively treated by the catalytic oxidizer. All data collected during the initial start-up phase of the remedial system will be used for ongoing system performance monitoring, evaluation and optimization. Upon completion of optimization activities, routine system O&M procedures will be conducted on the Site at a minimum frequency of at least twice per month. The following system operation parameters will be evaluated and documented during routine O&M activities:

- Vapor extraction flow rates;
- Vapor extraction system vacuums including individual wells and blower inlet;
- Equipment temperatures;
- Vapor phase hydrocarbon effluent concentration, as measured with a PID;
- Discharge water flow rates;
- Recovered and treated groundwater flow totalizer readings; and,
- Recovered LNAPL volume.

The following equipment will be inspected and adjusted as required during routine O&M activities:

- Moisture separator;
- Vacuum blower;
- Oil/water separator;
- Transfer pumps;
- LGAC; and,
- Level Sensors and other critical safety devices.

A system check form will be used to document and summarize all of the field activities completed during each system inspection. All system readings and vapor screening results collected in the field should be documented and maintained in an O&M Field Log. System performance data will be evaluated monthly and mass removal calculations are reviewed during each evaluation. The O&M and process monitoring schedule may be modified, as needed to ensure efficient system operation.

System compliance monitoring of the recovered groundwater treatment system and the system's SVE effluent vapors will be completed monthly to ensure discharged groundwater and effluent vapors meet NYSDEC permitting requirements. Influent (pre-treatment), pre-carbon, mid-

treatment and effluent (post-treatment) water samples will be collected and analyzed for NYSDEC STARS-listed VOCs to evaluate the concentration of dissolved-phase hydrocarbons entering the system and verify the removal of VOCs after treatment, including all parameters required by the discharge permit. Collected system water samples will be analyzed in accordance with EPA Method 8260C. Effluent vapor samples will be collected from the system's effluent vapor stream. Prior to vapor sampling, air flow measurements will be obtained with an anemometer. The air samples will be screened utilizing a PID to estimate total volatile hydrocarbon concentrations in the air stream. Both pre- and post-treatment vapor samples will be analyzed for benzene, $C_1 – C_4$ hydrocarbons, and C_5 - C_{10} hydrocarbons in accordance with EPA Method TO-3. System air and water samples will be analyzed at a NYSDOH ELAP certified laboratory.

5.7.2 System Performance Monitoring Plan

Monitoring wells located within and around the remediation system will be monitored regularly to evaluate system performance for optimization purposes. A total of 29 system performance monitoring wells located at the Site will be evaluated for performance data. The locations of the proposed system performance monitoring wells are depicted in red on **Figure 7**. It is recommended that the performance data be collected at a minimum of once per month for the first (six) 6 months so that the system operational parameters may be adjusted, where appropriate, to optimize the remediation process. After the first six (6) months of operation a schedule for data collection will be recommended. A regular evaluation of the LNAPL thicknesses and groundwater elevations occurring on the Site will also be documented and used to further assess the progress of the remediation activities.

Each of the selected performance monitoring wells will be gauged using an oil/water interface probe to determine the depth to water, depth to LNAPL, and LNAPL thickness (if present). A summary of the data and parameters that will be collected from each of the performance monitoring well locations is summarized on **Table 3**.

5.7.3 Groundwater Monitoring and Reporting

Quarterly groundwater monitoring of well locations across the Site will occur in conjunction with the operation of the remediation system. Data acquired from the monitoring wells will be compared with the data acquired prior to start-up of the remediation system and these results will be used as one method to evaluate the performance of the system. The wells included in the proposed groundwater monitoring network are summarized on **Table 1** and the procedures utilized to monitor and sample the wells are outlined in Section 5.4. Wells will be gauged, monitored with a water quality meter for pH, conductivity, dissolved oxygen, and oxidation/reduction potential, and sampled. Groundwater collected from each of the wells will be sent to a NYSDOH ELAP certified laboratory, and analyzed for STARS VOCs and the MNA parameters described in Section 5.7.4 below. Results will be summarized in quarterly reports to the NYSDEC, which will also include a summary of the system operational data and hydrocarbon mass removal information.

5.7.4 MNA Performance Monitoring

Post-remediation groundwater monitoring of selected monitoring wells located across the Site will be conducted when active remediation is completed at the Site. A total of 29 wells located across the Site will be monitored initially. A list of the proposed system performance monitoring wells is provided on **Table 1**. The locations of the performance monitoring wells are depicted in red on the Site Map provided as **Figure 7**. The wells will be gauged with an interface probe and the depth to water and LNAPL thickness (if present) will be recorded. Any LNAPL bailed during the monitoring events will be stored in the on-site storage tank and quantified upon disposal. Data will be collected from each well with a multi-parameter water quality meter to assess groundwater quality and to evaluate MNA. These parameters include temperature (^{o}C), pH (SU), conductivity (mS/cm), DO (mg/L) and ORP (mV) will be recorded to evaluate MNA indicators on the Site. Groundwater samples will be collected from each of the well locations in accordance with DER-10 guidelines. Individual wells will be purged of three (3) well volumes and subsequently sampled using disposable bailers. Samples will be analyzed for selected MNA analytes including nitrate/nitrite, sulfate, dissolved methane, alkalinity, dissolved ferrous iron and dissolved manganese. Chain-of-custody documentation will be maintained for all collected samples. Collected groundwater samples will be sent to a NYSDOH ELAP certified laboratory for analysis. The Site sampling plan will be reevaluated on a minimum annual basis.

5.8 Remedial System Deactivation Evaluation

Operation of the remediation system will continue until such time that the quantity of mobile-phase LNAPL present in the subsurface has been reduced to the extent practicable or it can be demonstrated that the applied technology is no longer effective and additional recovery efforts are no longer practicable, supported by asymptotic mass removal rates. Several criteria will be evaluated as potential indicators to determine when system deactivation is appropriate including one or more of the following: a reduction in the LNAPL extent, a reduction in LNAPL thickness, a reduction in the calculated LNAPL transmissivity values, asymptotic limits in hydrocarbon mass removal rates by the system, and/or decreasing concentrations of VOCs in groundwater. It may be appropriate to request a shutdown of the system in certain areas of the site prior to others, depending on the developing lines of evidence. Depending on the progression of the remediation, it may also be appropriate to request a temporary shutdown of the system to evaluate potential rebound in LNAPL thickness or areal extent. System shut down will be completed upon approval of the NYSDEC and in accordance with all applicable federal, state and local standards. Approval and successful shut down of the remediation system will be followed by the post-remediation groundwater monitoring plan outlined in Section 5.9.

5.8.1 Reduction in the LNAPL Extent and Thickness

The proposed performance monitoring activities presented in Section 5.7.2 includes gauging a total of 29 monitoring wells (refer to **Table 1**) to determine whether or not LNAPL is present and/or the LNAPL thickness at each well. These data will be evaluated regularly to determine the efficiency of system performance. Evidence of diminishing LNAPL extent and/or thickness

(cognizant of water level fluctuations and impacts on LNAPL thicknesses) in targeted areas of the Site may be used to support system deactivation in those areas. Decreasing LNAPL thickness can be qualitatively indicative of decreasing LNAPL transmissivity and reduced mobility. This may be supported by baildown tests on discrete wells to enable LNAPL transmissivity values to be calculated.

5.8.2 Asymptotic Hydrocarbon Mass Removal Rates

Hydrocarbon mass removal rates will be evaluated as an on-going process during the system O&M period. This line of evidence will be of greatest importance in determining when it is appropriate to shut down the remediation system. The rate of recovery of separate phase LNAPL is expected to decrease more rapidly than vapor phase hydrocarbon mass removal rates. The most recoverable portion of the LNAPL mass will be removed during the early phase of the operation of the remediation system. Both the LNAPL removal rate and the vapor phase removal rate should be graphed and evaluated for asymptotic conditions as lines of evidence supporting the timing of a system shut down.

5.8.3 Stable or Decreasing VOC Concentrations in Groundwater

The proposed performance monitoring activities presented in Section 5.7.3 includes monitoring and sampling a total of 29 monitoring wells located on the Northern, Southwestern and Southeastern Terminal properties on a quarterly schedule for dissolved VOCs. The data acquired from the laboratory analysis will be used to determine if dissolved VOCs demonstrate stable or decreasing trends across the Site. A statistical analysis of the data, such as a Mann-Kendall analysis, should be performed to verify trends in the data set. Evidence of stable and/or decreasing concentrations of VOCs in groundwater may be used as the basis to deactivate system operation in targeted areas of the Site.

5.9 Post-Remediation Groundwater Monitoring Plan

It is recommended that a period of post-remediation groundwater monitoring should be conducted at the Site following the system deactivation. An initial site-wide post-remediation groundwater sampling event will be conducted within 60 days of the remediation system deactivation. The wells included in the proposed post-remediation groundwater monitoring network and the methods and procedures utilized to monitor and sample the wells are identical to those listed in Section 5.4.2. A summary of the selected post-remediation groundwater monitoring well locations is provided on **Table 1** and depicted in red on the Site Map provided as **Figure 7**.

The post-remediation groundwater monitoring and sampling will continue on a quarterly basis for a minimum period of two (2) years or until the VOC concentrations consistently demonstrate stable and/or decreasing trends during four (4) consecutive sampling events, whichever occurs first. Data collected during this monitoring period can also be used to evaluate the potential for and progression of natural attenuation at the Site.

5.10 Post-Remediation LNAPL Evaluation

Soil core sampling is proposed to be completed at the Site after the remediation system has been deactivated to document the effects of the VEGE system operation and establish the post-remediation characteristics of the remaining LNAPL present. It is recommended that four (4) locations on the Site for sampled. The four (4) locations proposed for sampling (SC-01B, SC-03B, SC-05, and SC-06B) correspond with soil core locations sampled by AECOM during the 2014 environmental investigation at the Site and may be referenced on the Proposed Soil Core Location Map provided as **Figure 13**. Sampling any residual LNAPL that may be present from a well proximal to each soil core location and analyzing the liquid for viscosity, specific gravity, and density is also recommended.

Sampling methods to be utilized will target to replicate those used by AECOM (2014) as close as possible. Each core will be continuously sampled to a maximum depth of approximately 20 feet below grade depending on the location. Individual soil core samples will be collected, intact within 2.5-inch diameter, acetate tubes. Soil samples will be visually examined and characterized by qualified personnel and the grain-size, color, apparent moisture content and existing evidence of hydrocarbon impacts will be documented. Each sample sleeve will be sealed, labeled, and photographed. Samples will be packed on dry ice for preservation and sent to a qualified laboratory for selected analysis. Cores will be photographed at the lab in white light to document subsurface characteristics and also photographed in ultraviolet light to document LNAPL fluorescence. Selected core samples will then be analyzed for grain size, porosity, bulk density, hydraulic conductivity, and soil classification characteristics. In addition, undisturbed soil core samples will be analyzed for LNAPL and water saturation values, capillary pressure and relative permeability. Results will be compared to those obtained at the similar locations completed by AECOM in 2014. Data from the soil cores will be specifically evaluated in relation to LNAPL saturations in the discrete sand strata, considering grain size and thickness of the strata, with the assumption that limited remedial progress may be seen in fine-grained units. Based on these results, a post-remediation LNAPL conceptual site model can be prepared that documents the remedial progress and the post-remedial characteristics of the LNAPL remaining on site.

5.11 Remediation System Decommissioning

Following NYSDEC approval of a permanent system shut down, the remediation system and all associated components will be dismantled and removed from the Site. System piping that is located above-ground will be dismantled and removed from the Site; subsurface piping will be abandoned in place. All equipment and materials will be decontaminated prior to removal from the Site.

All remediation wells will be abandoned in accordance with NYSDEC guidelines. In addition, monitoring wells deemed unnecessary for future use at the Site will also be abandoned accordingly. Locations on the Site which were used for staging equipment, decontamination and/or temporarily staging waste materials will be restored to their pre-installation condition as necessary.

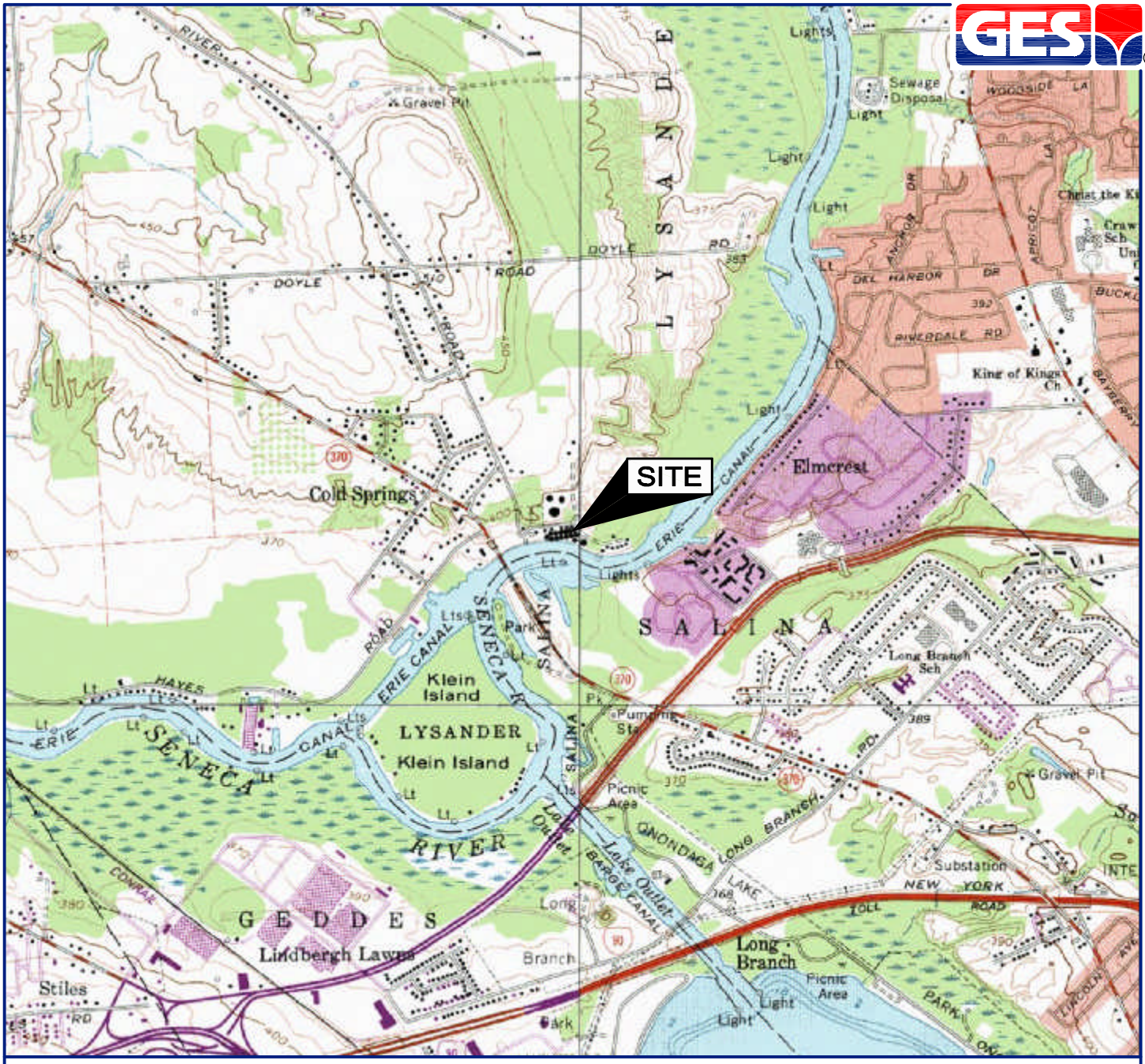
6.0 WASTE DISPOSAL PROCEDURES

All wastes generated during the installation, operation, maintenance, monitoring, and decommissioning of the remediation system on the Site will be disposed of or recycled in a timely manner and in accordance with all federal, state and local regulations. Specific wastes generated by remediation-related processes may include: recovered LNAPL, recovered petroleum impacted groundwater, drill cuttings, and spent LGAC. Any generated material that may be treated on the Site (groundwater) will be handled in accordance with NYSDEC guidelines and treated wastes will be released pursuant to all applicable permitting requirements. Wastes that cannot be treated on the Site may be temporarily and securely staged on the Site for later disposal. Any wastes temporarily staged on the Site will be transported from the Site and disposed of at client-approved facilities.

7.0 IMPLEMENTATION SCHEDULE

Implementation of the RAWP should begin at the onset of the earliest construction season following the NYSDEC approval of this document. Progress reports will be submitted on a quarterly basis in accordance with the requirements of the NYSDEC. A Remediation System Summary and Closure Report, including a detailed description of the remediation system, monitoring data and post-remediation sampling results, should be submitted in accordance with NYSDEC and DER-10 requirements upon completion of remediation and post-remediation monitoring activities.

FIGURES



SOURCE: USGS 7.5 MINUTE SERIES
TOPOGRAPHIC QUADRANGLE 1978
BALDWINSVILLE, NEW YORK
CONTOUR INTERVAL = 10'



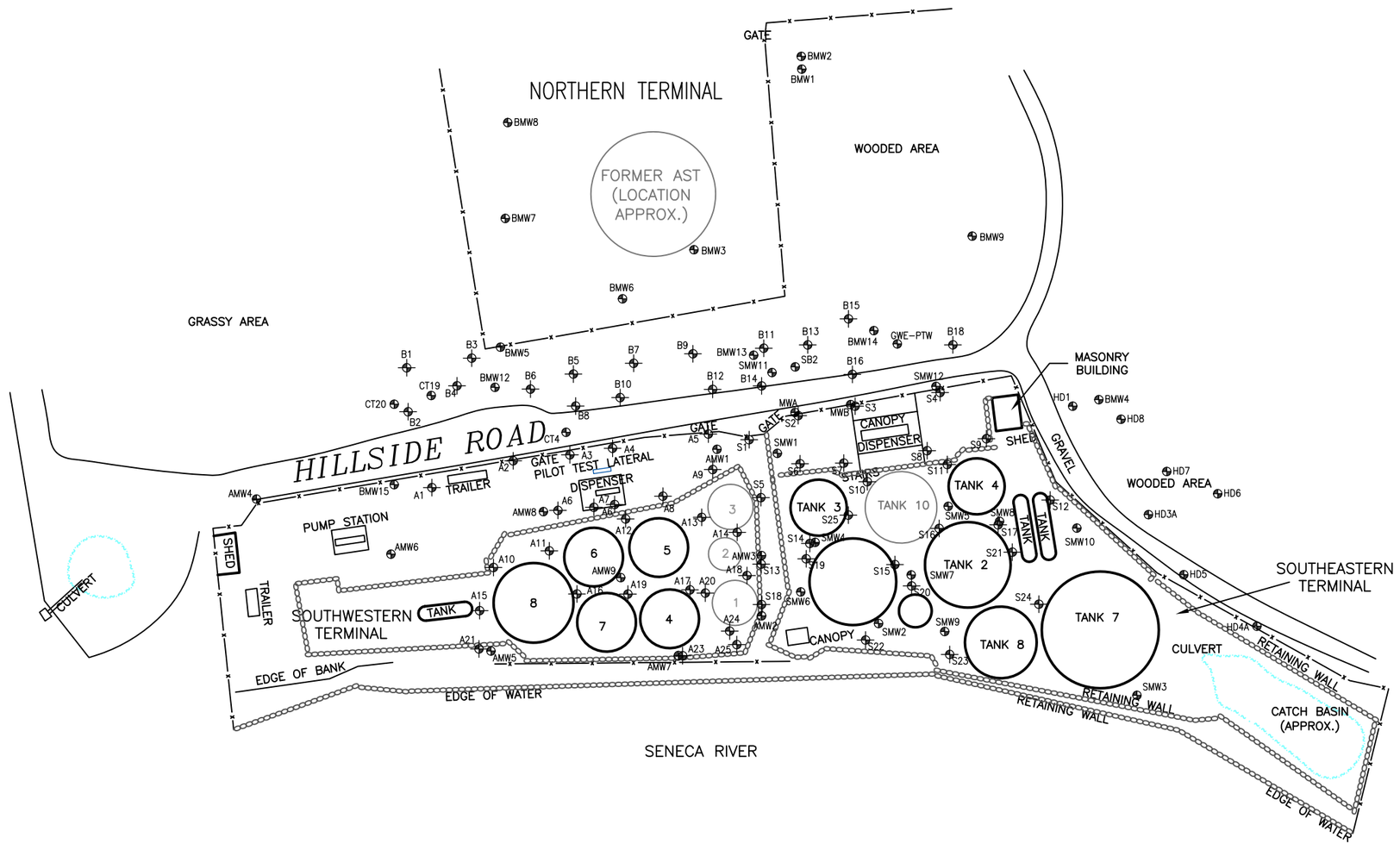
QUADRANGLE LOCATION

DRAFTED BY: W.G.S. (N.J.)	SITE LOCATION MAP
CHECKED BY:	COLD SPRINGS TERMINALS MUTUAL DEFENSE GROUP (CSTMDG) COLD SPRINGS TERMINALS HILLSIDE ROAD LYSANDER, NEW YORK
REVIEWED BY:	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DRIVE, NORTH SYRACUSE, NY 13212
NORTH	SCALE IN FEET: 0 — 2000 / DATE: 7-10-15 / FIGURE: 1

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LEGEND

- CHAIN LINK FENCE
- RETAINING WALL
- APPROXIMATE LOCATION OF WELDED PIPELINE PATCH
- MONITORING WELL

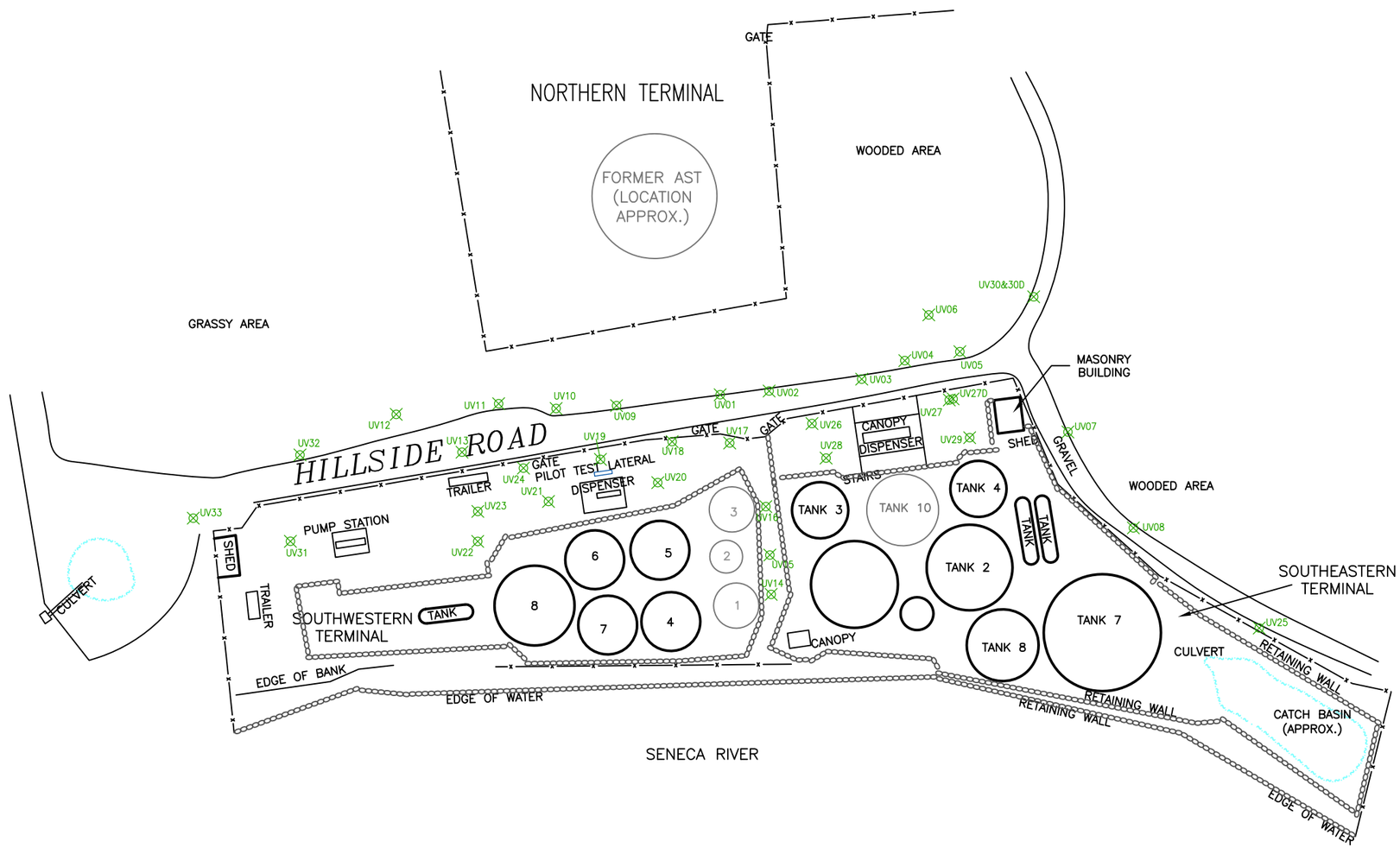


DRAFTED BY: W.G.S. (N.J.)	**SITE MAP**
CHECKED BY:	COLD SPRINGS TERMINALS MUTUAL DEFENSE GROUP (CSTMDG) COLD SPRINGS TERMINALS HILLSIDE ROAD LYSANDER, NEW YORK
REVIEWED BY:	
NORTH	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DRIVE, NORTH SYRACUSE, NY 13212
SCALE IN FEET: 0 APPROXIMATE 100	DATE: 9-30-15
	FIGURE: 2

M:\Graphics\0600-Syracuse\Misc\Cold Springs Settling\Cold Springs Terminal\Lysander\Lysander SM.dwg, B-100, WShea

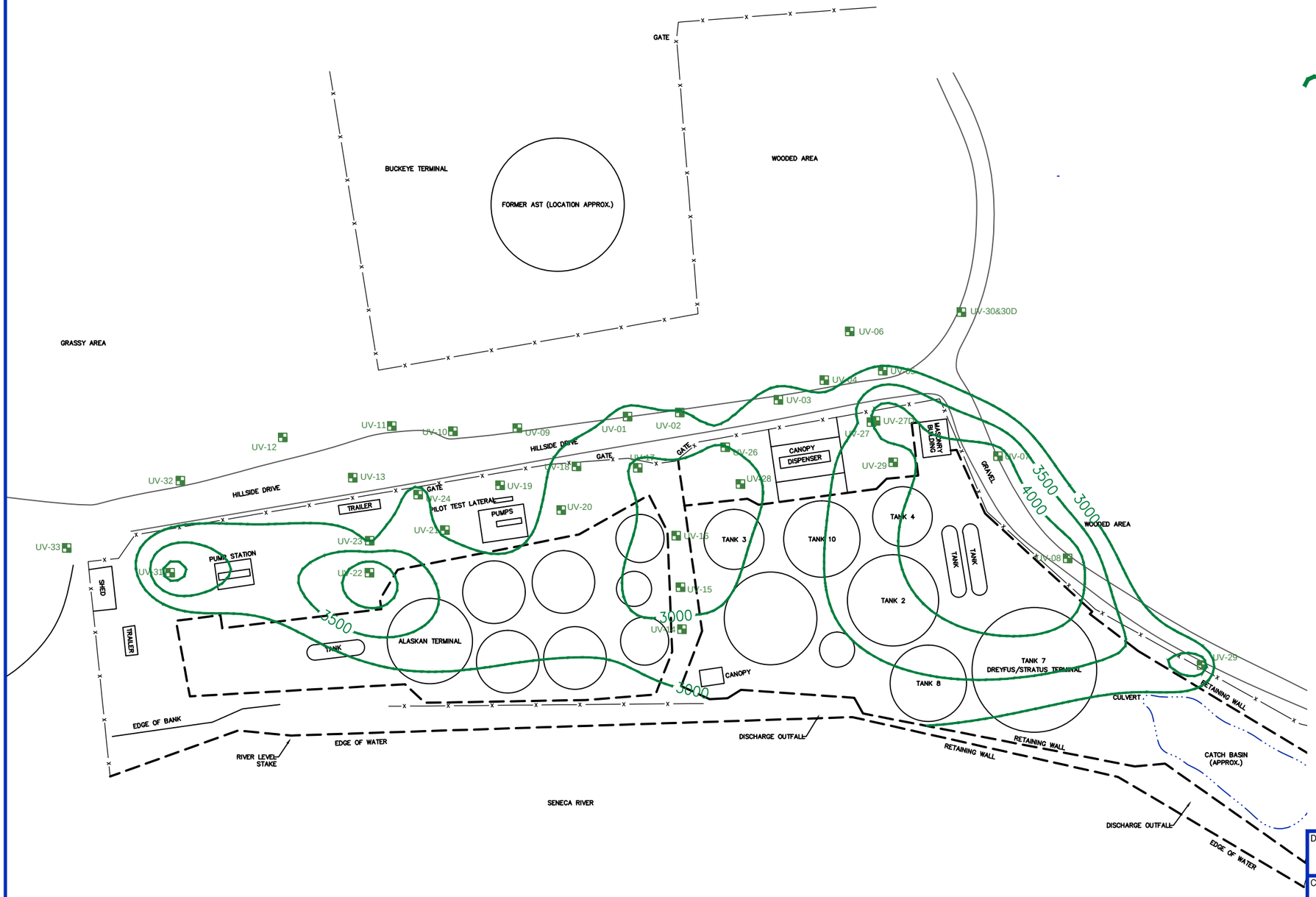
LEGEND

- CHAIN LINK FENCE
- RETAINING WALL
- APPROXIMATE LOCATION OF WELDED PIPELINE PATCH
- UVOST/CPT LOCATION



DRAFTED BY: W.G.S. (N.J.)	SITE MAP UVOST-CPT LOCATIONS
CHECKED BY:	COLD SPRINGS TERMINALS MUTUAL DEFENSE GROUP (CSTMDG) COLD SPRINGS TERMINALS HILLSIDE ROAD LYSANDER, NEW YORK
REVIEWED BY:	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DRIVE, NORTH SYRACUSE, NY 13212
NORTH	SCALE IN FEET: 0 APPROXIMATE 100 / DATE: 9-30-15 / FIGURE: 3

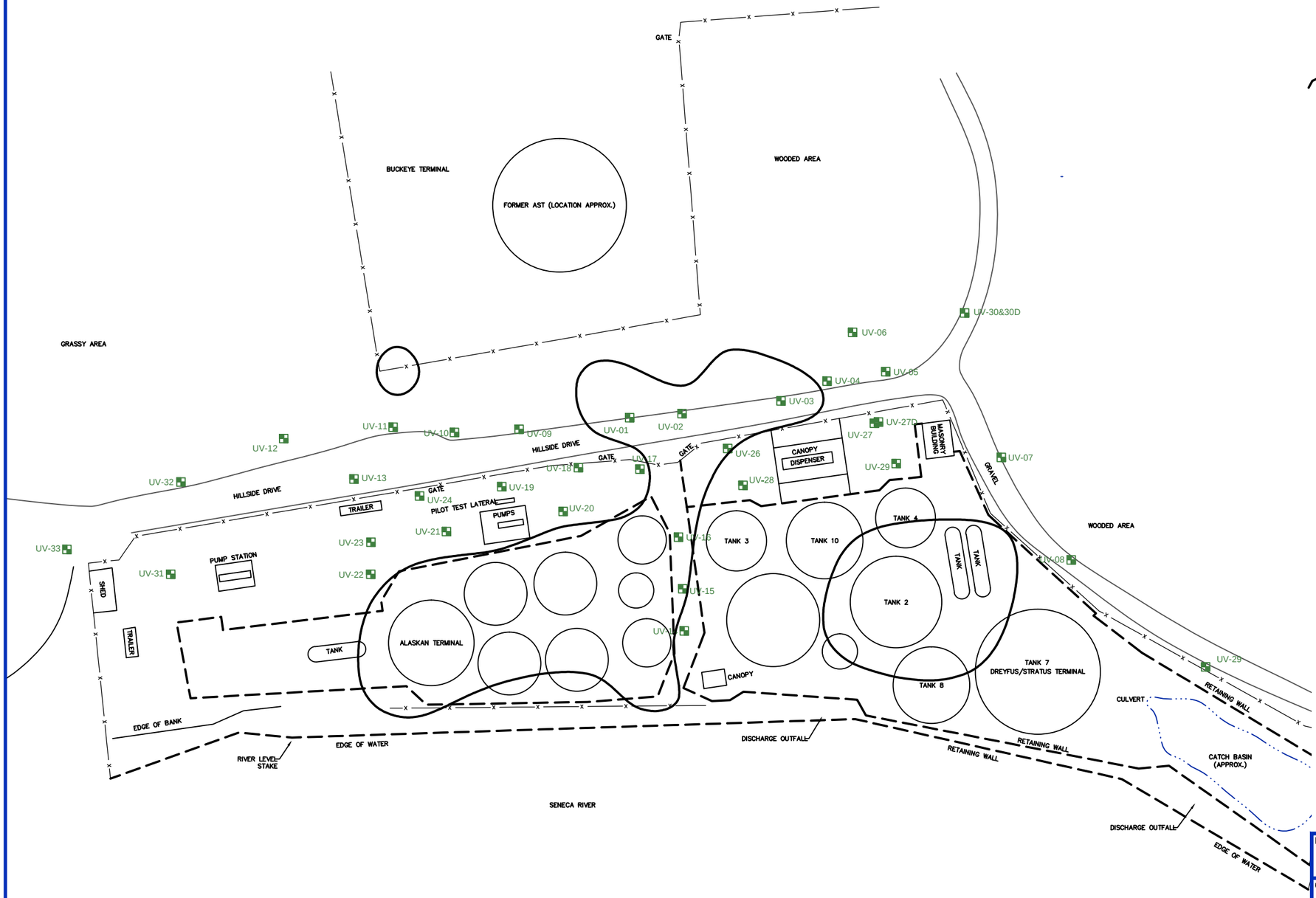
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NOTE:

LIF = LASER-INDUCED FLUORESCENCE
UVOST = ULTRAVIOLET OPTICAL SCREENING TOOL

DRAFTED BY: JCW	SUM TOTAL LIF RESPONSE MAP
CHECKED BY: LAT	COLD SPRINGS TERMINAL MUTUAL DEFENSE GROUP HILLSIDE ROAD, LYSANDER, NY
REVIEWED BY: DTS	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DR, NORTH SYRACUSE, NY 13212
NORTH	SCALE IN FEET: 0 — 80 / DATE: 9-1-15 / FIGURE: 4



LEGEND

- LIF/UVOST LOCATION
- EXTENT OF LNAPL – JULY 2013 (AFTER AECOM)

NOTE:

LIF = LASER-INDUCED FLUORESCENCE
UVOST = ULTRAVIOLET OPTICAL SCREENING TOOL
LNAPL = LIGHT NON-AQUEOUS PHASE LIQUID

DRAFTED BY: JCW	LNAPL DISTRIBUTION MAP JULY 2013
CHECKED BY: LAT	COLD SPRINGS TERMINAL MUTUAL DEFENSE GROUP HILLSIDE ROAD, LYSANDER, NY
REVIEWED BY: DTS	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DR, NORTH SYRACUSE, NY 13212
NORTH	SCALE IN FEET: 0 – 80 / DATE: 9-1-15 / FIGURE: 5



LEGEND

LIF/UVOST LOCATION

SPECIFIC VOLUME ≥ 0.5 gal/ft²

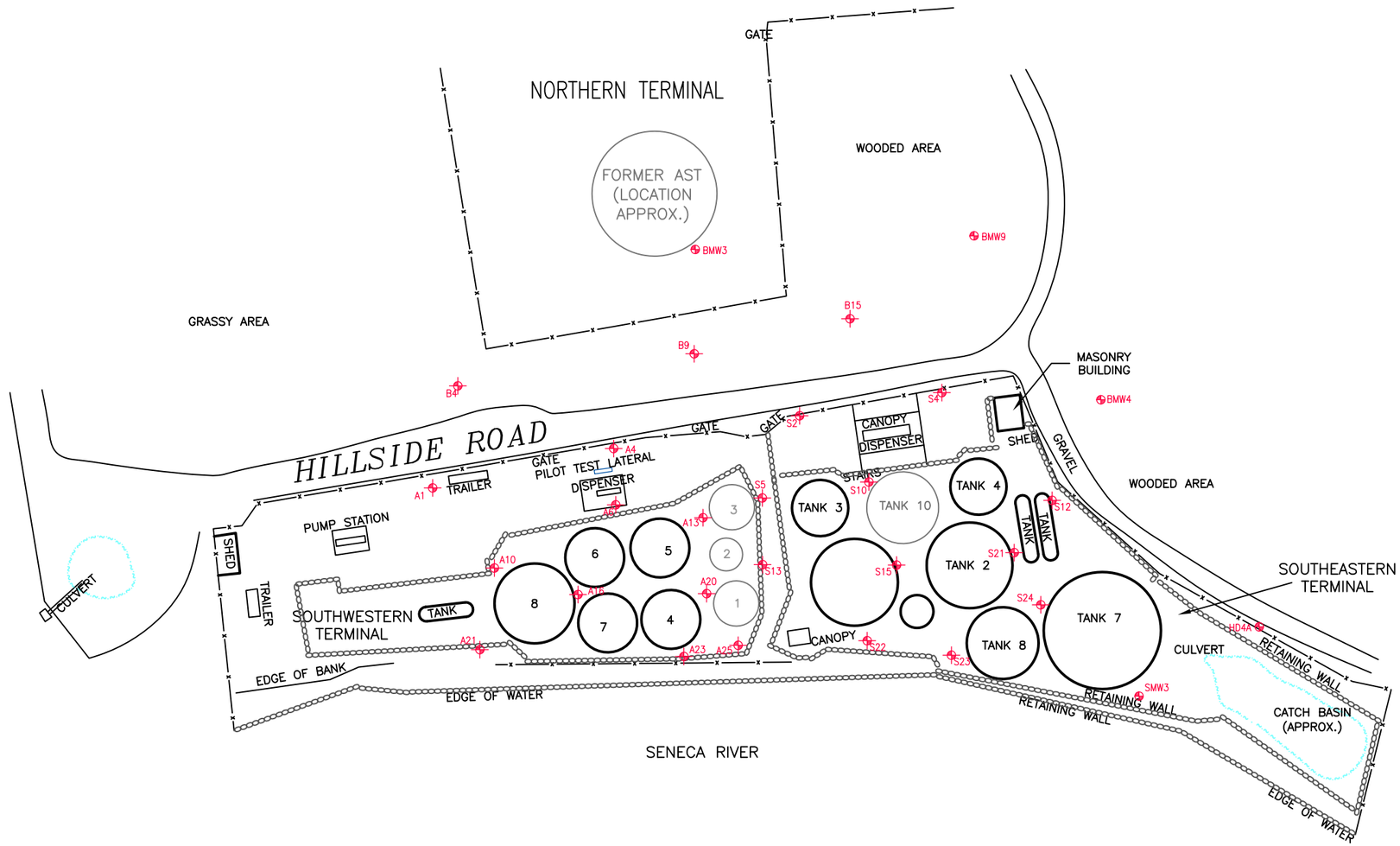
NOTE:

LIF = LASER-INDUCED FLUORESCENCE
UVOST = ULTRAVIOLET OPTICAL SCREENING TOOL
gal/ft² = GALLONS PER SQUARE FOOT

DRAFTED BY: JCW	SPECIFIC VOLUME DISTRIBUTION MAP
CHECKED BY: LAT	COLD SPRINGS TERMINAL MUTUAL DEFENSE GROUP HILLSIDE ROAD, LYSANDER, NY
REVIEWED BY: DTS	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DR, NORTH SYRACUSE, NY 13212
NORTH	SCALE IN FEET: 0 — 80 / DATE: 9-1-15 / FIGURE: 6

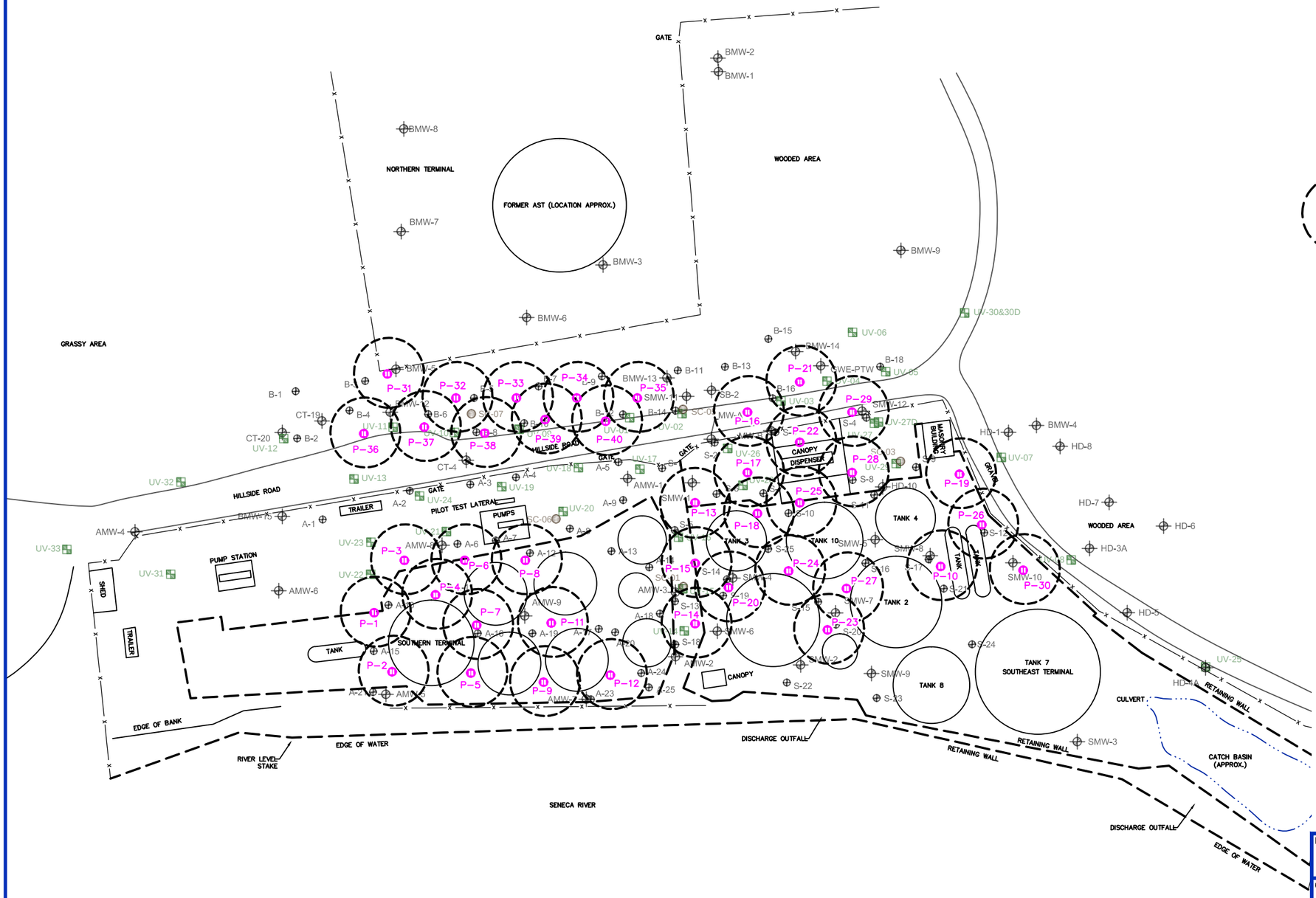
LEGEND

- CHAIN LINK FENCE
- RETAINING WALL
- APPROXIMATE LOCATION OF WELDED PIPELINE PATCH
- REMEDIATION MONITORING WELL



DRAFTED BY: W.G.S. (N.J.)	SITE MAP SYSTEM PERFORMANCE WELLS
CHECKED BY:	COLD SPRINGS TERMINALS MUTUAL DEFENSE GROUP (CSTMDG) COLD SPRINGS TERMINALS HILLSIDE ROAD LYSANDER, NEW YORK
REVIEWED BY:	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DRIVE, NORTH SYRACUSE, NY 13212
NORTH	SCALE IN FEET: 0 APPROXIMATE 100 / DATE: 9-30-15 / FIGURE: 7

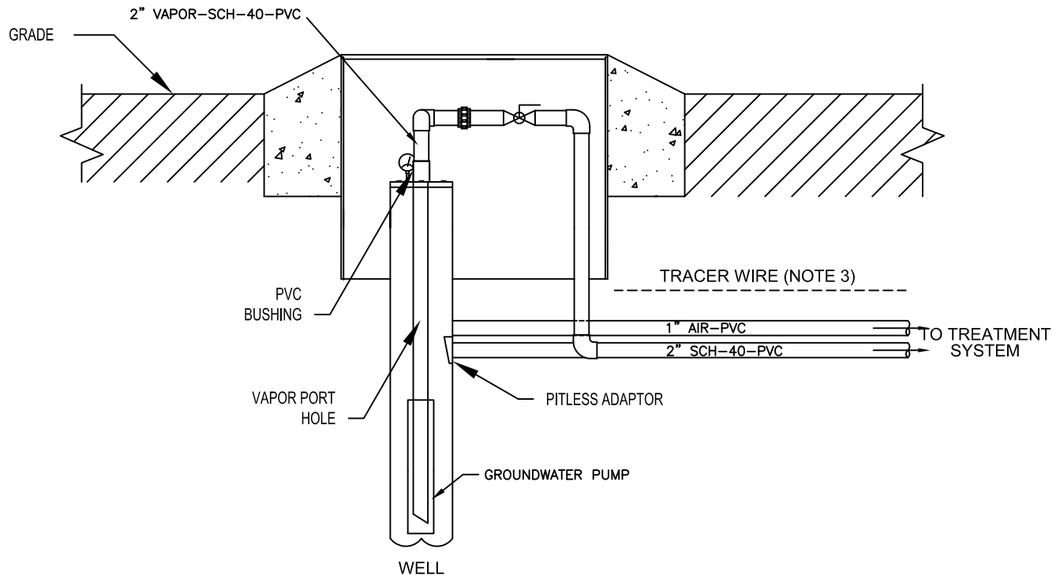
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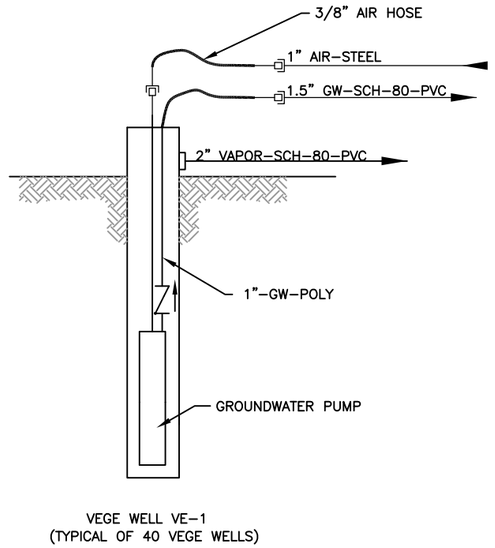
LEGEND

- LIF/UVOST LOCATION
- MONITORING WELL LOCATION
- REMEDIATION WELL LOCATION
- CORE SAMPLE LOCATION
- PROPOSED VEGE WELL LOCATION
- RADIUS OF INFLUENCE (ft)

DRAFTED BY: JCW	PROPOSED VEGE WELL LOCATION MAP
CHECKED BY: LAT	COLD SPRINGS TERMINAL MUTUAL DEFENSE GROUP HILLSIDE ROAD, LYSANDER, NY
REVIEWED BY: DTS	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DR, NORTH SYRACUSE, NY 13212
NORTH	SCALE IN FEET: 0 — 80 / DATE: 10-1-15 / FIGURE: 8



BELOW GRADE PIPPING



ABOVE GRADE PIPING

DRAFTED BY: W.G.S. (N.J.)	PROPOSED WELL CONSTRUCTION DETAILS
CHECKED BY:	COLD SPRINGS TERMINALS MUTUAL DEFENSE GROUP (CSTMDG) COLD SPRINGS TERMINALS HILLSIDE ROAD LYSANDER, NEW YORK
REVIEWED BY:	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DRIVE, NORTH SYRACUSE, NY 13212
	SCALE IN FEET / DATE 10–1–15 / FIGURE 9

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CONTROL VALVE BODIES

- BALL VALVE
- GATE VALVE
- GLOBE VALVE
- BUTTERFLY VALVE
- SWING CHECK VALVE
- DIAPHRAGM VALVE
- BALL CHECK VALVE
- NEEDLE VALVE
- 3 WAY VALVE
- 4 WAY VALVE
- FOOT VALVE
- SAMPLE VALVE
- SAMPLE PORT

ACTUATORS/ REGULATORS

- GEAR ACTUATOR
- PRESSURE RELIEF
- DIAPHRAGM ACTUATOR
- HYDRAULIC ACTUATOR
- SOLENOID ACTUATOR
- MOTOR ACTUATOR
- DIGITAL ACTUATOR
- WATER ACTUATOR
- REGULATOR
- FLOW INDICATOR
- PRESSURE RELIEF VALVE
- VACUUM RELIEF VALVE

MEASURING DEVICE SYMBOLS:

- SINGLE PORT PITOT TUBE
- AVERAGING PITOT TUBE
- POSITIVE DISPLACEMENT FLOW INDICATOR
- VORTEX SENSOR
- SONIC FLOW METER
- ROTAMETER FLOW INDICATOR
- TARGET TYPE SENSOR
- WEIR
- VENTURI TYPE FLOW ELEMENT
- FLOW NOZZLE
- ORIFICE PLATE FLOW ELEMENT

FITTINGS & PIPING

- VICTAULIC CONNECTOR
- FLANGED CONNECTION
- SCREWED CONNECTION
- UNION
- COUPLING
- RUPTURE DISK
- REDUCER
- STRAINER
- FLOW RESTRICTOR
- FLEX HOSE
- CAM LOCK
- REMOVABLE CLEAR PIPE
- EXPANSION JOINT/SLEEVE
- HOSE CONNECTION
- PNEUMATIC QUICK CONNECT
- PLUG
- PIPE CAP
- SLIP UPDRAFT VENT CAP
- ELBOW – TURNED UP
- ELBOW – TURNED DOWN
- ELBOW – 90°
- ELBOW – 45°
- ELBOW – LONG RADIUS
- REDUCING ELBOW
- TEE REDUCING
- TEE (OUTLET UP)
- TEE (OUTLET DOWN)
- TEE

SYMBOL & LEGEND SHEET EQUIPMENT

- LEVEL SWITCH FLOATS
- BAG FILTER
- LIQUID RING PUMP
- CENTRIFUGAL PUMP
- ROTARY VANE COMPRESSOR
- DISPLACEMENT PUMP
- PRODUCT DRUM
- AIR FILTER
- POSITIVE DISPLACEMENT BLOWER
- BLOWER
- PROPORTIONING PUMP
- CENTRIFUGAL BLOWER PUMP
- HEAT EXCHANGER/ CONDENSER
- HEATER
- OIL WATER SEPARATOR
- PACKED COLUMN AIR STRIPPING TOWER
- PISTON COMPRESSOR
- WELL WITH PUMP
- SKIMMER PUMP
- DIAPHRAGM PUMP
- SILENCER
- VAPOR PHASE CARBON
- LIQUID PHASE CARBON FRP
- LIQUID PHASE CARBON (STEEL)
- MOISTURE SEPARATOR
- LOW PROFILE AIR STRIPPER
- MAKEUP WATER SOURCE
- LIQUID RING PUMP HOLDING TANK

INSTRUMENTATION:

INSTRUMENT TYPE → PI
SYSTEM DESIGNATION → VE1 ← SYSTEM POSITION NUMBER

- REFERENCE POINT FOR DESIGN ONLY NOT ACTUAL INSTALLED INSTRUMENT. OPTIONAL FIELD MOUNTED INSTRUMENT TO BE INSTALLED AT THIS LOCATION IF CHOSEN.
- LOCAL MOUNTED INSTRUMENT
- INSTRUMENTS WITH INPUTS OR OUTPUTS AT THE SITE CONTROL PANEL
- PILOT LIGHT OR ALARM INDICATOR

INSTRUMENT TYPE/DESIGNATION:

PI	PRESSURE INDICATOR
PS	PRESSURE SWITCH
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
DPS	DIFFERENTIAL PRESSURE SWITCH
DPI	DIFFERENTIAL PRESSURE INDICATOR
PC	PRESSURE CONTROL
PAH	PRESSURE ALARM HIGH
PAL	PRESSURE ALARM LOW
FI	FLOW INDICATOR
FM	FLOW METER
FQI	FLOW METER (TOTALIZING)
FS	FLOW SWITCH
TI	TEMPERATURE INDICATOR
TSH	TEMPERATURE SWITCH HIGH
TSL	TEMPERATURE SWITCH LOW
TT	TEMPERATURE TRANSDUCER
TAH	TEMPERATURE ALARM HIGH
TAL	TEMPERATURE ALARM LOW
LSLL	LEVEL SWITCH LOW LOW
LSL	LEVEL SWITCH LOW
LSM	LEVEL SWITCH MIDRANGE
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH HIGH
LAL	LEVEL ALARM LOW
LAH	LEVEL ALARM HIGH
CP	CAPACITIVE SENSOR/PROBE
S	SAMPLE PORT

SYSTEM DESIGNATION:

ASW	AIR SPARGE WELL & MANIFOLD
VEW	VAPOR EXTRACTION WELL & MANIFOLD
DPW	DUAL PHASE WELL & MANIFOLD
ERW	ELECTRIC RECOVERY WELL & PUMP
PRW	PNEUMATIC RECOVERY WELL & PUMP
VER	VAPOR EXTRACTION REGENERATIVE BLOWER
VEP	VAPOR EXTRACTION POSITIVE DISPLACEMENT
ASV	AIR SPARGE ROTARY VANE COMPRESSOR
ASB	AIR SPARGE POSITIVE DISPLACEMENT BLOWER
DPO	DUAL PHASE SEALED LIQUID RING PUMP
DPL	DUAL PHASE LIQUID RING PUMP
DPB	DUAL PHASE POSITIVE DISPLACEMENT BLOWER
OW	OIL– WATER SEPARATOR SYSTEM
STL	AIR STRIPPER LOW PROFILE
VC	VAPOR PHASE CARBON
LC	LIQUID PHASE CARBON

VALVE ABBREVIATIONS

- N.C. – NORMALLY CLOSED
- N.O. – NORMALLY OPEN
- MAN – MANUAL

MATERIAL SPECIFICATION:

- PV – POLYVINYL CHLORIDE
- GM – GALVANIZED
- RC – RIGID COPPER
- IR – IRON
- ABS – ACRYLONITRILE BUTADIENE STYRENE
- FL – FLEX

PROCESS LINE INDICATORS

- FLOW DIRECTION
- MAJOR PROCESS
- MINOR PROCESS
- WATER/AIR PIPING
- AIR PIPING
- INSTRUMENTATION CONTROLS
- PNEUMATIC LINE
- CONNECTING LINE
- CROSSOVER LINE

PROCESS LINE ABBREVIATIONS

- ES – ELECTRIC SUPPLY
- GS – GAS SUPPLY
- HS – HYDRAULIC SUPPLY
- NS – NITROGEN SUPPLY
- SS – STEAM SUPPLY
- W – WATER SUPPLY
- V – VACUUM
- VR – VAPOR REMOVAL
- TF – TOTAL FLUIDS
- AP – ACCESS PIPE / CONDUIT
- SA – SPARGE AIR
- PN – PNEUMATIC SUPPLY

LINE DESIGNATION:

2 – VR – 01 – PV

2	VR	01	PV
SIZE IN INCHES	PROCESS	LINE NUMBER	MATERIAL SPECIFICATION

DRAFTED BY:	W.G.S. (N.J.)
CHECKED BY:	
REVIEWED BY:	

PROCESS & INSTRUMENTATION DIAGRAM LEGEND

COLD SPRINGS TERMINALS
MUTUAL DEFENSE GROUP (CSTMDG)
COLD SPRINGS TERMINALS
HILLSIDE ROAD
LYSANDER, NEW YORK

Groundwater & Environmental Services, Inc.
300 GATEWAY PARK DRIVE, NORTH SYRACUSE, NY 13212

NOT TO SCALE	DATE	FIGURE
	7–13–15	10

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M:\Graphics\0600-Syracuse\Misc\Cold Springs Settling\Cold Springs Terminal\Lysander\Engineering\Cold Springs Terminal PID-vege(revised).dwg, Model, WShea

HS 100
M
PSHL
PI
PRV
AIR COMPRESSOR AC-1
RECEIVER TANK
F-1
PARTICULATE FILTER
F-2
COALESCING FILTER
PI
2"-AIR-CS
HS 110
S
I1 I2 I3
3-WAY SOLENOID VALVE
NO
2"-AIR STEEL
NO
PRV
PI
1"-AIR CHEM-AIRE/DURAPLUS
VE-2
VE-3
VE-4
1"-AIR CHEM-AIRE/DURAPLUS
1.5"-GW-SCH 80 PVC
2"-GW-SCH 80 PVC
SP
NO
2" SCH 80 PVC-GW (GW HEADER)
TO GROUNDWATER TREATMENT SYSTEM P&ID
ABOVE GRADE (INSIDE EQUIPMENT CONTAINER)
BELOW GRADE
TYPICAL OF 40

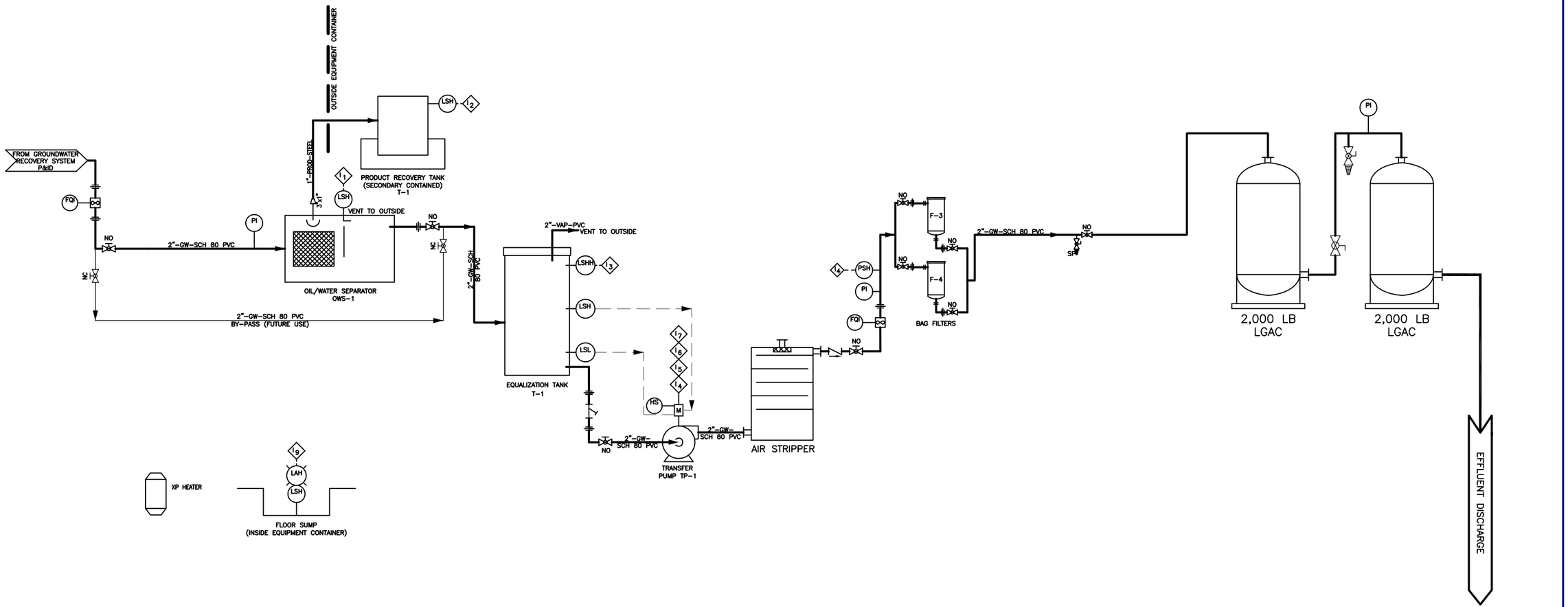
3/8" AIR HOSE
1" AIR-CHEM/AIRE
1.5" GW-SCH-80-PVC
2" VAPOR-SCH-40-PVC
1"-GW-POLY
PNEUMATIC GROUNDWATER PUMP
VEGE WELL VE-1
(TYPICAL OF 40 VEGE WELLS)

NOTE:
VEGE WELLS SHALL BE CONNECTED TO THE REMEDIAL SYSTEM VIA ABOVE GRADE PIPING.

2"-VAP-SCH 40 PVC
2"-VAP-SCH 40 PVC
VE-2
VE-3
VE-4
SP
NO
VI
BELOW GRADE
ABOVE GRADE (BY OTHERS)
8"-VAP-SCH 80 PVC

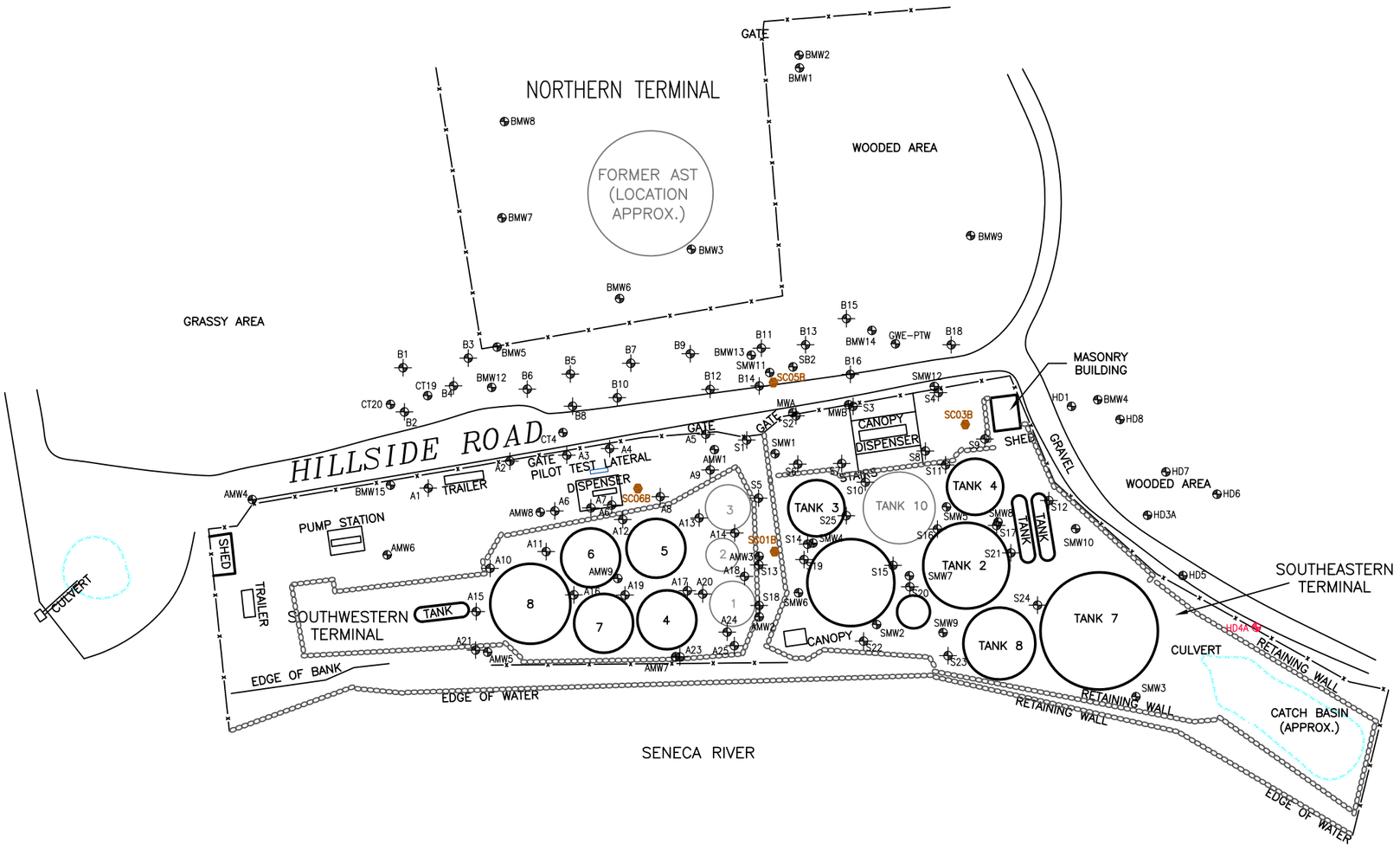
SP
EXHAUST STACK
NC
HEAT EXCHANGER BYPASS VALVE
I9
TS 100
TSHL 100
SP
I13
DEMISTER ELEMENT
LSHH
NC
VAPOR/LIQUID SEPARATOR VLS-1
MANUAL DILUTION AIR
NO
I15
I14
I13
I12
M
B-2 ROTARY LUBE BLOWER
NO
PI

DRAFTED BY: W.G.S. (N.J.)	PIPING & INSTRUMENTATION DIAGRAM VEGE SYSTEM
CHECKED BY:	COLD SPRINGS TERMINALS MUTUAL DEFENSE GROUP (CSTMDG) COLD SPRINGS TERMINALS HILLSIDE ROAD LYSANDER, NEW YORK
REVIEWED BY:	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DRIVE, NORTH SYRACUSE, NY 13212
	NOT TO SCALE / DATE 9-1-15 / FIGURE 11



DRAFTED BY: W.G.S. (N.J.)	PIPING & INSTRUMENTATION DIAGRAM GROUNDWATER TREATMENT SYSTEM
CHECKED BY:	COLD SPRINGS TERMINALS MUTUAL DEFENSE GROUP (CSTMDG) COLD SPRINGS TERMINALS HILLSIDE ROAD LYSANDER, NEW YORK
REVIEWED BY:	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DRIVE, NORTH SYRACUSE, NY 13212
	NOT TO SCALE / DATE 9-1-15 / FIGURE 12

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DRAFTED BY: W.G.S. (N.J.)	PROPOSED SOIL CORE LOCATION MAP
CHECKED BY:	COLD SPRINGS TERMINALS MUTUAL DEFENSE GROUP (CSTMDG) COLD SPRINGS TERMINALS HILLSIDE ROAD LYSANDER, NEW YORK
REVIEWED BY:	Groundwater & Environmental Services, Inc. 300 GATEWAY PARK DRIVE, NORTH SYRACUSE, NY 13212
NORTH	SCALE IN FEET: 0 APPROXIMATE 100 / DATE: 8-19-15 / FIGURE: 13

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TABLES

Table 1

SYSTEM PERFORMANCE WELL CONSTRUCTION SUMMARY

Cold Springs Terminal Mutual Defense Group
Cold Springs Terminal
Hillside Road
Lysander, New York

Well ID	Diameter (inches)	DTB (ft bgs)	TOS (ft bgs)
A1	2	12	7
A4	2	23	8
A6	2	12	7
A10	2	14	4
A13	4	19	4
A16	4	19	4
A20	4	15	5
A21	2	14	4
A23	2	12	7
A25	2	14	4
B4	4	24.5	9.5
B9	2	22	12
B15	2	17	7
BMW3	2	29.7	3.5
BMW4	2	12.5	2.75
BMW9	2	15	5
HD4A	2	12	2
S2	4	20	5
S4	4	20	5
S5	4	15.5	5.5
S10	4	19	4
S12	2	18	3
S13	4	20	5
S15	4	19	4
S21	2	18.5	3.5
S22	2	8	3
S23	2	8	3
S24	2	8	3
SMW3	2	15	5

Notes:

DTB = depth to bottom

ft bgs = feet below ground surface

TOS = top of screen

MNA Parameters collected at wellhead for - Temperature, pH, Conductivity, Dissolved Oxygen, and Oxygen Reduction Potential

MNA Analytes submitted for laboratory analysis of Nitrate/Nitrite, Sulfate, Methane, Alkalinity, Ferrous Iron, Manganese, and Carbon Dioxide

Table 2

VEGE WELL DESIGN SUMMARY

Cold Springs Terminal Mutual Defense Group
Cold Springs Terminal
Hillside Road
Lysander, New York

Well ID	General Location	Assumed DTW (ft bgs)	TOS (ft bgs)	BOW (ft bgs)	Well Material	Well Diameter (inches)	Screen Slot Size (inches)
P-1	Southwestern Terminal	10	7	22	Sch. 40 PVC	4	0.010
P-2	Southwestern Terminal	12	7	22	Sch. 40 PVC	4	0.010
P-3	Southwestern Terminal	12	7	22	Sch. 40 PVC	4	0.010
P-4	Southwestern Terminal	12	7	22	Sch. 40 PVC	4	0.010
P-5	Southwestern Terminal	12	7	22	Sch. 40 PVC	4	0.010
P-6	Southwestern Terminal	12	7	22	Sch. 40 PVC	4	0.010
P-7	Southwestern Terminal	10	7	22	Sch. 40 PVC	4	0.010
P-8	Southwestern Terminal	12	7	22	Sch. 40 PVC	4	0.010
P-9	Southwestern Terminal	10	7	22	Sch. 40 PVC	4	0.010
P-10	Southeastern Terminal	6	7	22	Sch. 40 PVC	4	0.010
P-11	Southwestern Terminal	10	7	22	Sch. 40 PVC	4	0.010
P-12	Southwestern Terminal	10	7	22	Sch. 40 PVC	4	0.010
P-13	Southeastern Terminal	12	7	22	Sch. 40 PVC	4	0.010
P-14	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-15	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-16	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-17	Southeastern Terminal	10	7	22	Sch. 40 PVC	4	0.010
P-18	Southeastern Terminal	7	6	21	Sch. 40 PVC	4	0.010
P-19	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-20	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-21	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-22	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-23	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-24	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-25	Southeastern Terminal	7	6	21	Sch. 40 PVC	4	0.010
P-26	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-27	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-28	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010

Table 2

VEGE WELL DESIGN SUMMARY

Cold Springs Terminal Mutual Defense Group
Cold Springs Terminal
Hillside Road
Lysander, New York

Well ID	General Location	Assumed DTW (ft bgs)	TOS (ft bgs)	BOW (ft bgs)	Well Material	Well Diameter (inches)	Screen Slot Size (inches)
P-29	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-30	Southeastern Terminal	8	6	21	Sch. 40 PVC	4	0.010
P-31	Northern Terminal	19	12	22	Sch. 40 PVC	4	0.010
P-32	Northern Terminal	20	12	22	Sch. 40 PVC	4	0.010
P-33	Northern Terminal	20	12	22	Sch. 40 PVC	4	0.010
P-34	Northern Terminal	20	12	22	Sch. 40 PVC	4	0.010
P-35	Northern Terminal	15	12	22	Sch. 40 PVC	4	0.010
P-36	Northern Terminal	16	12	22	Sch. 40 PVC	4	0.010
P-37	Northern Terminal	16	12	22	Sch. 40 PVC	4	0.010
P-38	Northern Terminal	13	12	22	Sch. 40 PVC	4	0.010
P-39	Northern Terminal	14	12	22	Sch. 40 PVC	4	0.010
P-40	Northern Terminal	13	12	22	Sch. 40 PVC	4	0.010

Notes:

DTW = depth to water
ft bgs = feet below ground surface
TOS = top of screen
BOW = bottom of well
Sch. 40 PVC = Schedule 40 polyvinyl chloride
The bottom of the screened interval at each location will be determined in the field based on existing site conditions.

Table 3

SYSTEM PERFORMANCE MONITORING PARAMETERS

Cold Springs Terminal Mutual Defense Group
Cold Springs Terminal
Hillside Road
Lysander, New York

Parameter	Minimum Recommended Frequency	Monitoring Location	Purpose	Laboratory Analysis
SVE Vapor Flow	Biweekly	Remediation System	Optimization, fouling	NA
SVE Vacuum	Biweekly	Remediation System	Optimization, fouling, upwelling	NA
Vapor Concentration - PID	Biweekly	Remediation System	Mass removal rate, trend analysis	NA
SVE CO2/Methane/O2 Gas Concentration	Monthly	Remediation System	Biological process monitoring	NA
Depth to Water/ LNAPL	Monthly	Quarterly MW network	Mounding, upwelling	NA
Dissolved Oxygen	Monthly	Quarterly MW network	Biological process monitoring	NA
Temperature, pH, Conductivity, Oxygen Reduction Potential	Monthly	Quarterly MW network	Biological process monitoring	NA
Vapor Effluent Concentrations	Monthly	Remediation System - Vapor Phase Effluent	Regulatory Compliance, Mass Removal Rate	Benzene, C_1-C_4 Hydrocarbons, and C_5-C_{10} Hydrocarbons
Water Treatment Process Concentrations	Monthly	Remediation System - Water Phase Influent, Pre-carbon, Mid-Carbon, and Effluent	Regulatory Compliance	STARS VOCs via EPA 8260C

Notes:
Quarterly MW Network indicates wells included in the quarterly groundwater quality well network
STARS = NYSDEC Spill Technology and Remediation Series
VOCs = Volatile organic compounds

APPENDICES

APPENDIX A
References

References:

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Zymax, 2009. *Cold Spring Terminal Project*. Zymax Forensics, January 12, 2009 (prepared on behalf of Aztech Technologies, Inc. Ballston Spa, New York 12020.

APPENDIX B

***Pilot Test Summary Report,* prepare by AECOM, Latham, New York**

Cold Springs Terminal
Lysander, New York
NYSDEC Spill #: 89-04923
September 2014

AECOM Environment

Prepared for:
Cold Springs Terminals Mutual
Defense Group
Albany, NY

Prepared by:
AECOM
Latham, NY
60248522
September 2014

Pilot Test Summary Report
Cold Springs Terminals
Lysander, New York
NYSDEC Spill #: 89-04923

AECOM Environment

Prepared for:
Cold Springs Terminals Mutual
Defense Group
Albany, NY

Prepared by:
AECOM
Latham, NY
60248522
September 2014

Pilot Test Summary Report
Cold Springs Terminals
Lysander, New York
NYSDEC Spill #: 89-04923

Prepared By Matthew J. Zenker, Ph.D., P.E., BCEE

Prepared By Sean Crowell, P.E.

Reviewed By John Santacroce

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List of Acronyms

AMSL	Above mean sea level
API	American Petroleum Institute
AST	Aboveground storage tank
ASTM	ASTM International
Aztec	Aztec Technologies, Inc.
bgs	Below ground surface
CFM	Cubic Feet Per Minute
CO2	Carbon Dioxide
CPT	Cone penetrometer
Dn	Specific volume
EIP	Electronic Interface Probe
ft^2/d	Square feet per day
ITRC	Interstate Technology & Regulatory Council
L	Liter
LDRM	LNAPL distrobution and recovery model
LEL	Lower Explosive Limit
LIF	Laser induced fluorescence
LNAPL	Light nonaqueous phase liquid
LTR	Land Tech Remedial, Inc.
MPE	Multi Phase Extraction
MTBE	Methyl tert butyl ether
MVS	Mining Visualization System
O2	Oxygen
PAHs	Polycyclic aromatic hydrocarbons
PID	Photon Ionization Detector
PPB	Parts Per Billion
PPM	Parts Per Million
PPMv	Parts Per Million By Volume
PVC	Polyvinyl Chloride
Report	*Pilot Test Summary Report*
Rn	Recoverable volume
ROI	Radius of Influence
Site	Cold Springs Terminals property located in Lysander, New York
TDS	Total Dissolved Solids
TPH	Total petroleum hydrocarbon
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
UVOST®	Ultra-Violet Optical Screening Tool
VOC	Volatile organic compound
VEGE	Vacuum Enhanced Groundwater Extraction
Work Plan	*Supplemental Site Investigation Work Plan*
%PV	Percent of pore volume
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
µg/g	Micrograms per gram
µm	Micrometers
ZOI	Zone of Influence

1.0 Introduction

AECOM was retained by the Cold Springs Terminals Mutual Defense Group to prepare this *Pilot Test Summary Report* (Report) for the Cold Springs Terminals property located in Lysander, New York (the Site) (Figure 1-1). The details of the work presented herein were described in the *Supplemental Site Investigation Work Plan* (Work Plan) (AECOM, 2012). A site map including the location of site features, monitoring wells, and pilot test wells is attached as Figure 1-2.

1.1 Objectives

As defined in the Work Plan, the objectives of the activities detailed herein are as follows:

- Provide additional information in terms of hydrogeology; light nonaqueous phase liquid (LNAPL) spatial distribution, LNAPL residual saturation, LNAPL mobility and LNAPL recoverability.
- Evaluate in-situ remedial feasibility for the Site.

A summary of the field and laboratory methods is provided in Appendix A.

1.2 Organization

This Report contains the following sections:

- Introduction – Provides a brief overview of the objectives and organization of the Report
- Summary of Site Conceptual Model – Presents the results of the activities defined in the Work Plan and presents the conceptual site model for the Site
- Conclusions – Discusses the applicability of MPE and VEGE at the Site
- References – Contains a listing of references utilized in the preparation of this Report

2.0 Summary Site Conceptual Model

2.1 Direct Sensing Technologies

In accordance with the approved work plan, a UVOST / CTP study was completed at the Site. The UVOST® and CPT logs are included in Appendix B and locations are identified in Figure 1-2. Following collection and surveying, the UVOST®/CPT data was utilized to generate a rendering of LNAPL impacts and soil type using Mining Visualization System (MVS) software (C Tech Development Corporation, Henderson, NV). Figure 2-1 illustrates a plan view of LNAPL impacts using the UVOST® data. The highest UVOST® response values were in the north central portion of the Site (UV-02, UV-03, and UV-29) and between the spill containment berm (UV-15). The waveform signature of these maximum UVOST® readings varied, depending on the location. Duplicate UVOST® borings were advanced in two locations (UV-27 and UV-30) to provide quality assurance/quality control checks on the UVOST® equipment and instrumentation. Differences in duplicate UVOST® borings can indicate operational difficulty with testing instruments, small scale (less than 5 feet) areal heterogeneity, or both. The reproducibility between the magnitude of the %RE response, the depth of observed response and waveforms were consistent between these borings. Comparison (butterfly) plots of these duplicate borings are presented in Figure 2-2. Information regarding the CPT data is presented in Section 2.4.

2.2 Soil Analysis

The TPH soil analyses performed on discrete samples are presented in Table 2-2. The soil TPH data ranged from 31.5 to 5,910 micrograms per gram (µg/g), with an average value of 2,470 µg/g. In addition, Table 2-2 also lists the calculated LNAPL saturation value, as calculated using methodology described in United States Environmental Protection Agency (USEPA) (1996). Calculated saturations ranged from 0.01 to 2.54 percent, with an average value of 1.06 percent. UVOST® readings from nearby borings (SC-01 and UV-15; SC-06 and UV-20) were averaged over the discrete sampling interval, and are also presented in Table 2-2. The linear coefficient of determination (R2) between these data is poor (less than 0.1), thus further comparison of these values was not performed. Laboratory reports for the TPH analyses are included in Appendix C.

Core photography data is included in Appendix D. A summary of grain size analysis data is presented in Table 2-3. The soil type at the Site is fining upward, with silt at shallow intervals, which transitions to fine and coarse sand with increasing depth. Complete grain size analysis data is included in Appendix D.

Pore fluid saturation data results are presented in Table 2-4. These data range from non-detectable levels (less than 0.1 percent of pore volume [%PV]) to 20.6 %PV, with an average value of 6.0 %PV (geometric mean). Data reports for pore fluid saturation data are included in Appendix D.

Air-water capillary pressure drainage data is presented in Table 2-5. The specific permeability to air, effective permeability to water and hydraulic conductivity values are presented. In addition, calculated van Genuchten and Brooks-Corey fitting parameters are presented. Full laboratory data reports for air-water capillary pressure drainage data are included in Appendix D.

LNAPL mobility data is presented in Table 2-6. The measured LNAPL residual saturation values ranged from 2.1 to 9.5 %PV, with an average value of 4.5 %PV (geometric mean). Of the 19 samples tested for free product mobility, 10 were already at residual saturation (i.e., did not produce measurable LNAPL as a result of testing). Of the remaining nine that did produce measurable LNAPL, the final LNAPL saturation ranged from 3.6 to 9.5 %PV, with an average value of 5.1 %PV (geometric mean). Full laboratory data reports for LNAPL mobility testing are included in Appendix D.

2.3 Light Nonaqueous Phase Liquid Mobility Testing

The results of the baildown testing are presented in Table 2-7. Baildown data was analyzed using the API LNAPL Transmissivity Workbook (API, 2012). Raw baildown data was adjusted to eliminate data that yielded zero or negative discharge values prior to analysis. Three different analysis methods were utilized to calculate the LNAPL transmissivity for each test. Results of each analysis method for each well are reported in Table 2-7, with average (arithmetic mean), standard deviation and coefficient of variation values. The average transmissivity values ranged from 0.001 to 0.49 square feet per day (ft2/d), with an average value of 0.016 ft2/d (geometric mean). Figure 2-3 illustrates the distribution of LNAPL transmissivity values throughout the Site. Raw data and analysis spreadsheets are included in Appendix E.

The baildown results suggest that the wells were not at an equilibrium condition prior to, and/or during the test period. LNAPL drawdown values for most wells did not equilibrate to a zero value, thus a drawdown adjustment was required for analysis. In addition, LNAPL thicknesses did not rebound to initial conditions following testing. Table 2-7 lists the initial and final LNAPL thickness measurements for each well. Nineteen of the 21 wells did not equilibrate to initial LNAPL thicknesses after approximately 28 days of recharge. Of these 19 wells, LNAPL thicknesses in AMW-9 and S-13increased until October 6, 2013 (18 days after test start) and then decreased to nearly zero. The LNAPL thickness in wells S-17 and SMW-5 increased to levels greater than initial conditions.

The variability in this LNAPL behavior suggests that local groundwater conditions fluctuated during the testing period. It is likely that the Seneca River is the primary source of this variation in groundwater level however empirical data was not collected during this investigation. The Seneca River is part of the Erie Canal System, and the water elevation can fluctuate in response to operations occurring at the Baldwinsville Lock and Dam, located approximately 5.5 miles upstream of the Site. During the baildown test period (September 16 to October 16, 2013), elevations at the stream gauge in Baldwinsville (downstream of lock/dam system) fluctuated by 1.9 feet. This fluctuation in river stage likely may have affected both drawdown and LNAPL discharge measurements. The median observed coefficient of variation of the estimated LNAPL transmissivity values is 75 percent (Table 2-7). Therefore, LNAPL transmissivity values should be considered accurate only within a range of 75 percent of the measured value.

2.4 Geology

According to the Finger Lakes Sheet of the Surficial Geologic Map of New York (Muller and others, 1991), the area is underlain by lacustrine silt and clay, generally characterized by laminated clay and silt. Upland soils north of Hillside Road are identified as till. Data collected during this investigation indicates that the Site is underlain by predominately fine grain soil consisting of heterogeneous interbedded silt, silty sands and sands with minor gravel lenses. The heterogeneous unit appears to fine upward from a dense underlying unit, which was not penetrated during this study. An increase in clay and clay horizons is noted in the shallow soil from Hillside Road toward the Seneca River which is consistent with previous investigations. As an example, up to 56 percent clay was detected in the SC-01 sample from 5.3 feet bgs. The grain size analysis is presented in Table 2-3 and CPT logs are

presented in Appendix B. Examination of the core photos from SC-01 shows that a heterogeneous finer clay and silt is from fill to a depth of approximately 10 feet bgs at this location. Cross sections of the soil behavior type (generated from the CPT investigation, were prepared using MVS. Figure 2-4 illustrates the cross section locations. Cross section A-A' (Figure 2-5) parallels the pipeline right of way north of Hillside Road south toward the Seneca River, and demonstrates this increase in fine grained material. Cross section B-B' (Figure 2-6) transects west to east along the south side of Hillside Road. This cross section shows that the subsurface soil is characterized by a fining upwards of fine sand to silt with heterogeneous lenses. Of the 60 samples analyzed for grain size, 49 were classified as silt, 10 were classified as fine sand, and one was classified as medium sand. The sands were detected in deeper soil samples and were typically interbedded with silts.

2.5 Hydrogeology

A comprehensive fluid level gauging event was performed at the Site on July 11, 2013. Fluid levels (depth to LNAPL, depth to water, total well depth) were attempted on 114 known groundwater monitoring well locations. The groundwater elevations were corrected using the LNAPL specific gravities utilized by previous contractors and were used to create the groundwater contour map provided as Figure 2-7. Groundwater elevations ranged from 389 feet to 363.48 feet in monitoring well AMW-5. A measured gradient of 0.13 to 0.2 ft/ft exists from the area north of Hillside Road to Hillside Drive, at which point there is gradient change to 0.019 to 0.009 ft/ft gradient south toward the Seneca River. There is some mounding of groundwater to the east of the eastern terminal which is likely related to recharge at the local catch basin and the wooded area to the east. There is also some mounding along the northern boundary of the western Terminal. In cross section, the groundwater appears to be confined by the overlaying finer materials, in some locations. Groundwater is found at 8 to 10 feet bgs within the finer silt and sandy silt units.

2.6 Light Nonaqueous Phase Liquid

This section presents a discussion of the site-specific aspects of LNAPL presence and mobility.

2.6.1 Source

Historic fuel terminal operations have resulted in the release of petroleum nonaqueous phase liquids to soil and groundwater.

2.6.2 Physical/Chemical Properties

Historical LNAPL and soil monitoring data have indicated that the petroleum products released at the Site consist of primarily leaded gasoline, with lesser amounts of diesel fuel and kerosene, as summarized by LTR (1996).

Physical properties (Table 2-8) are similar to reported values for gasoline (API, 1999). The density and viscosity values are slightly higher, however, than reported values for gasoline (API, 1999). These differences may be due to the presence of kerosene, or weathering processes.

2.6.3 Areal Extent

The current areal extent of LNAPL is defined using the results of the UVOST® study and the recent fluid gauging results. Figure 2-1 illustrates the UVOST®-defined extent of LNAPL. Extrapolation of UVOST® readings were not extended beyond the edges of the study area, or at depths of less than

five feet below ground surface[1]. Figure 2-1 illustrates that the LNAPL impacts are delineated to the east and west, but not to the north and south. Figure 2-8 illustrates an isocontour map of the measured LNAPL thickness in groundwater monitoring wells, based on the July 2013 gauging event. In addition, historic LNAPL extent (2004) and air-LNAPL interface elevations are presented in Figure 2-8.

For the first time since gauging LNAPL was detected in monitoring well HD-4A during the July 2013 gauging event. The product appeared to be different than product seen in other site wells. Well HD-4A was unsecured stickup well and in a readily accessible location. An attempt was made to sample the LNAPL for fingerprint analysis but there was insufficient volume. With concurrence from the NYSDEC the monitoring well was abandoned by pulling the well and grouting the annulus. A replacement monitoring well was installed 5-feet from the former well with identical construction. No impacts were observed in soil or water during installation and development. The well was secured with a pad lock after installation. There was no indication of LNAPL during subsequent gauging. The LNAPL detected in HD-4A was an anomaly and this area does not appear to be impacted by LNAPL as indicated by UVOST® data, observations during drilling, and the lack of LNAPL during subsequent drilling.

The areal extent of LNAPL impacts, using both UVOST® and gauging data, is approximately 114,500 square feet.

2.6.4 Vertical Distribution

The vertical distribution of LNAPL was defined using the results of the UVOST® study and MVS (Figures 2-5B and 2-6B). The vertical extent of LNAPL extends from ground surface to an average depth of approximately 15 feet bgs (364.5 to 359.5 feet AMSL). The maximum UVOST® response was observed near the groundwater potentiometric surface. Elevated LIF responses were also found in the vadose zone. North of Hillside Road, elevated UVOST® responses were observed as shallow as the ground surface. The top of the vertical interval could only be estimated in borings south of Hillside Road, as UVOST® borings in this area were hand augured to five feet bgs to insure protection of buried utilities. The auger cuttings were placed back into the boring, and the UVOST probe was then advanced through the cuttings to the desired depth.

Hydrostratigraphs and diagnostic gauge plots were prepared for several monitoring wells to illustrate the historic fluctuation of fluid elevations in relation to LNAPL vertical distribution, and the effect on observed LNAPL thickness. Figures for wells A-8, B-5, B-14, S-9, S-13, and SMW-11 are presented in Figures 2-9 through 2-14. These wells are near soil core and UVOST® boring locations. Therefore, these data are included in each hydrostratigraph for comparison. These graphs illustrate that the wells are appropriately screened to capture most water table fluctuations, as well as LNAPL impacts within the saturated zone. In some instances, fluid elevations rise above (B-14; Figure 2-11), or fall below (SMW-11; Figure 2-14), the screened interval.

The hydrostratigraphs also include the UVOST® data, soil core LNAPL saturation values and general soil type[2]. Using this information, the hydrostratigraphs show that the highest impacted vertical

[1] Each UVOST® boring was hand augered to five feet and then backfilled. Thus both CPT and UVOST® readings from this interval are not accurate.

[2] For simplicity, the soil type on the hydrostratigraphs illustrates the interface between the shallow silt/fill layer and the deeper sand layer. The soil type at the Site is discussed in Section 2.4.

interval is near the interface of the upper silt and lower sand layers. This interface also generally corresponds with average water table elevations. Based on UVOST® readings, a majority of LNAPL impacts are present above the water table. Approximately 60 percent of the UVOST® readings (above 5 percent reference emitter) occur above the July 11, 2013 water table (as estimated using the EVS model).

The measured LNAPL thicknesses (1989 to present) have fluctuated, ranging from less than 0.1 to over 10 feet. Individual wells (SMW-5 and SMW-11) have LNAPL thicknesses that have fluctuated as much as 10 feet, while 17 wells have fluctuated by at least five feet. This fluctuation is due to changes in the local groundwater potentiometric surface, which affects observed LNAPL thickness, depending on hydrogeologic conditions (e.g., unconfined, confined, and perched) which exist in the subsurface at this Site. As observed on the hydrostratigraphic logs, LNAPL thicknesses both increase (e.g., B-5) and decrease (e.g., A-8) in response to increasing groundwater potentiometric surface elevation, depending on the well. Also, the air-LNAPL and LNAPL-water interfaces are directly proportional to the potentiometric surface elevation for all wells. At equilibrium conditions, this combination of observations suggests that LNAPL is present in both confined (increasing LNAPL thickness with increasing potentiometric surface) and unconfined conditions (decreasing LNAPL thickness with increasing potentiometric surface) (Hawthorne, 2011).

The pattern of increasing/decreasing fluid elevations is due to the shallow aquifer at the Site likely not being at vertical equilibrium. This is suspected to be due to fluctuations in the Seneca River which likely affects shallow groundwater, although direct evidence linking the river to groundwater elevations was not collected. The presence of a mixture of unconfined/confined and perched condition is due to the proximity of the average water table depth to the interface between the upper silt and lower sand layers (described above). The presence of unconfined and/or perched conditions and river-induced potentiometric surface fluctuations result in variable measurements of equilibrium LNAPL thickness. The measured LNAPL thickness intervals are generally similar to the depth of higher LNAPL saturation (Figures 2-15 through 2-19).

The LDRM was utilized to generate theoretical vertical saturation profiles at each soil boring location. The LDRM is a tool used to predict recoverable LNAPL volumes present in the subsurface. However, the estimated volume can be skewed due to uncontrolled variables such as the non-equilibrium conditions in the aquifer and influence from a nearby water body which are conditions present at this Site. Laboratory measured LNAPL saturation data, and LDRM predictions of the vertical LNAPL saturation profile are presented in Figures 2-19 and 2-20. The LDRM input parameters were populated using site specific input data (e.g., fluid gauging, soil capillary analysis). Input parameters were then adjusted to match measured LNAPL saturation and measured transmissivity values, to the extent possible. A more detailed description of this fitting procedure for the LDRM is described in Appendix A. With the exception of vadose zone impacts, the LDRM yields a maximum LNAPL saturation value within approximately 25 percent of laboratory-derived vertical saturation values. The LDRM output also includes measurements of the LNAPL specific volume (Dn) and LNAPL specific recoverable volume (Rn). These parameters represent the estimated total (Dn) and recoverable (Rn) LNAPL volume[3], per unit area. These results are presented in Table 2-9. Assuming a total LNAPL impacted area of 114,500 square feet and a weighted average[4] analysis of the Dn/Rn values, the total

[3] The recoverable estimate represents the amount of LNAPL recovered as a liquid. This does not represent LNAPL that may volatilize due to vapor extraction processes.

[4] The weighted average utilized an area-based calculation. Each soil boring location was assigned a representative area of the total assumed LNAPL area using Thiessen polygons. This calculation is presented in Appendix A.

and recoverable LNAPL volume can be estimated. The estimated total and recoverable LNAPL using this methodology is 64,800 and 17,700 gallons, respectively. Therefore, the LDRM estimates that approximately 75 percent of the total LNAPL mass is present as residual saturation.

For the purposes of the work described herein, the volumetric estimates derived using the LDRM should be considered accurate to only within an order of magnitude. The volumetric estimates are subject to error, due to implicit LDRM assumptions (i.e., horizontal and vertical homogeneity of aquifer parameters and LNAPL distribution), as well as limited investigation within specific areas of the Site.

2.6.5 Mobility, Migration and Recoverability

Based on the LNAPL baildown testing results, the mobility of LNAPL is low compared to industry standards. The Interstate Technology & Regulatory Council (ITRC), (2009) reports that significant LNAPL cannot be recovered, and is not at risk of migration at LNAPL transmissivity values of 0.015 ft^2/d. The average LNAPL transmissivity at the Site is 0.016 ft^2/d (geometric mean) (Table 2-7). ITRC (2009) further states that an LNAPL transmissivity between 0.1 to 0.8 ft^2/d is the practical recovery limit for hydraulic and/or pneumatic recovery, and recovery beyond this point yields little benefit regarding reduction of total LNAPL mass, migration potential, risk or longevity. Only three wells (A-25, S-3, S-5) had LNAPL transmissivity values above 0.1 ft^2/d, and none exceeded 0.8 ft^2/d.

Historic and laboratory-derived data demonstrate that the migration potential of LNAPL is also very low. Historic gauging data has shown that the previous measured extent of LNAPL has not changed significantly in approximately 10 years. Figure 2-8 illustrates the measured extent of LNAPL from November 2004 compared to the July 2013 gauging event. The laboratory capillary pressure testing data yields information explaining this lack of migration. Using the capillary properties (Table 2-5) of the soil, a minimum LNAPL entry pressure head was calculated. The LNAPL entry pressure head is the thickness of LNAPL necessary to penetrate a fully water saturated aquifer (i.e., to migrate into areas that do not already contain LNAPL). This value was calculated using the method described in Charbeneau (2007). Based on this calculation, a LNAPL thickness of between 4.8 to 10.0 feet (7.7 feet geometric mean) is required for LNAPL to migrate as a separate phase liquid into portions of the silt saturated zone not previously exposed to LNAPL. For the fine sand zones, an LNAPL thickness of 2.5 to 3.8 feet is required. Table 2-10 contains a summary of the entry pressure head for the seven capillary pressure samples. Supporting information and an example LNAPL entry pressure calculation is presented in Appendix A.

During the July 2013 gauging, only eight wells exceeded a thickness of 2.5 feet, and none exceed a thickness of 7.7 feet. This indicates that there is a potential of LNAPL migration near these wells. These wells are located mostly within, or close to, the secondary containment berms. However, the majority of the LNAPL impacts are present in the shallower, silty soil (Figures 2-5B and 2-6B), thus requiring a higher LNAPL thickness to effect migration. The highest risk area for migration is in the vicinity of AMW-5, which is within approximately 20 feet of the Seneca River, and had a measured LNAPL thickness of 3.53 feet. However, since the inception of the project there has been no detection of LNAPL in the Seneca River.

The recoverability of LNAPL was also estimated using the calibrated LDRM. This calculation was performed only for soil core location SC-01, as this location was closest to a pilot test well (S-5). Assuming an average extraction rate of 0.7 gallons per minute (gpm) and an applied vacuum of 5 inches of water, the predicted initial LNAPL extraction rate was 1.5 gallons per day (Table 2-9). This estimate is higher than the actual volume observed during the pilot test, which recovered no

measurable LNAPL (Section 2.7). This discrepancy is due to idealized assumptions implicit in the LDRM (i.e., homogeneous soil type, ideal LNAPL distribution) and the actual heterogeneous conditions of the actual subsurface.

2.6.6 Effect on Groundwater Quality

The most recent groundwater investigation documented the presence of volatile organic compounds (VOCs) (primarily benzene, toluene, ethylbenzene and xylene isomers), methyl tert butyl ether (MTBE) and ethanol in groundwater at the Site (Aztech Technologies, Inc. [Aztec], 2009). Concentrations of total VOCs ranged from non-detectable levels to a maximum of 56,100 micrograms per liter (µg/L); MTBE was detected at a maximum concentration of 170 µg/L and ethanol was detected at a maximum concentration of 24,000 µg/L. The area of the groundwater impacts is similar to the extent of measured LNAPL.

2.7 Pilot Test Results

2.7.1 S-5 Pilot Test Results

2.7.1.1 Baseline Data

Baseline data was collected on June 23, 2014, prior to commencing the MPE Pilot test on S-5. The baseline groundwater measurements and soil vapor samples indicated the following:

- Depth to bottom of the well measured at 15.0 feet;
- LNAPL was detected at a thickness of 0.45 feet;
- DTW was 9.75 feet below top of well casing;
- Corrected Water Depth calculated to be 9.40 feet;
- LNAPL was detected in A-13 at 0.49 feet thick, A-18 at 0.28 feet thick, A-14 at 1.82 feet thick, AMW-3 at 1.46 feet thick, and S-13 at 1.60 feet thick;
- DTW in the wells monitored as indicated in Appendix A ranged from 8.62 to 13.25 feet below top of well casing; and,
- A baseline reading was not taken on S-1. The first reading was taken 30 minutes after the pumping step began.

2.7.1.2 Zero Vacuum Test

The pilot testing commenced on June 23, 2014 with a MPE set up. The drop tube was set approximately one foot above the bottom of the well (4.25 feet below the corrected water table elevation). With this set up, drawdown remained constant at approximately one foot off of the bottom of the well. While maintaining this specified drawdown, the blower was turned on and a zero vacuum test was run for one hour. In order to simulate zero vacuum for MPE the applied vacuum was adjusted using the VFD until the vacuum measured at the interstitial space of the well was as close to 0 as possible while still being measurable. A total of 25 gallons of groundwater were collected during the duration of the Zero Vacuum Test which pumped at a rate of 0.42 gallons per minute (gpm). Gauging was performed every 30 minutes and groundwater drawdown was observed in A-13, A-18, A-24, AMW-3, and S-13 from initial baseline readings.

As soon as the Zero Vacuum Test was completed, the vacuum was applied to the well head for the Step Test. Velocity of the MPE air flow was measured as the vacuum was turned on. Once the

velocity stabilized, the vacuum was increased and the process was repeated until a maximum vacuum was established. These results were utilized by the pilot test operator in order to select constant rate vacuums for the test. Based on these results, the three vacuums selected to run the MPE Constant Rate Tests were 8 “Hg, 13 “Hg, and 15 “Hg. The applied vacuum, soil vapor temperature, and differential pressure were measured after each sequential adjustment, were used to calculate the soil vapor recovery rate.

2.7.1.3 MPE Constant Rate Step Tests

The three Constant Rate Tests were conducted on S-5 on June 23, 2014 with the “drop tube” set approximately 4.25 feet below the corrected water table, at the applied interstitial space vacuums of 5 “Hg, 8 “Hg, and 13 “Hg for two hours each. The results are as follows:

Step #1
The first MPE Constant Rate Step Test (Step #1) was conducted for 120 minutes (min), while an applied vacuum of approximate 8 “Hg was applied to the drop tube of S-5 (corresponding interstitial space vacuum of 5”Hg). Prior to beginning the test, the Four-Gas meter that was to be used to measure, O_2, CO_2, and LEL was found to not be working so measurements were not able to be taken for these parameters. The VOC concentration measured at the beginning of the Constant Rate Test was 340 parts per million per unit volume (ppmv) and increased to 345 ppmv at the end of the 120 min and the average soil vapor flow rate was 29.71 standard cubic feet per minute (scfm). Refer to Appendix F for details associated with S-5 testing. A total of 48 gallons of groundwater was recovered during Step #1, and the average recovery rate was approximately 0.67 gpm. Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. No recordable volume of LNAPL was recovered during this step. The lack of measureable LNAPL recorded during the test on S-5 can be attributed to overall low recovery rates associated with the well, but also do to the fact that MPE extraction method leads to mixing of LNAPL, vapor, and water and means for accurate measurement of LNAPL are not available.

Two of the 11 monitoring points/wells had measurable vacuums during the first step. AMW-3 and S-13 showed vacuum influences of -1.42 “H_2O and -0.12 “H_2O respectively. An increase in DTW (drawdown) was seen in two of the wells, AMW-9, A-14, whereas a decrease in DTW was observed in five of the wells A-13, A-18, A-24, AMW-3, and S-1. Four of the wells, A-5, AMW-1, S-18, and S-13 had no change in groundwater level. The maximum drawdown distance, the furthest distance where significant drawdown was observed, was inconclusive as no well showed significant drawdown. The closest well to S-5 was 32 feet away, so it can be inferred that the maximum drawdown distance was less than this. Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum radius of influence (ROI) at the end of the Step #1 (i.e. 180 min), was undetermined based on the data collected. The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Refer to Appendix F.

Step #2
The second MPE Constant Rate Step Test (Step #2) was conducted for 120 min; while an applied vacuum of approximate 13 “Hg was applied on the drop tube in S-5 (corresponding interstitial space vacuum of 8”Hg). The average soil vapor flow rate during this step was 31.67 scfm. Due to equipment issues discussed above, O_2, CO_2, and LEL were not able to be measured.

The initial extracted vapors contained VOC concentrations of approximately 360 ppmv increased slightly during the test to 365 ppmv. Refer to Appendix F. A total of 63 gallons of groundwater were recovered up to the 270 minute interval of Step #2, and the average recovery rate was approximately 0.70 gpm. Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. No recordable volume of LNAPL was recovered during this step.

The initial VOC concentrations in the extracted vapors increased slightly compared to the final reading of Step #1, from 345 to 360 ppmv and during Step #2 they increased slightly from 360 ppmv to 365 ppmv. Refer to Appendix F.

Two of the 11 monitoring points/wells had measurable vacuums, AMW-3 at 45 feet and S-13 at approximately 50 feet away. The vacuums at these monitoring points/wells were -1.92 "H_2O and -0.17 "H2O respectively. An increase in drawdown, compared to the last reading of Step #1 was observed in only two of the wells, AMW-3 and A-9. There was a decrease in drawdown in four of the monitoring points/wells, A-18, A-24, S-13, and S-1. Wells A-5, AMW-1, A-13, A-14, and S-18 exhibited no change in drawdown. The maximum drawdown distance, the furthest distance where significant drawdown is still observed, was inconclusive as no well showed significant drawdown. The closest well to S-5 was 32 feet away, so it can be inferred that the maximum drawdown distance was less than this. Refer to Appendix F for the S-5 Constant Rate Step Test Summary Tables and Charts and a visual depiction of the change in groundwater levels (i.e. drawdown) measured in the monitoring points/wells and the test well over the duration of Step #2.

The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum ROI determined at the end of the Step #2 (i.e. 300 min), was undetermined based on the data collected. The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. Refer to Appendix F.

Step #3

The third MPE Constant Rate Step Test (Step #2) was conducted for 90 min; while an applied vacuum of approximate 15 "Hg was applied to the "drop tube" and less than 5 "H2O on the interstitial space of S-5. The average soil vapor flow rate during this step was 32.83 scfm. Due to equipment issues discussed above, O_2, CO_2, and LEL were not able to be measured.

The initial extracted vapors contained VOC concentrations of approximately 360 ppmv decreased during the test to 289 ppmv. Refer to Appendix F. A total of 65 gallons of groundwater were recovered between the 270 minute interval of step # 2 and the end of step Step #3, and the average recovery rate was approximately 0.54 gpm. Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. No recordable volume of LNAPL was recovered during this step.

The initial VOC concentrations in the extracted vapors decreased slightly compared to the final reading of Step #2, from 365 to 360 ppmv and over the course of Step #3, the VOC concentrations decreased from 360ppmv to 289 ppmv. Refer to Appendix F.

Two of the eleven monitoring points/wells had measurable vacuums, AMW-3 and S-13 at approximately 45 feet and approximately 50 feet away respectively. The vacuums at these monitoring points/wells were -2.90 "H_2O and -0.23 "H_2O respectively. An increase in drawdown, compared to the last reading of Step #2 was observed in three of the wells, S-13, S-1 and A-9. There was a decrease in drawdown in six of the monitoring points/wells, A-13, A-18, A-14, S-18, A-24, and AMW-3.

Wells A-5 and AMW-1 exhibited no change in drawdown. The maximum drawdown distance, the furthest distance where significant drawdown is observed, was inconclusive as no well showed significant drawdown. The closest well to S-5 was 32 feet away, so it can be inferred that the maximum drawdown distance was less than this. Refer to Appendix F.

The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum ROI determined at the end of the Step #2 (i.e. 390 min), was undetermined based on the data collected. Refer to Appendix F.

2.7.1.4 Recovery Step

During the last 2hours of the MPE Constant Rate Test, the blower and the pump were shut off and the groundwater was able to recharge the well. The surrounding monitoring points/wells were gauged for depth to LNAPL/water approximately every 30 minutes while the Test Well, S-5, was gauged every five minutes for 30 minutes . Refer to Appendix F for S-5 Drawdown vs. Time for gauging and recovery data.

The 0.45 feet of LNAPL detected during the baseline readings decreased to zero feet following the end of the last MPE Constant Rate Test, however the groundwater level decreased from a corrected value of 9.40 feet below the TOC to 11.25 feet below the top of casing, a depression of 1.85 feet, between the start and end of the MPE Constant Rate Tests (Appendix F).

2.7.1.5 Laboratory Data Evaluation

During the test on S-5, samples were collected on the influent vapor and groundwater at the 330 minute time interval of the test. The samples were collected in a 6 liter summa canister and standard preserved VOA's, respectively as grab samples. Samples were submitted to Pace Analytical of Schenectady, NY for analysis of total VOC's. Data from these samples was analyzed and used in order to determine the mass removal rate for the well for design considerations. The total calculated mass removal rate based on the analytical data and measured air and water flow rates for S-5 at the 130 minute interval of testing was approximately 0.041 lb/hr (0.0404 lbs vapor phase, 0.0002 lbs based on dissolved phased concentrations). This result is only representative of the short term test Further consideration and analysis to these data should be given prior to use in any design for a long term remedial solution. Refer to Appendix F for calculations and Appendix G for laboratory reports.

2.7.2 A-16 Pilot Test Results

2.7.2.1 Baseline Data

Baseline groundwater measurements and soil vapor samples were collected on June 24, 2014, prior to commencing the VEGE Pilot Set up Test on A-16. The baseline data indicated the following:

- Depth to bottom of the well measured 19.0 ft;
- LNAPL was detected with a thickness of 5.16 ft;
- DTW was 13.95 feet below the top of the well casing;
- Corrected Water Depth calculated to be 9.93 ft.;
- LNAPL was detected in three of the monitoring points/wells A-12 at 3.09 feet thick, AMW-9 at 3.64 feet thick, and A-10 at 2.74 feet thick; and,

- DTW in the wells monitored as indicated in Appendix A anged from 7.79 feet to 14.94 feet below top of well casing.

2.7.2.2 **Zero Vacuum Test**

The pilot testing commenced on June 24, 2014 with a VEGE set up. The top loading pump was set approximately six inches above the bottom of the well. With this set up, drawdown remained constant at the top of the pump, approximately three feet off of the bottom of the well, at 6.00 feet below the corrected water table. The zero vacuum test was run for a total of one and a half hours, during which a total of 71 gallons of groundwater (approximately 0.79 gpm) were recovered. Gauging was performed every 30 minutes for the duration of the test and groundwater drawdown was observed in A-12, A-19, A-11, and A-10 from initial baseline readings.

As soon as the Zero Vacuum Test was completed, the vacuum was applied to the well head for the Step Test. Velocity of the VEGE air flow was measured as the vacuum was turned on. Once the velocity stabilized, the vacuum was increased and the process was repeated until a maximum vacuum was established. These results were utilized by the pilot test operator in order to select constant rate vacuums for the test. Based on these results, the three vacuums selected to run the VEGE Constant Rate Tests were 5 “Hg, 8 “Hg, and 13 “Hg. The applied vacuum, soil vapor temperature, and differential pressure were measured after each sequential adjustment, were used to calculate the soil vapor recovery rate.

2.7.2.3 **VEGE Constant Rate Step Tests**

The three Constant Rate Tests were conducted on A-16 on June 24, 2014 with the top loading pneumatic pump set approximately six inches above the bottom of the well. The applied vacuums were run at the applied vacuums of approximately 5 “Hg, 8 “Hg, and 13 “Hg. The results are as follows:

Step #1
The first VEGE Constant Rate Step Test (Step #1) was conducted for 150 minutes (min), while an applied vacuum of approximate 5 “Hg was applied to the wellhead. During the test, at approximately 180 minutes, the air compressor overheated and shut off. Once the compressor cooled down, was moved to the shade, and switched to a separate breaker panel, the pump turned back on and began pumping again. Measurements were still taken during this period as scheduled when the pump was turned off to get good representative data, however, an additional reading was also taken. Prior to beginning the test, the Four-Gas meter that was to be used to measure, O_2, CO_2, and LEL was not working so measurements were not able to be taken for these parameters. The VOC concentration measured at the beginning of the Constant Rate Test was 260 ppmv and increased to 399 ppmv at the end of the 150 min and the average soil vapor flow rate was 29.55 scfm. Refer to Appendix H. A total of 183 gallons of groundwater were recovered during Step #1, and the average recovery rate was approximately 1.22 gpm. Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. A total of approximately 10 gallons of LNAPL were collected between the start of the test and this step.

One of the six monitoring points/wells had measurable vacuums, during the Step #1. A-11 showed a vacuum influence of -0.50 “H_2O at approximately 40 feet away. An increase in groundwater drawdown was seen in four of the wells, A-12, A-19, A-11, and A-10 two of the wells, A-7, AMW-9 displayed no change in groundwater level. The maximum drawdown distance, the furthest distance where significant drawdown is still observed, was inconclusive as AMW-9, 36 feet away, had no measured drawdown, but relatively significant drawdown was observed at both A-19 and A-11 each

approximately 40 feet away from the test well. The maximum drawdown distance falls somewhere between 36 feet and 39 feet.

Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum radius of influence (ROI) was determined at the end of the Step #1 (i.e. 150 min), which resulted in a ROI of 34 feet. The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Refer to Appendix H.

Step #2
The second VEGE Constant Rate Step Test (Step #2) was conducted for 90 min; while an applied vacuum of approximate 8 “Hg was applied to the wellhead and less than 3 “H2O on the interstitial space of A-16. Due to equipment issues discussed above, O2, CO2, and LEL were not able to be measured.

The initial extracted vapors contained VOC concentrations of approximately 291 ppmv decreased slightly during the test to 277 ppmv. The soil vapor extraction rate averaged 25.81 scfm during Step #2. Refer to Appendix H. A total of 317 gallons of groundwater were recovered during Step #2, and the average recovery rate was approximately 3.52 gpm. Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. Approximately 4 gallons of LNAPL were recovered during this step. The groundwater recovery rate increased with vacuum as expected with increased vacuum, however a decrease in vapor flow rate was observed. This decrease is likely do to upwelling caused by the vacuum and less effective well screen being available for air flow.

The initial VOC concentrations in the extracted vapors decreased compared to the final reading of Step #1, from 399 to 291 ppmv. During Step #2 the VOC concentrations decreased further to 277 ppmv. Refer to Appendix H.

One of the six monitoring points/wells had measurable vacuums, A-11 at approximately 40 feet away. The vacuum at this monitoring points/wells was -0.35 “H_2O. An increase in drawdown, compared to the last reading of Step #1 was observed in only four of the wells, A-12, A-19, A-11 and A-10. Wells A-7 and AMW-9 exhibited no change in drawdown. Refer to Appendix H. The maximum drawdown distance, the furthest distance where significant drawdown is still observed, was inconclusive as AMW-9 36 feet away had no measured drawdown, but relatively significant drawdown was observed at both A-19 and A-11 each approximately 40 feet from the test well. The maximum drawdown distance falls somewhere between 36 ft and 39 feet.

Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum ROI determined at the end of the Step #2 (i.e. 330 min), was of 35 feet. The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Refer to Appendix H.

Step #3
The third VEGE Constant Rate Step Test (Step #2) was conducted for 90 min; while an applied vacuum of approximate 13 “Hg was applied to the wellhead and less than 5 “H_2O on the interstitial space of A-16. Due to equipment issues discussed above, O_2, CO_2, and LEL were not able to be measured.

The initial extracted vapors contained VOC concentrations of approximately 367 ppmv increased during the test to 390 ppmv. The soil vapor extraction rate averaged 28.71 scfm during Step #3. Refer to Appendix H. A total of 226 gallons of groundwater were recovered during Step #3, and the average recovery rate was approximately 3.77 gpm.

Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. Approximately 2 gallons of LNAPL were recovered during this step.

The initial VOC concentrations in the extracted vapors increased compared to the final reading of Step #2, from 277 to 367 ppmv. During the course of Step #3, VOC concentrations increased to 390 ppmv. Refer to Appendix H.

Two of the six monitoring points/wells had measurable vacuums, A-11 and A-10 at approximately 40 feet and 67 feet away respectively. The vacuums at these monitoring points/wells were -1.94 "H_2O and -0.03 "H_2O respectively. An increase in drawdown, compared to the last reading of Step #2 was observed in four of the wells A-12, A-19, A-11 and A-10. Wells A-7 and AMW-9 exhibited no change in drawdown. Refer to Appendix H. The maximum drawdown distance, the furthest distance where significant drawdown is still observed, was inconclusive as AMW-9 36 feet away had no measured drawdown, but relatively significant drawdown was observed at both A-19 and A-11, each approximately 40 feet from the test well. The maximum drawdown distance falls somewhere between 36 feet and 39 feet.

Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum ROI determined at the end of the Step #3 (i.e. 420 min), was of 38 feet. The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Refer to Appendix H.

2.7.2.4 **Recovery Step**

During the last 2 hours of the VEGE Constant Rate Test, the blower and the pump were shut off and the groundwater was able to recharge the well. The surrounding monitoring points/wells were gauged for depth to LNAPL/water approximately every 30 minutes while the Test Well, A-16, was gauged every five minutes for 30 minutes. Refer to Appendix H.

The 5.16 feet of LNAPL detected during the baseline readings decreased to zero feet detected following the end of the last VEGE Constant Rate Test. The groundwater level decreased from a corrected value of 9.93 feet below the top of casing to 14.11 feet below the top of casing, a decrease of 4.18 ft between the start and end of the VEGE Constant Rate Tests. Refer to Appendix H.

2.7.2.5 **Laboratory Data Evaluation**

During the test on A-16 samples were collected on the influent vapor and groundwater at the 390 and 360 minute time interval of the test, respectively. The samples were collected in a 6 liter summa canister and standard preserved VOA's, respectively as grab samples. Samples were submitted to Pace analytical of Schenectady, NY for analysis of total VOC's. Data from these samples was analyzed and used in order to determine the mass removal rate for the well for design considerations. The total calculated mass removal rate based on the analytical data and measured air and water flow rates for A-16 during step # 3 was approximately 16.868 lbs/hr (0.0874 lbs vapor phase, 0.0427 lbs based on dissolved phased concentrations, and 16.74 lbs from measured LNAPL). This result is only representative of the short term test. Further consideration and analysis to these data should be given

prior to use in any design for a long term remedial solution. Refer to Appendix H for calculations and Appendix G for laboratory reports.

2.7.3 S-3 Pilot Test Results

2.7.3.1 Baseline Data

Baseline groundwater measurements and soil vapor samples were collected on June 25, 2014, prior to commencing the VEGE Pilot Step Test on S-3. The baseline data indicated the following:

- Depth to bottom of the well was measured to be 20.0 feet;
- LNAPL was detected with a thickness of 1.14 feet;
- Corrected Depth to Water was calculated to be 7.67 feet;
- DTW was 8.56 feet below the top of the well casing ;
- LNAPL was detected in three of the monitoring points/wells MW-B at 0.03 feet thick, S-2 at 0.49 feet thick, and S-6 at 0.03 feet thick; and,
- DTW in the wells monitored as indicated in Appendix A ranged from 6.75 feet to 12.22 feet below top of well casing.

2.7.3.2 Zero Vacuum Test

The pilot testing commenced on June 25, 2014 with a VEGE set up. The top loading pump was set approximately six inches above the bottom of the well. With this set up, drawdown remained constant at the top of the pump, approximately three feet off of the bottom of the well, at 9.30 feet below the corrected water table. While maintaining this specified drawdown, the blower was turned on and a zero vacuum test was run for one hour. A total of 5 gallons of groundwater were collected during the duration of the Zero Vacuum Test which pumped at a rate of 0.08 gallons per minute (gpm). Approximately 3 gallons of LNAPL were recovered during this step. Gauging was performed every 30 minutes for one hour and groundwater drawdown was observed in MW-1 from initial baseline readings. Throughout the duration of the pilot test, there was steady rain with periods of heavy precipitation, particularly around 120 min to 150 min and 230 min to 400 min. Under these conditions, the well vaults filled with runoff water from the streets and had to be continuously bailed out. For this reason, some of the depth to LNAPL/depth to water measurements may have been affected.

As soon as the Zero Vacuum Test was completed, the vacuum was applied to the well head for the Step Test. Velocity of the VEGE air flow was measured as the vacuum was turned on. Once the velocity stabilized, the vacuum was increased and the process was repeated until a maximum vacuum was established. These results were utilized by the pilot test operator in order to select constant rate vacuums for the test. Based on these results, the three vacuums selected to run the VEGE Constant Rate Tests were 5 “Hg, 8 “Hg, and 13 “Hg. The applied vacuum, soil vapor temperature, and differential pressure were measured after each sequential adjustment, were used to calculate the soil vapor recovery rate.

2.7.3.3 VEGE Constant Rate Step Tests

The three Constant Rate Tests were conducted on S-3 on June 25, 2014 with the top loading pneumatic pump set approximately six inches above the bottom of the well. The applied vacuums were run at the applied vacuums of approximately 5 “Hg, 8 “Hg, and 13 “Hg. The results are as follows:

Step #1
The first VEGE Constant Rate Step Test (Step #1) was conducted for 120 minutes (min), while an applied vacuum of approximate 5 “Hg was applied to the wellhead. The VOC concentration measured at the beginning of the Constant Rate Test was 577 ppmv and decreased to 446 ppmv at the end of the 120 min and the average soil vapor flow rate was 20.58 scfm. Refer to Appendix I. The O_2 and LEL level remained constant at ~16.5% and ~55, respectively, and CO_2 concentrations remained consistently around 40 ppmv. A total of 199 gallons of groundwater were recovered during Step #1, and the average recovery rate was approximately 1.66 gpm. Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. A total of 1.7 gallons of LNAPL was collected during this step.

Three of the six monitoring points/wells had measurable vacuums during Step #1. S-7 showed a vacuum influence of –1.26 “H_2O at approximately 40 feet away, MW-B showed a vacuum influence of -3.27 at 3.5 feet away, and S-6 showed a vacuum influence of -0.10 at approximately 61 feet away. An increase in groundwater drawdown was seen in three of the wells B-16, MW-B, and MW-A. A decrease in groundwater drawdown was seen in three of the wells, S-7, S-2, and S-6. The maximum drawdown distance, the furthest distance where significant drawdown is still observed, was 24 feet away from S-3.

Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum radius of influence (ROI) was determined at the end of the Step #1 (i.e. 120 min), which resulted in a ROI approximately 18 feet. The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Refer to Appendix I.

Step #2
The second VEGE Constant Rate Step Test (Step #2) was conducted for 120 min; while an applied vacuum of approximate 8 “Hg was applied to wellhead and less than 3 “H_2O on the interstitial space of S-3.

The initial extracted vapors contained VOC concentrations of approximately 521 ppmv decreased during the test to 481 ppmv and the average soil vapor flow rate was 28.38 scfm. VOC concentrations increased between Step #1 and Step #2 rising from 446 ppmv to 521 ppmv. Refer to Appendix I. The O_2 level remained constant at approximately19% and the LEL level ranged from 81% to 97%. CO_2 concentrations increased from 58 ppmv to 64 ppmv. A total of 202 gallons of groundwater were recovered during Step #2, and the average recovery rate was approximately 1.68 gpm. Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. An additional 1.6 gallons of LNAPL were recovered during this step.

Four of the six monitoring points/wells had measurable vacuums. S-7 showed a vacuum influence of –1.66 “H2O at approximately 45 feet away, MW-B showed a vacuum influence of -5.18 at 3.5 feet away, MW-A showed a vacuum influence of -0.07 at approximately 47 feet away, and S-6 showed a vacuum influence of -0.06 “H_2O at approximately 61 feet away. An increase in groundwater drawdown was seen in two of the wells B-16, and MW-B. A decrease in groundwater drawdown was seen in four of the wells, S-7, S-2, MW-A and S-6. The maximum drawdown distance, the furthest distance where significant drawdown is still observed, was 24 feet away from S-3.

Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum ROI determined at the end of the Step #2 (i.e. 300 min), was

approximately 24 feet. The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Refer to Appendix I.

Step #3
The third VEGE Constant Rate Step Test (Step #2) was conducted for 120 min; while an applied vacuum of approximate 13 “Hg was applied to the wellhead and less than 5 “H2O on the interstitial space of S-3.

The initial extracted vapors contained VOC concentrations of approximately 501 ppmv decreased during the test to 481 ppmv. The soil vapor extraction rate averaged 29.97 scfm during Step #3. Refer to Appendix I. The O_2 level remained constant at approximately 18.1% and the LEL level was consistently above the meter reading >99%. CO_2 concentrations were above the meter readings at >500 ppmv. A total of 316 gallons of groundwater were recovered during Step #3, and the average recovery rate was approximately 2.63 gpm. Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. An additional 4 gallons of LNAPL were recovered during this step.

The initial VOC concentrations in the extracted vapors increased compared to the final reading of Step #2, from 481 to 501 ppmv. During Step #3, VOC concentrations decreased slightly from 501 ppmv to 481 ppmv. Refer to Appendix I.

Three of the six monitoring points/wells had measurable vacuums. S-7 showed a vacuum influence of –0.82 “H_2O at approximately 45 feet away, MW-B showed a vacuum influence of -7.35 at 3.5 feet away, and MW-A showed a vacuum influence of -0.06 at approximately 47 feet away. An increase in groundwater drawdown was seen in three of the wells S-7, B-16, and MW-B. A decrease in groundwater drawdown was seen in four of the wells, S-2, MW-A and S-6. The maximum drawdown distance, the furthest distance where significant drawdown is still observed, was 24 feet away from S-3.

Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum ROI determined at the end of the Step #3 (i.e. 420 min), was approximately 32 feet. The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Refer to Appendix I.

2.7.3.4 **Recovery Step**

During the last 2 hours of the VEGE Constant Rate Test, the blower and the pump were shut off and the groundwater was able to recharge the well. The surrounding monitoring points/wells were gauged for depth to LNAPL/water approximately every 10 minutes for an hour while the Test Well, S-3, was gauged every 5 minutes for an hour. Refer to Appendix I for S-3 Drawdown vs. Time for gauging and recovery data.

The 1.14 feet of LNAPL detected during the baseline readings decreased to zero feet detected following the end of the lastVEGE Constant Rate Test. The groundwater level decreased from a corrected depth of 7.67 feet below the top of casing to 14.85 feet below the top of casing, a depression of 7.18 feet, between the start and end of the VEGE Constant Rate Tests. Refer to Appendix I.

2.7.3.5 Laboratory Data Evaluation

During the test on S-3 samples were collected on the influent vapor and groundwater at the 390 and 360 minute time interval of the test, respectively. The samples were collected in a 6 liter summa canister and standard preserved VOA's, respectively as grab samples. Samples were submitted to Pace analytical of Schenectady, NY for analysis of total VOC's. Data from these samples was analyzed and used in order to determine the mass removal rate for the well for design considerations. The total calculated mass removal rate based on the analytical data and measured air and water flow rates for S-3 during step # 3 was approximately 11.516 lbs/hr (0.0946 lbs from vapor phase, 0.0376 lbs based on dissolved phased concentrations, and 11.38 lbs from measured LNAPL). This result is only representative of the short term test. Further consideration and analysis to these data should be given prior to use in any design for a long term remedial solution. Refer to Appendix I for calculations and Appendix G for laboratory reports.

2.7.4 S-15 Pilot Test Results

2.7.4.1 Baseline Data

Baseline groundwater measurements and soil vapor samples were collected on June 26, 2014, prior to commencing the VEGE Pilot Step Test on S-15. The baseline data indicated the following:

- Depth to the bottom of the well was measured to be 19.0 feet;
- LNAPL was not detected;
- DTW was 5.15 feet below the top of the well casing;
- LNAPL was detected in three of the monitoring points/wells MW-7 at 0.09 feet thick, S-16 at 3.44 feet thick, and S-25 at 3.00 feet; and,
- DTW in the wells monitored as indicated in Appendix A ranged from 2.46 feet to 7.97 feet below top of well casing.

2.7.4.2 Zero Vacuum Test

The pilot testing commenced on June 26, 2014 with a VEGE set up. The top loading pump was set approximately six inches above the bottom of the well. With this set up, drawdown remained constant at the top of the pump, approximately three feet off of the bottom of the well, at 10.85 feet below the water table. While maintaining this specified drawdown, the blower was turned on and a zero vacuum test was run for one hour. A total of 38 gallons of groundwater were collected during the duration of the Zero Vacuum Test which pumped at a rate of 0.63 gallons per minute (gpm). Gauging was performed every 30 minutes and groundwater drawdown was observed in S-25, S-20, and MW-7 from initial baseline readings.

As soon as the Zero Vacuum Test was completed, the vacuum was applied to the well head for the Step Test. Velocity of the VEGE air flow was measured as the vacuum was turned on. Once the velocity stabilized, the vacuum was increased and the process was repeated until a maximum vacuum was established. These results were utilized by the pilot test operator in order to select constant rate vacuums for the test.

Based on these results, the three vacuums selected to run the VEGE Constant Rate Tests were 5 "Hg, 8 "Hg, and 13 "Hg. The applied vacuum, soil vapor temperature, and differential pressure were measured after each sequential adjustment, were used to calculate the soil vapor recovery rate.

2.7.4.3 VEGE Constant Rate Step Tests

The three Constant Rate Tests were conducted on S-15 on June 26, 2014 with the top loading pneumatic pump set approximately six inches above the bottom of the well. The applied vacuums were run at the applied vacuums of approximately 5 “Hg, 8 “Hg, and 13 “Hg. The results are as follows:

Step #1
The first VEGE Constant Rate Step Test (Step #1) was conducted for 120 minutes (min), while an applied vacuum of approximate 5 “Hg was applied to the wellhead. The VOC concentration measured at the beginning of the Constant Rate Test was 55 ppmv and decreased to 44 ppmv at the end of the 120 min and the average soil vapor flow rate was 21.53 scfm. Refer to Appendix J. The O_2 and LEL level remained constant at approximately 20.9% and approximately 5.0%, respectively, and CO_2 concentrations remained consistently at 0 ppmv. A total of 100 gallons of groundwater were recovered during Step #1, and the average recovery rate was approximately 0.83 gpm. Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. No measurable amount of LNAPL was recovered during this step.

Two of the 4 monitoring points/wells had measurable vacuums, during Step #1. S-20 showed a vacuum influence of 0.50 “H_2O at approximately 20 feet away, however the positive pressure reading could be attributed to the water table covering the entire length of the well screen. MW-7 showed a vacuum influence of -0.12 “H_2O at approximately 15 feet away. An increase in groundwater drawdown was seen in all four of the wells S-16, S-25, S-20 and MW-7. The maximum drawdown distance, the furthest distance where significant drawdown is still observed, was 50 feet away from S-15.

Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum radius of influence (ROI) was determined at the end of the Step #1 (i.e. 120 min), which resulted in a ROI approximately 23 feet. The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Refer to Appendix J.

Step #2
The second VEGE Constant Rate Step Test (Step #2) was conducted for 120 min; while an applied vacuum of approximate 8 “Hg was applied to wellhead and less than 3 “H2O on the interstitial space of S-15.

The initial extracted vapors contained VOC concentrations of approximately 38 ppmv and stayed constant over the three readings. The soil vapor extraction rate averaged 34.69 scfm during Step #2. Refer to Appendix J. The O_2 level remained constant at approximately 20.8% and the LEL was consistently 0%. The CO_2 concentrations ranged from 39 ppmv to 101 ppmv. A total of 113 gallons of groundwater were recovered during Step #2, and the average recovery rate was approximately 0.94 gpm. Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. The first measurable amount of product was detected at the end of this step. From the beginning of the test, a total of approximately 1.7 gallons of LNAPL were recovered.

The initial VOC concentrations in the extracted vapors decreased compared to the final reading of Step #1, from 44 to 38 ppmv. Throughout the duration of Step #2 VOC concentrations stayed consistent at 38 ppmv. Refer to Appendix J.

Two of the four monitoring points/wells had measurable vacuums during Step #2. S-20 showed a vacuum influence of 0.53 "H_2O at approximately 20 feet away, however the positive pressure reading could be attributed to the water table covering the entire length of the well screen. MW-7 showed a vacuum influence of -0.07 "H_2O at approximately 15 feet away. An increase in groundwater drawdown was seen in three of the wells S-16, S-20 and MW-7. The well S-25 did not show a change in groundwater drawdown. The maximum drawdown distance, the furthest distance where significant drawdown is still observed, was up to 50 feet away from S-15.

Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum ROI determined at the end of the Step #2 (i.e. 300 min), was approximately 18 feet. The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Refer to Appendix J.

Step #3
The third VEGE Constant Rate Step Test (Step #3) was conducted for 120 min; while an applied vacuum of approximate 13 "Hg was applied to the wellhead and less than 5 "H2O on the interstitial space of S-15.

The initial extracted vapors contained VOC concentrations of approximately 45 ppmv decreased during the test to 41 ppmv. The soil vapor extraction rate averaged 36.47 scfm during Step #3. Refer to Appendix J. The O_2 level remained constant at approximately 20.9% and the LEL level was consistently at 0%. CO_2 concentrations were ranged between 32 ppmv and 110 ppmv. A total of 117 gallons of groundwater were recovered during Step #3, and the average recovery rate was approximately 1.27 gpm. Recovered groundwater was pumped to a 5,000 gallon storage tank on site for disposal after completion of the test. One gallon of LNAPL was recovered during this step.

The initial VOC concentrations in the extracted vapors increased compared to the final reading of Step #2, from 38 to 45 ppmv. During Step #3, VOC concentrations decreased slightly from 45 ppmv to 41 ppmv. Refer to Appendix J.

Two of the six monitoring points/wells had measurable vacuums. S-20 showed a vacuum influence of 0.73 "H2O at approximately 21 feet away, however the positive pressure reading could be attributed to the water table covering the entire length of the well screen. MW-7 showed a vacuum influence of -0.16 "H2O at 15 feet away. An increase in groundwater drawdown was seen in three of the wells S-7, B-16, and MW-B. A decrease in groundwater drawdown was seen in three of the wells, S-16, S-20, and MW-7. The maximum drawdown distance, the furthest distance where significant drawdown is still observed, was up to 50 feet away from S-15.

Based on the applied vacuum on the interstitial space of the Test Well and the measured vacuums in the monitoring points/wells, the vacuum ROI determined at the end of the Step #2 (i.e. 420 min), was approximately 22 feet. The ROI was calculated by plotting the normalized vacuums versus distance from the Test Well on a semi-logarithmic graph. The ROI was determined to be the distance where 1% of the normalized vacuum was observed. Refer to Appendix J.

2.7.4.4 **Recovery Step**

During the last 2 hours of the VEGE Constant Rate Test, the blower and the pump were shut off and the groundwater was able to recharge the well. The surrounding monitoring points/wells were gauged

for depth to LNAPL/water approximately every 15 minutes for an hour while the Test Well, S-15, was gauged every five minutes for an hour. Refer to Appendix J.

The groundwater level decreased from 5.15 feet below the top of casing to 12.41 feet below the top of casing, a depression of 7.26 feet, between the start and end of the VEGE Constant Rate Tests. Refer to Appendix J.

2.7.4.5 **Laboratory Data Evaluation**

During the test on S-15 samples were collected on the influent vapor and groundwater at the 390 and 360 minute time interval of the test, respectively. The samples were collected in a 6 liter summa canister and standard preserved VOA's, respectively as grab samples. Samples were submitted to Pace analytical of Schenectady, NY for analysis of total VOC's. Data from these samples was analyzed and used in order to determine the mass removal rate for the well for design considerations. The total calculated mass removal rate based on the analytical data and measured air and water flow rates for S-15 during step # 3 was approximately 2.448 lbs/hr (0.0039 lbs from vapor phase, 0.0067 lbs based on dissolved phased concentrations, and 2.44 lbs from measured LNAPL). This result is only representative of the short term test. Further consideration and analysis to these data should be given prior to use in any design for a long term remedial solution. Refer to Appendix J for calculations and Appendix G for laboratory reports.

2.8 Summary of Pilot Testing Results

The following table summarizes the findings of the MPE and VEGE pilot testing.

Well	Draw down (ft)	Vac Step ("Hg)	Flow Rate (gpm)	Max Drawdown Distance (ft)	Flow Rate (SCFM)	SVE ROI (ft)	Mass Removal Rate (lb/hour)			
							Water	Vapor	LNAPL	Total
S-5	~4	0	0.4	IC (less than 32')	NA	NA	0.0002	0.0404	NM	0.041
		5	0.5	IC (less than 32')	30	IC			NM	
		8	0.7	IC (less than 32')	32	IC			NM	
		13	0.7	IC (less than 32')	33	IC			NM	
A-16	~6	0	0.8	IC (between 36' and 39')	NA	NA	0.0427	0.0874	16.26	16.868
		5	1.2	IC (between 36' and 39')	30	Less than 34'				
		8	3.5	IC (between 36' and 39')	26	Less than 35'			18.79	
		13	3.8	IC (between 36' and 39')	29	Less than 38'			15.17	
S-3	~9	0	0.1	24'	NA	NA	0.0376	0.0946	21.68	11.516
		5	1.7	24'	21	18			5.44	
		8	1.7	24'	28	24			5.40	
		13	2.6	24'	30	32			13.02	
S-15	~11	0	0.6	50'	NA	NA	0.0067	0.0039	2.17	2.448
		5	0.8	50'	22	23				
		8	0.9	50'	35	18				
		13	1.3	50'	36	22			2.70	

Notes:

Well - Identification of the selected pilot testing well

Drawdown - drawdown maintained at the test well throughout the test in ft (based on corrected water table elevation and set depth of pump/drop tube)

Vac Step - test step in "Hg

Flow Rate (gpm) - average water flow rate measured during the specified step in gallons per minute

Max Drawdown Distance – the furthest observed point where significant drawdown was achieved during the test in feet from the extraction well

Flow Rate (SCFM) - average air flow rate measured during the specified step in standard cubic feet per minute)

SVE ROI – Range of SVE radius of influence calculated based on where 1% of the normalized vacuum was observed by graphing the specified step in feet. Indicated as a range to account for directional anomalies observed in the test data.

Mass Removal - Estimated in lb/hr based on lab data for water and vapor, and thickness measurements for LNAPL.

IC - Data is considered inconclusive based on inconsistent results that cannot be quantified.

Drawdown was achieved within the recovery wells to the level required, water flow rates increased with increasing vacuum application and drawdown was observed at various distances from the recovery wells.

There were several data points that were unexpected during testing. Positive readings for drawdown occurred at some points that are expected to be outside of the wells zone of influence. These data points were considered for their value and included in the analysis as points that were not likely influenced during the testing. Similar data points were observed with the SVE testing (positive pressures) and were considered/included in the analysis as points not likely to be in the ROI for the testing well. In several instances vacuum influence and drawdown were achieved at distance in one direction, but not seen at the same distanced in another direction. This is primarily due to the documented heterogeneity of the sites subsurface and the inefficiency of wells utilized during testing because of their overall age and potential degree of fouling.

In addition, primarily during the testing on S-5 it was concluded that the majority of the testing points were greater than 30' from the test well and therefore for the most part were not valuable in determining drawdown vs distance or ROI for SVE. These results were deemed inconclusive.

3.0 Conclusions

3.1 Summary of the LNAPL CSM

- The surficial geology of the Site is characterized by a fining upward sequence sand from approximately 25 to 15 feet bgs, which transitions to a silt/fill layer from 15 feet bgs to the ground surface. The entire sequence is vertically and laterally heterogeneous in grain size and hydraulic properties. LNAPL is present in both the shallow silt and deeper fine sand zones.
- The water table is encountered between 8 to 10 feet bgs and can fluctuate at the Site (+/- 2 feet over several weeks). This fluctuation has resulted in smearing of the LNAPL over a formational thickness of 10 to 15 feet in several locations. The LNAPL smear zone extends across the interface between silt and the underlying fine sand, into both the saturated and unsaturated zones. Smearing results in the transfer of LNAPL from the mobile to residual phase.
- The measured transmissivity of LNAPL, based on 21 measurements, are predominantly below Interstate Technology & Regulatory Council (ITRC) recommended standards for viable recovery. The average (geometric mean) of LNAPL transmissivity was 0.016 ft^2/d, which is significantly below the ITRC practical recovery limit range of 0.1 to 0.8 ft^2/d. Only three wells exceeded a value of 0.1 ft^2/d, and none exceeded a value of 0.8 ft^2/d, even assuming a 75 percent variability in transmissivity measurements.
- The horizontal extent of LNAPL has been demonstrated to be stable (i.e., not expanding aerially) based on approximately 10 years of historic fluid gauging data. Capillary pressure testing has shown that high (greater than 2.5 feet) of LNAPL thickness (head) is required to initiate migration in sandier soils. Up to 10 feet of LNAPL (thickness (head) is required to initiate migration in the silt layers. The stability of the LNAPL is due to the fine-grained nature of the soils at the Site and the fact that any local migration (e.g. where LNAPL thickness exceeds 2.5 ft) is potentially offset by natural degradation of the LNAPL at its leading edge.
- The majority of LNAPL at the Site is present at residual saturation, based on laboratory testing and confirmed with pilot and bail down testing. Therefore, active LNAPL recovery efforts will yield minimal liquid volume. This was observed during pilot testing.

3.2 Remedial Option Evaluation

Based on pilot testing results and past experience with similar sites it has been determined that Vacuum Enhanced Groundwater Extraction (VEGE) is a potentially applicable remedy to recover LNAPL from selected areas of the Site. This involves lowering the water table via pneumatic pumps in recovery wells in order to expose smear zone soils to air flow, and then removing hydrocarbon mass via a soil vapor extraction system. The following design criteria and limitations should be considered:

- The heterogeneity of site soils produces some unexpected variability and thus inconsistency within the data set. In many cases vacuum influence and drawdown were inconsistent with distance (i.e. 30 feet plus in one direction from the extraction well, and not achieved at 20 feet in another direction). This inconsistency can be attributed to the heterogeneity of subsurface

soils in many cases, but also to the fact that the wells used for testing and monitoring were not new and may have (in some cases) lacked seal integrity between their well screens and the surface, affecting their ability to propagate vacuum through the subsurface.

- Due to the inconsistency of testing results and the noted heterogeneity of the subsurface it is necessary to consider Zone of Influence (ZOI) rather than Radius of Influence (ROI) for well spacing in a full scale system design. Since the ZOI cannot be directly determined through interpretation of the data, it will be necessary to estimate well spacing through available ROI methods. The heterogeneity of the soils leads to variability with regards to well construction, ZOI, applied vacuum and flow rates for both fluids and vapors. This variability makes design, installation, and operation of an MPE (removing all hydrocarbons via high vacuum alone) system challenging. . For this reason VEGE is likely a more applicable technology. However, as noted, well depths and ZOI will still vary.
- Test data indicated relatively high concentrations of oxygen in extracted vapor and correspondingly lower concentrations of VOC's then would be expected typically with a LNAPL remediation site. This may be indicative of short circuiting and the recovery of vapors from areas not sealed within the sites' subsurface. The short circuiting noted could be the result of some higher permeability lenses within the sites subsurface that are not in contact with LNAPL, or in some cases wells used may have had improper or deteriorated well seals. It possible that this condition would be improved with new wells that are installed specifically for VEGE or modifications to existing wells to improve well seals and thus communication with the subsurface.
- The majority of the hydrocarbon mass that is removed will be extracted as a vapor phase during application of VEGE. In addition, minimal drawdown of the water table was observed during pilot testing. Therefore, the success of VEGE will place a reliance on a lowered water table, thus exposing saturated LNAPL zones to air flow. This decrease will be achieved during long term application of VEGE (drying out of the soil pores) – a situation that was not observed during the short term pilot testing.
- A final design for site use of VEGE should consider the attainability of remedial objectives, the LNAPL. Conceptual Site Model (CSM), and the site-specific geography in the areas where remediation is necessary. The system operational parameters and wells spacing will be defined based on this evaluation and the presented pilot test data. It must however be recognized that soil heterogeneity and the predominance of fine-grained material in the upper surface soils make meeting remedial goals across the entire site challenging. For this reason the application of VEGE should be focused on specific areas where it can be most successful and where LNAPL is most prevalent in recoverable form.

4.0 References

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Tables

Table 2-1
Maximum UVOST® Response Summary
Cold Springs Terminals
Lysander, New York

Boring	Maximum Response %RE	Depth of Maximum Response ft bgs
UV-01	14.1	13.23
UV-02	34.2	3.02
UV-03	48.1	10.12
UV-04	16.8	14.01
UV-05	10.0	3.05
UV-06	8.3	13.12
UV-07	1.7	7.54
UV-08	7.2	4.41
UV-09	4.6	15.02
UV-10	9.6	15.64
UV-11	6.0	16.90
UV-12	6.3	16.72
UV-13	4.9	0.25
UV-14	8.5	0.09
UV-15	52.8	11.39
UV-16	12.6	8.44
UV-17	14.0	12.91
UV-18	6.3	12.12
UV-19	2.8	0.73
UV-20	11.2	12.01
UV-21	4.4	15.81
UV-22	2.6	2.85
UV-23	1.2	3.10
UV-24	6.8	14.32
UV-25	1.4	0.15
UV-26	21.4	8.26
UV-27	13.5	8.10
UV-27D	21.2	3.02
UV-28	22.9	9.71
UV-29	34.4	4.72
UV-30	10.2	0.00
UV-30B	5.1	0.72
UV-31	5.0	5.17
UV-32	3.1	0.00
UV-33	14.4	0.00

Notes:
%RE - percent of reference emitter
ft bgs - feet below ground surface

Table 2-2
Soil Total Petroleum Hydrocarbon Data and UVOST® Reading
Cold Springs Terminals
Lysander, New York

Core	Sample Depth Interval[1] ft	Sample Elevation Midpoint ft AMSL	Total Petroleum Hydrocarbons GRO µg/g	Total Petroleum Hydrocarbons DRO µg/g	Estimated Saturation[2] %Pv	UVOST® Reading[3] %RE
SC-01	1-2	372.64	30.5	1,730	0.76%	2.2%
SC-01	4-5	369.64	59	1,480	0.66%	14.5%
SC-01	5-6	368.64	35.4	352	0.17%	4.9%
SC-01	8.5-9.5	365.14	2,980	2,930	2.54%	14.6%
SC-01	13.5-14	360.39	10.4	21.1	0.01%	0.5%
SC-06	9-10	368.97	1,580	2,650	1.82%	0.4%
SC-06	10-11	367.97	1,990	3,180	2.22%	2.3%
SC-06	12.5-13.5	365.47	1,350	1,590	1.26%	1.5%
SC-06	13.5-14.5	364.47	134	125	0.11%	2.2%

Notes:
[1] Sample depth is equivalent to feet below ground surface
[2] Estimated saturation calculated based on USEPA (1996).
[3] Value is average %RE over sampling interval of corresponding UVOST® boring. respectively
UVOST borings UV-15 and UV-20 were compared to SC-01 and SC-06,
GRO - gasoline range organics
DRO - diesel range organics
ft AMSL - feet above mean sea level
µg/g - micrograms per gram
% PV - percent of pore volume

Table 2-3
Grain Size Analysis Data Summary
Cold Springs Terminals
Lysander, New York

Core	Sample Depth[1]	Sample Elevation	Mean Grain Size	Median Grain Size	Particle Size Distribution (% weight)						
						Sand Size					Silt &
	ft	ft AMSL	Description	mm	Gravel	Coarse	Medium	Fine	Silt	Clay	Clay
SC-01	2.7	371.44	Silt	0.047	0.00	0.00	3.54	35.49	46.64	14.33	60.97
SC-01	2.8	371.34	Fine sand	0.055	0.00	0.00	5.00	38.56	44.79	11.64	56.44
SC-01	3.3	370.84	Silt	0.038	0.00	0.00	2.43	30.70	51.39	15.48	66.87
SC-01	3.6	370.54	Silt	0.045	0.00	0.00	4.54	33.50	47.78	14.18	61.96
SC-01	5.3	368.84	Silt	0.004	0.00	0.00	0.00	0.01	43.35	56.64	99.99
SC-01	7.05	367.09	Silt	0.006	0.00	0.00	0.00	2.90	53.92	43.18	97.10
SC-01	7.8	366.34	Silt	0.026	0.00	0.00	0.00	2.83	81.88	15.28	97.17
SC-01	8.25	365.89	Silt	0.020	0.00	0.00	0.00	0.83	84.85	14.32	99.17
SC-01	8.63	365.51	Silt	0.029	0.00	0.00	0.00	9.35	79.54	11.11	90.65
SC-01	9.85	364.29	Silt	0.042	0.00	0.00	0.00	18.97	74.63	6.39	81.03
SC-01	10.35	363.79	Silt	0.046	0.00	0.00	0.00	20.08	74.40	5.52	79.92
SC-01	11.35	362.79	Silt	0.045	0.00	0.00	0.00	21.00	73.32	5.68	79.00
SC-01	11.85	362.29	Silt	0.055	0.00	0.00	0.00	29.61	65.80	4.59	70.39
SC-01	12.8	361.34	Silt	0.037	0.00	0.00	0.00	12.75	79.65	7.60	87.25
SC-03	3.75	369.30	Silt	0.034	0.00	0.00	1.80	26.19	59.51	12.51	72.02
SC-03	4.15	368.90	Silt	0.044	0.00	0.00	2.71	29.79	54.99	12.51	67.50
SC-03	5.3	367.75	Silt	0.024	0.00	0.00	0.58	16.23	68.58	14.61	83.19
SC-03	6.05	367.00	Silt	0.046	0.00	0.00	1.19	29.57	57.83	11.41	69.24
SC-03	6.93	366.12	Silt	0.022	0.00	0.00	0.00	11.02	74.36	14.62	88.98
SC-03	9.95	363.10	Silt	0.042	0.00	0.00	0.00	18.48	76.29	5.22	81.52
SC-03	11.75	361.30	Silt	0.055	0.00	0.00	0.00	29.35	66.59	4.06	70.65
SC-03	12.5	360.55	Silt	0.051	0.00	0.00	0.00	24.58	71.01	4.41	75.42
SC-03	14.5	358.55	Silt	0.026	0.00	0.00	0.00	1.67	86.10	12.23	98.33
SC-05	2.5	374.77	Silt	0.037	0.00	0.00	0.00	15.87	78.07	6.07	84.13
SC-05	2.95	374.32	Silt	0.038	0.00	0.00	0.00	14.33	78.93	6.74	85.67
SC-05	6.5	370.77	Silt	0.051	0.00	0.00	0.00	26.10	68.68	5.23	73.90
SC-05	8.15	369.12	Silt	0.055	0.00	0.00	0.00	28.99	67.32	3.69	71.01
SC-05	8.65	368.62	Silt	0.040	0.00	0.00	0.00	14.23	80.39	5.38	85.77
SC-05	9	368.27	Silt	0.058	0.00	0.00	0.00	32.89	63.84	3.27	67.11
SC-05	9.4	367.87	Silt	0.049	0.00	0.00	0.00	22.68	72.48	4.83	77.32
SC-05	10.65	366.62	Silt	0.042	0.00	0.00	0.00	15.10	78.45	6.46	84.90
SC-05	10.9	366.37	Silt	0.039	0.00	0.00	0.00	10.01	83.57	6.42	89.99
SC-05	11.3	365.97	Silt	0.066	0.00	0.00	0.00	40.04	57.19	2.77	59.96
SC-05	12.1	365.17	Silt	0.046	0.00	0.00	0.00	18.50	76.98	4.52	81.50
SC-05	12.35	364.92	Silt	0.061	0.00	0.00	0.00	36.97	59.65	3.38	63.03
SC-05	13.5	363.77	Silt	0.063	0.00	0.00	0.00	41.30	55.37	3.33	58.70
SC-05	13.8	363.47	Fine sand	0.112	0.00	0.00	0.00	77.02	21.22	1.77	22.98
SC-05	14.1	363.17	Silt	0.070	0.00	0.00	0.00	45.99	51.42	2.60	54.01
SC-05	14.3	362.97	Fine sand	0.080	0.00	0.00	0.00	55.98	41.58	2.44	44.02
SC-05	15.3	361.97	Fine sand	0.088	0.00	0.00	0.00	63.14	34.23	2.64	36.86
SC-05	16.1	361.17	Silt	0.053	0.00	0.00	0.00	29.67	65.10	5.23	70.33
SC-05	16.9	360.37	Fine sand	0.098	0.00	0.00	0.00	70.62	27.67	1.71	29.38
SC-05	17.9	359.37	Silt	0.062	0.00	0.00	0.00	38.55	57.86	3.59	61.45
SC-05	19.45	357.82	Fine sand	0.127	0.00	0.00	25.35	53.22	19.51	1.91	21.42
SC-05	21.1	356.17	Medium sand	0.519	0.00	0.00	58.13	28.41	10.57	2.89	13.46
SC-06	9.5	368.97	Silt	0.040	0.00	0.00	0.00	13.43	80.66	5.91	86.57
SC-06	10.15	368.32	Silt	0.038	0.00	0.00	0.00	8.93	84.60	6.48	91.07
SC-06	11.4	367.07	Fine sand	0.061	0.00	0.00	22.59	21.57	44.50	11.33	55.84
SC-06	11.6	366.87	Silt	0.051	0.00	0.00	0.00	24.54	71.44	4.03	75.46
SC-06	12.15	366.32	Silt	0.045	0.00	0.00	0.00	19.53	75.37	5.10	80.47
SC-06	15.1	363.37	Silt	0.056	0.00	0.00	0.00	31.77	64.43	3.80	68.23
SC-07	13.8	367.96	Silt	0.047	0.00	0.00	0.00	21.72	72.22	6.06	78.28
SC-07	14.5	367.26	Silt	0.060	0.00	0.00	0.00	34.47	62.03	3.49	65.53
SC-07	15.05	366.71	Silt	0.053	0.00	0.00	0.00	27.55	67.10	5.35	72.45
SC-07	15.45	366.31	Silt	0.025	0.00	0.00	0.00	7.38	81.94	10.68	92.62
SC-07	15.9	365.86	Fine sand	0.105	0.00	0.00	0.00	62.65	34.59	2.77	37.35
SC-07	16.2	365.56	Fine sand	0.104	0.00	0.00	0.00	75.02	23.17	1.81	24.98
SC-07	16.4	365.36	Fine sand	0.074	0.00	0.00	0.00	49.77	47.47	2.76	50.23
SC-07	17.25	364.51	Silt	0.056	0.00	0.00	0.00	33.54	61.61	4.86	66.46
SC-07	18.5	363.26	Silt	0.069	0.00	0.00	0.00	45.11	52.16	2.73	54.89

Notes:

1. Sample depth is equivalent to feet below ground surface

mm - millimeters

% weight - percent by weight

ft AMSL - feet above mean sea level

Table 2-4
Pore Fluid Saturation Data
Cold Springs Terminals
Lysander, New York

Core	Sample Depth[1] ft	Sample Elevation ft AMSL	Sample Orientation[2]	Moisture Content %w	Density		Porosity[3]		Pore Fluid Saturation[4]	
					Bulk g/cc	Grain g/cc	Total %Vb	Air Filled %Vb	Water %Pv	LNAPL %Pv
SC-01	2.7	371.44	H	14.2	1.72	2.64	34.7	9.3	55.9	17.3
SC-01	3.3	370.84	V	20.0	1.47	2.66	44.7	15.0	58.6	7.9
SC-01	3.6	370.54	V	18.8	1.51	2.67	43.5	14.9	58.4	7.3
SC-01	8.63	365.51	H	21.2	1.57	2.69	41.6	7.9	76.1	4.8
SC-01	9.85	364.29	H	24.4	1.49	2.69	44.7	9.0	70.8	9.1
SC-03	3.75	369.30	H	22.4	1.34	2.62	48.9	18.7	58.1	3.8
SC-03	4.15	368.90	H	16.9	1.65	2.66	38.1	9.9	68.4	5.7
SC-03	6.93	366.12	H	17.5	1.54	2.67	42.3	15.2	61.2	2.9
SC-03	10.15	362.90	H	22.0	1.61	2.67	39.9	4.4	85.5	3.4
SC-03	12.5	360.55	H	24.8	1.49	2.68	44.3	9.7	70.4	7.7
SC-05	2.5	374.77	H	25.3	1.42	2.66	46.7	10.9	73.9	2.7
SC-05	2.95	374.32	H	25.3	1.41	2.67	47.2	11.6	72.2	3.2
SC-05	8.15	369.12	H	12.1	1.41	2.67	47.4	30.5	32.2	3.5
SC-05	9	368.27	H	13.1	1.33	2.67	50.4	33.7	27.5	5.7
SC-05	10.45	366.82	H	17.0	1.39	2.69	48.1	23.7	36.6	14.2
SC-05	10.9	366.37	H	24.3	1.45	2.69	46.3	10.6	68.8	8.2
SC-05	11.3	365.97	H	15.7	1.36	2.69	49.4	27.7	37.1	6.8
SC-05	12.1	365.17	H	25.6	1.47	2.71	45.7	7.9	79.6	3.0
SC-05	13.5	363.77	H	28.5	1.43	2.71	47.1	5.4	67.9	20.6
SC-05	14.1	363.17	H	23.1	1.52	2.69	43.5	8.0	71.9	9.9
SC-05	14.3	362.97	H	25.7	1.48	2.69	45.1	6.8	76.4	8.6
SC-05	16.1	361.17	H	24.1	1.45	2.70	46.4	11.2	66.2	9.6
SC-05	16.95	360.32	H	21.5	1.58	2.70	41.6	7.6	77.8	4.0
SC-05	17.9	359.37	H	21.7	1.59	2.71	41.3	6.6	78.3	5.6
SC-06	9.5	368.97	H	20.6	1.49	2.70	44.7	13.6	64.7	4.9
SC-06	10.15	368.32	H	19.0	1.42	2.69	47.2	20.0	53.0	4.6
SC-06	11.25	367.22	H	13.7	1.53	2.68	42.9	21.8	45.3	3.9
SC-06	12.15	366.32	H	25.1	1.42	2.70	47.3	12.4	62.2	11.6
SC-06	15.1	363.37	H	22.8	1.53	2.70	43.3	9.3	78.6	ND<0.1
SC-07	13.8	367.96	H	16.2	1.37	2.65	48.6	26.2	41.3	4.9
SC-07	14.5	367.26	H	15.5	1.53	2.64	42.0	18.3	50.3	6.1
SC-07	15.45	366.31	H	25.5	1.36	2.65	48.8	14.8	63.7	5.9
SC-07	18.5	363.26	H	24.3	1.55	2.68	42.1	4.8	83.5	5.2

Notes:
[1] Sample depth is equivalent to feet below ground surface
[2] Sample Orientation: V = vertical; H = horizontal
[3] Total Porosity = all interconnected pore channels; Air Filled = pore channels not occupied by pore fluids
[4] Density calculations based on water density = 0.9996 g/cc, hydrocarbon density = 0.8600 g/cc
%w - percent by weight
g/cc - grams per cubic centimeter
%Vb - percent bulk volume
%Pv - percent pore volume
ft AMSL - feet above mean sea level

Table 2-5
Air/Water Capillary Pressure Data Summary
Cold Springs Terminals
Lysander, New York

Core	Sample Depth[1] ft	Sample Elevation ft AMSL	Sample Orientation[2]	Specific Effective Permeability to Air millidarcy	Permeability to Water millidarcy	Hydraulic Conductivity cm/s	van Genuchten Parameters Mualem α (ft^{-1})	Mualem N	Burdine α (ft^{-1})	Burdine N	Brooks-Corey Parameters Pd ft	λ unitless
SC-01	8.25	365.89	H	144	33.5	3.24E-05	0.05	1.9	0.07	2.7	8.6	0.45
SC-01	11.35	362.79	H	401	140	1.35E-04	0.07	2.2	0.10	3.0	7.6	0.78
SC-01	11.85	362.29	H	509	251	2.43E-04	0.08	2.3	0.10	3.0	7.6	0.86
SC-03	9.95	363.10	H	489	81.8	7.91E-05	0.10	1.9	0.13	2.7	6.4	0.68
SC-05	10.65	366.62	H	676	157	1.52E-04	0.12	1.9	0.18	2.7	4.1	0.59
SC-06	11.4	367.07	H	111	11.5	1.11E-05	0.15	1.3	0.26	2.2	3.2	0.23
SC-07	16.2	365.56	H	3460	1760	1.70E-03	0.25	2.3	0.33	3.1	2.1	0.82

Notes:
[1] Sample depth is equivalent to feet below ground surface
[2] Sample Orientation: H = horizontal
cm/s - centimeters per second
ft - feet
α - van Genuchten fitting parameter
N - van Genuchten fitting parameter (unitless)
Pd - Brooks-Corey displacement pressure head
λ - Brooks-Corey pore size distribution parameter 9 Unitless)
ft AMSL - feet above mean sea level

Table 2-6
LNAPL Mobility Data
Cold Springs Terminals
Lysander, New York

Core	Sample Depth[1] ft	Sample Elevation ft AMSL	Sample Orientation[2]	Density		Porosity[3]	Pore Fluid Saturation - Initial		Pore Fluid Saturation - Final	
				Bulk g/cc	Grain g/cc	Total %Vb	Water %Pv	LNAPL %Pv	Water %Pv	LNAPL %Pv
SC-01	7.8	366.34	H	1.6	2.67	41.44	75.6	3.8	41.7	3.7
SC-01	8.4	365.74	H	1.6	2.67	41.00	75.8	4.2	33.7	4.2
SC-01	10.35	363.79	H	1.6	2.69	40.40	79.3	4.3	15.5	4.3
SC-01	11.25	362.89	H	1.6	2.69	41.16	79.3	3.3	17.4	3.3
SC-03	11.75	361.30	H	1.4	2.68	47.33	71.5	7.9	10.8	4.0
SC-03	5.3	367.75	H	1.3	2.58	51.20	78.0	3.7	42.0	3.7
SC-03	6.05	367.00	H	1.7	2.67	35.94	93.8	5.4	41.2	5.4
SC-03	8.5	364.55	H	1.7	2.69	37.10	78.2	3.3	30.1	3.3
SC-03	9.8	363.25	H	1.5	2.68	42.73	76.9	4.8	17.4	4.7
SC-05	10.8	366.47	H	1.4	2.63	46.04	64.4	9.8	16.6	9.5
SC-05	12.35	364.92	H	1.5	2.65	43.22	68.3	8.3	9.0	8.1
SC-05	13.62	363.65	H	1.5	2.64	43.93	56.4	10.9	5.9	7.7
SC-05	15.3	361.97	H	1.5	2.65	42.48	77.5	3.9	8.1	3.8
SC-05	8.65	368.62	H	1.4	2.68	45.97	57.2	5.0	20.8	5.0
SC-05	9.4	367.87	H	1.41	2.69	47.57	44.5	7.0	13.1	7.0
SC-06	11.6	366.87	H	1.47	2.66	44.76	61.7	5.1	13.4	5.1
SC-07	15.05	366.71	H	1.46	2.68	45.46	71.7	2.1	17.7	2.1
SC-07	16.4	365.36	H	1.40	2.67	47.52	63.1	5.8	8.8	4.0
SC-07	17.25	364.51	H	1.38	2.68	48.49	49.3	4.3	7.6	3.6

Notes:
[1] Sample depth is equivalent to feet below ground surface
[2] Sample Orientation: H = horizontal
[3] Total Porosity = all interconnected pore channels
LNAPL mobility testing involves centrifuging sample at 1000G.
g/cc - grams per cubic centimeter
%Vb - percent bulk volume
%Pv - percent pore volume
ft AMSL - feet above mean sea level

Table 2-7
Baildown Test Results
Cold Springs Terminals
Lysander, New York

Well	Initial Thickness	Final Thickness	LNAPL Transmissivity			Average	Standard Deviation	Coefficient of Variation
			Bouwer-Rice	Jacob-Lohman	Cooper-Bredehoeft-Papadopulos			
	ft	ft	ft^2/d			ft^2/d		
A-8	1.28	0.37	0.040	0.010	0.028	0.026	0.02	59%
A-10	4.98	0.85	0.006	0.010	0.020	0.012	0.01	60%
A-12	2.35	0.58	0.003	0.027	0.015	0.015	0.01	79%
A-13	1.44	0.25	0.0003	0.020	0.044	0.021	0.02	102%
A-14	5.05	0.7	0.002	0.006	0.004	0.004	0.002	47%
A-16	6.78	2.4	0.024	0.034	0.040	0.033	0.008	24%
A-17	3.64	0.65	0.005	0.009	0.010	0.008	0.003	33%
A-25[1]	0.29	0.2	0.013	0.193	0.100	0.102	0.090	88%
AMW-9[2]	3.35	2.6	0.023	0.025	0.020	0.023	0.003	12%
BMW-5[1]	1.29	0.36	0.007	0.013	0.020	0.013	0.007	51%
S-1	1.13	0.32	0.001	0.006	0.009	0.005	0.004	75%
S-2	1.54	0.8	0.004	0.012	0.020	0.012	0.008	69%
S-3	1.6	0.55	0.166	0.063	0.700	0.310	0.342	110%
S-5	0.58	0.1	0.398	0.518	0.560	0.492	0.084	17%
S-9	1.42	0.73	0.0005	0.002	0.0003	0.001	0.001	109%
S-12	0.33	0.01	0.0001	0.007	0.005	0.004	0.004	88%
S-13[3]	3.48	0.55	0.002	0.010	0.020	0.011	0.009	82%
S-16	2.71	0.66	0.004	0.009	0.060	0.024	0.031	127%
S-17[4]	0.25	2.32	0.001	0.003	0.040	0.015	0.022	151%
S-24	0.76	0.24	0.001	0.004	0.020	0.008	0.010	123%
SMW-5[4]	0.42	2.03	0.002	0.007	0.013	0.008	0.005	70%

Notes:
[1] Drawdown calculated based on change in LNAPL thickness.
[2] Final thickness recorded on October 6, 2013; thicknees recorded on October 16, 2013 was zero
[3] Final thickness recorded on October 6, 2013; thicknees recorded on October 16, 2013 was 0.02 feet
[4] Well recovered to an LNAPL thickness higher than at start of test.
ft - feet
ft^2/d - square feet per day

Table 2-8
Fluid Physical Properties
Cold Springs Terminals
Lysander, New York

Sample ID	Matrix	Temperature	Specific Gravity	Density	Viscosity	
		°F	unitless	g/cc	centistokes	centipoise
A-16	Water	70	1.001	0.9986	1.02	1.02
		100	1.003	0.9956	0.699	0.696
		130	1.004	0.9899	0.523	0.517
A-16	NAPL	70	0.9799	0.7961	1.35	1.08
		100	0.7905	0.7850	1.066	0.837
		130	0.7827	0.7717	0.864	0.667
S-13	Water	70	1.000	0.9984	1.02	1.02
		100	1.002	0.9952	0.698	0.694
		130	1.004	0.9895	0.520	0.515
S-13	NAPL	70	0.8129	0.8112	1.53	1.24
		100	0.8057	0.8001	1.19	0.949
		130	0.7977	0.7865	0.958	0.754

Notes

°F - degrees Farenheit

g/cc - grams per cubic centimeters

Sample ID	Phase Pair	Temperature	Interfacial Tension
		°F	Dynes/centimeter
A-16	Water-Air	76	65.2
	NAPL -Air	76	25.1
	Water-NAPL	76	18.9
S-13	Water-Air	76	68.5
	NAPL -Air	76	28.7
	Water-NAPL	76	15.5

Table 2-9
LDRM Output
Cold Springs Terminals
Lysander, New York

Core and Well Pair	LNAPL Specific Volume (Dn)	LNAPL Specific Recoverable Volume (Rn)	Percent Recoverable	LNAPL Transmissivity		Initial LNAPL Recovery	
				LDRM	Measured	LDRM	Pilot test
	ft	ft	%	ft^2/d		gpd	
SC-01/A-14[1]	0.2485	0.088	36%	0.006	0.004	1.5	NRL
SC-03/S-9	0.0533	0.005	9%	<0.001	0.001	NC	NC
SC-05/B-14[2]	0.0657	0.033	51%	0.059	0.012	NC	NC
SC-06/A-8	0.0623	0.010	17%	0.013	0.026	NC	NC
SC-07/B-5	0.0041	0	0%	<0.001	NT	NC	NC

Notes:
[1] Well S-5 pilot test data was used for comparison
[2] Well S-2 baildown data was used for comparison; baildown test was not performed on B-14
LNAPL - light nonaqueous phase liquid
ft - feet
% - percent
ft^2/d - square feet per day
NT - not tested as well B-5 did not contain LNAPL
NRL - no recoverable LNAPL was generated during pilot testing
NC - not calculated

Table 2-10
Calculated LNAPL Entry Pressure Head
Cold Springs Terminals
Lysander, New York

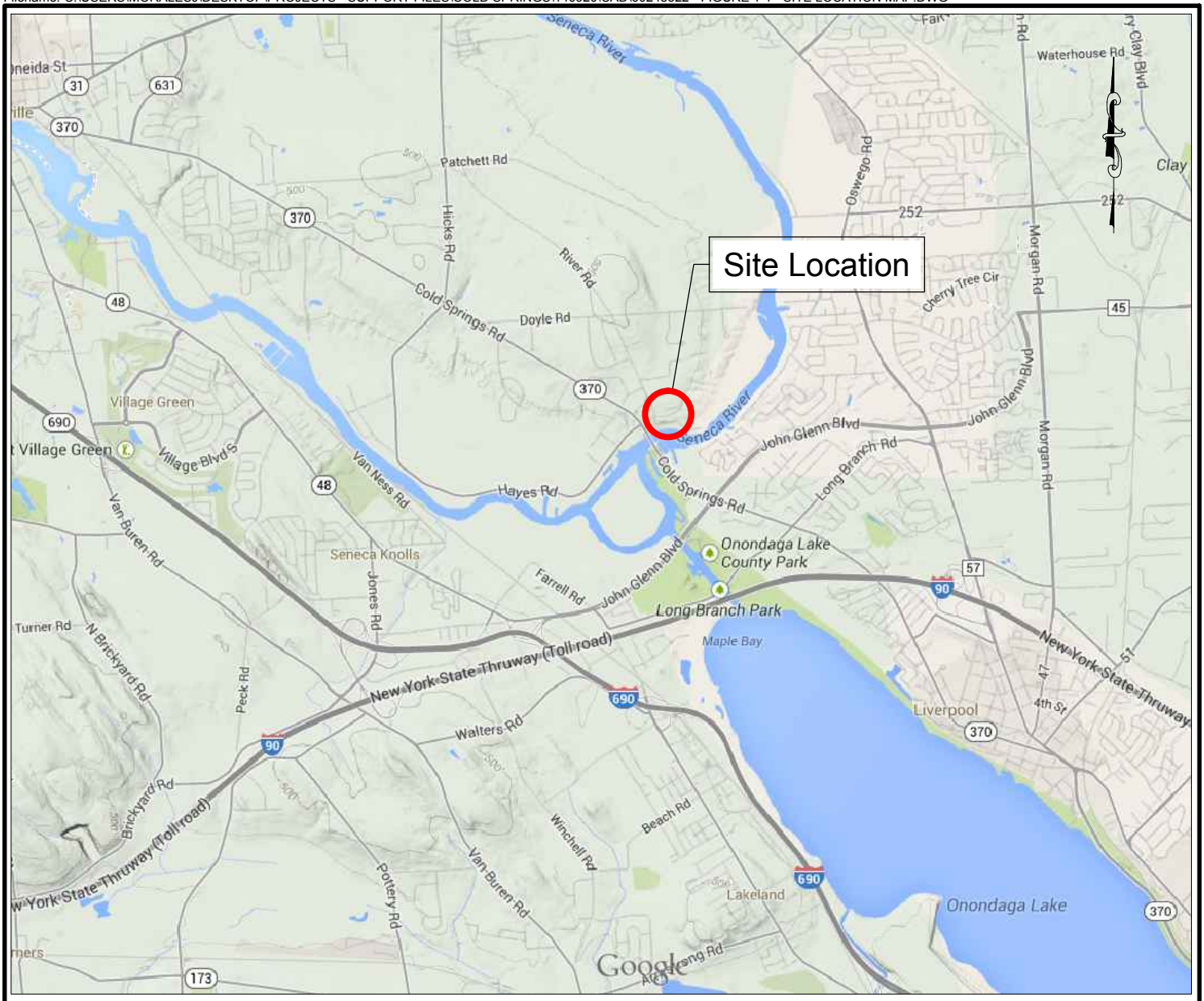
Core and Well Pair	Sample Depth	Soil Type	Air-Water Entry Pressure	LNAPL Entry Pressure Head
	ft bgs		(feet H_2O)	(feet LNAPL)
SC-01 6-9	8.25	Silt	8.59	10.0
SC-01 9-12	11.35	Silt	7.57	8.8
SC-01 9-12	11.85	Silt	7.57	8.8
SC-03- 8-11	9.95	Silt	6.39	7.4
SC-05 10-13	10.65	Silt	4.13	4.8
SC-06 11-14	11.4	Fine sand	3.24	3.8
SC-07 16-18	16.2	Fine sand	2.12	2.5

Notes:
- air/water surface tension assumed to be 65 dynes per centimeter
- air/LNAPL interfacial tension assumed to be 25 dynes per centimeter
- LNAPL/water interfacial tension assumed to be 20 dynes per centimeter
- LNAPL-water density ratio assumed to be 0.78

ft bgs - feet below ground surface
LNAPL - light nonaqueous phase liquid
H_2O - water

Figures

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Filename: C:\USERS\MORALESJ\DESKTOP\PROJECTS - SUPPORT FILES\COLD SPRINGS\140920\CAD\60248522 - FIGURE 1-1 - SITE LOCATION MAP.DWG







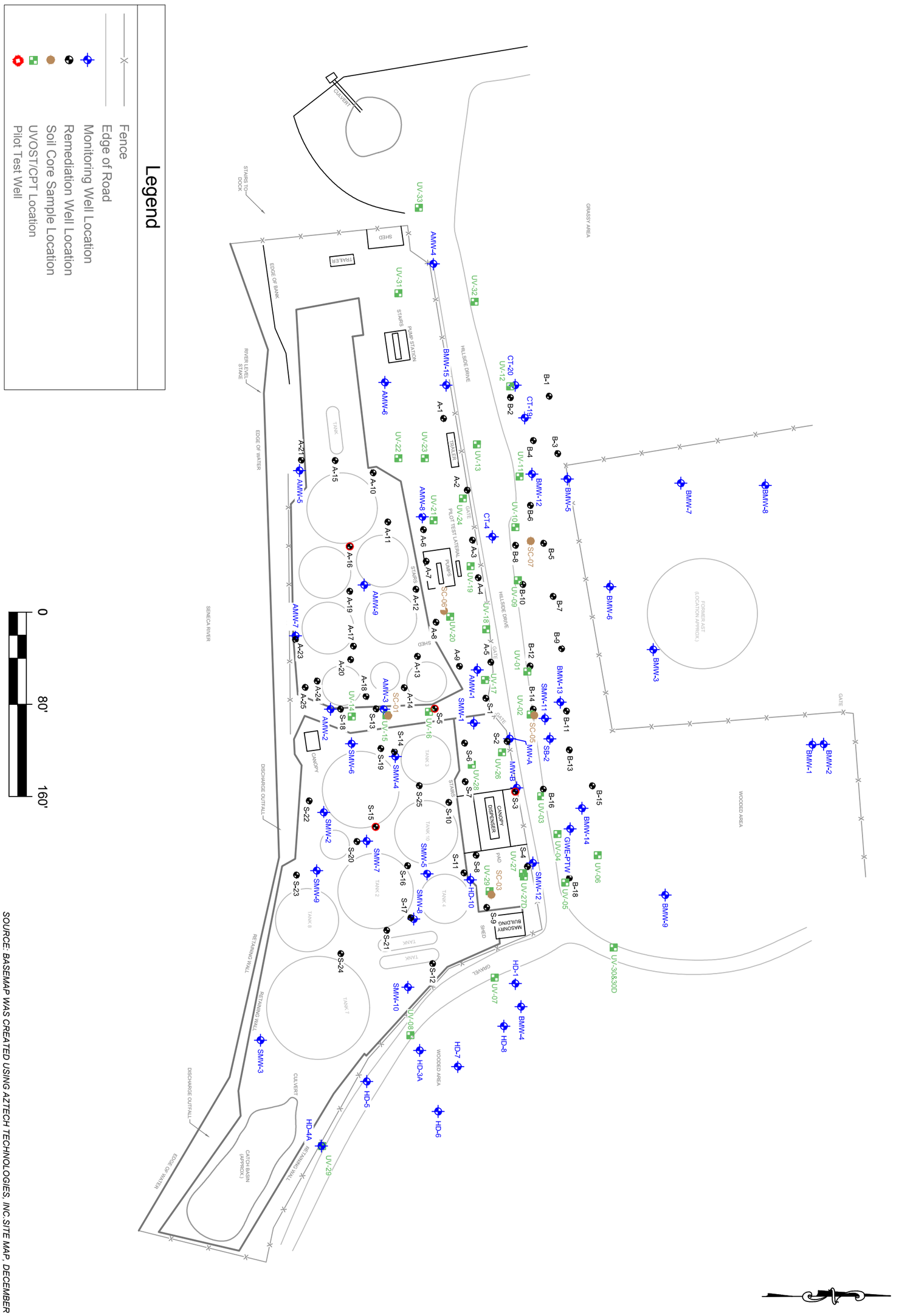
COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
Project Number: 60248522

SITE LOCATION MAP
COLD SPRINGS TERMINALS
SEPTEMBER 2014

AECOM

FIGURE: 1-1

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Filename: C:\USERS\MORALESJ\DESKTOP\PROJECTS - SUPPORT FILES\COLD SPRINGS\140920\CAD\60248522 - FIGURE 1-2 - SITE MAP.DWG
Project Management Initials: Designer: JM Checked:_____ Approved:_____ ANSI B 11" x 17"

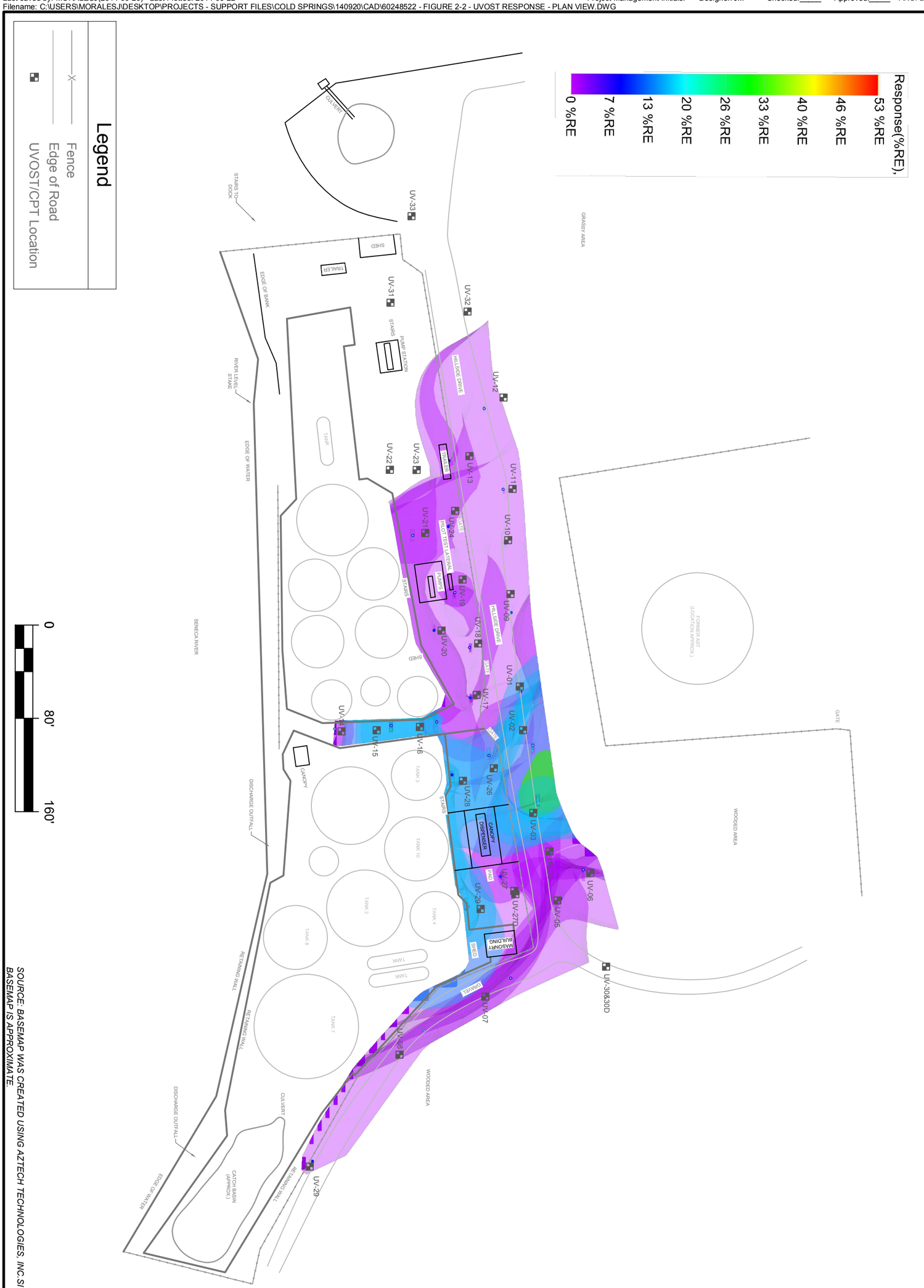


COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
60248522

SITE MAP
COLD SPRINGS TERMINALS
SEPTEMBER 2014

AECOM

Figure: 1-2



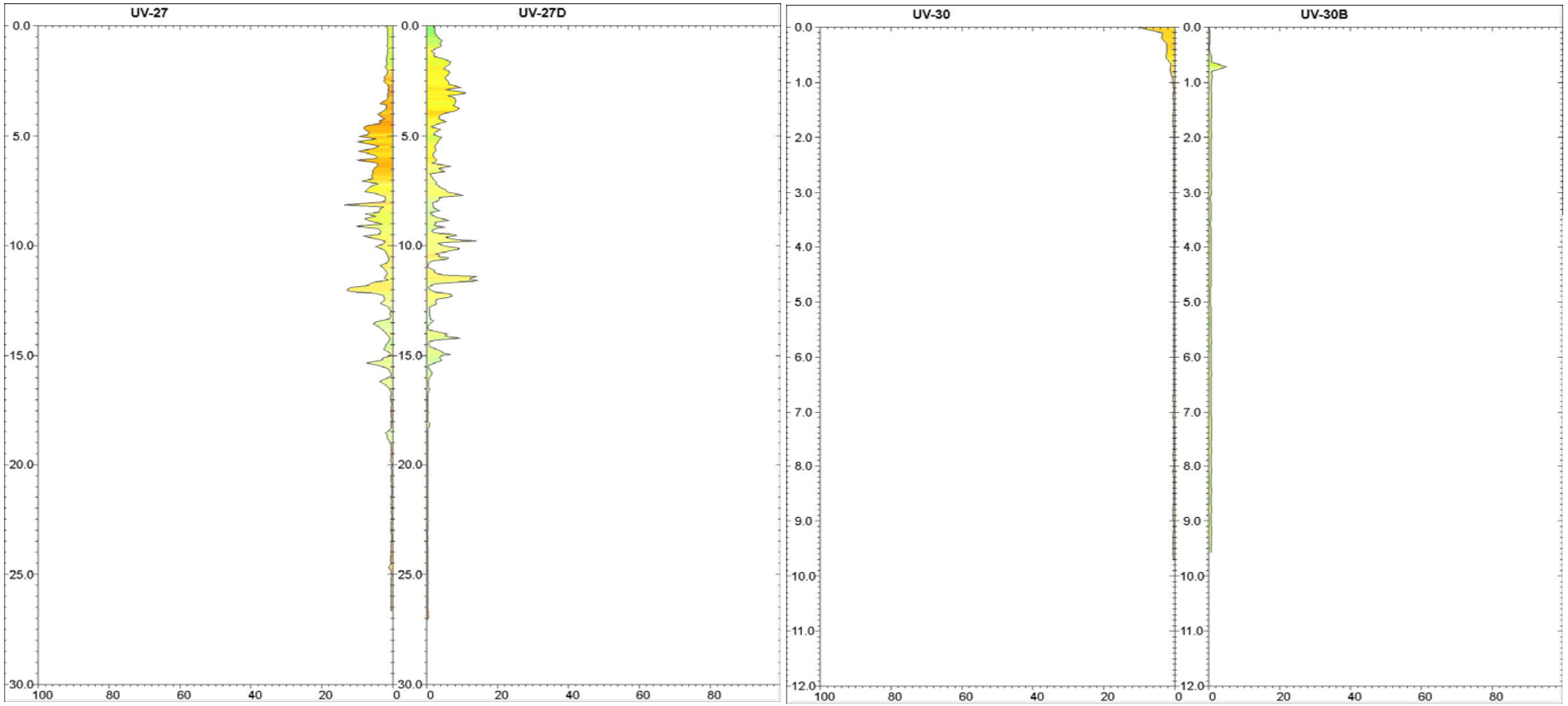
SOURCE: BASEMAP WAS CREATED USING AZTECH TECHNOLOGIES, INC SITE MAP, DECEMBER 15, 2006. BASEMAP IS APPROXIMATE.

COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
60248522

UVOST® RESPONSE - PLAN VIEW
COLD SPRINGS TERMINALS
SEPTEMBER 2014

AECOM

Figure: 2-1



x-axis values - percent reference emitter

y-axis values - feet below ground surface

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

Butterfly Plots
UV-27 and UV-30

Figure: 2-2

Project Management Initials: Designer: JM Checked:____ Approved:____ ANSI B 11" x 17"

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Filename: C:\USERS\MORALESJ\DESKTOP\PROJECTS - SUPPORT FILES\COLD SPRINGS\140920\CAD\60248522 - FIGURE 2-3 - SITE MAP.DWG

AECOM

Figure: 2-3

MEASURED LNAPL TRANSMISSIVITY
COLD SPRINGS TERMINALS
SEPTEMBER 2014

COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
60248522

Legend

- Fence
- Edge of Road
- Monitoring Well Location
- Remediation Well Location
- Transmissivity <0.01 Square Feet per Day
- Transmissivity >0.01 Square Feet per Day
- Transmissivity >0.1 Square Feet per Day

0 80' 160'

SOURCE: BASEMAP WAS CREATED USING AZTECH TECHNOLOGIES, INC.SITE MAP, DECEMBER 15, 2006. BASEMAP IS APPROXIMATE.

Project Management Initials: Designer: JM Checked:____ Approved:____ ANSI B 11" x 17"
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Filename: C:\USERS\MORALESJ\DESKTOP\PROJECTS - SUPPORT FILES\COLD SPRINGS\140920\CAD\60248522 - FIGURES 2-4, 2-5B, AND 2-6B.DWG



Legend

- Major Contour Line - Existing
- Minor Contour Line - Existing
- Fence
- Edge of Road
- Existing Structure

0 80' 160'

SOURCE: BASEMAP WAS CREATED USING AZTECH TECHNOLOGIES, INC.SITE MAP, DECEMBER 15, 2006. BASEMAP IS APPROXIMATE.

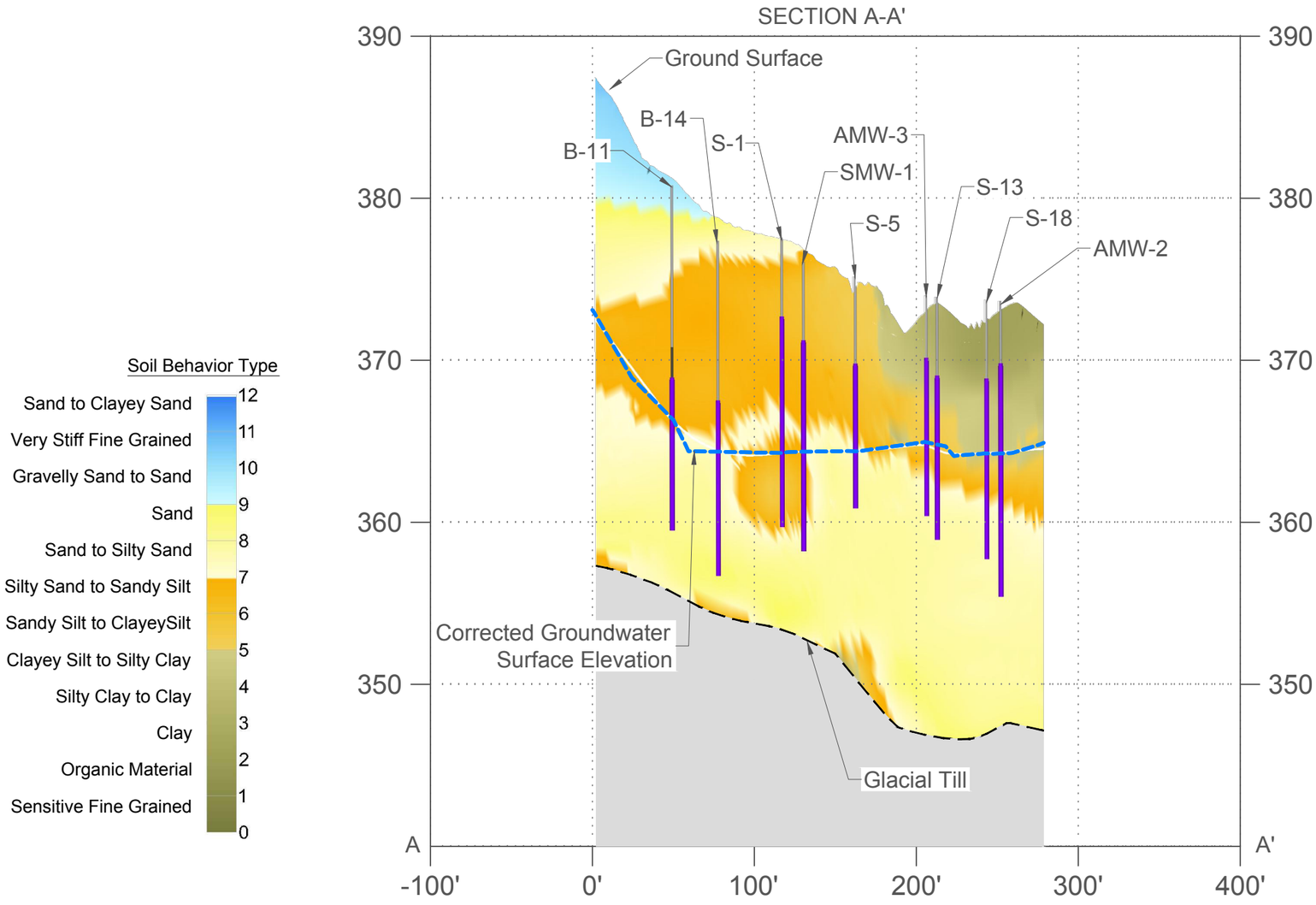
AECOM

Figure: 2-4

CROSS SECTION LOCATIONS
COLD SPRINGS TERMINALS
SEPTEMBER 2014

COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
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HORIZ. 0 40' 80' 160'
VERT. 0 4' 8' 80'

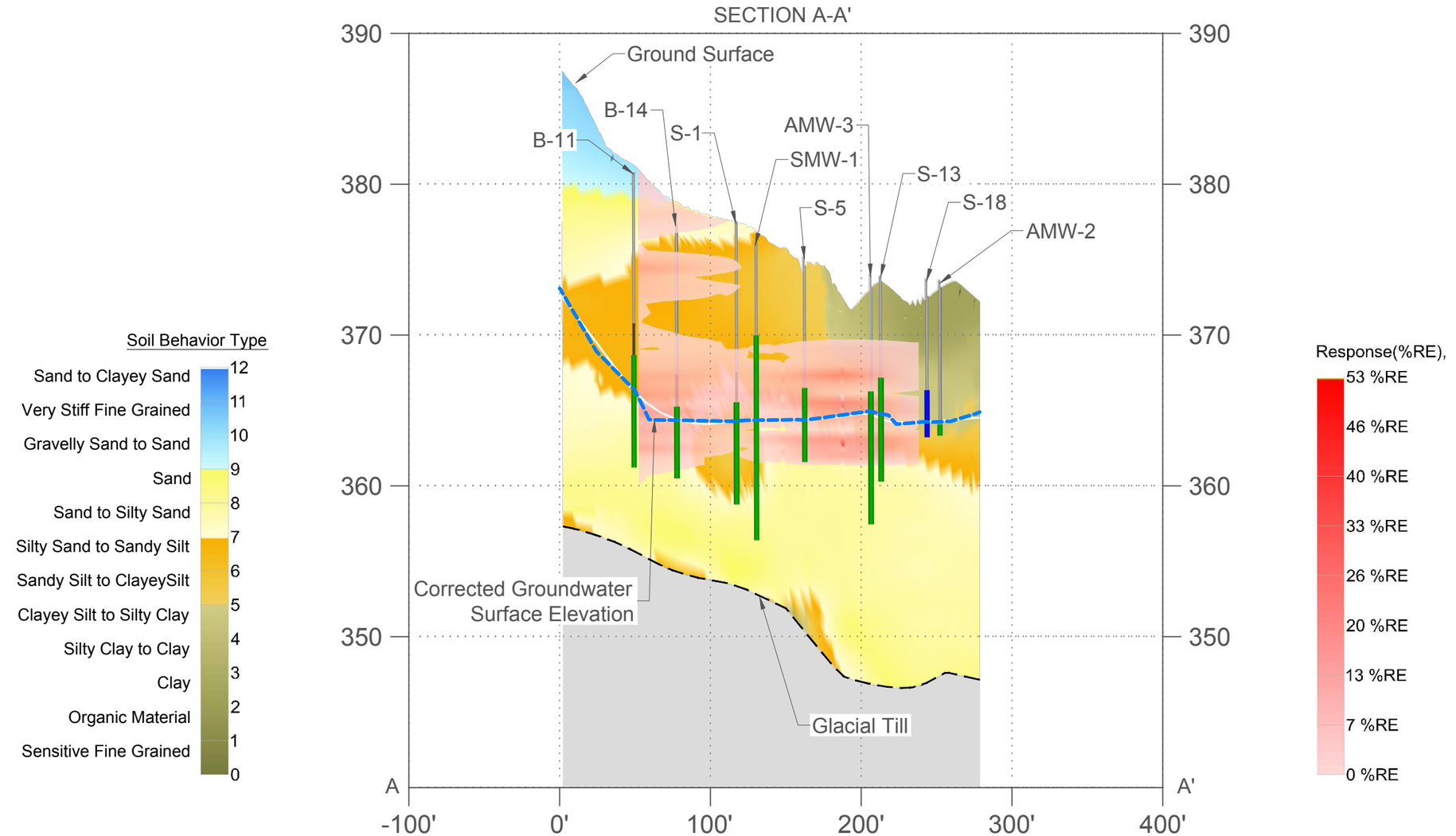
Notes:
1. Purple posts at monitoring well locations indicate the well screen interval.

Corrected groundwater surface as measured in July 2013

AECOM
Figure: 2-5A

CROSS SECTION A-A' - TANK BASIN BERM
COLD SPRINGS TERMINALS
SEPTEMBER 2014

COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
60248522



Notes:

1. Green posts at monitoring well locations indicate that LNAPL has been historically detected at that well. The depth interval shown represents the historic high elevation of the air-LNAPL interface and the historic low elevation of the LNAPL-water interface.
2. Blue posts at monitoring well locations indicate that LNAPL has not been historically detected at that well. The depth interval shown represents the historic high and low groundwater potentiometric surface elevations.

%RE - Percent of Reference Emitter
Corrected groundwater surface as measured in July 2013

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Figure: 2-5B

CROSS SECTION A-A' - TANK BASIN BERM
COLD SPRINGS TERMINALS
SEPTEMBER 2014

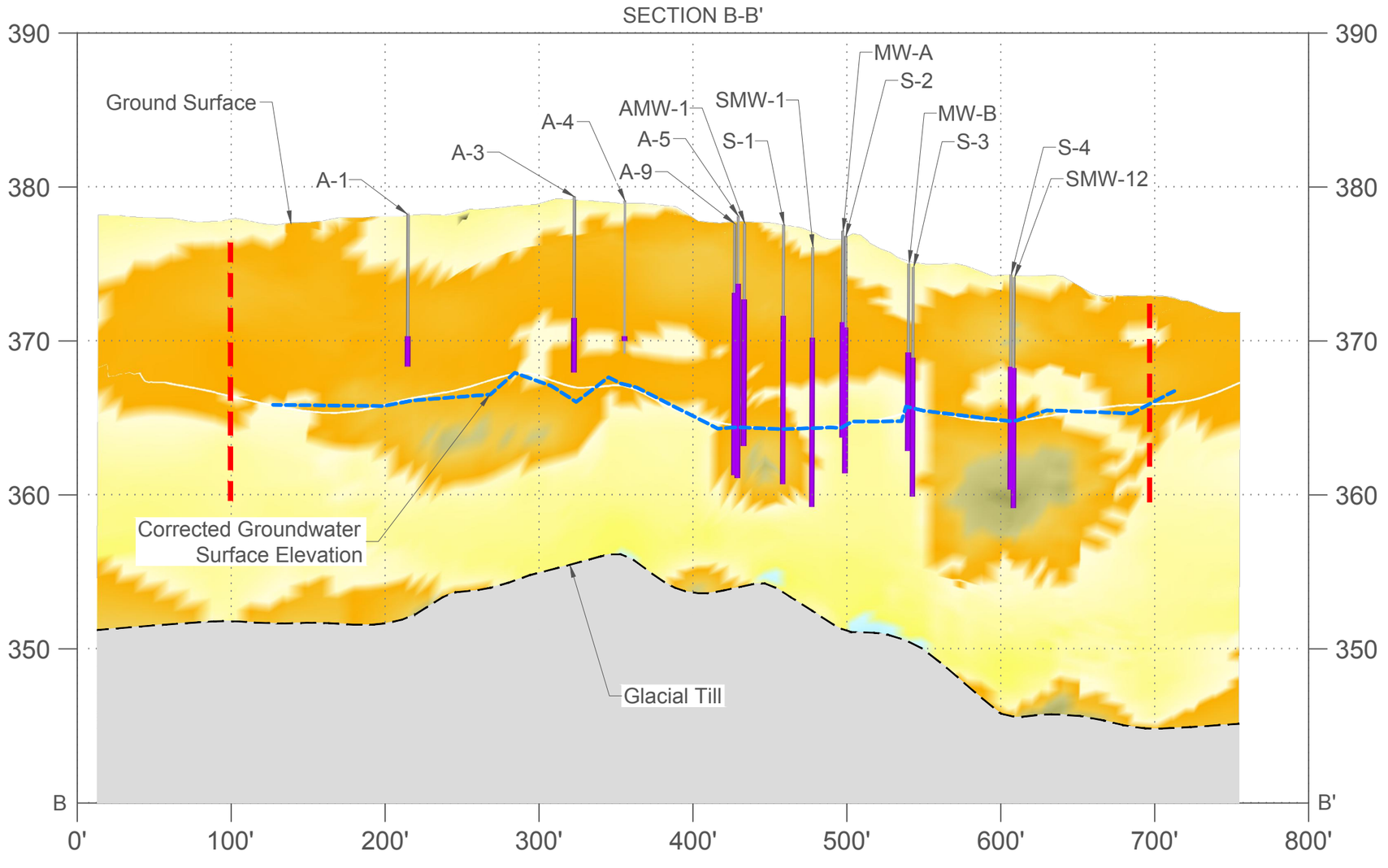
COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
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SECTION B-B'



Notes:
1. Purple posts at monitoring well locations indicate the well screen interval.
2. Red dashed lines represent extent of LIF investigation.

Corrected groundwater surface as measured in July 2013

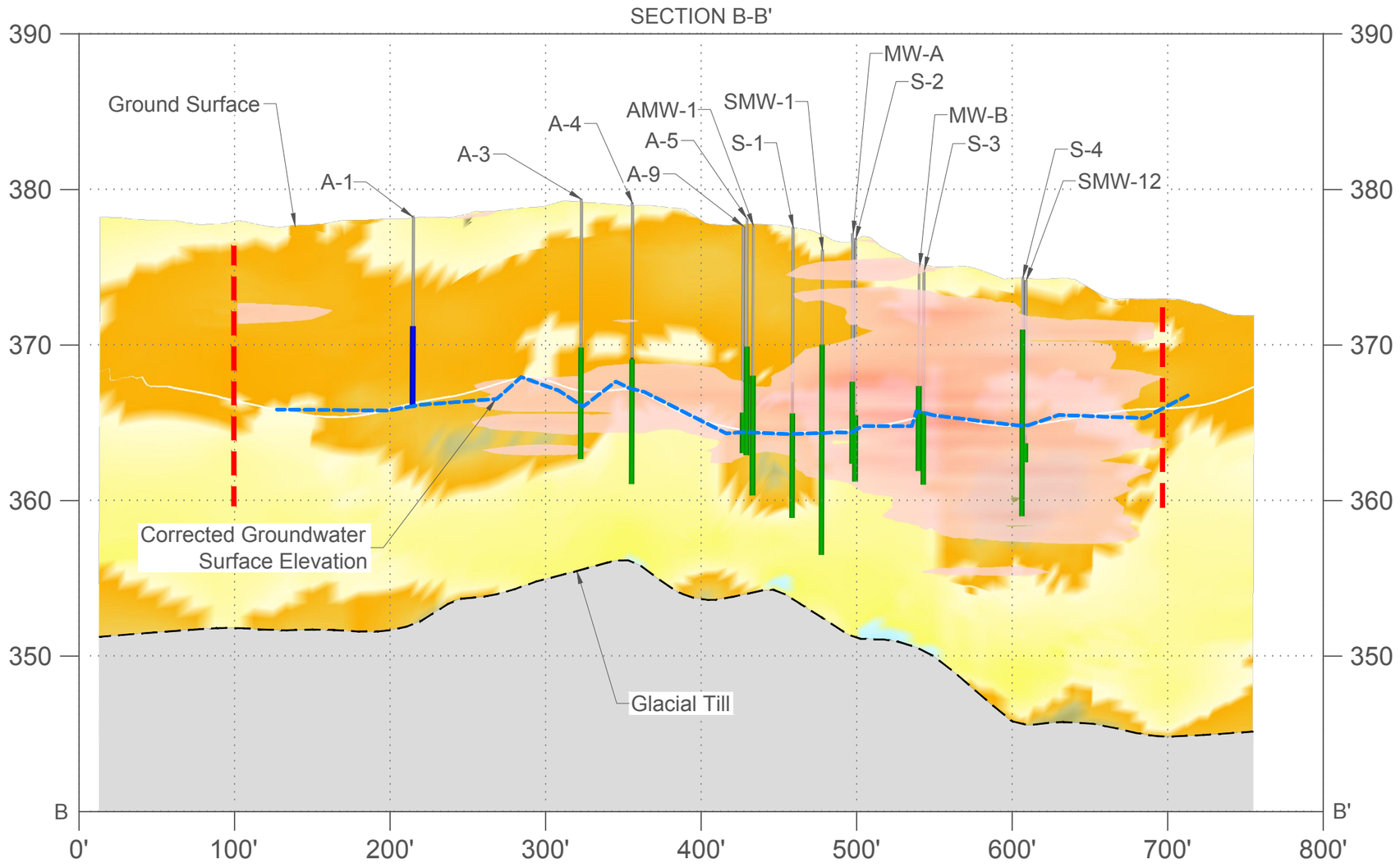
AECOM

Figure: 2-6A

CROSS SECTION B-B' - HILLSIDE ROAD
COLD SPRINGS TERMINALS
SEPTEMBER 2014

COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
60248522

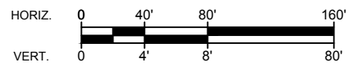
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Filename: C:\USERS\MORALESJ\DESKTOP\PROJECTS - SUPPORT FILES\COLD SPRINGS\140920\CAD\60248522 - FIGURES 2-4, 2-5B, AND 2-6B.DWG



Notes:

1. Green posts at monitoring well locations indicate that LNAPL has been historically detected at that well. The depth interval shown represents the historic high elevation of the air-LNAPL interface and the historic low elevation of the LNAPL-water interface.
2. Blue posts at monitoring well locations indicate that LNAPL has not been historically detected at that well. The depth interval shown represents the historic high and low groundwater potentiometric surface elevations.
3. Red dashed lines represent extent of LIF investigation. %RE values were not extrapolated beyond investigation extent.

%RE - Percent of Reference Emitter
Corrected groundwater surface as measured in July 2013



AECOM

Figure: 2-6B

CROSS SECTION B-B' - HILLSIDE ROAD
COLD SPRINGS TERMINALS
SEPTEMBER 2014

COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
60248522

Project Management Initials: Designer: JM Checked:____ Approved:____ ANSI B 11" x 17"

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Filename: C:\USERS\MORALES\DESKTOP\PROJECTS - SUPPORT FILES\COLD SPRINGS\140920\CAD\60248522 - FIGURE 2-8 - GROUNDWATER CONTOURS.DWG

Issue Status: DRAFT

AECOM

Figure: 2-7

GROUNDWATER POTENTIONMETRIC SURFACE - JULY 11, 2013
COLD SPRINGS TERMINALS
SEPTEMBER 2014

COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
60248522

Legend

- Monitoring Well Location
- Remediation Well Location
- Soil Core Sample Location
- Fence
- Groundwater Contour
- Flow Direction
- 83.7 — Corrected Groundwater Potentiometric Surface (feet above mean sea level)
- NG — Not Gauged

0 80' 160'

SOURCE: BASEMAP WAS CREATED USING AZTECH TECHNOLOGIES, INC.SITE MAP, DECEMBER 15, 2006. BASEMAP IS APPROXIMATE.

Project Management Initials: Designer: JM Checked:____ Approved:____ ANSI B 11" x 17"

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Filename: C:\USERS\MORALESJ\DESKTOP\PROJECTS - SUPPORT FILES\COLD SPRINGS\140920\CAD\60248522 - FIGURE 2-9 - HISTORICAL & CURRENT LNAPL.DWG

Issue Status: DRAFT

AECOM

Figure: 2-8

HISTORIC AND CURRENT EXTENT OF LNAPL
COLD SPRINGS TERMINALS
SEPTEMBER 2014

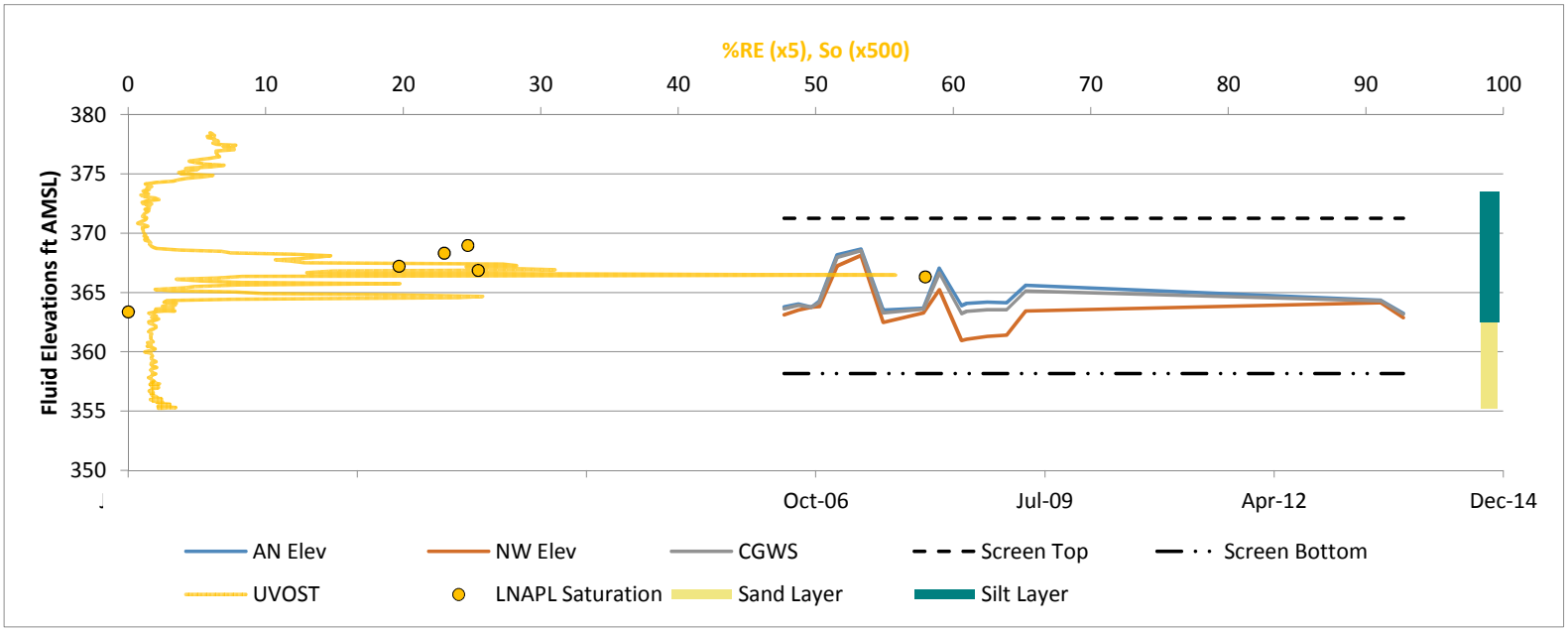
COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
60248522

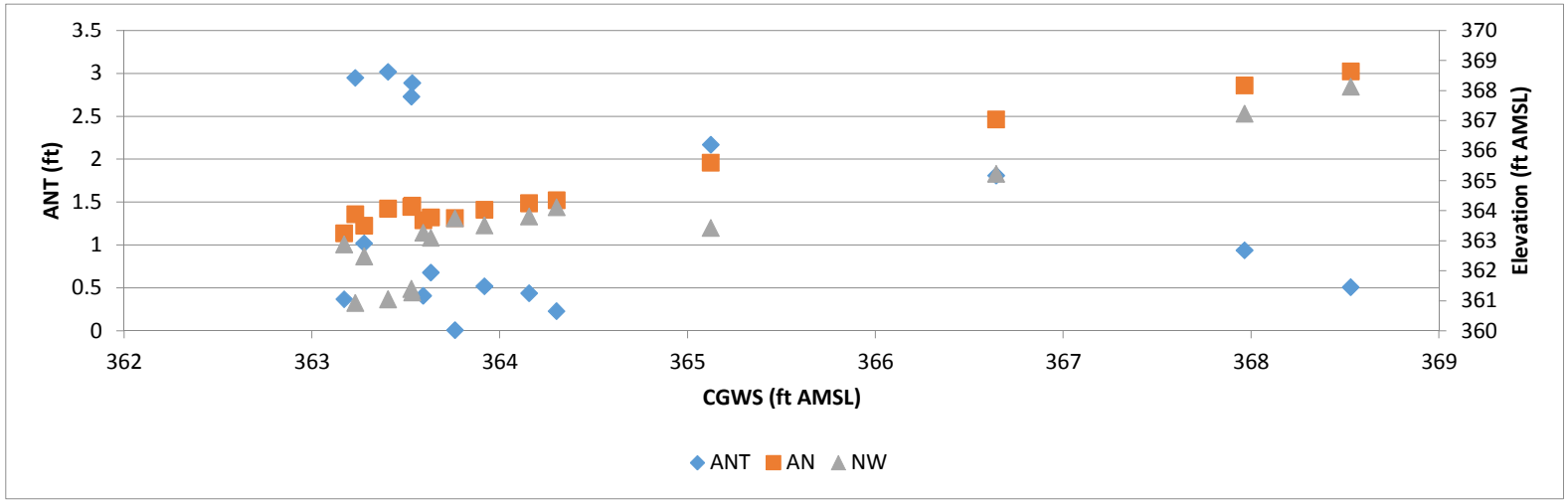
Legend

	Monitoring Well Location
	Remediation Well Location
	Fence
365.04	Air-LNAPL Interface Elevation (ft msl)
3.25	Apparent LNAPL Thickness (ft)
365	Air-LNAPL Interface Elevation Contour (ft msl)
	Extent of LNAPL - July 2013 (Dashed where Inferred)
	Extent of LNAPL - 2004
LNAPL	Light Non-Aqueous Phase Liquids
msl	Mean Sea Level

0 80' 160'

SOURCE: BASEMAP WAS CREATED USING AZTECH TECHNOLOGIES, INC.SITE MAP, DECEMBER 15, 2006. BASEMAP IS APPROXIMATE.





%RE & So adjusted by multiplier shown
%RE - percent reference emitter
So - LNAPL saturation

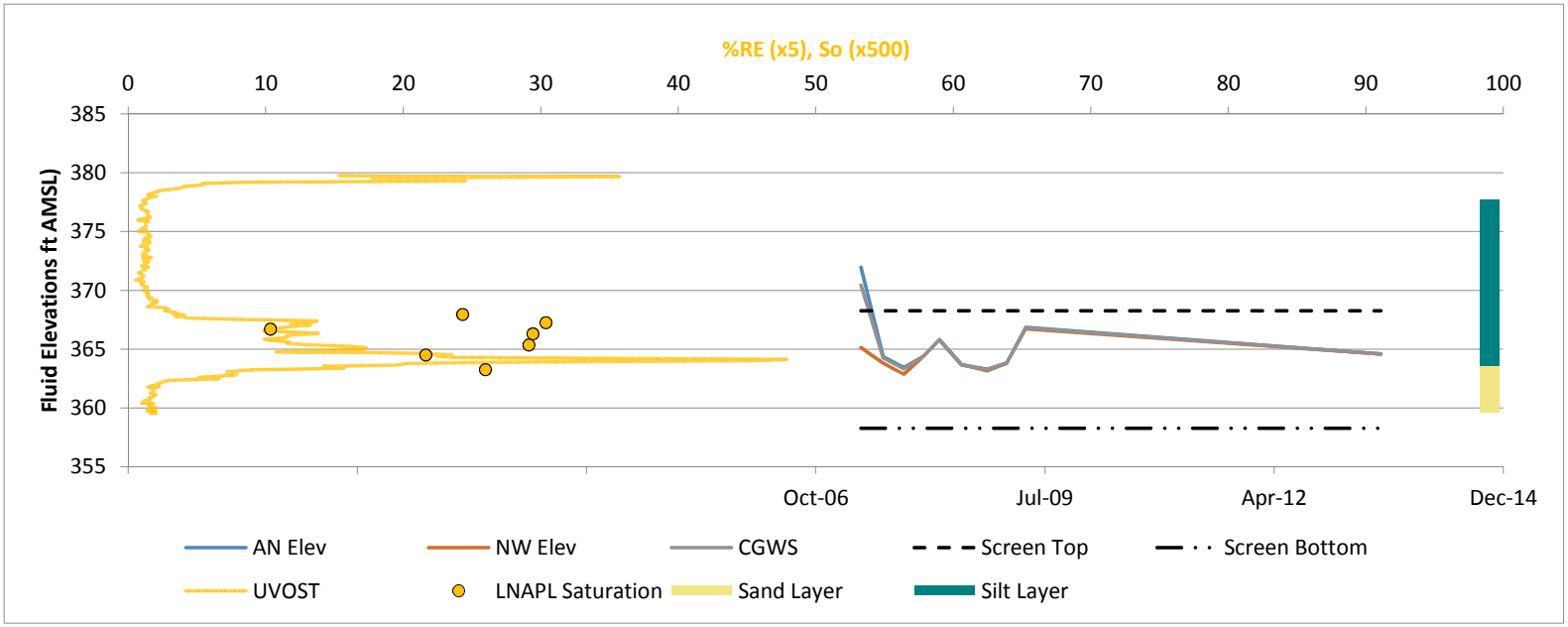
ft AMSL - feet above mean sea level
AN - air-LNAPL interface
NW - LNAPL-water interface

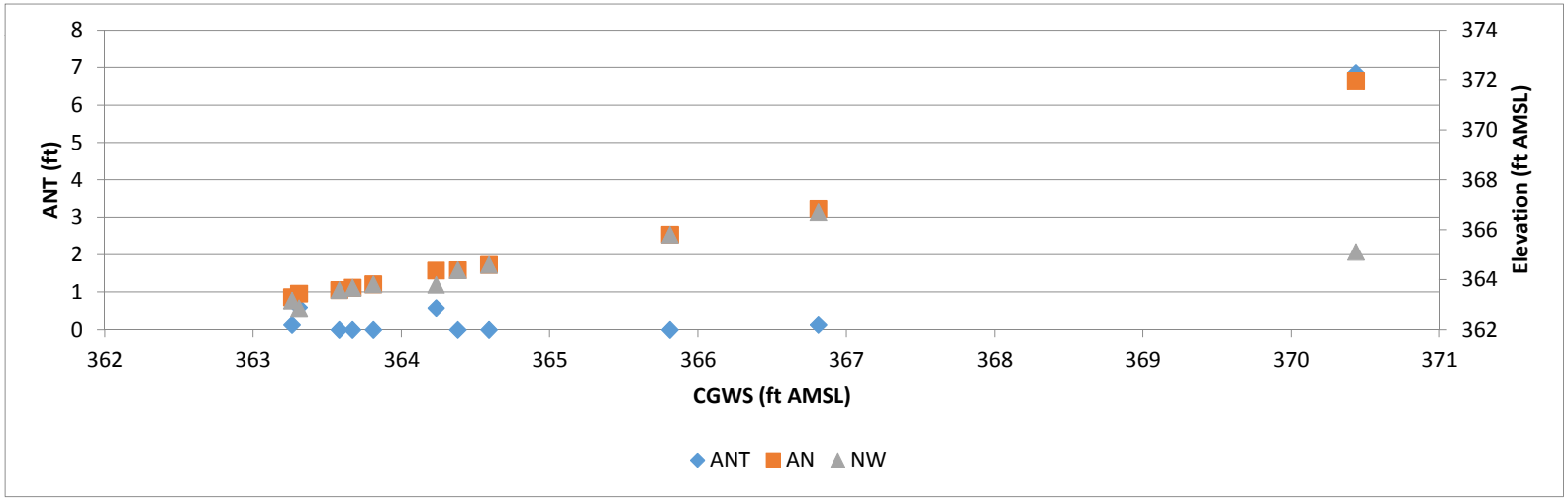
CGWS - corrected groundwater surface
ANT - apparent LNAPL thickness

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

Hydrostratigraph and Diagnostic Gauge Plot
A-8/UV-20/SC-06

Figure: 2-9





%RE & So adjusted by multiplier shown

%RE - percent reference emitter

So - LNAPL saturation

ft AMSL - feet above mean sea level

AN - air-LNAPL interface

NW - LNAPL-water interface

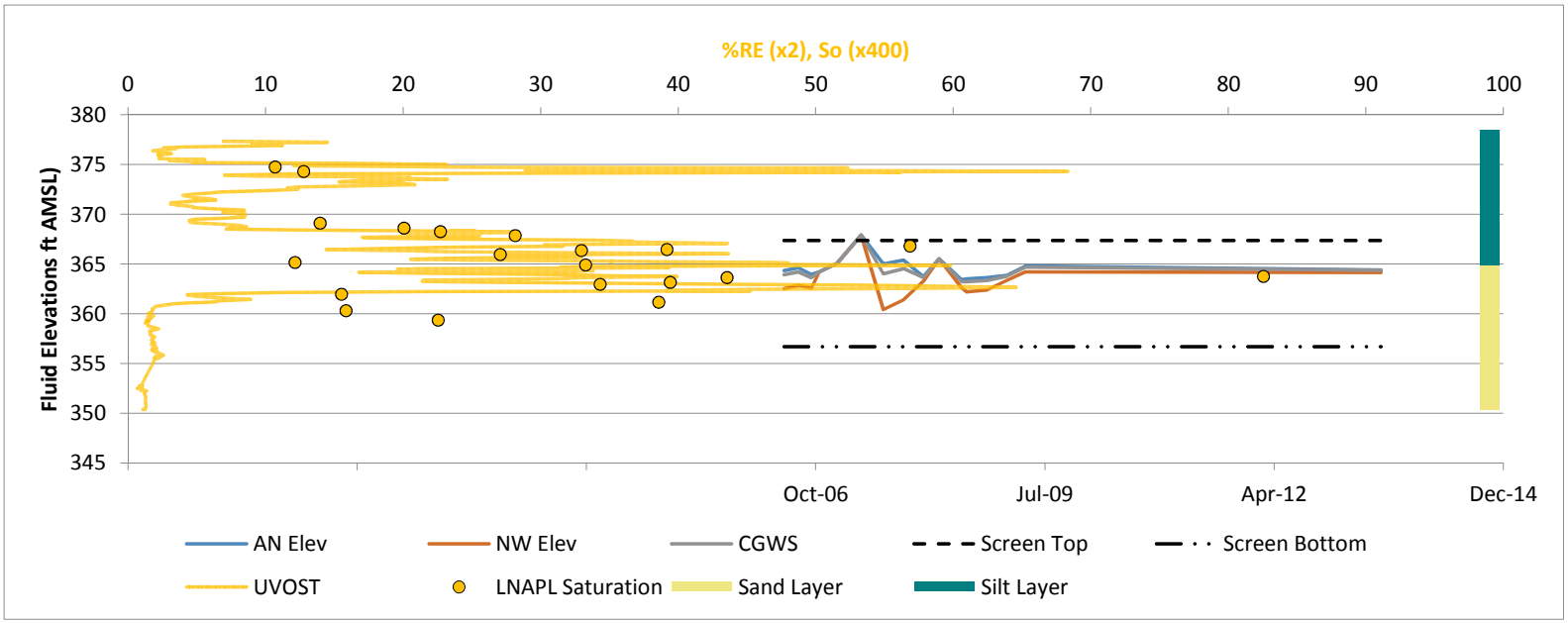
CGWS - corrected groundwater surface

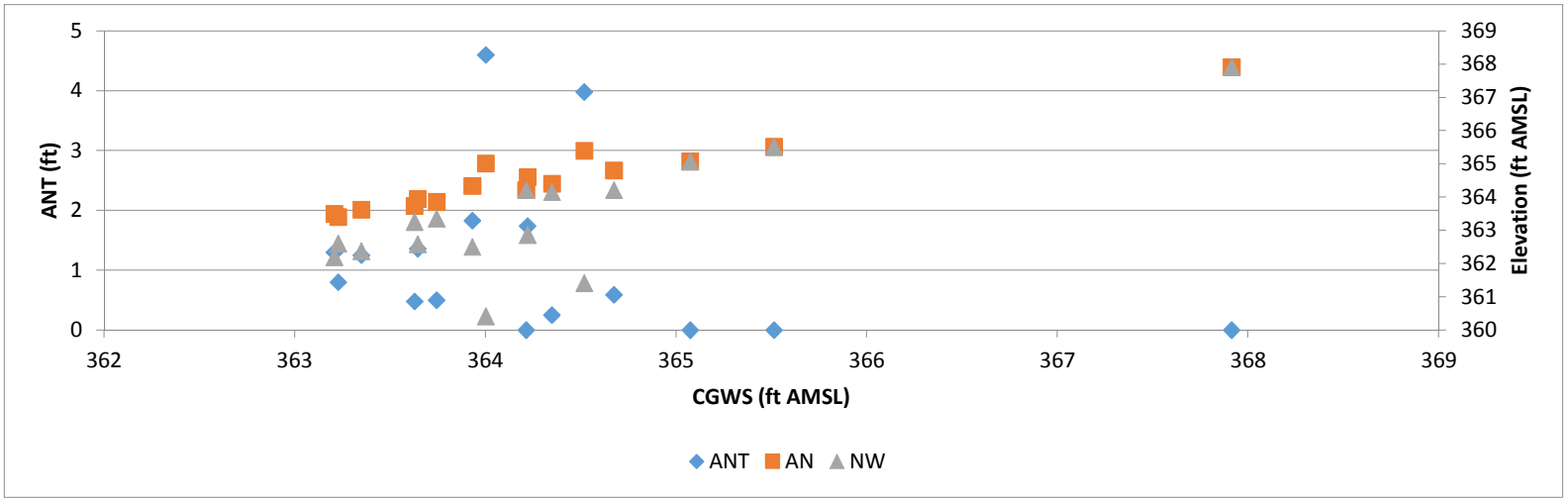
ANT - apparent LNAPL thickness

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

Hydrostratigraph and Diagnostic Gauge Plot
B-5/UV-10/SC-07

Figure: 2-10





%RE & So adjusted by multiplier shown
%RE - percent reference emitter
So - LNAPL saturation

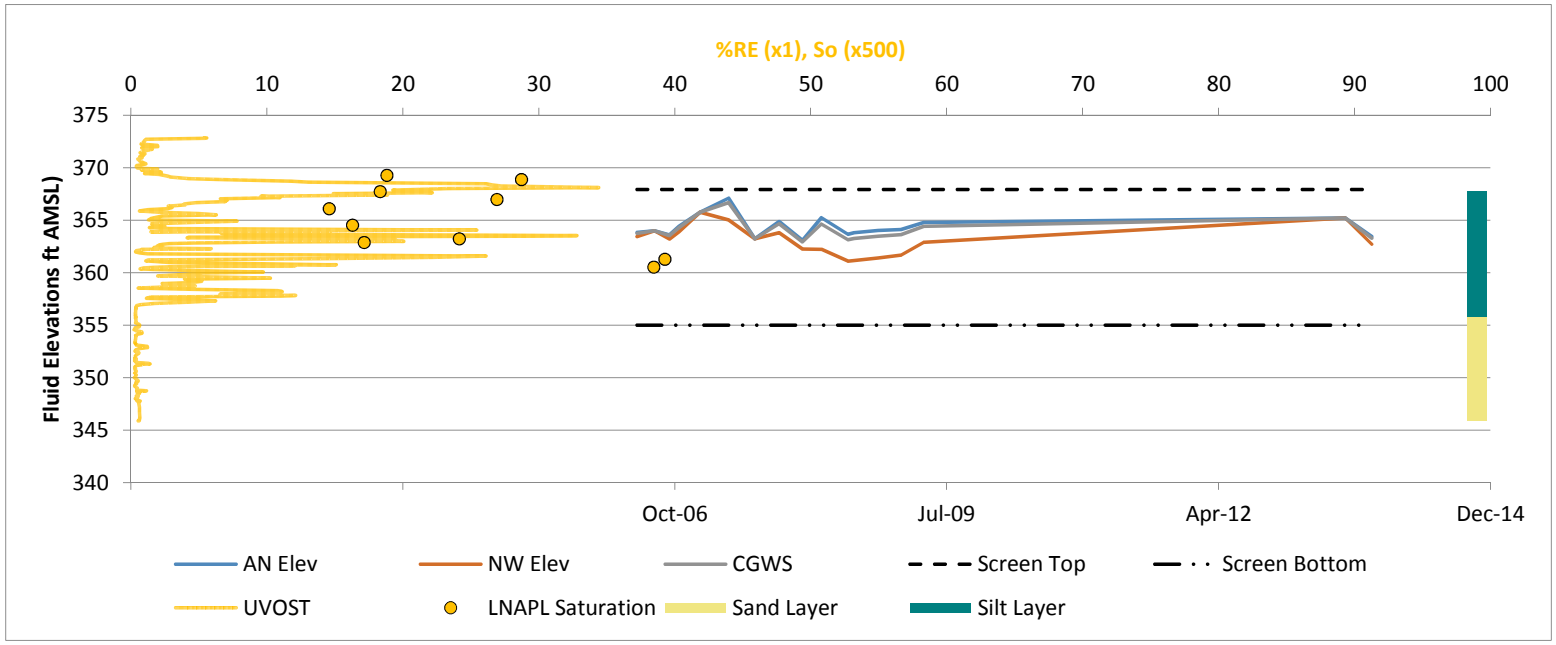
ft AMSL - feet above mean sea level
AN - air-LNAPL interface
NW - LNAPL-water interface

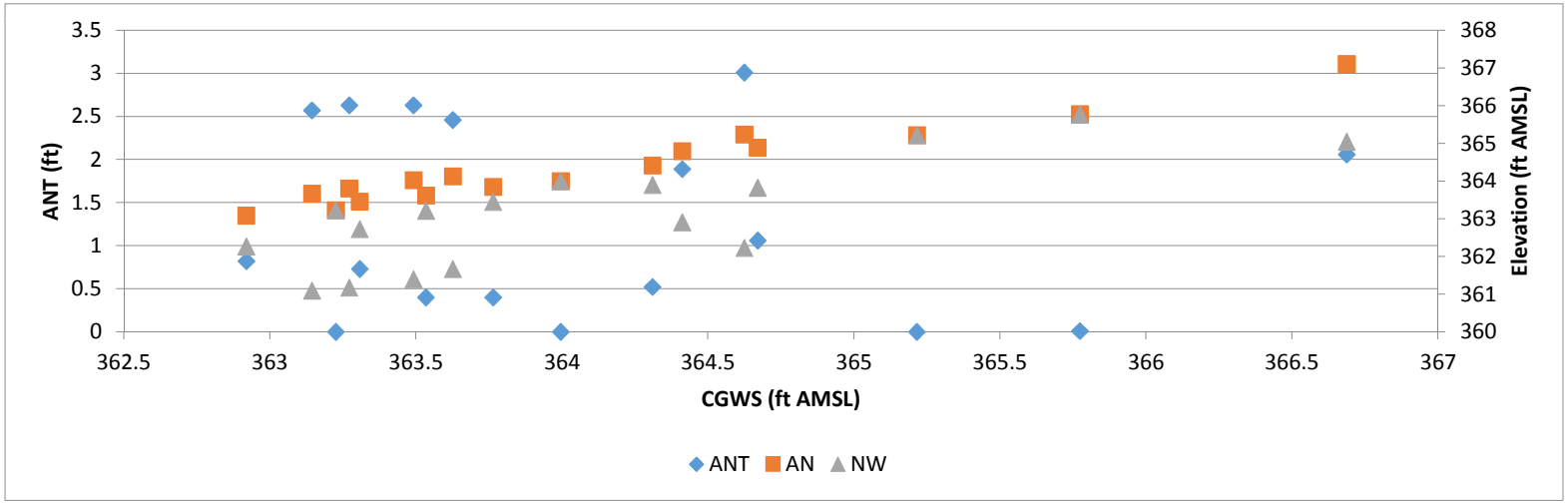
CGWS - corrected groundwater surface
ANT - apparent LNAPL thickness

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

Hydrostratigraph and Diagnostic Gauge Plot
B-14/UV-02/SC-05

Figure: 2-11





%RE & So adjusted by multiplier shown
%RE - percent reference emitter
So - LNAPL saturation

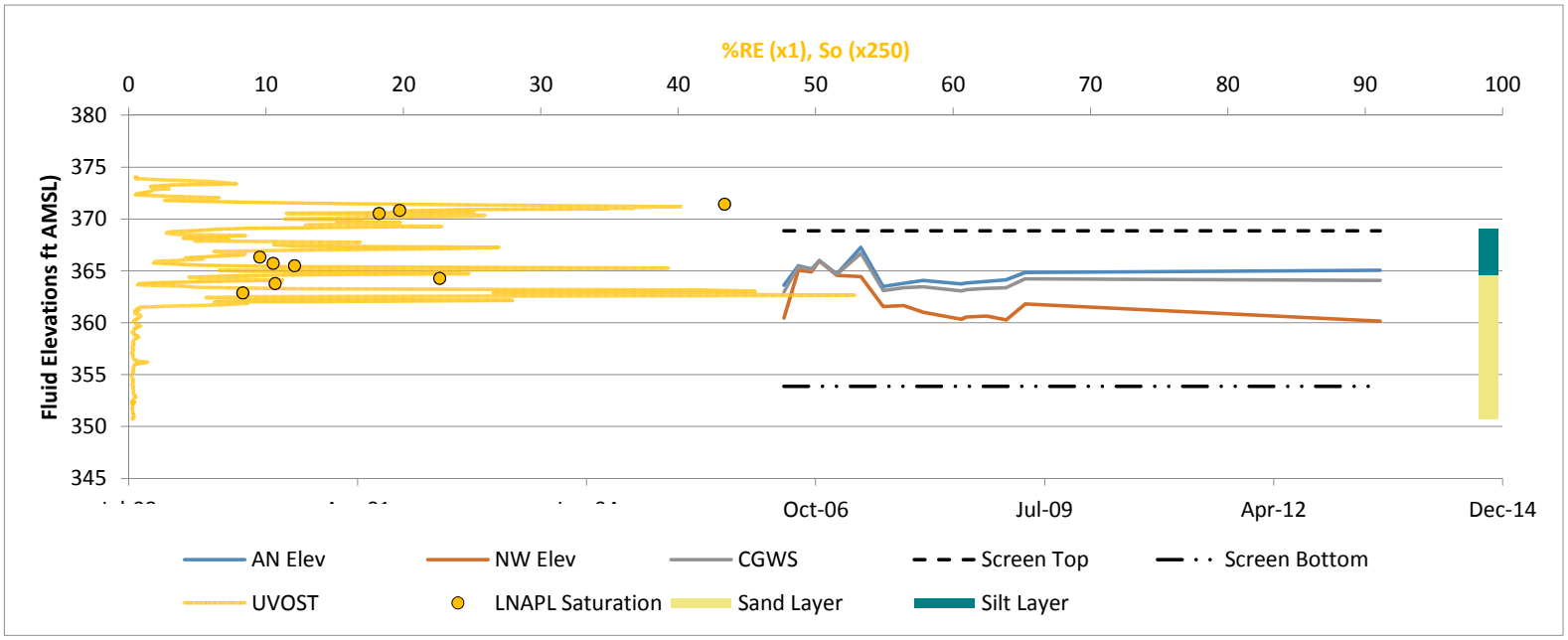
ft AMSL - feet above mean sea level
AN - air-LNAPL interface
NW - LNAPL-water interface

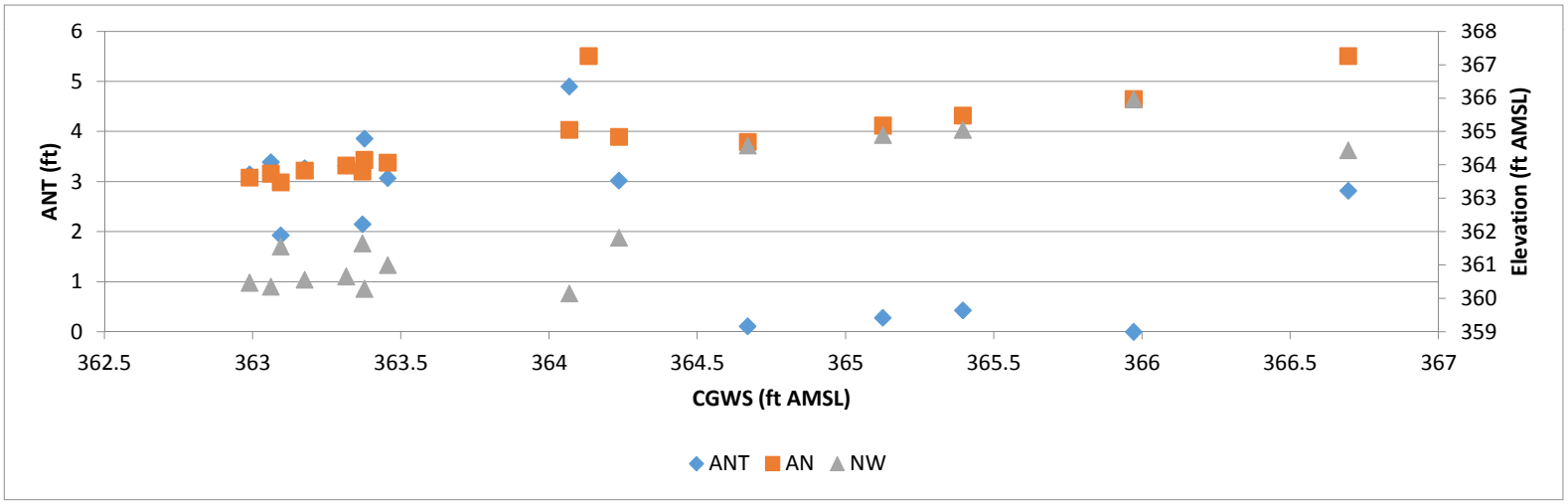
CGWS - corrected groundwater surface
ANT - apparent LNAPL thickness

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

Hydrostratigraph and Diagnostic Gauge Plot
S-9/UV-29/SC-03

Figure: 2-12





%RE & So adjusted by multiplier shown

%RE - percent reference emitter

So - LNAPL saturation

ft AMSL - feet above mean sea level

AN - air-LNAPL interface

NW - LNAPL-water interface

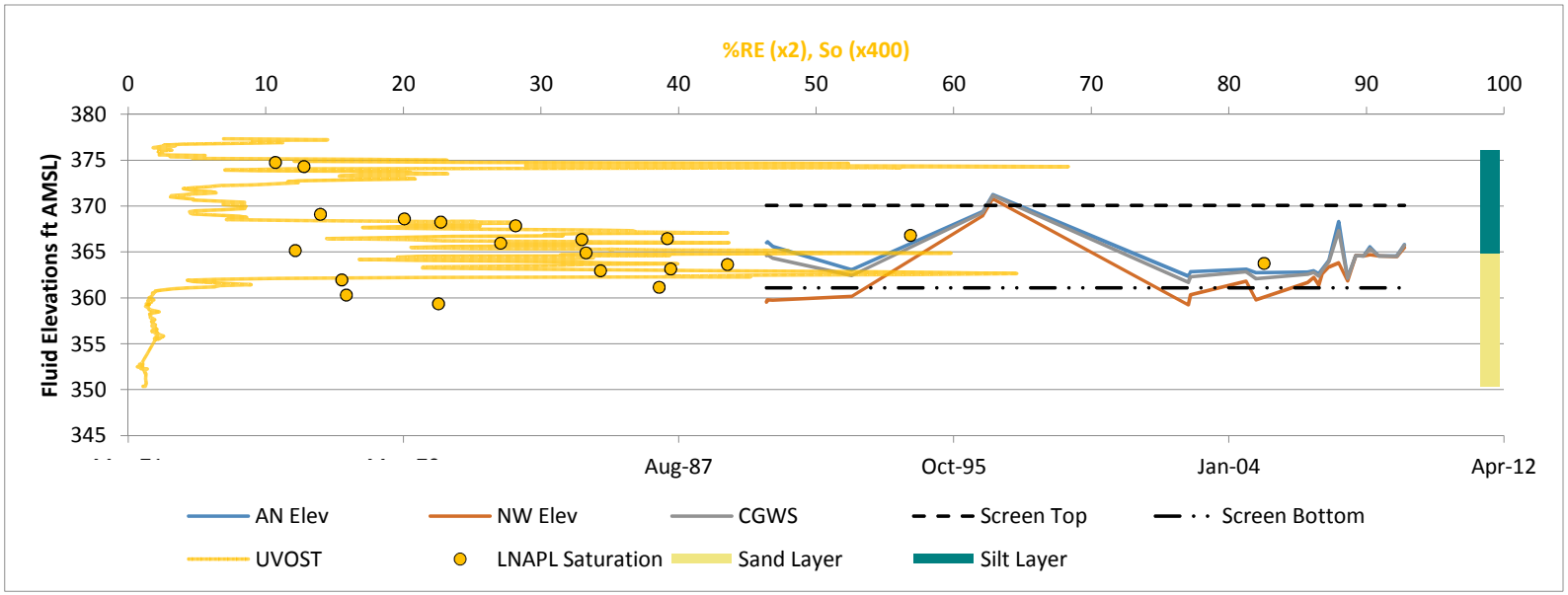
CGWS - corrected groundwater surface

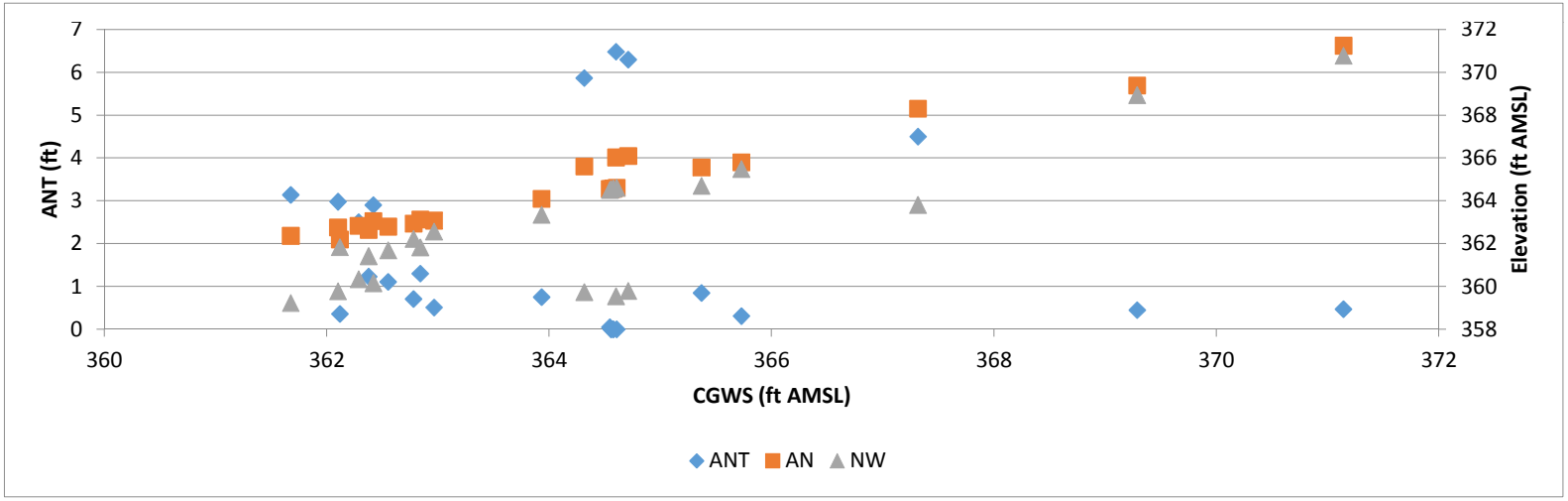
ANT - apparent LNAPL thickness

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

Hydrostratigraph and Diagnostic Gauge Plot
S-13/UV-15/SC-01

Figure: 2-13





%RE & So adjusted by multiplier shown

%RE - percent reference emitter

So - LNAPL saturation

ft AMSL - feet above mean sea level

AN - air-LNAPL interface

NW - LNAPL-water interface

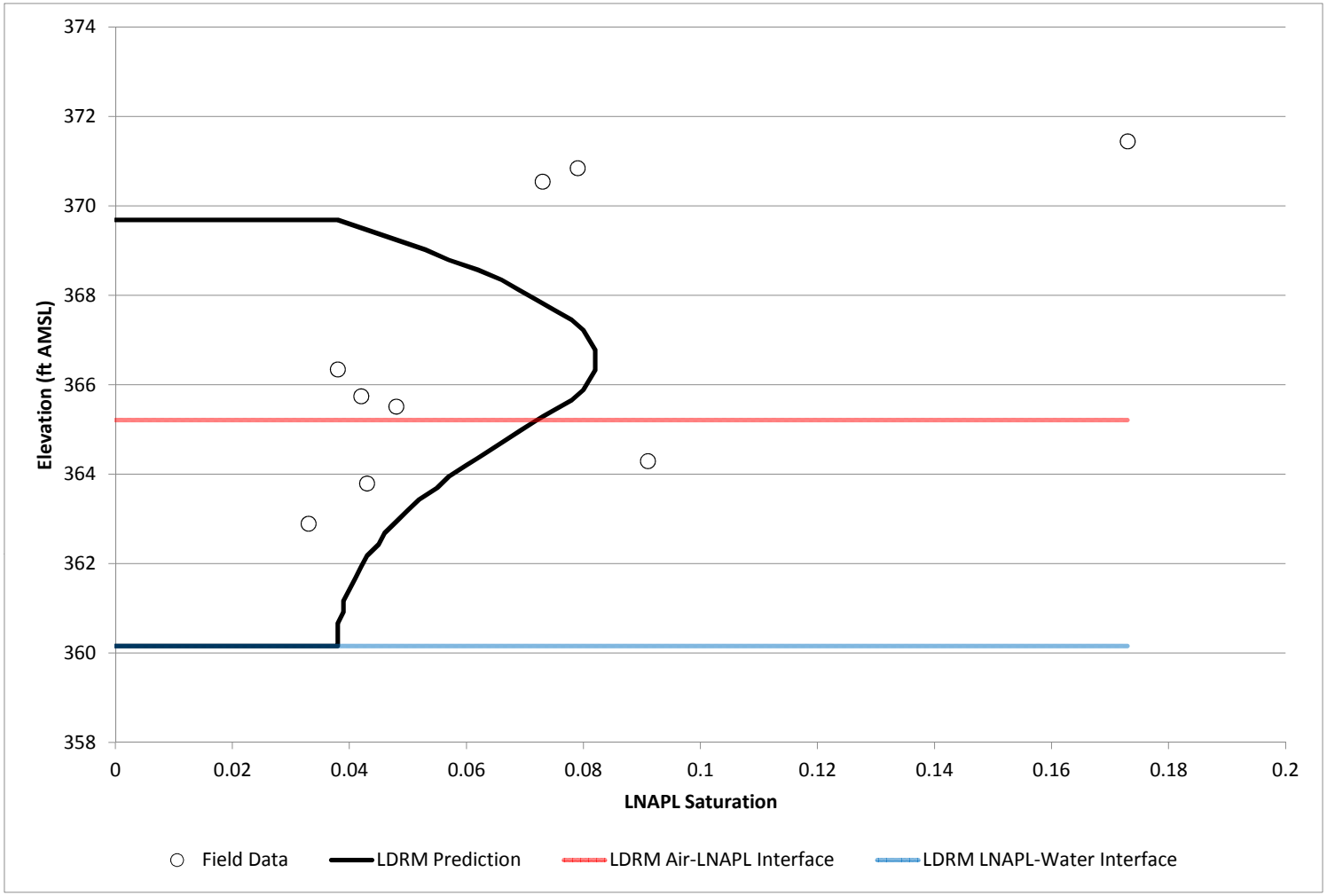
CGWS - corrected groundwater surface

ANT - apparent LNAPL thickness

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

Hydrostratigraph and Diagnostic Gauge Plot
SMW-11/UV-02/SC-05

Figure: 2-14

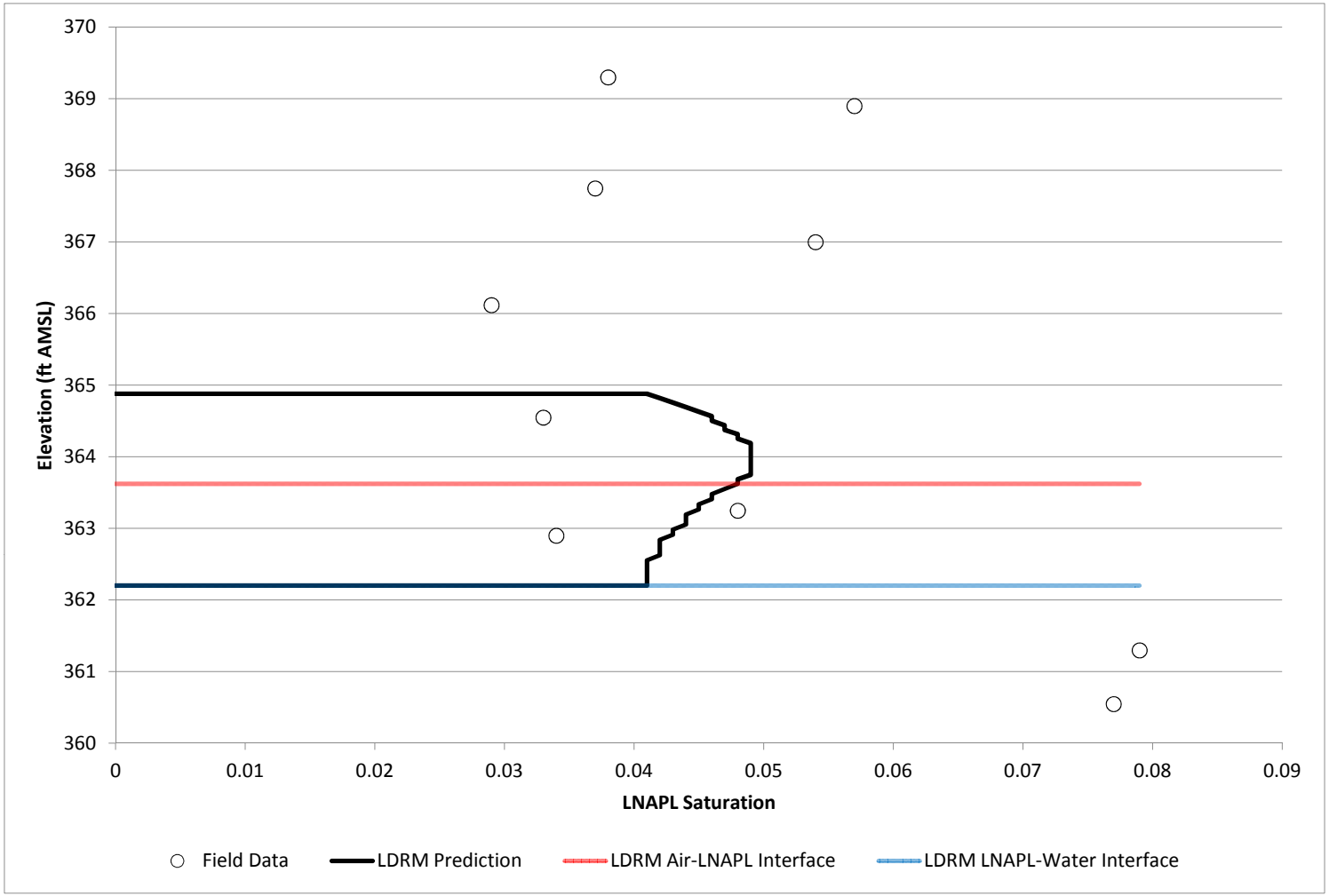


ft AMSL - feet above mean sea level

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

LNAPL Saturation Profile
SC-01

Figure: 2-15

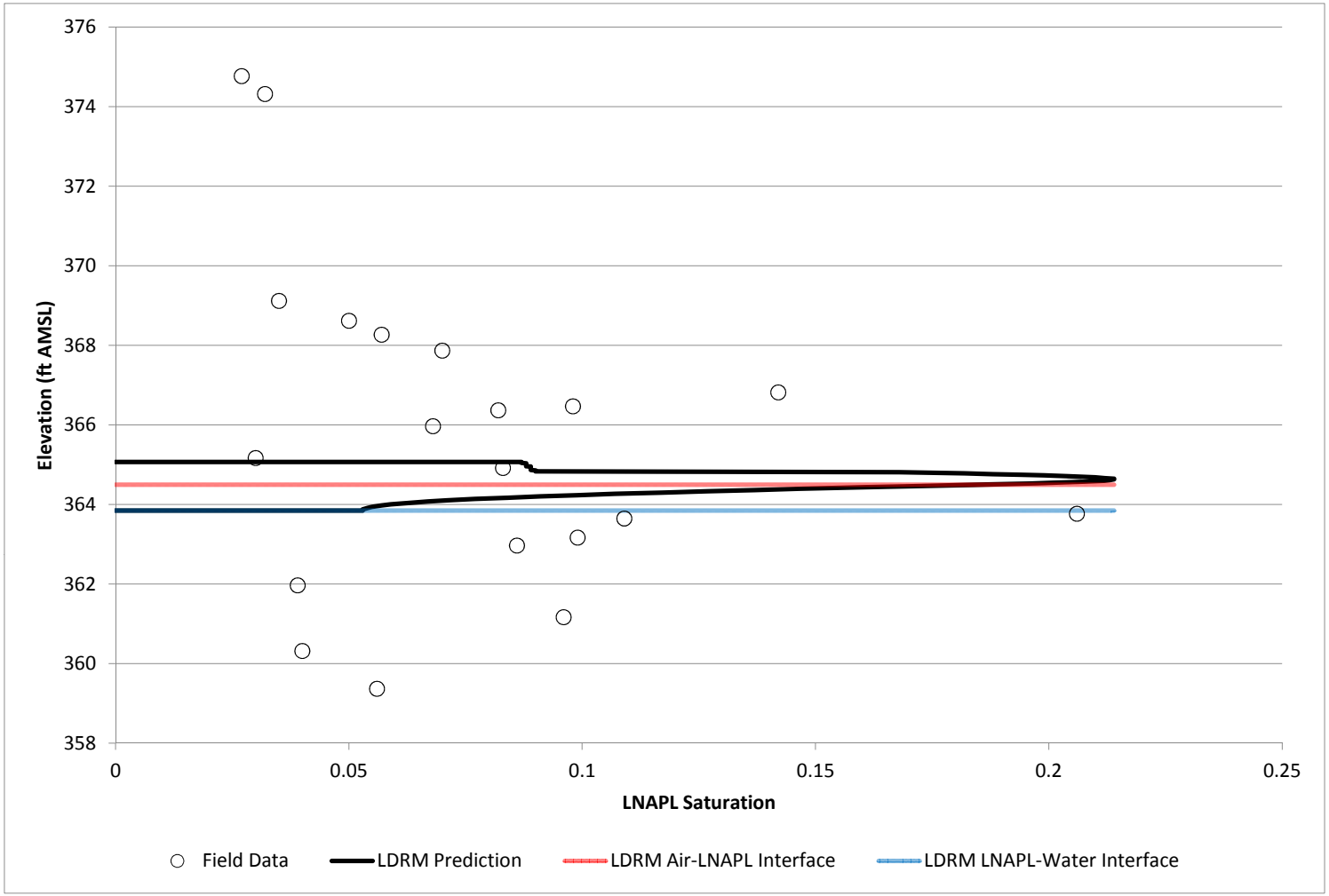


ft AMSL - feet above mean sea level

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

LNAPL Saturation Profile
SC-03

Figure: 2-16

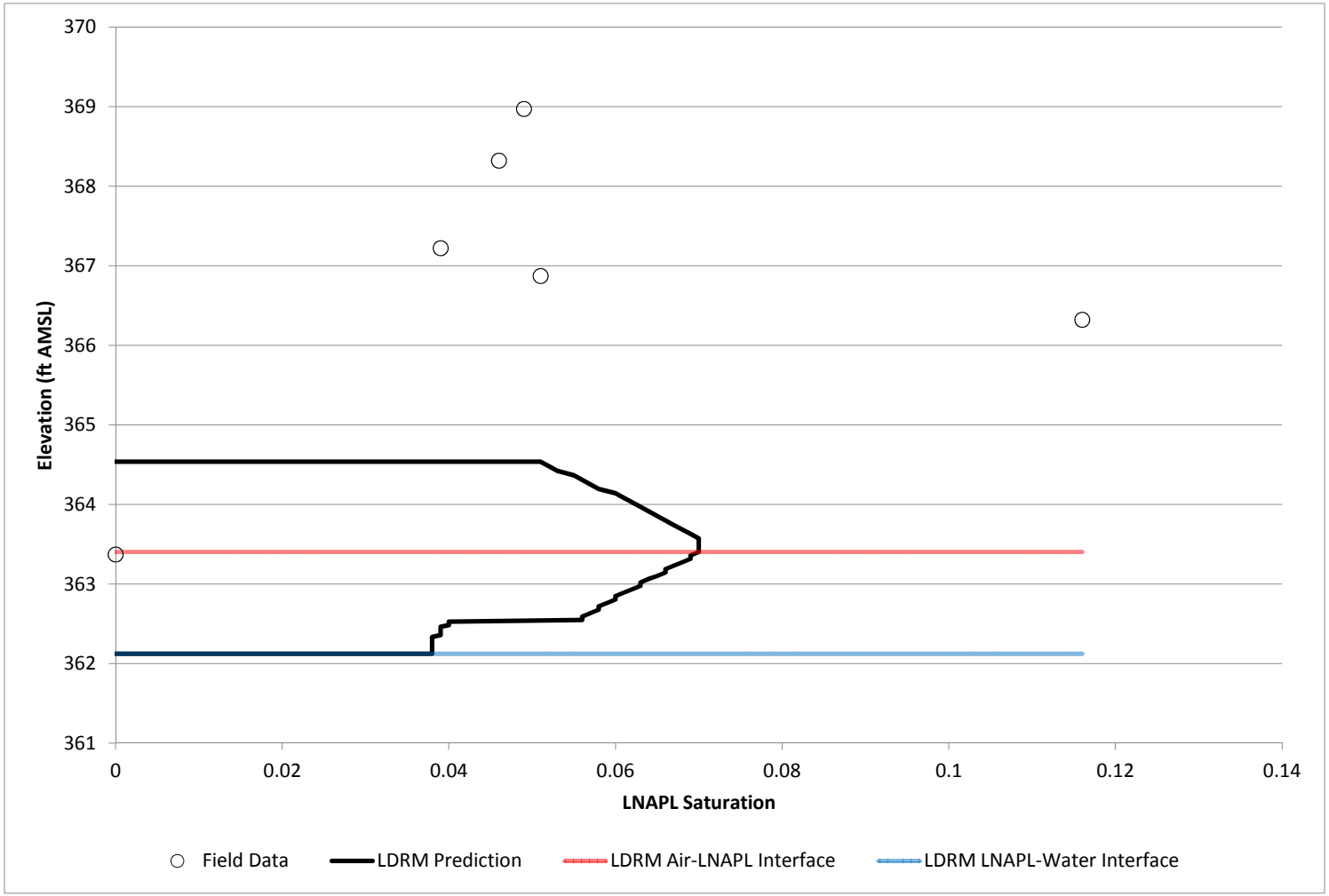


ft AMSL - feet above mean sea level

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

LNAPL Saturation Profile
SC-05

Figure: 2-17

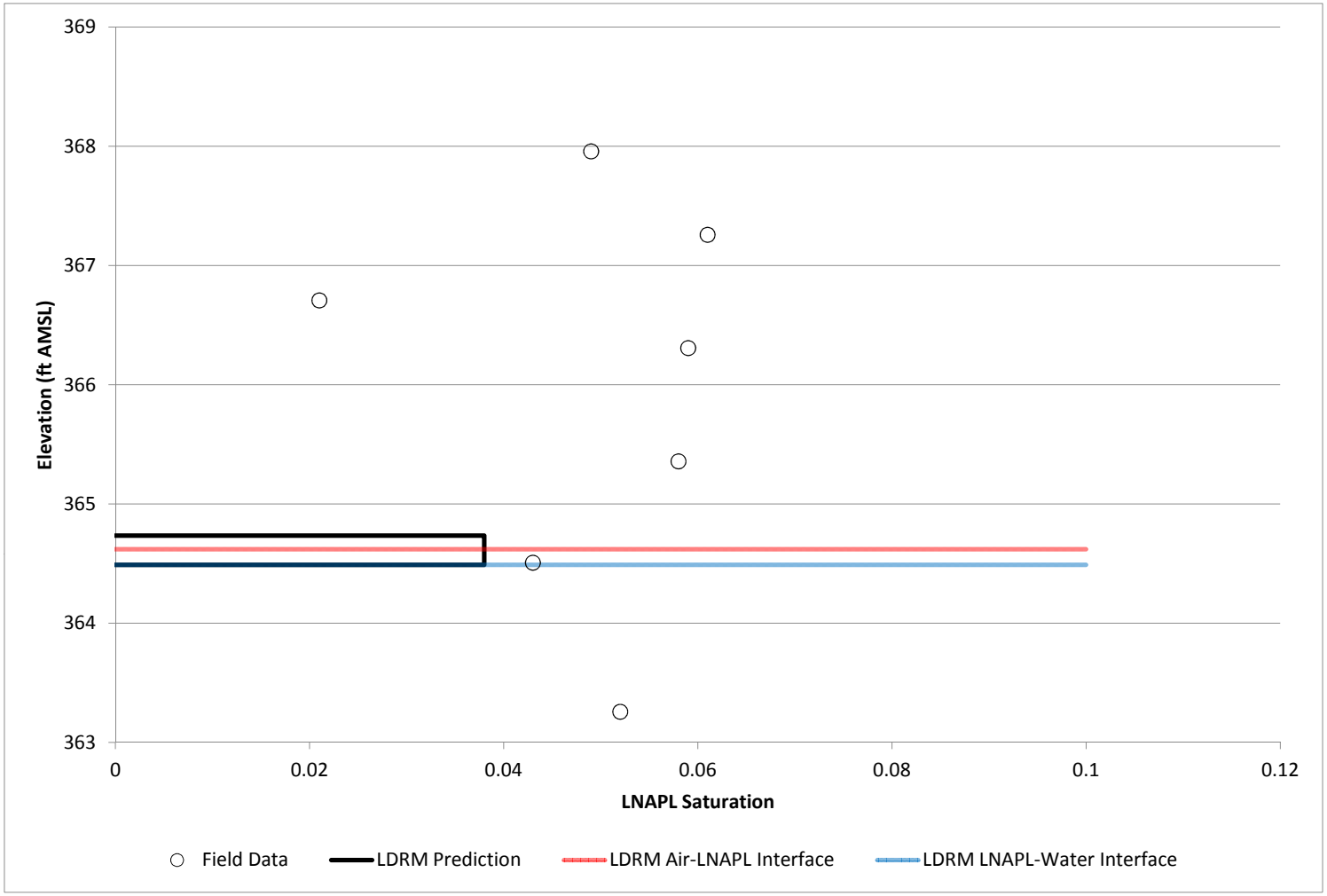


ft AMSL - feet above mean sea level

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

LNAPL Saturation Profile
SC-06

Figure: 2-18



ft AMSL - feet above mean sea level

Cold Springs Terminals
Lysander, New York
Date: 09-22-2014

LNAPL Saturation Profile
SC-07

Figure: 2-19

Appendix A

Field and Laboratory Methods

AECOM Environment

Prepared for:
Cold Springs Terminals
Mutual Defense Group
Albany, NY

Prepared by:
AECOM
Latham, NY
60248522
September 2014

Appendix A: Field and Laboratory Methods

Cold Springs Terminals
Lysander, New York
NYSDEC Spill #: 89-04923

Cold Springs Terminals
Lysander, New York
NYSDEC Spill # : 89-04923

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Appendix A. Calculations

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Table 1. Soil Sample Analysis Summary

Table 2. LNAPL Transmissivity Testing Summary

List of Acronyms

AMSL	Above mean sea level
API	American Petroleum Institute
AST	Aboveground storage tank
ASTM	ASTM International
Aztec	Aztec Technologies, Inc.
bgs	Below ground surface
CFM	Cubic Feet Per Minute
CO2	Carbon Dioxide
CPT	Cone penetrometer
Dn	Specific volume
EIP	Electronic Interface Probe
ft^2/d	Square feet per day
ITRC	Interstate Technology & Regulatory Council
L	Liter
LDRM	LNAPL distrobution and recovery model
LEL	Lower Explosive Limit
LIF	Laser induced fluorescence
LNAPL	Light nonaqueous phase liquid
LTR	Land Tech Remedial, Inc.
MPE	Multi Phase Extraction
MTBE	Methyl tert butyl ether
MVS	Mining Visualization System
O2	Oxygen
PAHs	Polycyclic aromatic hydrocarbons
PID	Photon Ionization Detector
PPB	Parts Per Billion
PPM	Parts Per Million
PPMv	Parts Per Million By Volume
PVC	Polyvinyl Chloride
Report	*Pilot Test Summary Report*
Rn	Recoverable volume
ROI	Radius of Influence
Site	Cold Springs Terminals property located in Lysander, New York
TDS	Total Dissolved Solids
TPH	Total petroleum hydrocarbon
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
UVOST®	Ultra-Violet Optical Screening Tool
VOC	Volatile organic compound
VEGE	Vacuum Enhanced Groundwater Extraction
Work Plan	*Supplemental Site Investigation Work Plan*
%PV	Percent of pore volume
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
µg/g	Micrograms per gram
µm	Micrometers
ZOI	Zone of Influence

1.0 Methods

This section provides a description of the tasks performed as detailed in the Supplemental Site Investigation Work Plan (November 2012). These data were collected and/or analyzed from August 2013 to July 2014 (Study Period). Deviations from, or data collected beyond that specified in the Work Plan, are noted in each applicable section. A site map is provided in the report as Figure 1-1.

1.1 Direct Sensing Technologies

Direct sensing technology was utilized to gain high resolution data regarding the areal and vertical extent of both LNAPL and soil type. This activity addresses the Work Plan goal of obtaining information concerning LNAPL spatial distribution. Laser induced fluorescence (LIF) was used to provide empirical data regarding the vertical distribution of LNAPL within the soil column. The Ultra-Violet Optical Screening Tool (UVOST®) instrument (Dakota Technologies, Fargo, ND) was selected for use at the Site.

Cone penetrometer (CPT) testing was selected to evaluate soil type. The CPT testing methodology utilizes direct push tooling to measure physical parameters that can be correlated to soil type. ConeTec Inc. (West Berlin, NJ) was utilized to advance combined UVOST® and CPT borings at the Site. A total of 35 UVOST®/CPT borings were advanced at 33 different locations at the Site (Figure 2-1) from July 22 to 25, 2013. The boring locations were selected to encompass the expected areal extent of LNAPL impacts, based on historic gauging data. Due to access limitations, UVOST®/CPT borings were not advanced within the footprint of the secondary containment berms of the two aboveground storage tank (AST) areas. Each UVOST®/CPT boring location was scanned for utilities using the New York state one-call system. Also, boring locations south of Hillside Road were hand augered to approximately 5 feet below ground surface (bgs) as an added precaution. Soil removed from hand augering was placed back in each boring. The UVOST®/CPT boring was then advanced through this disturbed soil. Each boring was advanced to probe refusal, which occurred at a depth of between 11.81 to 30.02 feet bgs. The average depth of all borings was 24.2 feet bgs.

1.2 Soil Analysis

Discrete and undisturbed soil samples were collected from the Site. Soil sampling objectives and collection/analysis methodology is discussed in separate sections below. The data described in this Section addresses the Work Plan goal of obtaining information concerning LNAPL residual saturation, LNAPL mobility and LNAPL recoverability.

1.2.1 Discrete Samples

The objective of the discrete soil sampling was to develop a correlation between a conventional soil analysis (i.e., total petroleum hydrocarbon [TPH]) and UVOST® readings. Discrete soil samples were collected from borings SC-01 and SC-06 (Figure 2-1) on August 14, 2013. Soil samples were collected using direct push methods. Soil samples were taken from intervals corresponding to high, medium and low UVOST® response depths. A total of five samples were taken from SC-01 from 1 to 14 feet bgs and four samples were taken from SC-06 from 9 to 14.5 feet bgs (Table 1). Samples were placed in two ounce glass jars with no headspace and submitted to Pace Analytical Services,

Inc. (Schenectady, NY) for analysis of gasoline and diesel range organics using analytical method SW-846 8015. As discussed in the report this comparison revealed no correlation.

1.2.2 Undisturbed Samples

Five soil borings (SC-01, SC-03, SC-05, SC-06, and SC-07) were collected from August 12 to 14, 2013 using undisturbed soil sampling techniques. This involved collection into lined, 3-inch diameter Macro-Core® samplers utilizing the Geoprobe® MC7 sampler (Geoprobe Systems, Salina, KS). Immediately following collection, the core barrel liners were sealed with plastic caps and frozen with liquid nitrogen. The cores were frozen to minimize movement of liquids within the collected soil cores and preserve fluid saturations and pore structure, to the extent possible. Soil cores were placed in coolers, packed in dry ice and submitted to PTS Laboratories, Inc. (Santa Fe Springs, CA) for core photography and soil and soil-fluid analyses.

Soil cores were photographed and analyzed for several parameters, including fluid saturation, grain size distribution, LNAPL mobility, and capillary pressure characteristics. The objectives of these analyses were to obtain quantitative estimates of LNAPL saturation versus depth/grain size, estimate the mobile and residual LNAPL fractions, and measure the capillary pressure parameters of the soil intervals containing the most significant LNAPL impacts. Table 1 contains a summary of the analytical testing performed on the undisturbed soil cores. The analytical testing procedures are described in the following sections.

1.2.2.1 Core Photography and Sample Interval Selection

The core samples were photographed under visible and ultraviolet light. A total of 72.5 feet of undisturbed soil cores were collected from the Site. The visible light photographs are used to identify changes in soil characteristics (color and texture), and the ultraviolet light is used to identify the presence of polycyclic aromatic hydrocarbons which exhibit visual fluorescence. The objective of core photography is to create a visual record of the soil cores, and to aid the selection of specific sample intervals for subsequent laboratory tests, as described below. In general, sample intervals were selected based on observed soil type and presence of LNAPL impacts, using a side-by-side comparison of both photographs and UVOST®/CPT logs. Sample plugs were obtained at the specified intervals from the cores at the laboratory while the core was in a frozen state.

1.2.2.2 Grain Size

The grain size analysis measures the grain size distribution using ASTM International (ASTM) D422 and D4464M methodology. The objective of the grain size analysis was to obtain a quantitative estimate of the changes in soil type at different depths. Grain size analyses were often paired with pore fluid saturation analyses to understand the relationship between soil type and LNAPL saturation. The soil grain size distributions of particle sizes larger than 75 micrometers (µm) (retained by the No. 200 sieve) were evaluated by sieving. The grain-size distributions of particle sizes finer than 75 µm (passing the No. 200 sieve) were evaluated using a laser light scattering method. This analysis also yields measurements of porosity, grain density and bulk density. A total of 60 samples were analyzed for grain size analysis. The tested sample depths from each core are listed in Table 1.

1.2.2.3 Pore Fluid Saturation

Pore fluid saturations in each core sample were analyzed using ASTM D2216 and American Petroleum Institute (API) methodology (API, 1998). The analysis is a distillation extraction method, the objective of which is to measure fluid (i.e., water and LNAPL) saturations which depend upon the distillation of the water fraction and the solvent extraction of LNAPL from a sample. The sample is

weighed and the water fraction is vaporized by boiling solvent. The water is condensed and collected in a calibrated receiver. Vaporized solvent also condenses, soaks the sample, and extracts the LNAPL. The sample is oven-dried and weighed, and the LNAPL content is then determined by gravimetric difference. This analysis also yields measurements of porosity, grain density and bulk density. A total of 33 samples were analyzed for pore fluid saturation. The tested sample depths from each core are listed in Table 1.

1.2.2.4 **Capillary Pressure**

The laboratory determined capillary pressure properties are used to predict the distribution of different immiscible fluids that are simultaneously present within a porous medium (e.g., air, water and LNAPL) (Amyx et al., 1960). Drainage capillary pressure properties for air and water were measured using the centrifugal technique following ASTM Method D6836. The method involves fully saturating the sample with water, and then displacing the water with air. The resulting water saturation at different applied pressure is recorded to develop the air-water drainage curve. It should be noted that the centrifuge method produces unrealistic forces far exceeding gravity drainage and therefore understates LNAPL residual saturation values.

The data derived from this test was utilized to estimate air-water drainage capillary properties using the equations derived by Brooks and Corey (1964) and van Genuchten (1980). The 'Brooks-Corey' parameters are necessary to calculate LNAPL entry pressure head. These parameters were calculated using least-squares regression of laboratory data. This analysis also yields measurements of porosity, grain density, bulk density, air permeability and hydraulic conductivity. A total of 7 samples were analyzed for capillary pressure. The tested sample depths from each core are listed in Table 1.

1.2.2.5 **Light Nonaqueous Phase Liquid Residual and Recoverable Fractions**

Centrifuge tests were performed on selected core samples to measure the percentage of residual and recoverable LNAPL using API methodology (API, 1998). Samples were generally chosen from zones with the highest soil core fluorescence response as observed from soil core photography, UVOST® boring logs and measured LNAPL thicknesses in nearby monitoring wells. The laboratory analysis methodology involves removing plugs from the soil cores and centrifuging them for one hour at a pressure that simulates 1,000 times the gravitational force to drain the sample of all recoverable LNAPL. The resulting values are extremely conservative estimates of the residual LNAPL saturation, and recoverable fractions. This analysis also yields measurements of the initial LNAPL saturation, porosity, grain density and bulk density. A total of 19 samples were analyzed using this analysis. The tested sample depths from each core are listed in Table 1.

1.3 Light Nonaqueous Phase Liquid Mobility Testing

The LNAPL mobility was evaluated using baildown tests. Measurement of LNAPL mobility is a goal of the investigation activities, as stated in the Work Plan. Prior to testing, a sitewide fluid level gauging event was performed to yield current estimates of LNAPL thickness and potentiometric surface elevations. Based on the initial gauging, it was observed that many wells contained a significant amount of silt and/or were dry. Therefore, 30 monitoring wells were redeveloped prior to baildown testing to remove this silt and thus improve the accuracy of baildown tests.

Fluid testing was also performed on Site groundwater and LNAPL to derive physical properties used to estimate recoverability. The fluid gauging, redevelopment, baildown fluid testing procedures are discussed below.

1.3.1 Fluid Level Gauging and Well Redevelopment

A comprehensive fluid level gauging event was performed at the Site on July 11, 2013. Fluid levels (depth to LNAPL, depth to water, total well depth) were attempted on 114 known groundwater monitoring well locations. Fluid elevations were measured using an oil-water interface probe, with depth measurements taken relative to the top of casing elevation. The depth to LNAPL, depth to water and total depth measurements were recorded in a dedicated field notebook.

Well redevelopment activities were performed in August 2013 to remove accumulated silt/fines observed in monitoring wells. Redevelopment was targeted on wells with large observed LNAPL thicknesses, or wells which formerly had LNAPL and did not have LNAPL during the July 2013 event. A total of 30 wells were redeveloped by various pumping/surging techniques. Initially, a vacuum truck was mobilized to the Site (Clean Harbors, East Syracuse, NY) for development activities. A stinger was constructed and inserted into the screened interval; a vacuum was then applied to remove silt and fluid from the well. The well was then surged with a surge-block and tubing in an attempt to clean the sand pack. This method proved to be inefficient, as there was difficulty accessing the wells with the vacuum truck and associated equipment. Additional wells were developed utilizing an inertia pump with 5/8 inch tubing fitted with a check valve and surge block. Redevelopment continued until the total depth was within 10 percent of the constructed depth and the extracted fluid was visually clear of sediment. Extracted fluids were initially containerized and stored on-site in a 500-gallon plastic tank within the footprint of a former tank bottom.

1.3.2 Baildown Testing

LNAPL transmissivity measurements were performed via baildown testing at 21 wells containing a measurable (approximately 0.5 feet or greater) LNAPL thickness through different areas of the Site. Table 2 summarizes the wells where LNAPL transmissivity testing was completed, as well as relevant well construction information. LNAPL transmissivity is used to estimate LNAPL mobility and recoverability. The baildown tests and the resulting data analysis were completed in accordance with ASTM standards (ASTM, 2012). Baildown tests were completed by removing a measured volume of LNAPL, approximately equal to the volume in the well casing and annular material (when possible) to ensure recharge is occurring from the formation, followed by monitoring of the LNAPL recovery through gauging of the fluid interfaces and calculating recovered volume based on well geometry.

1.3.3 Fluid Testing

Groundwater and LNAPL samples were collected from monitoring wells A-16 and S-13 for laboratory testing on June 26, 2014 and July 2, 2014, respectively. The objective of this sampling was to obtain fluid parameters necessary for use in LNAPL distribution and recoverability modeling (see Section 2.4). One liter (1 L) of groundwater and LNAPL was collected from each well and submitted for analysis to PTS Laboratories, Inc. The LNAPL and groundwater were analyzed for the following parameters:

- Air/water surface tension (ASTM D971)
- Air/LNAPL interfacial tension (ASTM D971)
- LNAPL/water interfacial tension (ASTM D971)
- LNAPL and water density (ASTM D1481)
- LNAPL and water viscosity (ASTM D445)

The work plan had included the collection of LNAPL samples from each of the pilot test wells; however there was not sufficient volume for analysis in two of the four wells tested.

1.4 Light Nonaqueous Phase Liquid Modeling

A model capable of predicting the vertical distribution and recoverability of LNAPL was developed using the LDRM (Charbeneau, 2007). This model addresses the Work Plan goal of developing an understanding of the recoverability of LNAPL. The LDRM model was developed using site-specific input parameters (e.g., fluid elevations, fluid physical properties, soil capillary properties), and was initiated by comparing model predictions of LNAPL vertical saturation profile and transmissivity to actual measurements. A description of the calibration process of the LDRM model is included in Appendix A.

The purpose of LNAPL modeling is to estimate the total and recoverable LNAPL mass. However, heterogeneous site conditions did not result in meaningful output from the LDRM model with respect to recoverability.

1.5 Extraction Pilot Test Procedures

Based on the Site history and a desk top remedial alternatives analysis screening completed by the project stake holders, Vacuum Enhanced Groundwater Extraction (VEGE) and Multi Phase Extraction (MPE) were chosen as a potentially applicable extraction based remedies. Inputs to this desktop screening include site setting, site remedial history, site geology, and site hydrogeology. This process included all project stakeholders including the NYSDEC. AECOM was selected to conduct specified testing in order to further evaluate the effectiveness of these potential remedies. The goals for these tests were to determine if VEGE and or MPE is an applicable remedial technology for the site and if so establish the criteria necessary in order to complete a full scale design for MPE.

For the purposes of this report VEGE and MPE can be defined as remedies that produce nearly identical effects on the subsurface. They both result in the recovery of total fluids to a controlled depth, and they both apply a vacuum to the formation which results in increased fluid flow rates and recovery of voltatiles through soil vapor extraction. The two technologies differ in terms of how they remove the total fluids. VEGE removes LNAPL/water and soil vapors through separate conveyance pipes, and MPE combines LNAPL/water and soil vapors into a common stream. One major advantage to VEGE is that having separate streams allows operators to more easily quantify extraction rates of each fluid. This is particularly useful for pilot testing approaches as it is extremely important during pilot testing to be able to quantify NAPL recovery rates vs time/drawdown/and applied vacuum. During full scale remediation the main advantage to VEGE is balancing flow/drawdown in a complex well network. It is AECOM's experience that with a complex well network it becomes extremely difficult to maintain a balanced drawdown and flow across a large site within a MPE system. It is even more difficult to optimize a system with a MPE set up.

1.5.1 Pilot Testing Plan

A total of four existing wells were selected to be the Test Wells for the field pilot test. The original plan for testing was to conduct tests on 7 individual wells during a 4 day period. However, it was determined during planning stages that in order to maximize data collected over the 4 day period it would be more efficient to limit the testing to 4 wells, with approximately 8 hours of test time on each well selected.

The wells selected included, S-5, A-16, S-3 and S-15 (Figure 1-1 or the report). These selections were based, in part, upon data obtained through the supplemental subsurface investigation. Criteria used in choosing pilot test wells included: location (Site-wide coverage), well construction (screen interval, depth and well diameter), presence of LNAPL, LNAPL composition (% of gasoline), proximity of nearby observation wells, geology, and representation of Site-wide hydrogeologic conditions. The wells selected represent the two wells with the highest transmissivity values (S-3 and S-5) across the site and one with lower transmissivity A-16 based on the baildown test data. Each is a 4 inch well with screened intervals targeting the expected smear zone of LNAPL. Well S-15 was selected as it met the criteria of being a 4 inch well with a screen interval targeting the expected smear zone and was provided a test point in the eastern terminal tank basin. Prior to testing, all test wells and surrounding wells to be used as observation wells were re-developed to remove all fines from the well screened interval.

Another consideration for testing was to ensure that at least one of each test (VEGE/MPE) was completed during the four day testing period. VEGE is typically better for testing purposes because it allows for separation of vapor and fluids at the well and allows for easier methods to quantify water/LNAPL recovery. MPE however is more versatile as it can be accomplished in smaller diameter wells and does not require space for insertion of a separate pump. In general VEGE was to be used if possible based on the diameter, depth, and screened interval of the wells selected for testing. The complete pilot testing procedures are discussed in detail below.

1.5.2 MPE Pilot Testing Procedures

On June 23 through June 26, 2014, AECOM conducted an MPE pilot test on wells S-5, A-16, S-3, and S-15. Initially baseline readings of depth to LNAPL/depth to water and depth to bottom on the Test Well and the surrounding monitoring points/wells were taken.

The first stage of the eight hour test was the Zero Vacuum Test. A drop tube set up was used for Test Well S-5 with the tube set approximately one foot above the bottom of the well. A top loading pneumatic pump was used for wells A-16, S-3, and S-15and was set approximately six inches off the bottom of the well. The drop tube set up or the pump were turned on and run for one hour. The depth to water/depth to LNAPL in the Test Well and in the surrounding monitoring points/wells at various radial distances from the Test Well was gauged to observe any effect of the pumping to the wells. In addition water/LNAPL recovery rates from the test well were recorded at regular intervals during this step.

The next stage of testing was a Vacuum Step Test, which consisted of connecting the vacuum to the closed wellhead while step-wise increasing the applied vacuum. The Step Test was conducted to establish a relationship between the applied vacuum to the wellhead and the soil vapor recovery rate for each Test Well. This data was then used to select three vacuums to use for short term Constant Rate Step Tests to be conducted at each Test Well. The Step Test was only conducted on the first day on S-3 and the three vacuums to be used for the remaining wells were based off these results. The results indicated that vacuums of approximately 5 “Hg, 8 “Hg and 13 “Hg would be used for the four separate MPE tests.

Three separate vacuums were selected for the MPE Constant Rate Test. Each step of the MPE Constant Rate Test was run at a stable vacuum for two hours. Once one step was completed at a specified vacuum, the vacuum was increased without interruption of the test. This part of the test required three different vacuums applied (decided upon based on the step test). After three steps were completed at three different vacuums, the blower and pump were shut off and the depth to

LNAPL/water was measured. During the course of the test, the water flow rate, applied vacuum, and induced vapor flow rates from the recovery well were monitored at regular intervals. Also, the monitoring points/wells in the vicinity of the extraction well were monitored at regular intervals for observed vacuum, depth to water, and depth to LNAPL. In order to establish a radius of influence (ROI) pressure values were recorded at varying distances from each Test Well to measure formation response to the applied vacuum. The VOC concentration at the effluent of the blower was also measured. Over the course of the test, the water/LNAPL flow rate, applied vacuum, and induced vapor flow rates from the recovery well were monitored at regular intervals.

The final stage in the pilot test was the Recovery Step. This step lasted for approximately one hour with readings on the Test Well taken approximately every five minutes, and the readings on the monitoring wells taken every 15 minutes. This was to observe how quickly the groundwater in the wells was able to be recharged after being pumped down during the MPE Constant Rate Steps. Readings collected during recovery testing consisted of depth to product (DTP) and depth to water (DTW) in each of the points monitored throughout the course of the test.

The monitoring points/wells that were monitored during the MPE Testing are shown in Figure 2-1, and are located at various radial distances from S-5, A-16, S-3, and S-15 as indicated in the following table. The baseline and operating parameters monitored are discussed in the following sections.

Monitoring Point/Well ID	Distance to S-5 (ft)
A-5	63
AMW-1	51
A-13	48
A-18	61
A-14	32
S-18	82
A-24	105
AMW-3	44
S-13	51
A-9	43
S-1	46

Monitoring Point/Well ID	Distance to A-16
A-7	68
A-12	69
AMW-9	36
A-19	39
A-11	39
A-10	67

Monitoring Point/Well ID	Distance to S-3
S-7	44
B-16	24
MW-B	4
S-2	44
MW-A	46
S-6	61

Monitoring Point/Well ID	Distance to S-15
S-16	44
S-25	50
S-20	21
MW-7	15

1.5.3 Baseline Data Collection

Prior to initiation of the pilot test each day, baseline monitoring of subsurface conditions was performed and the integrity of all systems and connections was inspected. This was conducted at the Test Well and the corresponding monitoring wells. The parameters listed below were measured at the MPE Test Wells, monitoring points/wells, and prior to commencement of the tests and at regular intervals during the test.

- Depth to LNAPL – measured from the top of casing (TOC) with an interface probe/groundwater level meter;
- Depth to Groundwater (DTW) – measured from the TOC with an interface probe/groundwater level meter;
- Depth to Bottom (DTB) – measure from the TOC with an interface probe/groundwater level meter (only collected as part of the baseline data);
- Applied/Observed Pressures (i.e. vacuums) – measured at the Test Well and monitoring points/wells wellheads with a digital manometer.

1.5.4 Data Collection During the Pilot Test

The following readings were collected at regular intervals throughout the pilot testing from the Test Well and monitoring points/wells:

Test Well

- Applied Pressure (i.e. vacuums) at the Test Wellhead (i.e. vacuum applied on the interstitial space of the well/on the formation) and on the “Drop Tube” (i.e. vacuum required to lift/overcome losses to recovery of groundwater entrained in the soil vapor stream) – measured with a digital manometer;
- Soil Vapor Flow – measured with a differential pitot tube using a digital manometer;
- Soil Vapor Temperature – measured with a hot-wire anemometer;
- Groundwater and LNAPL Levels in the Test Well –using an interface probe/groundwater level meter during the recovery stage of the test;
- Volatile Organic Compounds (VOCs), oxygen (O2), carbon dioxide (CO2), and Lower Explosive Level (LEL) – measured with a calibrated MiniRae 5-gas meter. Only measured for wells S-3 and S-16 due to equipment failure during testing on S-5 and A-16;

- Soil Vapor Sample (one from each test well) – a grab sample collected from the effluent vapor stream during testing, with a 6-liter SUMMA canister that was submitted for analysis by EPA TO-15; and
- Groundwater Sample (one from each test well) –a grab sample collected from each Test Well, for lab analysis for Metals, TDS, TSS, and VOCs, which could affect the treatment system design.

Monitoring Points/Wells

- Depth to Product (DTP) – measured from the TOC with an interface probe/groundwater level meter;
- Depth to Groundwater (DTW) – measured from the TOC with an interface probe/groundwater level meter;
- Volatile Organic Compounds (VOCs), oxygen (O2), carbon dioxide (CO2), and Lower Explosive Level (LEL) – measured with a calibrated MiniRae5-gas meter. Only measured on monitoring wells surrounding Test Wells S-3 and S-16 due to equipment failure during testing on S-5 and A-16; and
- Applied/Observed Pressure (i.e. vacuums) –in the zone measured with a digital manometer from a sample port on a wellhead cap.

1.6 Investigative Derived Waste

A total of five 55-gallon drums containing well development fluid and LNAPL were generated from the baildown tests. Approximately 2,000 gallons of LNAPL and water were generated during the pilot tests. Investigation derived LNAPL and water was transported by Op-Tech Environmental Services, Inc. (East Syracuse, NY) for recycling at Industrial Oil Tank Services Corporation (Oriskany, NY). No investigation derived wastes remain at the Site.

Tables

Table 1
Soil Sample Analysis Summary
Cold Springs Terminals Site
Lysander, New York

Boring	Sample Interval (ft bgs)	Core Recovery (ft)	Core Photography	Depth of Analysis (ft bgs)				Number of TPH Analyses
				Grain Size Sample	Pore Fluid Saturation	Air-Water Drainage Capillarity	LNAPL Mobility	
SC-01	0-3	2.95	X	2.7, 2.8	2.7	--	--	0
SC-01	3-6	2.5	X	3.3, 3.6, 5.3	3.3, 3.6	--	--	0
SC-01	6-9	2.85	X	7.05, 7.8, 8.25	8.63	8.25	7.8, 8.4	0
SC-01	9-12	3	X	8.63, 9.85, 10.35, 11.35, 11.85, 12.8	9.85	11.35, 11.85	10.35, 11.25	0
SC-01	12-15	3	X	--	--	--	--	0
SC-01	1-2	NA	--	--	--	--	--	1
SC-01	4-5	NA	--	--	--	--	--	1
SC-01	5-6	NA	--	--	--	--	--	1
SC-01	8.5-9.5	NA	--	--	--	--	--	1
SC-01	13.5-14	NA	--	--	--	--	--	1
SC-03	2-5	2.35	X	3.75, 4.15	3.75, 4.15	--	--	0
SC-03	5-8	2.25	X	5.3, 6.05, 6.93	6.93	--	5.3, 6.05	0
SC-03	8-11	2.5	X	9.95	10.15	9.95	8.5, 9.8	0
SC-03	11-14	2	X	11.75, 12.5, 14.5	12.5	--	11.75	0
SC-03	14-17	3	X	--	--	--	--	0
SC-05	1-4	2	X	2.5, 2.95	2.5, 2.95	--	--	0
SC-05	4-7	2.95		6.5	--	--	--	0
SC-05	7-10	2.85	X	8.15, 8.65, 9, 9.4	8.15, 9	--	--	0
SC-05	10-13	2.75	X	10.65, 10.9, 11.3, 12.1, 12.35	10.45, 10.9, 11.3, 12.1	10.65	10.8, 12.35	0
SC-05	13-16	3	X	13.5, 13.8, 14.1, 14.3, 15.3	13.5, 14.1, 14.3	--	13.62, 15.3	0
SC-05	16-19	3	X	16.1, 16.9, 17.9	16.1, 16.95, 17.9	--	--	0
SC-05	19-21	1.35	X	19.45	--	--	--	0
SC-05	21-24	2.4	X	21.1	--	--	--	0
SC-06	8-11	2.3	X	9.5, 10.15	9.5, 10.15	--	--	0
SC-06	11-14	2.5	X	11.4, 11.6, 12.15	11.25, 12.15	11.4	11.6	0
SC-06	14-17	3	X	15.1	15.1	--	--	0
SC-06	17-19	2	X	--	--	--	--	0
SC-06	9-10	NA	--	--	--	--	--	1
SC-06	10-11	NA	--	--	--	--	--	1
SC-06	12.5-13.5	NA	--	--	--	--	--	1
SC-06	13.5-14.5	NA	--	--	--	--	--	1
SC-07	7-10	3	--	--	--	--	--	0
SC-07	10-13	2.65	--	--	--	--	--	0
SC-07	13-16	2.95	X	13.8, 14.5, 15.05, 15.45, 15.9	13.8, 14.5, 15.45	--	15.05	0
SC-07	16-18	1.9	X	16.2, 16.4, 17.25	--	16.2	16.4, 17.25	0
SC-07	18-21	1.9	X	18.5	18.5	--	--	0

Notes:
ft - feet
ft bgs - feet below ground surface
TPH - total petroleum hydrocarbons
NA - sample was not collected via undisturbed methods

Table 2
LNAPL Transmissivity Testing Summary
Cold Springs Terminals
Lysander, New York

Well	Test Start Date	Test End Date	TOC (ft AMSL)	Ground Surface (ft AMSL)	TOS (ft bgs)	BOS (ft bgs)	Well Diameter (in)	Borehole Diameter (in)
A-8	9/17/2013	10/16/2013	377.68	378.24	7	20.09	2	8
A-10	9/17/2013	10/16/2013	373.98	371.86	4	14.14	2	8
A-12	9/17/2013	10/16/2013	373.02	370.97	5	15.22	4	10
A-13	9/16/2013	10/16/2013	374.45	372.07	4	20.73	4	10
A-14	9/16/2013	10/16/2013	374.24	371.34	7	21.84	4	10
A-16	9/17/2013	10/16/2013	373.62	371.02	4	18.30	4	10
A-17	9/17/2013	10/16/2013	372.27	370.78	4	17.65	4	10
A-25	9/17/2013	10/16/2013	374.62	372.50	4	15.99	2	8
AMW-9	9/17/2013	10/16/2013	376.16	370.32	5.5	14.18	2	6
BMW-5	9/20/2013	10/16/2013	389.59	388.05	10	26.70	2	8
S-1	9/16/2013	10/16/2013	375.64	377.54	5	17.85	4	10
S-2	9/18/2013	10/16/2013	375.02	376.82	5	16.45	4	10
S-3	9/19/2013	10/16/2013	373.22	374.84	5	15.87	4	10
S-5	9/19/2013	10/16/2013	373.35	375.13	5.5	14.30	4	10
S-9	9/18/2013	10/16/2013	372.22	372.94	5	17.95	2	8
S-12	9/19/2013	10/16/2013	372.67	370.07	3	12.70	2	8
S-13	9/19/2013	10/16/2013	372.75	373.87	5	15.00	4	10
S-16	9/18/2013	10/16/2013	370.08	368.59	3	13.65	2	8
S-17	9/18/2013	10/16/2013	369.38	368.14	4	10.84	2	8
S-24	9/18/2013	10/16/2013	371.18	368.88	3	10.31	2	8
SMW-5	9/18/2013	10/16/2013	371.32	369.07	5	12.48	2	unknown

Notes:
BOS - bottom of screen
LNAPL - Light Nonaqueous Phase Liquid
TOC - top of casing
TOS - top of screen
ft AMSL - feet above mean sea level
ft bgs - feet below ground surface
in - inches

Appendix A

Calculations

AECOM

JOB TITLE Cold Springs Terminals
JOB NO. 60248522 CALCULATION NO. 1
ORIGINATOR M. ZEUKER DATE 3/21/2014
REVIEWER _____ DATE _____
SCALE — SHEET NO. 1 OF 1

CALCULATE LNAPL ENTRY PRESSURE HEAD

$$\text{LNAPL Entry Pressure Head} = \Delta\psi = \left[\frac{\sigma_{ow}/\sigma_{aw}}{1 - P_o/P_w} - \frac{\sigma_{ao}/\sigma_{aw}}{P_o/P_w} \right] \psi_{baw}$$ Eqn. 3.5.24 API (1999)

where:

σ_{ow} = oil/water interfacial tension
= 20 dynes/cm (assumption)

σ_{aw} = air/water surface tension
= 65 dynes/cm (assumption)

σ_{ao} = air/oil surface tension
= 25 dynes/cm (assumption)

$\frac{P_o}{P_w}$ = 0.78 (assumption)

ψ_{baw} = air-water bubbling pressure
= 8.59 feet of water (Table 4-2; sample SC-01 6-9)

$\Delta\psi$ = 7.8 feet of water

$\Delta\psi$ = 10.0 feet of LNAPL

API (1999) Free-Product Recovery of Petroleum Hydrocarbon Liquids, Health and Environmental Sciences Department Publication 4682 June 1999

Grid: 5x5 = 1 in

AECOM

JOB TITLE Cold Springs Terminals
JOB NO. 60248522 CALCULATION NO. 2
ORIGINATOR M. ZENICER DATE
REVIEWER DATE
SCALE — SHEET NO. 1 OF 1

LNAPL VOLUME CALCULATION

SC-01 core:

Total LNAPL (D_n) = 0.2485 ft
Recoverable LNAPL (R_n) = 0.088 ft
} Table 4-1

Area of LNAPL EXTENT = 16,926 ft² (FIGURE G-1)

Total Volume = D_n x Area x 7.48 gallons/ft³
= 31,464 gallons

Total Recoverable Volume = R_n x Area x 7.48 gallon/ft³
= 11,193 gallons

* Calculation repeated for all soil cores.

Grid: 5x5 = 1 in

Project Management Initials: Designer: JM Checked:____ Approved:____ ANSI B 11" x 17"

Last saved by: MORALESJ (2014-09-29) Last Plotted: 2014-09-29
Filename: C:\USERS\MORALESJ\DESKTOP\PROJECTS - SUPPORT FILES\COLD SPRINGS\140920\CAD\60248522 - FIGURE A-1.DWG

AECOM

Figure: A-1

AREA CALCULATION OF LNAPL EXTENT
SEPTEMBER 2014

COLD SPRINGS TERMINALS
LYSANDER (COLD SPRINGS), NY
NYSDEC SPILL NO. 89-09423 PIN NO. 99528
60248522

Thiessen Polygons	
Soil Core	Area (sqf)
SC-01	16,926
SC-03	36,800
SC-05	13,442
SC-06	24,482
SC-07	22,851

Legend

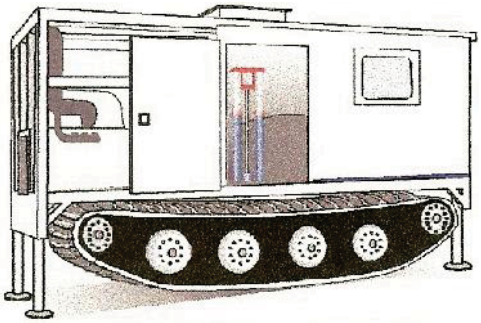
- Fence
- Edge of Road
- Thiessen Polygon
- Soil Core Sample Location

0 80' 160'

SOURCE: BASEMAP WAS CREATED USING AZTECH TECHNOLOGIES, INC.SITE MAP, DECEMBER 15, 2006. BASEMAP IS APPROXIMATE.

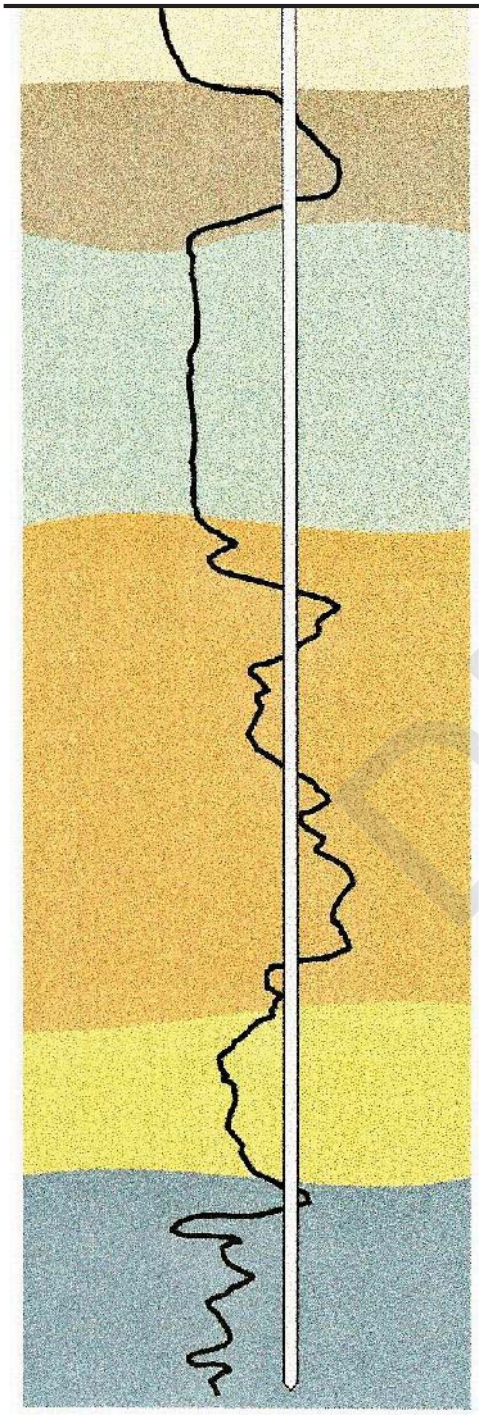
Appendix B

ConeTec Inc. Report



CONETEC

Geotechnical and Environmental In Situ Testing Contractors



ConeTec Field Report

Presentation of In Situ Test Results for:

Cold Springs Terminals Project
Lysander, New York

Presented to: AECOM Environmental

Date: August 9, 2013

Presented by: ConeTec Inc.
436 Commerce Lane, Unit C
West Berlin, NJ 08091
(856) 767-8600

DRAFT

PRESENTATION OF IN SITU TESTING PROGRAM RESULTS

Cold Springs Terminals Project
Hillside Road
Lysander, New York

July 22nd to 25th, 2013

DRAFT

Prepared for:

AECOM Environmental
Latham, New York

Prepared by:
ConeTec Inc.
West Berlin, NJ

August 9th, 2013

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FIGURE 1 Typical Cone Penetrometer
FIGURE 2 Typical CPT/LIF Sub Assembly
FIGURE 2 Typical Dissipation Tests

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APPENDIX A CPT Plots (CPT and LIF-CPT)
APPENDIX B CPT Data Interpretation
APPENDIX C Pore Pressure Dissipation Tests
APPENDIX D LIF Plots
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1.0 INTRODUCTION

This report presents the results of a combined piezocone penetrometer testing (CPTU, also CPT) and laser-induced fluorescence (LIF; also UVOST) program carried out at the Cold Springs Terminals facility located on Hillside Road in Lysander, New York. The work was performed under subcontract to AECOM Environmental (AECOM) of Latham, New York. The CPTU program took place between July 22nd and 25th, 2013.

A total of 18 soundings were completed at 16 different sounding locations. The CPT testing was performed to evaluate in situ geotechnical criteria of the soils.

CPT sounding locations were selected and numbered under the direction and supervision of AECOM personnel (Ms. Greta White).

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2.0 FIELD EQUIPMENT AND PROCEDURES

2.1 CONE PENETRATION TESTING

The cone penetrometer tests were carried out using an integrated electronic piezocone manufactured by ConeTec in Vancouver, Canada. The piezocone used was a compression model cone penetrometer with a 15 cm^2 tip and a 225 cm^2 friction sleeve. The cone is designed with an equal end area friction sleeve and an end area ratio of 0.80. The piezocone dimensions and the operating procedure were in accordance with ASTM Standard D-5778-12. A diagram of the cone penetrometer used for this project is shown as Figure 1.

Pore pressure filter elements, made of porous plastic, were saturated under a vacuum using silicone as the saturating fluid. The pore pressure element was six millimeters thick and was located immediately behind the tip (the u_2 location) for all soundings.

The cone was advanced using ConeTec's, unitized, 25-ton CPT truck rig. The following data were recorded onto magnetic media every five centimeters (approximately every two inches) as the cone was advanced into the ground:

- Tip Resistance (q_c)
- Sleeve Friction (f_s)
- Dynamic Pore Pressure (u)

Before each sounding a complete set of analog baseline readings are taken with a multi-meter and compared with the digitized value on the computer screen. This provides a check on the analog to digital conversion board.

The evaluation of the analog baselines is key to consistent readings. The baseline data should be stable and should not wander excessively during the course of a sounding. Baseline data can be used to apply corrections to the cone data where necessary. For this project, the baseline shift from sounding to sounding was small, typically less than 0.1% of full scale, and no data corrections were applied.

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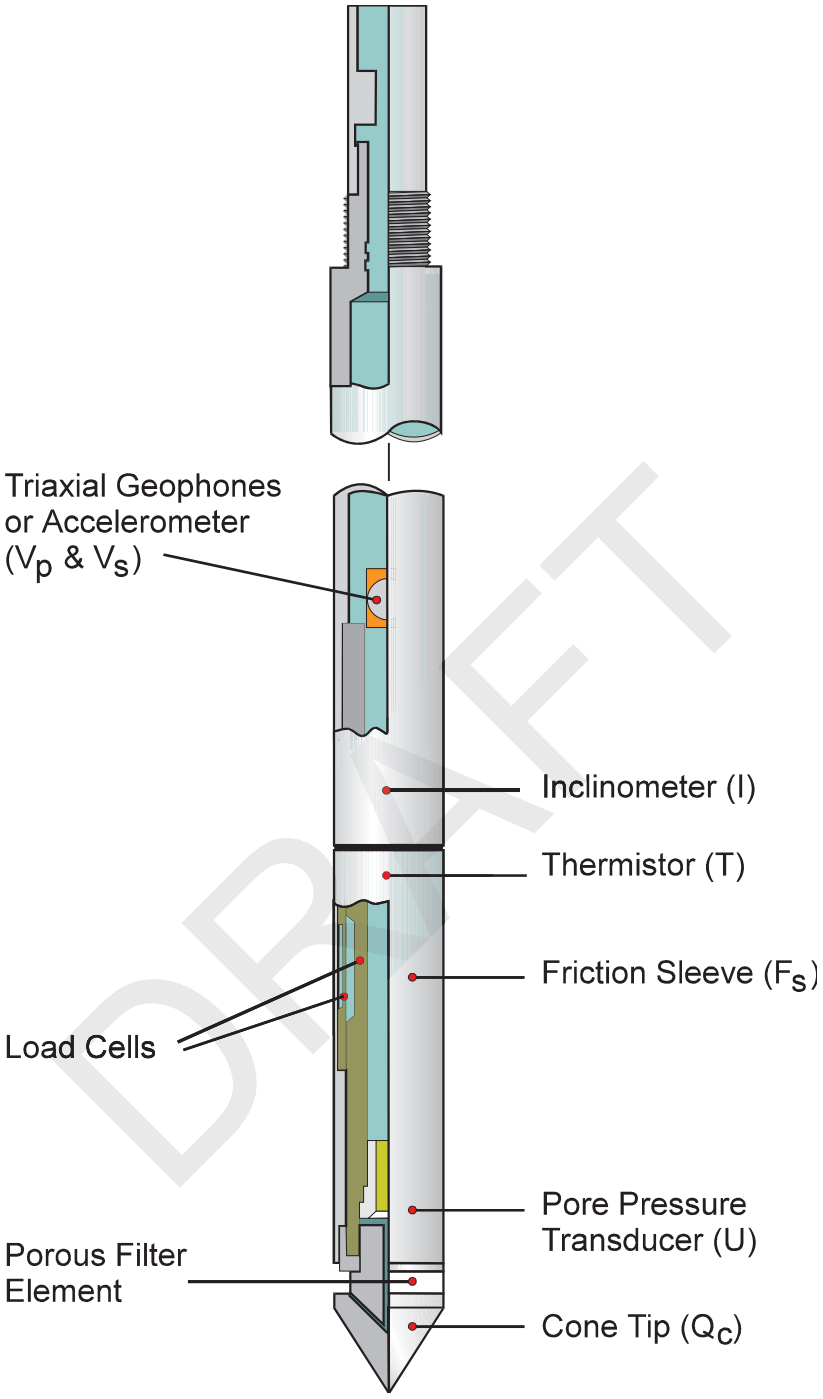


FIGURE 1 - TYPICAL CONE PENETROMETER

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2.2 LASER-INDUCED FLUORESCENCE (LIF) TESTING

The laser-induced fluorescence (LIF) portion of this project was completed using an ultraviolet optical screening tool (UVOST) system developed and produced by Dakota Technologies. The UVOST system is designed to assist in delineating petroleum non-aqueous phase liquid (NAPL) simultaneously during the advancement of ConeTec's cone penetrometer. The system is designed to excite poly-cyclic aromatic hydrocarbon (PAH) compounds found in all petroleum, oils and lubricants.

Dakota's UVOST system is fueled by a XeCL Excimer Laser producing a 308nm photon plasma (laser beam) which is directed to a down-the-hole module through one of two fiber-optic cables. The down-the-hole module contains a perpendicularly recessed sapphire window which launches the excitation light from the laser into the soil. The excitation laser triggers fluoresce within the NAPL. This fluoresce is captured by the return fiber and returned up-hole where a photomultiplier tube captures the signal which is then displayed on an oscilloscope. Using a sequence of delay fibers of different wavelengths of light, the UVOST system can create a signal which measures photons versus time in a unique waveform. The UVOST system measures return light across the 350, 400, 450 and 500nm spectrum while the intensity of each wavelength is also recorded.

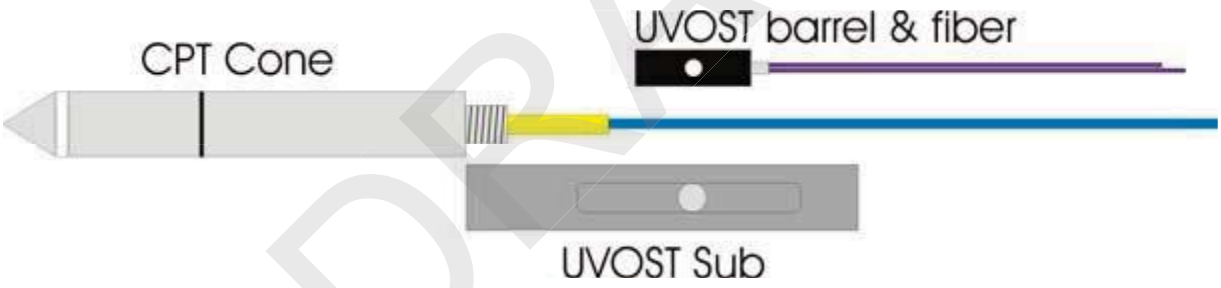


FIGURE 2 – TYPICAL CPT/LIF SUB ASSEMBLY

Prior to deployment of the CPT/LIF module, the UVOST is normalized with a known reference material (or reference emitter) in addition to QA of the background noise within the system. These steps are used to correct changes in optics, laser energy drifts and degradation of consumable parts to ensure continuity of results between test locations.

The waveform can provide qualitative information regarding the blend of light that is returned to the photomultiplier as well as provide a semi-quantitative assessment of NAPL. Comprehensive analysis of the returned waveform is useful in distinguishing the presence, type, and concentration of various PAH-containing NAPL.

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2.3 PORE PRESSURE DISSIPATION TESTS

When cone penetration is stopped, the piezocone essentially becomes a piezometer. While stopped, pore water pressures are automatically recorded at five-second intervals and the readings are stored in a dissipation file (.ppd). Dissipation data can then be plotted onto a dissipation curve consisting of pore water pressure (u) verses time (t). The shapes of dissipation curves are very useful in evaluating soil type, drainage and in situ static water level.

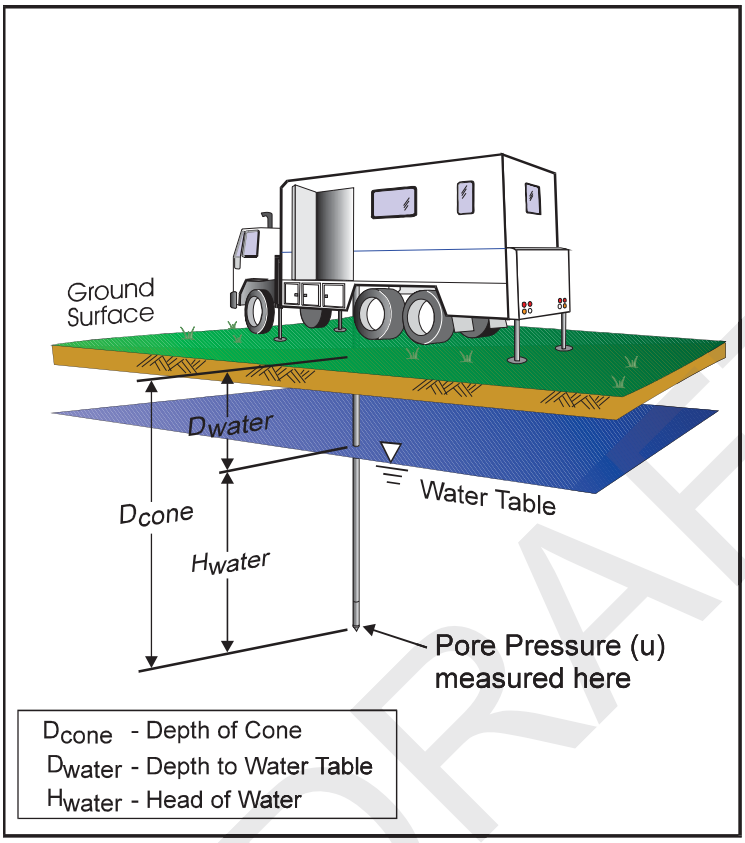
A flat curve that stabilizes quickly (i.e. less than 30 seconds) is typical of a free draining sand. In this case, the final measured pore water pressure is the static in situ water pressure.

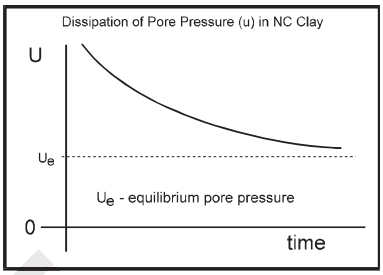
Soils that generate excess dynamic pore water pressure during penetration will dissipate this excess pressure when penetration stops. The shape of the dissipation curve and the time of dissipation can be used to estimate C_h, the coefficient of consolidation that can in turn be used to calculate K_h, the horizontal permeability.

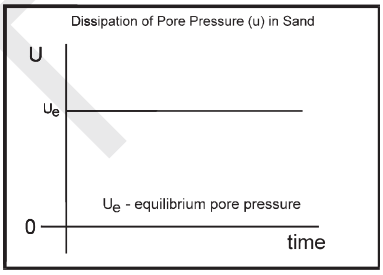
Figure 2 shows some idealized shapes of various pore water pressure dissipation curves. The reader is referred Robertson et. al., 1992 to reference dissipation test data analytical techniques.

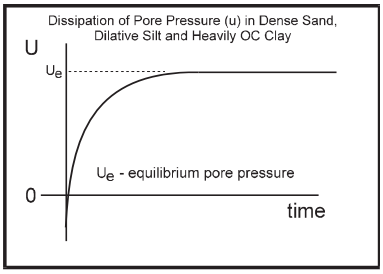
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Estimation of Ground Water Table from CPT Dissipation Tests









Water Table Calculation

$$D_{water} = D_{cone} - H_{water}$$

where $H_{water} = U_e$ (depth units)

Useful Conversion Factors: 1psi = 0.704m = 2.31 feet (water)
1tsf = 0.958 bar = 13.9 psi
1m = 3.28 feet

FIGURE 2 - TYPICAL DISSIPATION TESTS

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3.0 CONE PENETRATION TEST DATA AND INTERPRETATION

3.1 ANALYSIS OF PIEZOCONE DATA - GENERAL

A total of 18 CPT soundings, involving approximately 514 feet of testing, were completed.

The interpretation of cone data is based on the relationship between cone bearing, q_c, sleeve friction, f_s, and penetration pore water pressure, u. The friction ratio, Rf, (sleeve friction divided by cone bearing) is a calculated parameter which is used to infer soil behavior type. Generally, saturated cohesive soils have low tip resistance, high friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

The interpretation of soils encountered on this project was carried out using correlations developed by Robertson, 1990. It should be noted that it is not always possible to clearly identify a soil type based on q_c, f_s and u. Occasionally soils will fall within different soil categories on the classification charts. In these situations, experience and judgment and an assessment of the pore pressure dissipation data should be used to infer the soil behavior type. Computer tabulations of the interpreted soil types along with certain other geotechnical parameters for each cone sounding are presented in Appendix B.

Each of the parameters measured in the sounding is discussed briefly below. A detailed explanation of CPTU testing and interpretation of the results can be found in Robertson, 1989.

TIP RESISTANCE (q_c): The resistance to penetration, measured at the cone tip, provides an accurate profile of subsurface strata. The recorded tip resistance is a composite of the penetration resistance of the soils located five to ten cone diameters (7 to 14 inches) in front of and behind the tip. The actual resistance "sensed" by the tip depends on the soil properties and on the relative stiffness of the layers encountered. Tip resistance is often corrected for pore pressure effects when testing in soft saturated cohesive soils.

For this project the correction was made and the tip resistance shown, q_t is the corrected tip resistance.

The correction used is: $q_t = q_c + (1-a)u$

Where:
- q_t = corrected tip resistance
- q_c = measured tip resistance
- a = net area ratio for cone (0.80 for ConeTec cone penetrometers)
- u = dynamic pore water pressure measured behind tip

SLEEVE FRICTION (f_s) The resistance recorded on the friction sleeve, is a measure of the remolded strength of the soil. Values of sleeve friction in very soft soils (such as peat) may

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fluctuate due to the measured force being small relative to the capacity of the measuring load cell.

FRICTION RATIO (R_f) The ratio of sleeve friction to tip resistance expressed as a percentage, is an indicator of soil type. Cohesive soils generally have friction ratios that are greater than two, while sands and non-plastic silts have friction ratios that are lower than two.

PORE PRESSURE (u*)* Dynamic pore water pressure is measured during penetration. (dynamic pore water pressure data can be found in the .cor, and .xls files. Static pore water pressure is measured when cone penetration is stopped (static pore water pressure data can be found in the .ppd files). The measured dynamic pore water pressure changes with the location of the porous filter and negative readings are possible when the filter is located behind the tip.

It is important to note that the CPT classifies soil by physical behavior, not by grain size; therefore, the CPT classification should be verified against samples obtained from a conventional drilling program. While the CPT soil classification may not always be accurate in terms of the actual label it applies to a particular soil, it is very accurate in grouping soils with similar mechanical properties.

Table 1 presents a summary of CPT soundings including sounding depths, estimated phreatic surface depths and approximate sounding location coordinates.

3.2 CONE PLOTS

The data from each sounding was plotted using the computer program SCREENzW. The plots are included in Appendix A. SCREENzW was developed by ConeTec Inc. and it incorporates soil behavior type (SBT) classification as part of the plot. The soil classification is based on the classification chart reproduced chart in Appendix B.

3.3 PORE PRESSURE DISSIPATION TEST RESULTS

Pore water pressure dissipation data are collected and automatically recorded during pauses in penetration. The pore water pressure data is recorded at five second intervals. A total of 23 pore water pressure dissipation tests, involving approximately two hours of time, were performed on this project. Table 2 presents a summary of pore pressure dissipation tests. Table 2 together with the pore pressure dissipation plots can be found in Appendix C. The pore pressure dissipation tests were completed primarily to assess phreatic surface depths.

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3.4 LIF (UVOST) PLOTS

The LIF data were plotted using the Dakota Technologies' "OST" software. The LIF plots are located in Appendix D. Plots of combined CPT and LIF (UVOST) data can be found in Appendix A. Additional information regarding the interpretation of the LIF plots and the UVOST system can be found in Appendix D as well as on Dakota Technologies' website http://www.dakotatechnologies.com.

3.5 CPT DATA PROCESSING

The electronic data files were processed using the program SCREENzW. SCREENzW is a program developed by ConeTec to calculate common engineering parameters from CPT data. The processed data file summery sheet is attached in Appendix B. The files (IFI.xls) are included in the electronic data package. The calculations used are summarized in the table at the front of the Appendix. Each calculation is derived according to the referenced article.

For this project, the piezometric surface used was determined from the pore water pressure dissipation tests and the dynamic pore water pressure responses recorded during the CPT. The exact depth used can be found in the headers of the ifi.xls files.

3.6 ELECTRONIC DATA FILES

Along with the report, all of the project data can be downloaded from ConeTec's "ConeTec Data Services" (CDS) website (www.conetecdataservices.com) using a secure, project-specific user name and password. These electronic files contain all important project information including tabular data (.xls and ASCII formats), GPS coordinates of approximate sounding locations, dynamic and static pore water pressure and some basic interpretation files in Microsoft™ Excel format (.xls). Information regarding the digital file formats of the electronic files is included in Appendix E.

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5.0 REFERENCES

Robertson, P.K., 1990, "Soil Classification using the Cone Penetration Test", Canadian Geotechnical Journal, vol. 27, pages 151-158.

Robertson, P.K., Sully, J., Woeller, D.G., Lunne, T., Powell, J.M., and Gillespie, D.J., 1992, "Estimating Coefficient of Consolidation from Piezocone Tests", Canadian Geotechnical Journal, vol. 29, pages 539-550.

St. Germain, R. and Martin, T., 2008, "Direct Push Site Characterization of NAPL with Laser Induced Fluorescence (LIF)", North American Environmental Field Conference & Exposition, January 16, 2008, Tampa, FL

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APPENDIX A

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Job No: 13-53045
Client: AECOM
Project: Cold Springs Terminals, Lysander, NY
Date: 07/22/13 to 07/25/13

TABLE 1 - CPT SOUNDING SUMMARY

CPT Sounding	File Name	Date	Cone	Assumed Phreatic Surface (ft)	Final Depth (ft)	Northing UTM Zone 18 (m)	Easting UTM Zone 18 (m)
UV-01	13-53045_CP01	07/22/13	226:T1500F15U500	15.0	24.28	4776185	398271
UV-02	13-53045_CP02	07/22/13	226:T1500F15U500	12.0	24.11	4776188	398286
UV-03	13-53045_CP03	07/22/13	226:T1500F15U500	10.8	26.41	4776184	398312
UV-04	13-53045_CP04	07/22/13	226:T1500F15U500	10.6	25.92	4776195	398316
UV-05	13-53045_CP05	07/22/13	226:T1500F15U500	10.0	26.57	4776186	398334
UV-06	13-53045_CP06	07/23/13	243:T1500F15U500	10.0	19.36	4776204	398328
UV-07	13-53045_CP07	07/23/13	243:T1500F15U500	8.7	28.22	4776171	398340
UV-08	13-53045_CP08	07/23/13	243:T1500F15U500	4.6	30.02	4776156	398364
UV-09	13-53045_CP09	07/23/13	243:T1500F15U500	15.9	21.82	4776174	398259
UV-10	13-53045_CP10	07/23/13	243:T1500F15U500	17.0	22.80	4776185	398233
UV-11	13-53045_CP11	07/23/13	243:T1500F15U500	14.0	22.15	4776184	398220
UV-12	13-53045_CP12	07/23/13	243:T1500F15U500	14.0	19.52	4776186	398198
UV-13	13-53045_CP13	07/23/13	243:T1500F15U500	15.5	22.15	4776175	398215
UV-14	13-53045_CP14	07/23/13	243:T1500F15U500	11.4	27.40	4776133	398288
UV-15	13-53045_CP15	07/23/13	243:T1500F15U500	11.6	24.11	4776150	398286
UV-16	13-53045_CP16	07/24/13	243:T1500F15U500	12.3	23.29	4776163	398283
UV-17	13-53045_CP17	07/24/13	243:T1500F15U500	14.2	23.13	4776179	398275
UV-18	13-53045_CP18	07/24/13	243:T1500F15U500	17.2	24.28	4776180	398259
UV-19	13-53045_CP19	07/24/13	243:T1500F15U500	16.0	21.82	4776178	398245
UV-20	13-53045_CP20	07/24/13	243:T1500F15U500	14.0	26.08	4776172	398256
UV-21	13-53045_CP21	07/24/13	243:T1500F15U500	15.9	24.77	4776169	398233
UV-22	13-53045_CP22	07/24/13	243:T1500F15U500	14.4	30.02	4776158	398219
UV-23	13-53045_CP23	07/24/13	243:T1500F15U500	15.0	25.92	4776165	398222
UV-24	13-53045_CP24	07/24/13	243:T1500F15U500	15.3	24.44	4776174	398228
UV-25	13-53045_CP25	07/24/13	243:T1500F15U500	5.0	30.02	4776120	398415
UV-26	13-53045_CP26	07/25/13	243:T1500F15U500	13.8	26.41	4776179	398293
UV-27	13-53045_CP27	07/25/13	243:T1500F15U500	11.9	29.04	4776188	398321
UV-27D	13-53045_CP27D	07/25/13	243:T1500F15U500	11.9	29.20	4776182	398329

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CPT Sounding	File Name	Date	Cone	Assumed Phreatic Surface (ft)	Final Depth (ft)	Northing UTM Zone 18 (m)	Easting UTM Zone 18 (m)
UV-28	13-53045_CP28	07/25/13	243:T1500F15U500	12.9	24.44	4776171	398304
UV-29	13-53045_CP29	07/25/13	243:T1500F15U500	9.9	27.56	4776182	398323
UV-30	13-53045_CP30	07/25/13	243:T1500F15U500	17.0	11.81	4776210	398343
UV-30B	13-53045_CP30B	07/25/13	243:T1500F15U500	17.0	11.81	4776206	398343
UV-31	13-53045_CP31	07/25/13	243:T1500F15U500	15.0	27.23	4776159	398176
UV-32	13-53045_CP32	07/25/13	243:T1500F15U500	15.0	20.51	4776175	398175
UV-33	13-53045_CP33	07/25/13	243:T1500F15U500	15.9	19.85	4776161	398150
Totals:	**35**				**846.45**		

Note: Hydrostatic water table assumed for interpretation tables was based on pore pressure data.

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Non-Normalized CPT Plots

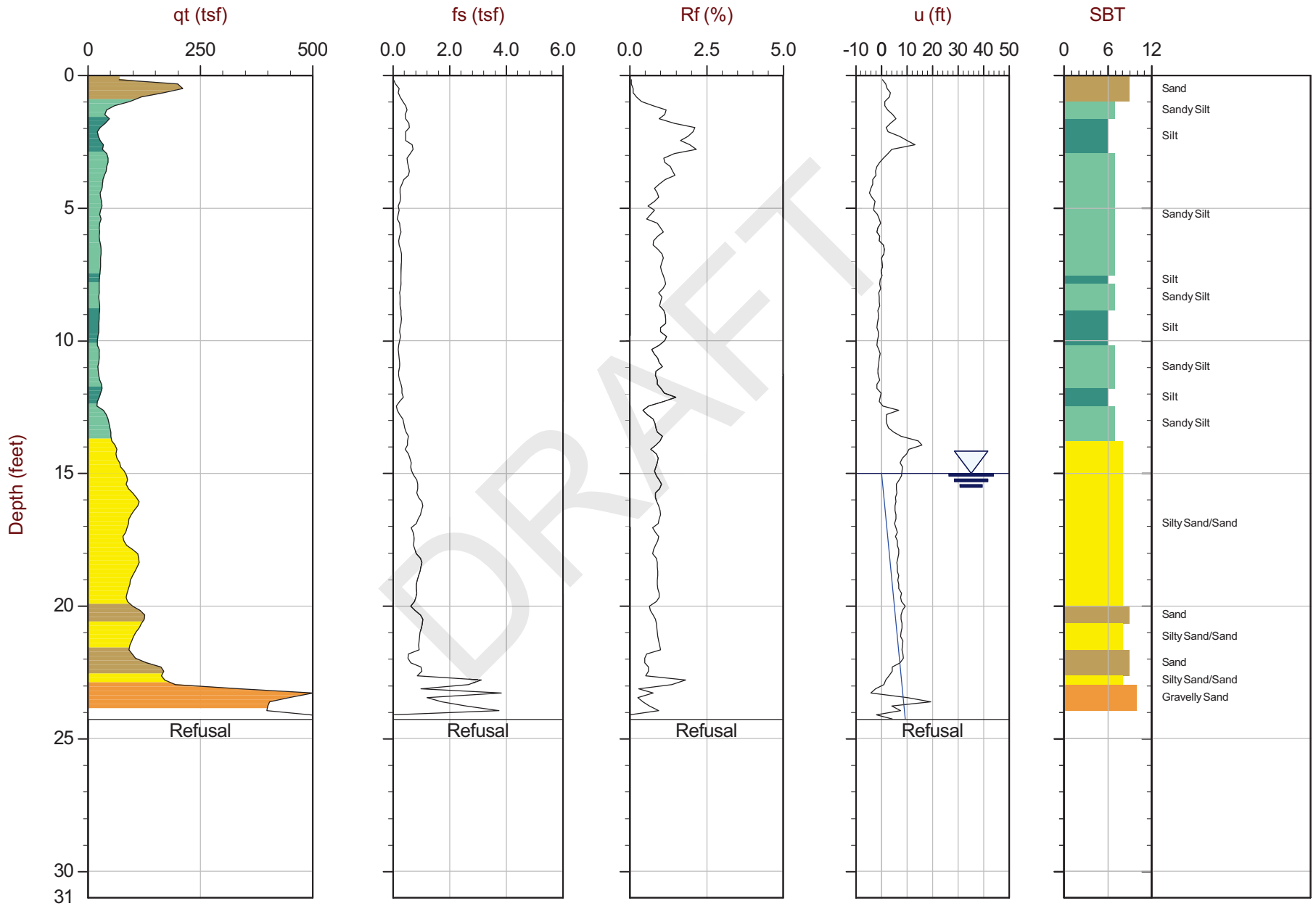
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CONETEC

AECOM

Job No: 13-53045
Date: 07:22:13 14:25
Site: Cold Springs Terminals

Sounding: UV-01
Cone: 226:T1500F15U500



DRAFT

Max Depth: 7.400 m / 24.28 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP01.COR

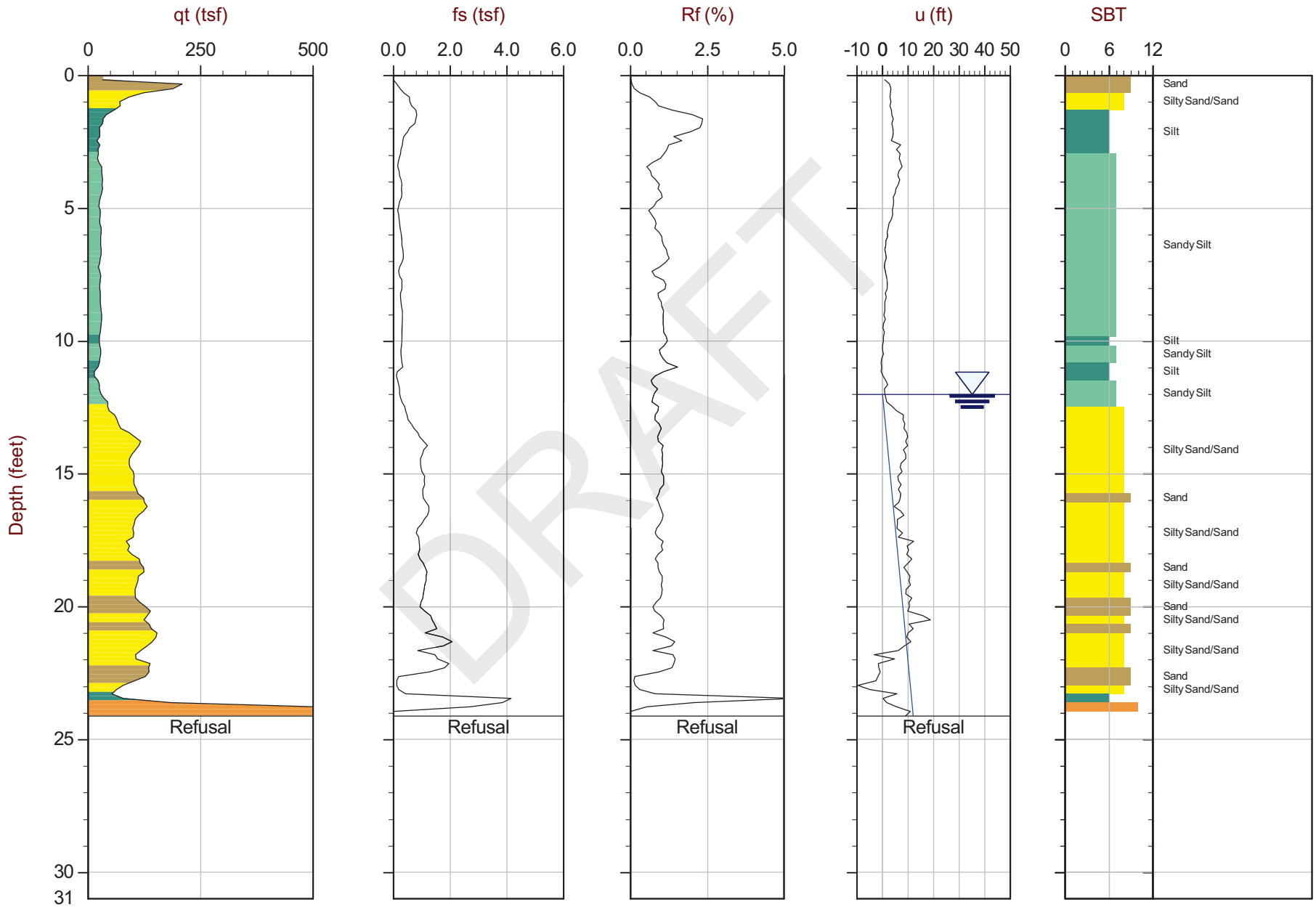
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Coords: UTM Zone 18 N: 4776185 E: 398271

CONETEC

AECOM

Job No: 13-53045
Date: 07:22:13 15:17
Site: Cold Springs Terminals

Sounding: UV-02
Cone: 226:T1500F15U500



DRAFT

Max Depth: 7.350 m / 24.11 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP02.COR

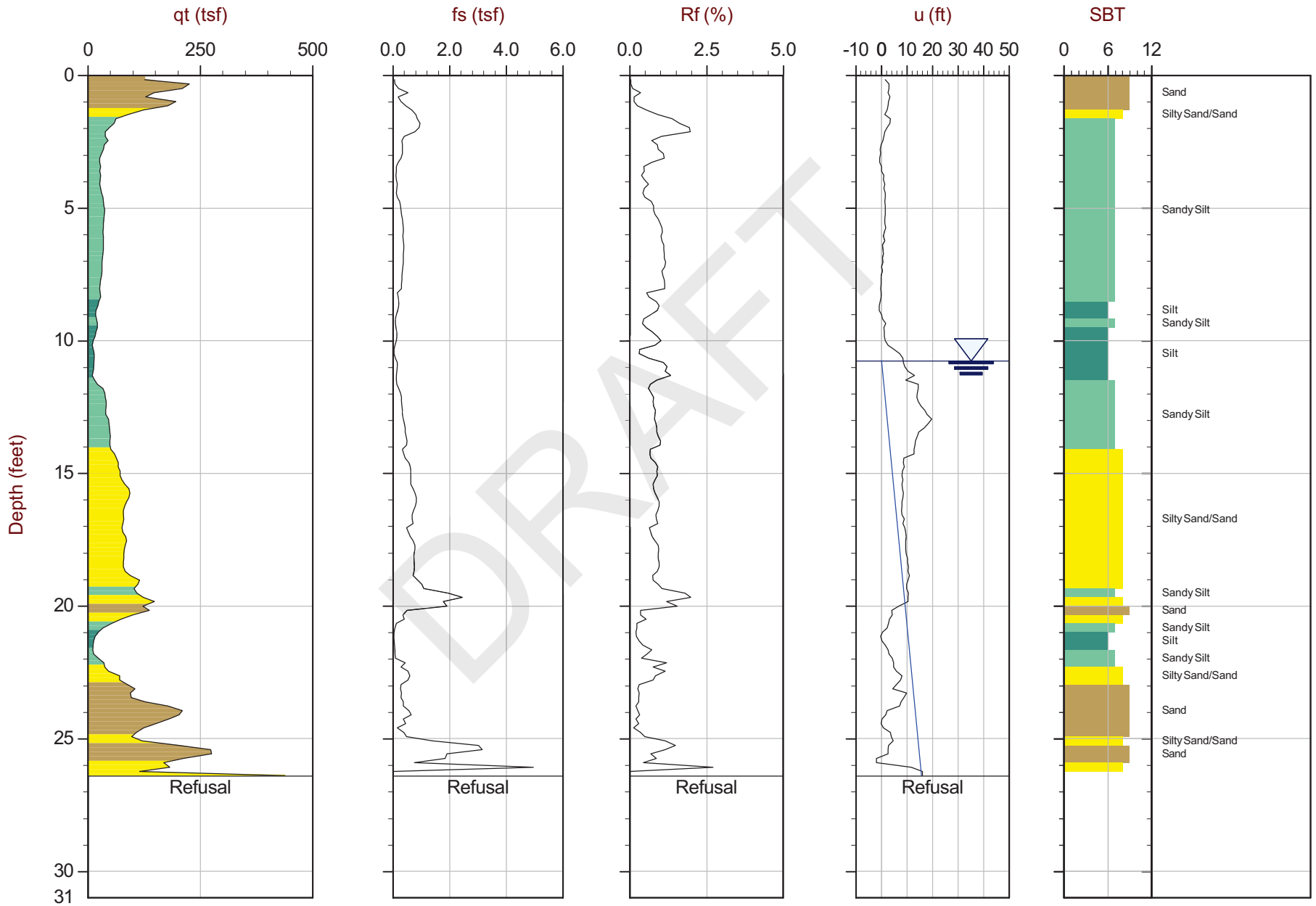
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CONETEC

AECOM

Job No: 13-53045
Date: 07:22:13 16:05
Site: Cold Springs Terminals

Sounding: UV-03
Cone: 226:T1500F15U500



DRAFT

Max Depth: 8.050 m / 26.41 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP03.COR

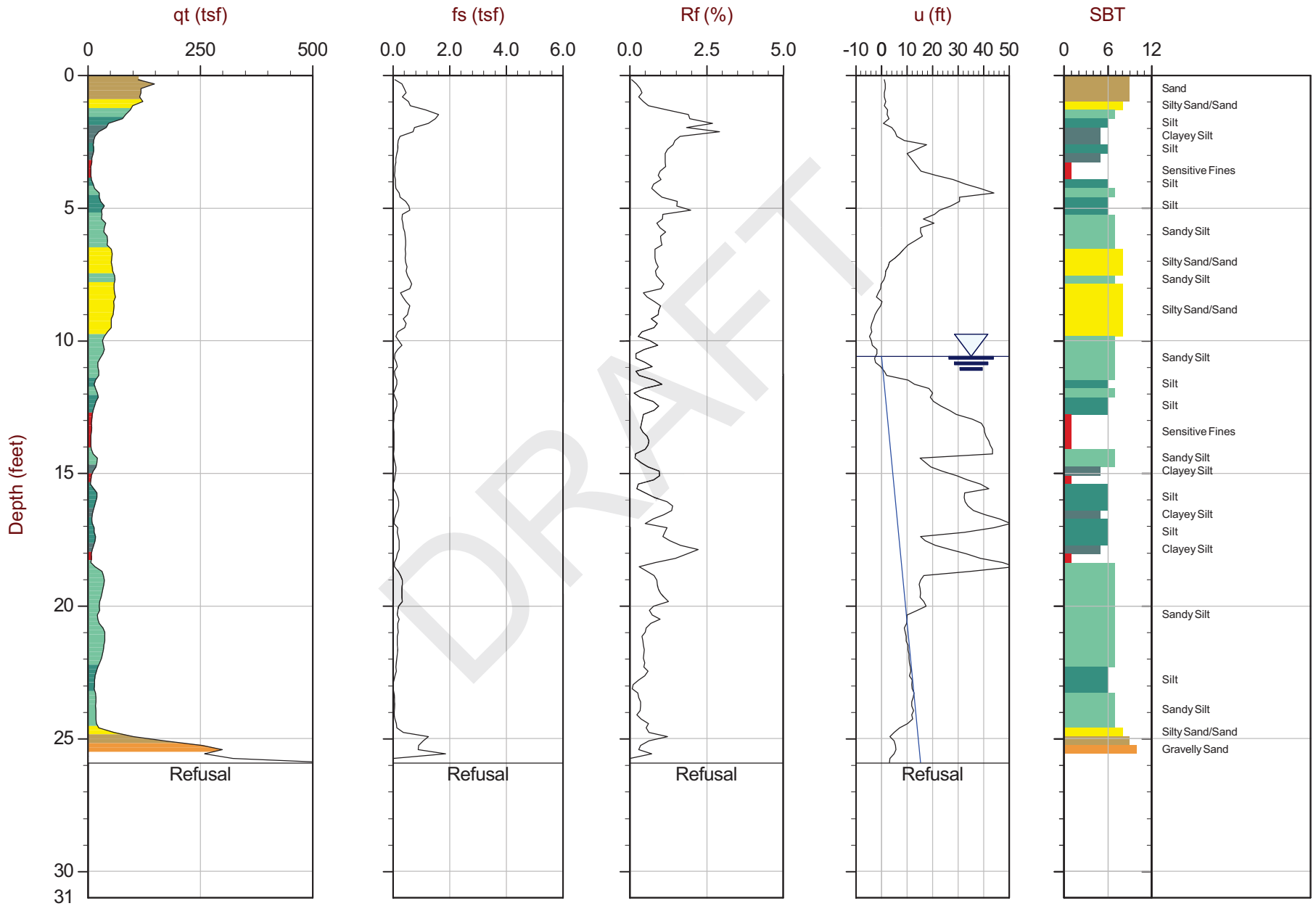
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CONETEC

AECOM

Job No: 13-53045
Date: 07:22:13 16:49
Site: Cold Springs Terminals

Sounding: UV-04
Cone: 226:T1500F15U500



DRAFT

Max Depth: 7.900 m / 25.92 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP04.COR

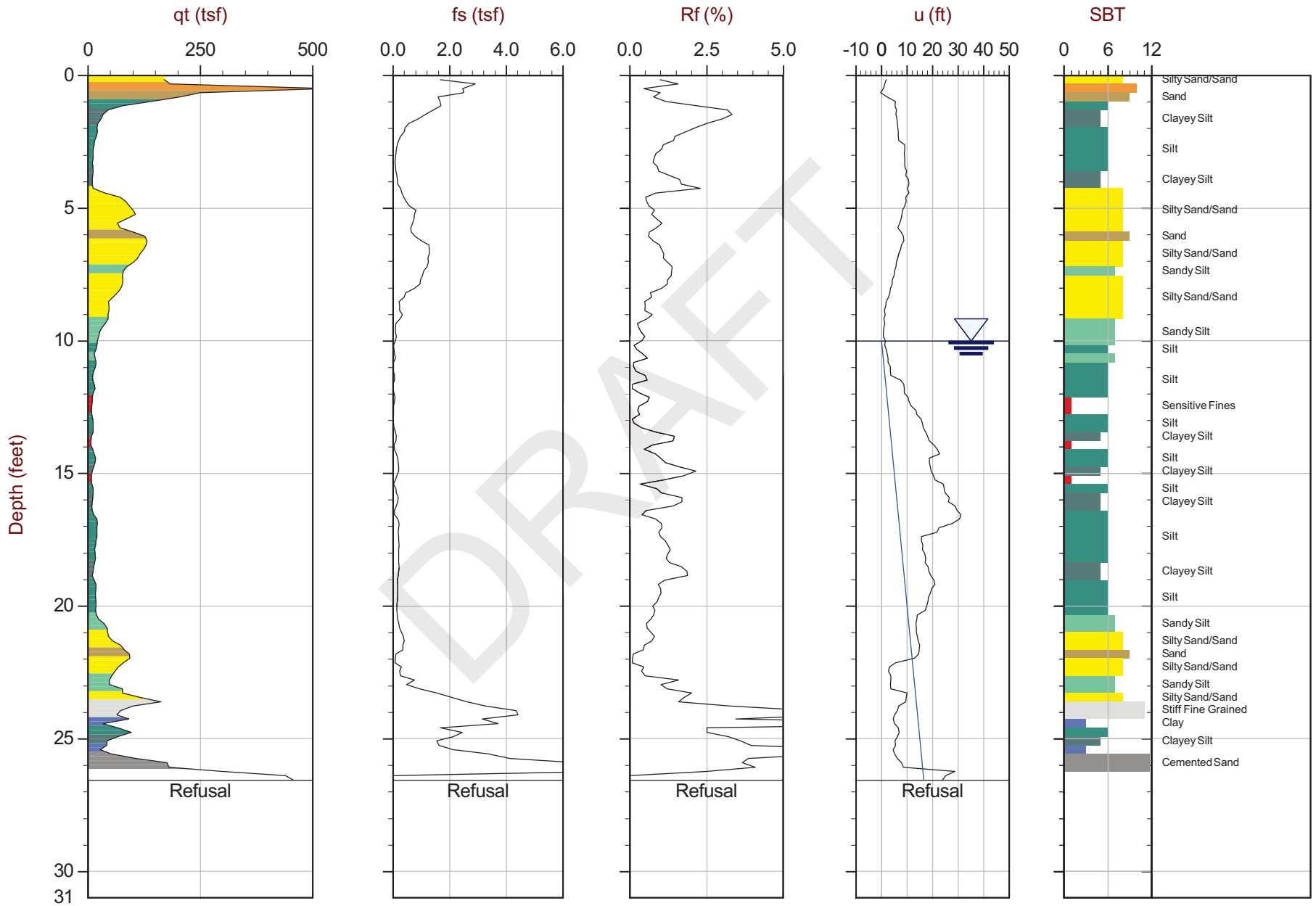
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CONETEC

AECOM

Job No: 13-53045
Date: 07:22:13 17:21
Site: Cold Springs Terminals

Sounding: UV-05
Cone: 226:T1500F15U500



DRAFT

Max Depth: 8.100 m / 26.57 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP05.COR

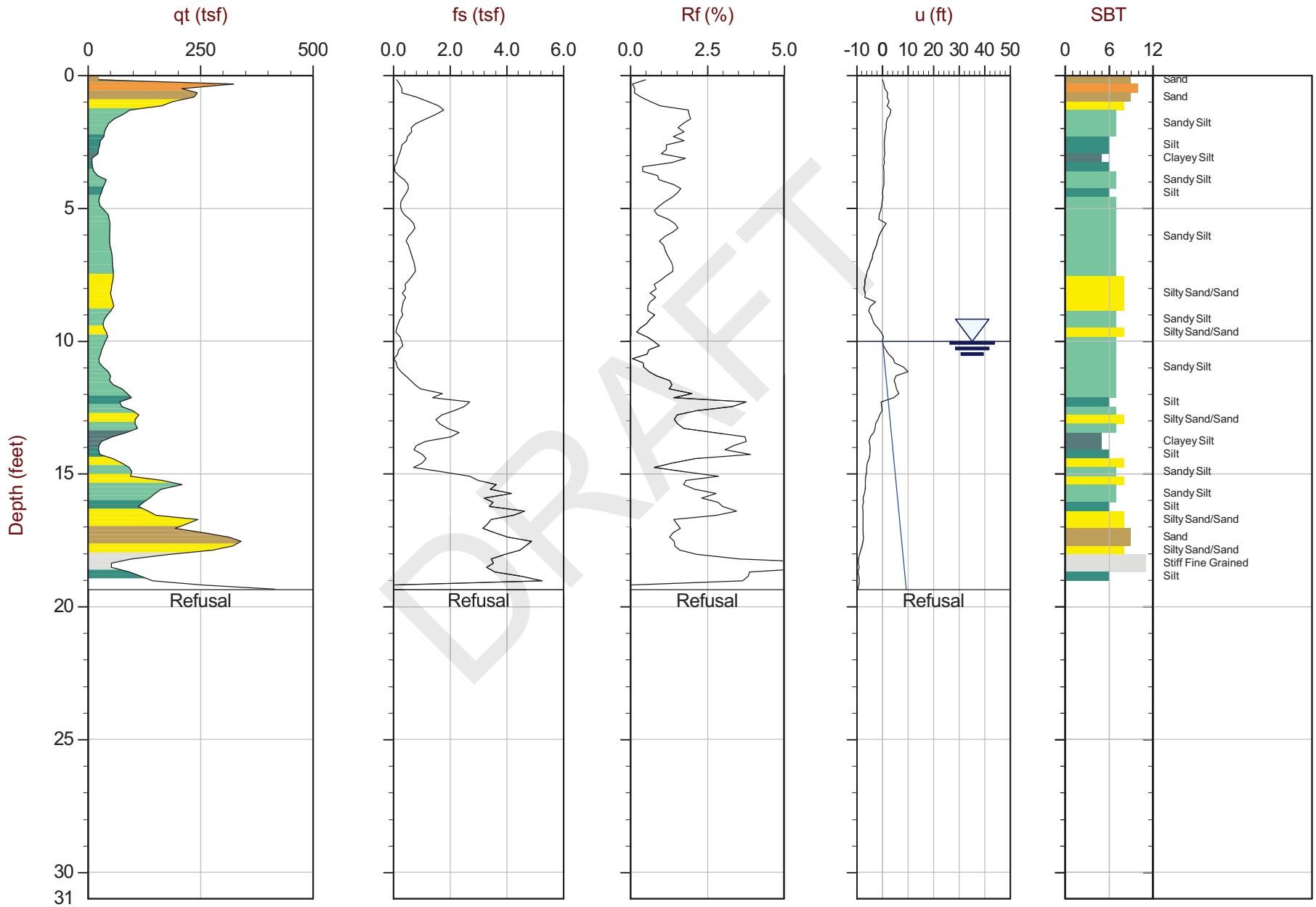
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CONETEC

AECOM

Job No: 13-53045
Date: 07:23:13 09:51
Site: Cold Springs Terminals

Sounding: UV-06
Cone: 243:T1500F15U500



DRAFT

Max Depth: 5.900 m / 19.36 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP06.COR

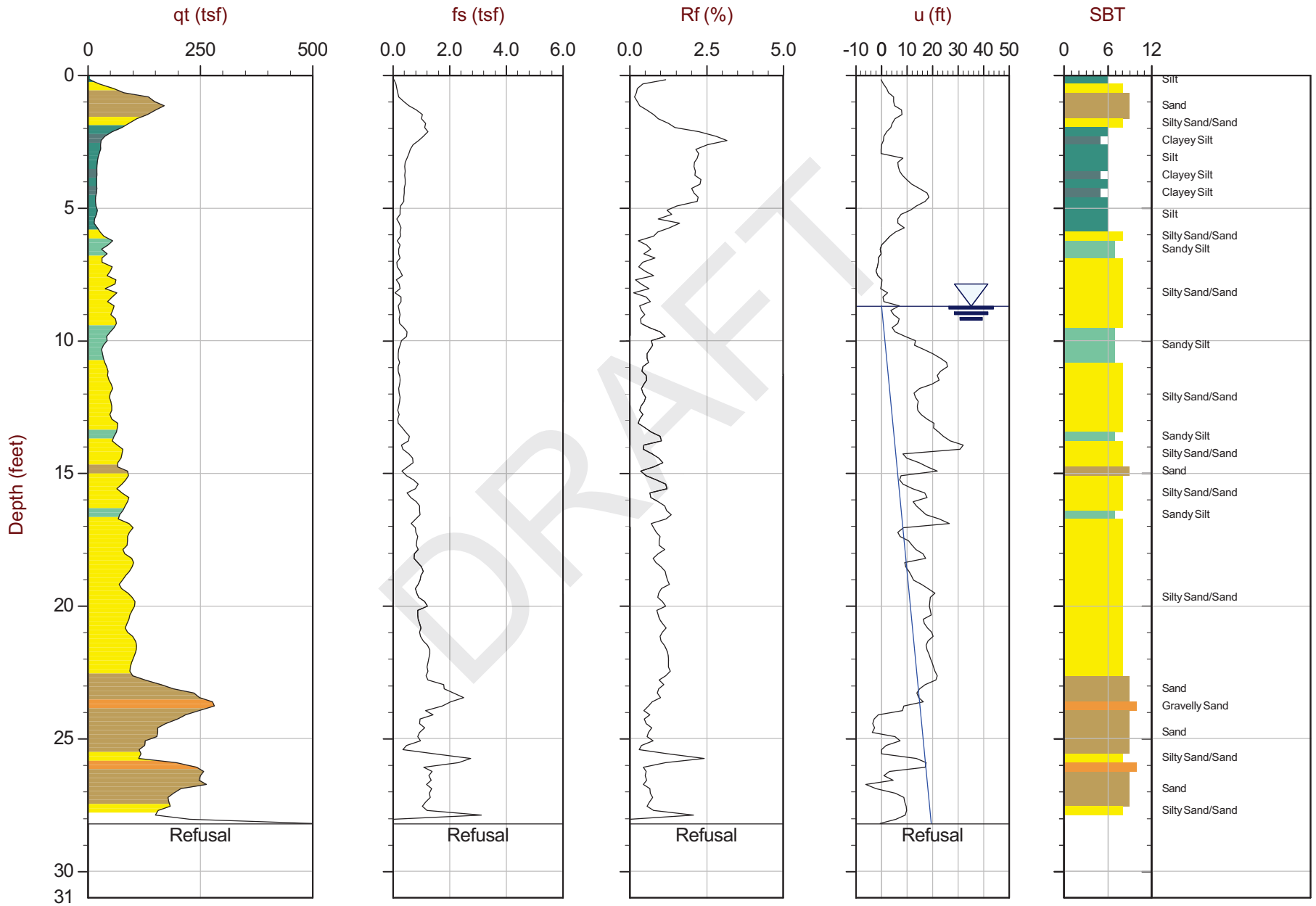
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CONETEC

AECOM

Job No: 13-53045
Date: 07:23:13 10:34
Site: Cold Springs Terminals

Sounding: UV-07
Cone: 243:T1500F15U500



DRAFT

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Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP07.COR

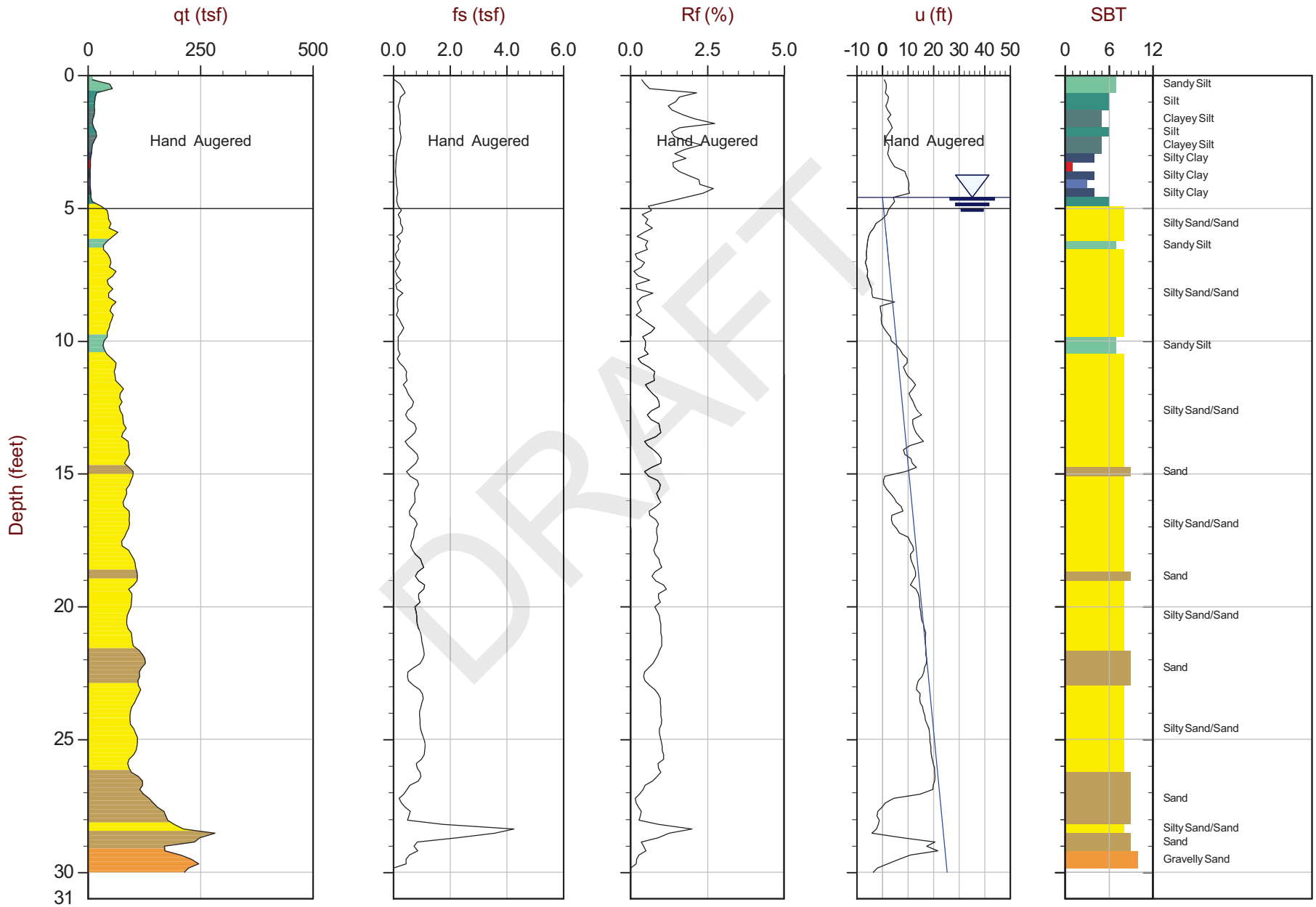
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Page No: 1 of 1

CONETEC

AECOM

Job No: 13-53045
Date: 07:23:13 12:12
Site: Cold Springs Terminals

Sounding: UV-08
Cone: 243:T1500F15U500



DRAFT

Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP08.COR

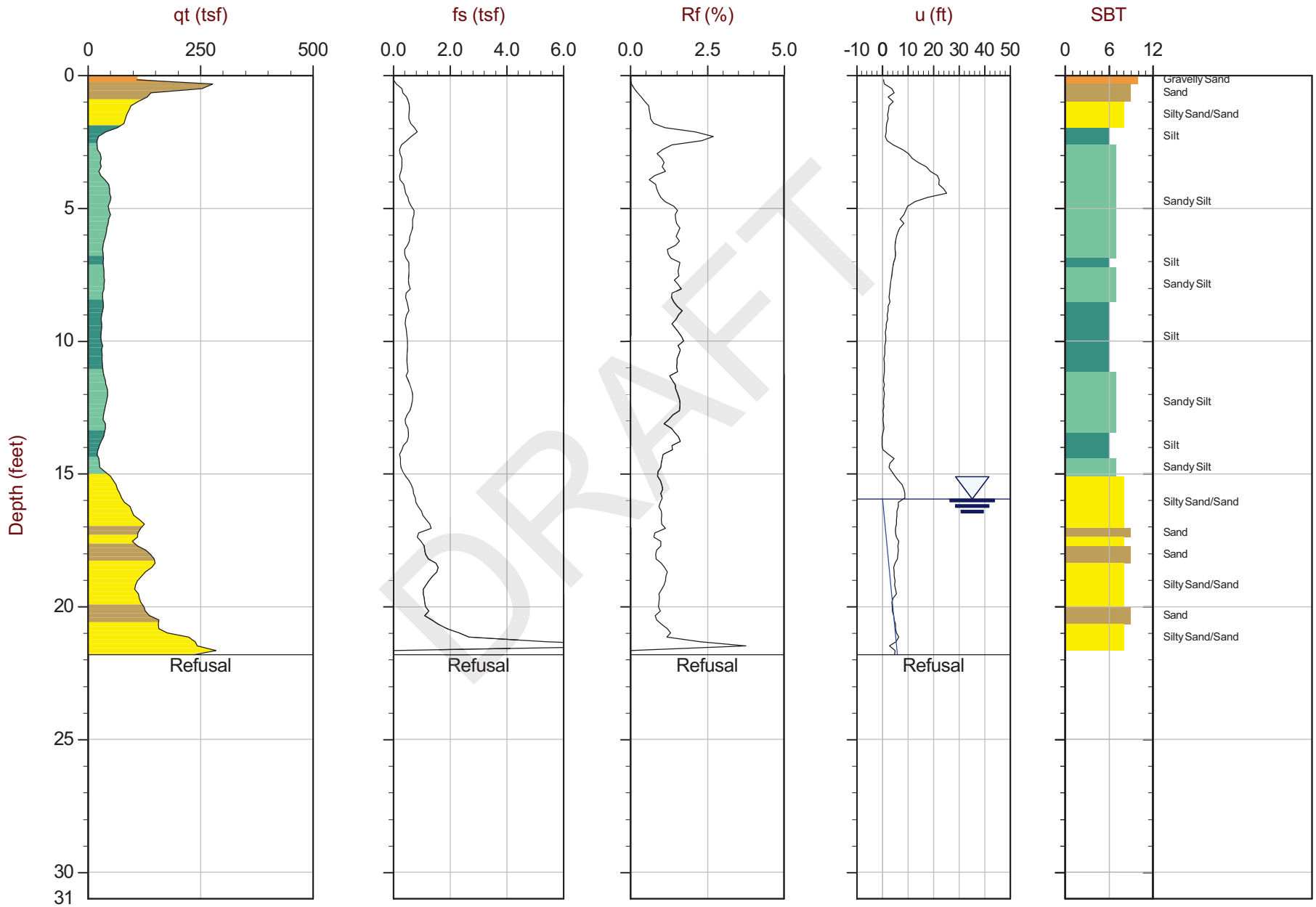
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CONETEC

AECOM

Job No: 13-53045
Date: 07:23:13 12:57
Site: Cold Springs Terminals

Sounding: UV-09
Cone: 243:T1500F15U500



DRAFT

Max Depth: 6.650 m / 21.82 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP09.COR

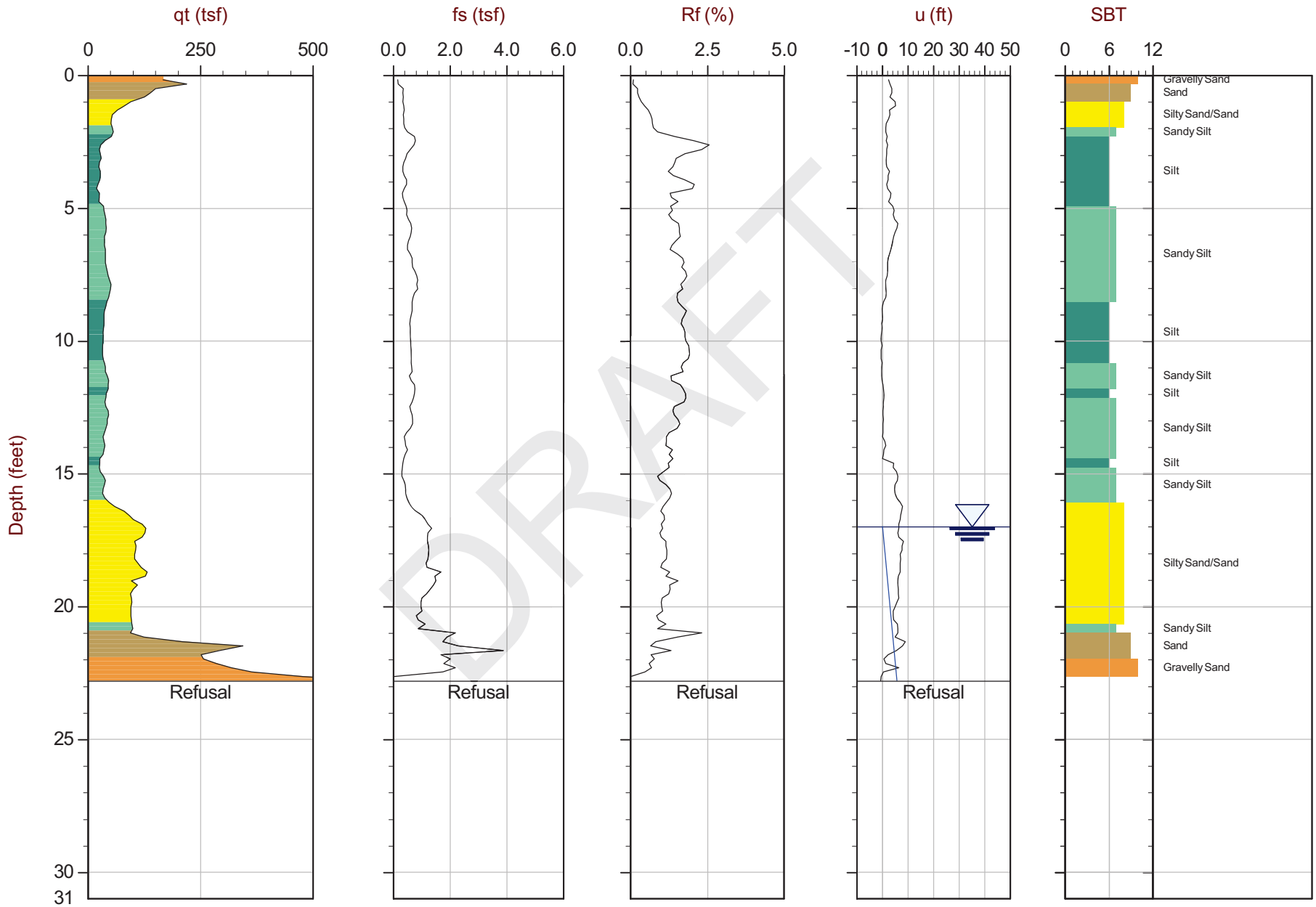
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CONETEC

AECOM

Job No: 13-53045
Date: 07:23:13 13:36
Site: Cold Springs Terminals

Sounding: UV-10
Cone: 243:T1500F15U500



DRAFT

Max Depth: 6.950 m / 22.80 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP10.COR

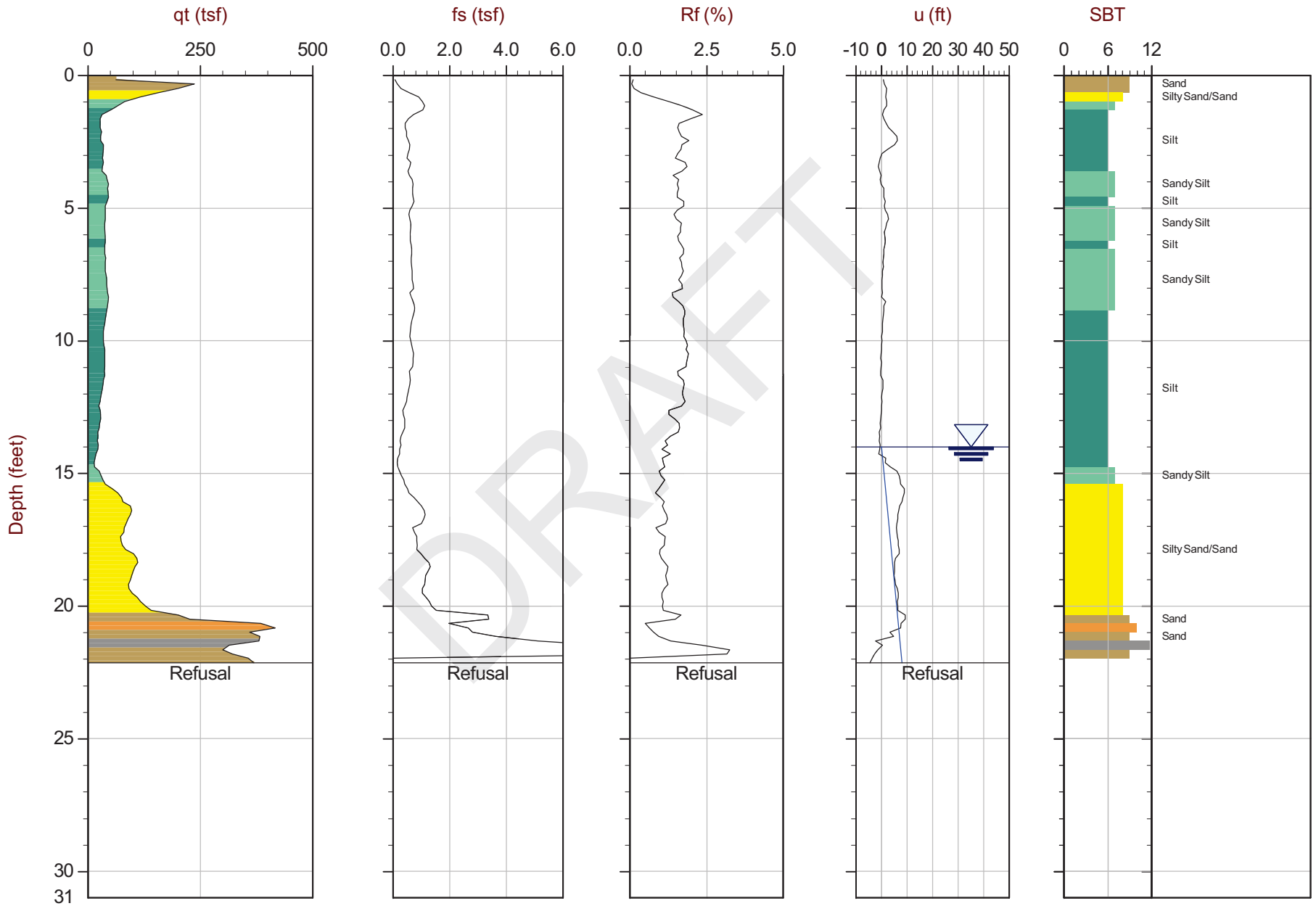
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CONETEC

AECOM

Job No: 13-53045
Date: 07:23:13 14:11
Site: Cold Springs Terminals

Sounding: UV-11
Cone: 243:T1500F15U500



DRAFT

Max Depth: 6.750 m / 22.15 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP11.COR

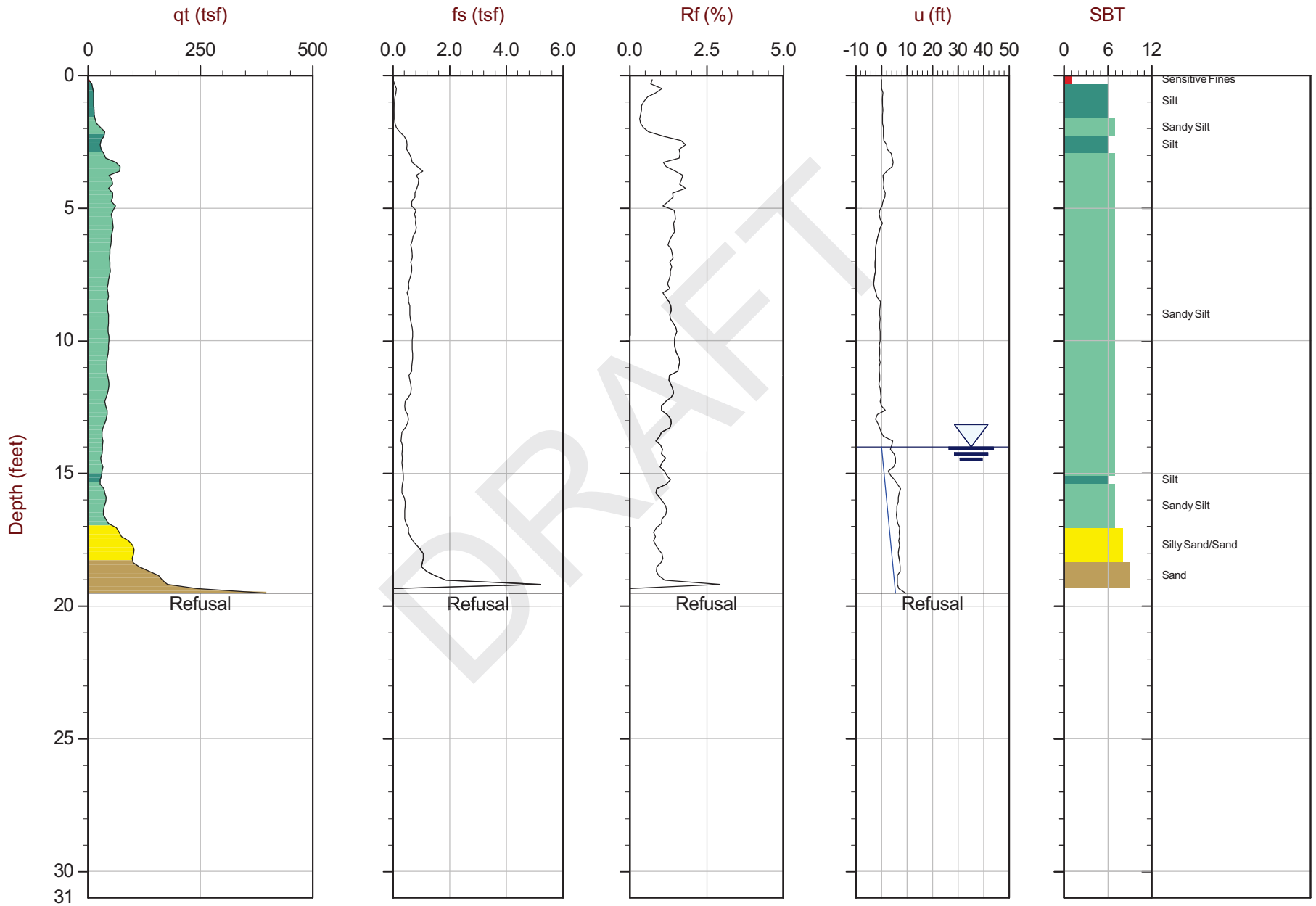
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CONETEC

AECOM

Job No: 13-53045
Date: 07:23:13 14:48
Site: Cold Springs Terminals

Sounding: UV-12
Cone: 243:T1500F15U500



DRAFT

Max Depth: 5.950 m / 19.52 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP12.COR

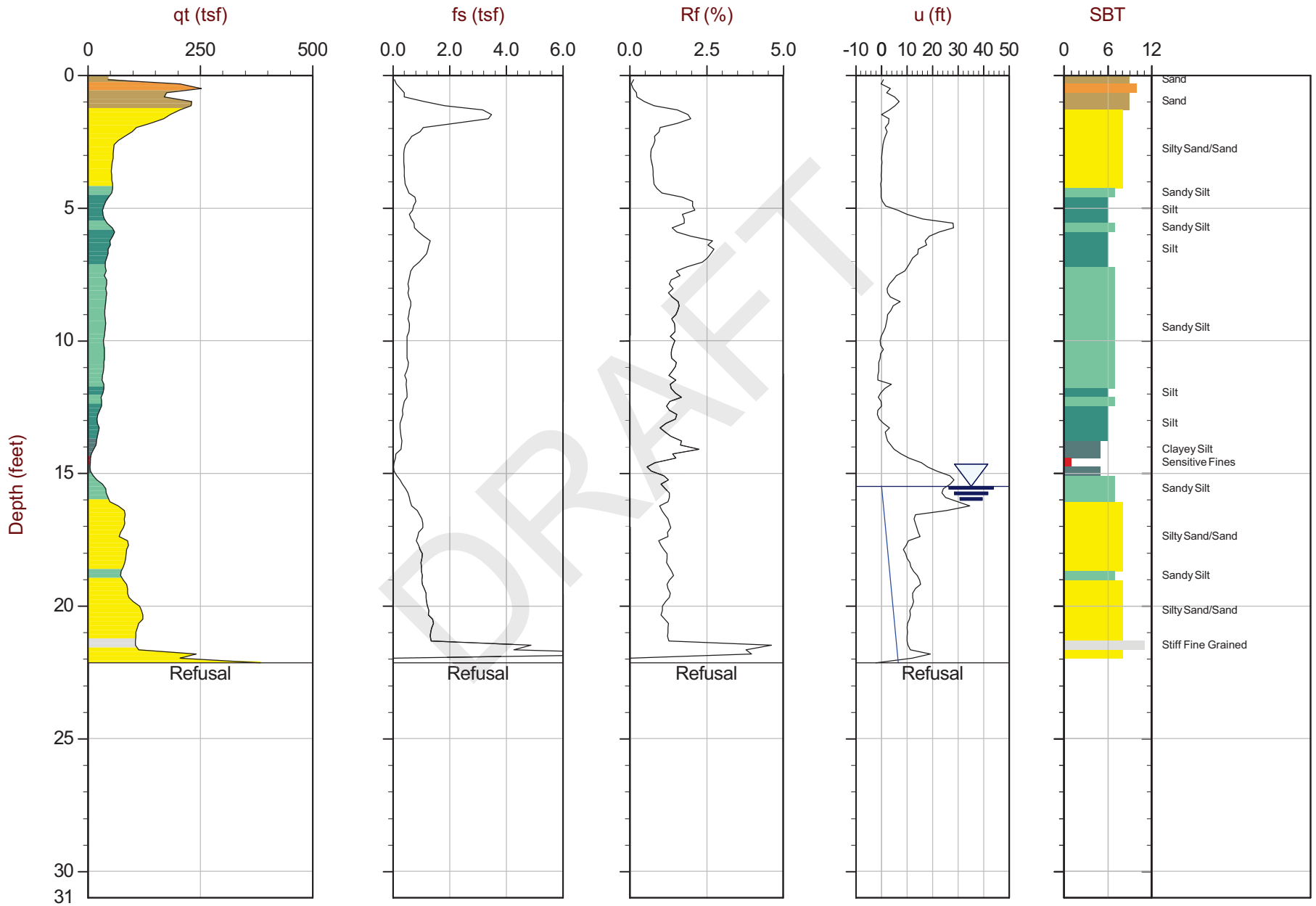
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CONETEC

AECOM

Job No: 13-53045
Date: 07:23:13 15:20
Site: Cold Springs Terminals

Sounding: UV-13
Cone: 243:T1500F15U500



DRAFT

Max Depth: 6.750 m / 22.15 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP13.COR

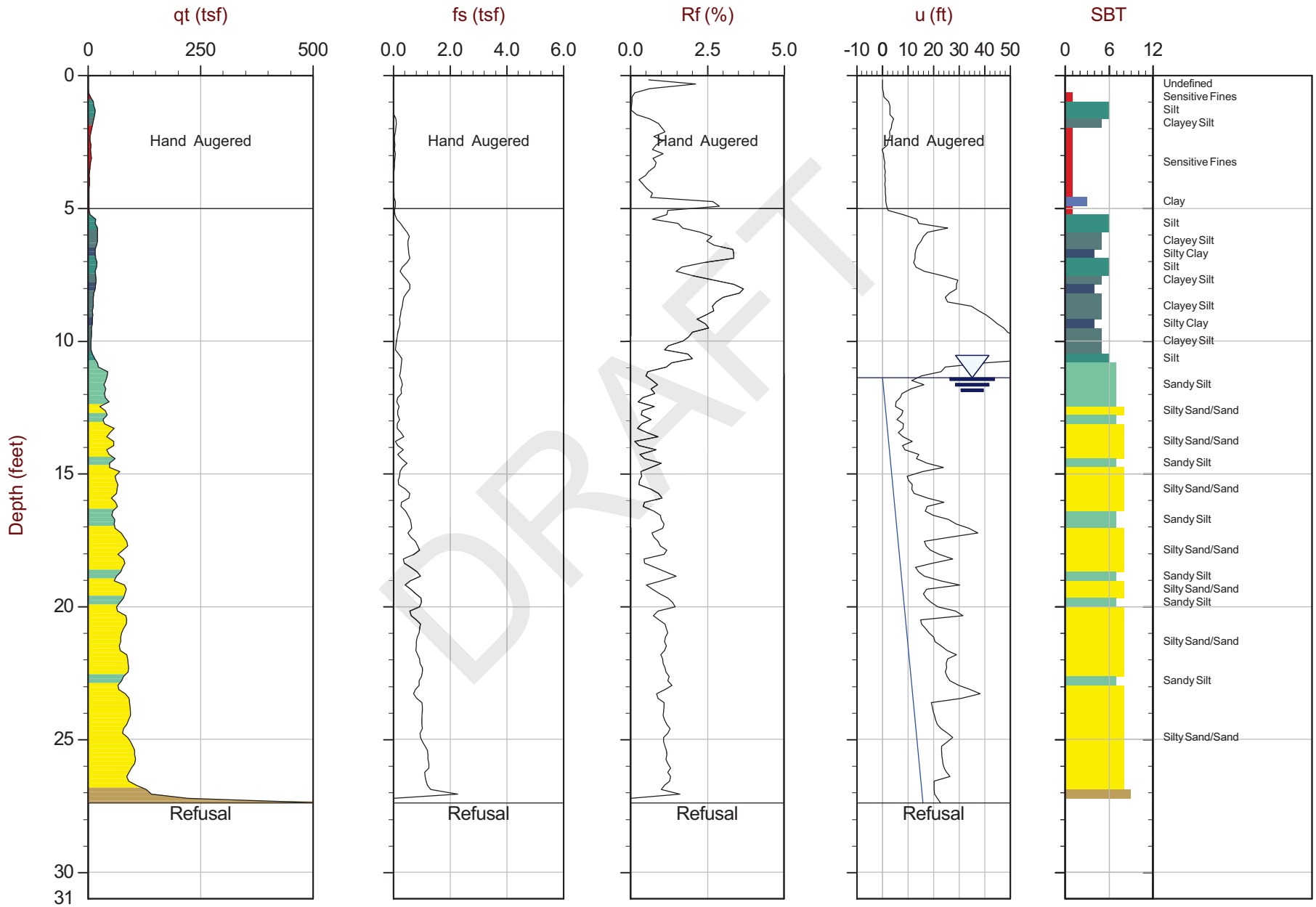
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CONETEC

AECOM

Job No: 13-53045
Date: 07:23:13 16:03
Site: Cold Springs Terminals

Sounding: UV-14
Cone: 243:T1500F15U500



DRAFT

Max Depth: 8.350 m / 27.39 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP14.COR

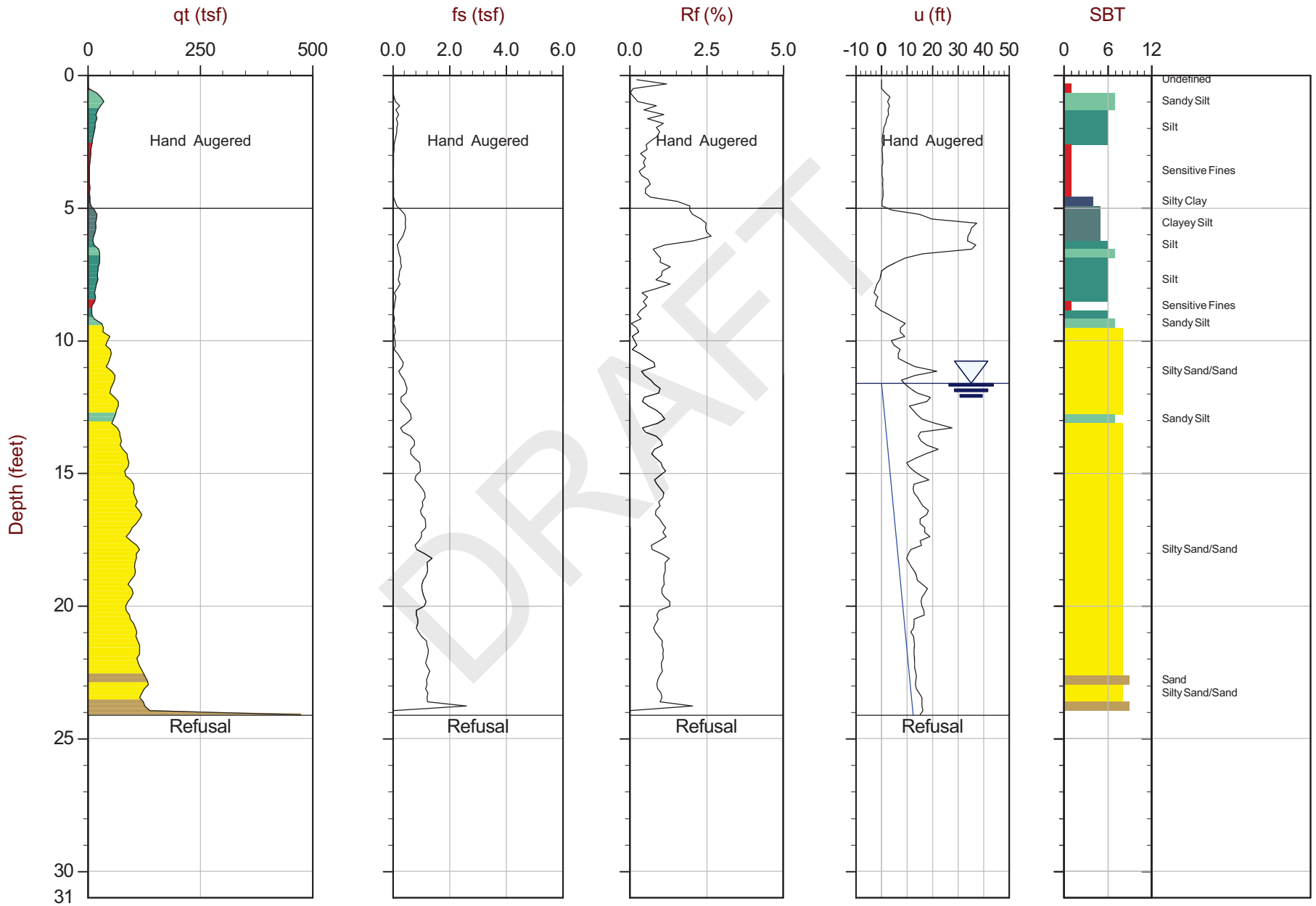
SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776133 E: 398288

CONETEC

AECOM

Job No: 13-53045
Date: 07:23:13 16:41
Site: Cold Springs Terminals

Sounding: UV-15
Cone: 243:T1500F15U500



DRAFT

Max Depth: 7.350 m / 24.11 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP15.COR

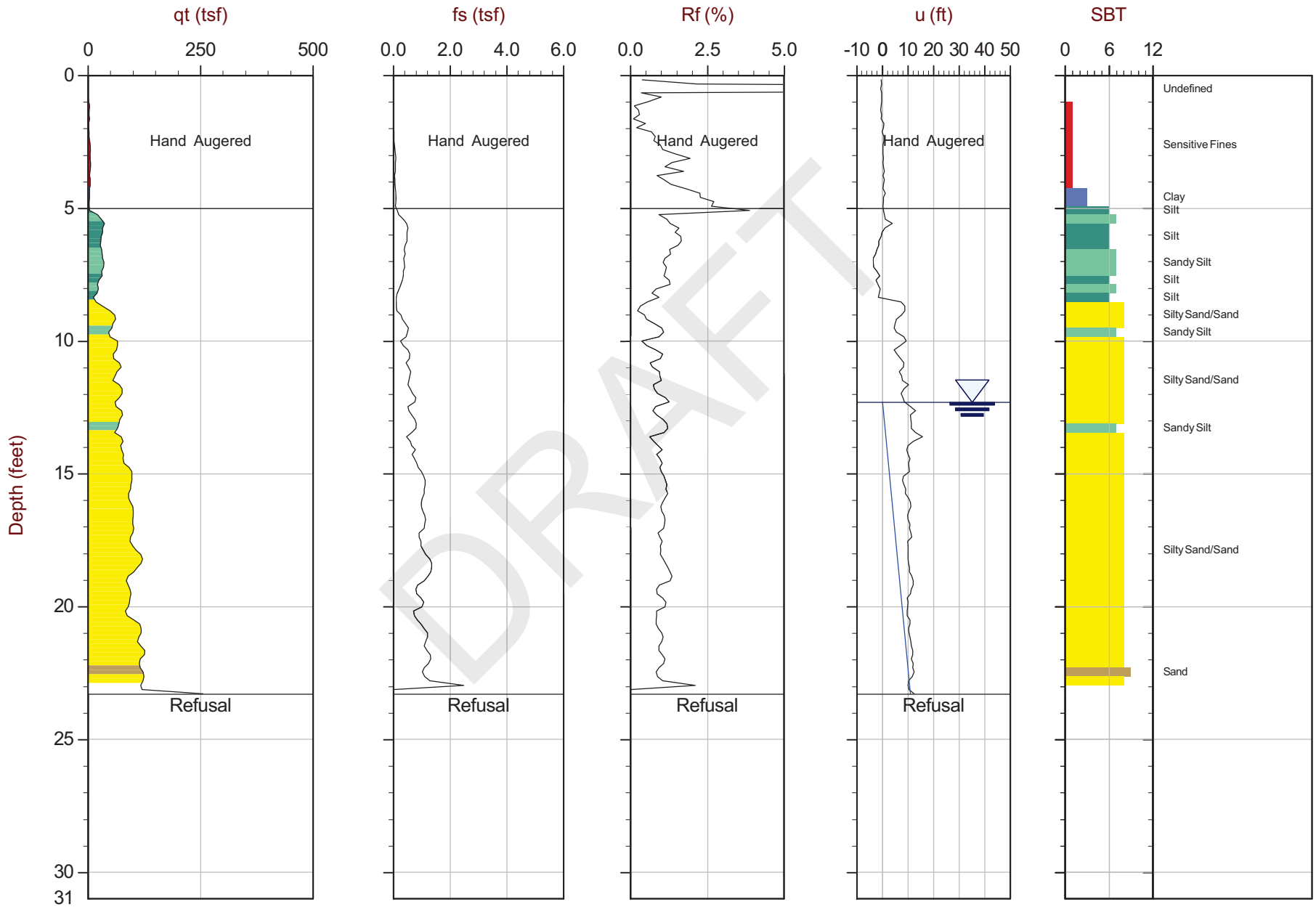
SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776150 E: 398286

CONETEC

AECOM

Job No: 13-53045
Date: 07:24:13 09:04
Site: Cold Springs Terminals

Sounding: UV-16
Cone: 243:T1500F15U500



DRAFT

Max Depth: 7.100 m / 23.29 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP16.COR

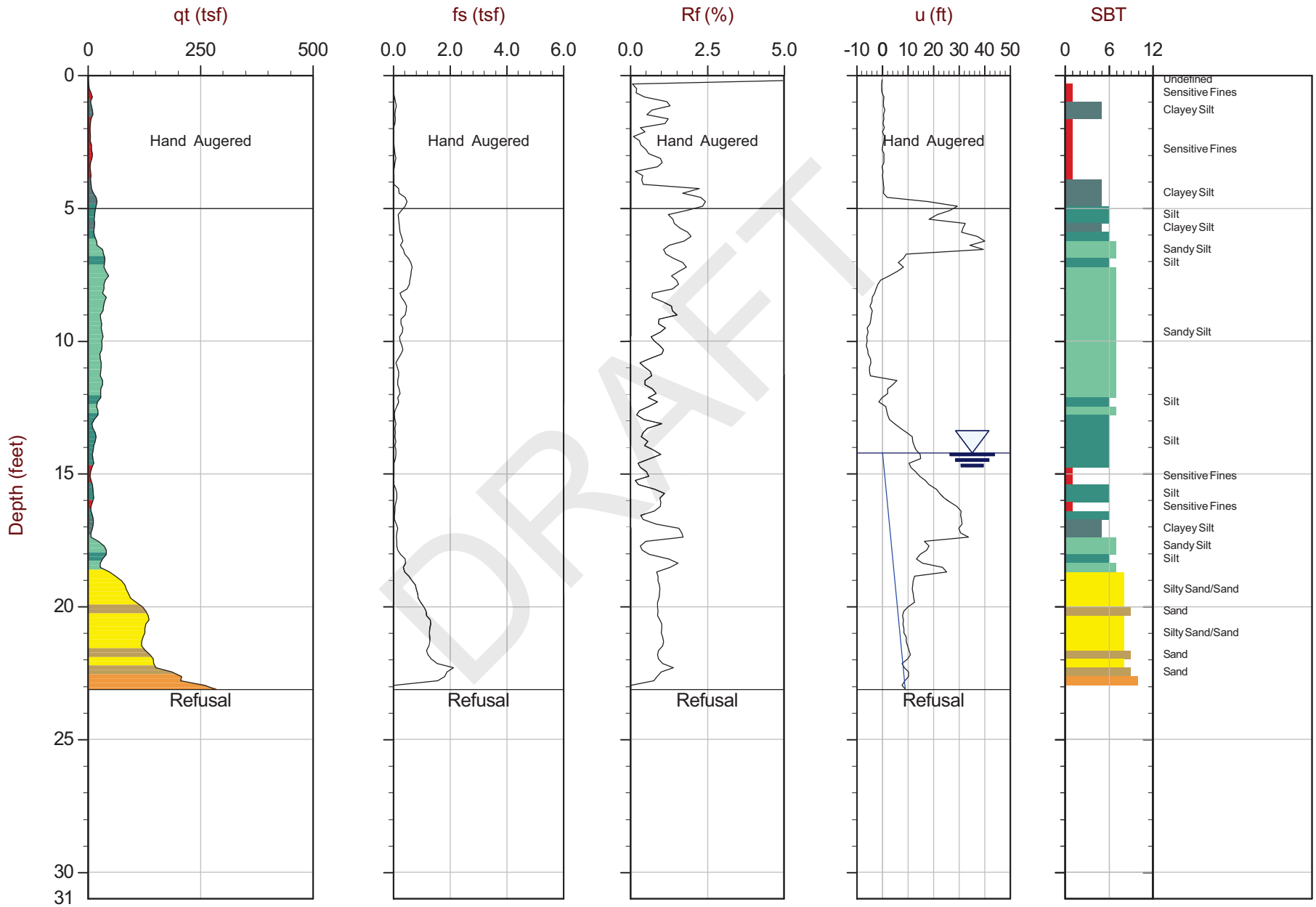
SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776163 E: 398283

CONETEC

AECOM

Job No: 13-53045
Date: 07:24:13 09:42
Site: Cold Springs Terminals

Sounding: UV-17
Cone: 243:T1500F15U500



DRAFT

Max Depth: 7.050 m / 23.13 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP17.COR

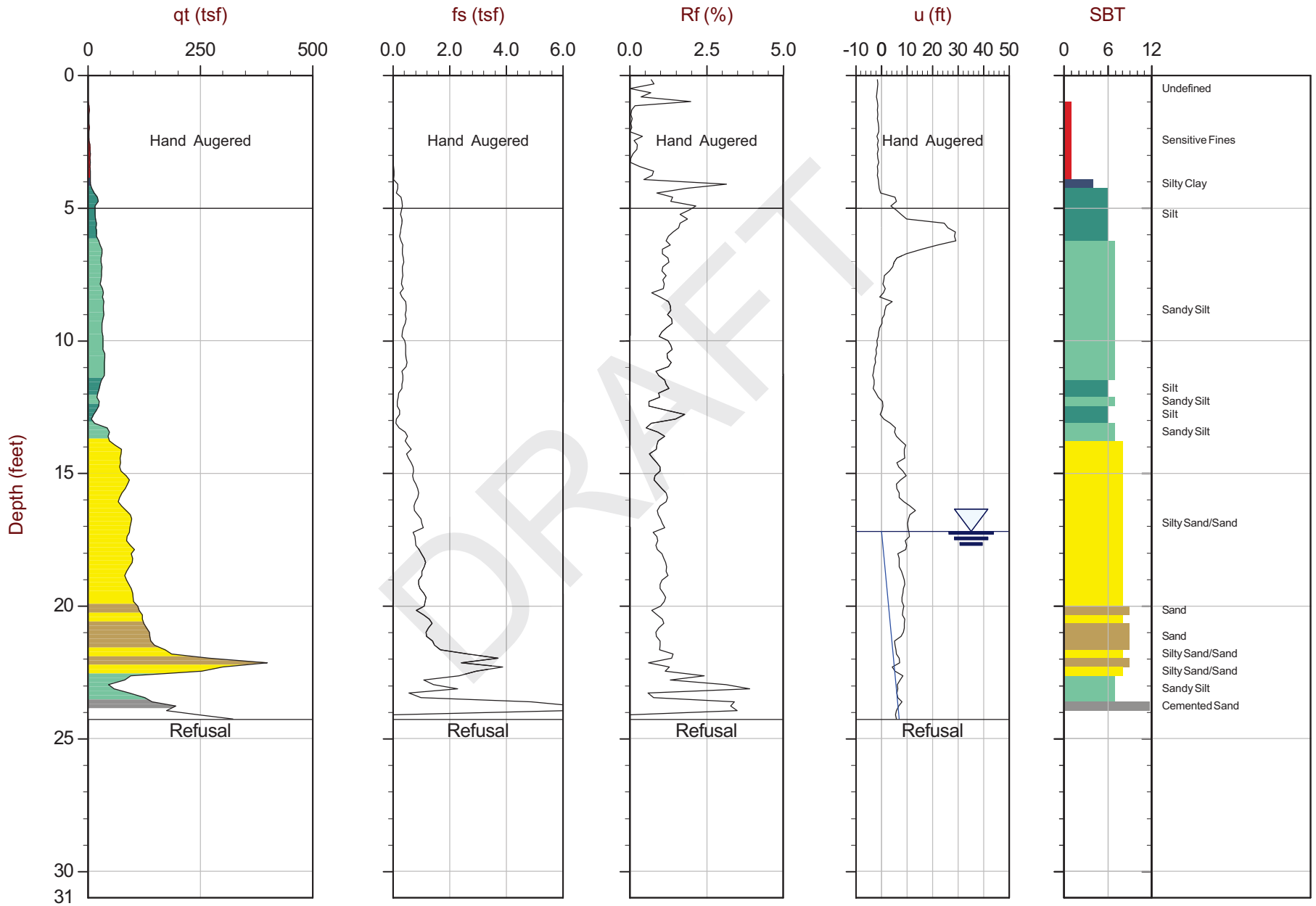
SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776179 E: 398275

CONETEC

AECOM

Job No: 13-53045
Date: 07:24:13 10:15
Site: Cold Springs Terminals

Sounding: UV-18
Cone: 243:T1500F15U500



DRAFT

Max Depth: 7.400 m / 24.28 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP18.COR

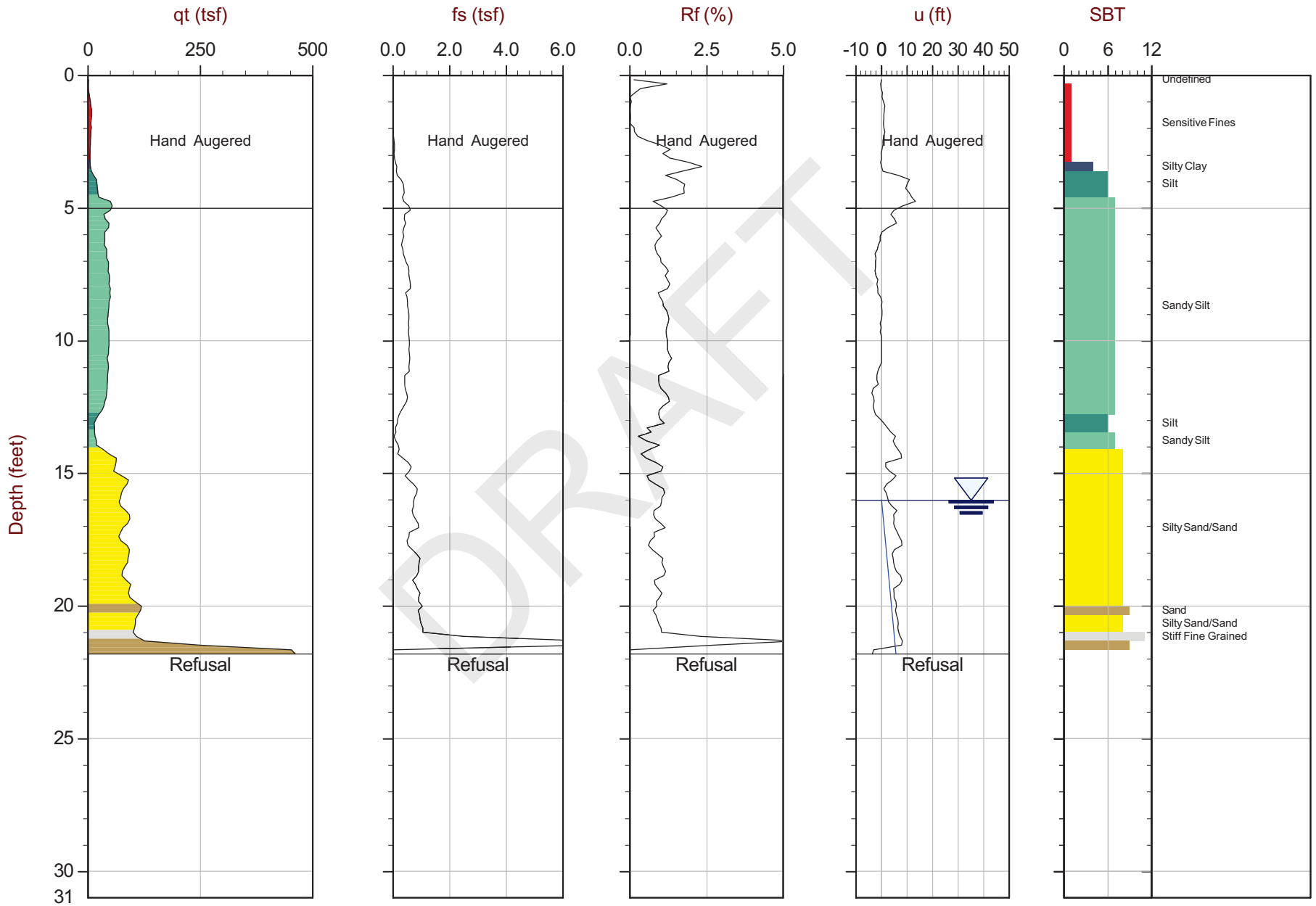
SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776180 E: 398259

CONETEC

AECOM

Job No: 13-53045
Date: 07:24:13 11:24
Site: Cold Springs Terminals

Sounding: UV-19
Cone: 243:T1500F15U500



DRAFT

Max Depth: 6.650 m / 21.82 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP19.COR

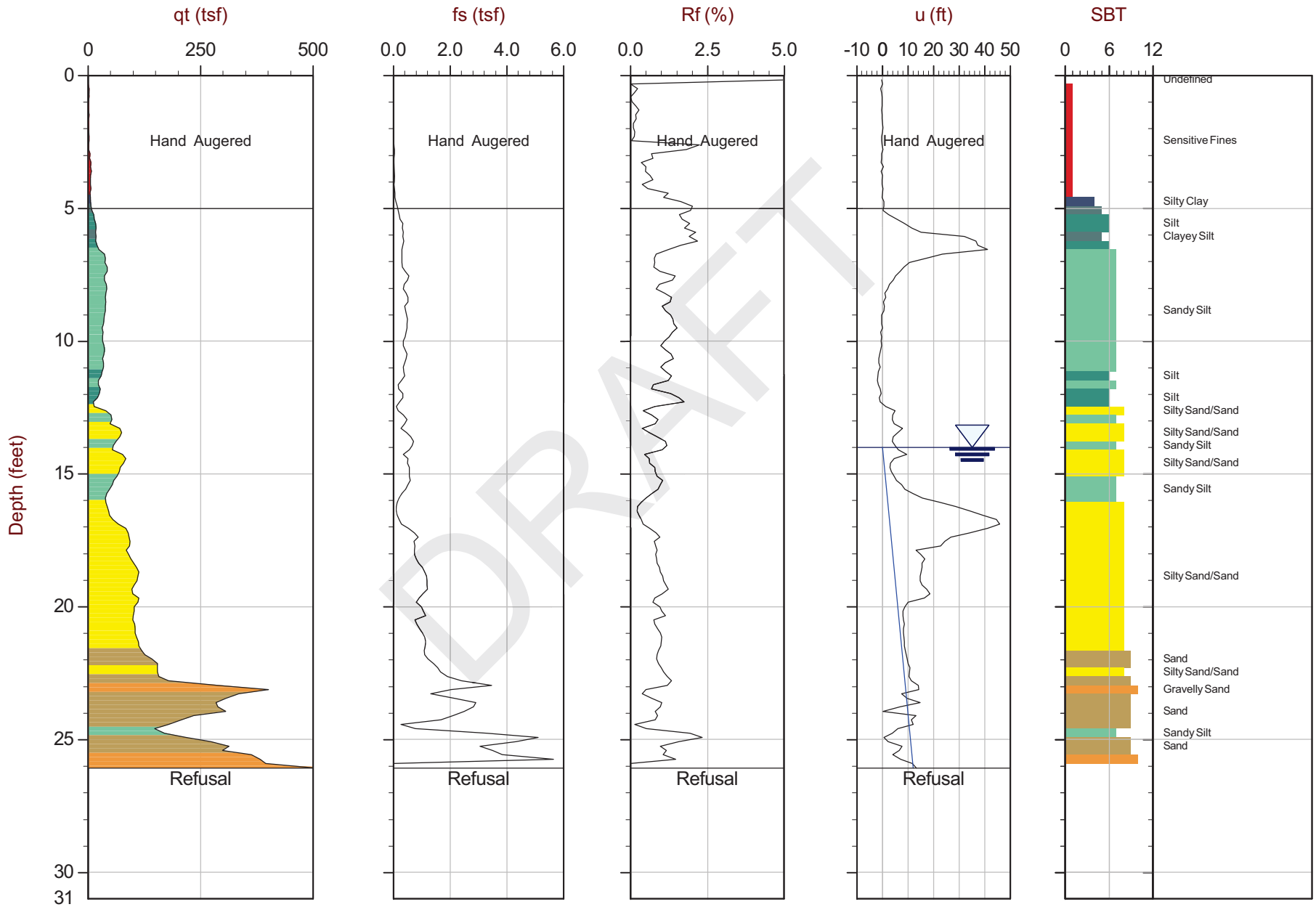
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Coords: UTM Zone 18 N: 4776178 E: 398245

CONETEC

AECOM

Job No: 13-53045
Date: 07:24:13 12:10
Site: Cold Springs Terminals

Sounding: UV-20
Cone: 243:T1500F15U500



DRAFT

Max Depth: 7.950 m / 26.08 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP20.COR

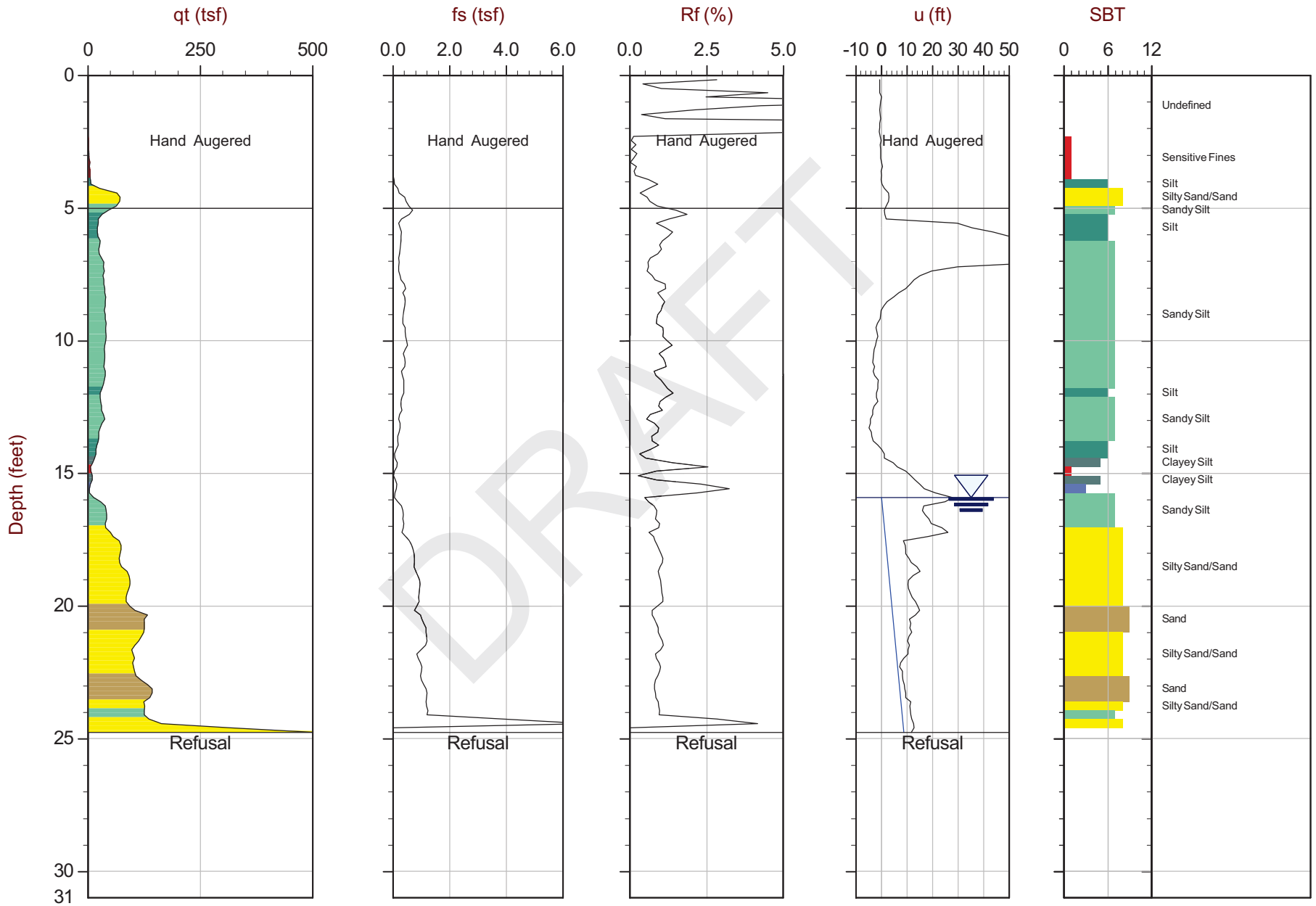
SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776172 E: 398256
Page No: 1 of 1

CONETEC

AECOM

Job No: 13-53045
Date: 07:24:13 13:02
Site: Cold Springs Terminals

Sounding: UV-21
Cone: 243:T1500F15U500



DRAFT

Max Depth: 7.550 m / 24.77 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP21.COR

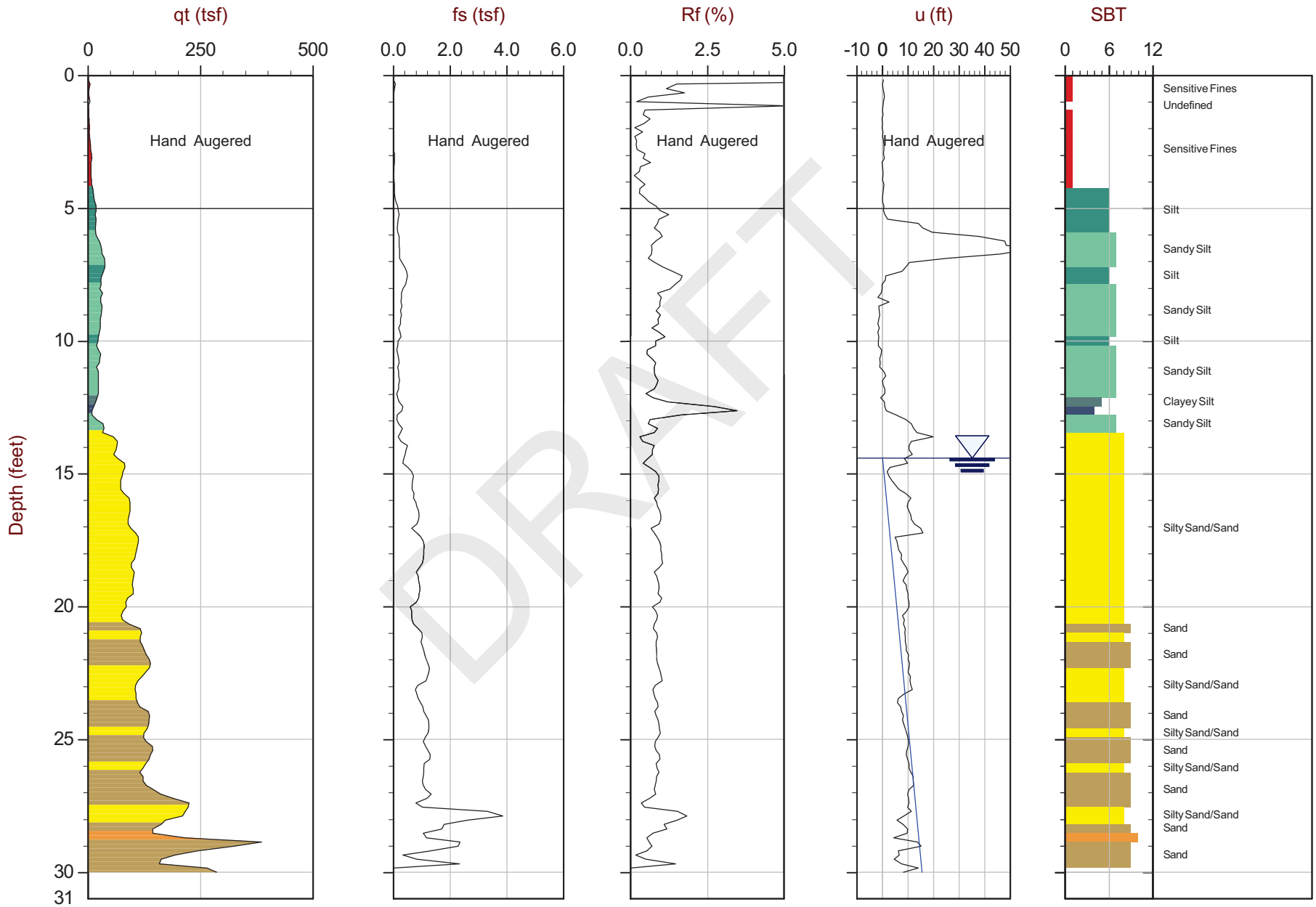
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Coords: UTM Zone 18 N: 4776169 E: 398233

CONETEC

AECOM

Job No: 13-53045
Date: 07:24:13 13:43
Site: Cold Springs Terminals

Sounding: UV-22
Cone: 243:T1500F15U500



DRAFT

Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP22.COR

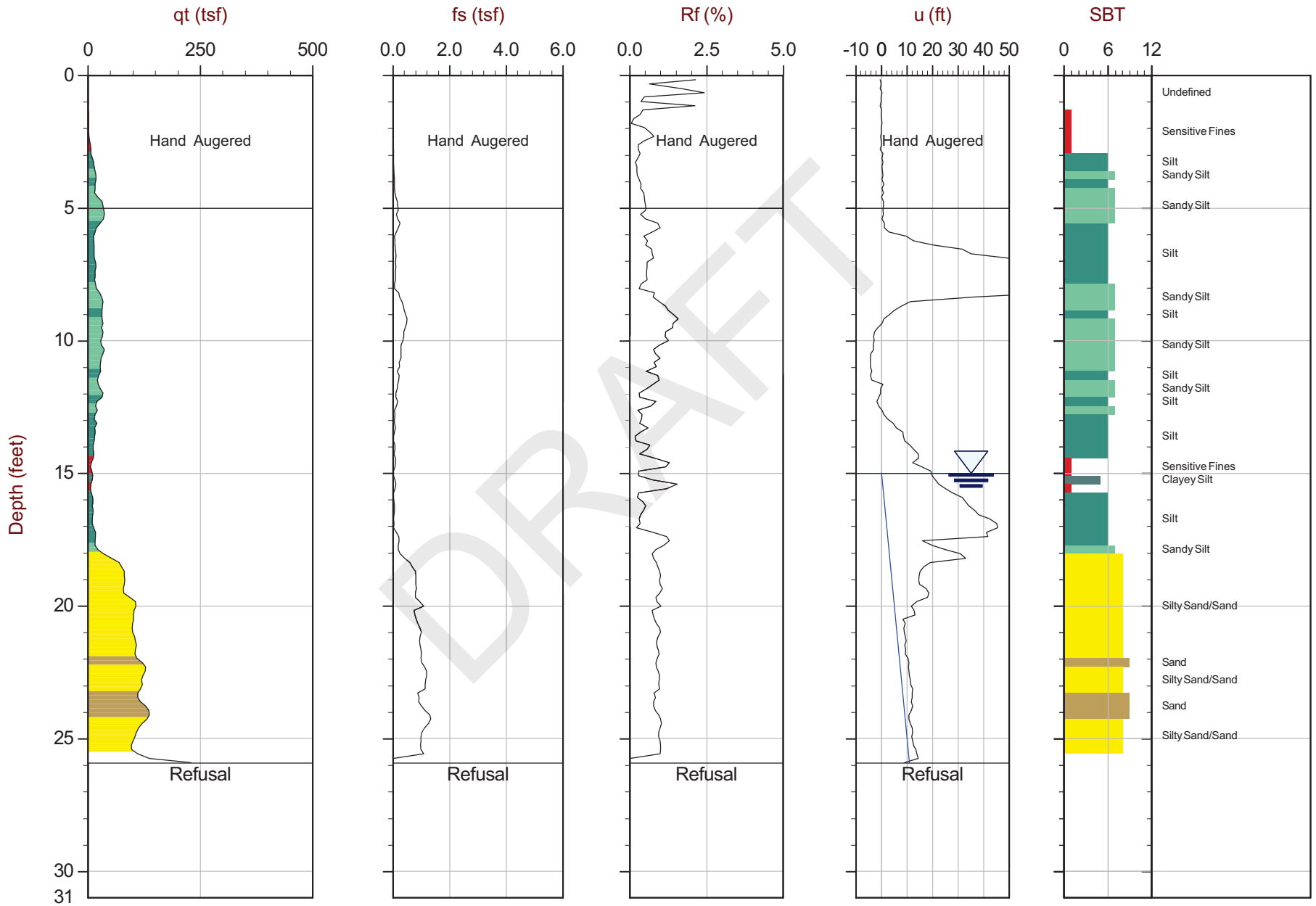
SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776158 E: 398219

CONETEC

AECOM

Job No: 13-53045
Date: 07:24:13 14:22
Site: Cold Springs Terminals

Sounding: UV-23
Cone: 243:T1500F15U500



DRAFT

Max Depth: 7.900 m / 25.92 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP23.COR

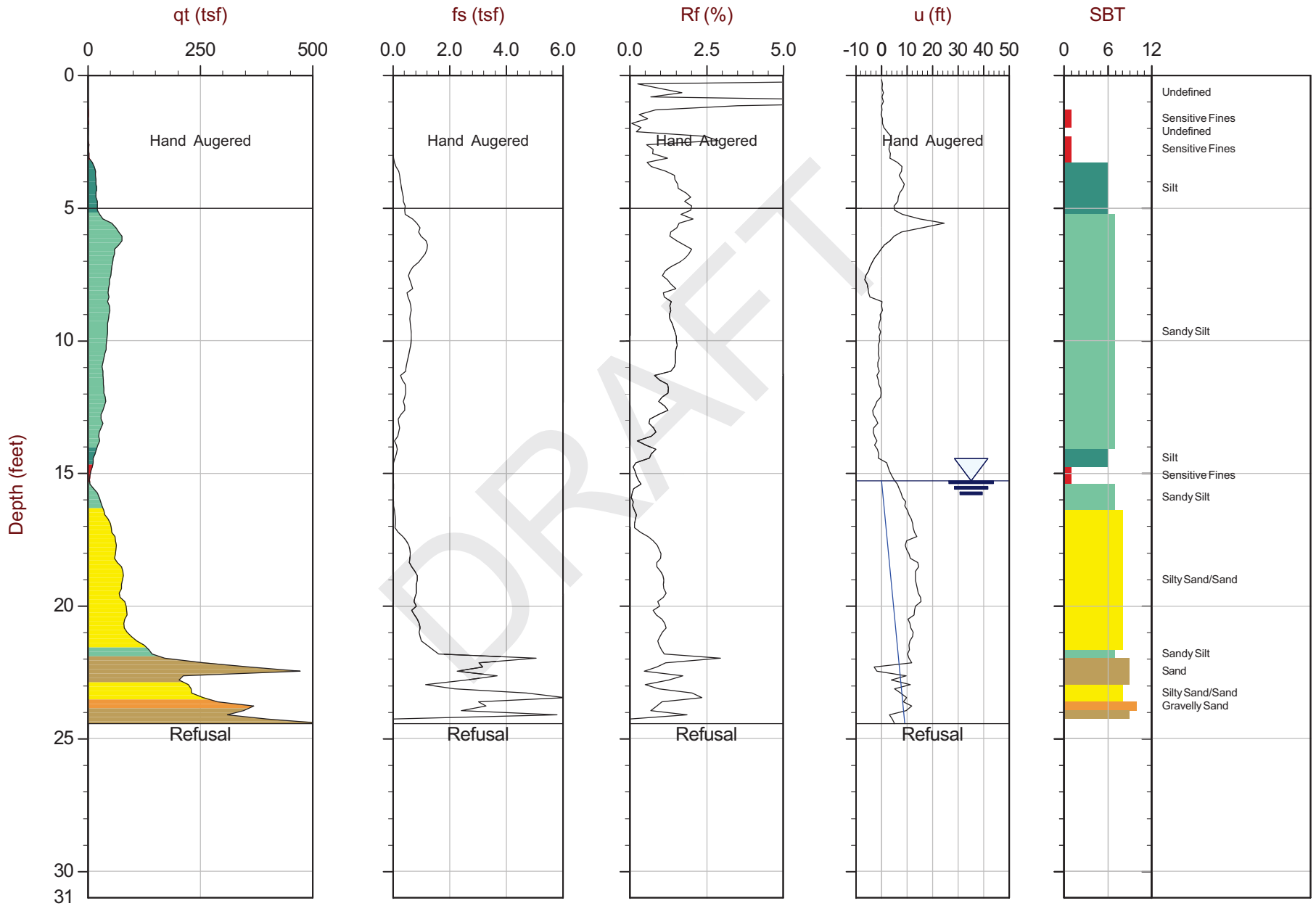
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Coords: UTM Zone 18 N: 4776165 E: 398222

CONETEC

AECOM

Job No: 13-53045
Date: 07:24:13 15:10
Site: Cold Springs Terminals

Sounding: UV-24
Cone: 243:T1500F15U500



DRAFT

Max Depth: 7.450 m / 24.44 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP24.COR

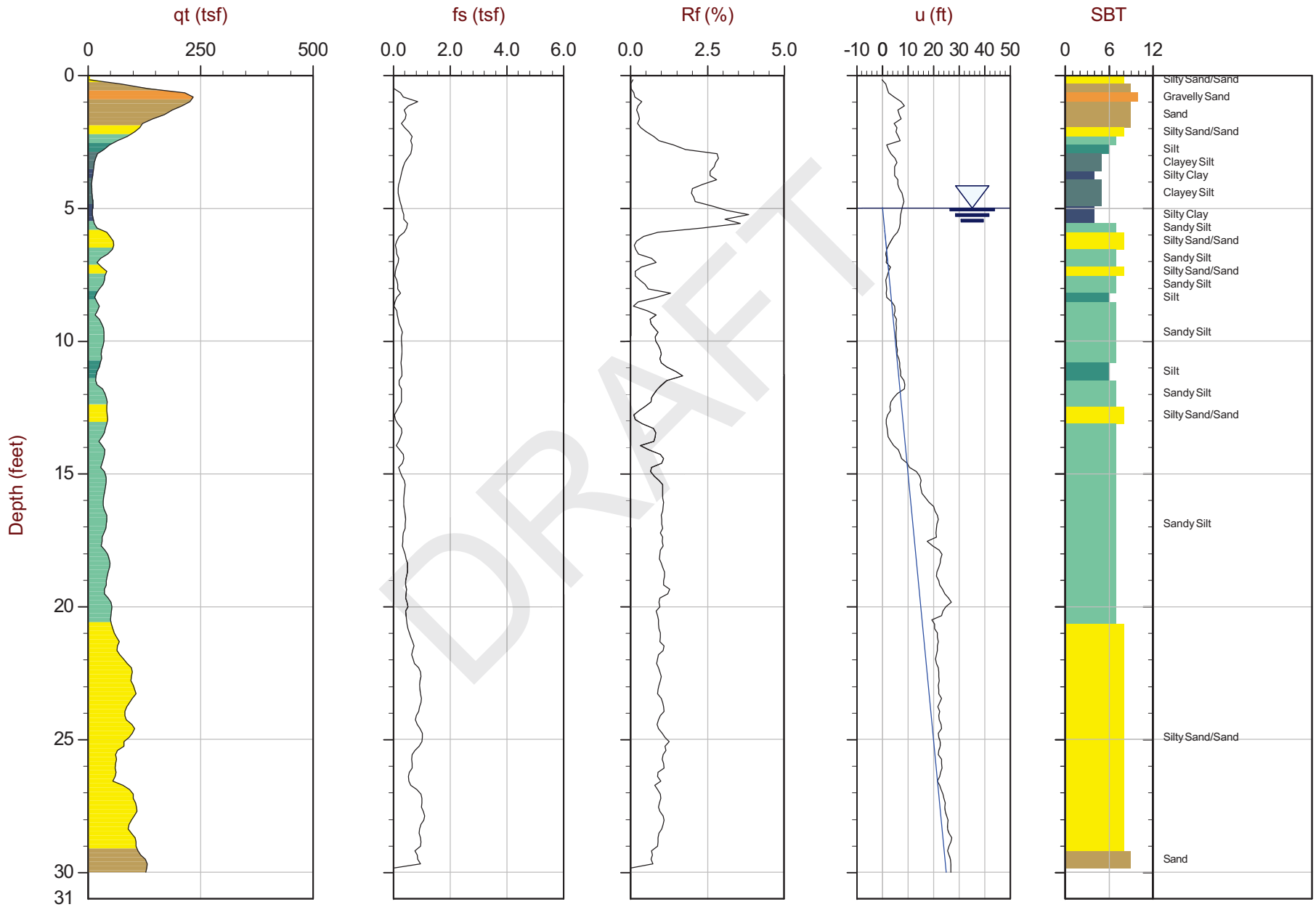
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Coords: UTM Zone 18 N: 4776174 E: 398228

CONETEC

AECOM

Job No: 13-53045
Date: 07:24:13 15:50
Site: Cold Springs Terminals

Sounding: UV-25
Cone: 243:T1500F15U500



DRAFT

Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP25.COR

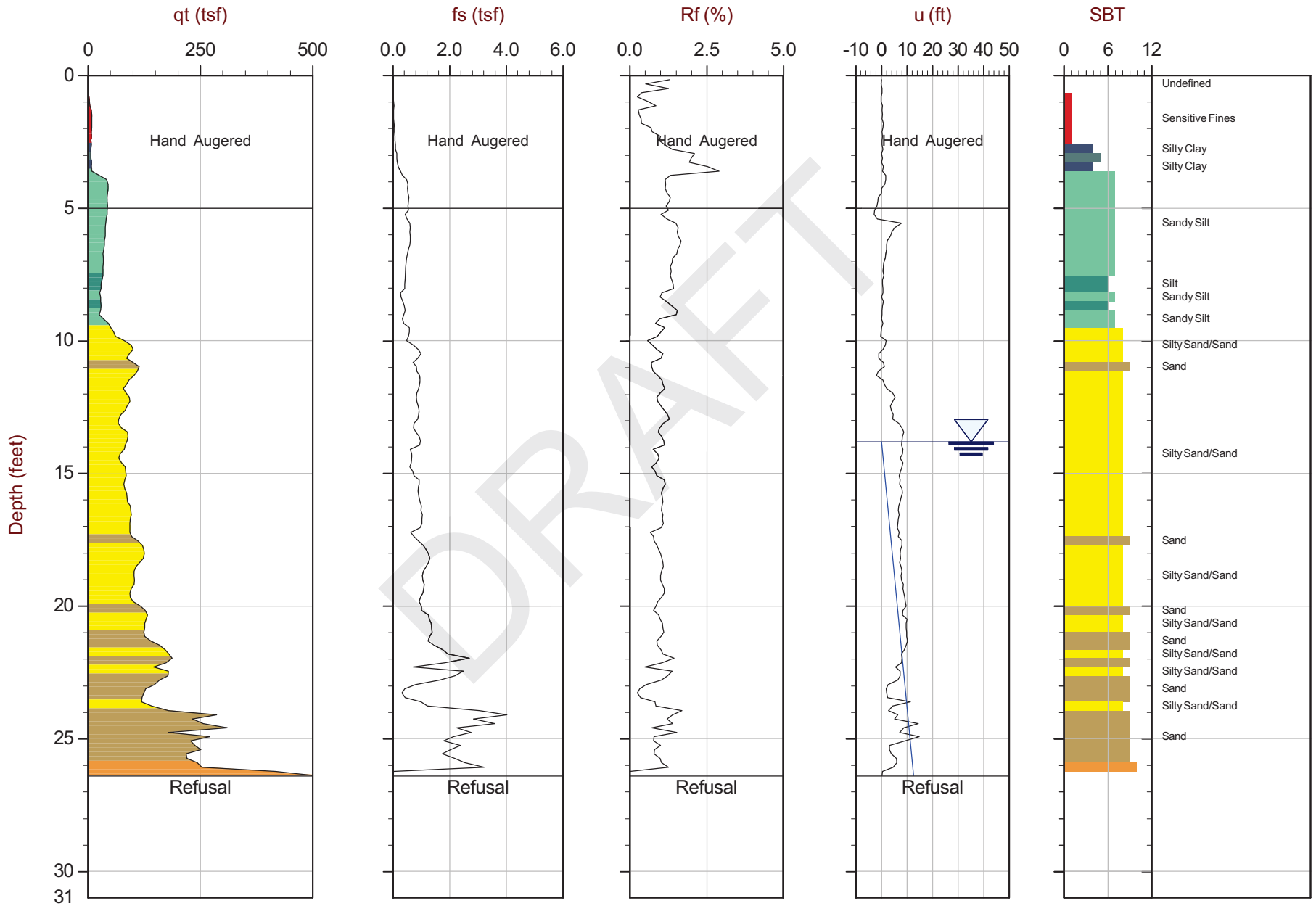
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Coords: UTM Zone 18 N: 4776120 E: 398415

CONETEC

AECOM

Job No: 13-53045
Date: 07:25:13 09:05
Site: Cold Springs Terminals

Sounding: UV-26
Cone: 243:T1500F15U500



DRAFT

Max Depth: 8.050 m / 26.41 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP26.COR

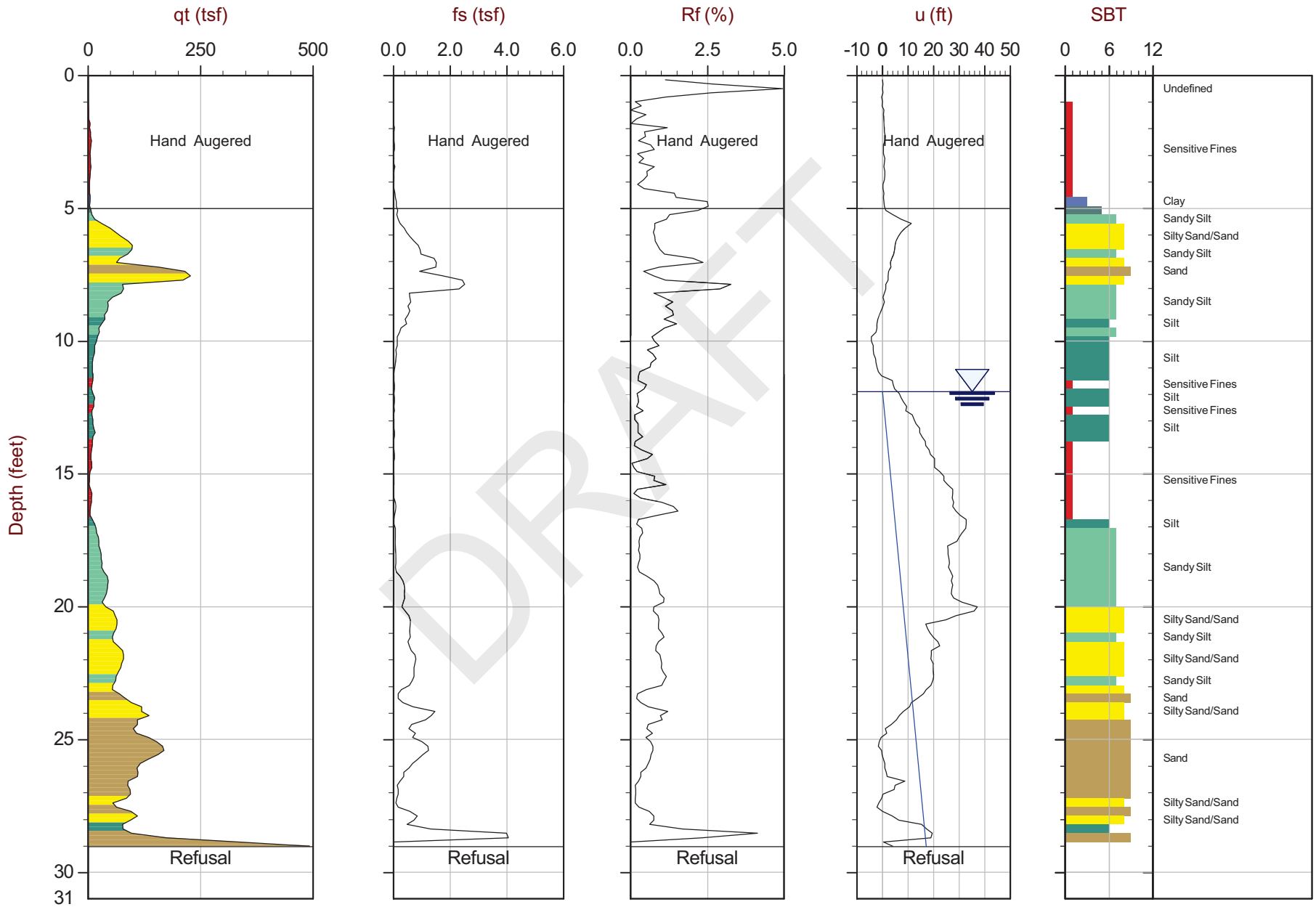
SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776179 E: 398293

CONETEC

AECOM

Job No: 13-53045
Date: 07:25:13 09:42
Site: Cold Springs Terminals

Sounding: UV-27
Cone: 243:T1500F15U500



DRAFT

Max Depth: 8.850 m / 29.04 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP27.COR

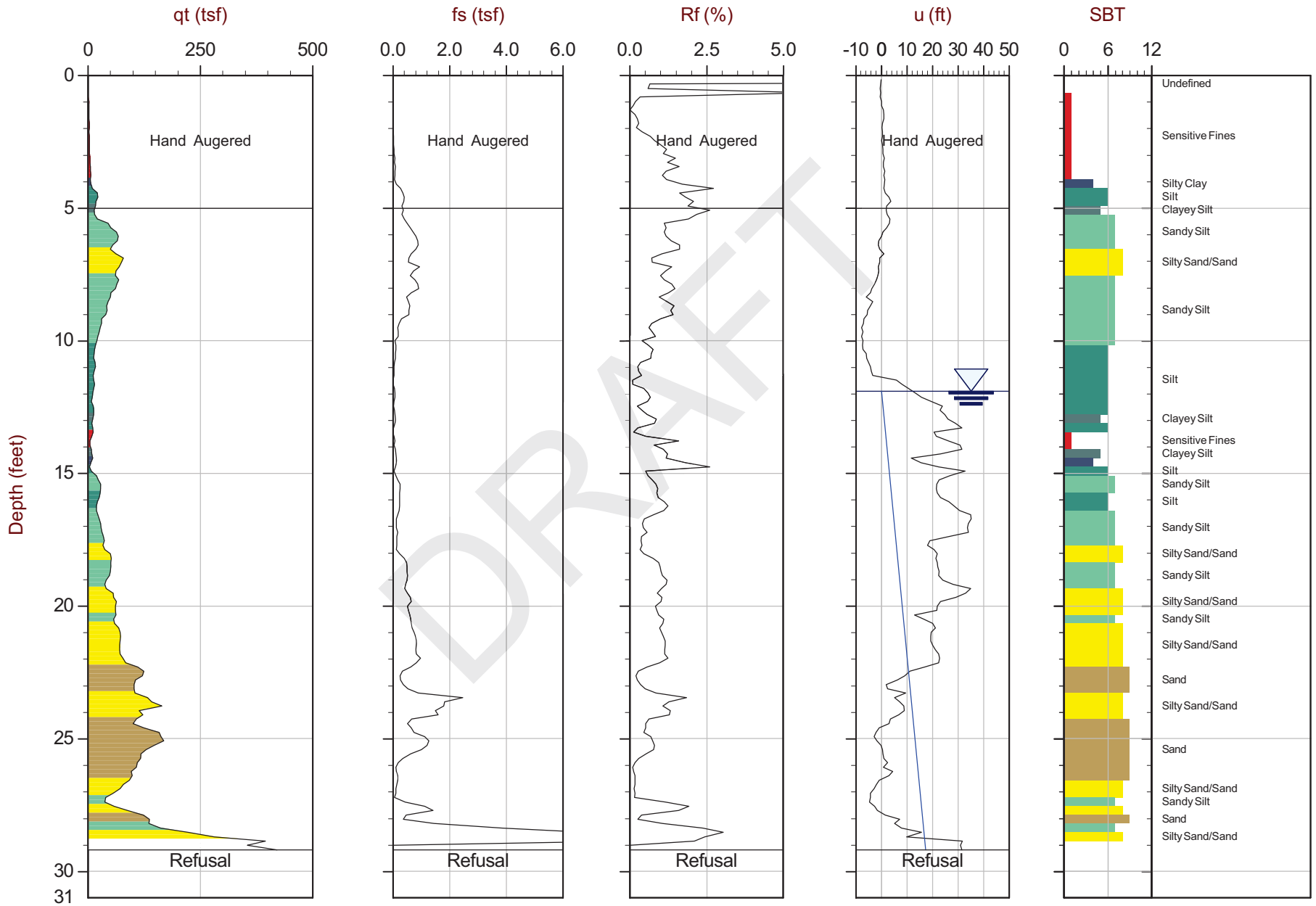
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Coords: UTM Zone 18 N: 4776188 E: 398321

CONETEC

AECOM

Job No: 13-53045
Date: 07:25:13 10:16
Site: Cold Springs Terminals

Sounding: UV-27D
Cone: 243:T1500F15U500



DRAFT

Max Depth: 8.900 m / 29.20 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP27D.COR

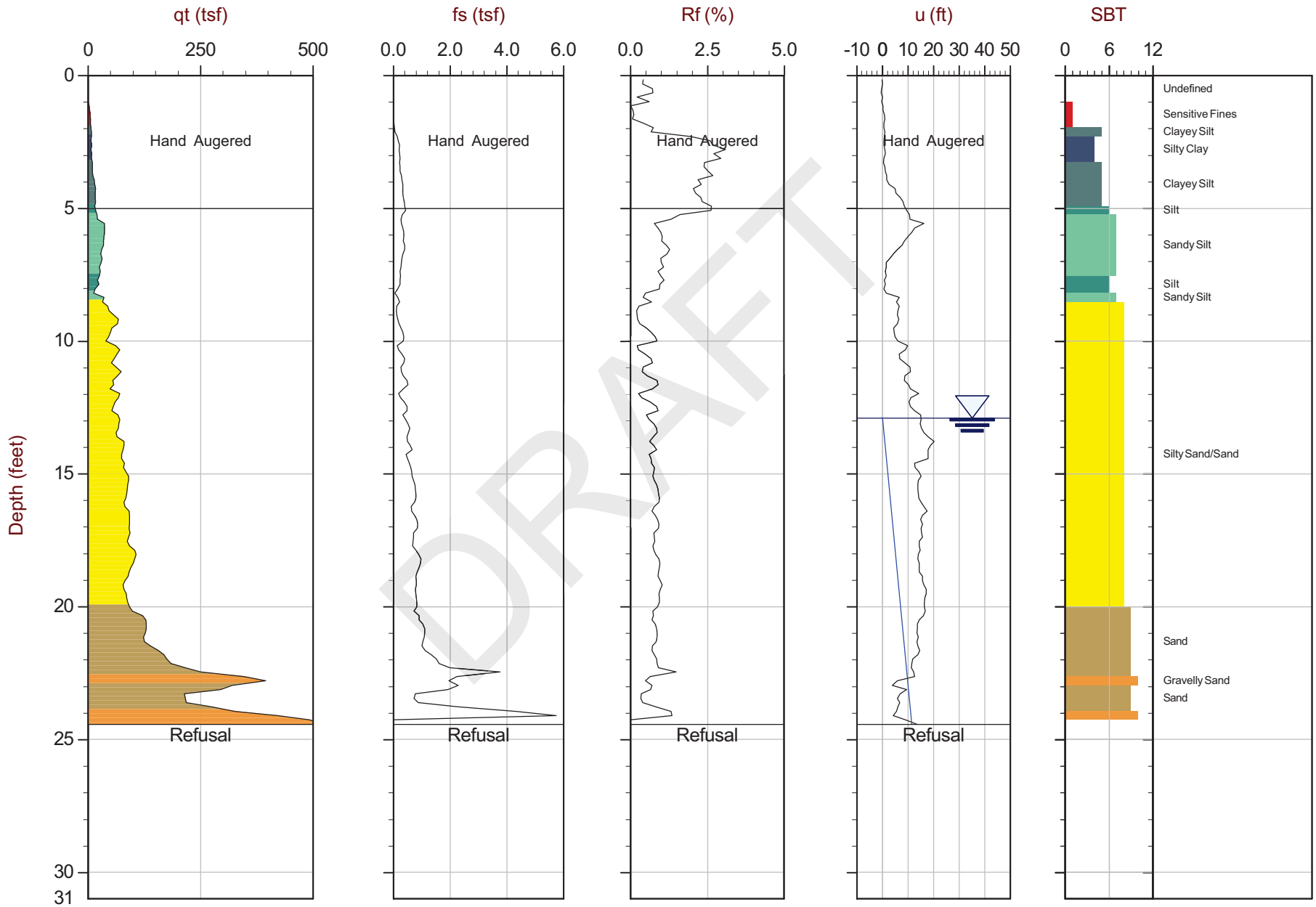
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Coords: UTM Zone 18 N: 4776182 E: 398329

CONETEC

AECOM

Job No: 13-53045
Date: 07:25:13 10:58
Site: Cold Springs Terminals

Sounding: UV-28
Cone: 243:T1500F15U500



DRAFT

Max Depth: 7.450 m / 24.44 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP28.COR

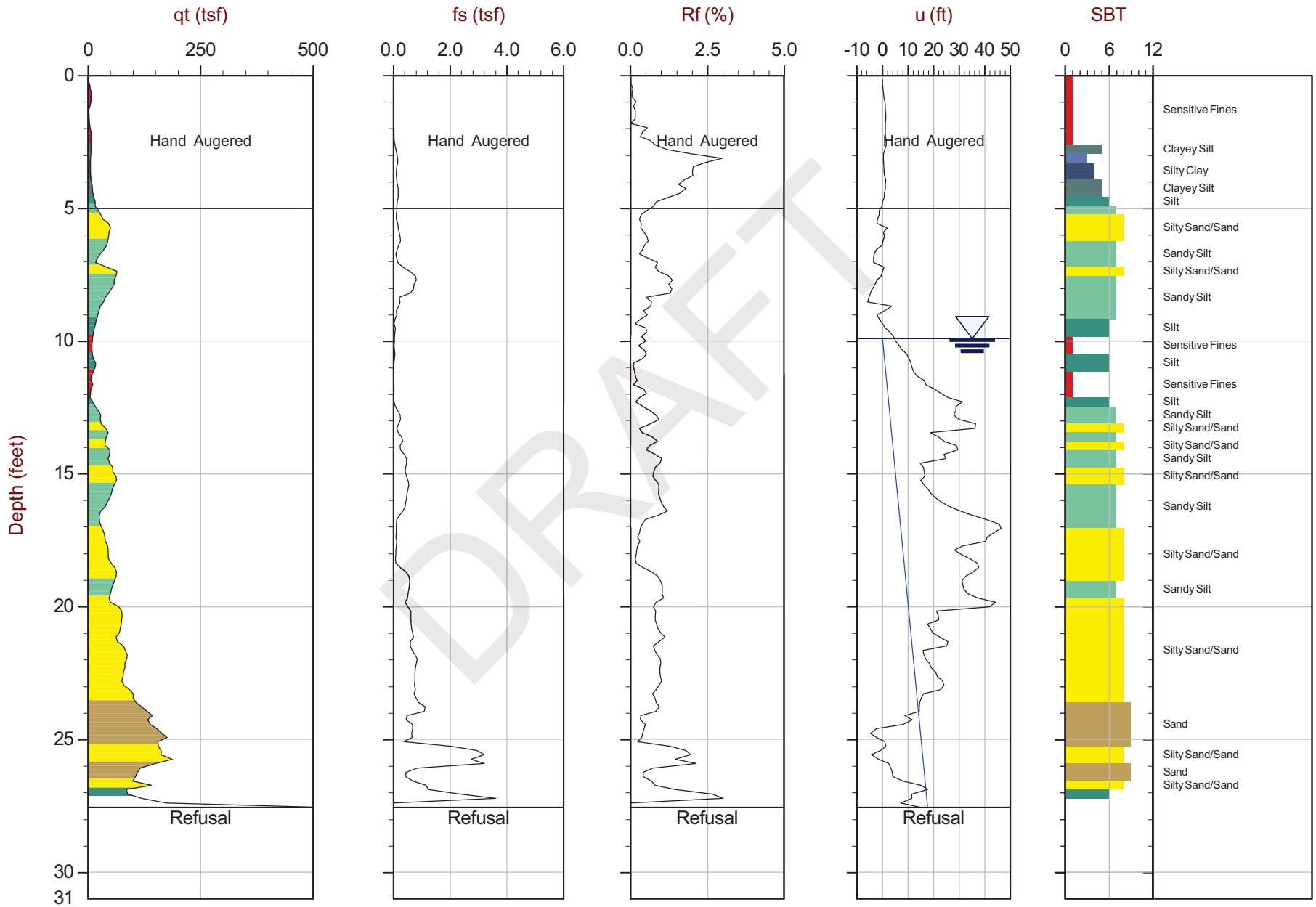
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Coords: UTM Zone 18 N: 4776171 E: 398304

CONETEC

AECOM

Job No: 13-53045
Date: 07:25:13 11:30
Site: Cold Springs Terminals

Sounding: UV-29
Cone: 243:T1500F15U500



DRAFT

Max Depth: 8.400 m / 27.56 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP29.COR

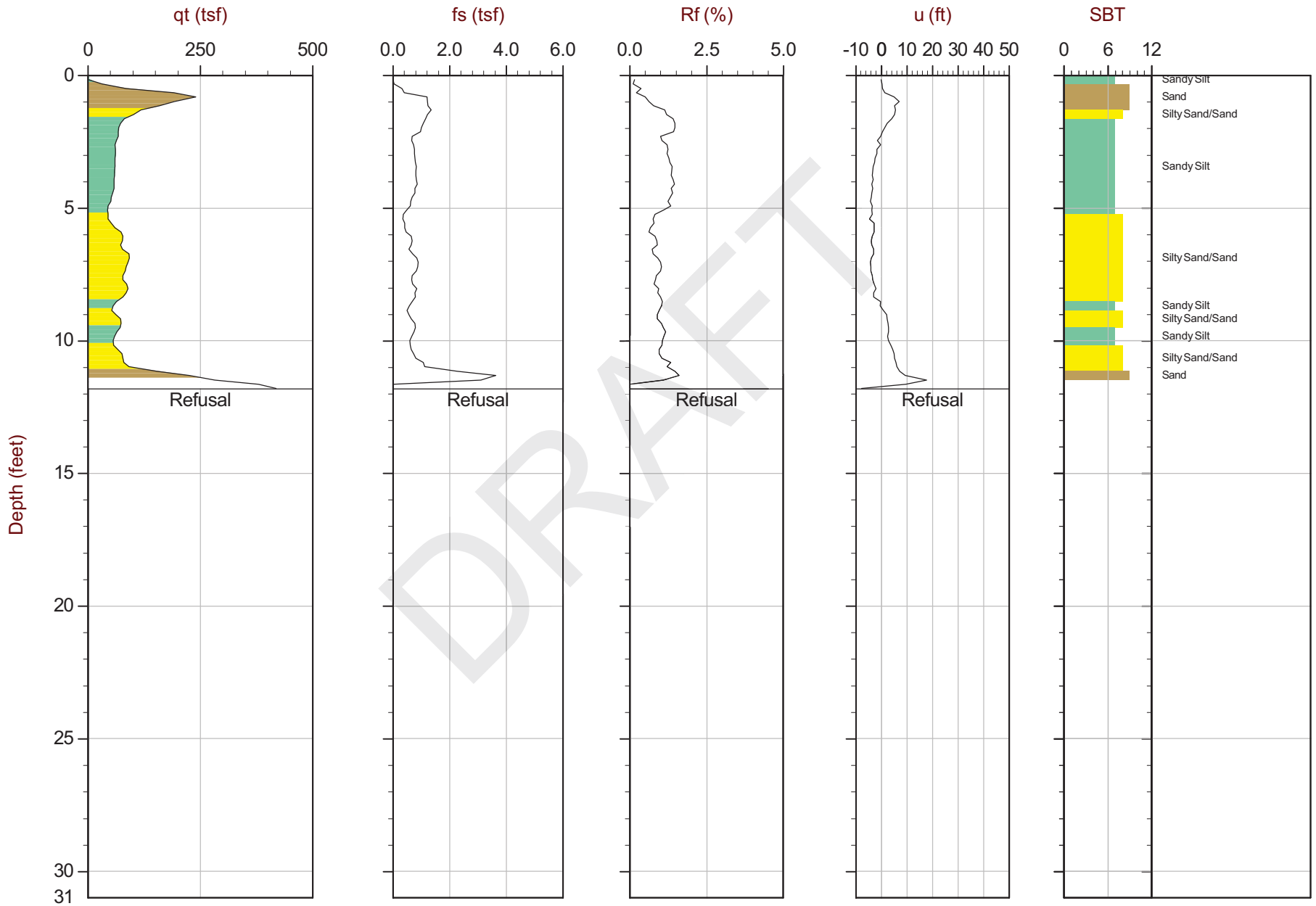
SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776182 E: 398323

CONETEC

AECOM

Job No: 13-53045
Date: 07:25:13 12:12
Site: Cold Springs Terminals

Sounding: UV-30
Cone: 243:T1500F15U500



DRAFT

Max Depth: 3.600 m / 11.81 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP30.COR

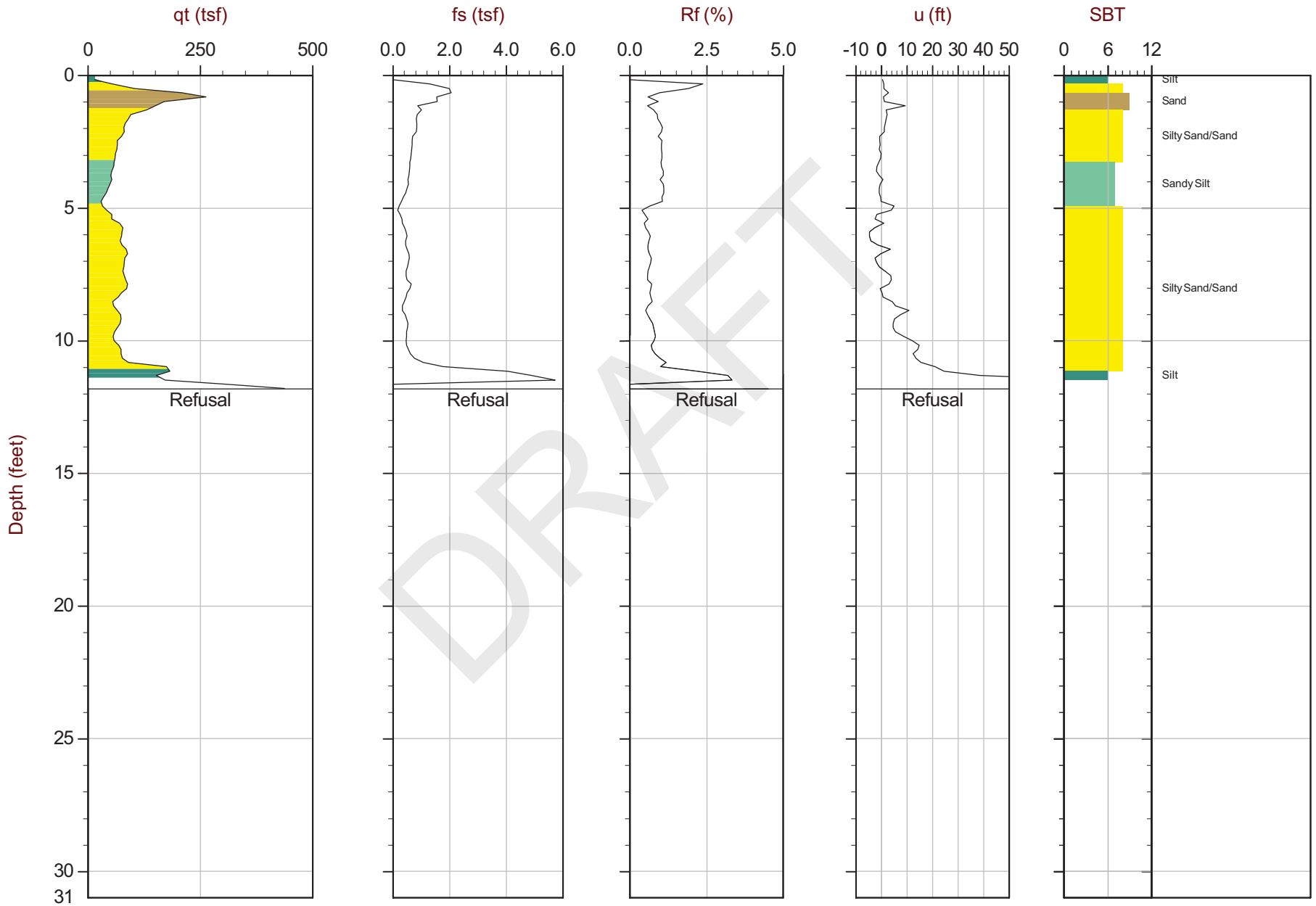
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Coords: UTM Zone 18 N: 4776210 E: 398343

CONETEC

AECOM

Job No: 13-53045
Date: 07:25:13 13:22
Site: Cold Springs Terminals

Sounding: UV-30B
Cone: 243:T1500F15U500



DRAFT

Max Depth: 3.600 m / 11.81 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP30B.COR

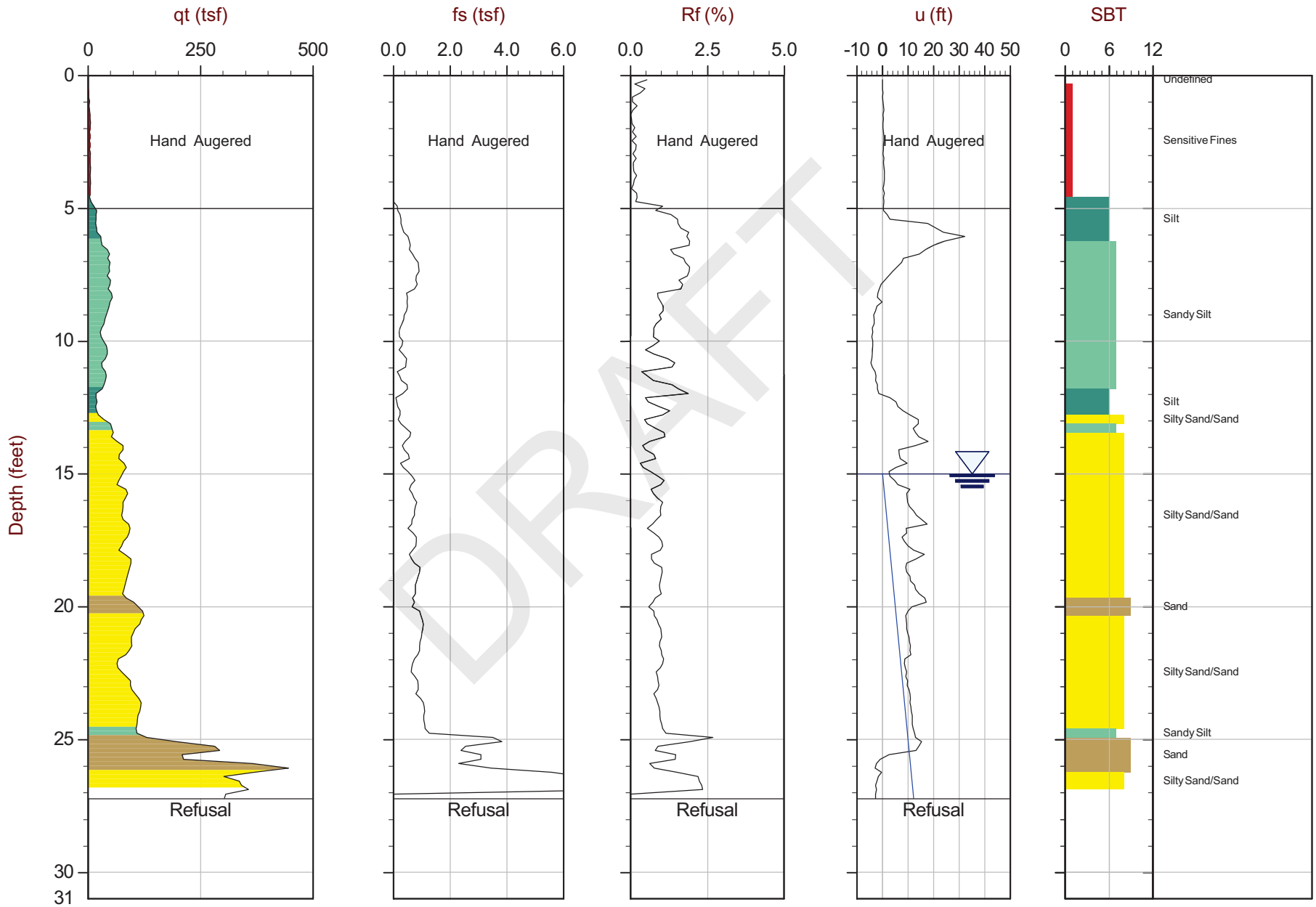
SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776206 E: 398343

CONETEC

AECOM

Job No: 13-53045
Date: 07:25:13 14:10
Site: Cold Springs Terminals

Sounding: UV-31
Cone: 243:T1500F15U500



DRAFT

Max Depth: 8.300 m / 27.23 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP31.COR

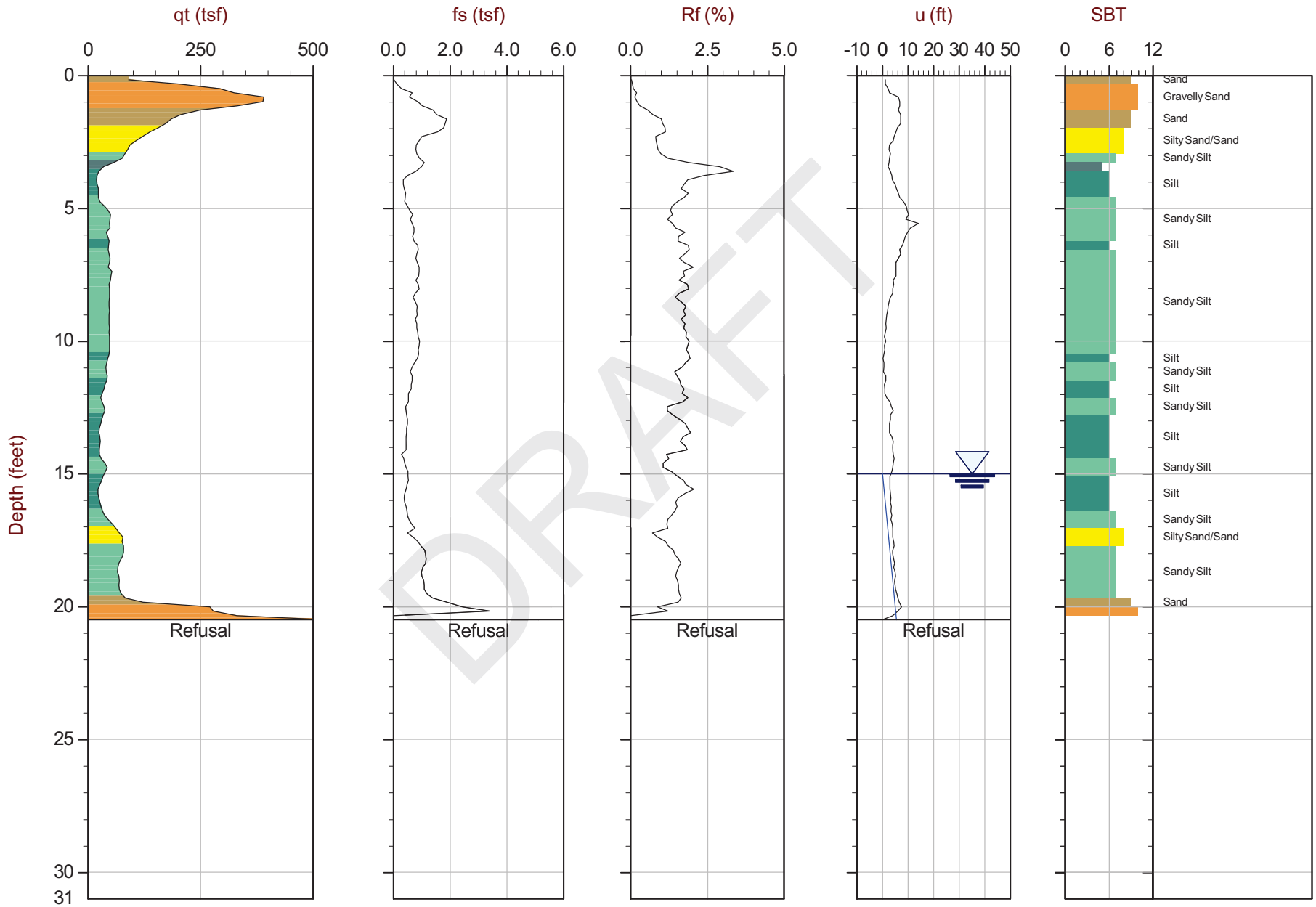
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Coords: UTM Zone 18 N: 4776159 E: 398176

CONETEC

AECOM

Job No: 13-53045
Date: 07:25:13 14:49
Site: Cold Springs Terminals

Sounding: UV-32
Cone: 243:T1500F15U500



DRAFT

Max Depth: 6.250 m / 20.51 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP32.COR

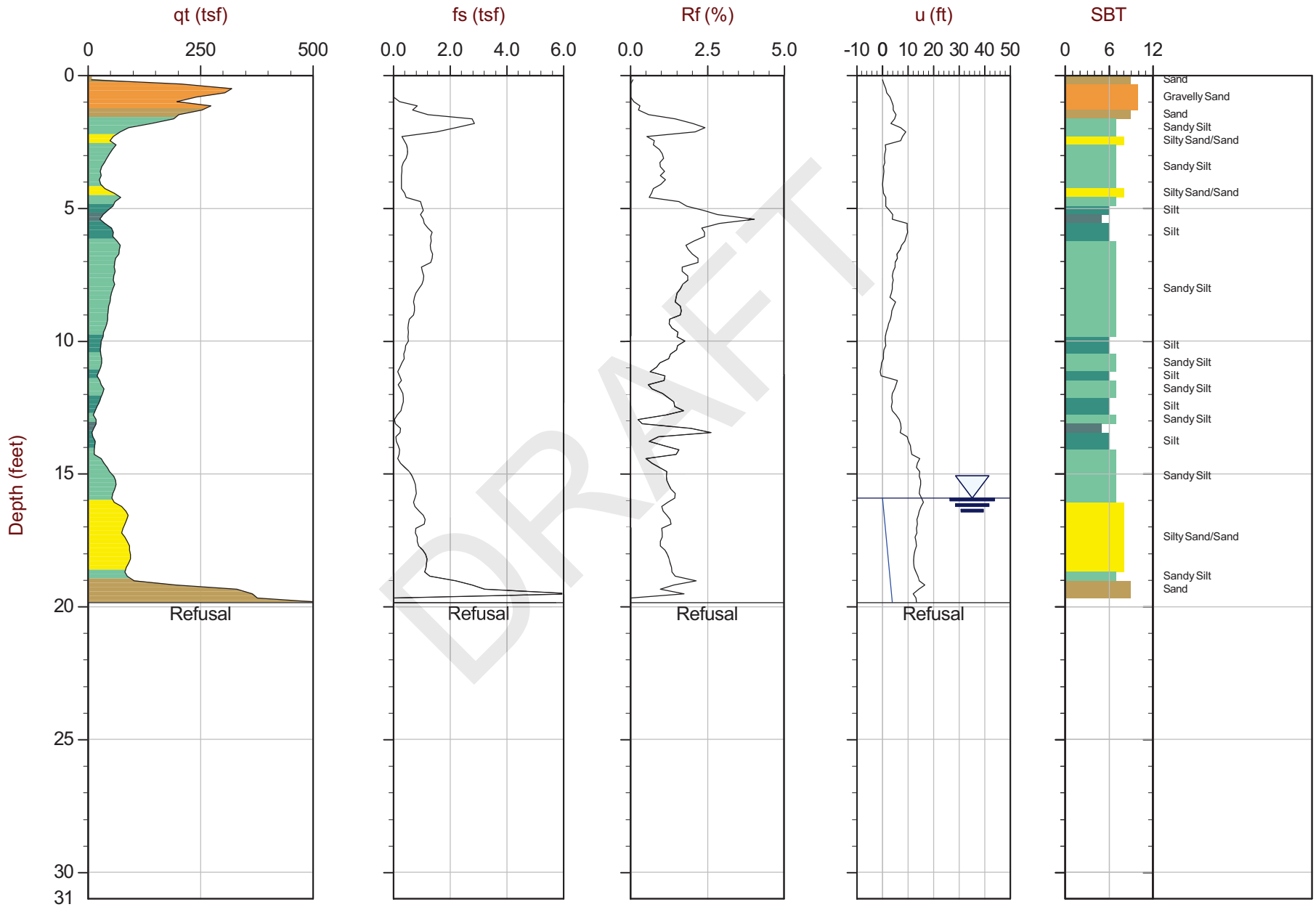
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Coords: UTM Zone 18 N: 4776175 E: 398175

CONETEC

AECOM

Job No: 13-53045
Date: 07:25:13 15:20
Site: Cold Springs Terminals

Sounding: UV-33
Cone: 243:T1500F15U500



DRAFT

Max Depth: 6.050 m / 19.85 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP33.COR

SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776161 E: 398150

LIF-CPT Plots

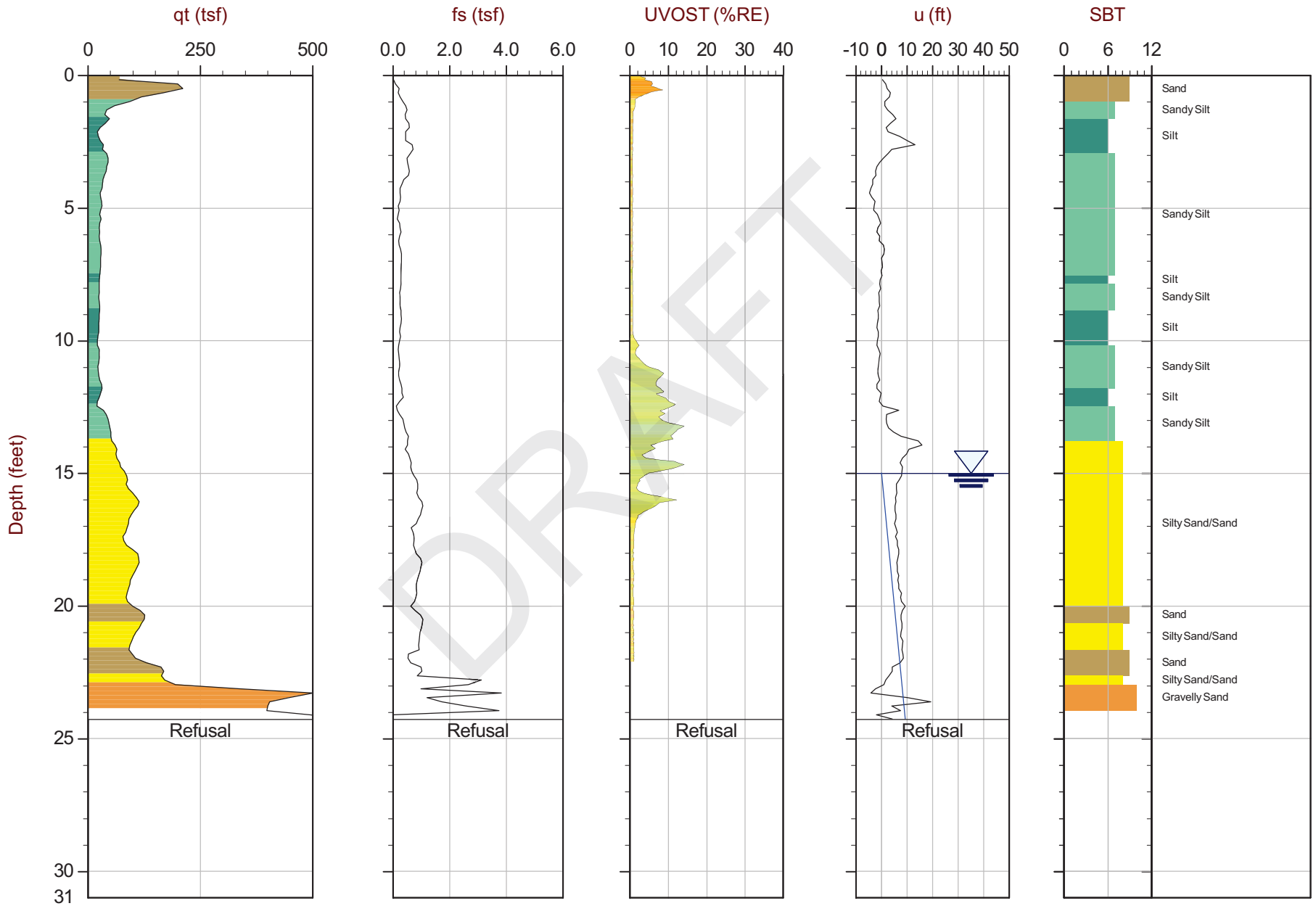
DRAFT

CONETEC

AECOM

Job No: 13-53045
Date: 07:22:13 14:25
Site: Cold Springs Terminals

Sounding: UV-01
Cone: 226:T1500F15U500



DRAFT

Max Depth: 7.400 m / 24.28 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP01.COR

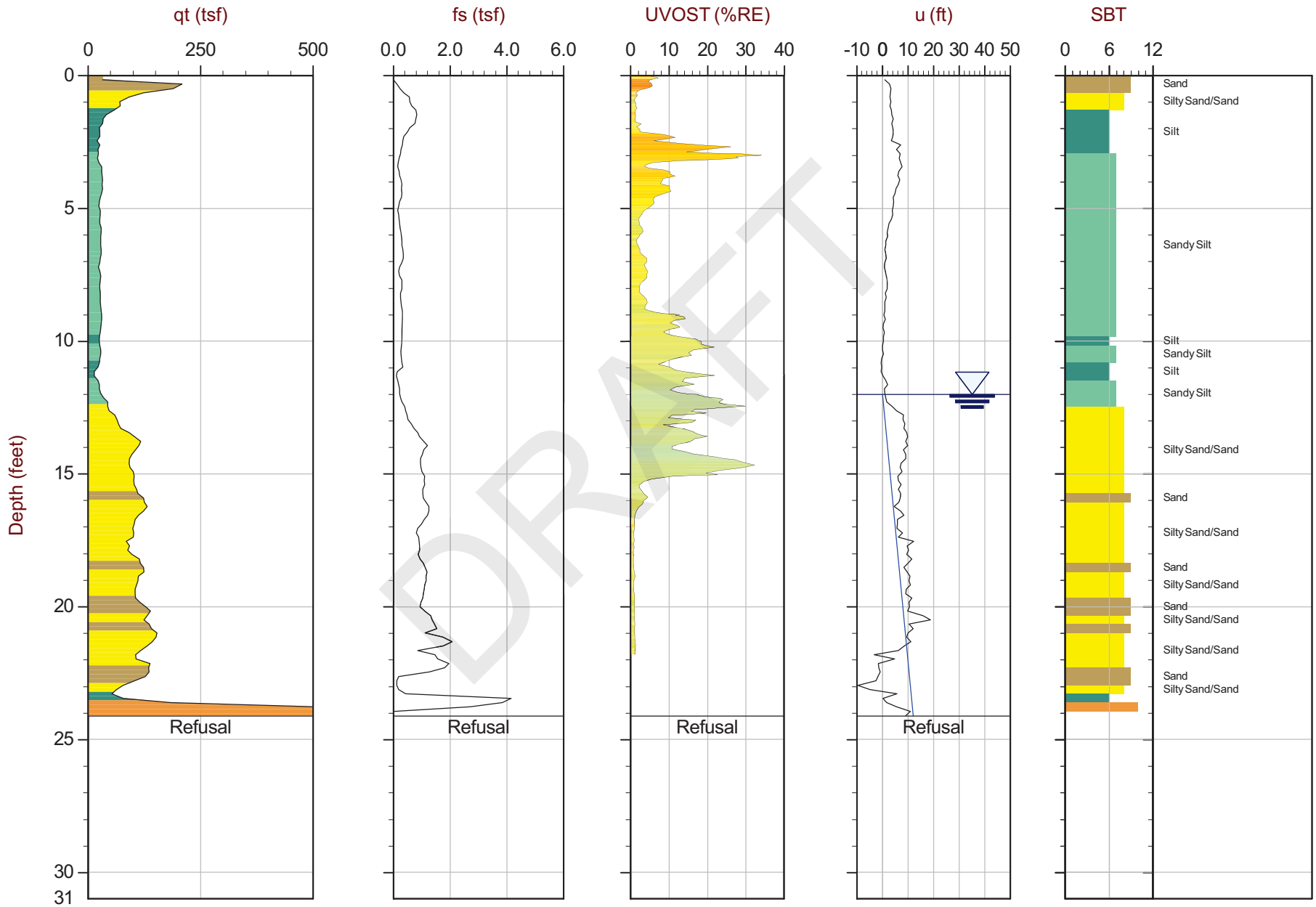
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Coords: UTM Zone 18 N: 4776185 E: 398271

CONETEC

AECOM

Job No: 13-53045
Date: 07:22:13 15:17
Site: Cold Springs Terminals

Sounding: UV-02
Cone: 226:T1500F15U500



DRAFT

Max Depth: 7.350 m / 24.11 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.100 m

File: 13-53045_CP02.COR

SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 18 N: 4776188 E: 398286

Appendix C

Pace Analytical Reports

Pace Analytical e-Report

Report prepared for:
AECOM
40 BRITISH AMERICAN BLVD
LATHAM, NY 12110
CONTACT: JOHN SANTACROCE

Project ID: COLD SPRINGS TERMINALS 60248522
Sampling Date(s): August 13, 2013
Lab Report ID: 13080286
Client Service Contact: Chelsea Farmer (518) 346-4592 ext. 3843

Analysis Included:
Diesel Range Organics
Gasoline Range Organics

Test results meet all National Environmental Laboratory Accreditation Conference (NELAC) requirements unless noted in the case narrative. The results contained within this document relate only to the samples included in this report. Pace Analytical is responsible only for the certified testing and is not directly responsible for the integrity of the sample before laboratory receipt. This report shall not be reproduced, except in full, without the written consent of Pace Analytical Services, Inc.

Dan Pfalzer
Laboratory Director

Certifications: New York (EPA: NY00906, ELAP: 11078), New Jersey (NY026), Connecticut (PH-0337), Massachusetts (M-NY906), Virgi nia (1884)

Pace Analytical Services, Inc.| 2190 Technology Drive | Schenectady, NY 12308
Phone: 518.346.4592 | internet: www.pacelabs.com

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Section 3: SAMPLE CHAIN OF CUSTODY 8

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Section 7: Quality Control Samples (Lab) 22

CASE NARRATIVE

August 28, 2013

CASE NARRATIVE

This data package (SDG ID: 13080286) consists of 4 soil samples received on 08/14/2013. The samples are from Project Name: COLD SPRINGS TERMINALS 60248522.

This sample delivery group consists of the following samples:

Lab Sample ID	Client ID	Collection Date
AQ22071	SC06-TPH-04 (9-10)	08/13/2013 15:18
AQ22072	SC06-TPH-04 (10-11)	08/13/2013 15:22
AQ22073	SC06-TPH-05 (12.5-13.5)	08/13/2013 15:28
AQ22074	SC06-TPH-06 (13.5-14.5)	08/13/2013 15:35

Sample Delivery and Receipt Conditions

(1.) All samples were delivered to the laboratory via FEDEX delivery service on 08/14/2013.

(2.) All samples were received at the laboratory intact and within holding times.

(3.) All samples were received at the laboratory properly preserved, if applicable.

(4.) The following cooler temperature was recorded at sample receipt (Control limits are between 0-6 Degrees Celsius): 1.0 (IR) degrees Celsius. Please see Chain of Custody for details.

Diesel Range Organics Analysis

Analysis for Diesel Range Organics was performed by method SW-846 8015. Samples were extracted by Accelerated Solvent Extraction (EPA Method 3545). The following technical and administrative items were noted for the analysis:

(1.) All quality assurance parameters were met for the analysis.

Gasoline Range Organics Analysis

Analysis for Gasoline Range Organics was performed by method SW-846 8015. The following technical and administrative items were noted for the analysis:

(1.) All quality assurance parameters were met for the analysis.

Respectfully submitted,

Chelsea L. Farmer
Project Manager

QUALIFIERS

Organic Laboratory Qualifiers Defined

B - Denotes analyte observed in associated method blank or extraction blank. Analyte concentration should be considered as estimated.

D - Surrogate was diluted. The analysis of the sample required a dilution such that the surrogate concentration was diluted below the laboratory acceptance criteria.

E - Denotes analyte concentration exceeded calibration range of instrument. Sample could not be re-analyzed at secondary dilution due to insufficient sample amount, quick turn-around request, sample matrix interference or hold time excursion. Concentration result should be considered as estimated.

J - Denotes an estimated concentration. The concentration result is greater than or equal to the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

P - Indicates relative percent difference (RPD) between primary and secondary gas chromatograph (GC) column analysis exceeds 40 % or indicates percent difference (PD) between primary and secondary gas chromatograph (GC) column analysis exceeds 25 %.

U - Denotes analyte not detected at concentration greater than or equal to the Reporting Limit (RL). Reporting Limit's (RL) are adjusted for sample weight/volume and dilution factors.

Z - Chromatographic interference due to polychlorinated biphenyl (PCB) co-elution.

* - Value not within control limits.

Inorganic Laboratory Qualifiers Defined

B - Denotes analyte observed in associated method blank or digestion blank. Analyte concentration should be considered as estimated.

E - Denotes analyte concentration exceeded calibration range of instrument. Sample could not be re-analyzed at secondary dilution due to insufficient sample amount, quick turn-around request, sample matrix interference or hold time excursion. Concentration result should be considered as estimated.

J - Denotes an estimated concentration. The concentration result is greater than or equal to the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

U - Denotes analyte not detected at concentration greater than or equal to the Reporting Limit (RL). Reporting Limit's (RL) are adjusted for sample weight/volume and dilution factors.

* - Value not within control limits.

SAMPLE CHAIN OF CUSTODY

Pace Analytical®
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

<13080286P1>

130302861

Page: 1 of 1

1701260

Section A Required Client Information:

Company: AECOM
Address: 40 British American Blvd
Latham, N.Y. 12110
Email To:
Phone: 518-951-2265 Fax: ...2300
Requested Due Date/TAT: Standard

Section B Required Project Information:

Report To: John.Santacroce@aecom.com
Copy To:
Purchase Order No.:
Project Name: Cold Springs Terminals
Project Number: 60248522

Section C Invoice Information:

Attention:
Company Name: AECOM
Address:
Pace Quote Reference:
Pace Project Manager: Chelsea Faimes
Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☑ OTHER

Site Location STATE: NY

Section D Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Matrix Codes MATRIX / CODE

Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Tissue	TS
Other	OT

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Analysis Test: TPH DRO/GRO	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	SC06-TPH-04(9-10)	SL	C	8/13/13	1518				2	✓								Y	✓	N	AQ22071
2	SC06-TPH-04(10-11)				1522																AQ22072
3	SC06-TPH-05(12.5-13.5)				1528																AQ22073
4	SC06-TPH-06(13.5-14.5)				1535																AQ22074
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	Greta White / AECOM	8/13/13	1705	[illegible] / PACE	8/13/13	17:05	1.0 (IR)	Y	N	Y
	[illegible] / PACE	8/13/13	18:00	FED EX						
	Fedex	8/14/13	9:58	L. McCall	8/14/13	9:58				

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Greta White
SIGNATURE of SAMPLER: Greta White
DATE Signed (MM/DD/YY): 08/13/13

Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

ORIGINAL

SAMPLE RECEIPT

SAMPLE RECEIPT REPORT
13080286

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

CLIENT: AECOM
PROJECT: COLD SPRINGS TERMINALS 60248522
LRF: 13080286
REPORT: ANALYTICAL REPORT
EDD: NO
LRF TAT: 2 WEEK

RECEIVED DATE: 08/14/2013 09:58
SHIPPED VIA: FEDEX
SHIPPING ID: 803465520369
NUMBER OF COOLERS: 1
CUSTODY SEAL INTACT: NA
TEMPERATURE(S):[5] 1.0 (IR) °C

SAMPLE SEALS INTACT: NA
[1,2]SAMPLES PROPERLY PRESERVED: YES
[3]SAMPLES REC'D IN HOLDTIME: YES
DISPOSAL: BY LAB (45 DAYS)
COC DISCREPANCY: NO

COMMENTS: CAP ON SAMPLE "SC06-TPH-06 (13.5-14.5)" WAS RECEIVED BROKEN.

CLIENT ID (LAB ID)	TAT-DUE Date[4]	DATE-TIME SAMPLED	MATRIX	METHOD	TEST DESCRIPTION	QC REQUESTED
SC06-TPH-04 (9-10) (AQ22071)	2 WEEK 08-28-13	08/13/2013 15:18	Soil	EPA 8015	Gasoline Range Organics	
	2 WEEK 08-28-13	08/13/2013 15:18	Soil	SW-846 8015	Diesel Range Organics	
SC06-TPH-04 (10-11) (AQ22072)	2 WEEK 08-28-13	08/13/2013 15:22	Soil	EPA 8015	Gasoline Range Organics	
	2 WEEK 08-28-13	08/13/2013 15:22	Soil	SW-846 8015	Diesel Range Organics	
SC06-TPH-05 (12.5-13.5) (AQ22073)	2 WEEK 08-28-13	08/13/2013 15:28	Soil	EPA 8015	Gasoline Range Organics	
	2 WEEK 08-28-13	08/13/2013 15:28	Soil	SW-846 8015	Diesel Range Organics	
SC06-TPH-06 (13.5-14.5) (AQ22074)	2 WEEK 08-28-13	08/13/2013 15:35	Soil	EPA 8015	Gasoline Range Organics	
	2 WEEK 08-28-13	08/13/2013 15:35	Soil	SW-846 8015	Diesel Range Organics	

[1]The pH preservation check of Oil and Grease (Method 1664) is performed as soon as possible after sample receipt and may not be included in this report.
[2]The pH preservation check of aqueous volatile samples is not performed until after the analysis of the sample to maintain zero headspace and is not included in this report.
[3]Samples received for pH analysis are not marked as a hold time exceedance here. SW-846 methods suggests analysis to be done within 15 minutes of sample collection. Because of transportation time it is not possible for the laboratory to perform the test in that time. Sample Certificates of Analysis reports are noted as such.
[4]Samples arriving at the laboratory after 4:00 pm are assigned a due date as if they arrived the following business day unless other arrangements have been made.
[5]All samples which require thermal preservation shall be considered acceptable when received greater than 6 degrees Celsius if they are collected on the same day as received and there is evidence that the chilling process has begun, such as arrival on ice.

Reporting Parameters and Lists

EPA 8015 - Gasoline Range Organics - (ug/g)

Gasoline Range Organics

SW-846 8015 - Diesel Range Organics - (ug/g)

Diesel Range Organics

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GC - DRO

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SC06-TPH-04 (9-10)
Lab Sample ID: 13080286-01 (AQ22071)

Collection Date: 08/13/2013 15:18
Sample Matrix: SOIL
Received Date: 08/14/2013 09:58
Percent Solid: 81.9 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-688-5	EPA Method 8015 DRO C10-C28	08/26/2013 16:26	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23610	EPA 3545	08/25/2013 12:18	ACB	10.0 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Diesel Range Organics	NA	**2650**	608	50.0		GC22-688-5

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	110	60.0-140	D	GC22-688-5
1-COD (S)	3386-33-2	113	60.0-140	D	GC22-688-5

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SC06-TPH-04 (10-11)
Lab Sample ID: 13080286-02 (AQ22072)

Collection Date: 08/13/2013 15:22
Sample Matrix: SOIL
Received Date: 08/14/2013 09:58
Percent Solid: 82.2 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-687-16	EPA Method 8015 DRO C10-C28	08/25/2013 20:51	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23610	EPA 3545	08/25/2013 12:19	ACB	10.1 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Diesel Range Organics	NA	**3180**	483	40.0		GC22-687-16

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	93.1	60.0-140	D	GC22-687-16
1-COD (S)	3386-33-2	66.6	60.0-140	D	GC22-687-16

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SC06-TPH-05 (12.5-13.5)
Lab Sample ID: 13080286-03 (AQ22073)

Collection Date: 08/13/2013 15:28
Sample Matrix: SOIL
Received Date: 08/14/2013 09:58
Percent Solid: 79.2 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-687-17	EPA Method 8015 DRO C10-C28	08/25/2013 21:32	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23610	EPA 3545	08/25/2013 12:20	ACB	10.3 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Diesel Range Organics	NA	**1590**	984	80.0		GC22-687-17

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	110	60.0-140	D	GC22-687-17
1-COD (S)	3386-33-2	119	60.0-140	D	GC22-687-17

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SC06-TPH-06 (13.5-14.5)
Lab Sample ID: 13080286-04 (AQ22074)

Collection Date: 08/13/2013 15:35
Sample Matrix: SOIL
Received Date: 08/14/2013 09:58
Percent Solid: 74.9 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-688-6	EPA Method 8015 DRO C10-C28	08/26/2013 17:08	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23610	EPA 3545	08/25/2013 12:21	ACB	10.1 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Diesel Range Organics	NA	**125**	26.5	2.00		GC22-688-6

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	120	60.0-140		GC22-688-6
1-COD (S)	3386-33-2	128	60.0-140		GC22-688-6

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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GC - GRO

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SC06-TPH-04 (9-10)
Lab Sample ID: 13080286-01 (AQ22071)

Collection Date: 08/13/2013 15:18
Sample Matrix: SOIL
Received Date: 08/14/2013 09:58
Percent Solid: 81.9 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-9	EPA Method 8015 GRO C6-C10	08/20/2013 16:00	TJH	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:31	TJH	6.36 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Gasoline Range Organics	NA	**1580**	192	1000		GC03-558-9

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	109	47.7-146		GC03-558-9

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SC06-TPH-04 (10-11)
Lab Sample ID: 13080286-02 (AQ22072)

Collection Date: 08/13/2013 15:22
Sample Matrix: SOIL
Received Date: 08/14/2013 09:58
Percent Solid: 82.2 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-10	EPA Method 8015 GRO C6-C10	08/20/2013 16:37	ALC	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:33	TJH	5.95 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Gasoline Range Organics	NA	**1990**	204	1000		GC03-558-10

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	108	47.7-146		GC03-558-10

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SC06-TPH-05 (12.5-13.5)
Lab Sample ID: 13080286-03 (AQ22073)

Collection Date: 08/13/2013 15:28
Sample Matrix: SOIL
Received Date: 08/14/2013 09:58
Percent Solid: 79.2 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-11	EPA Method 8015 GRO C6-C10	08/20/2013 17:14	ALC	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:34	TJH	6.25 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Gasoline Range Organics	NA	**1350**	202	1000		GC03-558-11

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	102	47.7-146		GC03-558-11

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SC06-TPH-06 (13.5-14.5)
Lab Sample ID: 13080286-04 (AQ22074)

Collection Date: 08/13/2013 15:35
Sample Matrix: SOIL
Received Date: 08/14/2013 09:58
Percent Solid: 74.9 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-4	EPA Method 8015 GRO C6-C10	08/20/2013 12:55	ALC	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:35	TJH	6.16 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Gasoline Range Organics	NA	**134**	10.8	50.0		GC03-558-4

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	102	47.7-146		GC03-558-4

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Quality Control Samples (Lab)

Pace Analytical®

Quality Control Results
Method Blank

Job Number: 13080286

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AQ22072B)
Lab Sample ID: DBLK-79

Collection Date: N/A
Sample Matrix: SOIL
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-687-13	EPA Method 8015 DRO C10-C28	08/25/2013 18:47	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23610	EPA 3545	08/25/2013 12:16	ACB	10.0 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Diesel Range Organics	NA	ND	10.0	1.00	U	GC22-687-13

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	112	60.0-140		GC22-687-13
1-COD (S)	3386-33-2	118	60.0-140		GC22-687-13

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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Pace Analytical®

Quality Control Results
Lab Control Sample (LCS)
Job Number: 13080286

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AQ22072L)
Lab Sample ID: LCS-79

Collection Date: N/A
Sample Matrix: SOIL
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-687-14	EPA Method 8015 DRO C10-C28	08/25/2013 19:28	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23610	EPA 3545	08/25/2013 12:17	ACB	10.1 g	10.0 mL	NA

Analyte Spiked	CAS No.	Added (ug/g)	LCS (ug/g)	LCS % Rec.	Q[1]	Limits (%)
Diesel Range Organics	NA	49.4	42.5	86.1		70.0-130

[1]Qualifier column where '*' denotes value outside the control limits. Note: RPD criteria does not apply if either the sample and duplicate sample are not detected.

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	121	60.0-140		GC22-687-14
1-COD (S)	3386-33-2	128	60.0-140		GC22-687-14

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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Pace Analytical®

Quality Control Results
Method Blank

Job Number: 13080286

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AQ22071B)
Lab Sample ID: GRO Blank-63

Collection Date: N/A
Sample Matrix: SOIL
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-3	EPA Method 8015 GRO C6-C10	08/20/2013 11:07	TJH	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:28	TJH	5.24 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Gasoline Range Organics	NA	ND	9.54	50.0	U	GC03-558-3

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	93.7	47.7-146		GC03-558-3

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Fax: 518.381.6055

Quality Control Results
Lab Control Sample (LCS)

Job Number: 13080286

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AQ22071L)
Lab Sample ID: LCS-91

Collection Date: N/A
Sample Matrix: SOIL
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-2	EPA Method 8015 GRO C6-C10	08/20/2013 10:30	TJH	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:29	TJH	5.33 g	10.0 mL	NA

Analyte Spiked	CAS No.	Added (ug/g)	LCS (ug/g)	LCS % Rec.	Q[1]	Limits (%)
Gasoline Range Organics	NA	93.8	80.6	85.9		70.0-130

[1]Qualifier column where '*' denotes value outside the control limits. Note: RPD criteria does not apply if either the sample and duplicate sample are not detected.

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	95.3	47.7-146		GC03-558-2

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Pace Analytical e-Report

Report prepared for:
AECOM
40 BRITISH AMERICAN BLVD
LATHAM, NY 12110
CONTACT: JOHN SANTACROCE

Project ID: COLD SPRINGS TERMINALS 60248522
Sampling Date(s): August 14, 2013
Lab Report ID: 13080340
Client Service Contact: Chelsea Farmer (518) 346-4592 ext. 3843

Analysis Included:
Diesel Range Organics
Gasoline Range Organics

Test results meet all National Environmental Laboratory Accreditation Conference (NELAC) requirements unless noted in the case narrative. The results contained within this document relate only to the samples included in this report. Pace Analytical is responsible only for the certified testing and is not directly responsible for the integrity of the sample before laboratory receipt. This report shall not be reproduced, except in full, without the written consent of Pace Analytical Services, Inc.

Dan Pfalzer
Laboratory Director

Certifications: New York (EPA: NY00906, ELAP: 11078), New Jersey (NY026), Connecticut (PH-0337), Massachusetts (M-NY906), Virgi nia (1884)

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CASE NARRATIVE

August 28, 2013

CASE NARRATIVE

This data package (SDG ID: 13080340) consists of 5 soil samples received on 08/15/2013. The samples are from Project Name: COLD SPRINGS TERMINALS 60248522.

This sample delivery group consists of the following samples:

Lab Sample ID	Client ID	Collection Date
AQ22393	SCO1-TPH-01 (1-2)	08/14/2013 09:58
AQ22394	SCO1-TPH-02 (4-5)	08/14/2013 10:03
AQ22395	SCO1-TPH-03 (5-6)	08/14/2013 10:08
AQ22396	SCO1-TPH-04 (8.5-9.5)	08/14/2013 10:25
AQ22397	SCO1-TPH-05 (13.5-14)	08/14/2013 10:29

Sample Delivery and Receipt Conditions

(1.) All samples were delivered to the laboratory via FEDEX delivery service on 08/15/2013.

(2.) All samples were received at the laboratory intact and within holding times.

(3.) All samples were received at the laboratory properly preserved.

(4.) The following cooler temperature was recorded at sample receipt (Control limits are between 0-6 Degrees Celsius): 0.2 (IR) degrees Celsius. Please see Chain of Custody for details.

Diesel Range Organics Analysis

Analysis for Diesel Range Organics was performed by method SW-846 8015. Samples were extracted by Accelerated Solvent Extraction (EPA Method 3545). The following technical and administrative items were noted for the analysis:

(1.) All quality assurance parameters were met for the analysis.

Gasoline Range Organics Analysis

Analysis for Gasoline Range Organics was performed by method SW-846 8015. The following technical and administrative items were noted for the analysis:

(1.) All quality assurance parameters were met for the analysis.

Respectfully submitted,

Chelsea L. Farmer
Project Manager

QUALIFIERS

Organic Laboratory Qualifiers Defined

B - Denotes analyte observed in associated method blank or extraction blank. Analyte concentration should be considered as estimated.

D - Surrogate was diluted. The analysis of the sample required a dilution such that the surrogate concentration was diluted below the laboratory acceptance criteria.

E - Denotes analyte concentration exceeded calibration range of instrument. Sample could not be re-analyzed at secondary dilution due to insufficient sample amount, quick turn-around request, sample matrix interference or hold time excursion. Concentration result should be considered as estimated.

J - Denotes an estimated concentration. The concentration result is greater than or equal to the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

P - Indicates relative percent difference (RPD) between primary and secondary gas chromatograph (GC) column analysis exceeds 40 % or indicates percent difference (PD) between primary and secondary gas chromatograph (GC) column analysis exceeds 25 %.

U - Denotes analyte not detected at concentration greater than or equal to the Reporting Limit (RL). Reporting Limit's (RL) are adjusted for sample weight/volume and dilution factors.

Z - Chromatographic interference due to polychlorinated biphenyl (PCB) co-elution.

* - Value not within control limits.

Inorganic Laboratory Qualifiers Defined

B - Denotes analyte observed in associated method blank or digestion blank. Analyte concentration should be considered as estimated.

E - Denotes analyte concentration exceeded calibration range of instrument. Sample could not be re-analyzed at secondary dilution due to insufficient sample amount, quick turn-around request, sample matrix interference or hold time excursion. Concentration result should be considered as estimated.

J - Denotes an estimated concentration. The concentration result is greater than or equal to the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

U - Denotes analyte not detected at concentration greater than or equal to the Reporting Limit (RL). Reporting Limit's (RL) are adjusted for sample weight/volume and dilution factors.

* - Value not within control limits.

SAMPLE CHAIN OF CUSTODY

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

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<13080340P1>

130303401

Page: 1 of 1

1753991

Section A Required Client Information:

Company: AECOM
Address: 40 British American Blvd Latham, N.Y. 12110
Email To: John.Santacroce@aecom.com
Phone: 518-951-2265 Fax: ..2300
Requested Due Date/TAT: Std.

Section B Required Project Information:

Report To: AECOM
Copy To:
Purchase Order No.:
Project Name: Cold Springs Terminals
Project Number: 60248522

Section C Invoice Information:

Attention: AECOM
Company Name:
Address:
Pace Quote Reference:
Pace Project Manager: Chelsea Farmer
Pace Profile #:

REGULATORY AGENCY

NPDES GROUND WATER DRINKING WATER
UST RCRA OTHER

Site Location STATE: NY

Requested Analysis Filtered (Y/N)

Section D Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Matrix Codes (MATRIX / CODE)

Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Tissue	TS
Other	OT

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Analysis Test: TPH GRO/DRO	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	SC01-TPH-01 (1-2)	SL	C	8/14/13	0958				2	1							Y	Y	N	AQ22393
2	SC01-TPH-02 (4-5)				1003															AQ22394
3	SC01-TPH-03 (5-6)				1008															AQ22395
4	SC01-TPH-04 (8.5-9.5)				1025															AQ22396
5	SC01-TPH-05 (13.5-14)				1029															AQ22397
6																				
7																				
8																				
9																				
10																				
11																				
12																				

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	Greta White (AECOM)	8/14/13	1705	[illegible]	8/14/13	17:05				
	[illegible] PACE	8/14/13	18:00	VIA FEDEX →			0.3°C	Y	N	Y
	VIA FEDEX →			F. Butler (PACE)	8/15/13	10:14	(IR)			

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Greta White

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 08/14/13

ORIGINAL

SAMPLE RECEIPT

SAMPLE RECEIPT REPORT
13080340

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

CLIENT: AECOM
PROJECT: COLD SPRINGS TERMINALS 60248522
LRF: 13080340
REPORT: ANALYTICAL REPORT
EDD: YES
LRF TAT: 2 WEEK

RECEIVED DATE: 8/15/2013 10:14
SHIPPED VIA: FEDEX
SHIPPING ID: 8034 6552 1387
NUMBER OF COOLERS: 1
CUSTODY SEAL INTACT: NA
TEMPERATURE(S):[5] 0.2 (IR) °C

SAMPLE SEALS INTACT: NA
[1,2]SAMPLES PROPERLY PRESERVED: NO
[3]SAMPLES REC'D IN HOLDTIME: YES
DISPOSAL: BY LAB (45 DAYS)
COC DISCREPANCY: NO

COMMENTS: SAMPLES FOR GRO ANALYSIS NOT PROPERLY PRESERVED PER COLLECTION METHOD 5035.

CLIENT ID (LAB ID)	TAT-DUE Date[4]	DATE-TIME SAMPLED	MATRIX	METHOD	TEST DESCRIPTION	QC REQUESTED
SCO1-TPH-01 (1-2) (AQ22393)	2 WEEK 08-29-13	8/14/2013 09:58	Soil	EPA 8015	Gasoline Range Organics	
	2 WEEK 08-29-13	8/14/2013 09:58	Soil	SW-846 8015	Diesel Range Organics	
SCO1-TPH-02 (4-5) (AQ22394)	2 WEEK 08-29-13	8/14/2013 10:03	Soil	EPA 8015	Gasoline Range Organics	
	2 WEEK 08-29-13	8/14/2013 10:03	Soil	SW-846 8015	Diesel Range Organics	
SCO1-TPH-03 (5-6) (AQ22395)	2 WEEK 08-29-13	8/14/2013 10:08	Soil	EPA 8015	Gasoline Range Organics	
	2 WEEK 08-29-13	8/14/2013 10:08	Soil	SW-846 8015	Diesel Range Organics	
SCO1-TPH-04 (8.5-9.5) (AQ22396)	2 WEEK 08-29-13	8/14/2013 10:25	Soil	EPA 8015	Gasoline Range Organics	
	2 WEEK 08-29-13	8/14/2013 10:25	Soil	SW-846 8015	Diesel Range Organics	
SCO1-TPH-05 (13.5-14) (AQ22397)	2 WEEK 08-29-13	8/14/2013 10:29	Soil	EPA 8015	Gasoline Range Organics	
	2 WEEK 08-29-13	8/14/2013 10:29	Soil	SW-846 8015	Diesel Range Organics	

[1]The pH preservation check of Oil and Grease (Method 1664) is performed as soon as possible after sample receipt and may not be included in this report.
[2]The pH preservation check of aqueous volatile samples is not performed until after the analysis of the sample to maintain zero headspace and is not included in this report.
[3]Samples received for pH analysis are not marked as a hold time exceedance here. SW-846 methods suggests analysis to be done within 15 minutes of sample collection. Because of transportation time it is not possible for the laboratory to perform the test in that time. Sample Certificates of Analysis reports are noted as such.
[4]Samples arriving at the laboratory after 4:00 pm are assigned a due date as if they arrived the following business day unless other arrangements have been made.
[5]All samples which require thermal preservation shall be considered acceptable when received greater than 6 degrees Celsius if they are collected on the same day as received and there is evidence that the chilling process has begun, such as arrival on ice.

Reporting Parameters and Lists

EPA 8015 - Gasoline Range Organics - (ug/g)

Gasoline Range Organics

SW-846 8015 - Diesel Range Organics - (ug/g)

Diesel Range Organics

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GC - DRO

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Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SCO1-TPH-01 (1-2)
Lab Sample ID: 13080340-01 (AQ22393)

Collection Date: 08/14/2013 09:58
Sample Matrix: SOIL
Received Date: 08/15/2013 10:14
Percent Solid: 90.7 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-687-6	EPA Method 8015 DRO C10-C28	08/25/2013 13:43	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23447	EPA 3545	08/16/2013 08:50	MBG	10.1 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Diesel Range Organics	NA	**1730**	326	30.0		GC22-687-6

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	141	60.0-140	D	GC22-687-6
1-COD (S)	3386-33-2	150	60.0-140	D	GC22-687-6

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SCO1-TPH-02 (4-5)
Lab Sample ID: 13080340-02 (AQ22394)

Collection Date: 08/14/2013 10:03
Sample Matrix: SOIL
Received Date: 08/15/2013 10:14
Percent Solid: 82.2 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-687-7	EPA Method 8015 DRO C10-C28	08/25/2013 14:25	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23447	EPA 3545	08/16/2013 08:53	MBG	10.2 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Diesel Range Organics	NA	**1480**	358	30.0		GC22-687-7

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	126	60.0-140	D	GC22-687-7
1-COD (S)	3386-33-2	125	60.0-140	D	GC22-687-7

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SCO1-TPH-03 (5-6)
Lab Sample ID: 13080340-03 (AQ22395)

Collection Date: 08/14/2013 10:08
Sample Matrix: SOIL
Received Date: 08/15/2013 10:14
Percent Solid: 79.6 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-687-8	EPA Method 8015 DRO C10-C28	08/25/2013 15:06	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23447	EPA 3545	08/16/2013 08:55	MBG	10.3 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Diesel Range Organics	NA	**352**	85.2	7.00		GC22-687-8

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	132	60.0-140	D	GC22-687-8
1-COD (S)	3386-33-2	131	60.0-140	D	GC22-687-8

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SCO1-TPH-04 (8.5-9.5)
Lab Sample ID: 13080340-04 (AQ22396)

Collection Date: 08/14/2013 10:25
Sample Matrix: SOIL
Received Date: 08/15/2013 10:14
Percent Solid: 76.7 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-687-9	EPA Method 8015 DRO C10-C28	08/25/2013 15:47	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23447	EPA 3545	08/16/2013 08:59	MBG	10.2 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Diesel Range Organics	NA	**2930**	765	60.0		GC22-687-9

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	157	60.0-140	D	GC22-687-9
1-COD (S)	3386-33-2	144	60.0-140	D	GC22-687-9

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SCO1-TPH-05 (13.5-14)
Lab Sample ID: 13080340-05 (AQ22397)

Collection Date: 08/14/2013 10:29
Sample Matrix: SOIL
Received Date: 08/15/2013 10:14
Percent Solid: 80.4 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-686-21	EPA Method 8015 DRO C10-C28	08/24/2013 22:35	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23447	EPA 3545	08/16/2013 09:01	MBG	10.5 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Diesel Range Organics	NA	**21.1**	11.9	1.00		GC22-686-21

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	126	60.0-140		GC22-686-21
1-COD (S)	3386-33-2	129	60.0-140		GC22-686-21

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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GC - GRO

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SCO1-TPH-01 (1-2)
Lab Sample ID: 13080340-01 (AQ22393)

Collection Date: 08/14/2013 09:58
Sample Matrix: SOIL
Received Date: 08/15/2013 10:14
Percent Solid: 90.7 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-5	EPA Method 8015 GRO C6-C10	08/20/2013 13:32	TJH	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:51	TJH	6.29 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Gasoline Range Organics	NA	**30.5**	8.76	50.0		GC03-558-5

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	90.0	47.7-146		GC03-558-5

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SCO1-TPH-02 (4-5)
Lab Sample ID: 13080340-02 (AQ22394)

Collection Date: 08/14/2013 10:03
Sample Matrix: SOIL
Received Date: 08/15/2013 10:14
Percent Solid: 82.2 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-6	EPA Method 8015 GRO C6-C10	08/20/2013 14:09	TJH	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:52	TJH	5.92 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Gasoline Range Organics	NA	**59.0**	10.3	50.0		GC03-558-6

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	89.4	47.7-146		GC03-558-6

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SCO1-TPH-03 (5-6)
Lab Sample ID: 13080340-03 (AQ22395)

Collection Date: 08/14/2013 10:08
Sample Matrix: SOIL
Received Date: 08/15/2013 10:14
Percent Solid: 79.6 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-7	EPA Method 8015 GRO C6-C10	08/20/2013 14:46	TJH	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:53	TJH	6.00 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Gasoline Range Organics	NA	**35.4**	10.5	50.0		GC03-558-7

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	88.9	47.7-146		GC03-558-7

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SCO1-TPH-04 (8.5-9.5)
Lab Sample ID: 13080340-04 (AQ22396)

Collection Date: 08/14/2013 10:25
Sample Matrix: SOIL
Received Date: 08/15/2013 10:14
Percent Solid: 76.7 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-12	EPA Method 8015 GRO C6-C10	08/20/2013 17:51	TJH	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:53	TJH	5.94 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Gasoline Range Organics	NA	**2980**	220	1000		GC03-558-12

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	102	47.7-146		GC03-558-12

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: SCO1-TPH-05 (13.5-14)
Lab Sample ID: 13080340-05 (AQ22397)

Collection Date: 08/14/2013 10:29
Sample Matrix: SOIL
Received Date: 08/15/2013 10:14
Percent Solid: 80.4 - Results are based on dry weight unless otherwise noted.

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-8	EPA Method 8015 GRO C6-C10	08/20/2013 15:23	TJH	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:55	TJH	6.00 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Gasoline Range Organics	NA	**10.4**	10.4	50.0		GC03-558-8

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	91.2	47.7-146		GC03-558-8

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Quality Control Samples (Lab)

Pace Analytical®

Quality Control Results
Method Blank

Job Number: 13080340

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AQ22393B)
Lab Sample ID: DBLK-70

Collection Date: N/A
Sample Matrix: SOIL
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-686-15	EPA Method 8015 DRO C10-C28	08/24/2013 18:28	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23447	EPA 3545	08/16/2013 08:48	MBG	10.2 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Diesel Range Organics	NA	ND	10.0	1.00	U	GC22-686-15

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	137	60.0-140		GC22-686-15
1-COD (S)	3386-33-2	139	60.0-140		GC22-686-15

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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Pace Analytical®

Quality Control Results
Lab Control Sample (LCS)
Job Number: 13080340

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AQ22393L)
Lab Sample ID: LCS-70

Collection Date: N/A
Sample Matrix: SOIL
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC22-686-16	EPA Method 8015 DRO C10-C28	08/24/2013 19:09	JES	NA	NA	Phenomenex, Zebron ZB-5, 30 m, 0.25 mm ID, 0.25 µm
Prep 1:	23447	EPA 3545	08/16/2013 08:48	MBG	10.2 g	10.0 mL	NA

Analyte Spiked	CAS No.	Added (ug/g)	LCS (ug/g)	LCS % Rec.	Q[1]	Limits (%)
Diesel Range Organics	NA	48.9	48.1	98.4		70.0-130

[1]Qualifier column where '*' denotes value outside the control limits. Note: RPD criteria does not apply if either the sample and duplicate sample are not detected.

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
O TERPHENYL (S)	84-15-1	136	60.0-140		GC22-686-16
1-COD (S)	3386-33-2	138	60.0-140		GC22-686-16

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.
Note: Solvent blank correction applied.
As per SW-846 8015 DRO the positive detector baseline response for the associated solvent blank was subtracted from the positive detector response for the sample.

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Pace Analytical®

Quality Control Results
Method Blank

Job Number: 13080340

Pace Analytical Services, Inc.
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Phone: 518.346.4592
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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AQ22071B)
Lab Sample ID: GRO Blank-63

Collection Date: N/A
Sample Matrix: SOIL
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-3	EPA Method 8015 GRO C6-C10	08/20/2013 11:07	TJH	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:28	TJH	5.24 g	10.0 mL	NA

Analyte	CAS No.	Result (ug/g)	PQL	Dilution Factor	Flags	File ID
Gasoline Range Organics	NA	ND	9.54	50.0	U	GC03-558-3

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	93.7	47.7-146		GC03-558-3

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Quality Control Results
Lab Control Sample (LCS)

Job Number: 13080340

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AQ22071L)
Lab Sample ID: LCS-91

Collection Date: N/A
Sample Matrix: SOIL
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	GC03-558-2	EPA Method 8015 GRO C6-C10	08/20/2013 10:30	TJH	NA	NA	Restek, Rtx-502.2, 105 m, 0.53 mm ID, 3 µm
Prep 1:	2078	EPA 5035A-H	08/15/2013 14:29	TJH	5.33 g	10.0 mL	NA

Analyte Spiked	CAS No.	Added (ug/g)	LCS (ug/g)	LCS % Rec.	Q[1]	Limits (%)
Gasoline Range Organics	NA	93.8	80.6	85.9		70.0-130

[1]Qualifier column where '*' denotes value outside the control limits. Note: RPD criteria does not apply if either the sample and duplicate sample are not detected.

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	95.3	47.7-146		GC03-558-2

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Appendix D

PTS Analytical Reports

PTS Laboratories, Inc.

8100 Secura Way • Santa Fe Springs, CA 90670
Telephone (562) 347-2500 • Fax (562) 907-3610

February 5, 2014

John Santacroce
AECOM
40 British American Blvd.
Latham, NY 12110

Re: PTS File No: 43519
Physical Properties Data
Cold Springs Terminal; 60248522

Dear Mr. Santacroce:

Please find enclosed report for Physical Properties analyses conducted upon cores received from your Cold Springs Terminal; 60248522 project. All analyses were performed by applicable ASTM, EPA, or API methodologies. Electronic versions of the core images have been uploaded to PTS Laboratories drop box. The cores remain in frozen storage and will be held indefinitely. Please note that core storage is currently being billed quarterly.

PTS Laboratories appreciates the opportunity to be of service. If you have any questions or require additional information, please give me a call at (562) 347-2502.

Sincerely,
PTS Laboratories, Inc.

Michael Mark Brady, P.G.
District Manager

Encl.

PTS Laboratories

Project Name: Cold Springs Terminal
Project Number: 60248522

PTS File No: 43519
Client: AECOM

TEST PROGRAM - 20131119

CORE ID	Depth ft.	Core Recovery ft.	Slab and Core Photo	Grain Size Analyses	Pore Fluid Saturation Package	A/W Drng. Capillarity Pkg.	Free Product Mobility	Residual Saturation by Water Drive	Notes
Method:		**Plugs:**	1/4:3/4	Grab	Hor. 1.5"	Hor. 1"	Hor. 1.5"	Vert. 1.5"	Keep core frozen
Date Received: 20130814									
SC-07 7-10	**7-10**	**3.00**	**3**						
SC-07 10-13	**10-12.8**	**2.65**	**3**						
SC-07 13-16	**13-16**	**2.95**	**3**	**13.8, 14.5, 15.05, 15.45, 15.9**	**13.8, 14.5, 15.45**		**15.05**		
SC-07 16-18	**16-18**	**1.90**	**2**	**16.2, 16.4, 17.25**		**16.2**	**16.4, 17.25**		
SC-07 18-21	**18-20**	**1.90**	**2**	**18.5**	**18.5**				
SC-03 2-5	**2-4.3**	**2.35**	**3**	**3.75, 4.15**	**3.75, 4.15**				
SC-03 5-8	**5-7.1**	**2.25**	**3**	**5.3, 6.05, 6.93**	**6.93**		**5.3, 6.05**		
SC-03- 8-11	**8-10.2**	**2.50**	**3**	**8.5, 9.95**	**10.15**	**9.95**	**8.5, 9.8**		
SC-03 11-14	**11-13**	**2.00**	**2**	**11.75, 12.5**	**12.5**		**11.75**		
SC-03 14-17	**14-17**	**3.00**	**3**	**14.5**					
SC-05 1-4	**1-3.25**	**2.00**	**2**	**2.5, 2.95**	**2.5, 2.95**				
SC-05 4-7	**4-7**	**2.95**	**3**	**6.5**					
SC-05 7-10	**7-10**	**2.85**	**3**	**8.15, 8.65, 9.0, 9.4**	**8.15, 9.0**		**8.65, 9.4**		
TOTALS:	**13 cores**	**32.30**	**35**	**26**	**13**	**2**	**10**	**0**	**35**

Laboratory Test Program Notes

Contaminant identification:

Sample locations to be selected by AECOM personnel from core photography.

PTS Laboratories

PTS File No: 43519
Client: AECOM
Report Date: 02/05/14

PHYSICAL PROPERTIES DATA - PORE FLUID SATURATIONS

Project Name: Cold Springs Terminal
Project No: 60248522

		METHODS:	API RP 40 / ASTM D2216	API RP 40		API RP 40		API RP 40	
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENTATION (1)	MOISTURE CONTENT, % weight	DENSITY		POROSITY, %Vb (2)		PORE FLUID SATURATIONS, % Pv (3)	
				DRY BULK, g/cc	GRAIN, g/cc	TOTAL	AIR FILLED	WATER	NAPL
SC-07 13-16	13.80	H	16.2	1.37	2.65	48.6	26.2	41.3	4.9
SC-07 13-16	14.50	H	15.5	1.53	2.64	42.0	18.3	50.3	6.1
SC-07 13-16	15.45	H	25.5	1.36	2.65	48.8	14.8	63.7	5.9
SC-07 18-21	18.50	H	24.3	1.55	2.68	42.1	4.8	83.5	5.2
SC-03 2-5	3.75	H	22.4	1.34	2.62	48.9	18.7	58.1	3.8
SC-03 2-5	4.15	H	16.9	1.65	2.66	38.1	9.9	68.4	5.7
SC-03 5-8	6.93	H	17.5	1.54	2.67	42.3	15.2	61.2	2.9
SC-03- 8-11	10.15	H	22.0	1.61	2.67	39.9	4.4	85.5	3.4
SC-03 11-14	12.50	H	24.8	1.49	2.68	44.3	9.7	70.4	7.7
SC-05 1-4	2.50	H	25.3	1.42	2.66	46.7	10.9	73.9	2.7
SC-05 1-4	2.95	H	25.3	1.41	2.67	47.2	11.6	72.2	3.2
SC-05 7-10	8.15	H	12.1	1.41	2.67	47.4	30.5	32.2	3.5
SC-05 7-10	9.00	H	13.1	1.33	2.67	50.4	33.7	27.5	5.7

(1) Sample Orientation: H = horizontal; V = vertical; R = remold

(2) Total Porosity = all interconnected pore channels; Air Filled = pore channels not occupied by pore fluids.

(3) Fluid density used to calculate pore fluid saturations: Water = 0.9996 g/cc, NAPL = 0.8600 g/cc.

Vb = Bulk Volume, cc; Pv = Pore Volume, cc; ND = Not Detected

PTS Laboratories

PTS File No: 43519
Client: AECOM
Report Date: 02/05/14

FREE PRODUCT MOBILITY: INITIAL AND RESIDUAL SATURATIONS

(Centrifugal method: samples spun under air)

Project Name: Cold Springs Terminal
Project No: 60248522

			METHODS:	API RP 40		API RP 40	ASTM D425M, DEAN-STARK			
							PORE FLUID SATURATIONS (3), % Pv			
				DENSITY			Initial Fluid Saturations		After Centrifuge at 1000xG	
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENTATION (1)	ANALYSIS DATE	DRY BULK, g/cc	GRAIN, g/cc	TOTAL POROSITY (2), %Vb	WATER (Swi) SATURATION	NAPL (Soi) SATURATION	WATER (Srw) SATURATION	NAPL (Sor) SATURATION
SC-07 13-16	15.05	H	20140122	1.46	2.68	45.5	71.7	2.1	17.7	2.1
NOTE: No visible NAPL produced. Produced water clear with strong hydrocarbon odor.										
SC-07 16-18	16.4	H	20140122	1.40	2.67	47.5	63.1	5.8	8.8	4.0
NOTE: Yellow LNAPL produced. Produced water clear.										
SC-07 16-18	17.25	H	20140122	1.38	2.68	48.5	49.3	4.3	7.6	3.6
NOTE: Yellow LNAPL produced. Produced water clear.										
SC-03 5-8	5.3	H	20140122	1.26	2.58	51.2	78.0	3.7	42.0	3.7
NOTE: No visible NAPL produced. Produced water clear with strong hydrocarbon odor.										
SC-03 5-8	6.05	H	20140124	1.71	2.67	35.9	93.8	5.4	41.2	5.4
NOTE: No visible NAPL produced. Produced water clear with strong hydrocarbon odor.										
SC-03- 8-11	8.5	H	20140124	1.69	2.69	37.1	78.2	3.3	30.1	3.3
NOTE: No visible NAPL produced. Produced water clear with strong hydrocarbon odor.										
SC-03- 8-11	9.8	H	20140124	1.53	2.68	42.7	76.9	4.8	17.4	4.7
NOTE: Trace yellow LNAPL produced. Produced water clear.										
SC-03 11-14	11.75	H	20140124	1.41	2.68	47.3	71.5	7.9	10.8	4.0
NOTE: Yellow LNAPL produced. Produced water clear.										

(1) Sample Orientation: H = horizontal; V = vertical; R = remold

(2) Total Porosity = all interconnected pore channels.

(3) Fluid density used to calculate pore fluid saturations: Water = 0.9996 g/cc, NAPL = 0.8600 g/cc.

Swi = Initial Water Saturation as received prior to centrifuging at 1000xG, Soi = Initial NAPL Saturation as received prior to centrifuging at 1000xG.

Srw = Residual Water Saturation after centrifuging at 1000xG, Sor = Residual NAPL Saturation after centrifuging at 1000xG.

Vb = Bulk Volume, cc; Pv = Pore Volume, cc; ND = Not Detected

PTS Laboratories

PTS File No: 43519
Client: AECOM
Report Date: 02/05/14

FREE PRODUCT MOBILITY: INITIAL AND RESIDUAL SATURATIONS

(Centrifugal method: samples spun under air)

Project Name: Cold Springs Terminal
Project No: 60248522

			METHODS:	API RP 40		API RP 40	ASTM D425M, DEAN-STARK			
							PORE FLUID SATURATIONS (3), % Pv			
				DENSITY		TOTAL	Initial Fluid Saturations		After Centrifuge at 1000xG	
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENTATION (1)	ANALYSIS DATE	DRY BULK, g/cc	GRAIN, g/cc	POROSITY (2), %Vb	WATER (Swi) SATURATION	NAPL (Soi) SATURATION	WATER (Srw) SATURATION	NAPL (Sor) SATURATION
SC-05 7-10	8.65	H	20140124	1.45	2.68	46.0	57.2	5.0	20.8	5.0
NOTE: No visible NAPL produced. Produced water clear with strong hydrocarbon odor.										
SC-05 7-10	9.4	H	20140124	1.41	2.69	47.6	44.5	7.0	13.1	7.0
NOTE: No visible NAPL produced. Produced water clear with strong hydrocarbon odor.										

(1) Sample Orientation: H = horizontal; V = vertical; R = remold

(2) Total Porosity = all interconnected pore channels.

(3) Fluid density used to calculate pore fluid saturations: Water = 0.9996 g/cc, NAPL = 0.8600 g/cc.

Swi = Initial Water Saturation as received prior to centrifuging at 1000xG, Soi = Initial NAPL Saturation as received prior to centrifuging at 1000xG.

Srw = Residual Water Saturation after centrifuging at 1000xG, Sor = Residual NAPL Saturation after centrifuging at 1000xG.

Vb = Bulk Volume, cc; Pv = Pore Volume, cc; ND = Not Detected

PTS Laboratories

PTS File No: 43519
Client: AECOM
Report Date: 02/05/14

SAMPLE PROPERTIES - AIR/WATER CAPILLARY PRESSURE

Project Name: Cold Springs Terminal
Project No: 60248522

		METHODS:	API RP 40 / ASTM D2216	API RP 40		API RP 40		API RP 40
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENTATION (1)	MOISTURE CONTENT, % weight	DENSITY		POROSITY, %Vb (2)		TOTAL PORE FLUID SATURATIONS (3), % Pv
				DRY BULK, g/cc	GRAIN, g/cc	TOTAL	AIR FILLED	
SC-07 16-18	16.2	H	21.5	1.41	2.66	47.2	16.9	64.1
SC-03- 8-11	9.95	H	24.4	1.52	2.66	42.9	5.8	86.4

(1) Sample Orientation: H = horizontal; V = vertical; R = remold

(2) Total Porosity = all interconnected pore channels; Air Filled = pore channels not occupied by pore fluids.

(3) Fluid density used to calculate pore fluid saturations: Water = 0.9996 g/cc.

Vb = Bulk Volume, cc; Pv = Pore Volume, cc; ND = Not Detected

PTS Laboratories

PTS File No: 43519
Client: AECOM
Report Date: 02/05/14

PERMEABILITY DATA - AIR/WATER CAPILLARY PRESSURE

Project Name: Cold Springs Terminal
Project No: 60248522

		METHODS:	API RP 40; EPA 9100		
			25 PSI CONFINING STRESS		
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENTATION (1)	SPECIFIC PERMEABILITY TO AIR, millidarcy (2)	EFFECTIVE PERMEABILITY TO WATER, millidarcy (3,4)	HYDRAULIC CONDUCTIVITY, cm/s (4)
SC-07 16-18	16.2	H	3460	1760	1.70E-03
SC-03- 8-11	9.95	H	489	81.8	7.91E-05

(1) Sample Orientation: H = horizontal; V = vertical; R = remold
(2) Specific = No pore fluids in place.
(3) Effective (Native) = With as-received pore fluids in place.
(4) Permeability to water and hydraulic conductivity measured at saturated conditions.
Air = Nitrogen gas, Water = filtered Laboratory Fresh (tap) or Site water.

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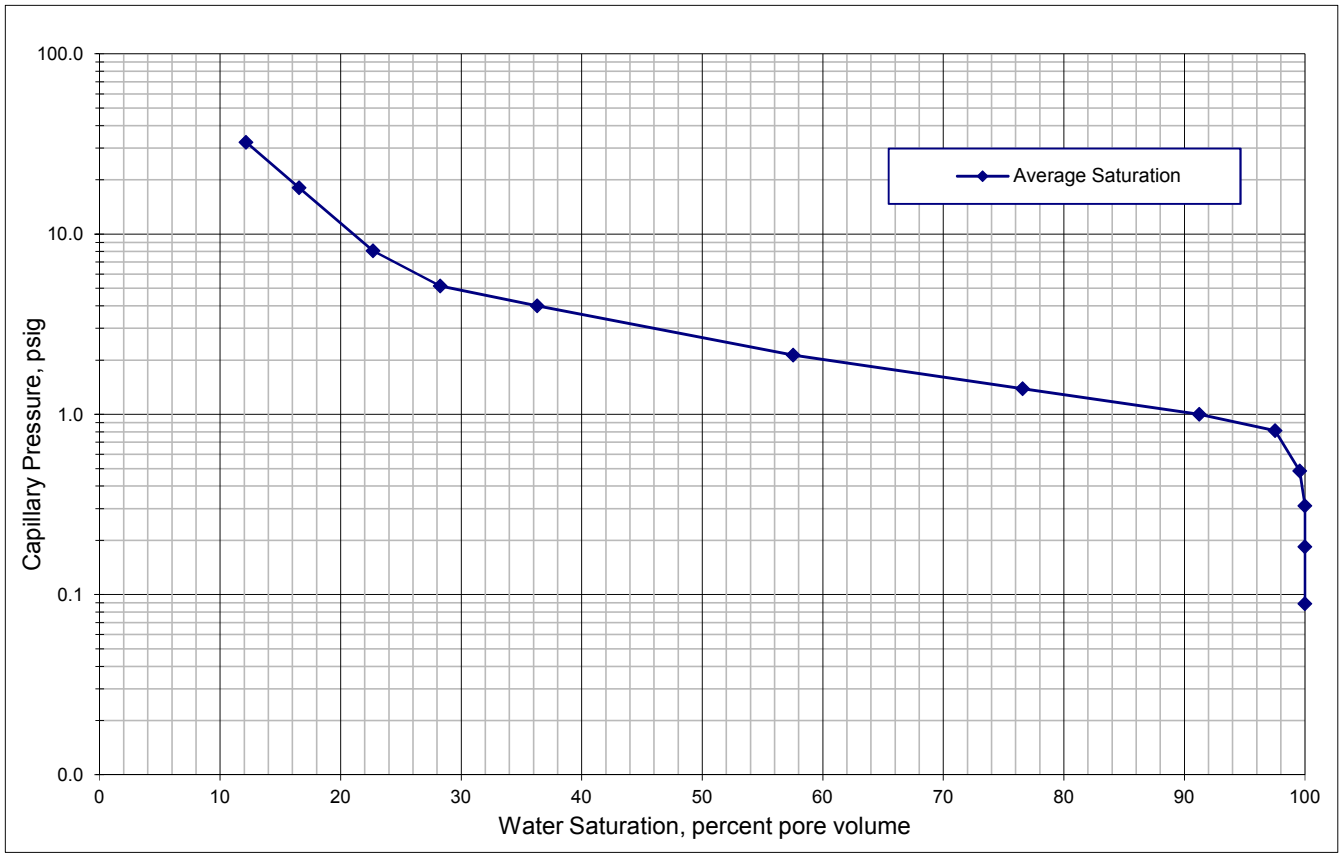
PTS File No: 43519
Client: AECOM
Report Date: 02/05/14

AIR/WATER CAPILLARY PRESSURE TABULAR DATA

ASTM D6836; Method E (Centrifugal Method: air displacing water)

Project Name: Cold Springs Terminal
Project No: 60248522

Capillary Pressure		Height Above Water Table,	Sample ID SC-07 16-18 at 16.2 ft.	
			Average Saturation	Moisture,
psi	cm water	ft	% pore volume	% dry weight
0.000	0.00	0.000	100.0	28.4
0.089	6.26	0.206	100.0	28.4
0.184	13.0	0.426	100.0	28.4
0.310	21.8	0.718	100.0	28.4
0.485	34.1	1.12	99.6	28.3
0.812	57.1	1.88	97.5	27.7
1.00	70.4	2.32	91.2	25.9
1.38	97.4	3.20	76.6	21.8
2.13	150	4.94	57.5	16.4
4.00	282	9.27	36.3	10.4
5.16	363	11.9	28.3	8.1
8.10	569	18.7	22.7	6.5
18.1	1270	41.8	16.5	4.7
32.3	2272	74.8	12.2	3.5



PTS Laboratories

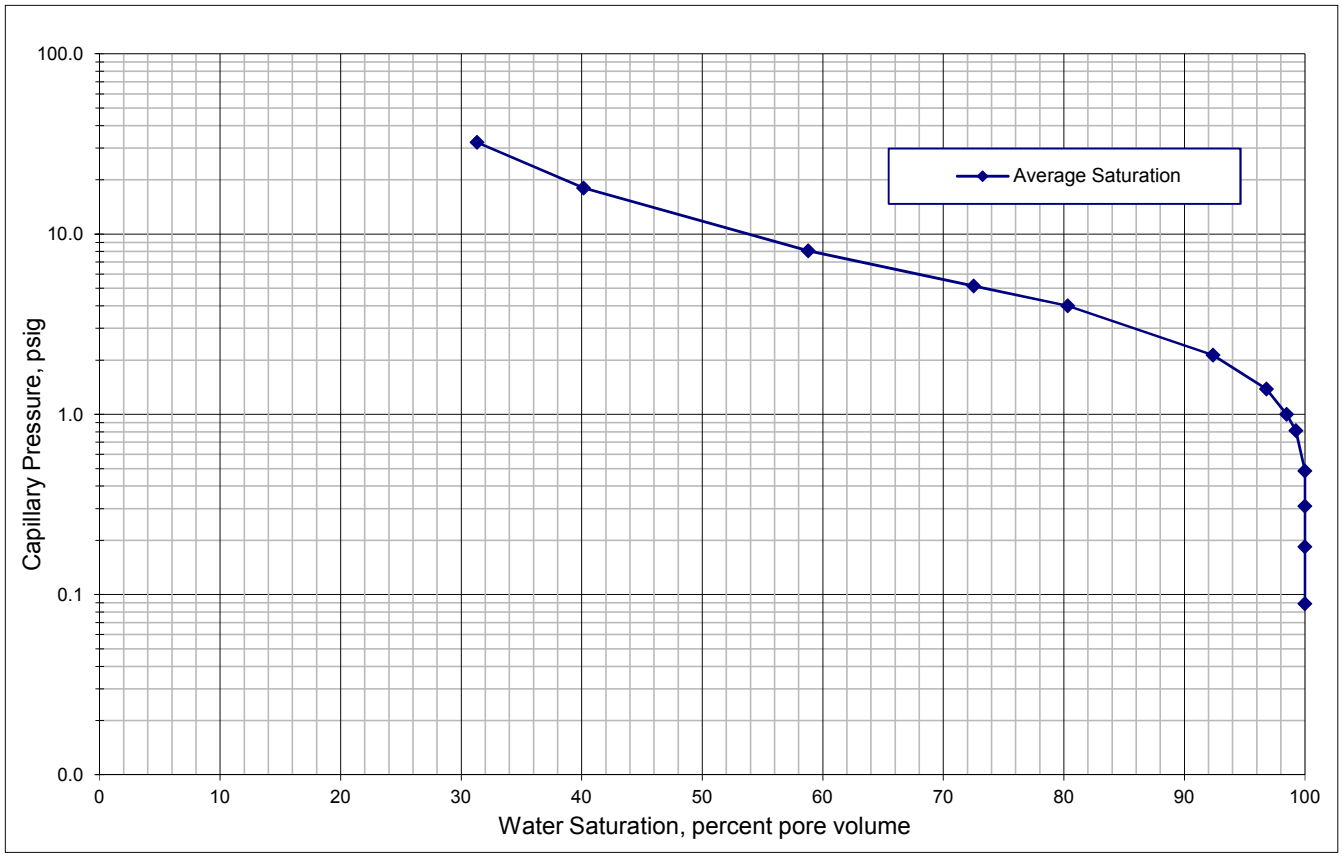
PTS File No: 43519
Client: AECOM
Report Date: 02/05/14

AIR/WATER CAPILLARY PRESSURE TABULAR DATA

ASTM D6836; Method E (Centrifugal Method: air displacing water)

Project Name: Cold Springs Terminal
Project No: 60248522

Capillary Pressure		Height Above Water Table,	Sample ID SC-03- 8-11 at 9.95 ft.	
			Average Saturation	Moisture,
psi	cm water	ft	% pore volume	% dry weight
0.000	0.00	0.000	100.0	25.4
0.089	6.25	0.206	100.0	25.4
0.184	12.9	0.426	100.0	25.4
0.310	21.8	0.717	100.0	25.4
0.484	34.1	1.12	100.0	25.4
0.811	57.0	1.88	99.2	25.2
1.00	70.3	2.31	98.5	25.0
1.38	97.2	3.20	96.8	24.6
2.13	150	4.93	92.4	23.5
4.00	281	9.25	80.3	20.4
5.15	362	11.9	72.5	18.4
8.08	568	18.7	58.8	15.0
18.0	1268	41.7	40.2	10.2
32.3	2269	74.7	31.3	8.0



PARTICLE SIZE SUMMARY

(METHODOLOGY: ASTM D422/D4464M)

PROJECT NAME: Cold Springs Terminal
PROJECT NO: 60248522

Sample ID	Depth, ft.	Mean Grain Size Description (1)	Median Grain Size mm	Particle Size Distribution, wt. percent						Silt & Clay
				Gravel	Sand Size			Silt	Clay	
					Coarse	Medium	Fine			
SC-07 13-16 at 13.80	13.80	Silt	0.047	0.00	0.00	0.00	21.72	72.22	6.06	78.28
SC-07 13-16 at 14.50	14.50	Silt	0.060	0.00	0.00	0.00	34.47	62.03	3.49	65.53
SC-07 13-16 at 15.05	15.05	Silt	0.053	0.00	0.00	0.00	27.55	67.10	5.35	72.45
SC-07 13-16 at 15.45	15.45	Silt	0.025	0.00	0.00	0.00	7.38	81.94	10.68	92.62
SC-07 13-16 at 15.90	15.90	Fine sand	0.105	0.00	0.00	0.00	62.65	34.59	2.77	37.35
SC-07 16-18 at 16.20	16.20	Fine sand	0.104	0.00	0.00	0.00	75.02	23.17	1.81	24.98
SC-07 16-18 at 16.40	16.40	Fine sand	0.074	0.00	0.00	0.00	49.77	47.47	2.76	50.23
SC-07 16-18 at 17.25	17.25	Silt	0.056	0.00	0.00	0.00	33.54	61.61	4.86	66.46
SC-07 18-21 at 18.50	18.50	Silt	0.069	0.00	0.00	0.00	45.11	52.16	2.73	54.89
SC-03 2-5 at 3.75	3.75	Silt	0.034	0.00	0.00	1.80	26.19	59.51	12.51	72.02
SC-03 2-5 at 4.15	4.15	Silt	0.044	0.00	0.00	2.71	29.79	54.99	12.51	67.50
SC-03 5-8 at 5.30	5.30	Silt	0.024	0.00	0.00	0.58	16.23	68.58	14.61	83.19
SC-03 5-8 at 6.05	6.05	Silt	0.046	0.00	0.00	1.19	29.57	57.83	11.41	69.24
SC-03 5-8 at 6.93	6.93	Silt	0.022	0.00	0.00	0.00	11.02	74.36	14.62	88.98

(1) Based on Mean from Trask

PARTICLE SIZE SUMMARY

(METHODOLOGY: ASTM D422/D4464M)

PROJECT NAME: Cold Springs Terminal
PROJECT NO: 60248522

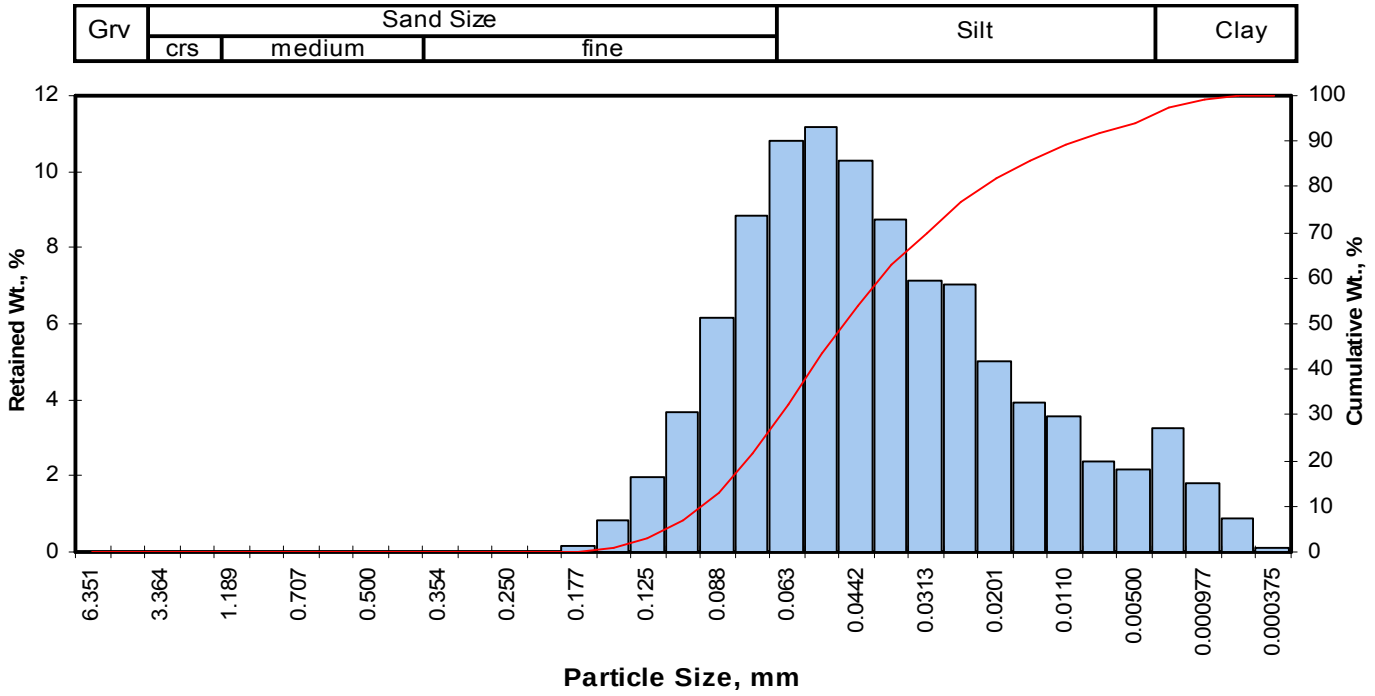
Sample ID	Depth, ft.	Mean Grain Size Description (1)	Median Grain Size mm	Particle Size Distribution, wt. percent						Silt & Clay
				Gravel	Sand Size			Silt	Clay	
					Coarse	Medium	Fine			
SC-03- 8-11 at 9.95	9.95	Silt	0.042	0.00	0.00	0.00	18.48	76.29	5.22	81.52
SC-03 11-14 at 11.75	11.75	Silt	0.055	0.00	0.00	0.00	29.35	66.59	4.06	70.65
SC-03 11-14 at 12.50	12.50	Silt	0.051	0.00	0.00	0.00	24.58	71.01	4.41	75.42
SC-03 14-17 at 14.50	14.50	Silt	0.026	0.00	0.00	0.00	1.67	86.10	12.23	98.33
SC-05 1-4 at 2.50	2.50	Silt	0.037	0.00	0.00	0.00	15.87	78.07	6.07	84.13
SC-05 1-4 at 2.95	2.95	Silt	0.038	0.00	0.00	0.00	14.33	78.93	6.74	85.67
SC-05 4-7 at 6.50	6.50	Silt	0.051	0.00	0.00	0.00	26.10	68.68	5.23	73.90
SC-05 7-10 at 8.15	8.15	Silt	0.055	0.00	0.00	0.00	28.99	67.32	3.69	71.01
SC-05 7-10 at 8.65	8.65	Silt	0.040	0.00	0.00	0.00	14.23	80.39	5.38	85.77
SC-05 7-10 at 9.00	9.00	Silt	0.058	0.00	0.00	0.00	32.89	63.84	3.27	67.11
SC-05 7-10 at 9.40	9.40	Silt	0.04903572	0.00	0.00	0.00	22.68	72.48	4.83	77.32

(1) Based on Mean from Trask

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-07 13-16 at 13.80
Project No:	60248522	**Depth, ft:**	13.80



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.01	0.01	0.01
0.0070	0.177	2.50	80	0.17	0.17	0.18
0.0059	0.149	2.75	100	0.84	0.84	1.02
0.0049	0.125	3.00	120	1.98	1.98	3.00
0.0041	0.105	3.25	140	3.70	3.70	6.70
0.0035	0.088	3.50	170	6.16	6.16	12.85
0.0029	0.074	3.75	200	8.87	8.87	21.72
0.0025	0.063	4.00	230	10.80	10.79	32.51
0.0021	0.053	4.25	270	11.20	11.19	43.71
0.00174	0.0442	4.50	325	10.30	10.29	54.00
0.00146	0.0372	4.75	400	8.75	8.75	62.75
0.00123	0.0313	5.00	450	7.13	7.13	69.87
0.000986	0.0250	5.32	500	7.03	7.03	76.90
0.000790	0.0201	5.64	635	5.03	5.03	81.93
0.000615	0.0156	6.00		3.93	3.93	85.86
0.000435	0.0110	6.50		3.56	3.56	89.41
0.000308	0.00781	7.00		2.37	2.37	91.78
0.000197	0.00500	7.65		2.16	2.16	93.94
0.000077	0.00195	9.00		3.27	3.27	97.21
0.000038	0.000977	10.00		1.82	1.82	99.03
0.000019	0.000488	11.00		0.89	0.89	99.92
0.000015	0.000375	11.38		0.08	0.08	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.14	0.0045	0.114
10	3.38	0.0038	0.096
16	3.59	0.0033	0.083
25	3.83	0.0028	0.071
40	4.17	0.0022	0.056
50	4.40	0.0019	0.047
60	4.67	0.0015	0.039
75	5.23	0.0010	0.027
84	5.83	0.0007	0.018
90	6.62	0.0004	0.010
95	8.08	0.0001	0.004

Measure	Trask	Inman	Folk-Ward
Median, phi	4.40	4.40	4.40
Median, in.	0.0019	0.0019	0.0019
Median, mm	0.047	0.047	0.047
Mean, phi	4.36	4.71	4.61
Mean, in.	0.0019	0.0015	0.0016
Mean, mm	0.049	0.038	0.041
Sorting	1.629	1.121	1.310
Skewness	0.916	0.274	0.381
Kurtosis	0.256	1.208	1.441
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

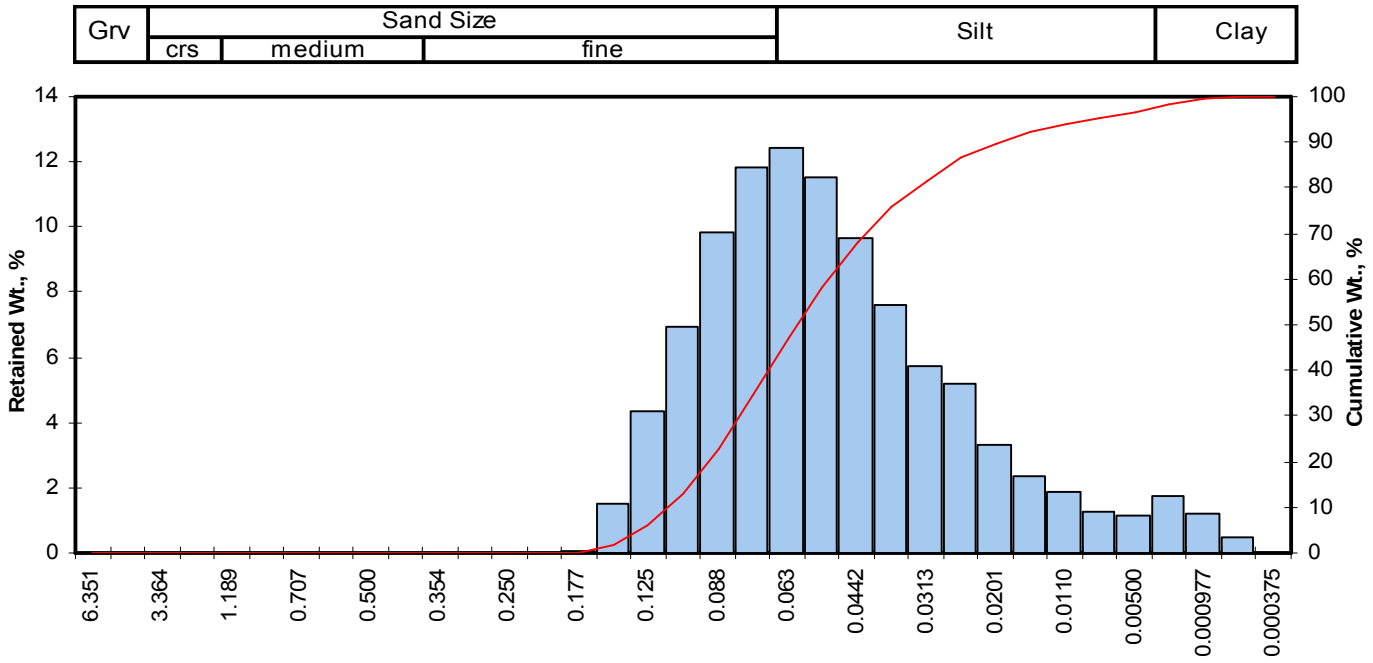
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	21.72
Silt	>0.005 mm	72.22
Clay	<0.005 mm	6.06
	Total	**100**

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PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-07 13-16 at 14.50
Project No:	60248522	**Depth, ft:**	14.50



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.03	0.03	0.03
0.0059	0.149	2.75	100	1.53	1.53	1.56
0.0049	0.125	3.00	120	4.36	4.36	5.92
0.0041	0.105	3.25	140	6.93	6.93	12.86
0.0035	0.088	3.50	170	9.81	9.81	22.67
0.0029	0.074	3.75	200	11.80	11.80	34.47
0.0025	0.063	4.00	230	12.40	12.40	46.88
0.0021	0.053	4.25	270	11.50	11.50	58.38
0.00174	0.0442	4.50	325	9.67	9.67	68.06
0.00146	0.0372	4.75	400	7.59	7.59	75.65
0.00123	0.0313	5.00	450	5.73	5.73	81.38
0.000986	0.0250	5.32	500	5.17	5.17	86.55
0.000790	0.0201	5.64	635	3.30	3.30	89.86
0.000615	0.0156	6.00		2.33	2.33	92.19
0.000435	0.0110	6.50		1.90	1.90	94.09
0.000308	0.00781	7.00		1.26	1.26	95.35
0.000197	0.00500	7.65		1.16	1.16	96.51
0.000077	0.00195	9.00		1.74	1.74	98.25
0.000038	0.000977	10.00		1.22	1.22	99.47
0.000019	0.000488	11.00		0.50	0.50	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	2.95	0.0051	0.130
10	3.15	0.0044	0.113
16	3.33	0.0039	0.099
25	3.55	0.0034	0.085
40	3.86	0.0027	0.069
50	4.07	0.0023	0.060
60	4.29	0.0020	0.051
75	4.73	0.0015	0.038
84	5.16	0.0011	0.028
90	5.66	0.0008	0.020
95	6.86	0.0003	0.009

Measure	Trask	Inman	Folk-Ward
Median, phi	4.07	4.07	4.07
Median, in.	0.0023	0.0023	0.0023
Median, mm	0.060	0.060	0.060
Mean, phi	4.02	4.25	4.19
Mean, in.	0.0024	0.0021	0.0022
Mean, mm	0.062	0.053	0.055
Sorting	1.505	0.916	1.051
Skewness	0.952	0.195	0.311
Kurtosis	0.256	1.137	1.361

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	34.47
Silt	>0.005 mm	62.03
Clay	<0.005 mm	3.49
	Total	**100**

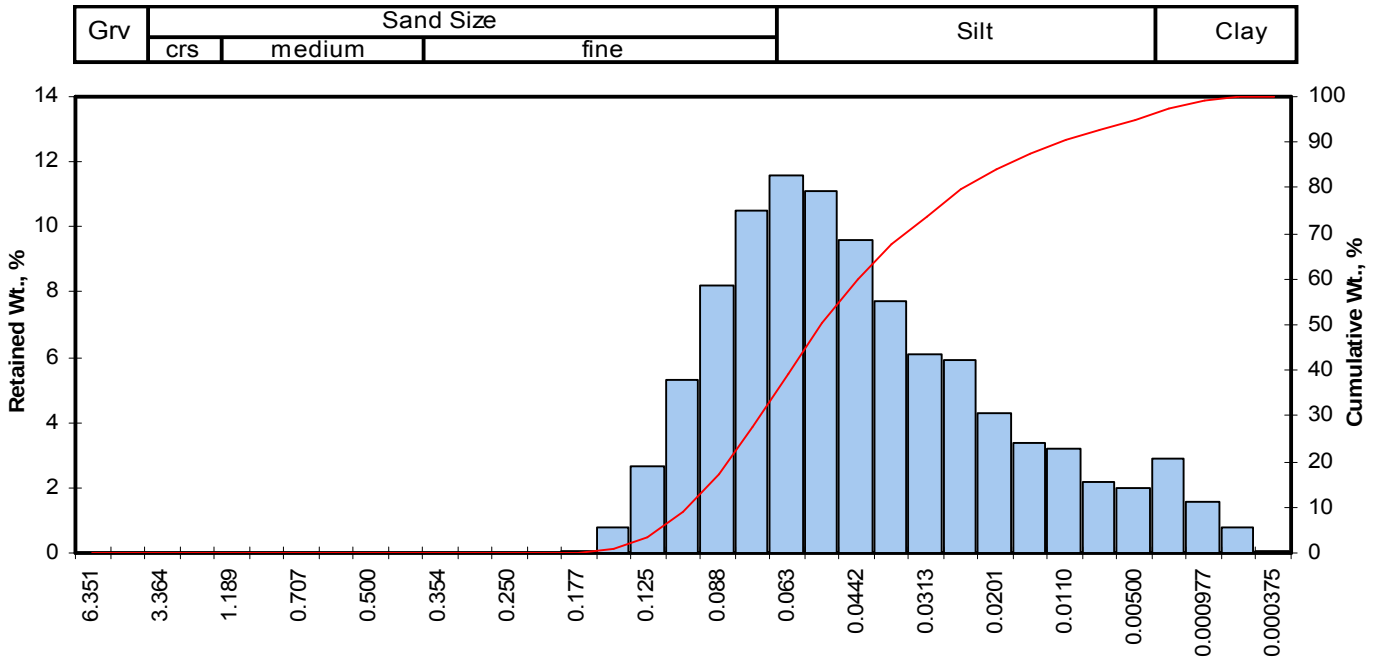
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PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client: AECOM
Project: Cold Springs Terminal
Project No: 60248522

PTS File No: 43519
Sample ID: SC-07 13-16 at 15.05
Depth, ft: 15.05



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.06	0.06	0.06
0.0059	0.149	2.75	100	0.77	0.77	0.83
0.0049	0.125	3.00	120	2.67	2.67	3.51
0.0041	0.105	3.25	140	5.33	5.34	8.84
0.0035	0.088	3.50	170	8.19	8.20	17.04
0.0029	0.074	3.75	200	10.50	10.51	27.55
0.0025	0.063	4.00	230	11.60	11.61	39.16
0.0021	0.053	4.25	270	11.10	11.11	50.27
0.00174	0.0442	4.50	325	9.60	9.61	59.88
0.00146	0.0372	4.75	400	7.74	7.75	67.63
0.00123	0.0313	5.00	450	6.10	6.11	73.73
0.000986	0.0250	5.32	500	5.93	5.94	79.67
0.000790	0.0201	5.64	635	4.27	4.27	83.94
0.000615	0.0156	6.00		3.40	3.40	87.35
0.000435	0.0110	6.50		3.17	3.17	90.52
0.000308	0.00781	7.00		2.16	2.16	92.68
0.000197	0.00500	7.65		1.97	1.97	94.65
0.000077	0.00195	9.00		2.89	2.89	97.54
0.000038	0.000977	10.00		1.59	1.59	99.14
0.000019	0.000488	11.00		0.79	0.79	99.93
0.000015	0.000375	11.38		0.07	0.07	100.00
TOTALS				**99.90**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.07	0.0047	0.119
10	3.29	0.0040	0.103
16	3.47	0.0036	0.090
25	3.69	0.0031	0.078
40	4.02	0.0024	0.062
50	4.24	0.0021	0.053
60	4.50	0.0017	0.044
75	5.07	0.0012	0.030
84	5.65	0.0008	0.020
90	6.42	0.0005	0.012
95	7.81	0.0002	0.004

Measure	Trask	Inman	Folk-Ward
Median, phi	4.24	4.24	4.24
Median, in.	0.0021	0.0021	0.0021
Median, mm	0.053	0.053	0.053
Mean, phi	4.22	4.56	4.45
Mean, in.	0.0021	0.0017	0.0018
Mean, mm	0.054	0.042	0.046
Sorting	1.613	1.089	1.262
Skewness	0.911	0.288	0.396
Kurtosis	0.263	1.176	1.408
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

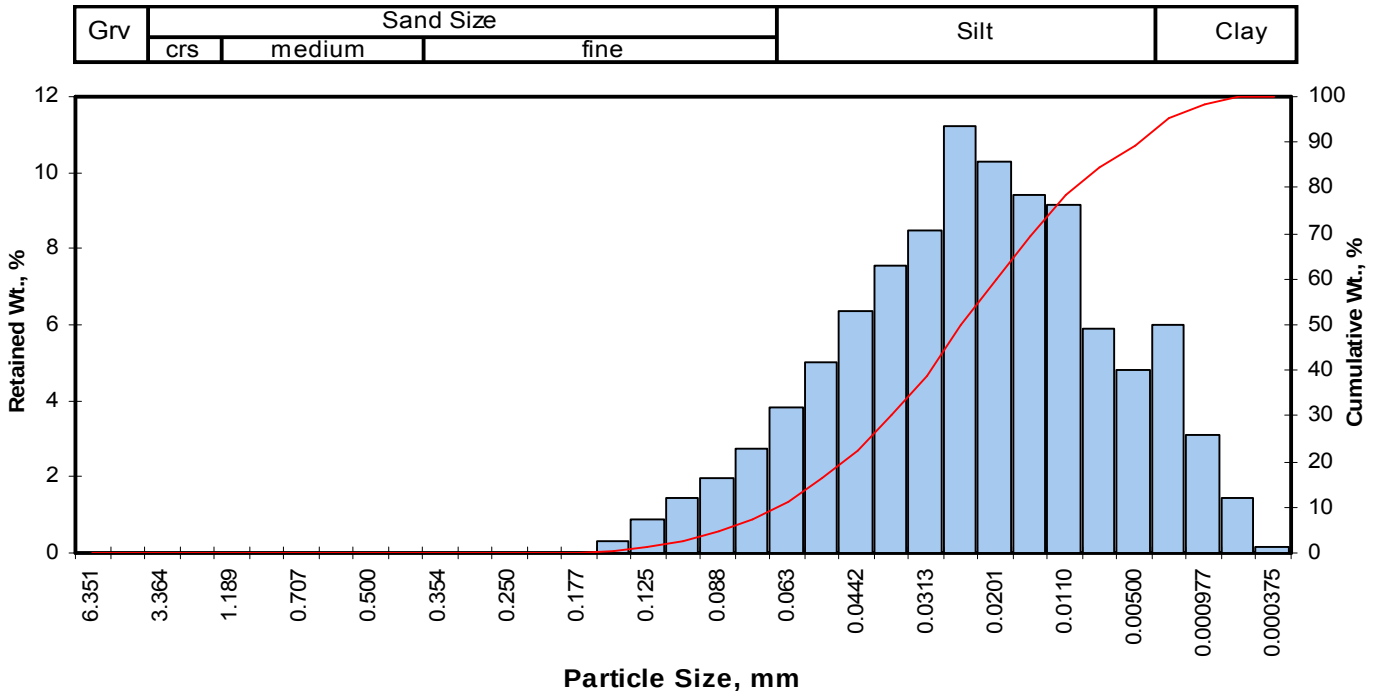
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	27.55
Silt	>0.005 mm	67.10
Clay	<0.005 mm	5.35
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-07 13-16 at 15.45
Project No:	60248522	**Depth, ft:**	15.45



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.02	0.02	0.02
0.0059	0.149	2.75	100	0.31	0.31	0.33
0.0049	0.125	3.00	120	0.90	0.90	1.23
0.0041	0.105	3.25	140	1.43	1.43	2.66
0.0035	0.088	3.50	170	1.96	1.96	4.62
0.0029	0.074	3.75	200	2.76	2.76	7.38
0.0025	0.063	4.00	230	3.83	3.83	11.22
0.0021	0.053	4.25	270	5.01	5.01	16.23
0.00174	0.0442	4.50	325	6.34	6.34	22.57
0.00146	0.0372	4.75	400	7.54	7.54	30.12
0.00123	0.0313	5.00	450	8.46	8.46	38.58
0.000986	0.0250	5.32	500	11.20	11.21	49.79
0.000790	0.0201	5.64	635	10.30	10.31	60.09
0.000615	0.0156	6.00		9.39	9.39	69.49
0.000435	0.0110	6.50		9.14	9.14	78.63
0.000308	0.00781	7.00		5.89	5.89	84.52
0.000197	0.00500	7.65		4.80	4.80	89.32
0.000077	0.00195	9.00		6.01	6.01	95.34
0.000038	0.000977	10.00		3.10	3.10	98.44
0.000019	0.000488	11.00		1.43	1.43	99.87
0.000015	0.000375	11.38		0.13	0.13	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.53	0.0034	0.086
10	3.92	0.0026	0.066
16	4.24	0.0021	0.053
25	4.58	0.0016	0.042
40	5.04	0.0012	0.030
50	5.33	0.0010	0.025
60	5.64	0.0008	0.020
75	6.30	0.0005	0.013
84	6.96	0.0003	0.008
90	7.80	0.0002	0.004
95	8.92	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	5.33	5.33	5.33
Median, in.	0.0010	0.0010	0.0010
Median, mm	0.025	0.025	0.025
Mean, phi	5.20	5.60	5.51
Mean, in.	0.0011	0.0008	0.0009
Mean, mm	0.027	0.021	0.022
Sorting	1.816	1.359	1.496
Skewness	0.924	0.199	0.267
Kurtosis	0.237	0.984	1.283

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

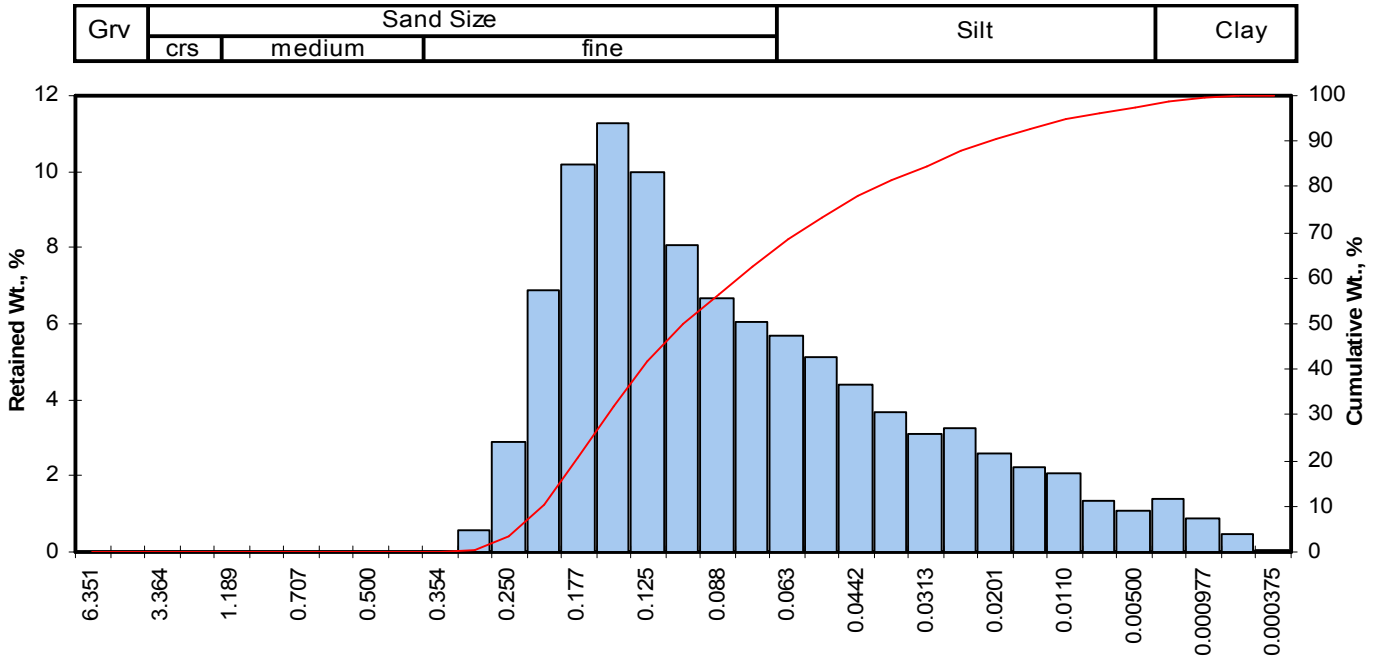
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	7.38
Silt	>0.005 mm	81.94
Clay	<0.005 mm	10.68
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-07 13-16 at 15.90
Project No:	60248522	**Depth, ft:**	15.90



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.01	0.01	0.01
0.0117	0.297	1.75	50	0.57	0.57	0.58
0.0098	0.250	2.00	60	2.91	2.91	3.49
0.0083	0.210	2.25	70	6.86	6.86	10.35
0.0070	0.177	2.50	80	10.20	10.20	20.55
0.0059	0.149	2.75	100	11.30	11.30	31.85
0.0049	0.125	3.00	120	9.99	9.99	41.84
0.0041	0.105	3.25	140	8.07	8.07	49.91
0.0035	0.088	3.50	170	6.69	6.69	56.60
0.0029	0.074	3.75	200	6.05	6.05	62.65
0.0025	0.063	4.00	230	5.69	5.69	68.34
0.0021	0.053	4.25	270	5.14	5.14	73.48
0.00174	0.0442	4.50	325	4.40	4.40	77.87
0.00146	0.0372	4.75	400	3.68	3.68	81.55
0.00123	0.0313	5.00	450	3.10	3.10	84.65
0.000986	0.0250	5.32	500	3.28	3.28	87.93
0.000790	0.0201	5.64	635	2.59	2.59	90.52
0.000615	0.0156	6.00		2.20	2.20	92.72
0.000435	0.0110	6.50		2.09	2.09	94.81
0.000308	0.00781	7.00		1.34	1.34	96.15
0.000197	0.00500	7.65		1.08	1.08	97.23
0.000077	0.00195	9.00		1.38	1.38	98.61
0.000038	0.000977	10.00		0.86	0.86	99.47
0.000019	0.000488	11.00		0.48	0.48	99.95
0.000015	0.000375	11.38		0.05	0.05	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	2.06	0.0095	0.241
10	2.24	0.0084	0.212
16	2.39	0.0075	0.191
25	2.60	0.0065	0.165
40	2.95	0.0051	0.129
50	3.25	0.0041	0.105
60	3.64	0.0032	0.080
75	4.34	0.0019	0.049
84	4.95	0.0013	0.032
90	5.58	0.0008	0.021
95	6.57	0.0004	0.011

Measure	Trask	Inman	Folk-Ward
Median, phi	3.25	3.25	3.25
Median, in.	0.0041	0.0041	0.0041
Median, mm	0.105	0.105	0.105
Mean, phi	3.22	3.67	3.53
Mean, in.	0.0042	0.0031	0.0034
Mean, mm	0.107	0.079	0.087
Sorting	1.827	1.279	1.324
Skewness	0.862	0.324	0.396
Kurtosis	0.302	0.764	1.064

Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

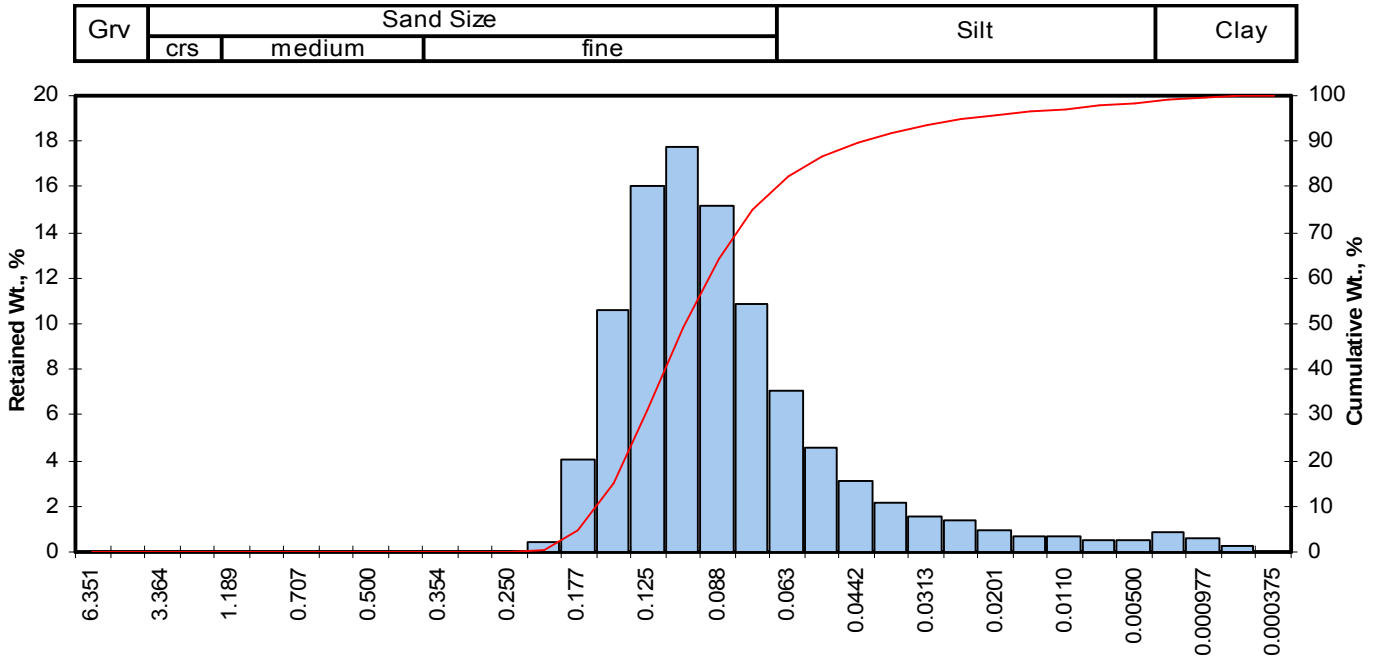
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	62.65
Silt	>0.005 mm	34.59
Clay	<0.005 mm	2.77
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-07 16-18 at 16.20
Project No:	60248522	**Depth, ft:**	16.20



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.47	0.47	0.47
0.0070	0.177	2.50	80	4.06	4.06	4.53
0.0059	0.149	2.75	100	10.60	10.60	15.13
0.0049	0.125	3.00	120	16.00	16.00	31.13
0.0041	0.105	3.25	140	17.80	17.80	48.93
0.0035	0.088	3.50	170	15.20	15.20	64.13
0.0029	0.074	3.75	200	10.90	10.90	75.02
0.0025	0.063	4.00	230	7.10	7.10	82.12
0.0021	0.053	4.25	270	4.59	4.59	86.71
0.00174	0.0442	4.50	325	3.08	3.08	89.79
0.00146	0.0372	4.75	400	2.15	2.15	91.94
0.00123	0.0313	5.00	450	1.53	1.53	93.47
0.000986	0.0250	5.32	500	1.38	1.38	94.85
0.000790	0.0201	5.64	635	0.93	0.93	95.78
0.000615	0.0156	6.00		0.70	0.70	96.48
0.000435	0.0110	6.50		0.66	0.66	97.14
0.000308	0.00781	7.00		0.52	0.52	97.66
0.000197	0.00500	7.65		0.53	0.53	98.19
0.000077	0.00195	9.00		0.87	0.87	99.06
0.000038	0.000977	10.00		0.63	0.63	99.69
0.000019	0.000488	11.00		0.29	0.29	99.98
0.000015	0.000375	11.38		0.02	0.02	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	2.51	0.0069	0.175
10	2.63	0.0064	0.162
16	2.76	0.0058	0.147
25	2.90	0.0053	0.134
40	3.12	0.0045	0.115
50	3.27	0.0041	0.104
60	3.43	0.0036	0.093
75	3.75	0.0029	0.074
84	4.10	0.0023	0.058
90	4.52	0.0017	0.043
95	5.37	0.0010	0.024

Measure	Trask	Inman	Folk-Ward
Median, phi	3.27	3.27	3.27
Median, in.	0.0041	0.0041	0.0041
Median, mm	0.104	0.104	0.104
Mean, phi	3.27	3.43	3.38
Mean, in.	0.0041	0.0036	0.0038
Mean, mm	0.104	0.093	0.096
Sorting	1.340	0.669	0.768
Skewness	0.960	0.247	0.359
Kurtosis	0.251	1.136	1.387

Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	75.02
Silt	>0.005 mm	23.17
Clay	<0.005 mm	1.81
	Total	**100**

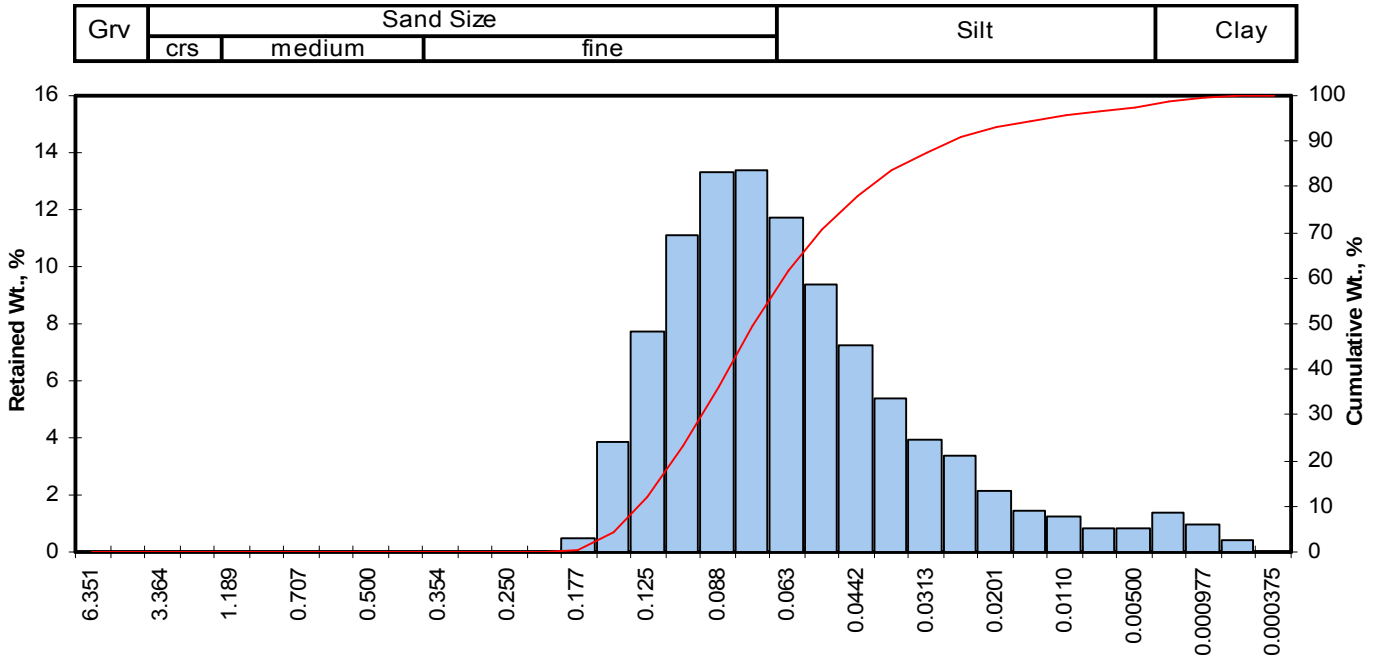
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Particle Size Analysis - ASTM D4464M

Client: AECOM
Project: Cold Springs Terminal
Project No: 60248522

PTS File No: 43519
Sample ID: SC-07 16-18 at 16.40
Depth, ft: 16.40



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.45	0.45	0.45
0.0059	0.149	2.75	100	3.85	3.85	4.30
0.0049	0.125	3.00	120	7.71	7.70	12.00
0.0041	0.105	3.25	140	11.10	11.09	23.09
0.0035	0.088	3.50	170	13.30	13.29	36.38
0.0029	0.074	3.75	200	13.40	13.39	49.77
0.0025	0.063	4.00	230	11.70	11.69	61.46
0.0021	0.053	4.25	270	9.40	9.39	70.85
0.00174	0.0442	4.50	325	7.26	7.25	78.11
0.00146	0.0372	4.75	400	5.39	5.39	83.49
0.00123	0.0313	5.00	450	3.91	3.91	87.40
0.000986	0.0250	5.32	500	3.41	3.41	90.80
0.000790	0.0201	5.64	635	2.11	2.11	92.91
0.000615	0.0156	6.00		1.47	1.47	94.38
0.000435	0.0110	6.50		1.21	1.21	95.59
0.000308	0.00781	7.00		0.83	0.83	96.42
0.000197	0.00500	7.65		0.82	0.82	97.24
0.000077	0.00195	9.00		1.35	1.35	98.59
0.000038	0.000977	10.00		0.98	0.98	99.57
0.000019	0.000488	11.00		0.41	0.41	99.98
0.000015	0.000375	11.38		0.02	0.02	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	2.77	0.0058	0.146
10	2.93	0.0051	0.131
16	3.09	0.0046	0.117
25	3.29	0.0040	0.103
40	3.57	0.0033	0.084
50	3.75	0.0029	0.074
60	3.97	0.0025	0.064
75	4.39	0.0019	0.048
84	4.78	0.0014	0.036
90	5.24	0.0010	0.026
95	6.26	0.0005	0.013

Measure	Trask	Inman	Folk-Ward
Median, phi	3.75	3.75	3.75
Median, in.	0.0029	0.0029	0.0029
Median, mm	0.074	0.074	0.074
Mean, phi	3.74	3.94	3.88
Mean, in.	0.0030	0.0026	0.0027
Mean, mm	0.075	0.065	0.068
Sorting	1.468	0.846	0.951
Skewness	0.943	0.214	0.325
Kurtosis	0.263	1.058	1.289

Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

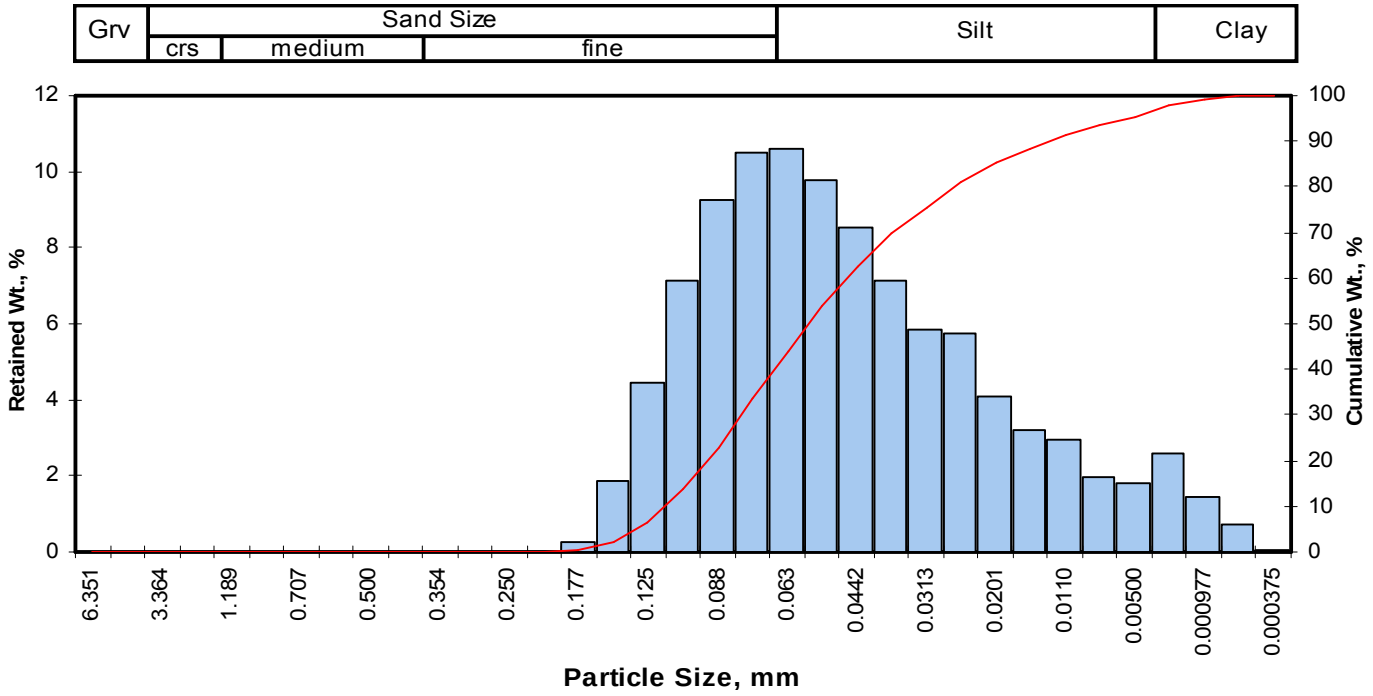
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	49.77
Silt	>0.005 mm	47.47
Clay	<0.005 mm	2.76
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-07 16-18 at 17.25
Project No:	60248522	**Depth, ft:**	17.25



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.01	0.01	0.01
0.0070	0.177	2.50	80	0.28	0.28	0.29
0.0059	0.149	2.75	100	1.84	1.84	2.13
0.0049	0.125	3.00	120	4.47	4.47	6.60
0.0041	0.105	3.25	140	7.16	7.16	13.76
0.0035	0.088	3.50	170	9.28	9.28	23.04
0.0029	0.074	3.75	200	10.50	10.50	33.54
0.0025	0.063	4.00	230	10.60	10.60	44.14
0.0021	0.053	4.25	270	9.79	9.79	53.93
0.00174	0.0442	4.50	325	8.54	8.54	62.47
0.00146	0.0372	4.75	400	7.15	7.15	69.61
0.00123	0.0313	5.00	450	5.82	5.82	75.43
0.000986	0.0250	5.32	500	5.73	5.73	81.16
0.000790	0.0201	5.64	635	4.08	4.08	85.24
0.000615	0.0156	6.00		3.19	3.19	88.43
0.000435	0.0110	6.50		2.93	2.93	91.36
0.000308	0.00781	7.00		1.98	1.98	93.34
0.000197	0.00500	7.65		1.80	1.80	95.14
0.000077	0.00195	9.00		2.61	2.61	97.75
0.000038	0.000977	10.00		1.45	1.45	99.20
0.000019	0.000488	11.00		0.73	0.73	99.93
0.000015	0.000375	11.38		0.07	0.07	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	2.91	0.0052	0.133
10	3.12	0.0045	0.115
16	3.31	0.0040	0.101
25	3.55	0.0034	0.086
40	3.90	0.0026	0.067
50	4.15	0.0022	0.056
60	4.43	0.0018	0.046
75	4.98	0.0012	0.032
84	5.54	0.0008	0.021
90	6.27	0.0005	0.013
95	7.59	0.0002	0.005

Measure	Trask	Inman	Folk-Ward
Median, phi	4.15	4.15	4.15
Median, in.	0.0022	0.0022	0.0022
Median, mm	0.056	0.056	0.056
Mean, phi	4.09	4.43	4.33
Mean, in.	0.0023	0.0018	0.0020
Mean, mm	0.059	0.047	0.050
Sorting	1.644	1.116	1.268
Skewness	0.924	0.248	0.359
Kurtosis	0.264	1.098	1.338
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

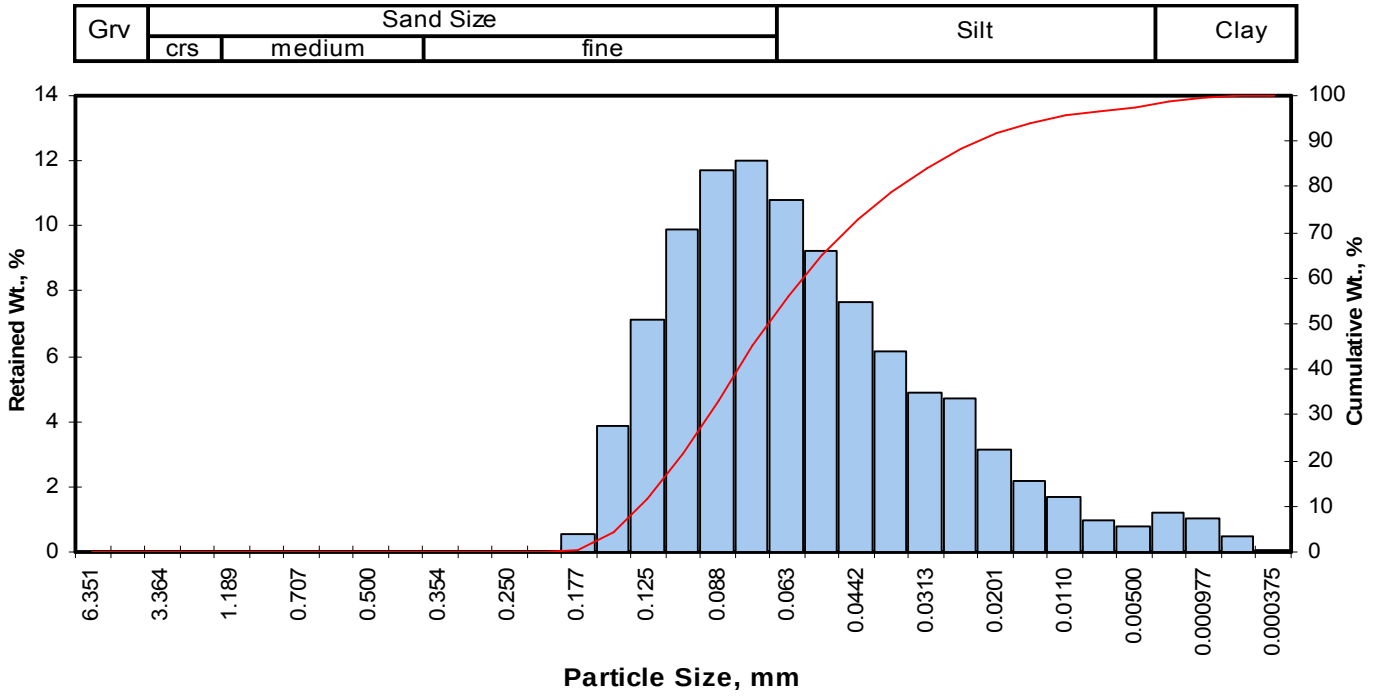
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	33.54
Silt	>0.005 mm	61.61
Clay	<0.005 mm	4.86
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-07 18-21 at 18.50
Project No:	60248522	**Depth, ft:**	18.50



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.01	0.01	0.01
0.0070	0.177	2.50	80	0.53	0.53	0.54
0.0059	0.149	2.75	100	3.87	3.87	4.40
0.0049	0.125	3.00	120	7.14	7.14	11.54
0.0041	0.105	3.25	140	9.87	9.87	21.41
0.0035	0.088	3.50	170	11.70	11.70	33.11
0.0029	0.074	3.75	200	12.00	12.00	45.11
0.0025	0.063	4.00	230	10.80	10.80	55.91
0.0021	0.053	4.25	270	9.23	9.23	65.13
0.00174	0.0442	4.50	325	7.66	7.66	72.79
0.00146	0.0372	4.75	400	6.17	6.17	78.96
0.00123	0.0313	5.00	450	4.91	4.91	83.87
0.000986	0.0250	5.32	500	4.69	4.69	88.56
0.000790	0.0201	5.64	635	3.11	3.11	91.67
0.000615	0.0156	6.00		2.19	2.19	93.86
0.000435	0.0110	6.50		1.68	1.68	95.54
0.000308	0.00781	7.00		0.95	0.95	96.49
0.000197	0.00500	7.65		0.78	0.78	97.27
0.000077	0.00195	9.00		1.23	1.23	98.50
0.000038	0.000977	10.00		1.00	1.00	99.50
0.000019	0.000488	11.00		0.47	0.47	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	2.77	0.0058	0.147
10	2.95	0.0051	0.130
16	3.11	0.0046	0.116
25	3.33	0.0039	0.100
40	3.64	0.0032	0.080
50	3.86	0.0027	0.069
60	4.11	0.0023	0.058
75	4.59	0.0016	0.042
84	5.01	0.0012	0.031
90	5.47	0.0009	0.023
95	6.34	0.0005	0.012

Measure	Trask	Inman	Folk-Ward
Median, phi	3.86	3.86	3.86
Median, in.	0.0027	0.0027	0.0027
Median, mm	0.069	0.069	0.069
Mean, phi	3.82	4.06	3.99
Mean, in.	0.0028	0.0024	0.0025
Mean, mm	0.071	0.060	0.063
Sorting	1.549	0.948	1.015
Skewness	0.936	0.208	0.298
Kurtosis	0.271	0.882	1.158

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

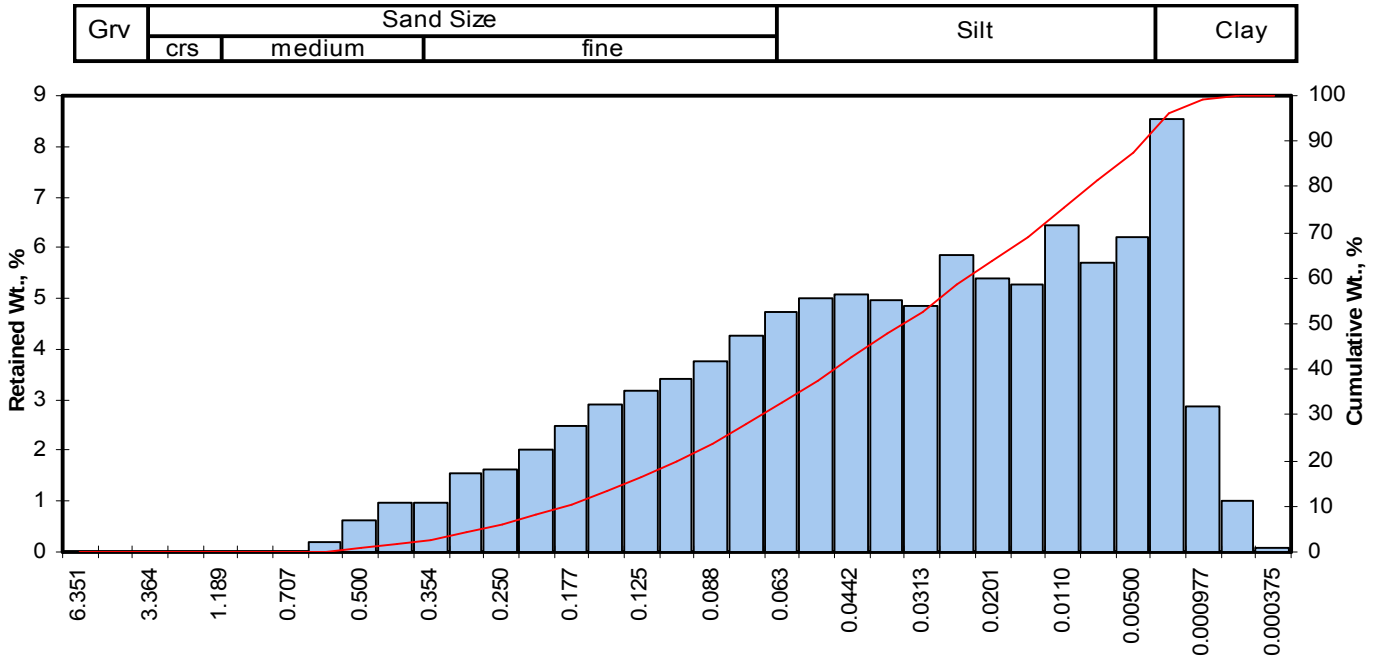
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	45.11
Silt	>0.005 mm	52.16
Clay	<0.005 mm	2.73
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-03 2-5 at 3.75
Project No:	60248522	**Depth, ft:**	3.75



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.02	0.02	0.02
0.0234	0.595	0.75	30	0.19	0.19	0.21
0.0197	0.500	1.00	35	0.62	0.62	0.83
0.0166	0.420	1.25	40	0.97	0.97	1.80
0.0139	0.354	1.50	45	0.97	0.97	2.77
0.0117	0.297	1.75	50	1.56	1.56	4.33
0.0098	0.250	2.00	60	1.63	1.63	5.96
0.0083	0.210	2.25	70	2.02	2.02	7.98
0.0070	0.177	2.50	80	2.48	2.48	10.46
0.0059	0.149	2.75	100	2.91	2.91	13.36
0.0049	0.125	3.00	120	3.17	3.17	16.53
0.0041	0.105	3.25	140	3.40	3.40	19.93
0.0035	0.088	3.50	170	3.77	3.77	23.70
0.0029	0.074	3.75	200	4.28	4.28	27.98
0.0025	0.063	4.00	230	4.74	4.74	32.72
0.0021	0.053	4.25	270	4.99	4.99	37.71
0.00174	0.0442	4.50	325	5.07	5.07	42.78
0.00146	0.0372	4.75	400	4.98	4.98	47.76
0.00123	0.0313	5.00	450	4.84	4.84	52.60
0.000986	0.0250	5.32	500	5.87	5.87	58.47
0.000790	0.0201	5.64	635	5.38	5.38	63.85
0.000615	0.0156	6.00		5.29	5.29	69.14
0.000435	0.0110	6.50		6.43	6.43	75.56
0.000308	0.00781	7.00		5.71	5.71	81.27
0.000197	0.00500	7.65		6.22	6.22	87.49
0.000077	0.00195	9.00		8.55	8.55	96.04
0.000038	0.000977	10.00		2.89	2.89	98.93
0.000019	0.000488	11.00		0.99	0.99	99.92
0.000015	0.000375	11.38		0.08	0.08	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.85	0.0109	0.277
10	2.45	0.0072	0.182
16	2.96	0.0051	0.129
25	3.58	0.0033	0.084
40	4.36	0.0019	0.049
50	4.87	0.0014	0.034
60	5.41	0.0009	0.024
75	6.46	0.0004	0.011
84	7.28	0.0003	0.006
90	8.04	0.0001	0.004
95	8.84	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	4.87	4.87	4.87
Median, in.	0.0014	0.0014	0.0014
Median, mm	0.034	0.034	0.034
Mean, phi	4.39	5.12	5.04
Mean, in.	0.0019	0.0011	0.0012
Mean, mm	0.048	0.029	0.030
Sorting	2.714	2.162	2.139
Skewness	0.901	0.118	0.127
Kurtosis	0.203	0.614	0.993

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	1.80
Fine Sand	200	26.19
Silt	>0.005 mm	59.51
Clay	<0.005 mm	12.51
	Total	**100**

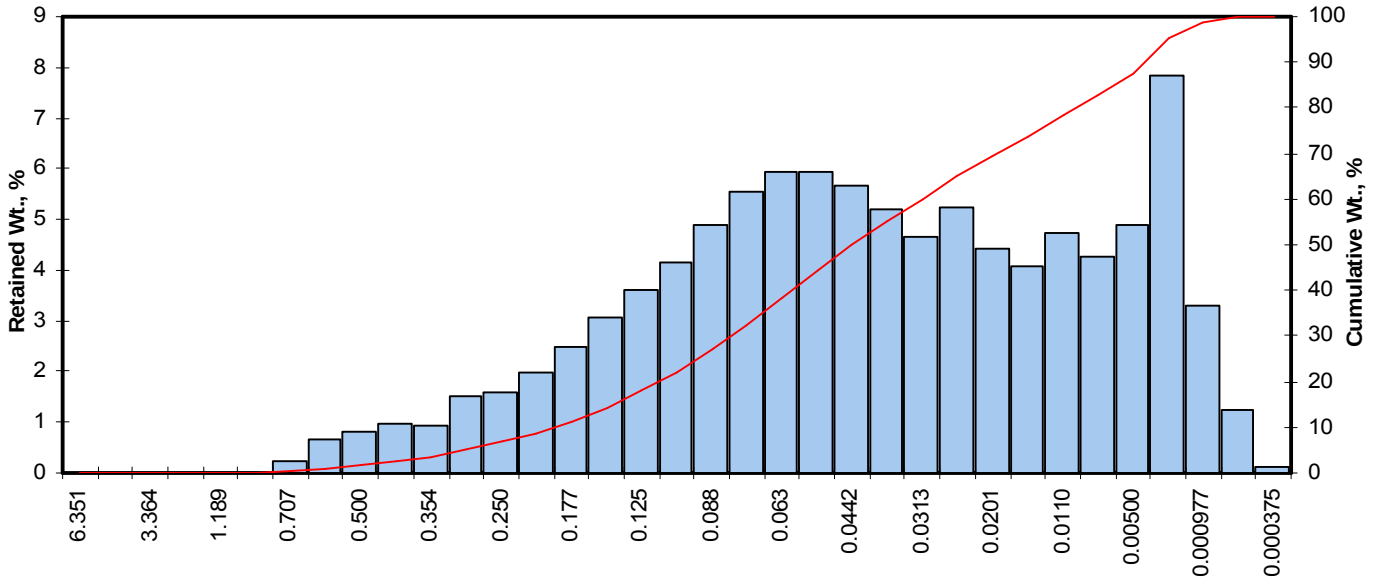
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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-03 2-5 at 4.15
Project No:	60248522	**Depth, ft:**	4.15

Grv	Sand Size			Silt	Clay
	crs	medium	fine		



Particle Size, mm

Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.02	0.02	0.02
0.0278	0.707	0.50	25	0.24	0.24	0.26
0.0234	0.595	0.75	30	0.65	0.65	0.91
0.0197	0.500	1.00	35	0.82	0.82	1.73
0.0166	0.420	1.25	40	0.98	0.98	2.71
0.0139	0.354	1.50	45	0.95	0.95	3.66
0.0117	0.297	1.75	50	1.53	1.53	5.19
0.0098	0.250	2.00	60	1.58	1.58	6.77
0.0083	0.210	2.25	70	1.99	1.99	8.76
0.0070	0.177	2.50	80	2.50	2.50	11.26
0.0059	0.149	2.75	100	3.07	3.07	14.33
0.0049	0.125	3.00	120	3.59	3.59	17.92
0.0041	0.105	3.25	140	4.17	4.17	22.09
0.0035	0.088	3.50	170	4.87	4.87	26.96
0.0029	0.074	3.75	200	5.54	5.54	32.50
0.0025	0.063	4.00	230	5.94	5.94	38.44
0.0021	0.053	4.25	270	5.94	5.94	44.38
0.00174	0.0442	4.50	325	5.66	5.66	50.04
0.00146	0.0372	4.75	400	5.18	5.18	55.22
0.00123	0.0313	5.00	450	4.67	4.67	59.89
0.000986	0.0250	5.32	500	5.24	5.24	65.13
0.000790	0.0201	5.64	635	4.41	4.41	69.54
0.000615	0.0156	6.00		4.06	4.06	73.60
0.000435	0.0110	6.50		4.74	4.74	78.34
0.000308	0.00781	7.00		4.26	4.26	82.60
0.000197	0.00500	7.65		4.89	4.89	87.49
0.000077	0.00195	9.00		7.84	7.84	95.33
0.000038	0.000977	10.00		3.31	3.31	98.64
0.000019	0.000488	11.00		1.26	1.26	99.90
0.000015	0.000375	11.38		0.10	0.10	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	1.72	0.0120	0.304
10	2.37	0.0076	0.193
16	2.87	0.0054	0.137
25	3.40	0.0037	0.095
40	4.07	0.0024	0.060
50	4.50	0.0017	0.044
60	5.01	0.0012	0.031
75	6.15	0.0006	0.014
84	7.18	0.0003	0.007
90	8.08	0.0001	0.004
95	8.94	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	4.50	4.50	4.50
Median, in.	0.0017	0.0017	0.0017
Median, mm	0.044	0.044	0.044
Mean, phi	4.20	5.03	4.85
Mean, in.	0.0021	0.0012	0.0014
Mean, mm	0.054	0.031	0.035
Sorting	2.592	2.159	2.174
Skewness	0.826	0.244	0.237
Kurtosis	0.213	0.673	1.077

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

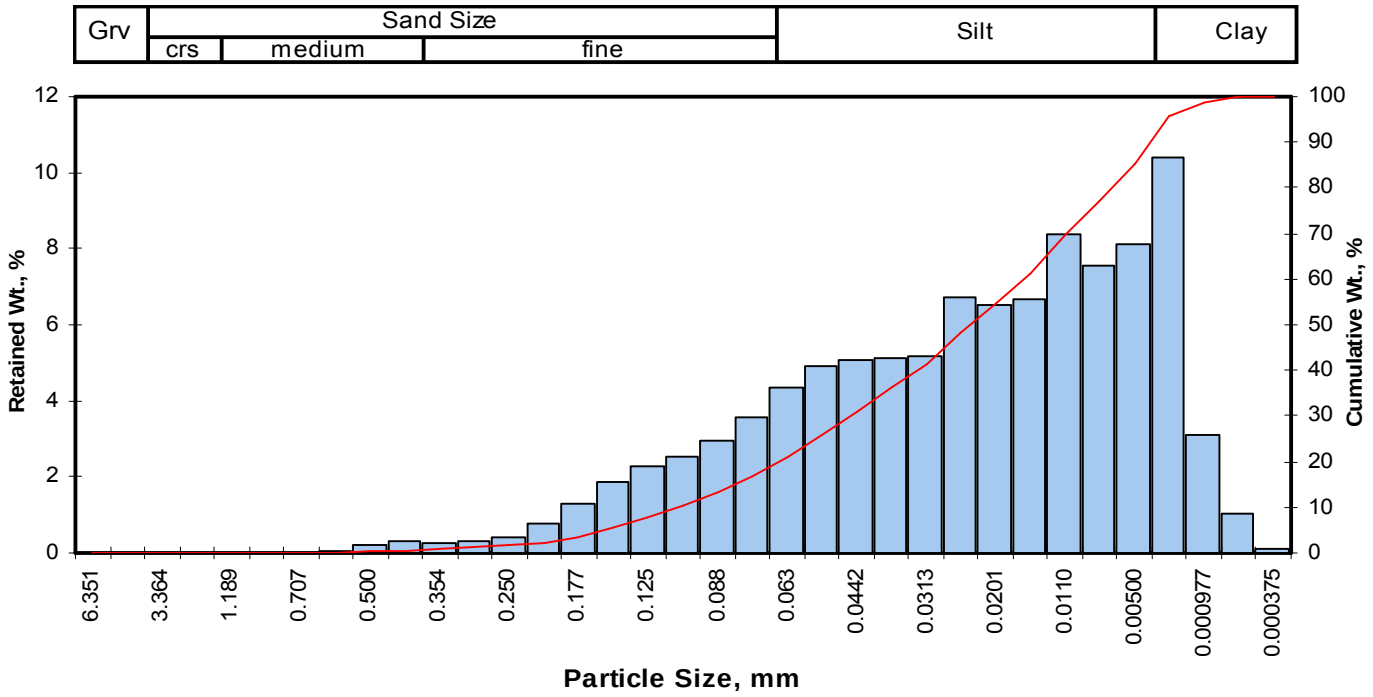
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	2.71
Fine Sand	200	29.79
Silt	>0.005 mm	54.99
Clay	<0.005 mm	12.51
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-03 5-8 at 5.30
Project No:	60248522	**Depth, ft:**	5.30



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.04	0.04	0.04
0.0197	0.500	1.00	35	0.21	0.21	0.25
0.0166	0.420	1.25	40	0.33	0.33	0.58
0.0139	0.354	1.50	45	0.26	0.26	0.84
0.0117	0.297	1.75	50	0.32	0.32	1.16
0.0098	0.250	2.00	60	0.41	0.41	1.57
0.0083	0.210	2.25	70	0.77	0.77	2.34
0.0070	0.177	2.50	80	1.30	1.30	3.64
0.0059	0.149	2.75	100	1.86	1.86	5.50
0.0049	0.125	3.00	120	2.26	2.26	7.76
0.0041	0.105	3.25	140	2.53	2.53	10.29
0.0035	0.088	3.50	170	2.93	2.93	13.22
0.0029	0.074	3.75	200	3.59	3.59	16.81
0.0025	0.063	4.00	230	4.37	4.37	21.18
0.0021	0.053	4.25	270	4.90	4.90	26.07
0.00174	0.0442	4.50	325	5.09	5.09	31.16
0.00146	0.0372	4.75	400	5.10	5.10	36.26
0.00123	0.0313	5.00	450	5.18	5.18	41.44
0.000986	0.0250	5.32	500	6.71	6.71	48.15
0.000790	0.0201	5.64	635	6.53	6.53	54.68
0.000615	0.0156	6.00		6.68	6.68	61.36
0.000435	0.0110	6.50		8.39	8.39	69.74
0.000308	0.00781	7.00		7.54	7.54	77.28
0.000197	0.00500	7.65		8.11	8.11	85.39
0.000077	0.00195	9.00		10.40	10.40	95.79
0.000038	0.000977	10.00		3.10	3.10	98.89
0.000019	0.000488	11.00		1.03	1.03	99.92
0.000015	0.000375	11.38		0.08	0.08	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	2.68	0.0061	0.156
10	3.22	0.0042	0.107
16	3.69	0.0030	0.077
25	4.20	0.0021	0.055
40	4.93	0.0013	0.033
50	5.41	0.0009	0.024
60	5.93	0.0006	0.016
75	6.85	0.0003	0.009
84	7.53	0.0002	0.005
90	8.25	0.0001	0.003
95	8.90	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	5.41	5.41	5.41
Median, in.	0.0009	0.0009	0.0009
Median, mm	0.024	0.024	0.024
Mean, phi	4.98	5.61	5.55
Mean, in.	0.0012	0.0008	0.0008
Mean, mm	0.032	0.020	0.021
Sorting	2.508	1.920	1.902
Skewness	0.926	0.106	0.114
Kurtosis	0.221	0.618	0.960

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

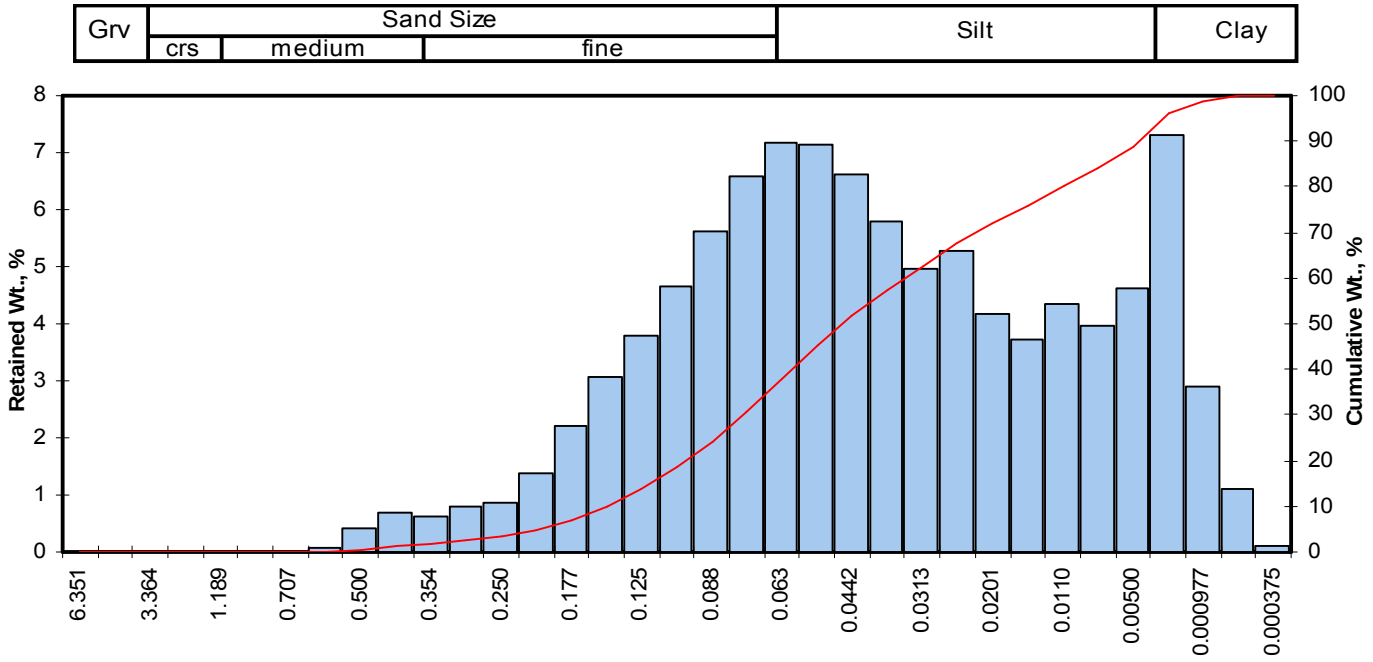
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.58
Fine Sand	200	16.23
Silt	>0.005 mm	68.58
Clay	<0.005 mm	14.61
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-03 5-8 at 6.05
Project No:	60248522	**Depth, ft:**	6.05



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.08	0.08	0.08
0.0197	0.500	1.00	35	0.41	0.41	0.49
0.0166	0.420	1.25	40	0.70	0.70	1.19
0.0139	0.354	1.50	45	0.62	0.62	1.81
0.0117	0.297	1.75	50	0.80	0.80	2.61
0.0098	0.250	2.00	60	0.85	0.85	3.46
0.0083	0.210	2.25	70	1.38	1.38	4.84
0.0070	0.177	2.50	80	2.19	2.19	7.03
0.0059	0.149	2.75	100	3.06	3.06	10.09
0.0049	0.125	3.00	120	3.81	3.81	13.90
0.0041	0.105	3.25	140	4.64	4.64	18.54
0.0035	0.088	3.50	170	5.63	5.63	24.17
0.0029	0.074	3.75	200	6.59	6.59	30.76
0.0025	0.063	4.00	230	7.17	7.17	37.93
0.0021	0.053	4.25	270	7.15	7.15	45.08
0.00174	0.0442	4.50	325	6.62	6.62	51.70
0.00146	0.0372	4.75	400	5.81	5.81	57.51
0.00123	0.0313	5.00	450	4.97	4.97	62.48
0.000986	0.0250	5.32	500	5.26	5.26	67.74
0.000790	0.0201	5.64	635	4.18	4.18	71.92
0.000615	0.0156	6.00		3.74	3.74	75.66
0.000435	0.0110	6.50		4.34	4.34	80.00
0.000308	0.00781	7.00		3.96	3.96	83.96
0.000197	0.00500	7.65		4.63	4.63	88.59
0.000077	0.00195	9.00		7.32	7.32	95.91
0.000038	0.000977	10.00		2.91	2.91	98.82
0.000019	0.000488	11.00		1.09	1.09	99.91
0.000015	0.000375	11.38		0.09	0.09	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	2.27	0.0082	0.208
10	2.74	0.0059	0.149
16	3.11	0.0045	0.116
25	3.53	0.0034	0.086
40	4.07	0.0023	0.059
50	4.44	0.0018	0.046
60	4.88	0.0013	0.034
75	5.94	0.0006	0.016
84	7.01	0.0003	0.008
90	7.91	0.0002	0.004
95	8.83	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	4.44	4.44	4.44
Median, in.	0.0018	0.0018	0.0018
Median, mm	0.046	0.046	0.046
Mean, phi	4.28	5.06	4.85
Mean, in.	0.0020	0.0012	0.0014
Mean, mm	0.051	0.030	0.035
Sorting	2.301	1.946	1.968
Skewness	0.813	0.320	0.330
Kurtosis	0.242	0.686	1.118

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

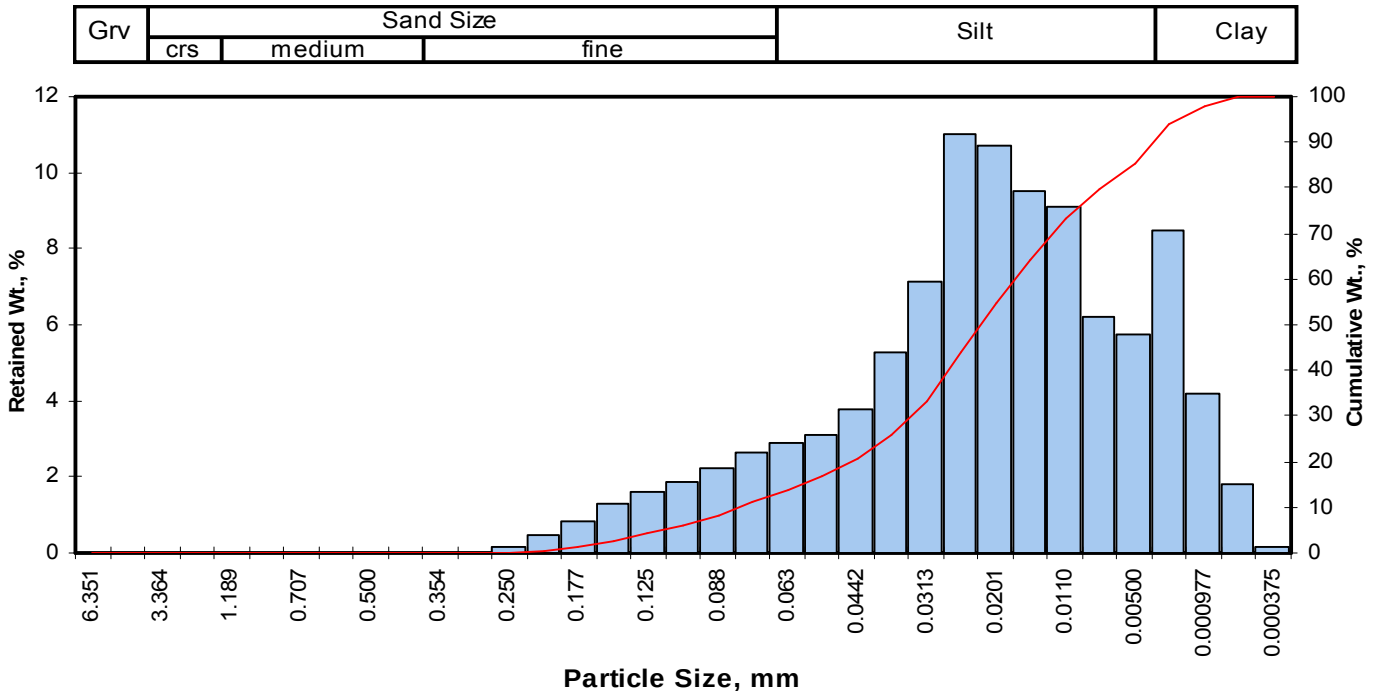
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	1.19
Fine Sand	200	29.57
Silt	>0.005 mm	57.83
Clay	<0.005 mm	11.41
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-03 5-8 at 6.93
Project No:	60248522	**Depth, ft:**	6.93



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.02	0.02	0.02
0.0098	0.250	2.00	60	0.14	0.14	0.16
0.0083	0.210	2.25	70	0.44	0.44	0.60
0.0070	0.177	2.50	80	0.85	0.85	1.45
0.0059	0.149	2.75	100	1.27	1.27	2.72
0.0049	0.125	3.00	120	1.59	1.59	4.30
0.0041	0.105	3.25	140	1.87	1.87	6.17
0.0035	0.088	3.50	170	2.23	2.23	8.40
0.0029	0.074	3.75	200	2.62	2.62	11.02
0.0025	0.063	4.00	230	2.88	2.88	13.90
0.0021	0.053	4.25	270	3.09	3.09	16.99
0.00174	0.0442	4.50	325	3.78	3.78	20.76
0.00146	0.0372	4.75	400	5.26	5.26	26.02
0.00123	0.0313	5.00	450	7.16	7.16	33.17
0.000986	0.0250	5.32	500	11.00	10.99	44.17
0.000790	0.0201	5.64	635	10.70	10.69	54.86
0.000615	0.0156	6.00		9.50	9.49	64.35
0.000435	0.0110	6.50		9.09	9.08	73.44
0.000308	0.00781	7.00		6.19	6.19	79.62
0.000197	0.00500	7.65		5.76	5.76	85.38
0.000077	0.00195	9.00		8.47	8.46	93.84
0.000038	0.000977	10.00		4.18	4.18	98.02
0.000019	0.000488	11.00		1.82	1.82	99.84
0.000015	0.000375	11.38		0.16	0.16	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.09	0.0046	0.117
10	3.65	0.0031	0.080
16	4.17	0.0022	0.056
25	4.70	0.0015	0.038
40	5.20	0.0011	0.027
50	5.49	0.0009	0.022
60	5.83	0.0007	0.018
75	6.63	0.0004	0.010
84	7.49	0.0002	0.006
90	8.38	0.0001	0.003
95	9.28	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	5.49	5.49	5.49
Median, in.	0.0009	0.0009	0.0009
Median, mm	0.022	0.022	0.022
Mean, phi	5.36	5.83	5.72
Mean, in.	0.0010	0.0007	0.0007
Mean, mm	0.024	0.018	0.019
Sorting	1.949	1.660	1.767
Skewness	0.889	0.202	0.213
Kurtosis	0.185	0.862	1.317
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

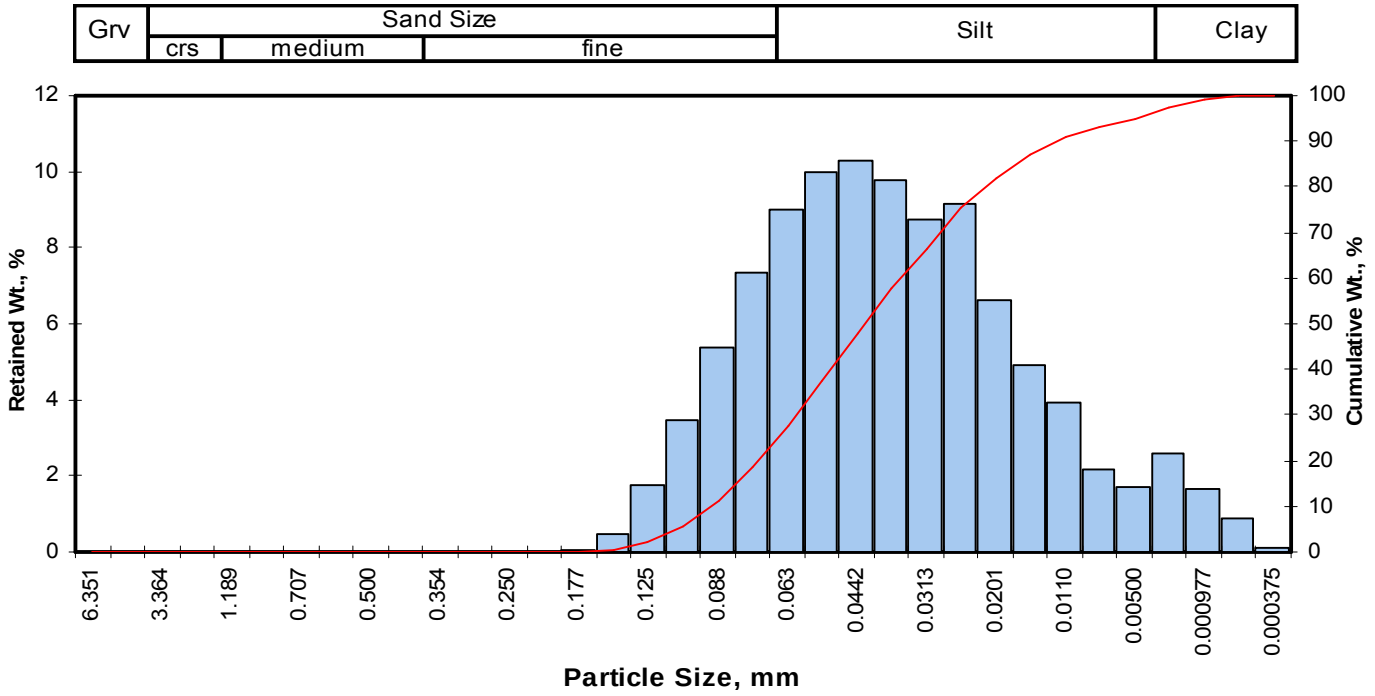
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	11.02
Silt	>0.005 mm	74.36
Clay	<0.005 mm	14.62
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-03- 8-11 at 9.95
Project No:	60248522	**Depth, ft:**	9.95



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.03	0.03	0.03
0.0059	0.149	2.75	100	0.48	0.48	0.51
0.0049	0.125	3.00	120	1.75	1.75	2.26
0.0041	0.105	3.25	140	3.46	3.46	5.72
0.0035	0.088	3.50	170	5.40	5.40	11.12
0.0029	0.074	3.75	200	7.37	7.37	18.48
0.0025	0.063	4.00	230	9.02	9.02	27.50
0.0021	0.053	4.25	270	9.99	9.99	37.49
0.00174	0.0442	4.50	325	10.30	10.30	47.78
0.00146	0.0372	4.75	400	9.77	9.77	57.55
0.00123	0.0313	5.00	450	8.75	8.75	66.30
0.000986	0.0250	5.32	500	9.17	9.17	75.46
0.000790	0.0201	5.64	635	6.63	6.63	82.09
0.000615	0.0156	6.00		4.93	4.93	87.02
0.000435	0.0110	6.50		3.91	3.91	90.93
0.000308	0.00781	7.00		2.16	2.16	93.09
0.000197	0.00500	7.65		1.69	1.69	94.78
0.000077	0.00195	9.00		2.57	2.57	97.35
0.000038	0.000977	10.00		1.68	1.68	99.03
0.000019	0.000488	11.00		0.89	0.89	99.92
0.000015	0.000375	11.38		0.08	0.08	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.20	0.0043	0.109
10	3.45	0.0036	0.092
16	3.67	0.0031	0.079
25	3.93	0.0026	0.066
40	4.31	0.0020	0.050
50	4.56	0.0017	0.042
60	4.82	0.0014	0.035
75	5.30	0.0010	0.025
84	5.78	0.0007	0.018
90	6.38	0.0005	0.012
95	7.76	0.0002	0.005

Measure	Trask	Inman	Folk-Ward
Median, phi	4.56	4.56	4.56
Median, in.	0.0017	0.0017	0.0017
Median, mm	0.042	0.042	0.042
Mean, phi	4.46	4.72	4.67
Mean, in.	0.0018	0.0015	0.0015
Mean, mm	0.045	0.038	0.039
Sorting	1.609	1.057	1.220
Skewness	0.959	0.157	0.281
Kurtosis	0.253	1.159	1.362

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

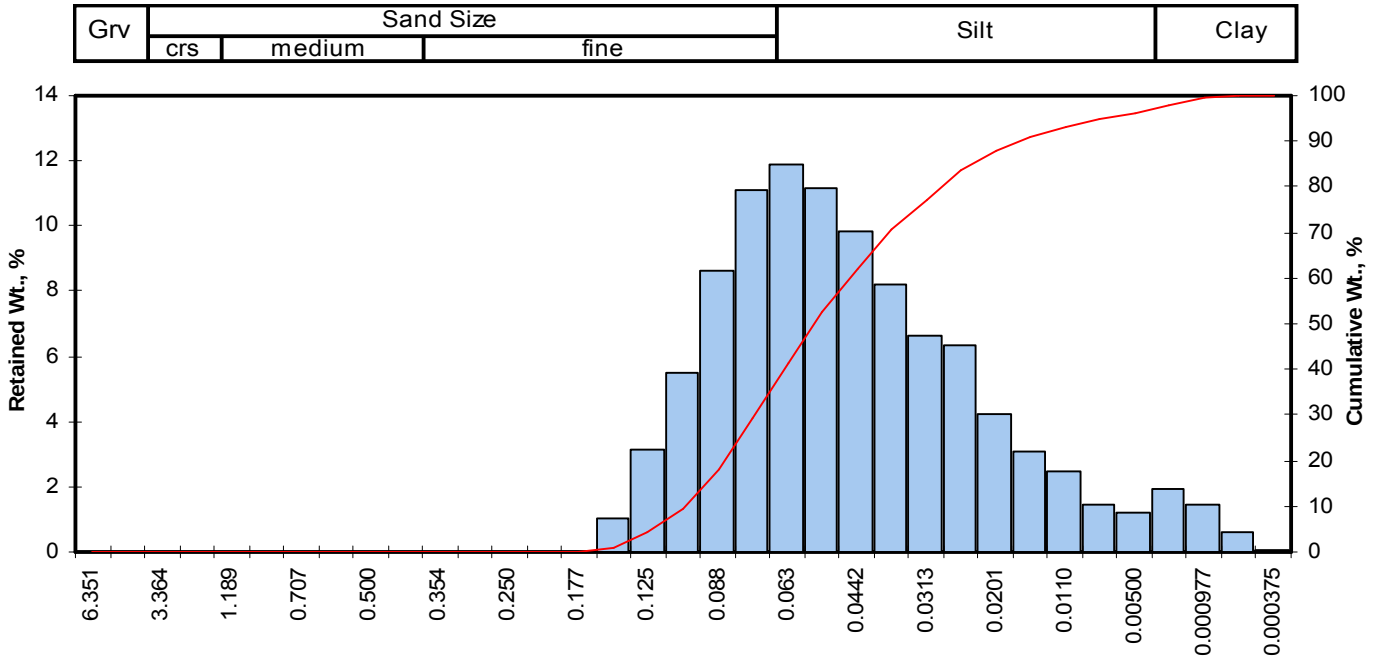
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	18.48
Silt	>0.005 mm	76.29
Clay	<0.005 mm	5.22
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-03 11-14 at 11.75
Project No:	60248522	**Depth, ft:**	11.75



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.02	0.02	0.02
0.0059	0.149	2.75	100	1.01	1.01	1.03
0.0049	0.125	3.00	120	3.13	3.13	4.16
0.0041	0.105	3.25	140	5.49	5.49	9.64
0.0035	0.088	3.50	170	8.62	8.61	18.26
0.0029	0.074	3.75	200	11.10	11.09	29.35
0.0025	0.063	4.00	230	11.90	11.89	41.24
0.0021	0.053	4.25	270	11.20	11.19	52.43
0.00174	0.0442	4.50	325	9.84	9.83	62.26
0.00146	0.0372	4.75	400	8.22	8.21	70.48
0.00123	0.0313	5.00	450	6.66	6.66	77.13
0.000986	0.0250	5.32	500	6.36	6.36	83.49
0.000790	0.0201	5.64	635	4.24	4.24	87.72
0.000615	0.0156	6.00		3.09	3.09	90.81
0.000435	0.0110	6.50		2.46	2.46	93.27
0.000308	0.00781	7.00		1.44	1.44	94.71
0.000197	0.00500	7.65		1.23	1.23	95.94
0.000077	0.00195	9.00		1.96	1.96	97.90
0.000038	0.000977	10.00		1.47	1.47	99.37
0.000019	0.000488	11.00		0.60	0.60	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.04	0.0048	0.122
10	3.26	0.0041	0.104
16	3.43	0.0036	0.092
25	3.65	0.0031	0.080
40	3.97	0.0025	0.064
50	4.20	0.0021	0.055
60	4.44	0.0018	0.046
75	4.92	0.0013	0.033
84	5.36	0.0010	0.024
90	5.91	0.0007	0.017
95	7.15	0.0003	0.007

Measure	Trask	Inman	Folk-Ward
Median, phi	4.20	4.20	4.20
Median, in.	0.0021	0.0021	0.0021
Median, mm	0.055	0.055	0.055
Mean, phi	4.15	4.40	4.33
Mean, in.	0.0022	0.0019	0.0020
Mean, mm	0.056	0.047	0.050
Sorting	1.552	0.962	1.104
Skewness	0.939	0.209	0.323
Kurtosis	0.265	1.138	1.330

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

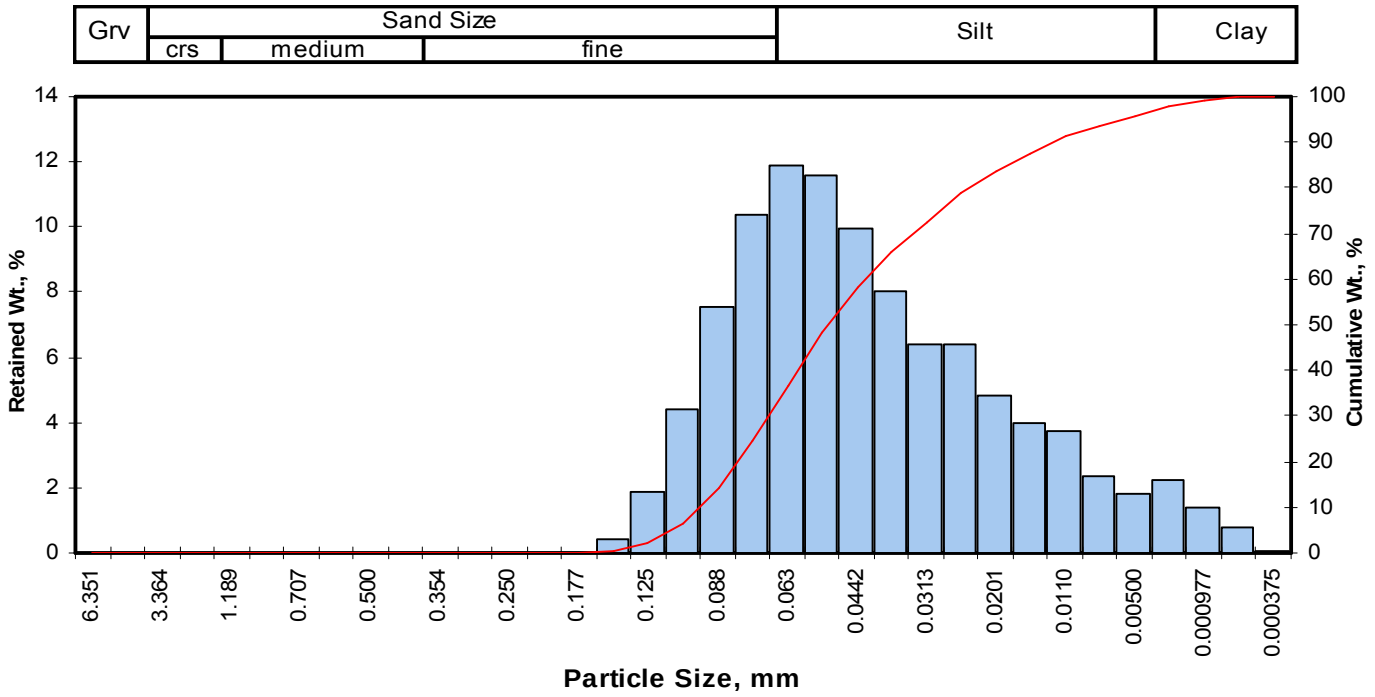
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	29.35
Silt	>0.005 mm	66.59
Clay	<0.005 mm	4.06
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-03 11-14 at 12.50
Project No:	60248522	**Depth, ft:**	12.50



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.02	0.02	0.02
0.0059	0.149	2.75	100	0.42	0.42	0.44
0.0049	0.125	3.00	120	1.86	1.86	2.30
0.0041	0.105	3.25	140	4.38	4.38	6.68
0.0035	0.088	3.50	170	7.52	7.51	14.19
0.0029	0.074	3.75	200	10.40	10.39	24.58
0.0025	0.063	4.00	230	11.90	11.89	36.47
0.0021	0.053	4.25	270	11.60	11.59	48.06
0.00174	0.0442	4.50	325	9.97	9.96	58.03
0.00146	0.0372	4.75	400	8.03	8.02	66.05
0.00123	0.0313	5.00	450	6.41	6.41	72.46
0.000986	0.0250	5.32	500	6.42	6.42	78.87
0.000790	0.0201	5.64	635	4.84	4.84	83.71
0.000615	0.0156	6.00		3.98	3.98	87.68
0.000435	0.0110	6.50		3.72	3.72	91.40
0.000308	0.00781	7.00		2.35	2.35	93.75
0.000197	0.00500	7.65		1.84	1.84	95.59
0.000077	0.00195	9.00		2.21	2.21	97.80
0.000038	0.000977	10.00		1.36	1.36	99.15
0.000019	0.000488	11.00		0.77	0.77	99.92
0.000015	0.000375	11.38		0.08	0.08	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.15	0.0044	0.112
10	3.36	0.0038	0.097
16	3.54	0.0034	0.086
25	3.76	0.0029	0.074
40	4.08	0.0023	0.059
50	4.30	0.0020	0.051
60	4.56	0.0017	0.042
75	5.13	0.0011	0.029
84	5.67	0.0008	0.020
90	6.31	0.0005	0.013
95	7.44	0.0002	0.006

Measure	Trask	Inman	Folk-Ward
Median, phi	4.30	4.30	4.30
Median, in.	0.0020	0.0020	0.0020
Median, mm	0.051	0.051	0.051
Mean, phi	4.29	4.61	4.50
Mean, in.	0.0020	0.0016	0.0017
Mean, mm	0.051	0.041	0.044
Sorting	1.607	1.062	1.180
Skewness	0.905	0.289	0.377
Kurtosis	0.267	1.018	1.283
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

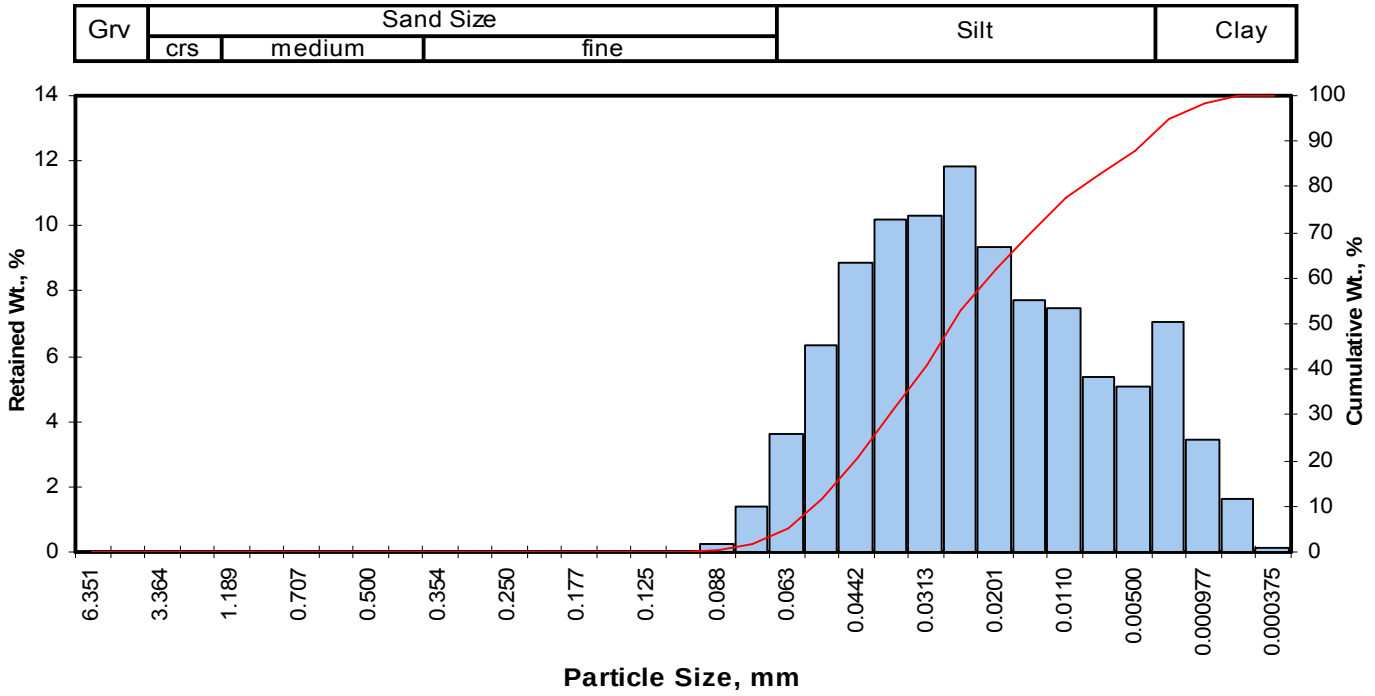
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	24.58
Silt	>0.005 mm	71.01
Clay	<0.005 mm	4.41
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-03 14-17 at 14.50
Project No:	60248522	**Depth, ft:**	14.50



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.00	0.00	0.00
0.0059	0.149	2.75	100	0.00	0.00	0.00
0.0049	0.125	3.00	120	0.00	0.00	0.00
0.0041	0.105	3.25	140	0.01	0.01	0.01
0.0035	0.088	3.50	170	0.26	0.26	0.27
0.0029	0.074	3.75	200	1.40	1.40	1.67
0.0025	0.063	4.00	230	3.63	3.63	5.30
0.0021	0.053	4.25	270	6.35	6.35	11.66
0.00174	0.0442	4.50	325	8.85	8.85	20.51
0.00146	0.0372	4.75	400	10.20	10.21	30.72
0.00123	0.0313	5.00	450	10.30	10.31	41.02
0.000986	0.0250	5.32	500	11.80	11.81	52.83
0.000790	0.0201	5.64	635	9.32	9.32	62.15
0.000615	0.0156	6.00		7.73	7.73	69.88
0.000435	0.0110	6.50		7.49	7.49	77.38
0.000308	0.00781	7.00		5.35	5.35	82.73
0.000197	0.00500	7.65		5.04	5.04	87.77
0.000077	0.00195	9.00		7.04	7.04	94.82
0.000038	0.000977	10.00		3.42	3.42	98.24
0.000019	0.000488	11.00		1.61	1.61	99.85
0.000015	0.000375	11.38		0.15	0.15	100.00
TOTALS				**99.90**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.98	0.0025	0.063
10	4.18	0.0022	0.055
16	4.37	0.0019	0.048
25	4.61	0.0016	0.041
40	4.98	0.0013	0.032
50	5.24	0.0010	0.026
60	5.57	0.0008	0.021
75	6.34	0.0005	0.012
84	7.16	0.0003	0.007
90	8.07	0.0001	0.004
95	9.05	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	5.24	5.24	5.24
Median, in.	0.0010	0.0010	0.0010
Median, mm	0.026	0.026	0.026
Mean, phi	5.23	5.77	5.59
Mean, in.	0.0010	0.0007	0.0008
Mean, mm	0.027	0.018	0.021
Sorting	1.822	1.395	1.466
Skewness	0.851	0.376	0.439
Kurtosis	0.279	0.819	1.201

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

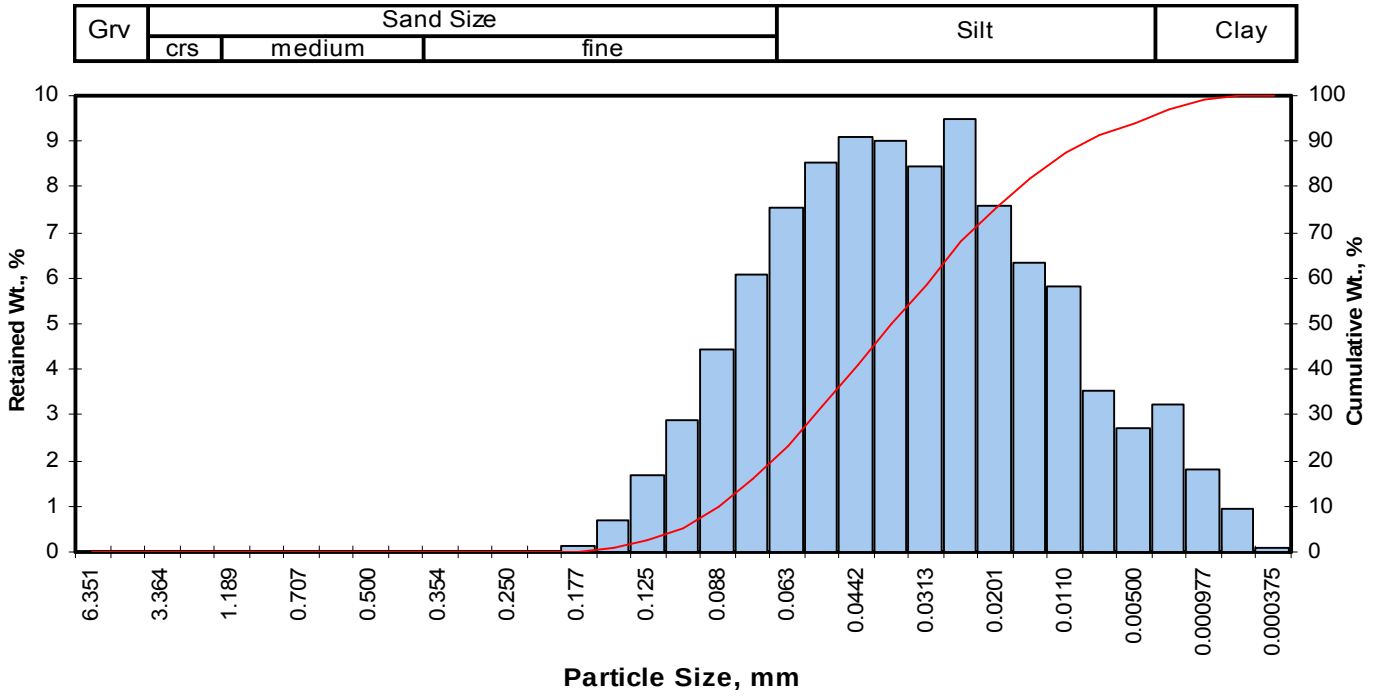
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	1.67
Silt	>0.005 mm	86.10
Clay	<0.005 mm	12.23
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-05 1-4 at 2.50
Project No:	60248522	**Depth, ft:**	2.50



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.01	0.01	0.01
0.0070	0.177	2.50	80	0.12	0.12	0.13
0.0059	0.149	2.75	100	0.69	0.69	0.82
0.0049	0.125	3.00	120	1.66	1.66	2.48
0.0041	0.105	3.25	140	2.90	2.90	5.38
0.0035	0.088	3.50	170	4.42	4.42	9.80
0.0029	0.074	3.75	200	6.07	6.07	15.87
0.0025	0.063	4.00	230	7.53	7.53	23.39
0.0021	0.053	4.25	270	8.54	8.54	31.93
0.00174	0.0442	4.50	325	9.09	9.09	41.02
0.00146	0.0372	4.75	400	9.02	9.02	50.04
0.00123	0.0313	5.00	450	8.47	8.47	58.51
0.000986	0.0250	5.32	500	9.47	9.47	67.98
0.000790	0.0201	5.64	635	7.57	7.57	75.55
0.000615	0.0156	6.00		6.33	6.33	81.88
0.000435	0.0110	6.50		5.80	5.80	87.68
0.000308	0.00781	7.00		3.54	3.54	91.22
0.000197	0.00500	7.65		2.71	2.71	93.93
0.000077	0.00195	9.00		3.22	3.22	97.15
0.000038	0.000977	10.00		1.82	1.82	98.97
0.000019	0.000488	11.00		0.94	0.94	99.91
0.000015	0.000375	11.38		0.09	0.09	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.22	0.0042	0.107
10	3.51	0.0035	0.088
16	3.75	0.0029	0.074
25	4.05	0.0024	0.060
40	4.47	0.0018	0.045
50	4.75	0.0015	0.037
60	5.05	0.0012	0.030
75	5.62	0.0008	0.020
84	6.18	0.0005	0.014
90	6.83	0.0003	0.009
95	8.09	0.0001	0.004

Measure	Trask	Inman	Folk-Ward
Median, phi	4.75	4.75	4.75
Median, in.	0.0015	0.0015	0.0015
Median, mm	0.037	0.037	0.037
Mean, phi	4.63	4.97	4.90
Mean, in.	0.0016	0.0013	0.0013
Mean, mm	0.040	0.032	0.034
Sorting	1.723	1.214	1.346
Skewness	0.944	0.181	0.277
Kurtosis	0.254	1.009	1.273

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

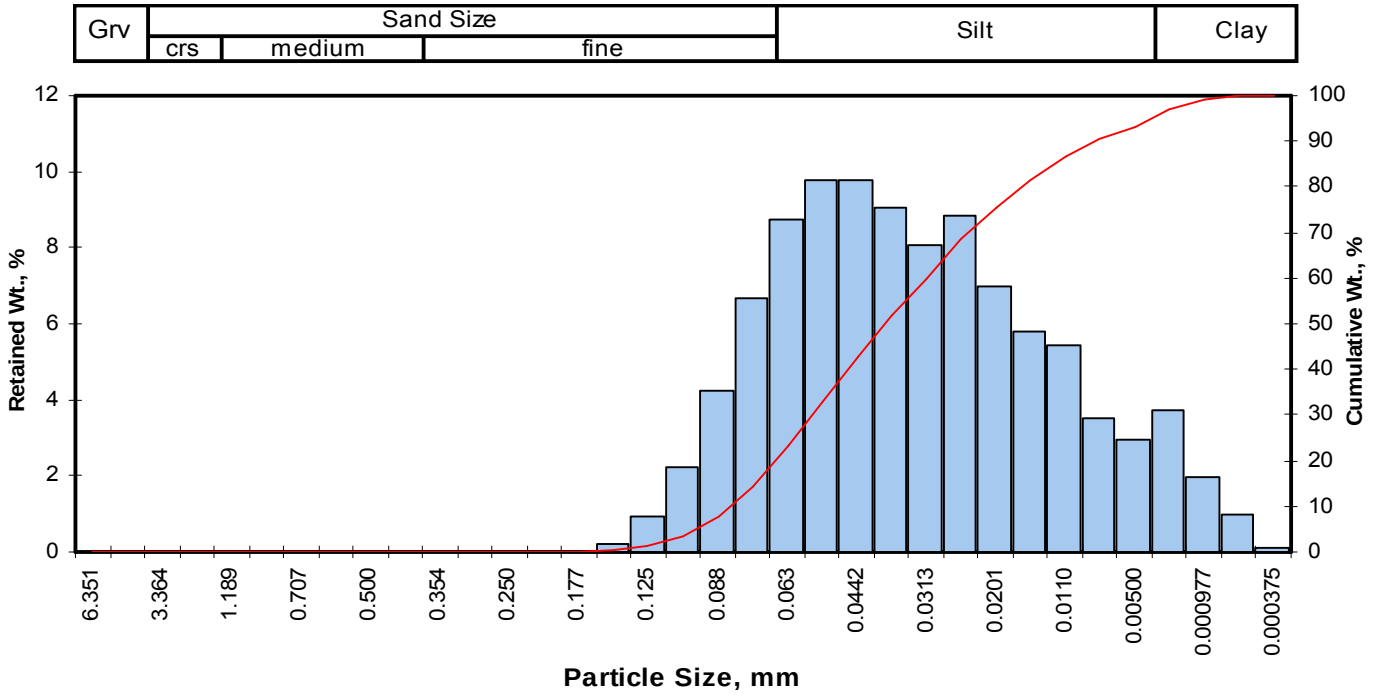
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	15.87
Silt	>0.005 mm	78.07
Clay	<0.005 mm	6.07
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-05 1-4 at 2.95
Project No:	60248522	**Depth, ft:**	2.95



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.01	0.01	0.01
0.0059	0.149	2.75	100	0.21	0.21	0.22
0.0049	0.125	3.00	120	0.92	0.92	1.14
0.0041	0.105	3.25	140	2.24	2.24	3.38
0.0035	0.088	3.50	170	4.26	4.26	7.64
0.0029	0.074	3.75	200	6.69	6.69	14.33
0.0025	0.063	4.00	230	8.76	8.76	23.09
0.0021	0.053	4.25	270	9.77	9.77	32.86
0.00174	0.0442	4.50	325	9.76	9.76	42.62
0.00146	0.0372	4.75	400	9.03	9.03	51.66
0.00123	0.0313	5.00	450	8.09	8.09	59.75
0.000986	0.0250	5.32	500	8.82	8.82	68.57
0.000790	0.0201	5.64	635	6.97	6.97	75.54
0.000615	0.0156	6.00		5.81	5.81	81.35
0.000435	0.0110	6.50		5.45	5.45	86.80
0.000308	0.00781	7.00		3.53	3.53	90.33
0.000197	0.00500	7.65		2.93	2.93	93.26
0.000077	0.00195	9.00		3.71	3.71	96.97
0.000038	0.000977	10.00		1.96	1.96	98.93
0.000019	0.000488	11.00		0.98	0.98	99.91
0.000015	0.000375	11.38		0.09	0.09	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.34	0.0039	0.098
10	3.59	0.0033	0.083
16	3.80	0.0028	0.072
25	4.05	0.0024	0.060
40	4.43	0.0018	0.046
50	4.70	0.0015	0.038
60	5.01	0.0012	0.031
75	5.62	0.0008	0.020
84	6.24	0.0005	0.013
90	6.95	0.0003	0.008
95	8.28	0.0001	0.003

Measure	Trask	Inman	Folk-Ward
Median, phi	4.70	4.70	4.70
Median, in.	0.0015	0.0015	0.0015
Median, mm	0.038	0.038	0.038
Mean, phi	4.63	5.02	4.92
Mean, in.	0.0016	0.0012	0.0013
Mean, mm	0.040	0.031	0.033
Sorting	1.721	1.223	1.359
Skewness	0.915	0.259	0.354
Kurtosis	0.267	1.018	1.291
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

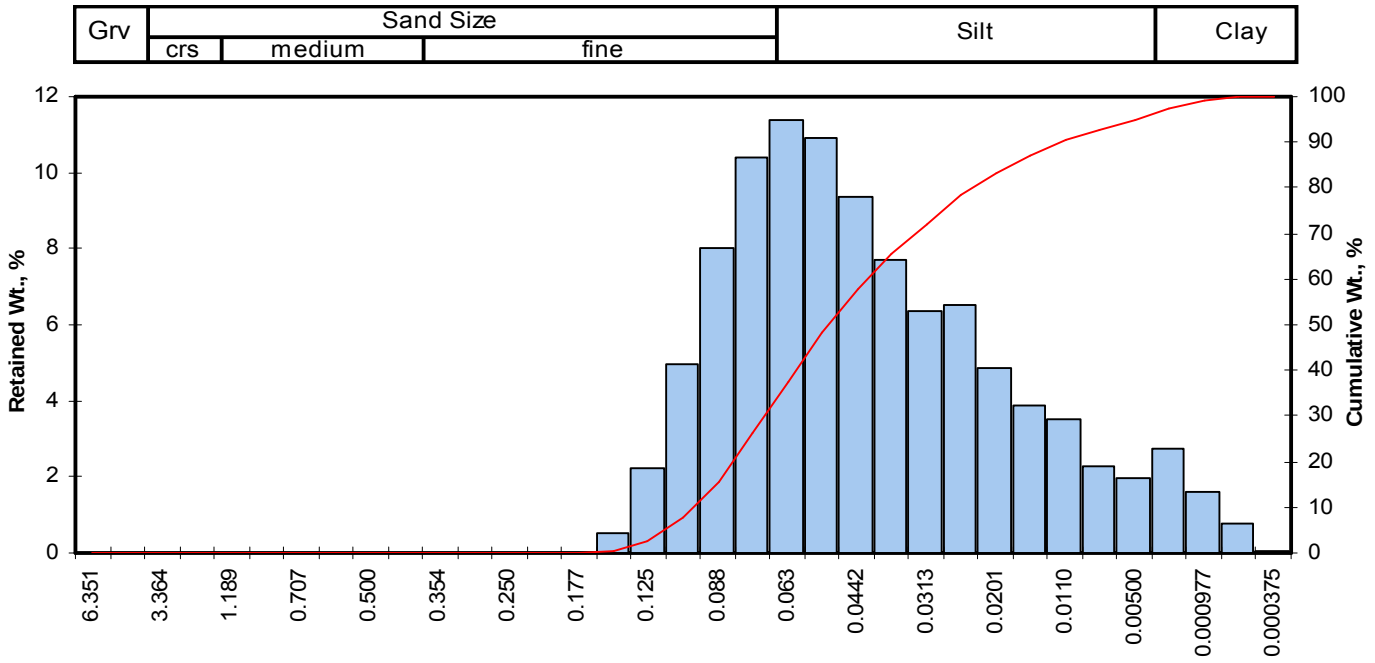
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	14.33
Silt	>0.005 mm	78.93
Clay	<0.005 mm	6.74
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-05 4-7 at 6.50
Project No:	60248522	**Depth, ft:**	6.50



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.02	0.02	0.02
0.0059	0.149	2.75	100	0.50	0.50	0.52
0.0049	0.125	3.00	120	2.22	2.22	2.74
0.0041	0.105	3.25	140	4.96	4.96	7.70
0.0035	0.088	3.50	170	7.99	7.99	15.70
0.0029	0.074	3.75	200	10.40	10.40	26.10
0.0025	0.063	4.00	230	11.40	11.40	37.50
0.0021	0.053	4.25	270	10.90	10.90	48.40
0.00174	0.0442	4.50	325	9.35	9.35	57.76
0.00146	0.0372	4.75	400	7.70	7.70	65.46
0.00123	0.0313	5.00	450	6.34	6.34	71.80
0.000986	0.0250	5.32	500	6.50	6.50	78.30
0.000790	0.0201	5.64	635	4.86	4.86	83.16
0.000615	0.0156	6.00		3.89	3.89	87.05
0.000435	0.0110	6.50		3.52	3.52	90.57
0.000308	0.00781	7.00		2.26	2.26	92.83
0.000197	0.00500	7.65		1.94	1.94	94.77
0.000077	0.00195	9.00		2.76	2.76	97.54
0.000038	0.000977	10.00		1.59	1.59	99.13
0.000019	0.000488	11.00		0.80	0.80	99.93
0.000015	0.000375	11.38		0.07	0.07	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.11	0.0045	0.116
10	3.32	0.0039	0.100
16	3.51	0.0035	0.088
25	3.72	0.0030	0.076
40	4.06	0.0024	0.060
50	4.29	0.0020	0.051
60	4.57	0.0017	0.042
75	5.16	0.0011	0.028
84	5.72	0.0007	0.019
90	6.42	0.0005	0.012
95	7.76	0.0002	0.005

Measure	Trask	Inman	Folk-Ward
Median, phi	4.29	4.29	4.29
Median, in.	0.0020	0.0020	0.0020
Median, mm	0.051	0.051	0.051
Mean, phi	4.27	4.61	4.51
Mean, in.	0.0020	0.0016	0.0017
Mean, mm	0.052	0.041	0.044
Sorting	1.644	1.105	1.256
Skewness	0.903	0.289	0.391
Kurtosis	0.270	1.100	1.327

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	26.10
Silt	>0.005 mm	68.68
Clay	<0.005 mm	5.23
	Total	**100**

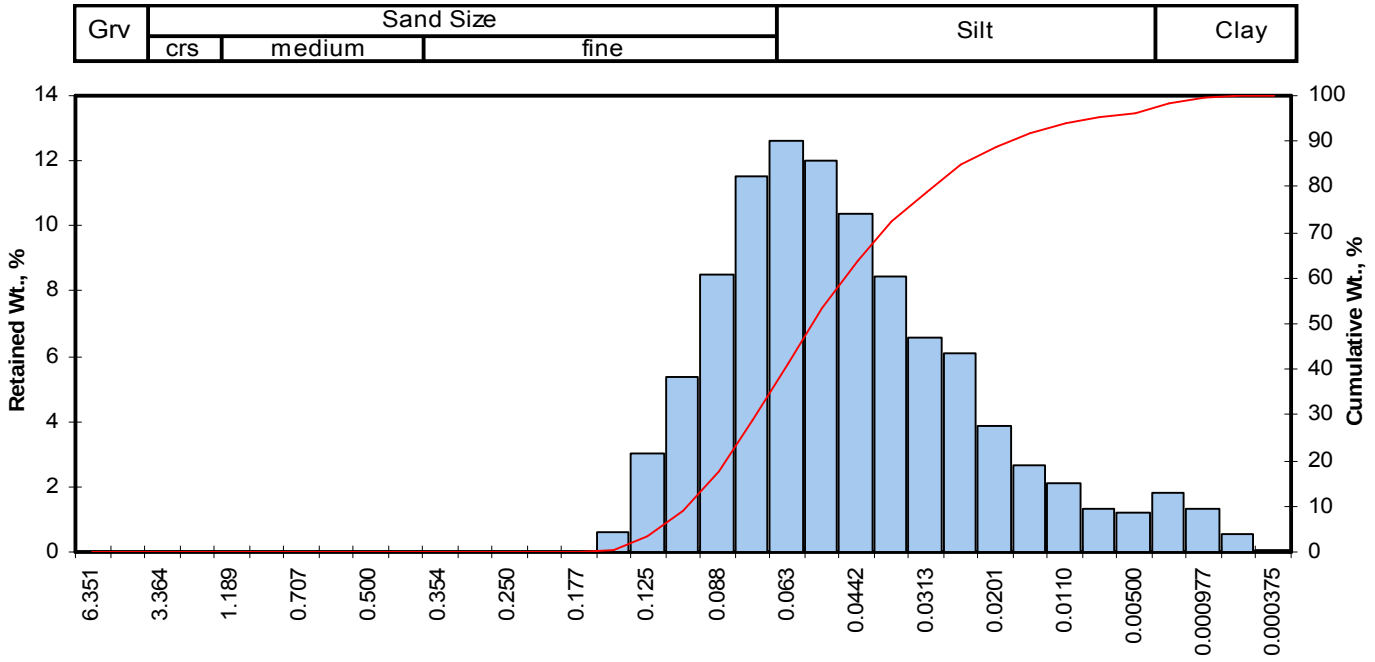
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Particle Size Analysis - ASTM D4464M

Client: AECOM
Project: Cold Springs Terminal
Project No: 60248522

PTS File No: 43519
Sample ID: SC-05 7-10 at 8.15
Depth, ft: 8.15



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.00	0.00	0.00
0.0059	0.149	2.75	100	0.61	0.61	0.61
0.0049	0.125	3.00	120	3.03	3.03	3.64
0.0041	0.105	3.25	140	5.35	5.35	8.99
0.0035	0.088	3.50	170	8.51	8.51	17.50
0.0029	0.074	3.75	200	11.50	11.50	28.99
0.0025	0.063	4.00	230	12.60	12.60	41.59
0.0021	0.053	4.25	270	12.00	12.00	53.58
0.00174	0.0442	4.50	325	10.40	10.40	63.98
0.00146	0.0372	4.75	400	8.46	8.46	72.44
0.00123	0.0313	5.00	450	6.61	6.61	79.05
0.000986	0.0250	5.32	500	6.08	6.08	85.12
0.000790	0.0201	5.64	635	3.87	3.87	88.99
0.000615	0.0156	6.00		2.68	2.68	91.67
0.000435	0.0110	6.50		2.10	2.10	93.77
0.000308	0.00781	7.00		1.33	1.33	95.10
0.000197	0.00500	7.65		1.21	1.21	96.31
0.000077	0.00195	9.00		1.83	1.83	98.14
0.000038	0.000977	10.00		1.30	1.30	99.44
0.000019	0.000488	11.00		0.53	0.53	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.06	0.0047	0.120
10	3.28	0.0041	0.103
16	3.46	0.0036	0.091
25	3.66	0.0031	0.079
40	3.97	0.0025	0.064
50	4.18	0.0022	0.055
60	4.40	0.0019	0.047
75	4.85	0.0014	0.035
84	5.26	0.0010	0.026
90	5.78	0.0007	0.018
95	6.96	0.0003	0.008

Measure	Trask	Inman	Folk-Ward
Median, phi	4.18	4.18	4.18
Median, in.	0.0022	0.0022	0.0022
Median, mm	0.055	0.055	0.055
Mean, phi	4.14	4.36	4.30
Mean, in.	0.0022	0.0019	0.0020
Mean, mm	0.057	0.049	0.051
Sorting	1.507	0.902	1.042
Skewness	0.946	0.203	0.316
Kurtosis	0.261	1.160	1.350

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

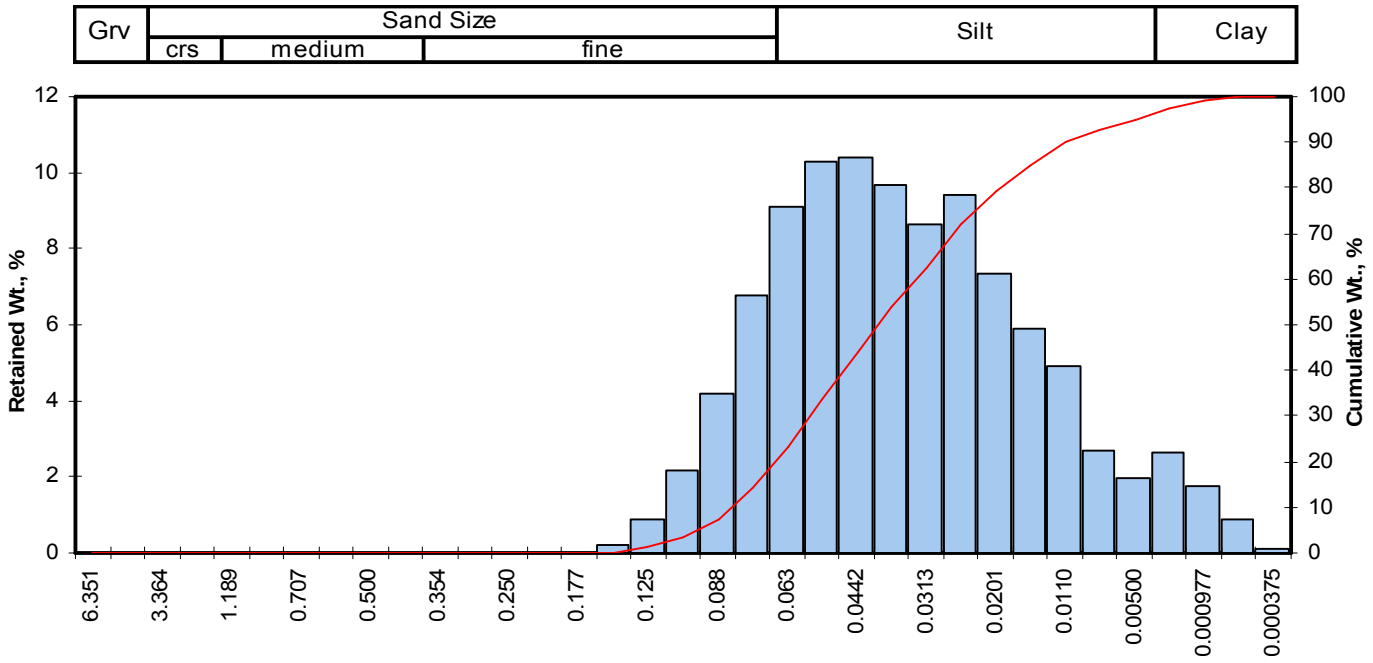
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	28.99
Silt	>0.005 mm	67.32
Clay	<0.005 mm	3.69
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-05 7-10 at 8.65
Project No:	60248522	**Depth, ft:**	8.65



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.01	0.01	0.01
0.0059	0.149	2.75	100	0.20	0.20	0.21
0.0049	0.125	3.00	120	0.87	0.87	1.08
0.0041	0.105	3.25	140	2.16	2.16	3.24
0.0035	0.088	3.50	170	4.20	4.20	7.45
0.0029	0.074	3.75	200	6.78	6.79	14.23
0.0025	0.063	4.00	230	9.11	9.12	23.35
0.0021	0.053	4.25	270	10.30	10.31	33.66
0.00174	0.0442	4.50	325	10.40	10.41	44.06
0.00146	0.0372	4.75	400	9.67	9.68	53.74
0.00123	0.0313	5.00	450	8.64	8.65	62.39
0.000986	0.0250	5.32	500	9.41	9.42	71.81
0.000790	0.0201	5.64	635	7.34	7.35	79.15
0.000615	0.0156	6.00		5.87	5.87	85.03
0.000435	0.0110	6.50		4.93	4.93	89.96
0.000308	0.00781	7.00		2.71	2.71	92.67
0.000197	0.00500	7.65		1.95	1.95	94.62
0.000077	0.00195	9.00		2.65	2.65	97.27
0.000038	0.000977	10.00		1.74	1.74	99.02
0.000019	0.000488	11.00		0.90	0.90	99.92
0.000015	0.000375	11.38		0.08	0.08	100.00
TOTALS				**99.90**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.35	0.0038	0.098
10	3.59	0.0033	0.083
16	3.80	0.0028	0.072
25	4.04	0.0024	0.061
40	4.40	0.0019	0.047
50	4.65	0.0016	0.040
60	4.93	0.0013	0.033
75	5.46	0.0009	0.023
84	5.94	0.0006	0.016
90	6.51	0.0004	0.011
95	7.84	0.0002	0.004

Measure	Trask	Inman	Folk-Ward
Median, phi	4.65	4.65	4.65
Median, in.	0.0016	0.0016	0.0016
Median, mm	0.040	0.040	0.040
Mean, phi	4.58	4.87	4.80
Mean, in.	0.0016	0.0013	0.0014
Mean, mm	0.042	0.034	0.036
Sorting	1.635	1.069	1.214
Skewness	0.935	0.201	0.311
Kurtosis	0.265	1.096	1.295
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

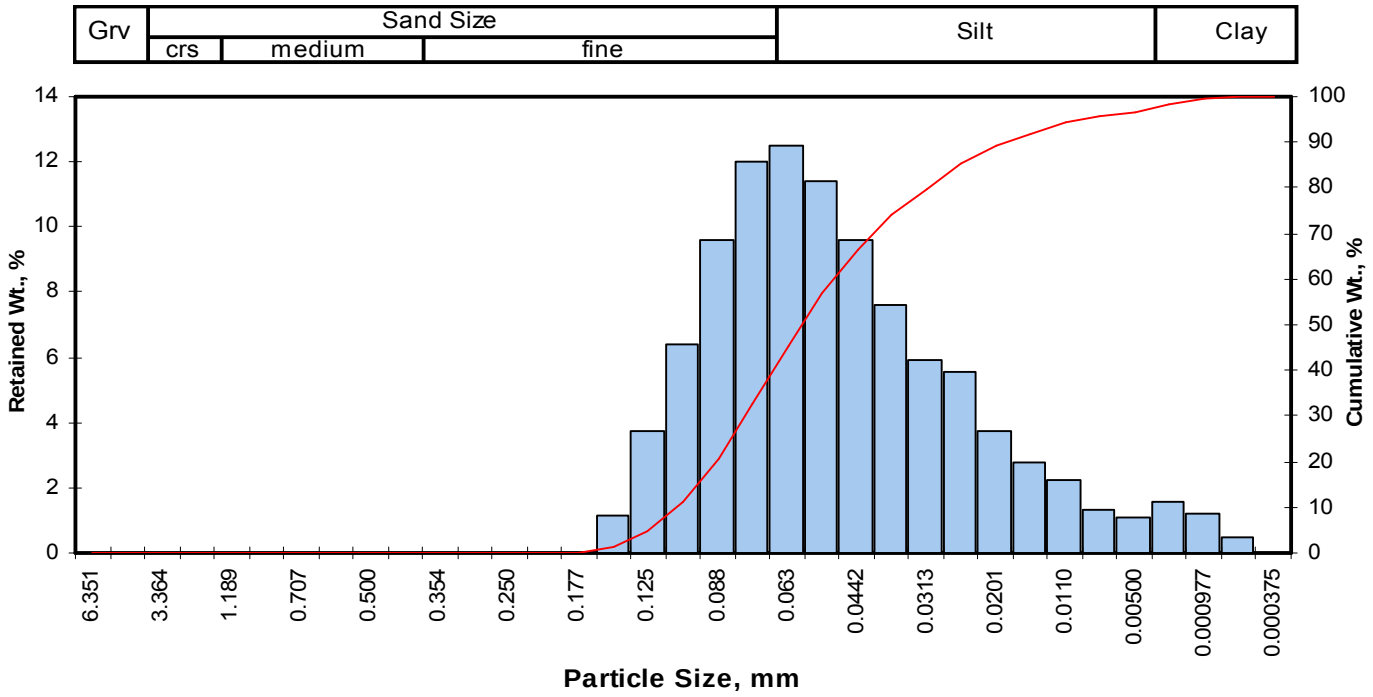
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	14.23
Silt	>0.005 mm	80.39
Clay	<0.005 mm	5.38
	Total	**100**

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Particle Size Analysis - ASTM D4464M

Client:	AECOM	**PTS File No:**	43519
Project:	Cold Springs Terminal	**Sample ID:**	SC-05 7-10 at 9.00
Project No:	60248522	**Depth, ft:**	9.00



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.02	0.02	0.02
0.0059	0.149	2.75	100	1.13	1.13	1.15
0.0049	0.125	3.00	120	3.75	3.75	4.90
0.0041	0.105	3.25	140	6.39	6.39	11.29
0.0035	0.088	3.50	170	9.59	9.59	20.89
0.0029	0.074	3.75	200	12.00	12.00	32.89
0.0025	0.063	4.00	230	12.50	12.50	45.39
0.0021	0.053	4.25	270	11.40	11.40	56.80
0.00174	0.0442	4.50	325	9.57	9.57	66.37
0.00146	0.0372	4.75	400	7.61	7.61	73.98
0.00123	0.0313	5.00	450	5.92	5.92	79.90
0.000986	0.0250	5.32	500	5.58	5.58	85.49
0.000790	0.0201	5.64	635	3.76	3.76	89.25
0.000615	0.0156	6.00		2.77	2.77	92.02
0.000435	0.0110	6.50		2.26	2.26	94.28
0.000308	0.00781	7.00		1.35	1.35	95.63
0.000197	0.00500	7.65		1.10	1.10	96.73
0.000077	0.00195	9.00		1.56	1.56	98.29
0.000038	0.000977	10.00		1.18	1.18	99.47
0.000019	0.000488	11.00		0.50	0.50	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.00	0.0049	0.125
10	3.20	0.0043	0.109
16	3.37	0.0038	0.097
25	3.59	0.0033	0.083
40	3.89	0.0027	0.067
50	4.10	0.0023	0.058
60	4.33	0.0020	0.050
75	4.79	0.0014	0.036
84	5.23	0.0010	0.027
90	5.74	0.0007	0.019
95	6.77	0.0004	0.009

Measure	Trask	Inman	Folk-Ward
Median, phi	4.10	4.10	4.10
Median, in.	0.0023	0.0023	0.0023
Median, mm	0.058	0.058	0.058
Mean, phi	4.07	4.30	4.24
Mean, in.	0.0023	0.0020	0.0021
Mean, mm	0.060	0.051	0.053
Sorting	1.520	0.931	1.036
Skewness	0.941	0.218	0.317
Kurtosis	0.262	1.021	1.277
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	32.89
Silt	>0.005 mm	63.84
Clay	<0.005 mm	3.27
	Total	**100**

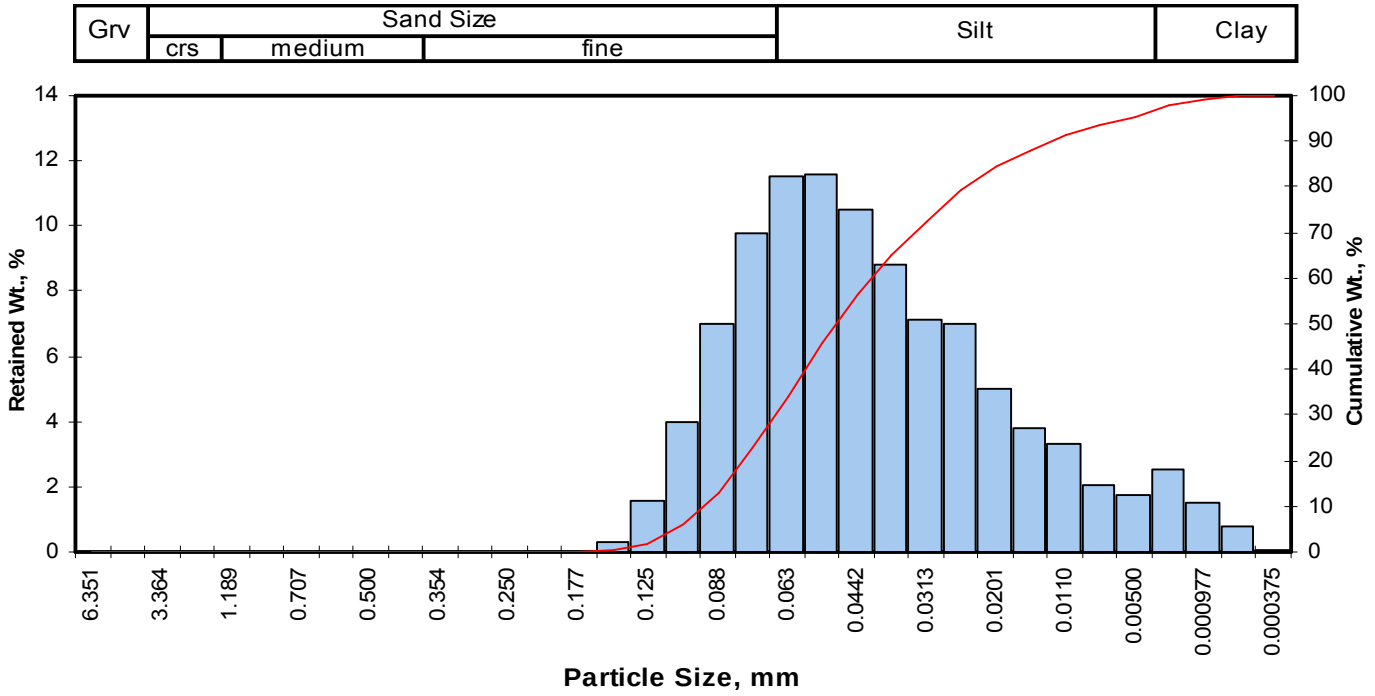
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Particle Size Analysis - ASTM D4464M

Client: AECOM
Project: Cold Springs Terminal
Project No: 60248522

PTS File No: 43519
Sample ID: SC-05 7-10 at 9.40
Depth, ft: 9.40



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.01	0.01	0.01
0.0059	0.149	2.75	100	0.29	0.29	0.30
0.0049	0.125	3.00	120	1.58	1.58	1.88
0.0041	0.105	3.25	140	3.99	3.99	5.87
0.0035	0.088	3.50	170	7.00	7.00	12.88
0.0029	0.074	3.75	200	9.80	9.81	22.68
0.0025	0.063	4.00	230	11.50	11.51	34.19
0.0021	0.053	4.25	270	11.60	11.61	45.80
0.00174	0.0442	4.50	325	10.50	10.51	56.30
0.00146	0.0372	4.75	400	8.81	8.82	65.12
0.00123	0.0313	5.00	450	7.14	7.14	72.26
0.000986	0.0250	5.32	500	7.02	7.02	79.29
0.000790	0.0201	5.64	635	4.98	4.98	84.27
0.000615	0.0156	6.00		3.82	3.82	88.09
0.000435	0.0110	6.50		3.30	3.30	91.39
0.000308	0.00781	7.00		2.04	2.04	93.43
0.000197	0.00500	7.65		1.73	1.73	95.17
0.000077	0.00195	9.00		2.51	2.51	97.68
0.000038	0.000977	10.00		1.49	1.49	99.17
0.000019	0.000488	11.00		0.76	0.76	99.93
0.000015	0.000375	11.38		0.07	0.07	100.00
TOTALS				**99.90**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	3.20	0.0043	0.109
10	3.40	0.0037	0.095
16	3.58	0.0033	0.084
25	3.80	0.0028	0.072
40	4.13	0.0023	0.057
50	4.35	0.0019	0.049
60	4.60	0.0016	0.041
75	5.12	0.0011	0.029
84	5.62	0.0008	0.020
90	6.29	0.0005	0.013
95	7.58	0.0002	0.005

Measure	Trask	Inman	Folk-Ward
Median, phi	4.35	4.35	4.35
Median, in.	0.0019	0.0019	0.0019
Median, mm	0.049	0.049	0.049
Mean, phi	4.32	4.60	4.52
Mean, in.	0.0020	0.0016	0.0017
Mean, mm	0.050	0.041	0.044
Sorting	1.582	1.022	1.176
Skewness	0.925	0.246	0.360
Kurtosis	0.263	1.148	1.358

Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	22.68
Silt	>0.005 mm	72.48
Clay	<0.005 mm	4.83
	Total	**100**

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DATE **PTS FILE#** **CHAIN OF CUSTODY RECORD** 43518 **PAGE** 1 **OF** 2

COMPANY: AECOM

ADDRESS: 40 British American Blvd., Latham, NY 12110

PROJECT MANAGER: John Santacroce

PROJECT NAME: Cold Springs Terminals — PHONE NUMBER: 518-951-2265

PROJECT NUMBER: 60248522 — FAX NUMBER: 518-951-2300

SITE LOCATION: Baldwinsville, N.Y.

SAMPLER SIGNATURE: [signature]

ANALYSIS REQUEST

PO#

SPECIAL HANDLING

24 HOURS 5 DAYS
72 HOURS NORMAL

OTHER

SAMPLE CONDITIONS 4.1°F

RECEIVED ON ICE (YES)/NO
SEALED (YES)/NO
OTHER YES/NO

COMMENTS

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES	COMMENTS
✓ SC-07 7-10	8/12/13	1430	7-10' Bg			✓	✓	✓													1	For analysis regarding scope inquire or call Trevre Andrews @ 651-261-7310
✓ SC-07 10-13		1530	10-12.8' Bg																			
✓ SC-07 13-16		1500	13-16' Bg																			
✓ SC-07 16-18		1600	16-18' Bg																			
✓ SC-07 18-21		1630	18-20' Bg																			
✓ SC-03 2-5	8/13/13	1015	2-4.3' Bg																			
✓ SC-03 5-8		0800	5-7.1' Bg																			
✓ SC-03 8-11		0830	8-10.2' Bg																			
✓ SC-03 11-14		0900	11-13' Bg																			
✓ SC-03 14-17		0930	14-17' Bg																			

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
[signature]	Fedex		[signature] 4.1°F
COMPANY: AECOM	COMPANY	COMPANY	COMPANY: PTS LABS
DATE: 8/13/13 TIME	DATE TIME	DATE TIME	DATE: 8/14/13 TIME: 14:33

DATE **PTS FILE#** **CHAIN OF CUSTODY RECORD** 43518 **PAGE** 2 **OF** 2

COMPANY: AECOM 12110

ADDRESS: 40 British American Blvd, Latham, N.Y.

PROJECT MANAGER: John Santacroce

PROJECT NAME: Cold Springs Terminal PHONE NUMBER: 518-951-2265

PROJECT NUMBER: 60248522 FAX NUMBER: 2300

SITE LOCATION: Baldwinsville, N.Y.

SAMPLER SIGNATURE: Luc White

ANALYSIS REQUEST

PO#

SPECIAL HANDLING

24 HOURS 5 DAYS
72 HOURS NORMAL
OTHER

SAMPLE CONDITIONS 4.1°F

RECEIVED ON ICE (YES)/NO
SEALED (YES)/NO
OTHER YES/NO

COMMENTS

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES	COMMENTS
✓ SC-05 1-4	8/13/13	1055	1-3'3" Bg																		1	For analysis refer to scope/quote or call Trevor Andrews at 651-261-7310
✓ SC-05 4-7		1110	4-7' Bg																			
✓ SC-05 7-10		1125	7-10' Bg																			
~~SC-05 10-13~~		~~1140~~	~~10-12.9' Bg~~																			
~~SC-05 13-16~~		~~1150~~	~~13-16' Bg~~																			
~~SC-05 16-19~~		~~1200~~	~~16-19' Bg~~																			
~~SC-05 19-21~~		~~1215~~	~~19-20'5" Bg~~																			

moved to another shipment

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
Luc White	Fedex		4.1°F
COMPANY: AECOM	COMPANY:	COMPANY:	COMPANY: PTS LABS
DATE: 8/13/13 TIME:	DATE: TIME:	DATE: TIME:	DATE: 8/14/13 TIME: 14:33

PTS Laboratories, Inc.

8100 Secura Way • Santa Fe Springs, CA 90670
Telephone (562) 347-2500 • Fax (562) 907-3610

August 5, 2014

John Santacroce
AECOM
40 British American Blvd.
Latham, NY 12153

Re: PTS File No: 44436
Physical Properties Data
Cold Springs Terminals; 60248522

Dear Mr. Santacroce:

Please find enclosed report for Physical Properties analyses conducted upon samples received from your Cold Springs Terminals project. All analyses were performed by applicable ASTM, EPA, or API methodologies. An electronic version of the report has previously been sent to your attention via the internet. The samples are currently in storage and will be retained for thirty days past completion of testing at no charge. Please note that the samples will be disposed of at that time. You may contact me regarding storage, disposal, or return of the samples.

PTS Laboratories appreciates the opportunity to be of service. If you have any questions or require additional information, please give me a call at (562) 347-2502.

Sincerely,
PTS Laboratories, Inc.

Michael Mark Brady, P.G.
Laboratory Director

Encl.

Project Name: **Cold Springs Terminals** **PTS File No: 44436**
Project Number: **60248522** **Client: AECOM**

TEST PROGRAM - 20140722

FLUID ID	Date	Time	Fluid Type	Fluid Cleaning	Fluid Properties Pkg.				Comments
			Method:	Proprietary	ASTM D1481, 445, 971				
Date Received: 20140722									
A-16	**20140626**	**1130**	**NAPL / Water**	**X**	**X**				2 - 8 oz. Jars
S-13	**20140702**	**1200**	**NAPL / Water**	**X**	**X**				2 - 8 oz. Jars
TOTALS:	**4 Jars**			**2**	**2**				**4**

Laboratory Test Program Notes

Standard TAT for basic analysis is 10 business days.

Fluid Properties Package - LNAPL & Water: Includes dynamic viscosity and fluid density at three temperatures (70, 100, 130°F), surface tension for each fluid, and interfacial tensions

CLIENT CONFIDENTIAL

PTS Laboratories

PTS File No: 44436
Client: AECOM
Report Date: 08/05/14

VISCOSITY, DENSITY, and SPECIFIC GRAVITY DATA

(METHODOLOGY: ASTM D445, ASTM D1481, API RP40)

Project Name: Cold Springs Terminals
Project No: 60248522

SAMPLE ID	MATRIX	TEMPERATURE, °F	SPECIFIC GRAVITY	DENSITY, g/cc	VISCOSITY	
					centistokes	centipoise
A-16	Water	70	1.001	0.9986	1.02	1.02
		100	1.003	0.9956	0.699	0.696
		130	1.004	0.9899	0.523	0.517
A-16	NAPL	70	0.7977	0.7961	1.35	1.08
		100	0.7905	0.7850	1.066	0.837
		130	0.7827	0.7717	0.864	0.667
S-13	Water	70	1.000	0.9984	1.02	1.02
		100	1.002	0.9952	0.698	0.694
		130	1.004	0.9895	0.520	0.515
S-13	NAPL	70	0.8129	0.8112	1.53	1.24
		100	0.8057	0.8001	1.19	0.949
		130	0.7977	0.7865	0.958	0.754

QUALITY CONTROL DATA

Date:	07/28/14	07/28/14	08/01/14	08/01/14
FLUID TYPE:	Cannon® CVS S3	DI Water	Cannon® CVS S3	DI Water
TEMPERATURE, °F:	70	70	70	70
DENSITY, MEASURED:	0.8653	0.9987		
DENSITY, PUBLISHED:	0.8649	0.9980		
RPD:	0.05	0.07		
VISCOSITY, MEASURED:			4.74	1.01
VISCOSITY, PUBLISHED:			4.63	0.977
RPD:			2.42	3.49

CVS Lot #: 13401 CVS = Certified Viscosity Standard

PTS File No: 44436
Client: AECOM
Report Date: 08/05/14

PTS Laboratories

INTERFACIAL / SURFACE TENSION DATA

(METHODOLOGY: DuNuoy Method - ASTM D971)

Project Name: Cold Springs Terminals
Project No: 60248522

PHASE PAIR		TEMPERATURE,	INTERFACIAL TENSION,
SAMPLE ID / PHASE	SAMPLE ID / PHASE	°F	Dynes/centimeter
A-16 / Water	Air	76	65.2
A-16 / NAPL	Air	76	25.1
A-16 / Water	A-16 / NAPL	76	18.9
S-13 / Water	Air	76	68.5
S-13 / NAPL	Air	76	28.7
S-13 / Water	S-13 / NAPL	76	15.5

QUALITY CONTROL DATA

Date: 08/01/14
PHASE PAIR: DIWATER / AIR
TEMPERATURE, °F: 76
IFT, MEASURED: 72.5
IFT, PUBLISHED: 72.1
RPD: 0.63

PTS Laboratories, Inc.

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

COMPANY: AECOM

ADDRESS: 40 British American Blvd CITY: Latham ZIP CODE: NY 12153

PROJECT MANAGER: John Santacroce PHONE NUMBER: 518-951-2265

PROJECT NAME: Cold Springs Terminals FAX NUMBER:

PROJECT NUMBER: 60248522

SITE LOCATION: Baldwinsville NY

SAMPLER SIGNATURE:

PO#:

TURNAROUND TIME
- 24 HOURS ☐
- 48 HOURS ☐
- 72 HOURS ☐
- 5 DAYS ☐
- NORMAL ☒

OTHER:

SAMPLE INTEGRITY (CHECK):
INTACT X ON ICE 78 °F

PTS QUOTE NO.:

PTS FILE: 44436

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	NUMBER OF SAMPLES	SOIL PROPERTIES PACKAGE	HYDRAULIC CONDUCTIVITY PACKAGE	PORE FLUID SATURATIONS PACKAGE	TCEQ/TNRCC PROPERTIES PACKAGE	CAPILLARITY PACKAGE	FLUID PROPERTIES PACKAGE	PHOTOLOG: CORE PHOTOGRAPHY	MOISTURE CONTENT, ASTM D2216	POROSITY: TOTAL, API RP40	POROSITY: EFFECTIVE, ASTM D425M	SPECIFIC GRAVITY, ASTM D854	BULK DENSITY (DRY), API RP40 or ASTM D2937	AIR PERMEABILITY, API RP40	HYDRAULIC CONDUCTIVITY, EPA9100, API RP40, D5084	GRAIN SIZE DISTRIBUTION, ASTM D422/4464M	TOC: WALKLEY-BLACK	ATTERBERG LIMITS, ASTM D4318	COMMENTS
A-16	6/26/14	1130	—							X	X											
S-13	7/2/14	1200	—							X												

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
John Santacroce			
COMPANY: AECOM	COMPANY: PTS LABS	COMPANY:	COMPANY:
DATE: 7/14/14 TIME: 1600	DATE: 7/22/14 TIME: 15:20	DATE: TIME:	DATE: TIME:

Appendix E

Baildown Analysis Data

Well Designation:	A-8
Date:	17-Sep-13

Beckett and Lyverse (2002)

Ground Surface Elev (ft msl)	378.2	Enter These Data
Top of Casing Elev (ft msl)	377.7	
Well Casing Radius, r_c (ft):	0.083	r_{e1}
Well Radius, r_w (ft):	0.333	
LNAPL Specific Yield, S_y:	0.175	
LNAPL Density Ratio, ρ_r:	0.779	
Top of Screen (ft bgs):	7.0	
Bottom of Screen (ft bgs):	20.1	
LNAPL Baildown Vol. (gal.):	0.9	
Effective Radius, r_{e3} (ft):	0.159	Calculated Parameters
Effective Radius, r_{e2} (ft):	0.129	
Initial Casing LNAPL Vol. (gal.):	0.21	
Initial Filter LNAPL Vol. (gal.):	0.55	

Drawdown Adjustment (ft)
0.15

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	14.28	15.56	14.84	16.12	15.12					1.28	
Enter Test Data:	1.0	15.08	15.18	15.64	15.74	15.66	0.65				0.10	
	2.0	15.04	15.17	15.60	15.73	15.63	0.61	1.5	3.416	0.63	0.13	0.159
	3.0	14.99	15.15	15.55	15.71	15.59	0.56	2.5	3.416	0.59	0.16	0.159
	5.0	14.94	15.11	15.50	15.67	15.54	0.51	4.0	0.569	0.54	0.17	0.159
	17.0	14.73	14.91	15.29	15.47	15.33	0.30	11.0	0.095	0.41	0.18	0.159
	32.0	14.61	14.80	15.17	15.36	15.21	0.18	24.5	0.076	0.24	0.19	0.159
	47.0	14.55	14.75	15.11	15.31	15.15	0.12	39.5	0.076	0.15	0.20	0.159
	57.0	14.53	14.74	15.09	15.30	15.14	0.10	52.0	0.114	0.11	0.21	0.159
	131.0	14.5	14.72	15.06	15.28	15.11	0.07	94.0	0.015	0.09	0.22	0.159
	231.00	14.47	14.73	15.03	15.29	15.09	0.04	181.0	0.046	0.06	0.26	0.159
	1151.00	14.45	14.72	15.01	15.28	15.07	0.02	691.0	0.001	0.03	0.27	0.159
	2876.0	14.47	14.75	15.03	15.31	15.09	0.04	2013.5	0.001	0.03	0.28	0.159
	3111.0	14.47	14.77	15.03	15.33	15.10	0.04	2993.5	0.010	0.04	0.30	0.159
	4099.0	14.50	14.85	15.06	15.41	15.14	0.07	3605.0	0.006	0.06	0.35	0.159
	41811.00	14.43	14.80	14.99	15.36	15.07	0.00	22955.0	0.000	0.04	0.37	0.159

Figure 1

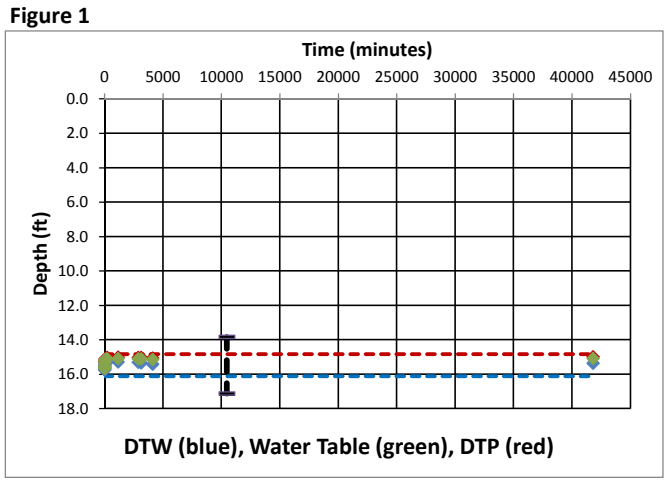
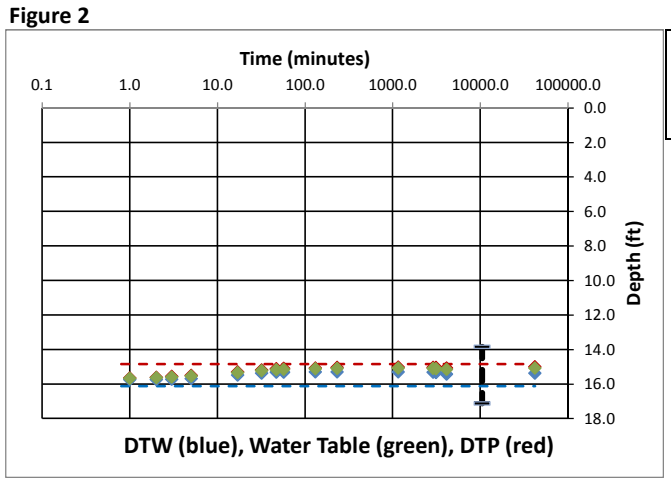


Figure 2



0.8	14.84
41811	14.84
0.8	16.12
41811	16.12

10452.7	13.84	13.8
10452.7	17.1	17.1

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.2	0.38

Drawdown Adjust.	
Δs_n (ft)	0.15

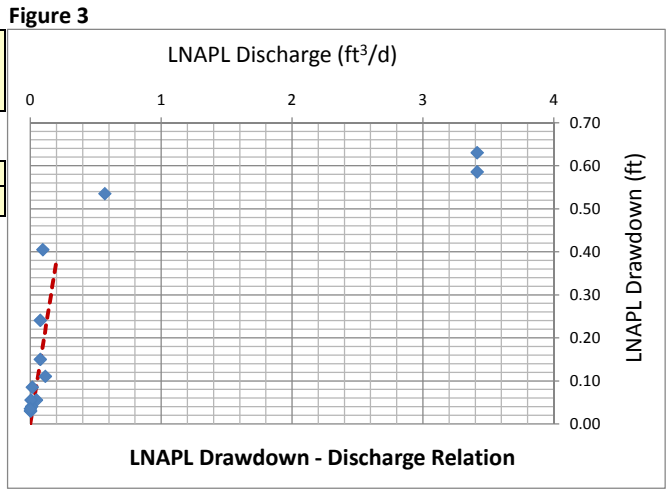
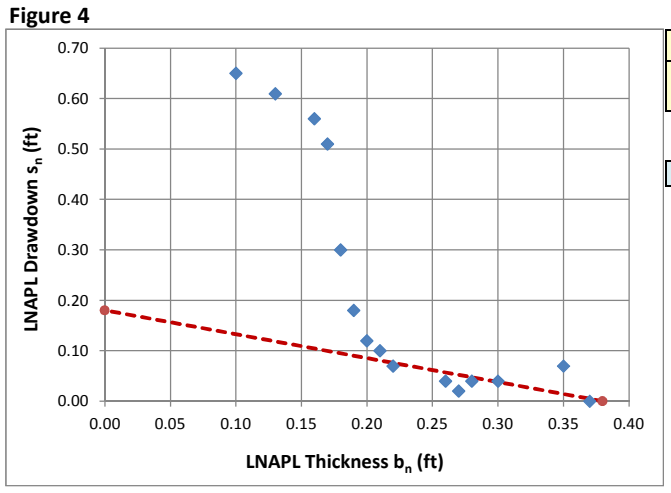


Figure 4



b_n	s_n
0.38	0
0	0.18

J-ratio	-0.474

Figure 5

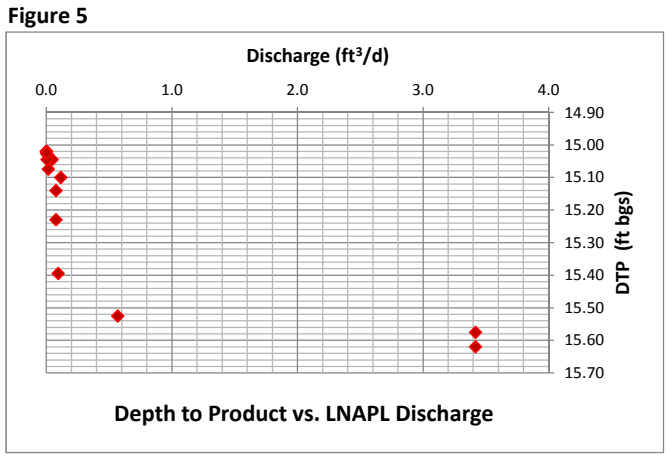


Figure 6

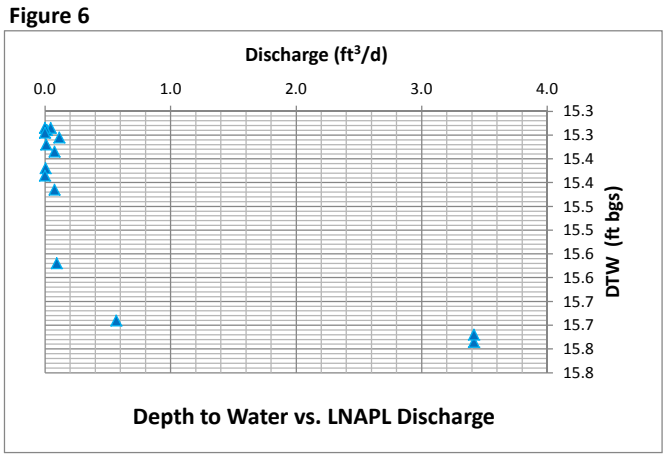


Figure 7

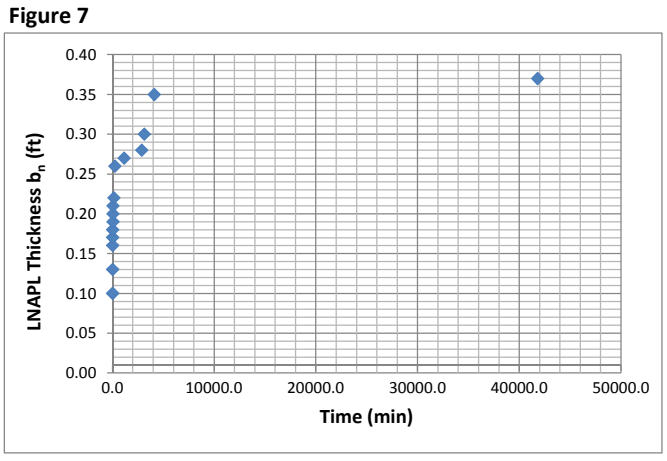


Figure 8

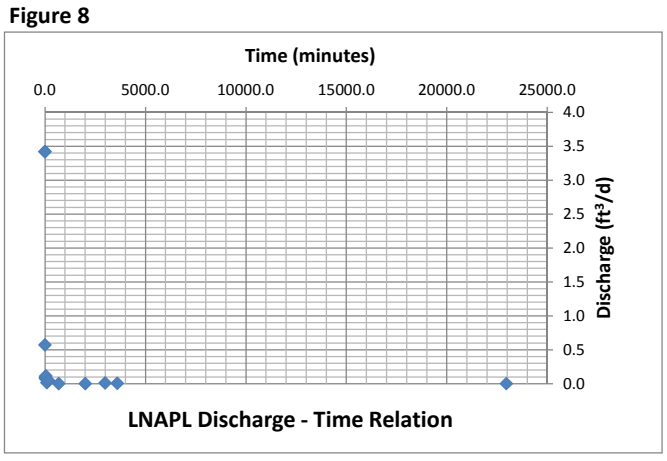


Figure 9

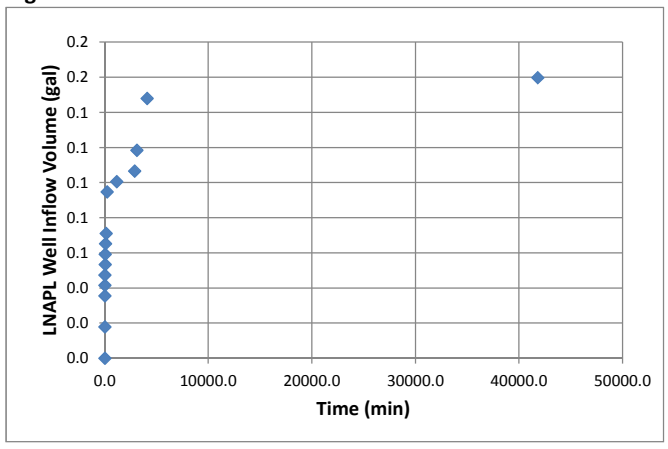
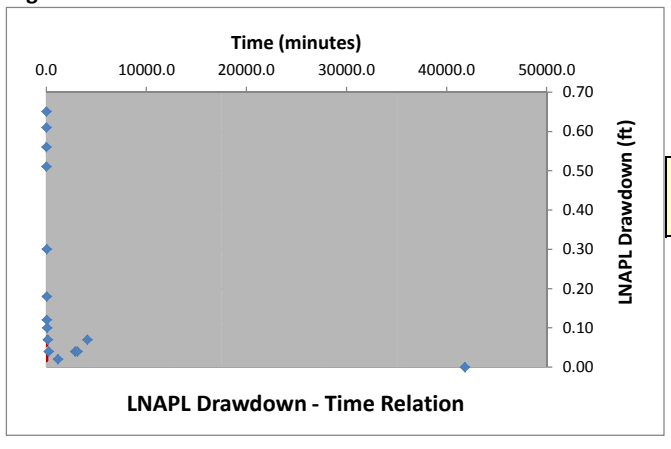


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	A-8
Date:	17-Sep-13

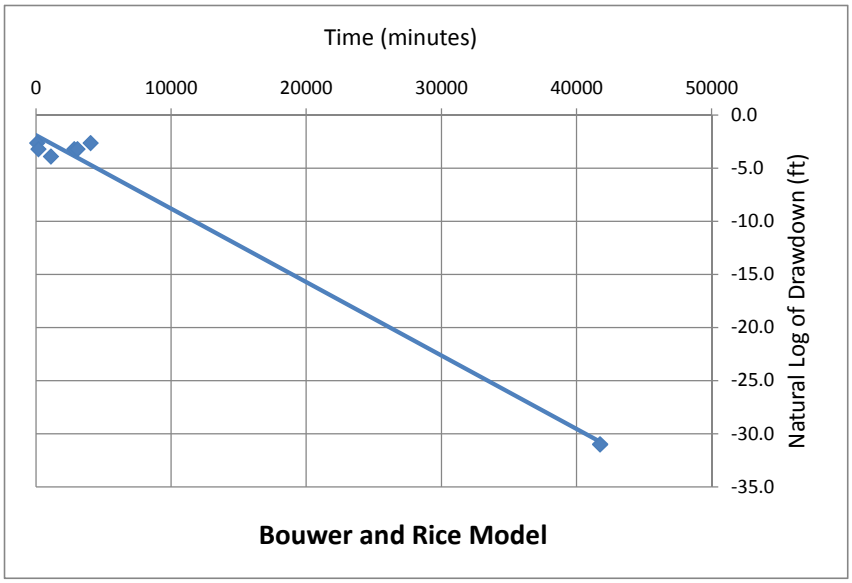
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

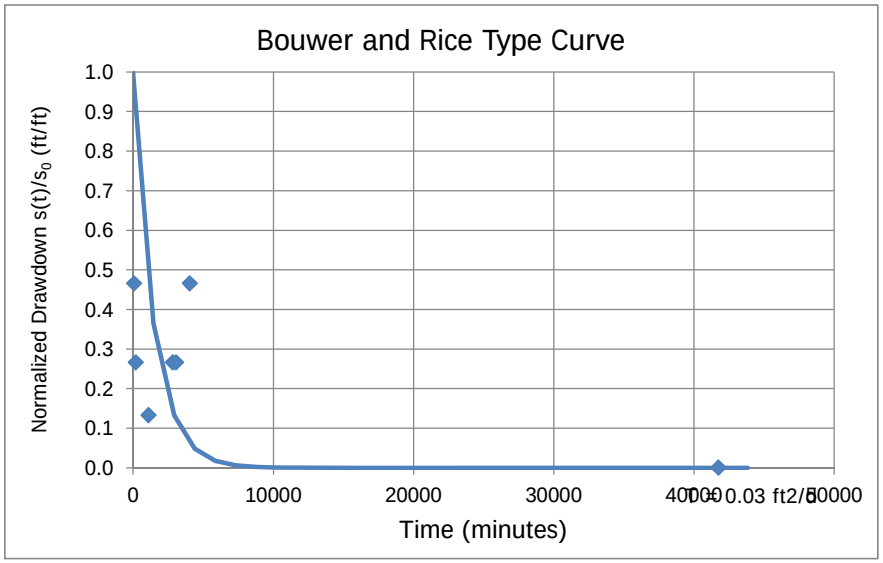
$Time_{cut}$	60	<- Enter or change value here

Model Results:	T_n (ft^2/d) = 0.04	+/-	0.00	ft^2/d

L_e/r_e	8.1
C	1.11
R/r_e	4.50
J-Ratio	-0.474
Coef. Of Variation	0.05



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	A-8
Date:	17-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^{\,2} S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	60	<- Enter or change values here
Time Adjustment (min):	40	

Trial S_n: d <-- Enter d for default or enter S_n value

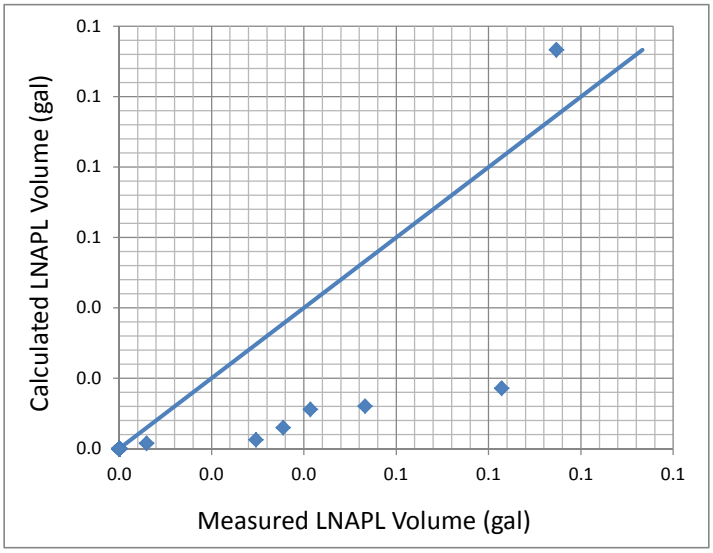
Root-Mean-Square Error: 0.094 <-- Minimize this using "Solver"

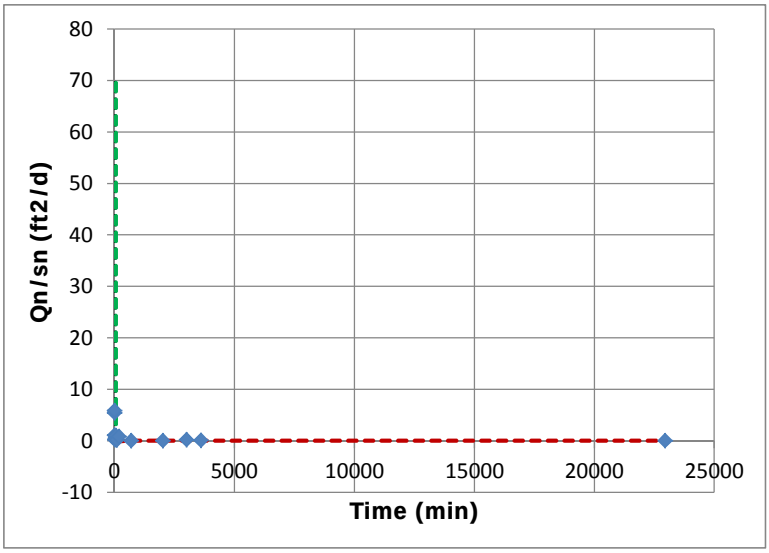
0.002 <-- Working S_n

Trial T_n (ft^2/d): 0.010 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.01**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	A-8
Date:	17-Sep-13

Enter early time cut-off for least-squares model fit

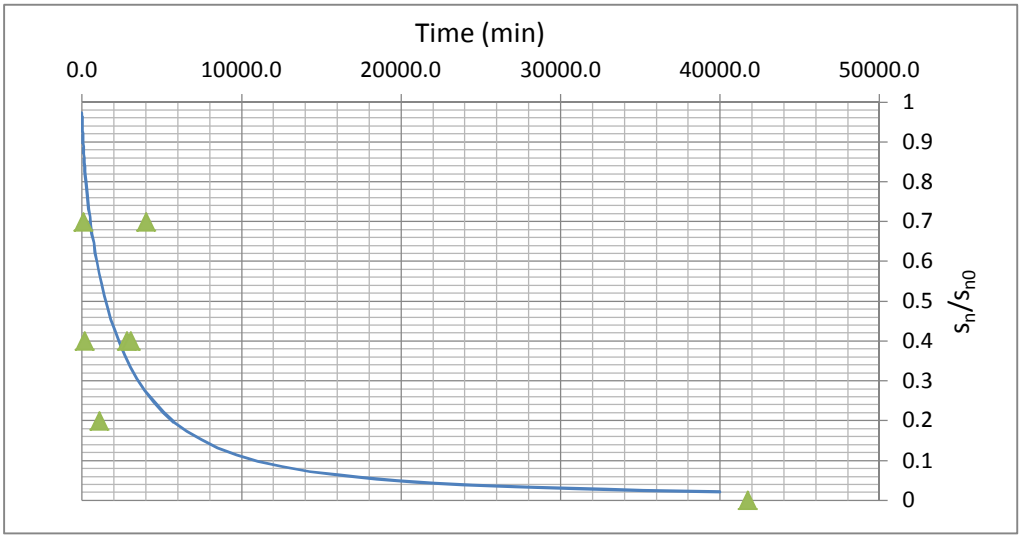
$Time_{cut}$ (min):	60	<- Enter or change values here
Initial Drawdown s_n (ft):	0.1	

Trial S_n:	d	<-- Enter d for default
Root-Mean-Square Error:	0.750	<-- Minimize this using "Solver"
Trial T_n (ft^2/d):	0.028	<-- By changing T_n through "Solver"
	0.050	<-- Working S_n

Add constraint Tn > 0.00001

T_{min}	0.1
T_{max}	40000

Model Result: T_n (ft^2/d) = **0.03**



J-Ratio
-0.474

Well Designation:	A-10	Beckett and Lyverse (2002)
Date:	17-Sep-13	

Ground Surface Elev (ft msl)	371.9	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	374.0		
Well Casing Radius, r_c (ft):	0.167	r_{e1}	0.7
Well Radius, r_w (ft):	0.417		
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.773		
Top of Screen (ft bgs):	5.0		
Bottom of Screen (ft bgs):	14.1		
LNAPL Baildown Vol. (gal.):	4.5		
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.204		
Initial Casing LNAPL Vol. (gal.):	3.25		
Initial Filter LNAPL Vol. (gal.):	2.99		

	Enter Data Here										
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	8.94	13.92	6.82	11.8	7.95					4.98	
Enter Test Data:	2.0	11.37	11.38	9.25	9.26	9.25	1.73				0.01	
	3.0	11.25	11.27	9.13	9.15	9.13	1.61	2.5	2.411	1.67	0.02	0.231
	4.0	11.15	11.18	9.03	9.06	9.04	1.51	3.5	2.411	1.56	0.03	0.231
	5.0	11.04	11.09	8.92	8.97	8.93	1.40	4.5	4.822	1.46	0.05	0.231
	9.0	10.75	10.81	8.63	8.69	8.64	1.11	7.0	0.603	1.26	0.06	0.231
	10.0	10.7	10.77	8.58	8.65	8.60	1.06	9.5	2.411	1.09	0.07	0.231
	16.00	10.45	10.53	8.33	8.41	8.35	0.81	13.0	0.402	0.93	0.08	0.231
	18.00	10.4	10.49	8.28	8.37	8.30	0.76	17.0	1.206	0.78	0.09	0.231
	20.00	10.36	10.46	8.24	8.34	8.26	0.72	19.0	1.206	0.74	0.10	0.231
	25.0	10.25	10.38	8.13	8.26	8.16	0.61	22.5	1.447	0.67	0.13	0.231
	30.0	10.19	10.33	8.07	8.21	8.10	0.55	27.5	0.482	0.58	0.14	0.231
	35.0	10.13	10.32	8.01	8.20	8.05	0.49	32.5	2.411	0.52	0.19	0.231
	40.00	10.1	10.31	7.98	8.19	8.03	0.46	37.5	0.964	0.48	0.21	0.231
	60.0	10.02	10.26	7.90	8.14	7.95	0.38	50.0	0.362	0.42	0.24	0.231
	80.0	10.01	10.27	7.89	8.15	7.95	0.37	70.0	0.241	0.37	0.26	0.231
	100.0	10	10.27	7.88	8.15	7.94	0.36	90.0	0.121	0.36	0.27	0.231
	120.0	10.00	10.28	7.88	8.16	7.94	0.36	110.0	0.121	0.36	0.28	0.231
	1043.0	9.92	10.31	7.80	8.19	7.89	0.28	581.5	0.029	0.32	0.39	0.231
	1283.00	9.9	10.30	7.78	8.18	7.87	0.26	1163.0	0.010	0.27	0.40	0.231
	2983.00	9.95	10.40	7.83	8.28	7.93	0.31	2133.0	0.007	0.28	0.45	0.231
	3993	9.99	10.49	7.87	8.37	7.98	0.35	3488.0	0.012	0.33	0.50	0.231
	4196.00	9.99	10.50	7.87	8.38	7.99	0.35	4094.5	0.012	0.35	0.51	0.231
	12743	9.92	10.45	7.80	8.33	7.92	0.28	8469.5	0.001	0.32	0.53	0.231
	29853	9.70	10.25	7.58	8.13	7.70	0.06	21298.0	0.000	0.17	0.55	0.231
	41683.00	9.8	10.65	7.68	8.53	7.87	0.16	35768.0	0.006	0.11	0.85	0.231

Figure 1

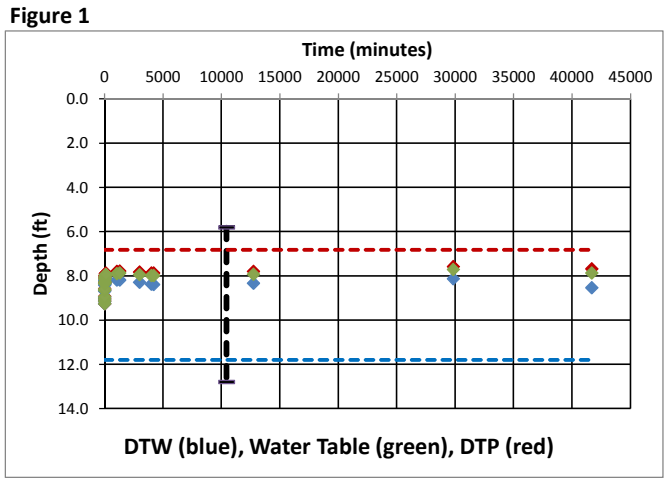
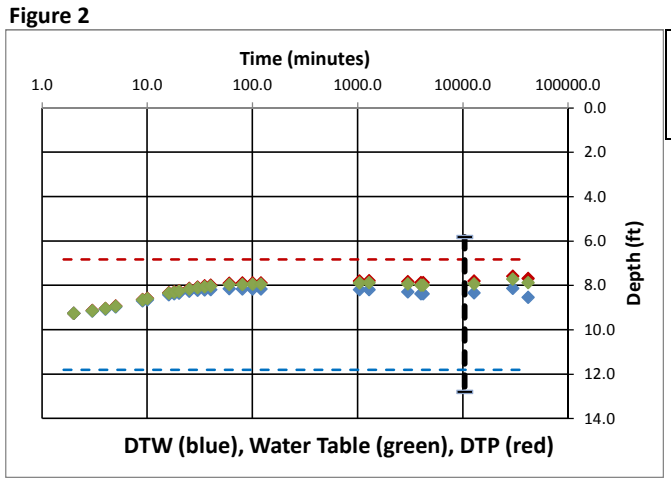


Figure 2



1.6	6.82
41683	6.82
1.6	11.8
41683	11.8

10420.8	5.82	5.8
10420.8	12.8	12.8

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.2	0.38

Drawdown Adjust.	
Δs_n (ft)	0.7

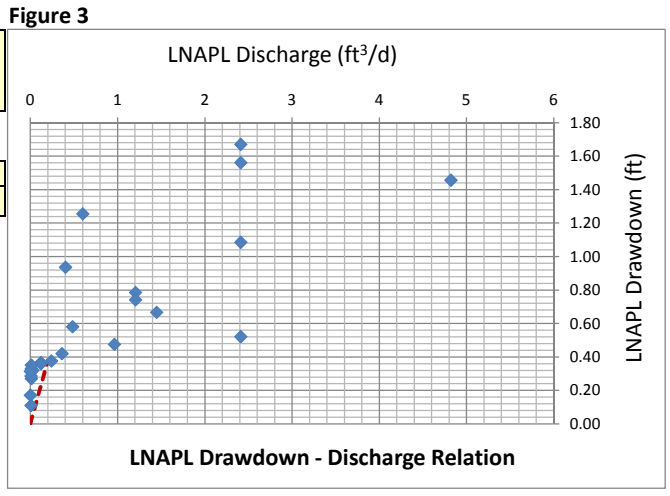
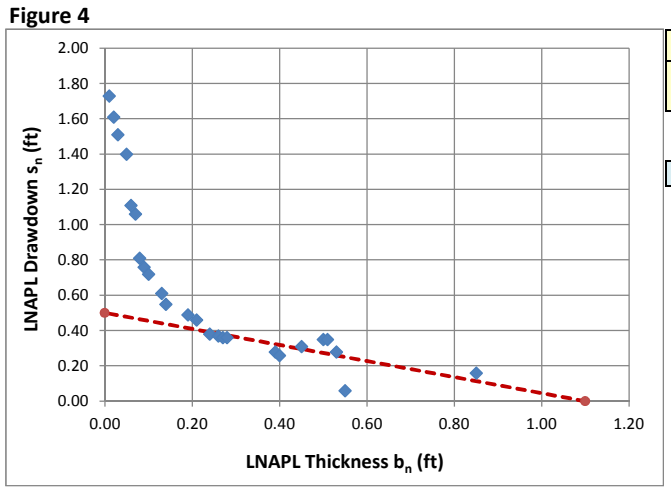


Figure 4



b_n	s_n
1.1	0
0	0.5

J-ratio	-0.455

Figure 5

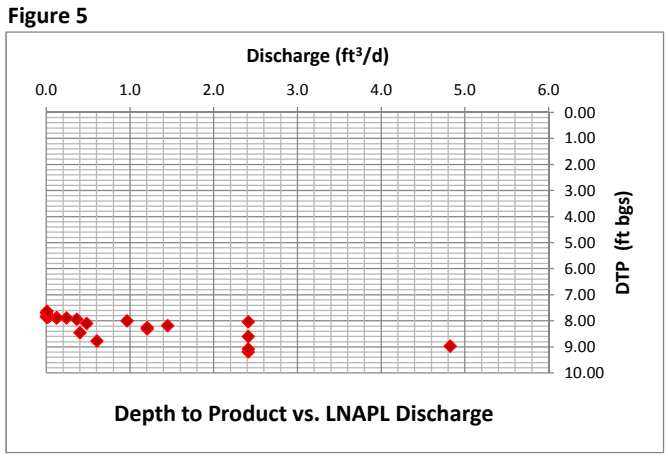


Figure 6

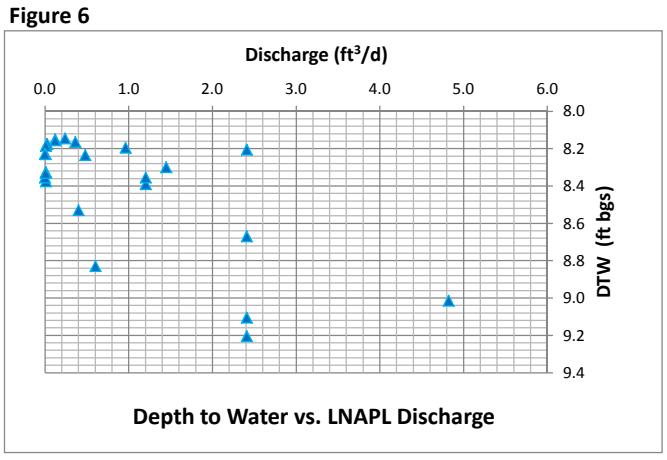


Figure 7

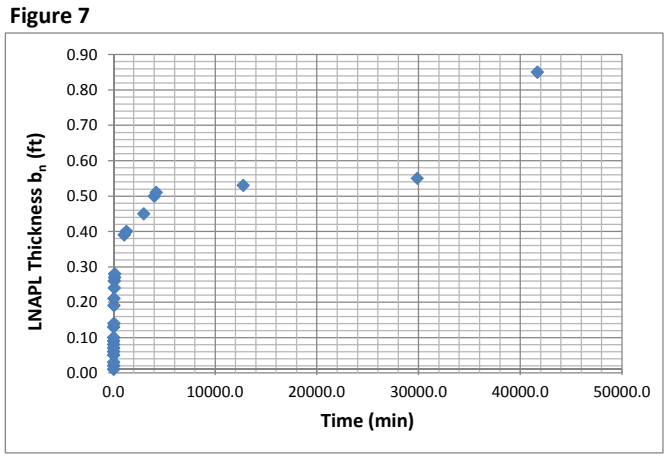


Figure 8

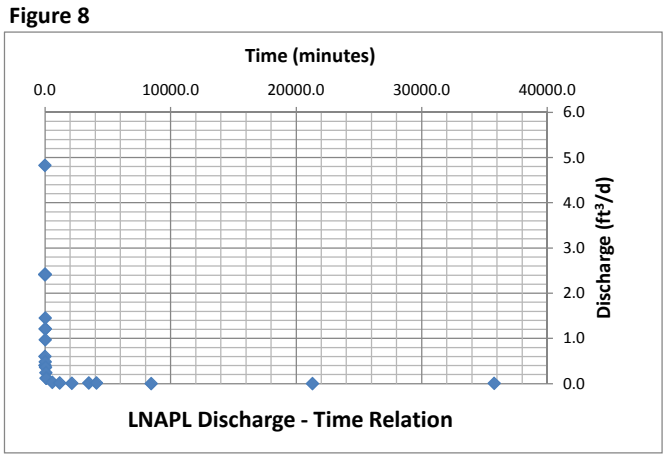


Figure 9

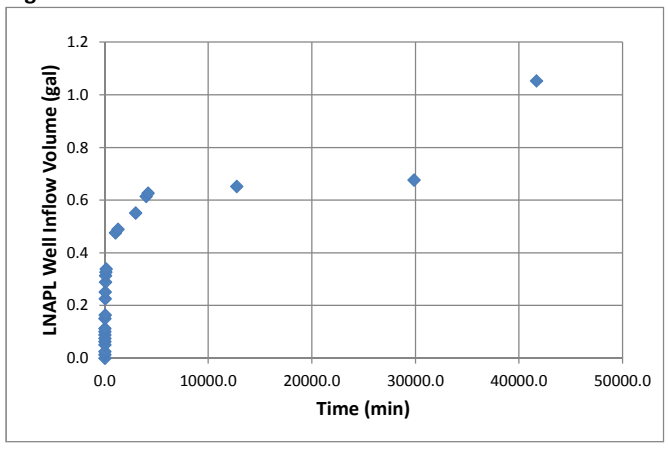
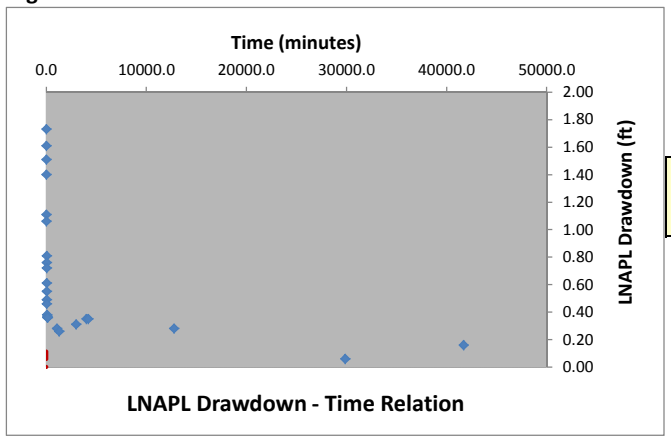


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	A-10
Date:	17-Sep-13

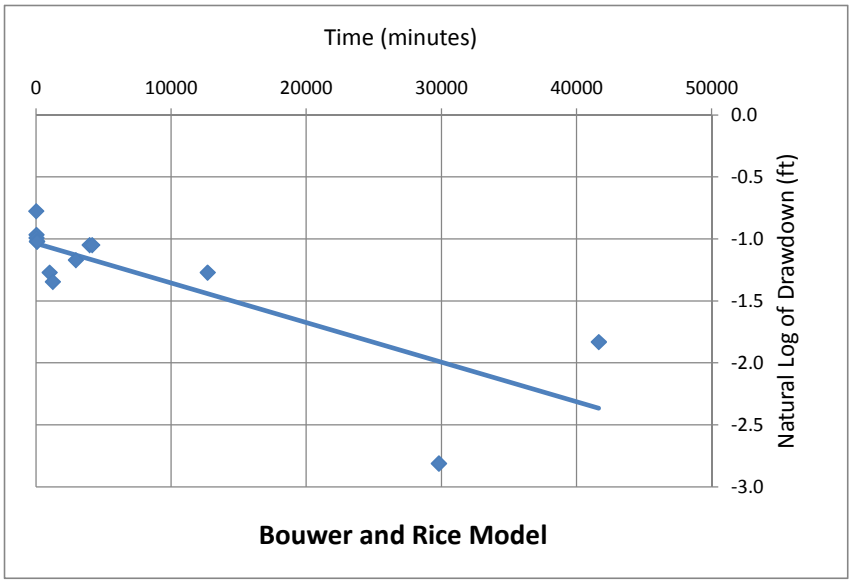
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

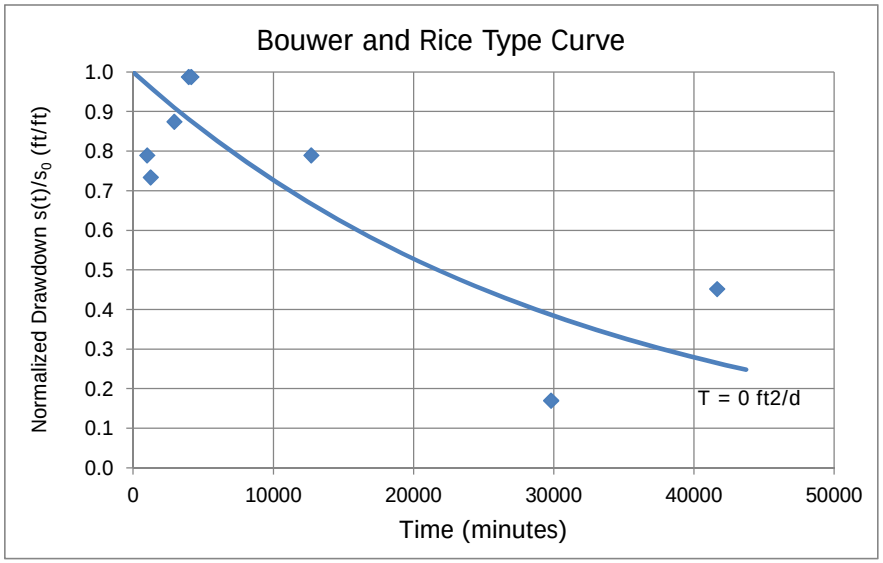
$Time_{cut}$	39	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.01 +/- 0.00 ft^2/d

L_e/r_e	21.6
C	1.65
R/r_e	9.97
J-Ratio	-0.455
Coef. Of Variation	0.23



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	A-10
Date:	17-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	39	<- Enter or change values here
Time Adjustment (min):	26	

Trial S_n: d <-- Enter d for default or enter S_n value

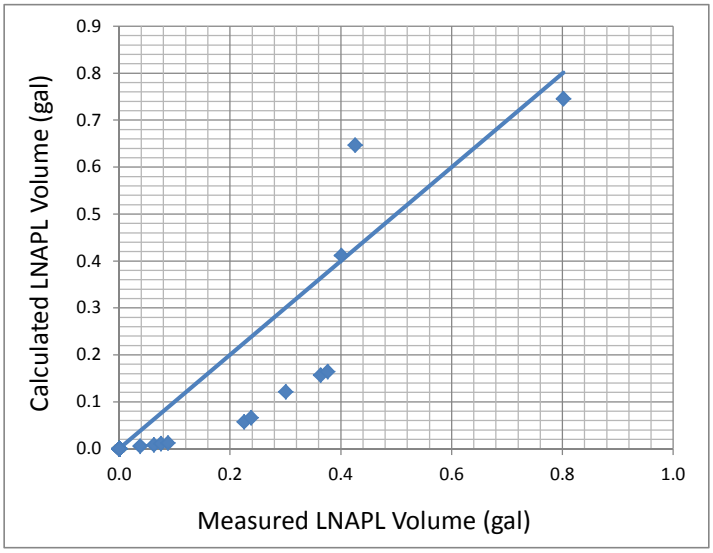
Root-Mean-Square Error: 0.493 <-- Minimize this using "Solver"

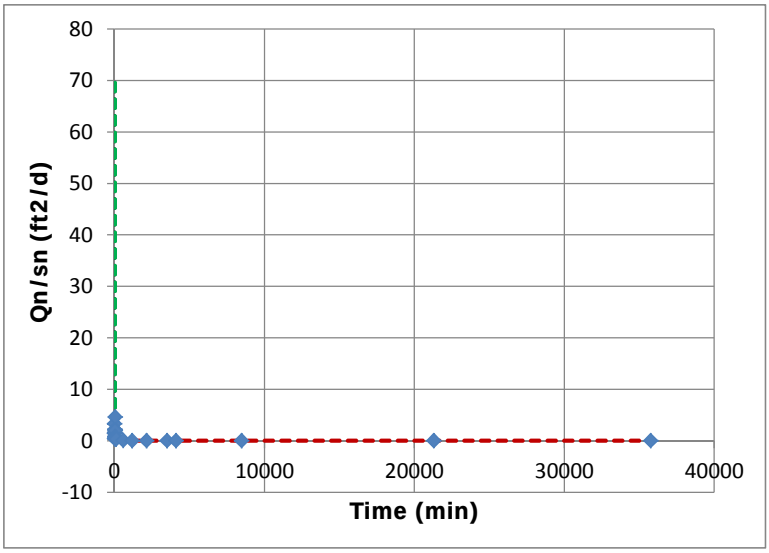
0.002 <-- Working S_n

Trial T_n (ft^2/d): 0.010 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.01**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	A-10
Date:	17-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	39	<- Enter or change values here
Initial Drawdown s_n (ft):	0.46	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.644 <-- Minimize this using "Solver"

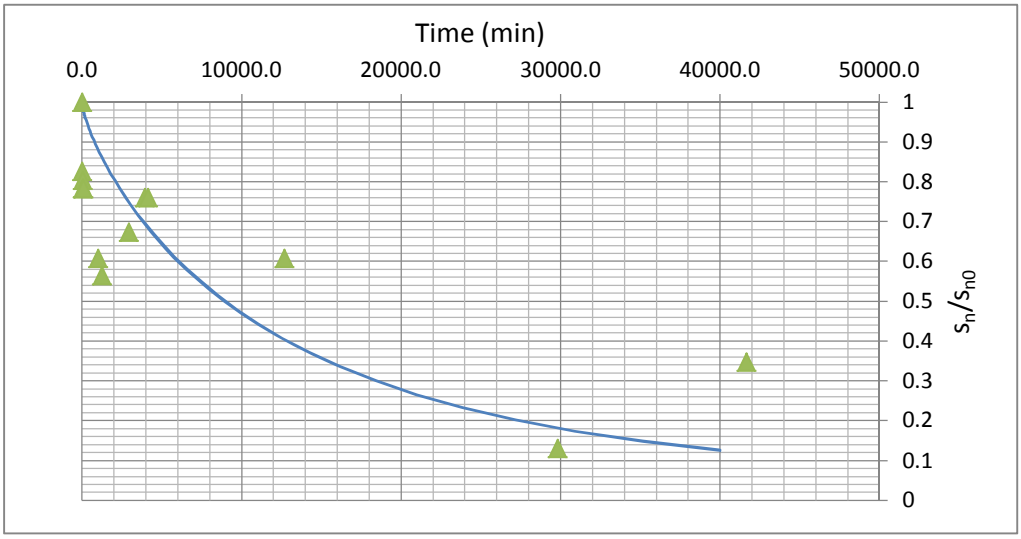
Trial T_n (ft^2/d): 0.020 <-- By changing T_n through "Solver"

0.004 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.02**

T_{min}	0.1
T_{max}	40000



J-Ratio
-0.455

Well Designation:	A-12	Beckett and Lyverse (2002)
Date:	date	

Ground Surface Elev (ft msl)	371.0	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	373.0		
Well Casing Radius, r_c (ft):	0.167	r_{e1}	0.25
Well Radius, r_w (ft):	0.417		
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.760		
Top of Screen (ft bgs):	5.0		
Bottom of Screen (ft bgs):	15.2		
LNAPL Baildown Vol. (gal.):	3.0		
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.207		
Initial Casing LNAPL Vol. (gal.):	1.53		
Initial Filter LNAPL Vol. (gal.):	1.41		

	Enter Data Here											
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	9.35	11.7	7.30	9.65	7.86					2.35	
Enter Test Data:	1.0	10.10	10.17	8.05	8.12	8.07	0.50				0.07	
	3.0	10.05	10.13	8.00	8.08	8.02	0.45	2.0	1.206	0.47	0.08	0.231
	6.0	10.02	10.11	7.97	8.06	7.99	0.42	4.5	0.804	0.43	0.09	0.231
	12.0	9.93	10.03	7.88	7.98	7.90	0.33	9.0	0.402	0.37	0.10	0.231
	14.0	9.91	10.03	7.86	7.98	7.89	0.31	13.0	2.411	0.32	0.12	0.231
	16.0	9.9	10.03	7.85	7.98	7.88	0.30	15.0	1.206	0.30	0.13	0.231
	26.00	9.86	10.00	7.81	7.95	7.84	0.26	21.0	0.241	0.28	0.14	0.231
	31.00	9.85	10.00	7.80	7.95	7.84	0.25	28.5	0.482	0.25	0.15	0.231
	36.00	9.83	10.00	7.78	7.95	7.82	0.23	33.5	0.964	0.24	0.17	0.231
	46.0	9.8	10.00	7.75	7.95	7.80	0.20	41.0	0.723	0.21	0.20	0.231
	56.0	9.78	10.02	7.73	7.97	7.79	0.18	51.0	0.964	0.19	0.24	0.231
	76.00	9.77	10.05	7.72	8.00	7.79	0.17	66.0	0.482	0.17	0.28	0.231
	89.00	9.75	10.09	7.70	8.04	7.78	0.15	82.5	1.113	0.16	0.34	0.231
	188.0	9.69	10.15	7.64	8.10	7.75	0.09	138.5	0.292	0.12	0.46	0.231
	1349.00	9.62	10.15	7.57	8.10	7.70	0.02	768.5	0.015	0.05	0.53	0.231
	3049.0	9.68	10.24	7.63	8.19	7.76	0.08	2199.0	0.004	0.05	0.56	0.231
	41756.00	9.65	10.23	7.60	8.18	7.74	0.05	22402.5	0.000	0.06	0.58	0.231

Figure 1

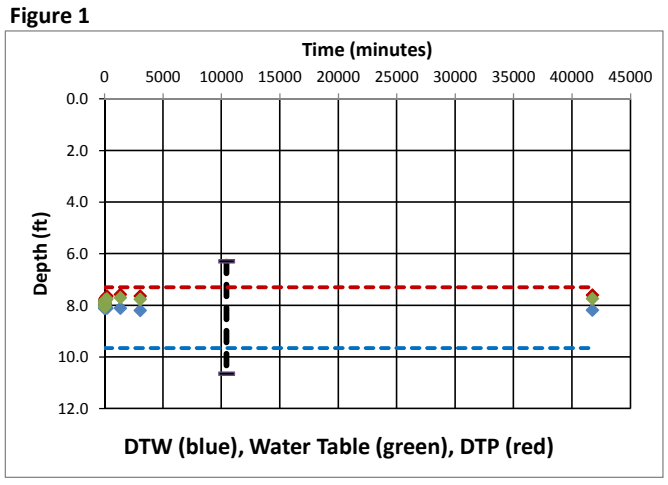
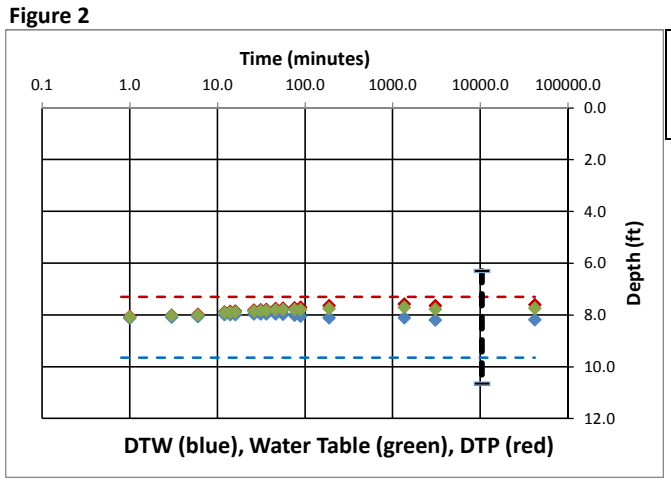


Figure 2



0.8	7.30
41756	7.30
0.8	9.65
41756	9.65

10439.0	6.3	6.3
10439.0	10.7	10.7

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
4	0.38

Drawdown Adjust.	
Δs_n (ft)	0.25

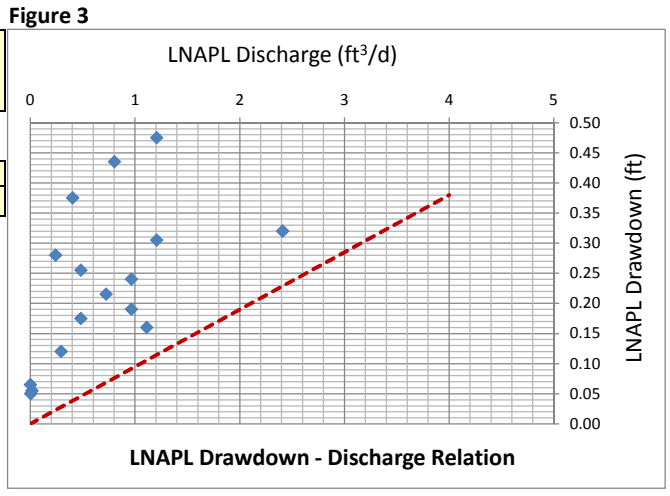
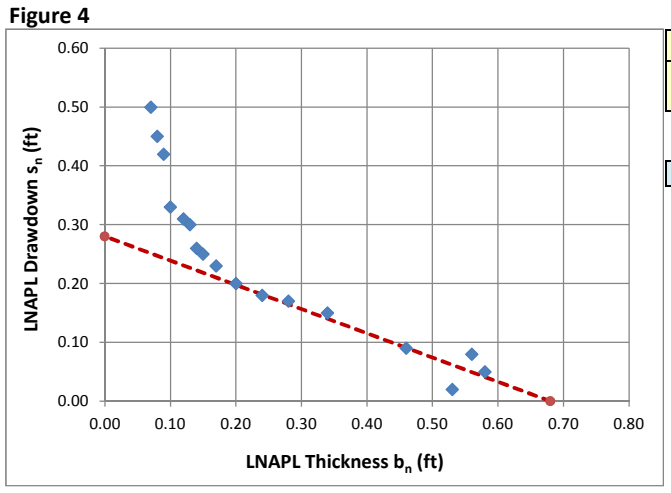


Figure 4



b_n	s_n
0.68	0
0	0.28

J-ratio	-0.412

Figure 5

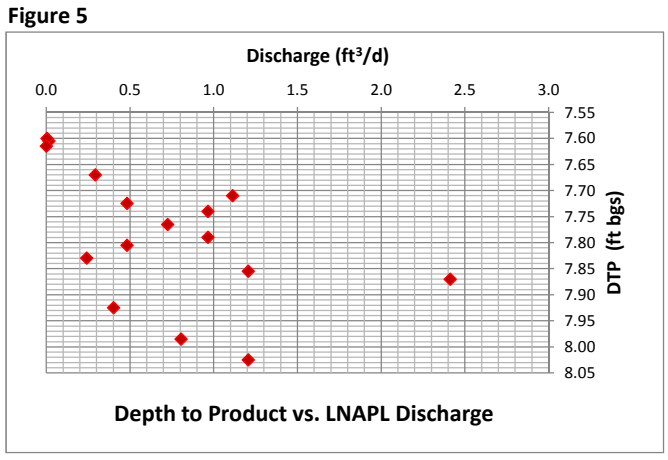


Figure 6

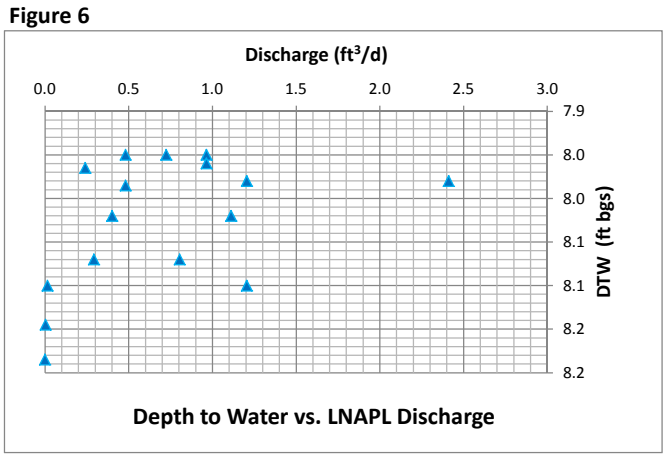


Figure 7

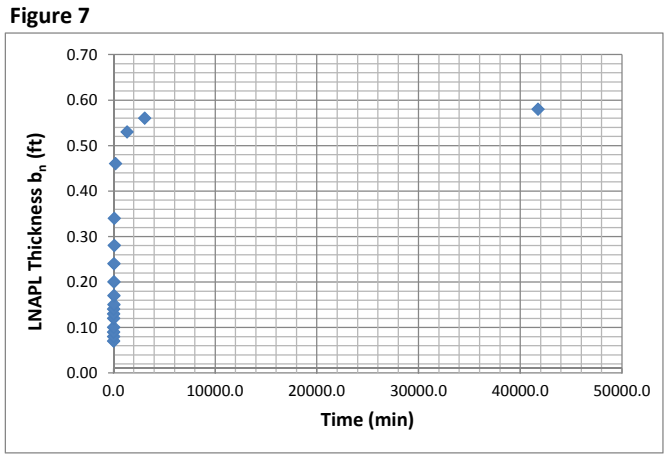


Figure 8

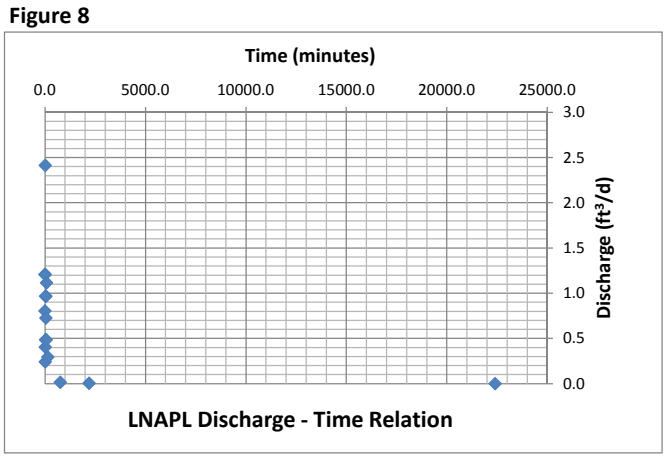


Figure 9

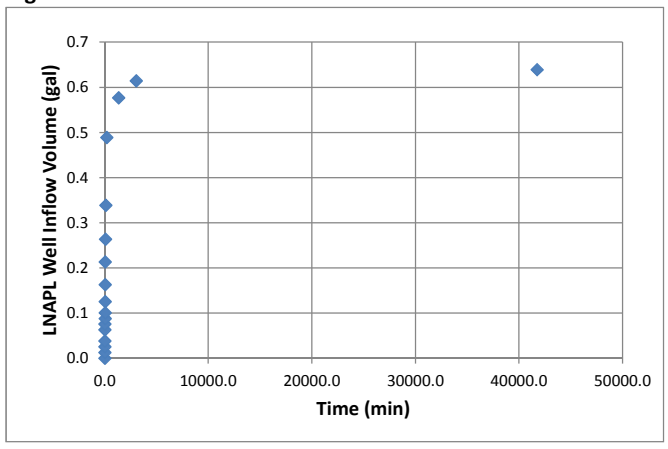
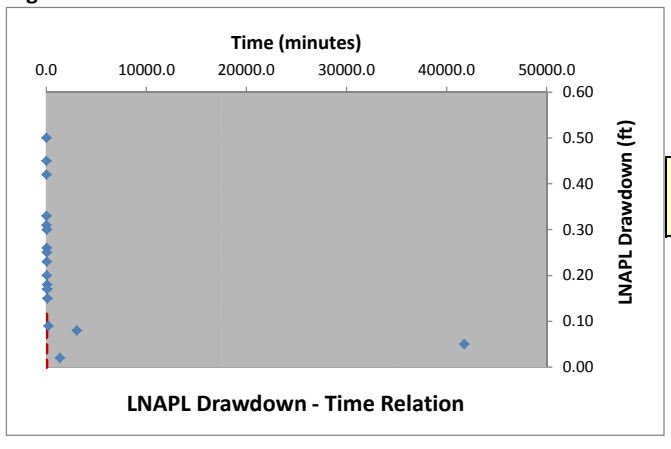


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	A-12
Date:	date

$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

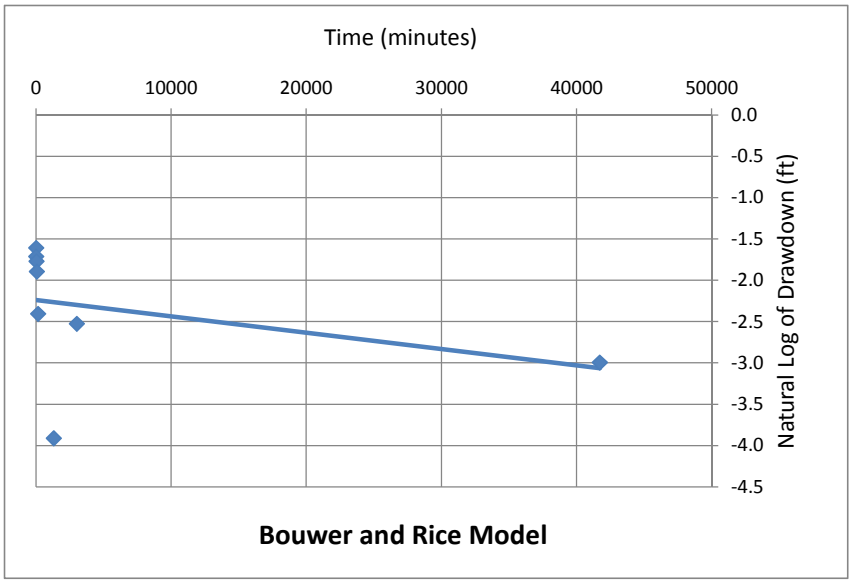
Enter early time cut-off for least-squares model fit

$Time_{cut}$	40	<- Enter or change value here

L_e/r_e	C	R/r_e
10.2	1.20	5.42

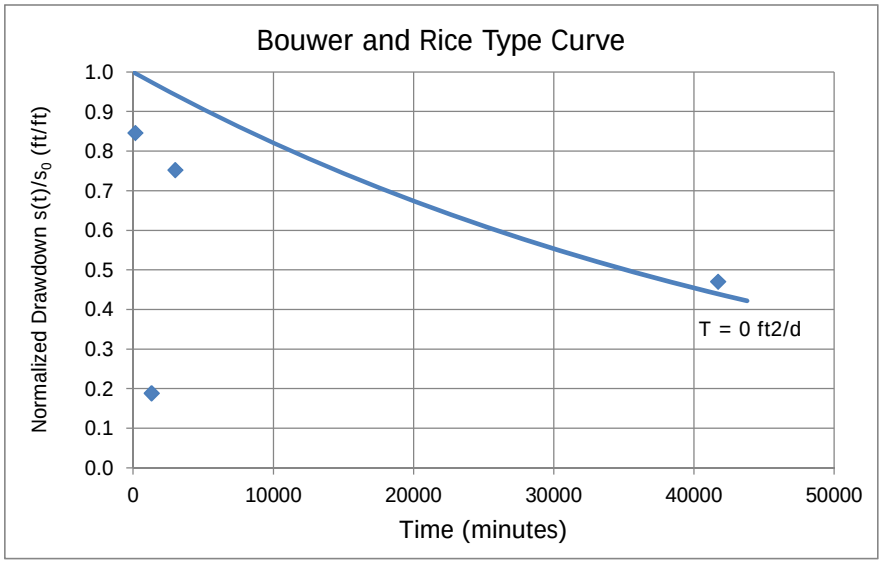
Model Results: T_n (ft^2/d) = 0.00 +/- 0.00 ft^2/d

J-Ratio
-0.412



Coef. Of Variation
1.05

C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	A-12
Date:	date

$$V_n(t_i) = \sum_{j}^{i} \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^{\,2} S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	40	<- Enter or change values here
Time Adjustment (min):	26.66667	

Trial S_n: d <-- Enter d for default or enter S_n value

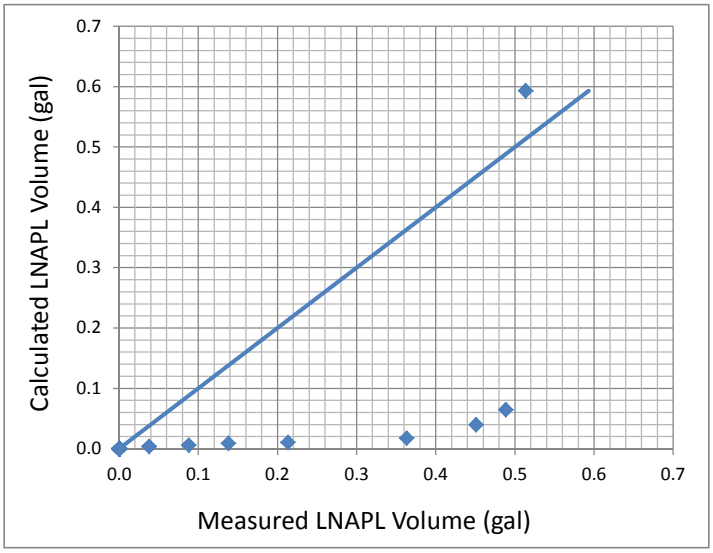
Root-Mean-Square Error: 0.735 <-- Minimize this using "Solver"

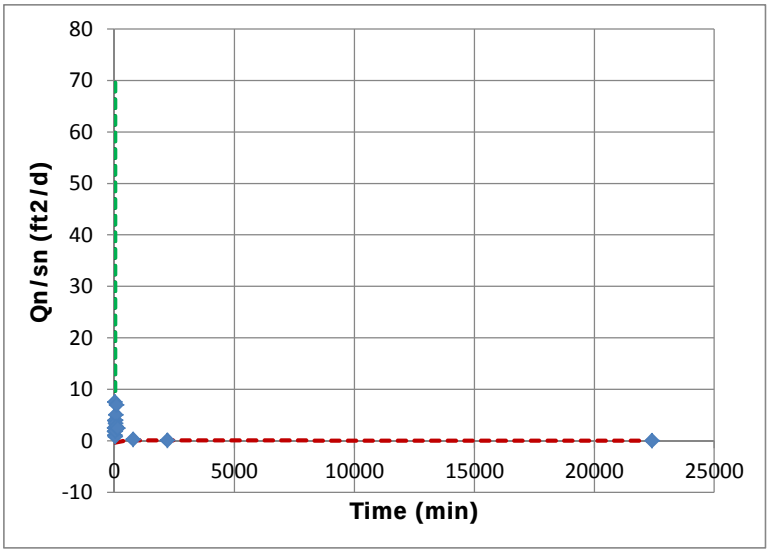
0.004 <-- Working S_n

Trial T_n (ft^2/d): 0.027 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.03**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	A-12
Date:	date

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	40	<- Enter or change values here
Initial Drawdown s_n (ft):	0.21	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 1.119 <-- Minimize this using "Solver"

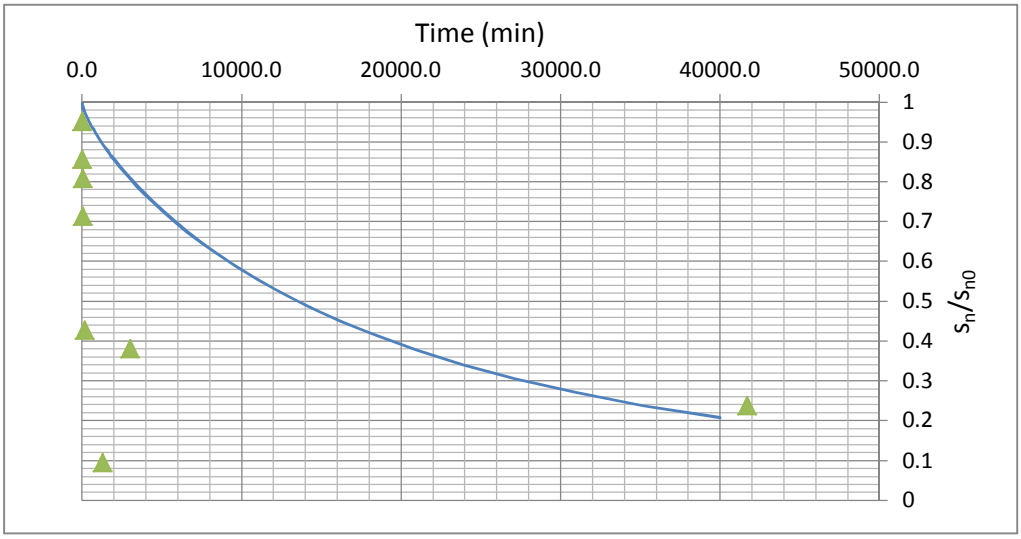
Trial T_n (ft^2/d): 0.015 <-- By changing T_n through "Solver"

0.003 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.02**

T_{min}	0.1
T_{max}	40000



J-Ratio
-0.412

Well Designation:	A-13	Beckett and Lyverse (2002)
Date:	16-Sep-13	

Ground Surface Elev (ft msl)	372.1	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	374.5		
Well Casing Radius, r_c (ft):	0.167	r_{e1}	
Well Radius, r_w (ft):	0.417		0.27
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.813		
Top of Screen (ft bgs):	5.0		
Bottom of Screen (ft bgs):	20.7		
LNAPL Baildown Vol. (gal.):	2.4		
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.225		
Initial Casing LNAPL Vol. (gal.):	0.94		
Initial Filter LNAPL Vol. (gal.):	0.86		

	Enter Data Here											
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	10.98	12.42	8.60	10.04	8.87					1.44	
Enter Test Data:	1.00	11.45	11.46	9.07	9.08	9.07	0.20				0.01	
	27.0	11.29	11.31	8.91	8.93	8.91	0.04	14.0	0.093	0.12	0.02	0.231
	32.0	11.28	11.32	8.90	8.94	8.91	0.03	29.5	0.964	0.03	0.04	0.231
	37.0	11.28	11.35	8.90	8.97	8.91	0.03	34.5	1.447	0.03	0.07	0.231
	47.0	11.28	11.37	8.90	8.99	8.92	0.03	42.0	0.482	0.03	0.09	0.231
	57.0	11.27	11.38	8.89	9.00	8.91	0.02	52.0	0.482	0.02	0.11	0.231
	67.00	11.26	11.38	8.88	9.00	8.90	0.01	62.0	0.241	0.01	0.12	0.231
	77.00	11.27	11.40	8.89	9.02	8.91	0.02	72.0	0.241	0.01	0.13	0.231
	97.0	11.26	11.40	8.88	9.02	8.91	0.01	87.0	0.121	0.01	0.14	0.231
	117.00	11.28	11.43	8.90	9.05	8.93	0.03	107.0	0.121	0.02	0.15	0.231
	147.0	11.28	11.45	8.90	9.07	8.93	0.03	132.0	0.161	0.03	0.17	0.231
	2758.0	11.27	11.47	8.89	9.09	8.93	0.02	1452.5	0.003	0.02	0.20	0.231
	43175	11.27	11.52	8.89	9.14	8.94	0.02	22966.5	0.000	0.02	0.25	0.231

Figure 1

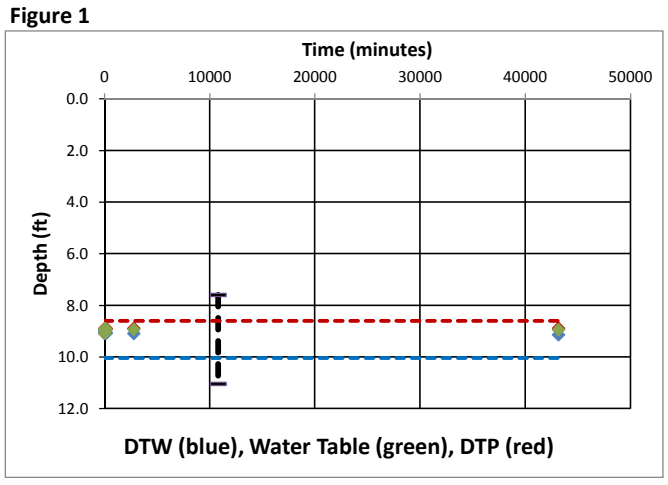
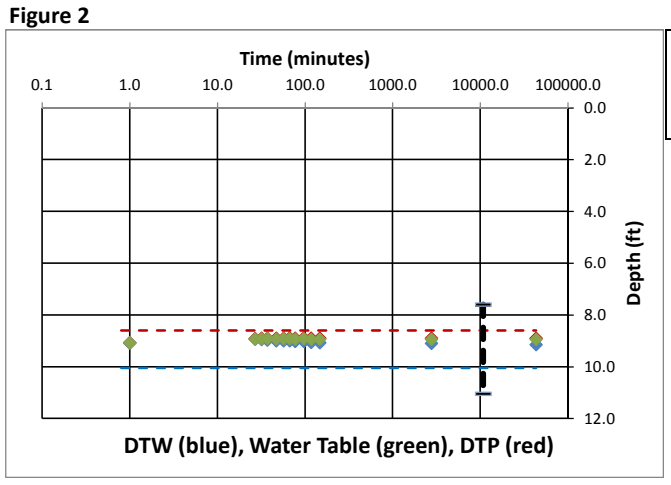


Figure 2



0.8	8.60
43175	8.60
0.8	10.04
43175	10.04

10793.8	7.6	7.6
10793.8	11.0	11.0

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.1	0.15

Drawdown Adjust.	
Δs_n (ft)	0.27

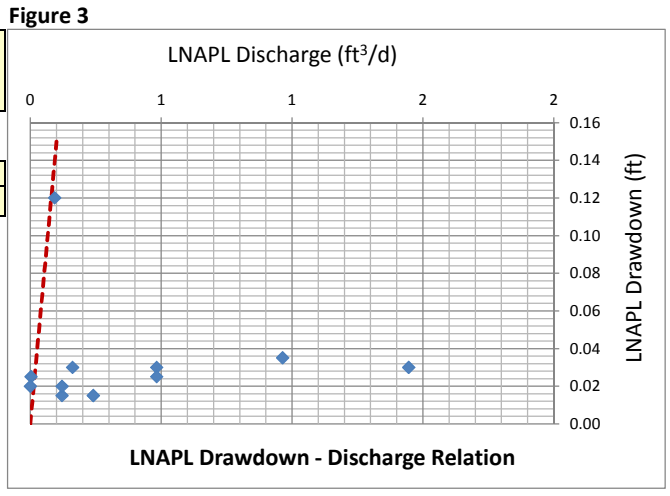
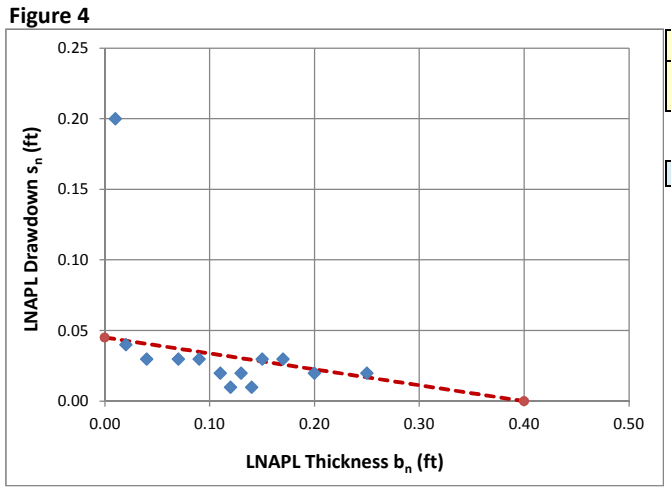


Figure 4



b_n	s_n
0.4	0
0	0.045

J-ratio	-0.113

Figure 5

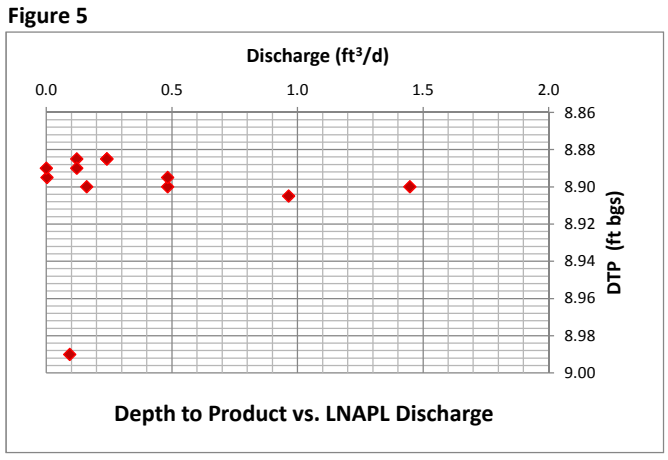


Figure 6

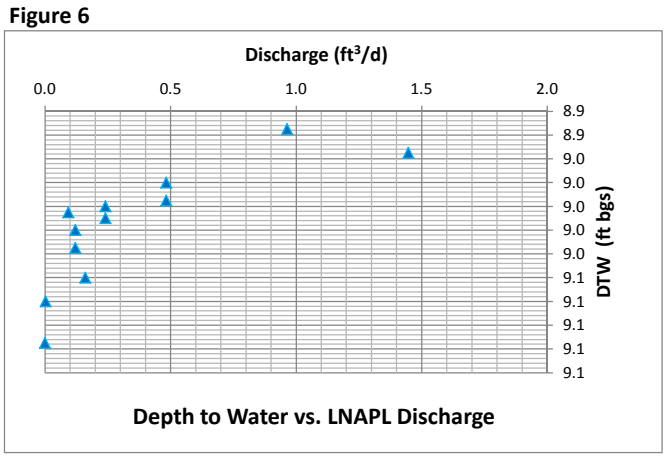


Figure 7

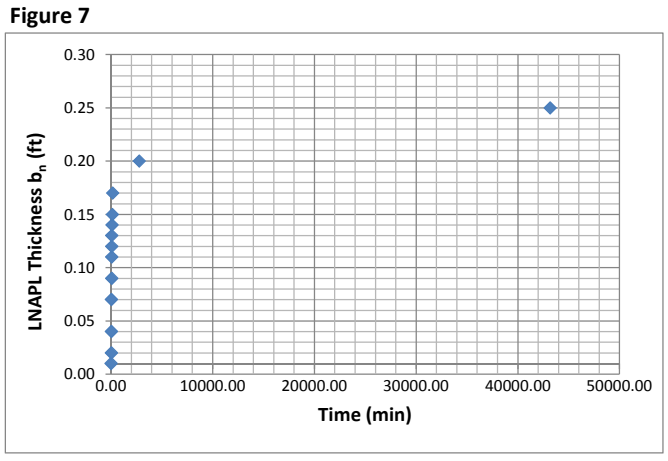


Figure 8

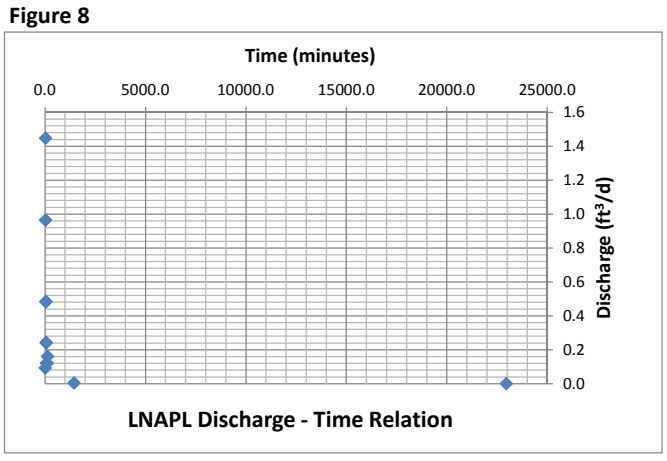


Figure 9

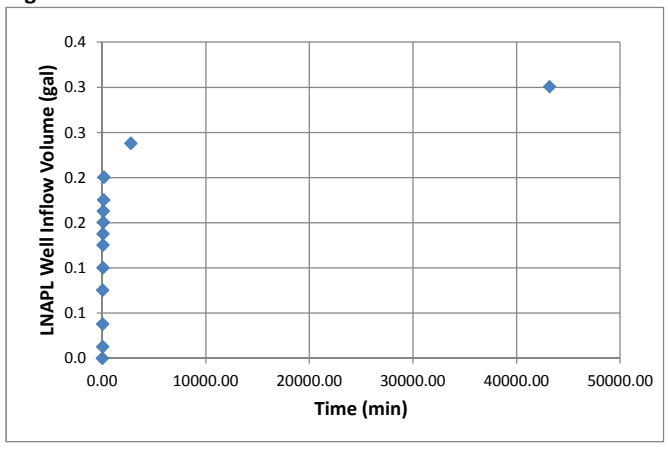
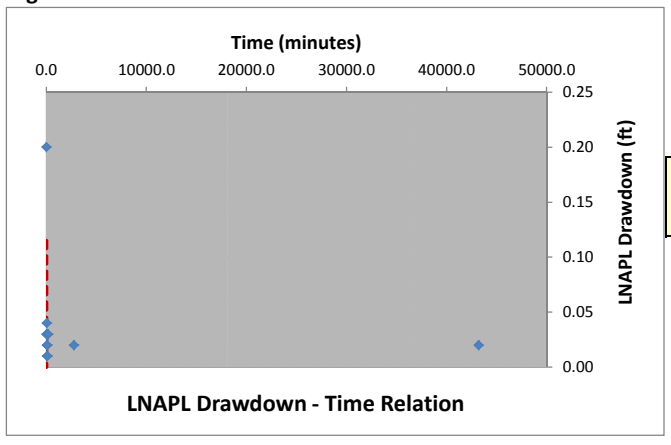


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	A-13
Date:	16-Sep-13

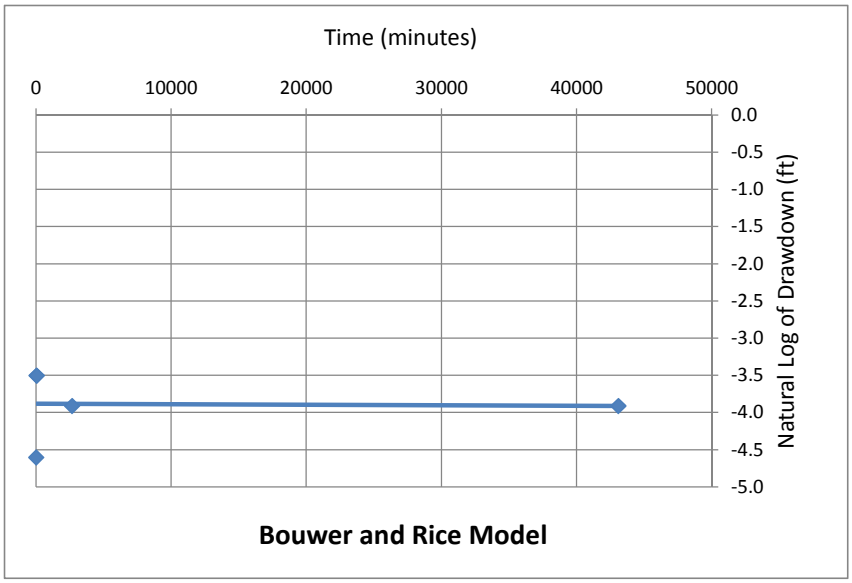
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

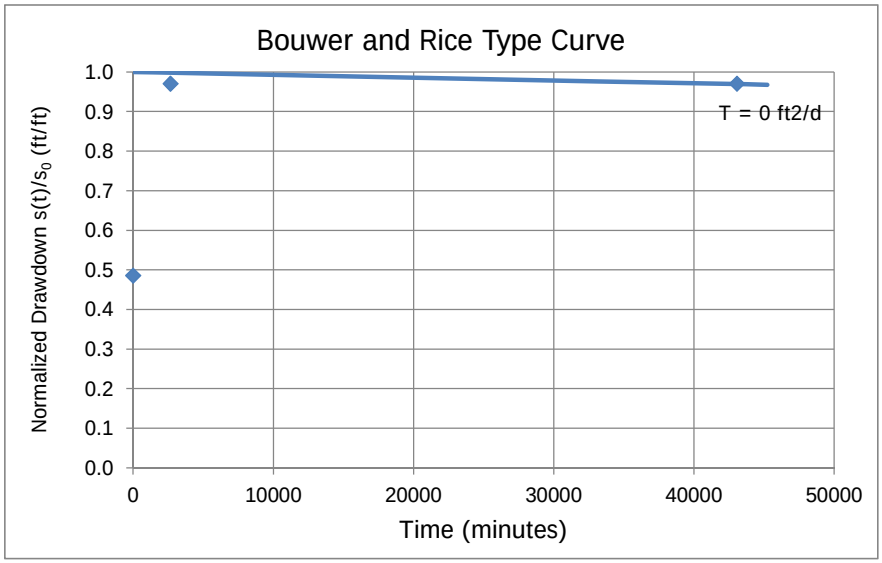
$Time_{cut}$	96	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.00 +/- 0.01 ft^2/d

L_e/r_e	6.2
C	1.04
R/r_e	3.68
J-Ratio	-0.113
Coef. Of Variation	18.74



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	A-13
Date:	16-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	96	<- Enter or change values here
Time Adjustment (min):	64	

Trial S_n: d <-- Enter d for default or enter S_n value

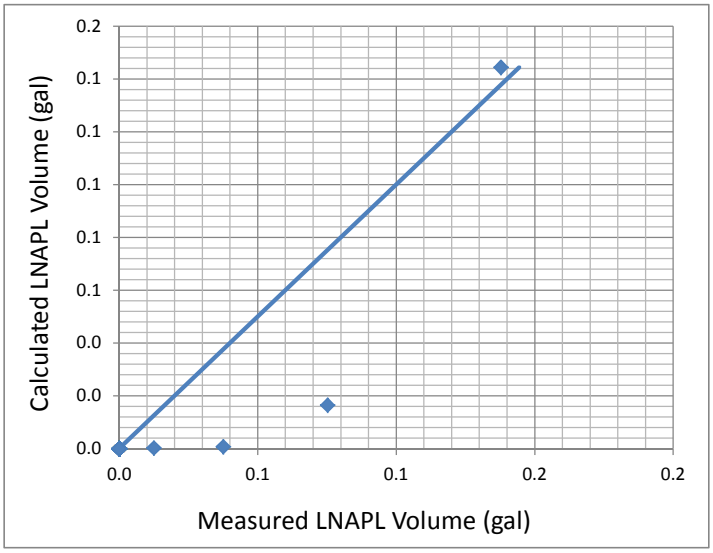
Root-Mean-Square Error: 0.071 <-- Minimize this using "Solver"

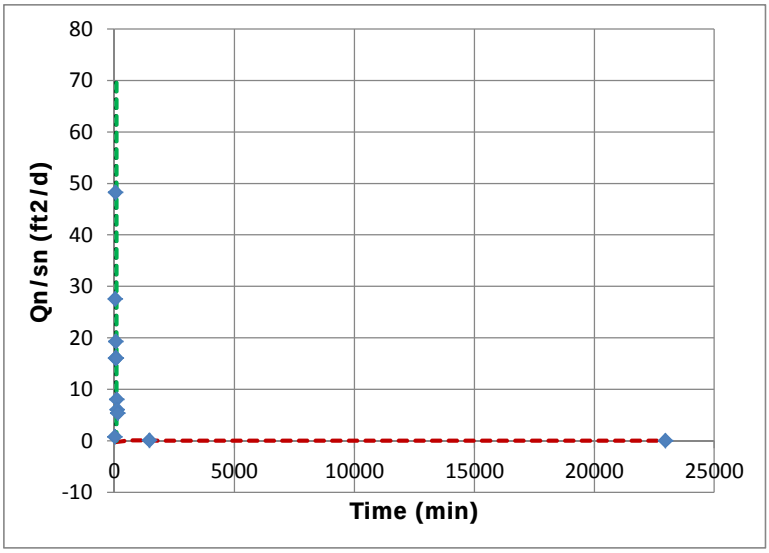
0.004 <-- Working S_n

Trial T_n (ft^2/d): 0.020 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.02**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	A-13
Date:	16-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	96	<- Enter or change values here
Initial Drawdown s_n (ft):	0.04	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.928 <-- Minimize this using "Solver"

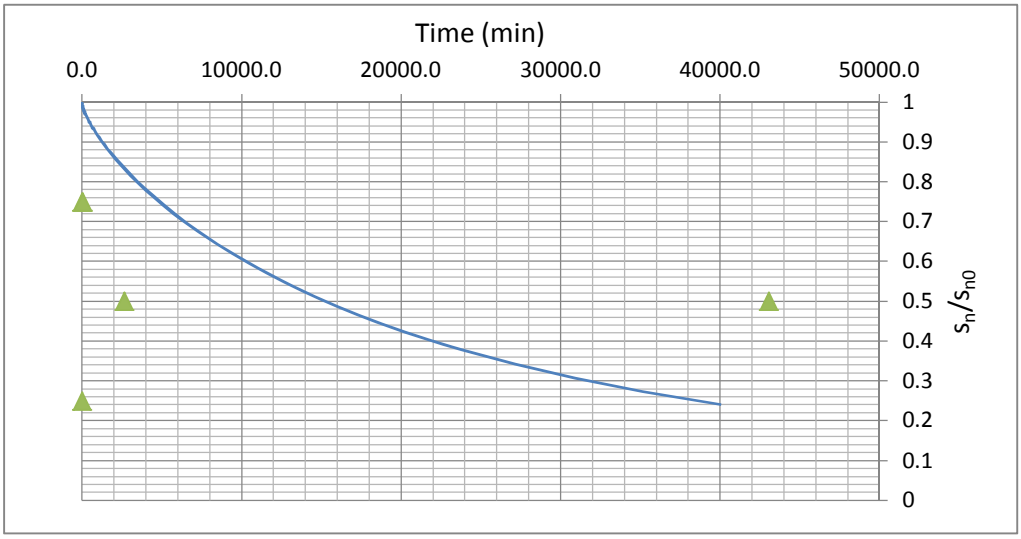
Trial T_n (ft^2/d): 0.044 <-- By changing T_n through "Solver"

0.005 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.04**

T_{min}	0.1
T_{max}	40000



J-Ratio
-0.113

Well Designation:	A-14	Beckett and Lyverse (2002)
Date:	16-Sep-13	

Ground Surface Elev (ft msl)	371.3	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	374.2		
Well Casing Radius, r_c (ft):	0.167	r_{e1}	
Well Radius, r_w (ft):	0.417		0.75
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.799		
Top of Screen (ft bgs):	10.0		
Bottom of Screen (ft bgs):	21.8		
LNAPL Baildown Vol. (gal.):	29.5		
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.219		
Initial Casing LNAPL Vol. (gal.):	3.30		
Initial Filter LNAPL Vol. (gal.):	1.35		

	Enter Data Here											
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	10.10	15.15	7.20	12.25	8.21					5.05	
Enter Test Data:	26.0	11.38	11.43	8.48	8.53	8.49	0.53				0.05	
	28.0	11.33	11.39	8.43	8.49	8.44	0.48	27.0	0.628	0.50	0.06	0.167
	29.0	11.31	11.38	8.41	8.48	8.42	0.46	28.5	1.257	0.47	0.07	0.167
	32.0	11.27	11.35	8.37	8.45	8.39	0.42	30.5	0.419	0.44	0.08	0.167
	34.00	11.23	11.33	8.33	8.43	8.35	0.38	33.0	1.257	0.40	0.10	0.167
	40.0	11.2	11.31	8.30	8.41	8.32	0.35	37.0	0.209	0.36	0.11	0.167
	45.0	11.17	11.30	8.27	8.40	8.30	0.32	42.5	0.503	0.33	0.13	0.167
	55.00	11.14	11.28	8.24	8.38	8.27	0.29	50.0	0.126	0.30	0.14	0.167
	60.00	11.12	11.28	8.22	8.38	8.25	0.27	57.5	0.503	0.28	0.16	0.167
	70.0	11.13	11.30	8.23	8.40	8.26	0.28	65.0	0.126	0.27	0.17	0.167
	90.0	11.12	11.30	8.22	8.40	8.26	0.27	80.0	0.063	0.27	0.18	0.167
	110.0	11.12	11.31	8.22	8.41	8.26	0.27	100.0	0.063	0.27	0.19	0.167
	120.0	11.12	11.32	8.22	8.42	8.26	0.27	115.0	0.126	0.27	0.20	0.167
	965.0	11.18	11.52	8.28	8.62	8.35	0.33	542.5	0.021	0.30	0.34	0.167
	1205.0	11.16	11.52	8.26	8.62	8.33	0.31	1085.0	0.010	0.32	0.36	0.167
	1535.00	11.12	11.51	8.22	8.61	8.30	0.27	1370.0	0.011	0.29	0.39	0.167
	2945.00	11.07	11.47	8.17	8.57	8.25	0.22	2240.0	0.001	0.24	0.40	0.167
	3890.00	11.09	11.52	8.19	8.62	8.28	0.24	3417.5	0.004	0.23	0.43	0.167
	5662.00	11.17	11.62	8.27	8.72	8.36	0.32	4776.0	0.001	0.28	0.45	0.167
	9911	10.88	11.34	7.98	8.44	8.07	0.03	7786.5	0.000	0.17	0.46	0.167
	14158	11.11	11.61	8.21	8.71	8.31	0.26	12034.5	0.001	0.14	0.50	0.167
	43120	11.03	11.73	8.13	8.83	8.27	0.18	28639.0	0.001	0.22	0.70	0.167

Figure 1

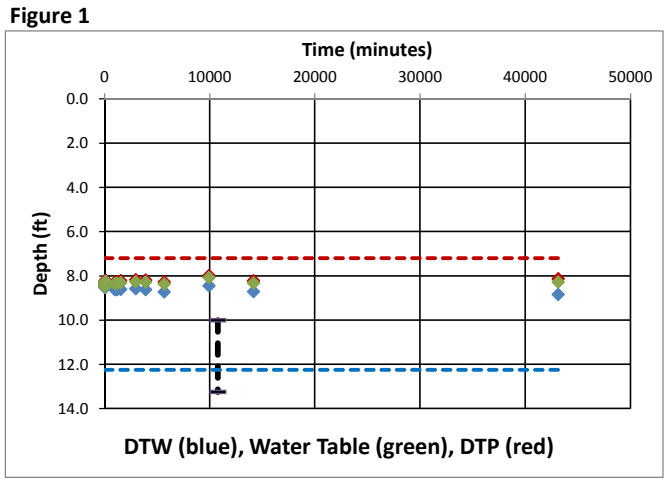
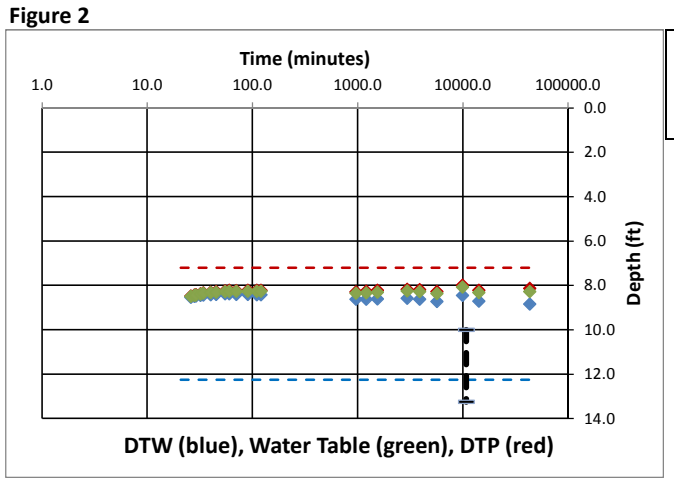


Figure 2



20.8	7.20
43120	7.20
20.8	12.25
43120	12.25

10780.0	10	10.0
10780.0	13.3	13.3

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.01	0.38

Drawdown Adjust.	
Δs_n (ft)	0.75

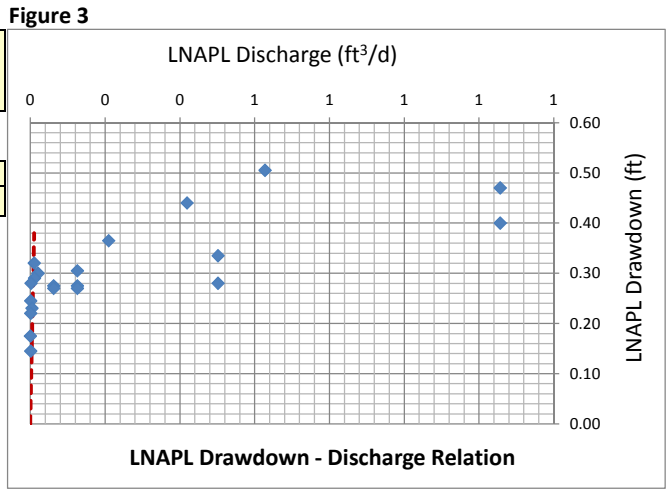
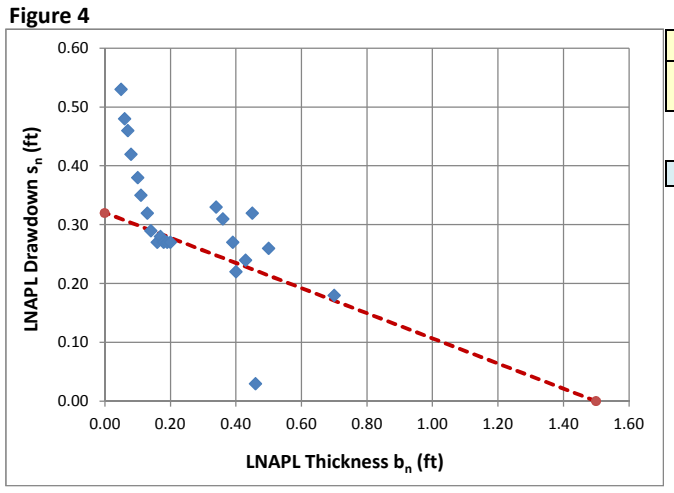


Figure 4



b_n	s_n
1.5	0
0	0.32

J-ratio	-0.213

Figure 5

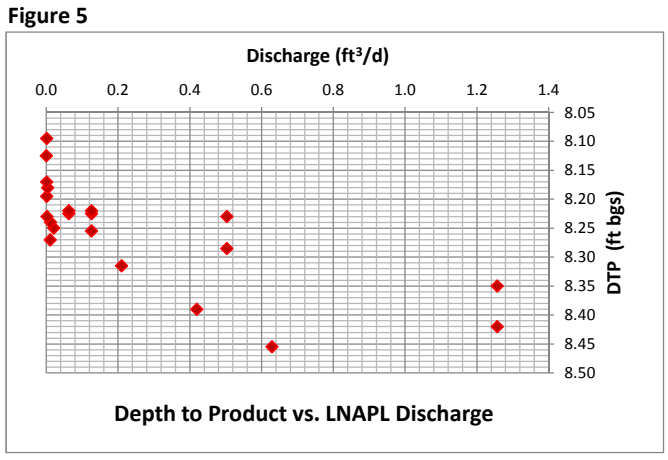


Figure 6

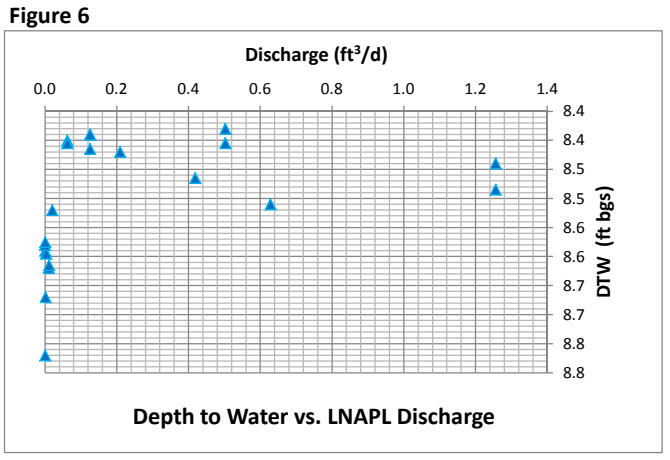


Figure 7

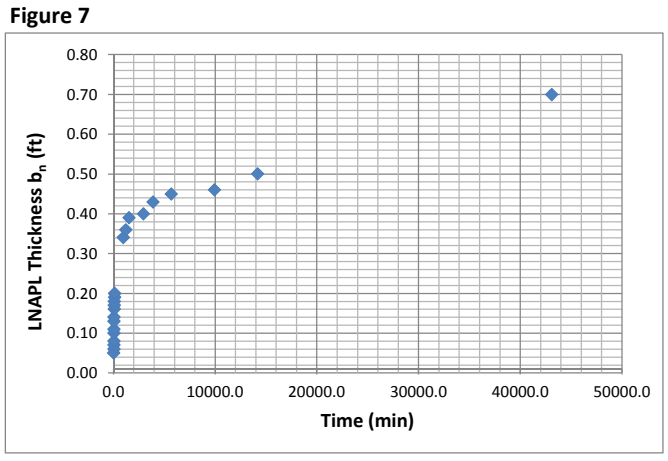


Figure 8

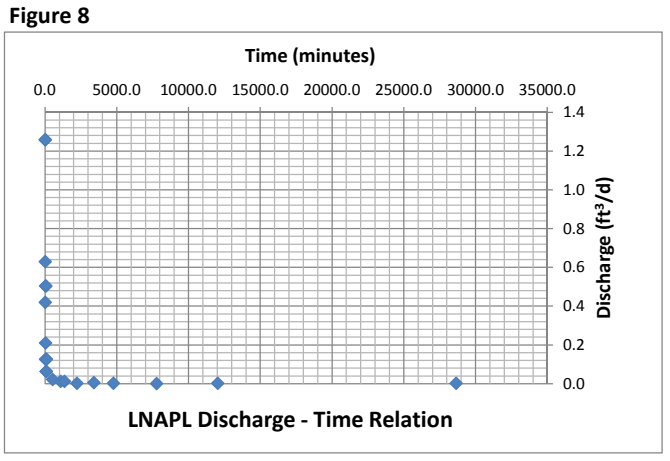


Figure 9

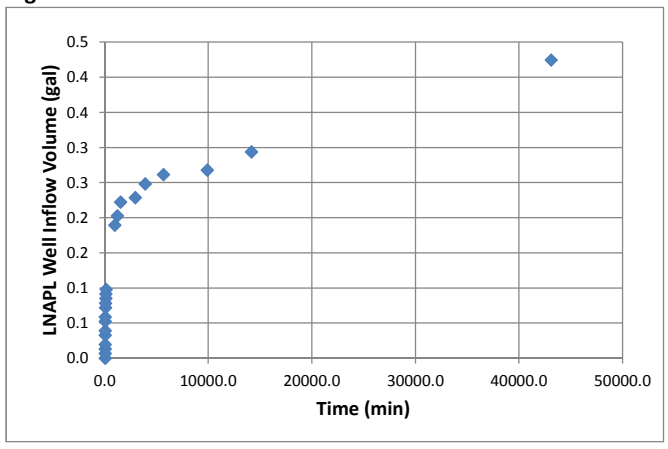
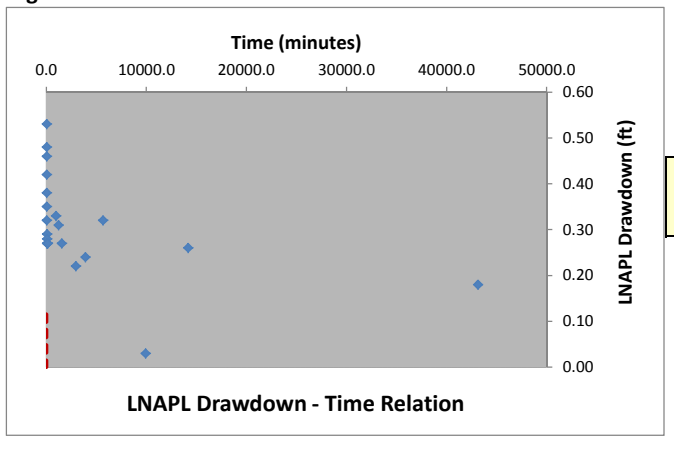


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	A-14
Date:	16-Sep-13

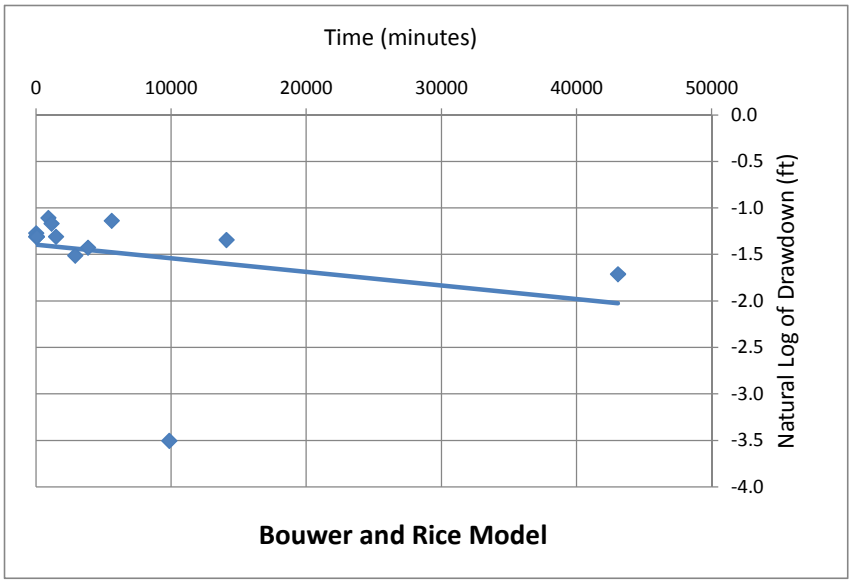
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

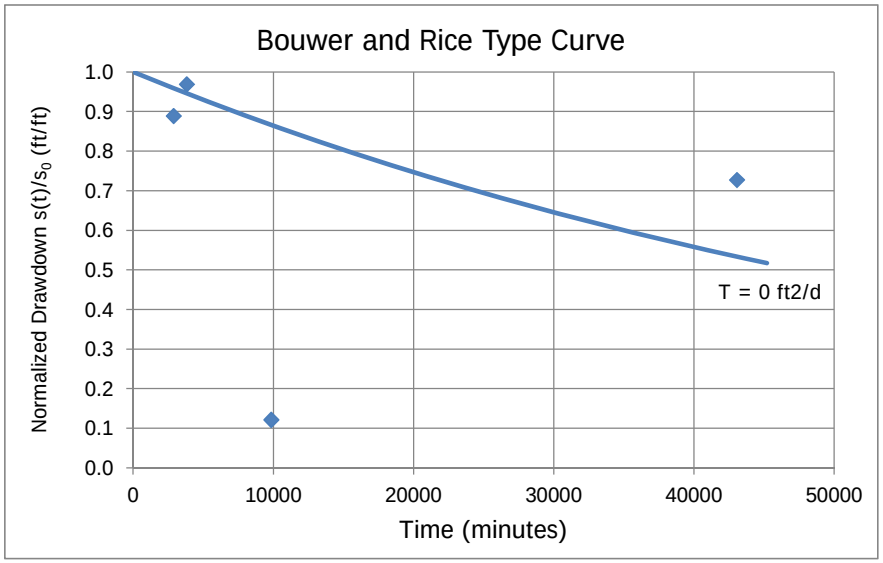
$Time_{cut}$	56	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.00 +/- 0.00 ft^2/d

L_e/r_e	9.7
C	1.18
R/r_e	5.23
J-Ratio	-0.213
Coef. Of Variation	1.00



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	A-14
Date:	16-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	56	<- Enter or change values here
Time Adjustment (min):	37.33333	

Trial S_n: d <-- Enter d for default or enter S_n value

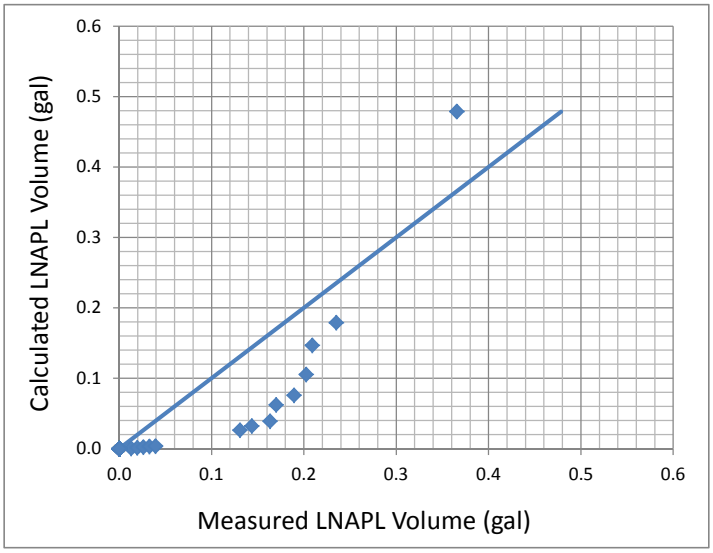
Root-Mean-Square Error: 0.309 <-- Minimize this using "Solver"

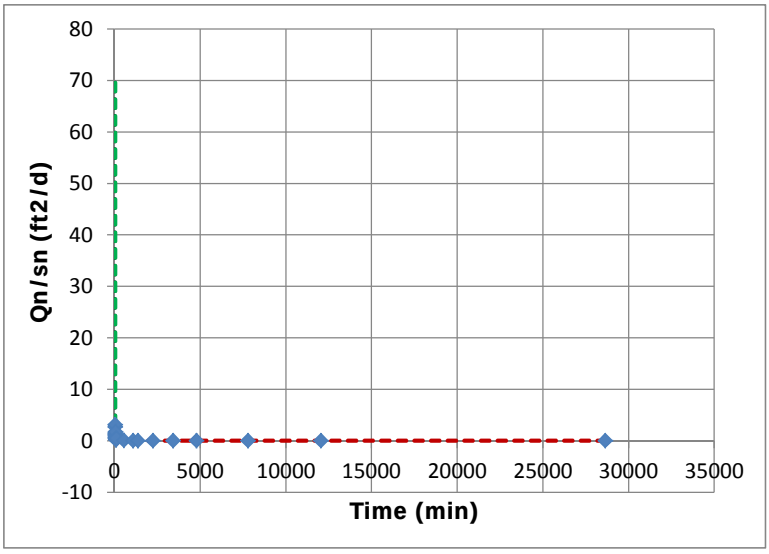
0.002 <-- Working S_n

Trial T_n (ft^2/d): 0.006 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.01**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	A-14
Date:	16-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	56	<- Enter or change values here
Initial Drawdown s_n (ft):	0.29	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.838 <-- Minimize this using "Solver"

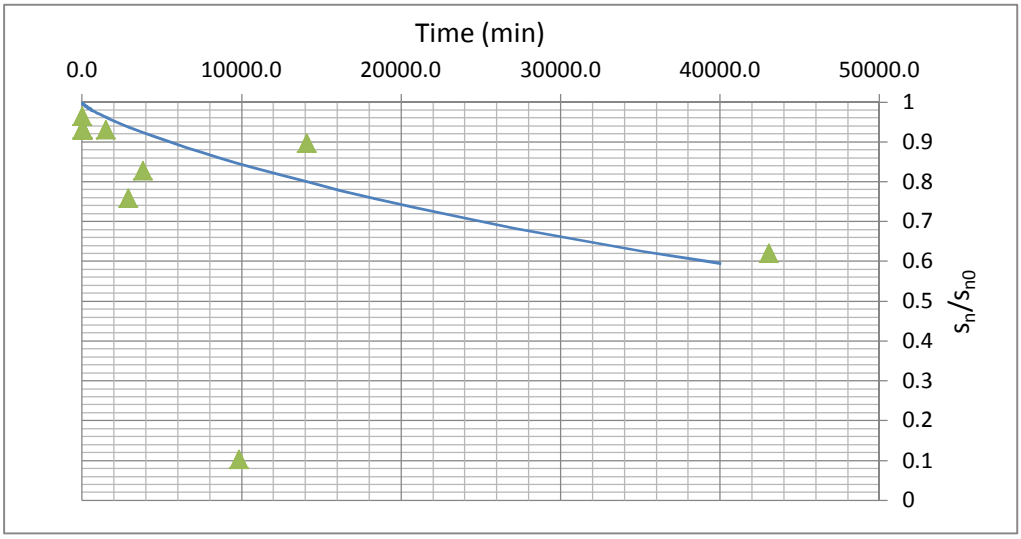
Trial T_n (ft^2/d): 0.004 <-- By changing T_n through "Solver"

0.002 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.00**

T_{min}	0.1
T_{max}	40000



J-Ratio
-0.213

Well Designation:	A-16	Beckett and Lyverse (2002)
Date:	17-Sep-13	

Ground Surface Elev (ft msl)	371.0	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	373.6		
Well Casing Radius, r_c (ft):	0.167	r_{e1}	0.75
Well Radius, r_w (ft):	0.417		
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.760		
Top of Screen (ft bgs):	5.0		
Bottom of Screen (ft bgs):	18.3		
LNAPL Baildown Vol. (gal.):	10.5		
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.217		
Initial Casing LNAPL Vol. (gal.):	4.43		
Initial Filter LNAPL Vol. (gal.):	4.07		

	Enter Data Here											
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	9.31	16.09	6.71	13.49	8.34					6.78	
Enter Test Data:	1.0	11.58	11.66	8.98	9.06	9.00	1.52				0.08	
	2.0	11.54	11.64	8.94	9.04	8.96	1.48	1.5	4.822	1.50	0.10	0.231
	3.0	11.44	11.57	8.84	8.97	8.87	1.38	2.5	7.234	1.43	0.13	0.231
	4.0	11.26	11.47	8.66	8.87	8.71	1.20	3.5	19.289	1.29	0.21	0.231
	5.0	11.2	11.44	8.60	8.84	8.66	1.14	4.5	7.234	1.17	0.24	0.231
	33.0	10.69	10.99	8.09	8.39	8.16	0.63	19.0	0.517	0.88	0.30	0.231
	38.0	10.67	10.98	8.07	8.38	8.14	0.61	35.5	0.482	0.62	0.31	0.231
	48.0	10.63	10.95	8.03	8.35	8.11	0.57	43.0	0.241	0.59	0.32	0.231
	101.0	10.58	10.97	7.98	8.37	8.07	0.52	74.5	0.318	0.54	0.39	0.231
	178.0	10.56	10.99	7.96	8.39	8.06	0.50	139.5	0.125	0.51	0.43	0.231
	226.00	10.57	11.02	7.97	8.42	8.08	0.51	202.0	0.100	0.50	0.45	0.231
	363.0	10.54	11.04	7.94	8.44	8.06	0.48	294.5	0.088	0.50	0.50	0.231
	1527.0	10.45	11.05	7.85	8.45	7.99	0.39	945.0	0.021	0.44	0.60	0.231
	1774.0	10.42	11.09	7.82	8.49	7.98	0.36	1650.5	0.068	0.38	0.67	0.231
	2711.0	10.45	11.26	7.85	8.66	8.04	0.39	2242.5	0.036	0.38	0.81	0.231
	3011.0	10.45	11.31	7.85	8.71	8.06	0.39	2861.0	0.040	0.39	0.86	0.231
	3231.00	10.48	11.35	7.88	8.75	8.09	0.42	3121.0	0.011	0.41	0.87	0.231
	4230.00	10.48	11.52	7.88	8.92	8.13	0.42	3730.5	0.041	0.42	1.04	0.231
	8727.00	10.19	11.25	7.59	8.65	7.84	0.13	6478.5	0.001	0.28	1.06	0.231
	12982.00	10.35	11.80	7.75	9.20	8.10	0.29	10854.5	0.022	0.21	1.45	0.231
	41928.00	10.1	12.50	7.50	9.90	8.08	0.04	27455.0	0.008	0.17	2.40	0.231

Figure 1

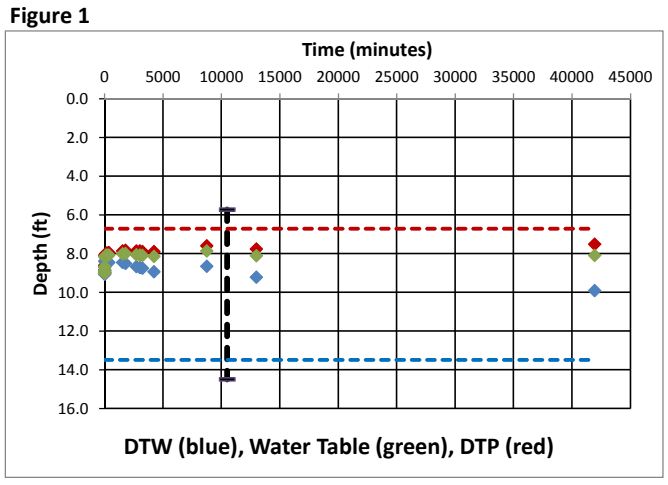
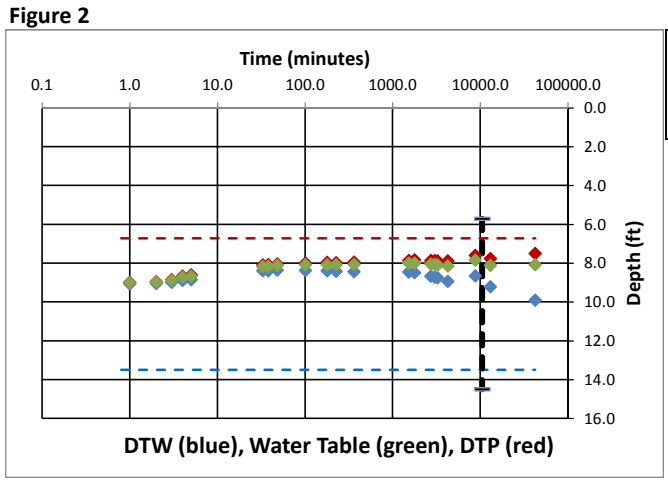


Figure 2



0.8	6.71
41928	6.71
0.8	13.49
41928	13.49

10482.0	5.71	5.7
10482.0	14.5	14.5

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.5	0.38

Drawdown Adjust.	
Δs_n (ft)	0.75

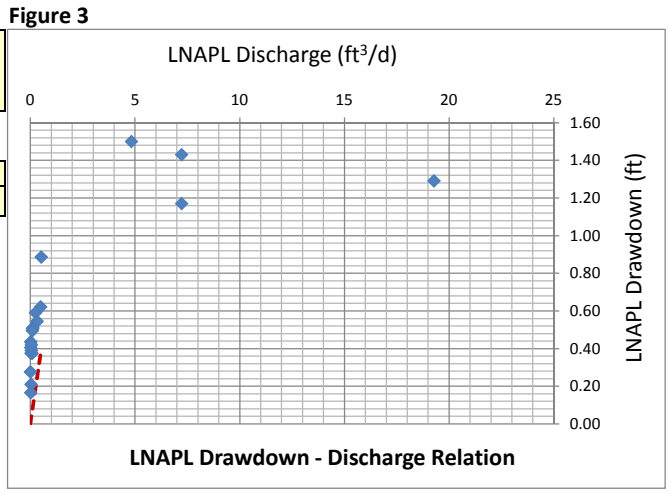
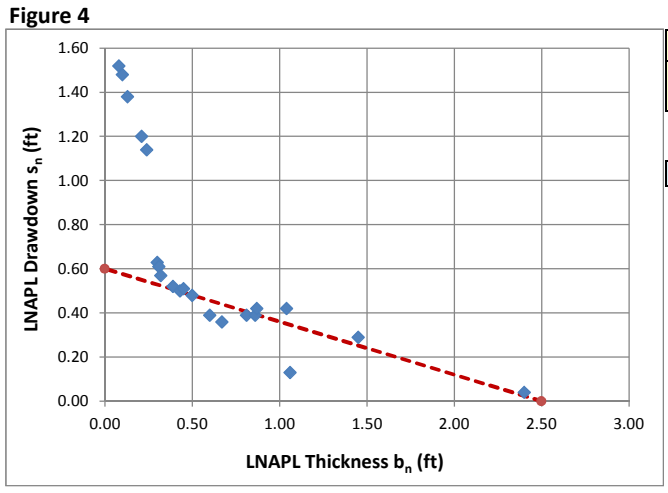


Figure 4



b_n	s_n
2.5	0
0	0.6

J-ratio	-0.240

Figure 5

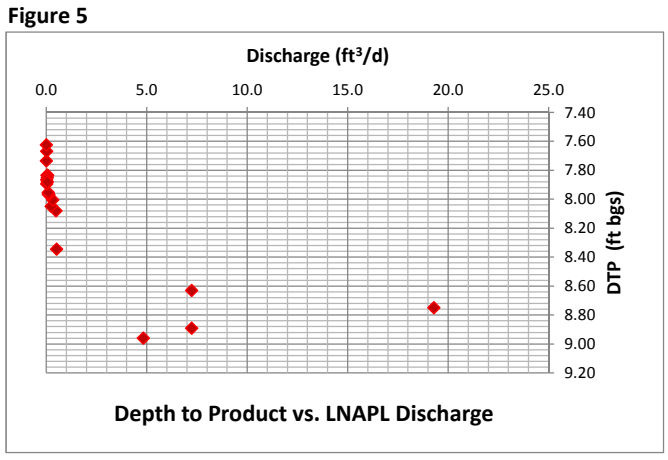


Figure 6

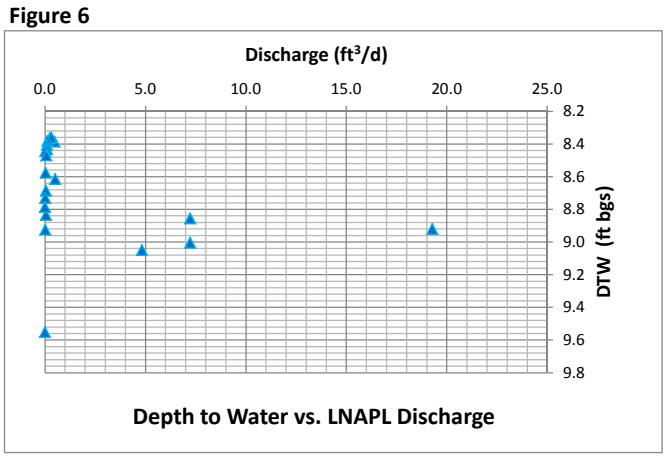


Figure 7

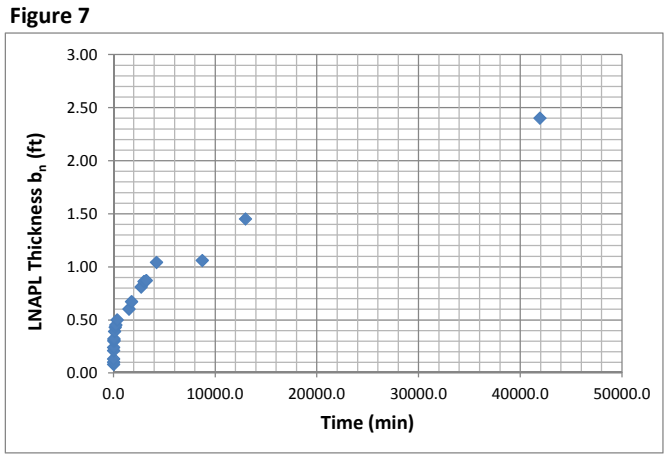


Figure 8

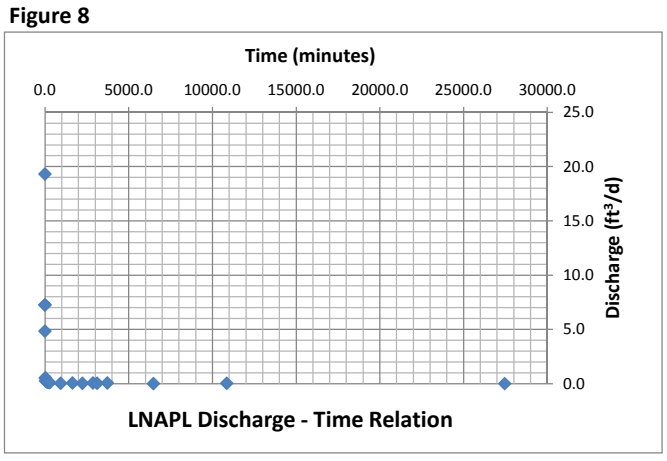


Figure 9

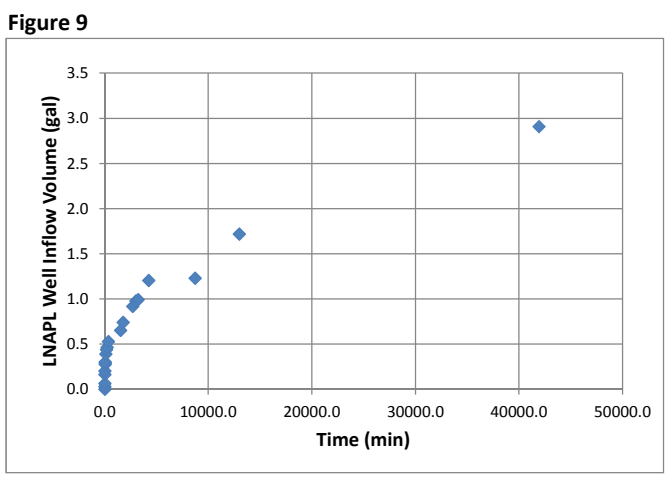
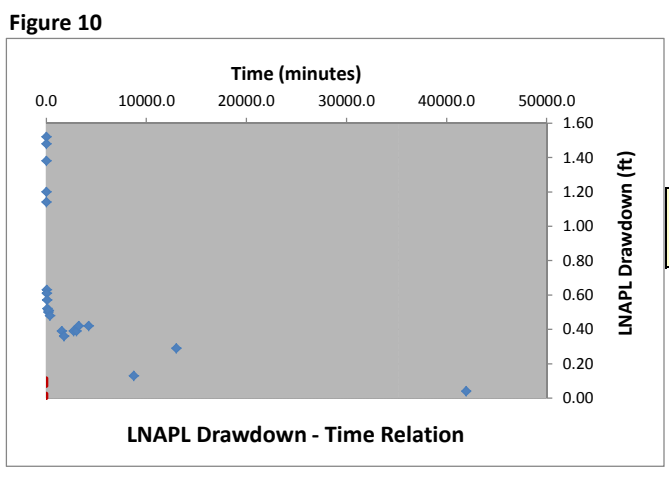


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	A-16
Date:	17-Sep-13

$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

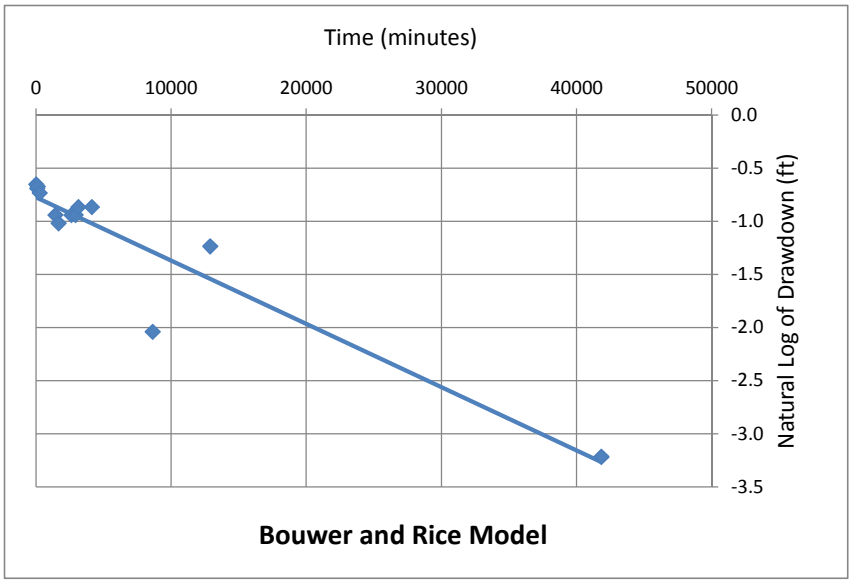
$Time_{cut}$	100	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.02 +/- 0.00 ft^2/d

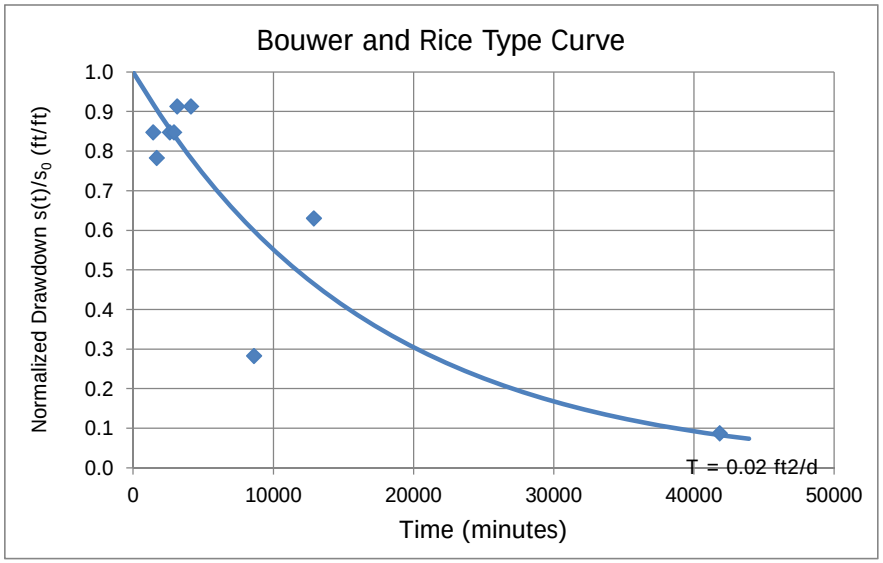
L_e/r_e
29.4
C
1.97
R/r_e
12.79

J-Ratio
-0.240

Coef. Of Variation
0.11



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	A-16
Date:	17-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^{\,2} S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	100	<- Enter or change values here
Time Adjustment (min):	66.66667	

Trial S_n: d <-- Enter d for default or enter S_n value

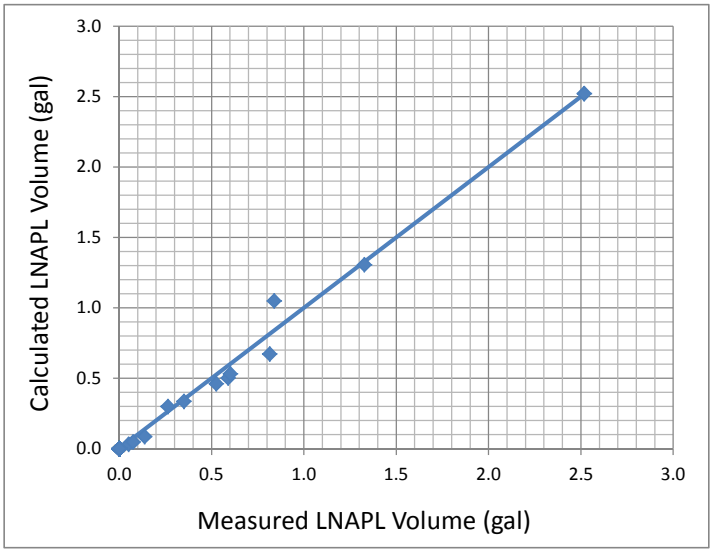
Root-Mean-Square Error: 0.295 <-- Minimize this using "Solver"

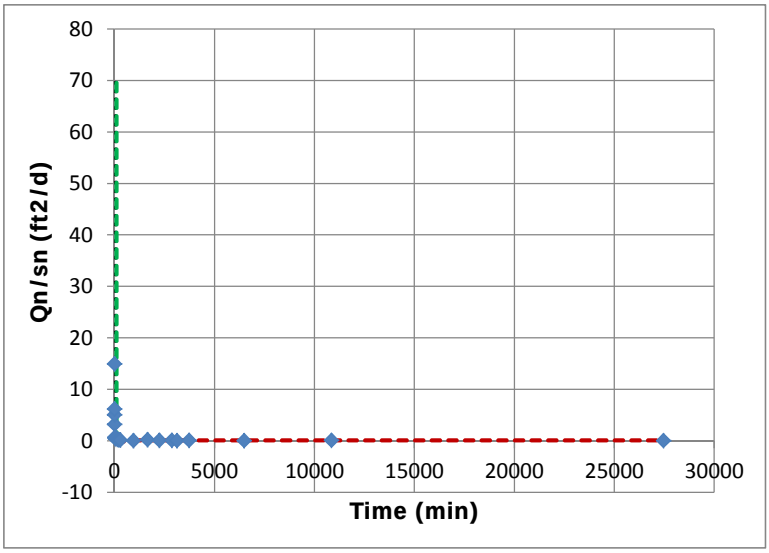
0.005 <-- Working S_n

Trial T_n (ft^2/d): 0.034 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.03**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	A-16
Date:	17-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	100	<- Enter or change values here
Initial Drawdown s_n (ft):	0.52	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.377 <-- Minimize this using "Solver"

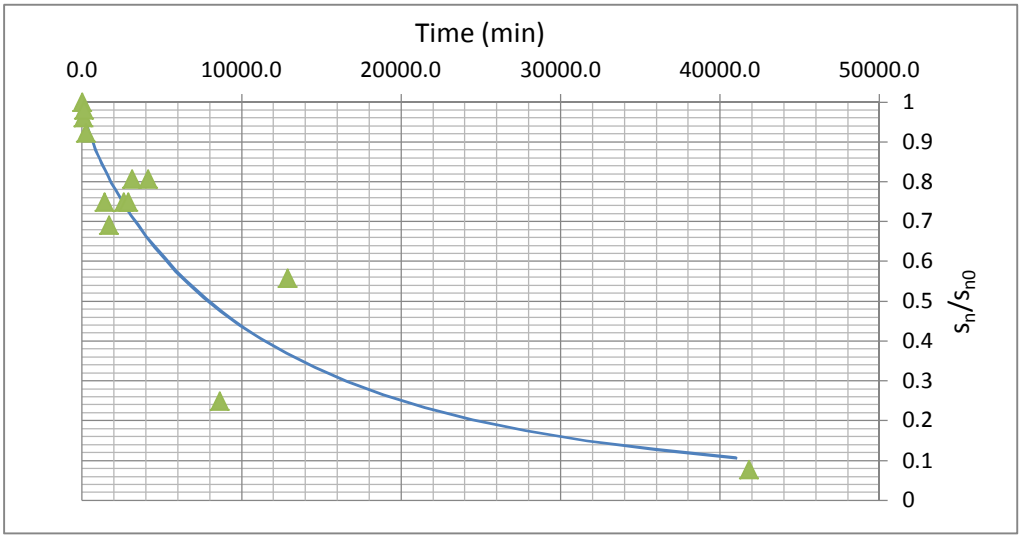
Trial T_n (ft^2/d): 0.040 <-- By changing T_n through "Solver"

0.005 <-- Working S_n

Add constraint Tn > 0.00001

T_{min}	0.1
T_{max}	41000

Model Result: T_n (ft^2/d) = **0.04**



J-Ratio
-0.240

Well Designation:	A-17	Beckett and Lyverse (2002)
Date:	17-Sep-13	

Ground Surface Elev (ft msl)	370.8	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	372.3		
Well Casing Radius, r_c (ft):	0.167	r_{e1}	-0.3
Well Radius, r_w (ft):	0.417		
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.797		
Top of Screen (ft bgs):	5.0		
Bottom of Screen (ft bgs):	17.7		
LNAPL Baildown Vol. (gal.):	4.3		
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.188		
Initial Casing LNAPL Vol. (gal.):	4.43		
Initial Filter LNAPL Vol. (gal.):	4.07		

	Enter Data Here										
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	9.31	16.09	7.82	14.6	9.20					6.78	
Enter Test Data:	1.0	10.65	10.86	9.16	9.37	9.20	1.64				0.21	
	2.0	10.57	10.79	9.08	9.30	9.12	1.56	1.5	2.411	1.60	0.22	0.231
	3.0	10.45	10.71	8.96	9.22	9.01	1.44	2.5	9.645	1.50	0.26	0.231
	4.0	10.36	10.63	8.87	9.14	8.92	1.35	3.5	2.411	1.40	0.27	0.231
	18.0	9.63	9.93	8.14	8.44	8.20	0.62	11.0	0.517	0.99	0.30	0.231
	23.0	9.51	9.84	8.02	8.35	8.09	0.50	20.5	1.447	0.56	0.33	0.231
	28.0	9.44	9.80	7.95	8.31	8.02	0.43	25.5	1.447	0.46	0.36	0.231
	33.0	9.39	9.77	7.90	8.28	7.98	0.38	30.5	0.964	0.40	0.38	0.231
	38.00	9.34	9.75	7.85	8.26	7.93	0.33	35.5	1.447	0.35	0.41	0.231
	48.00	9.28	9.72	7.79	8.23	7.88	0.27	43.0	0.723	0.30	0.44	0.231
	58.00	9.25	9.70	7.76	8.21	7.85	0.24	53.0	0.241	0.25	0.45	0.231
	68.00	9.23	9.70	7.74	8.21	7.84	0.22	63.0	0.482	0.23	0.47	0.231
	90.00	9.21	9.71	7.72	8.22	7.82	0.20	79.0	0.329	0.21	0.50	0.231
	105.0	9.2	9.71	7.71	8.22	7.81	0.19	97.5	0.161	0.19	0.51	0.231
	125.00	9.19	9.71	7.70	8.22	7.81	0.18	115.0	0.121	0.18	0.52	0.231
	154.00	9.19	9.73	7.70	8.24	7.81	0.18	139.5	0.166	0.18	0.54	0.231
	237.00	9.16	9.72	7.67	8.23	7.78	0.15	195.5	0.058	0.17	0.56	0.231
	370.0	9.18	9.75	7.69	8.26	7.81	0.17	303.5	0.018	0.16	0.57	0.231
	1661.0	9.10	9.70	7.61	8.21	7.73	0.09	1015.5	0.006	0.13	0.60	0.231
	3366.00	9.14	9.75	7.65	8.26	7.77	0.13	2513.5	0.001	0.11	0.61	0.231
	42073	9.05	9.70	7.56	8.21	7.69	0.04	22719.5	0.000	0.08	0.65	0.231

Figure 1

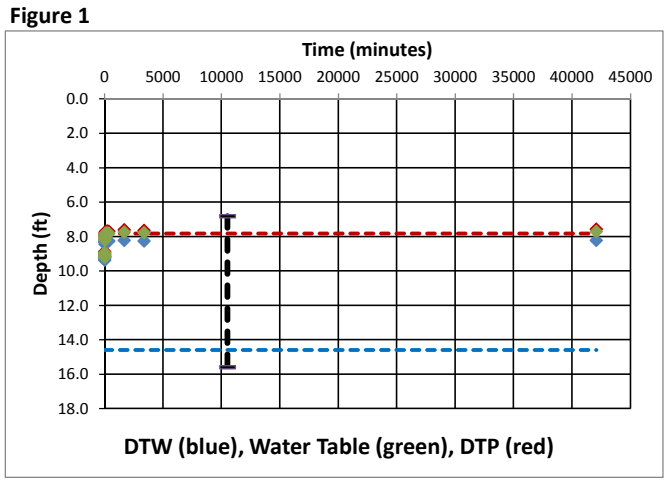
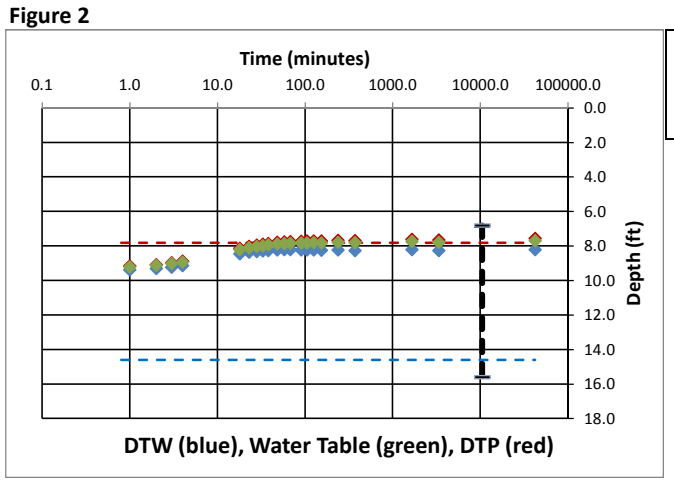


Figure 2



0.8	7.82
42073	7.82
0.8	14.6
42073	14.6

10518.3	6.82	6.8
10518.3	15.6	15.6

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.5	0.38

Drawdown Adjust.	
Δs_n (ft)	-0.3

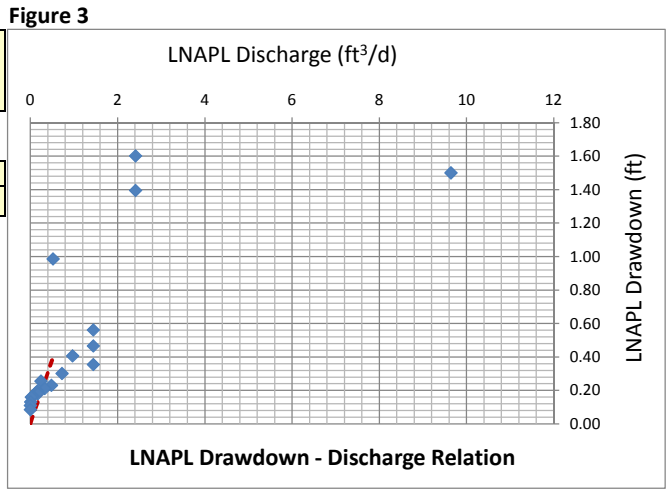
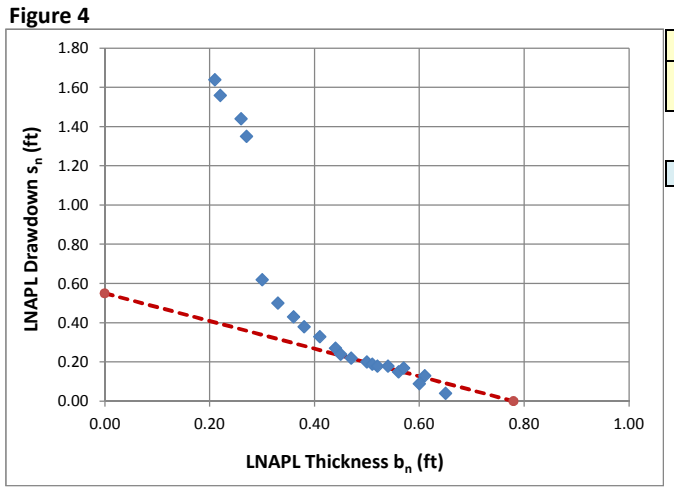


Figure 4



b_n	s_n
0.78	0
0	0.55

J-ratio	-0.705

Figure 5

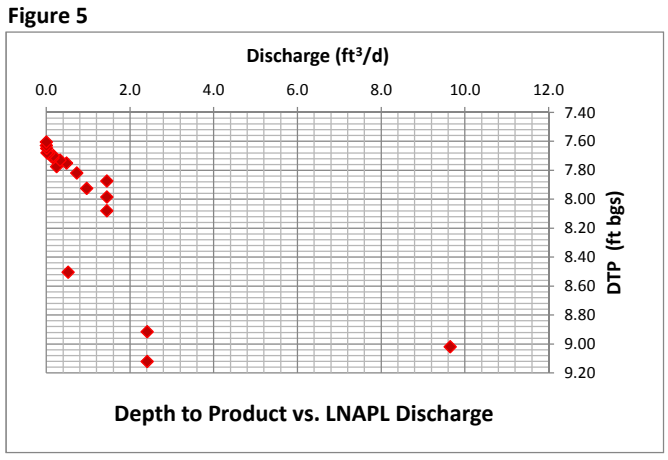


Figure 6

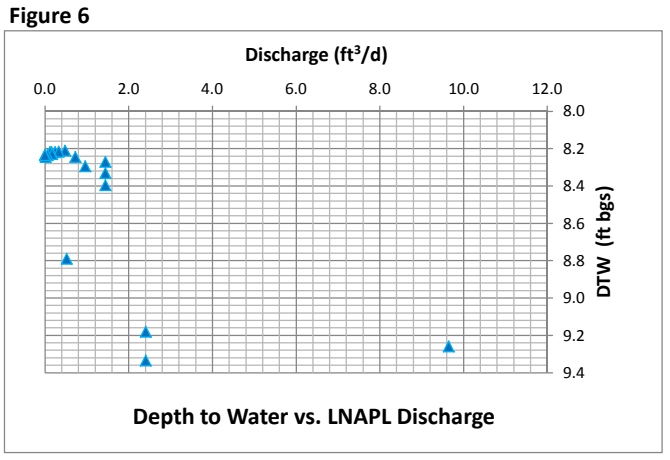


Figure 7

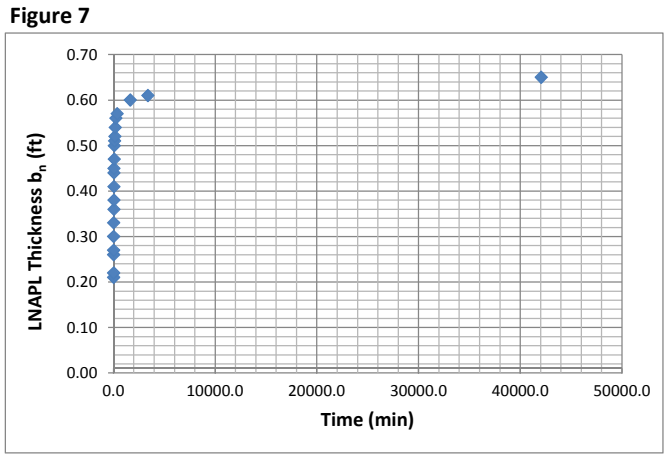


Figure 8

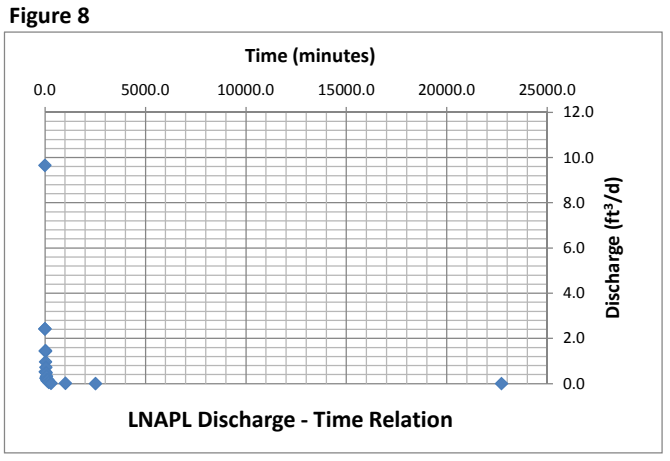


Figure 9

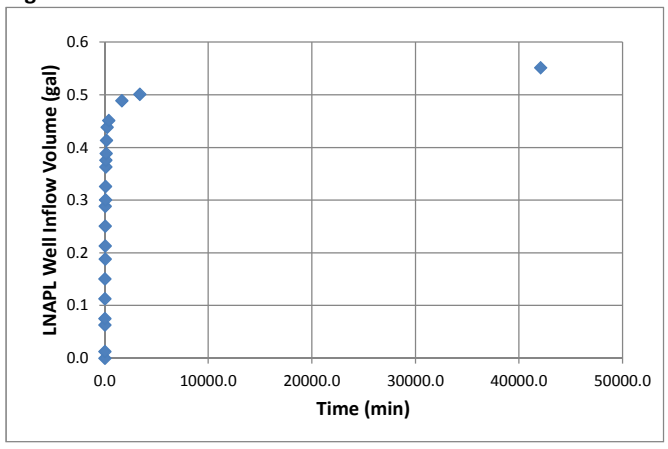
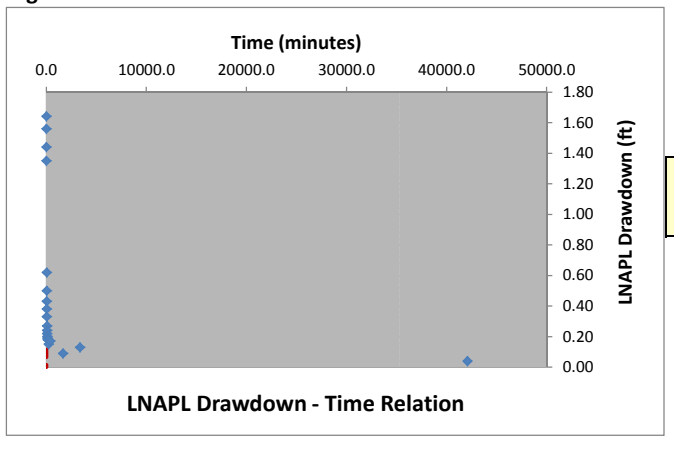


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	A-17
Date:	17-Sep-13

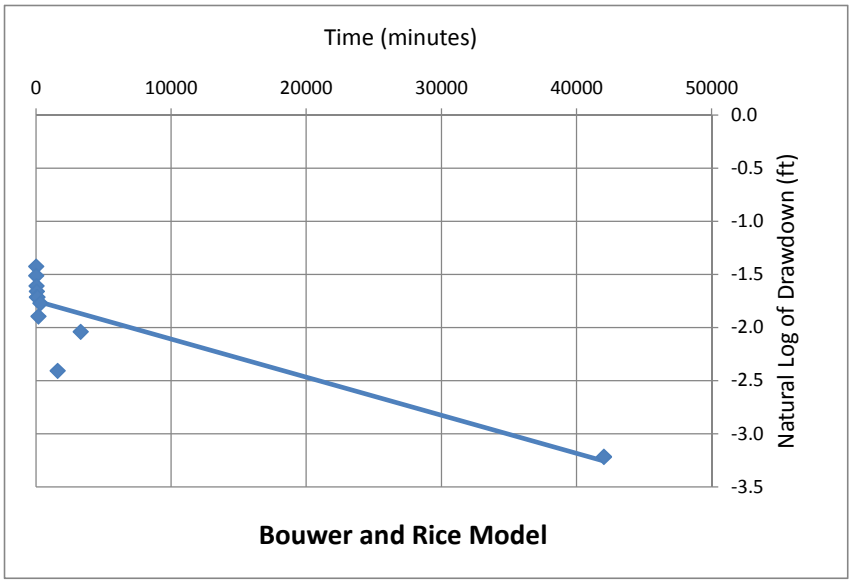
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

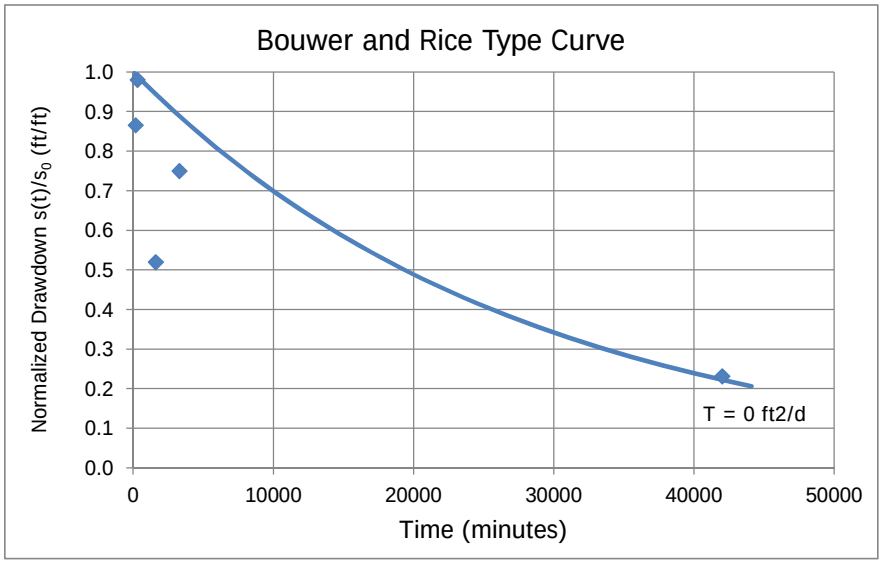
$Time_{cut}$	57	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.00 +/- 0.00 ft^2/d

L_e/r_e	29.4
C	1.97
R/r_e	12.79
J-Ratio	-0.705
Coef. Of Variation	0.18



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	A-17
Date:	17-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^{\,2} S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	57	<- Enter or change values here
Time Adjustment (min):	38	

Trial S_n: d <-- Enter d for default or enter S_n value

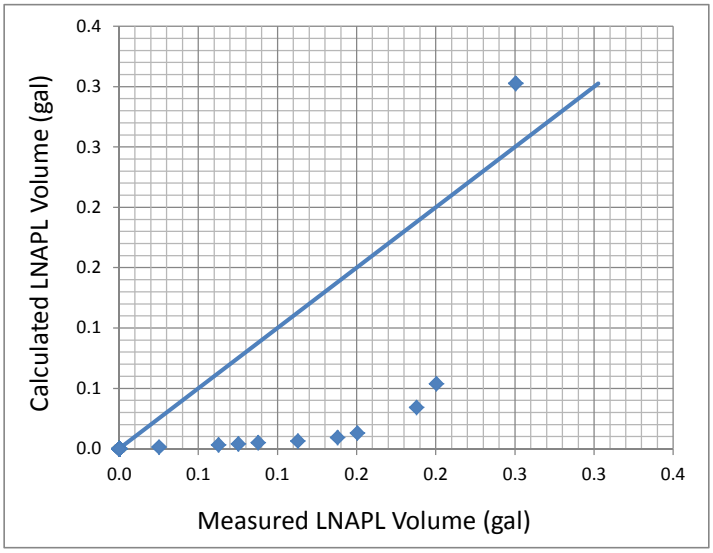
Root-Mean-Square Error: 0.333 <-- Minimize this using "Solver"

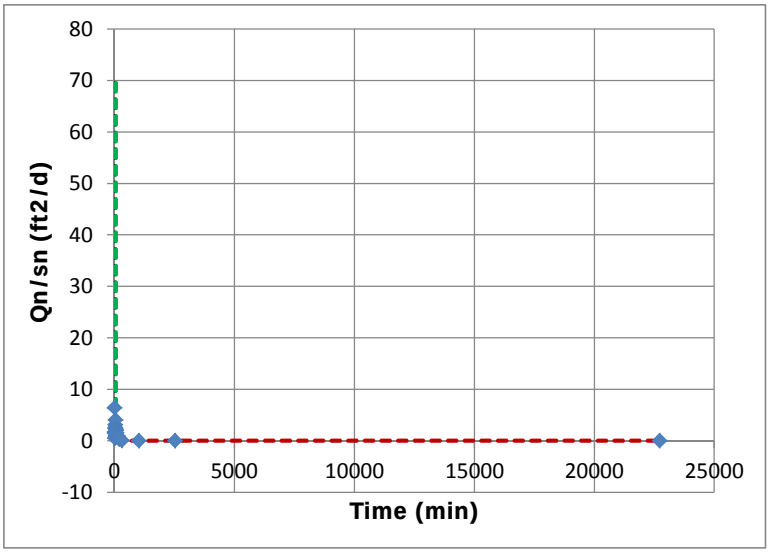
0.002 <-- Working S_n

Trial T_n (ft^2/d): 0.009 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.01**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	A-17
Date:	17-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	57	<- Enter or change values here
Initial Drawdown s_n (ft):	0.24	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.817 <-- Minimize this using "Solver"

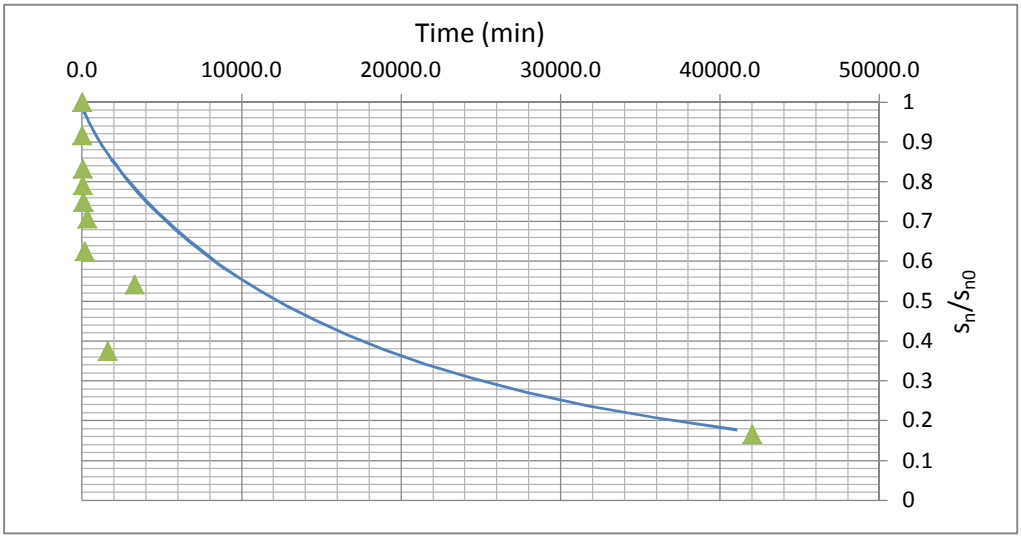
Trial T_n (ft^2/d): 0.010 <-- By changing T_n through "Solver"

0.003 <-- Working S_n

Add constraint Tn > 0.00001

T_{min}	0.1
T_{max}	41000

Model Result: T_n (ft^2/d) = **0.01**



J-Ratio
-0.705

Well Designation:	A-25
Date:	17-Sep-13

Beckett and Lyverse (2002)

Ground Surface Elev (ft msl)	372.5
Top of Casing Elev (ft msl)	374.6
Well Casing Radius, r_c (ft):	0.083
Well Radius, r_w (ft):	0.333
LNAPL Specific Yield, S_y:	0.175
LNAPL Density Ratio, ρ_r:	0.764
Top of Screen (ft bgs):	5.0
Bottom of Screen (ft bgs):	16.0
LNAPL Baildown Vol. (gal.):	0.2
Effective Radius, r_{e3} (ft):	0.159
Effective Radius, r_{e2} (ft):	0.144
Initial Casing LNAPL Vol. (gal.):	0.05
Initial Filter LNAPL Vol. (gal.):	0.12

Enter These Data

r_{e1}

Calculated Parameters

Drawdown Adjustment (ft)
-0.01

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	9.01	9.3	6.89	7.18	6.96	0.04				0.29	
Enter Test Data:	13.0	9.64	9.65	7.52	7.53	7.52	0.05				0.01	
	17.0	9.60	9.62	7.48	7.50	7.48	0.04	15.0	0.285	0.04	0.02	0.159
	22.0	9.56	9.60	7.44	7.48	7.45	0.04	19.5	0.456	0.04	0.04	0.159
	32.0	9.5	9.55	7.38	7.43	7.39	0.04	27.0	0.114	0.04	0.05	0.159
	37.0	9.46	9.52	7.34	7.40	7.35	0.03	34.5	0.228	0.03	0.06	0.159
	47.0	9.41	9.49	7.29	7.37	7.31	0.03	42.0	0.228	0.03	0.08	0.159
	77.00	9.28	9.38	7.16	7.26	7.18	0.02	62.0	0.076	0.03	0.10	0.159
	137.00	9.15	9.26	7.03	7.14	7.06	0.02	107.0	0.019	0.02	0.11	0.159
	257.00	9.02	9.15	6.90	7.03	6.93	0.02	197.0	0.019	0.02	0.13	0.159
	333.0	8.98	9.12	6.86	7.00	6.89	0.01	295.0	0.015	0.02	0.14	0.159
	483.0	8.95	9.10	6.83	6.98	6.87	0.01	408.0	0.008	0.01	0.15	0.159
	1893.00	8.94	9.10	6.82	6.98	6.86	0.01	1188.0	0.001	0.01	0.16	0.159

Figure 1

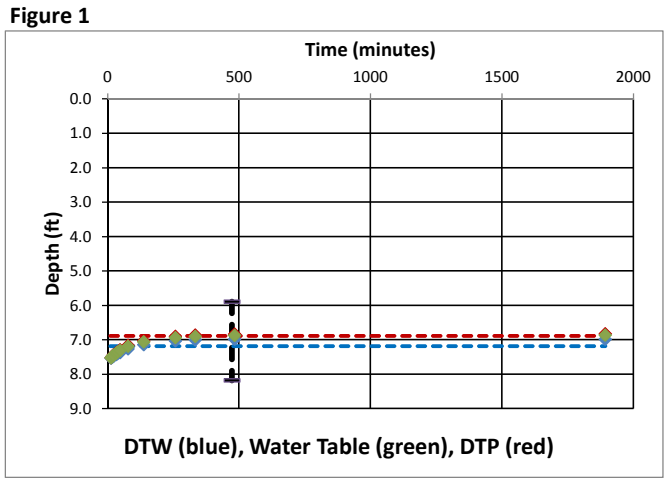
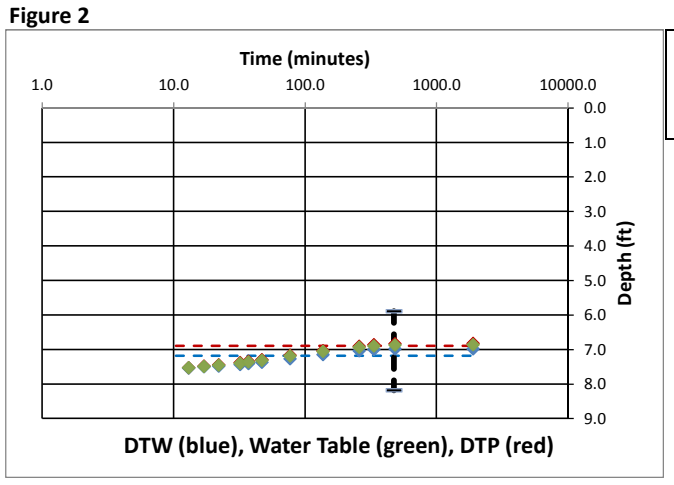


Figure 2



10.4	6.89
1893	6.89
10.4	7.18
1893	7.18

473.2	5.89	5.9
473.2	8.2	8.2

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.03	0.06

Drawdown Adjust.	
Δs_n (ft)	-0.01

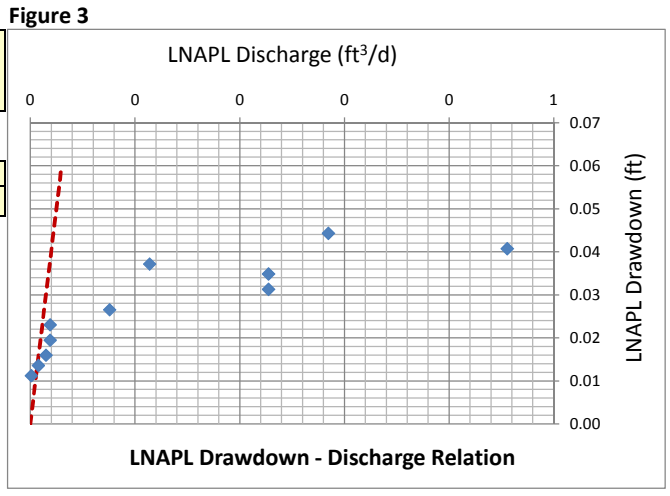
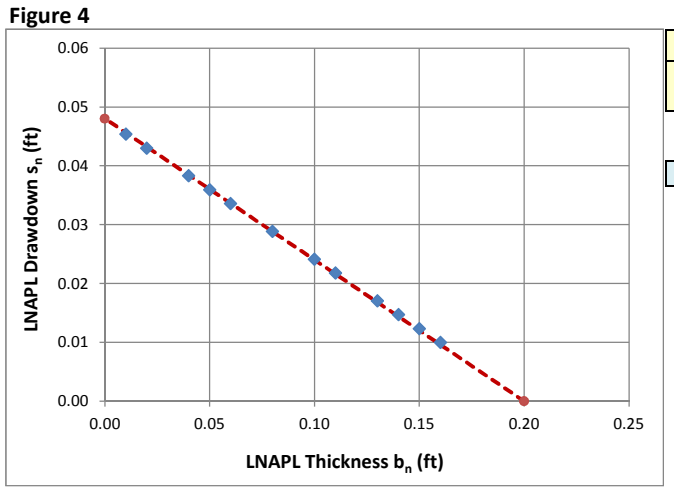


Figure 4



b_n	s_n
0.2	0
0	0.048

J-ratio	-0.240

Figure 5

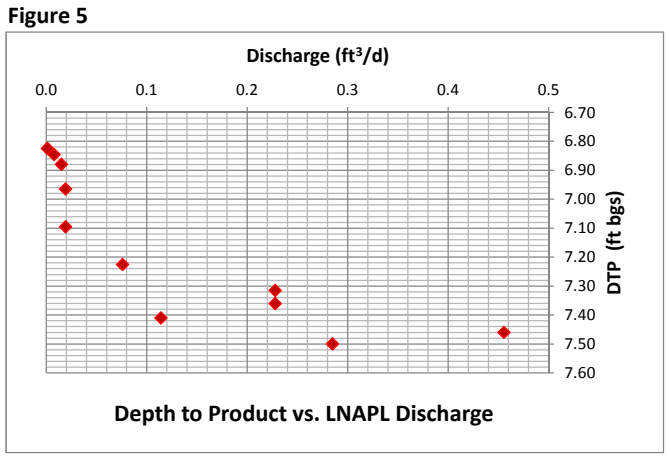


Figure 6

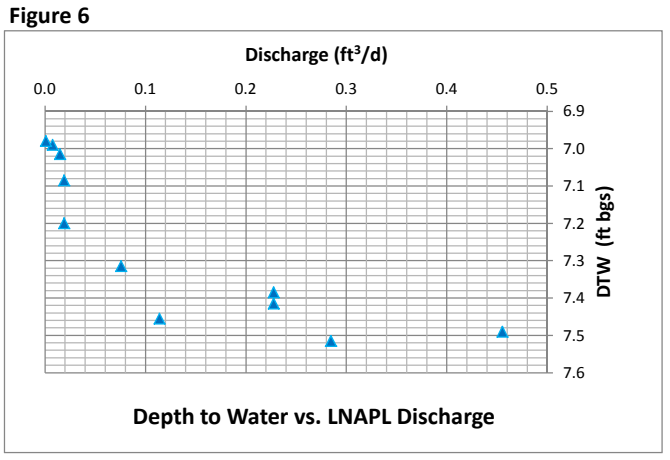


Figure 7

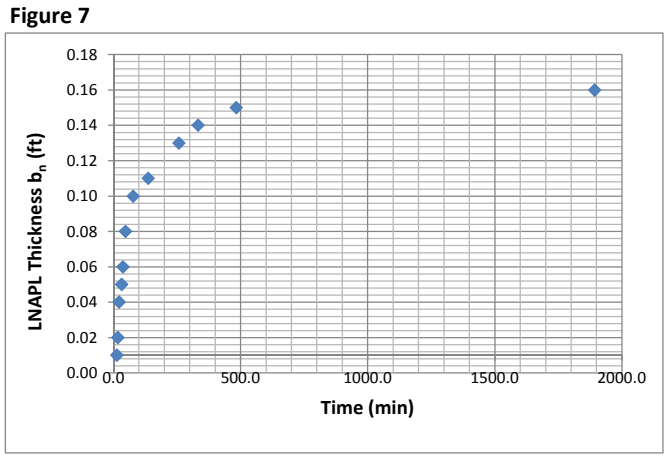


Figure 8

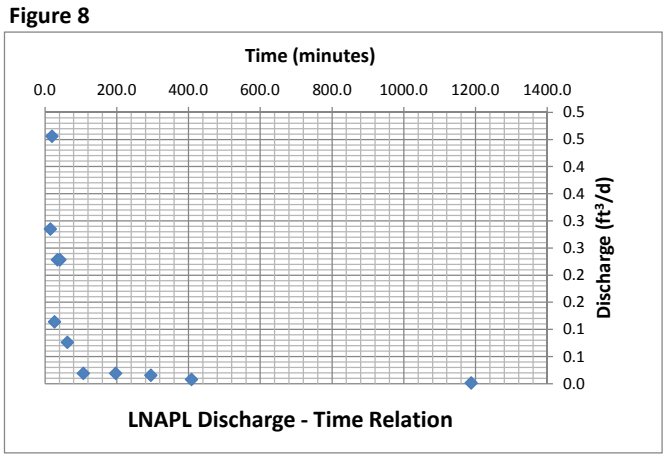


Figure 9

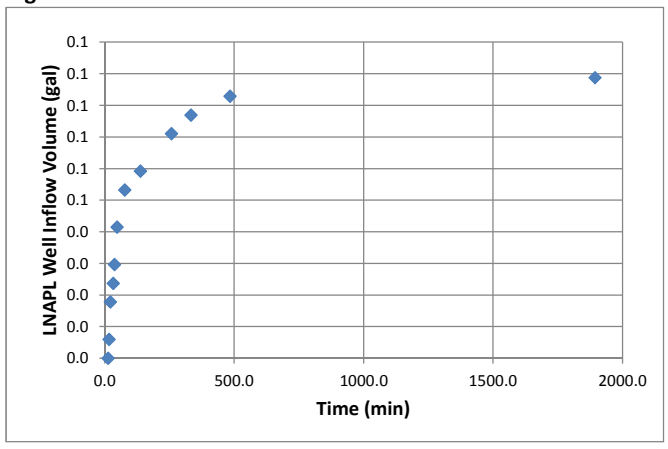
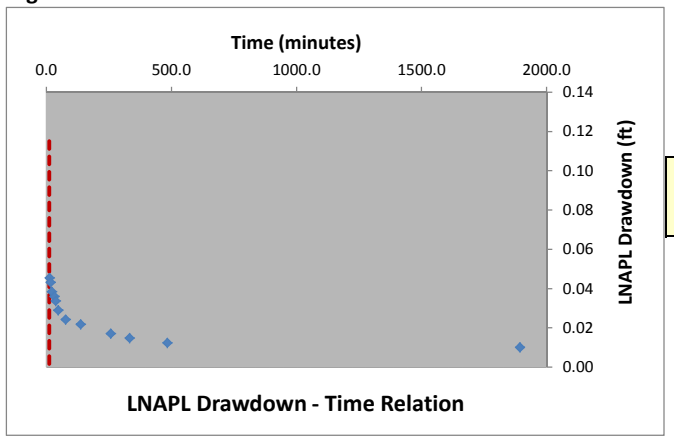


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	A-25
Date:	17-Sep-13

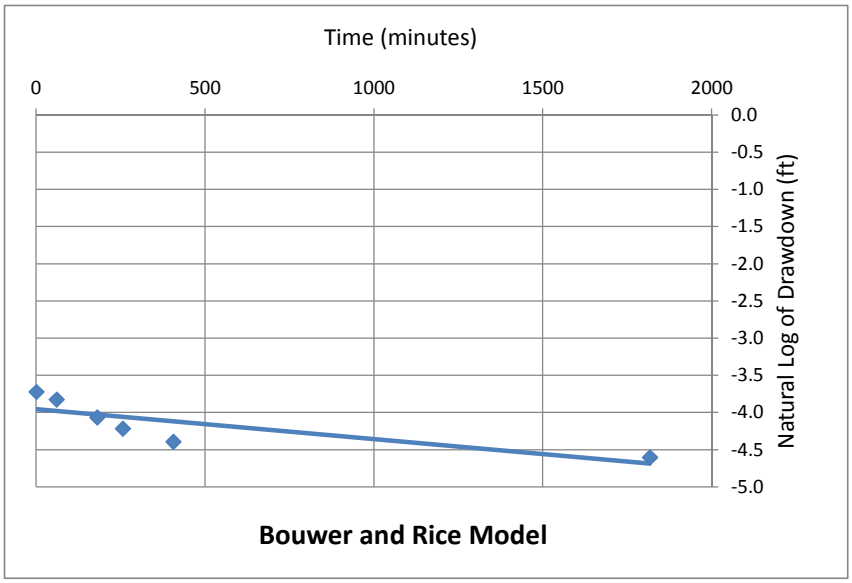
$$T_n = \frac{r_e^{\,2}\,\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

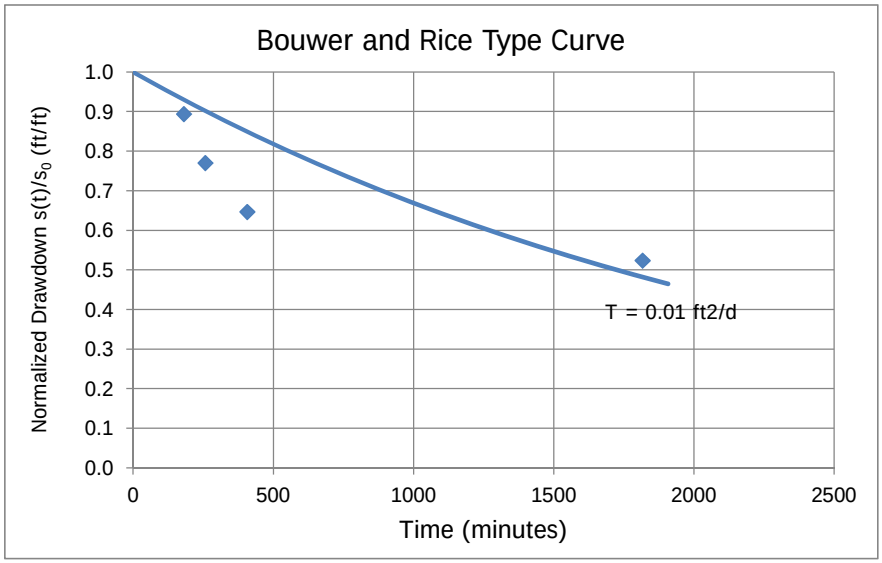
$Time_{cut}$	76	<- Enter or change value here

Model Results:	T_n (ft^2/d) = 0.01	+/-	0.00	ft^2/d

L_e/r_e	1.8
C	0.86
R/r_e	1.55
J-Ratio	-0.240
Coef. Of Variation	0.35



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	A-25
Date:	17-Sep-13

$$V_n(t_i) = \sum_{j}^{i} \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^{\,2} S_n}\right)} \Delta t_j$$

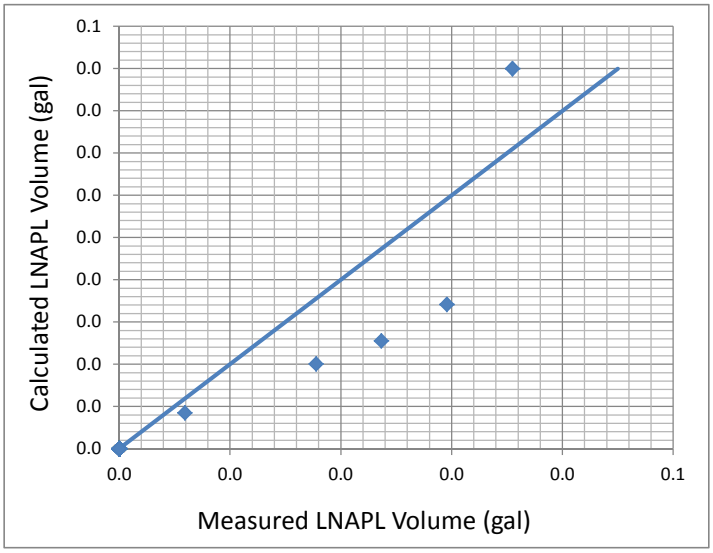
Enter early time cut-off for least-squares model fit

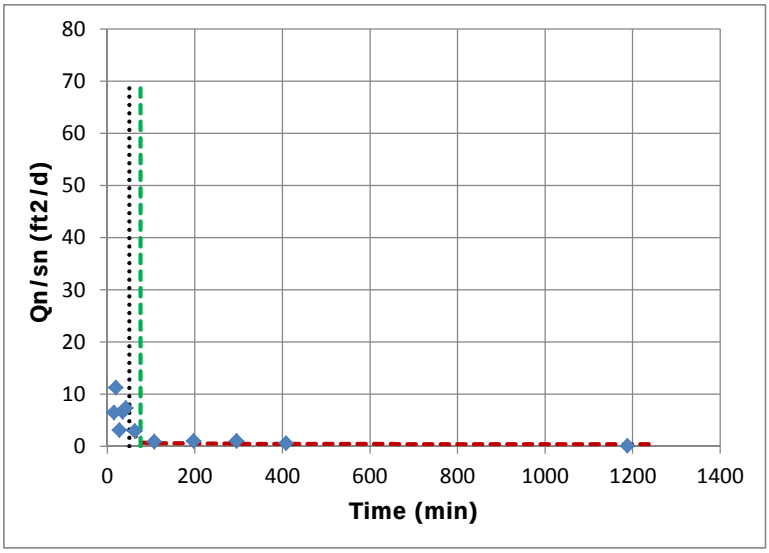
$Time_{cut}$ (min):	76	<- Enter or change values here
Time Adjustment (min):	50.66667	

Trial S_n:	d	<-- Enter d for default or enter S_n value
Root-Mean-Square Error:	0.021	<-- Minimize this using "Solver"
	0.011	<-- Working S_n
Trial T_n (ft^2/d):	0.193	<-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.19**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	A-25
Date:	17-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	76	<- Enter or change values here
Initial Drawdown s_n (ft):	0.02	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.321 <-- Minimize this using "Solver"

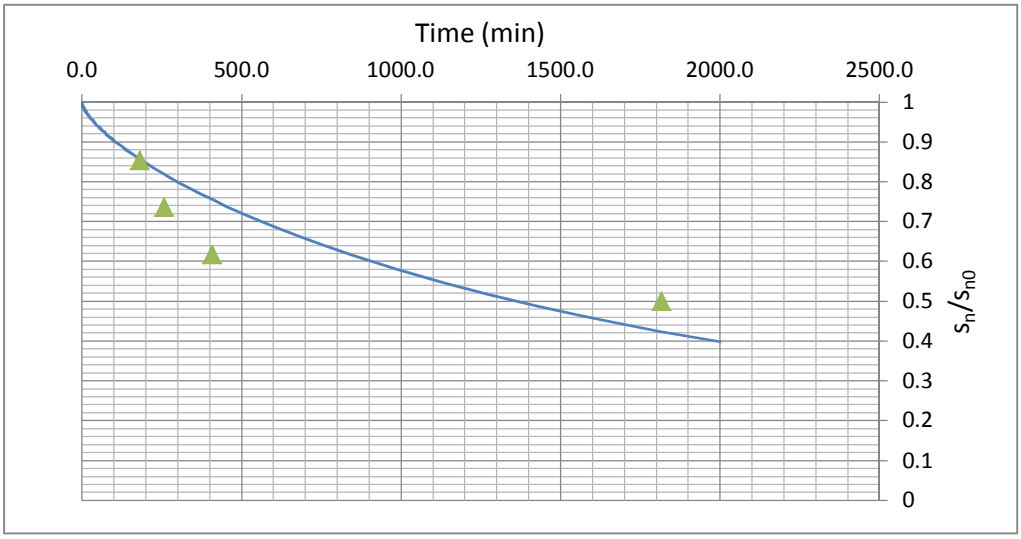
Trial T_n (ft^2/d): 0.100 <-- By changing T_n through "Solver"

0.008 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.10**

T_{min}	0.1
T_{max}	2000



J-Ratio
-0.240

Well Designation:	AMW-9	Beckett and Lyverse (2002)
Date:	17-Sep-13	

Ground Surface Elev (ft msl)	370.3	Enter These Data
Top of Casing Elev (ft msl)	376.2	
Well Casing Radius, r_c (ft):	0.083	r_{e1}
Well Radius, r_w (ft):	0.333	
LNAPL Specific Yield, S_y:	0.175	
LNAPL Density Ratio, ρ_r:	0.785	
Top of Screen (ft bgs):	3.5	
Bottom of Screen (ft bgs):	14.2	
LNAPL Baildown Vol. (gal.):	2.5	
Effective Radius, r_{e3} (ft):	0.159	Calculated Parameters
Effective Radius, r_{e2} (ft):	0.145	
Initial Casing LNAPL Vol. (gal.):	0.55	
Initial Filter LNAPL Vol. (gal.):	1.44	

Drawdown Adjustment (ft)
0.38

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	11.86	15.21	6.02	9.37	6.74					3.35	
Enter Test Data:	1.0	14.16	14.34	8.32	8.50	8.36	1.92				0.18	
	3.0	14.08	14.27	8.24	8.43	8.28	1.84	2.0	0.569	1.88	0.19	0.159
	4.00	14.04	14.24	8.20	8.40	8.24	1.80	3.5	1.139	1.82	0.20	0.159
	6.0	13.92	14.13	8.08	8.29	8.13	1.68	5.0	0.569	1.74	0.21	0.159
	9.0	13.83	14.06	7.99	8.22	8.04	1.59	7.5	0.759	1.63	0.23	0.159
	11.00	13.8	14.04	7.96	8.20	8.01	1.56	10.0	0.569	1.57	0.24	0.159
	17.0	13.70	13.96	7.86	8.12	7.92	1.46	14.0	0.380	1.51	0.26	0.159
	37.0	13.33	13.62	7.49	7.78	7.55	1.09	27.0	0.171	1.27	0.29	0.159
	68.0	13.1	13.40	7.26	7.56	7.32	0.86	52.5	0.037	0.97	0.30	0.159
	128.0	12.91	13.30	7.07	7.46	7.15	0.67	98.0	0.171	0.77	0.39	0.159
	258.0	12.86	13.32	7.02	7.48	7.12	0.62	193.0	0.061	0.65	0.46	0.159
	382.0	12.79	13.36	6.95	7.52	7.07	0.55	320.0	0.101	0.59	0.57	0.159
	1308.0	12.72	13.49	6.88	7.65	7.05	0.48	845.0	0.025	0.52	0.77	0.159
	1548.00	12.71	13.50	6.87	7.66	7.04	0.47	1428.0	0.009	0.47	0.79	0.159
	1794.00	12.67	13.50	6.83	7.66	7.01	0.43	1671.0	0.019	0.45	0.83	0.159
	2733.0	12.70	13.72	6.86	7.88	7.08	0.46	2263.5	0.023	0.44	1.02	0.159
	3253.00	12.7	13.92	6.86	8.08	7.12	0.46	2993.0	0.044	0.46	1.22	0.159
	4250.0	12.7	14.11	6.86	8.27	7.16	0.46	3751.5	0.022	0.46	1.41	0.159
	4489.00	12.7	14.17	6.86	8.33	7.18	0.46	4369.5	0.029	0.46	1.47	0.159
	13003.0	12.42	15.10	6.58	9.26	7.16	0.18	8746.0	0.016	0.32	2.68	0.159
	30185.00	12.25	14.85	6.41	9.01	6.97	0.01	21594.0	-0.001	0.09	2.60	0.159

Figure 1

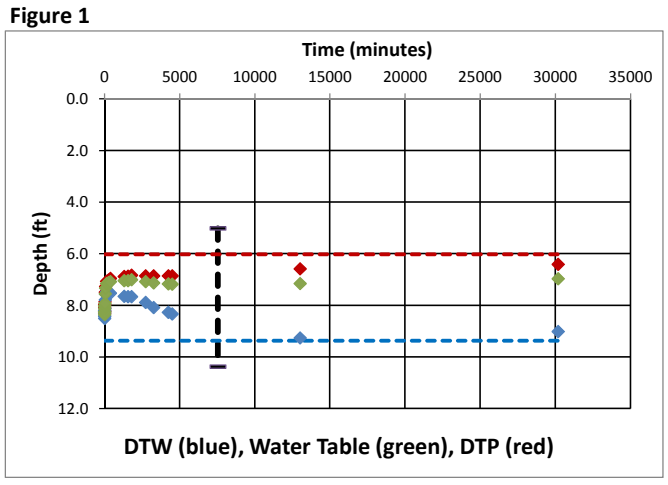
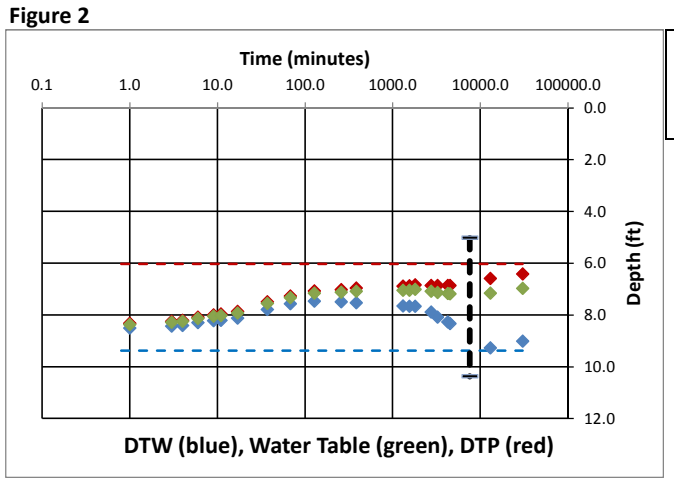


Figure 2



0.8	6.02
30185	6.02
0.8	9.37
30185	9.37

7546.2	5.02	5.0
7546.2	10.4	10.4

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.1	1.5

Drawdown Adjust.	
Δs_n (ft)	0.38

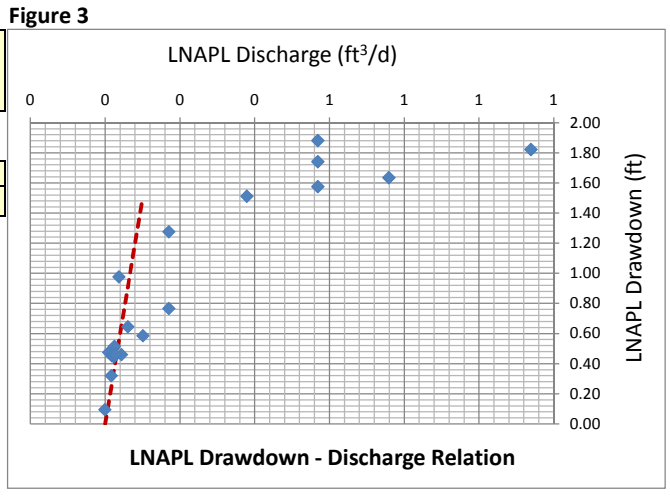
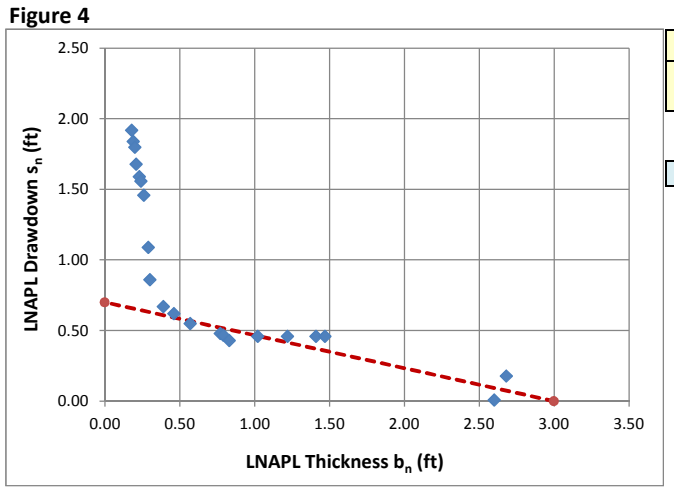


Figure 4



b_n	s_n
3	0
0	0.7

J-ratio	-0.233

Figure 5

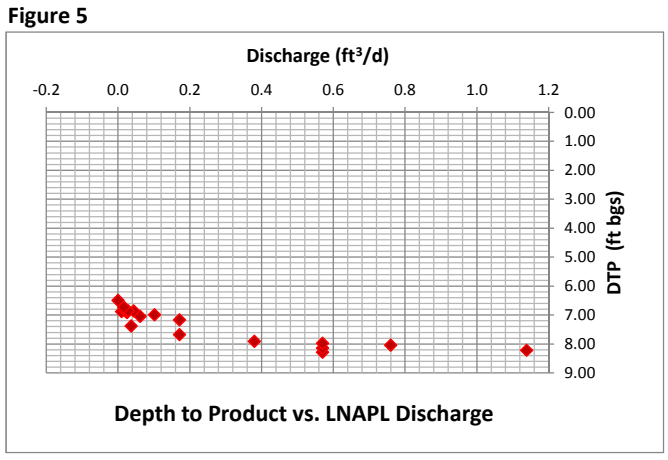


Figure 6

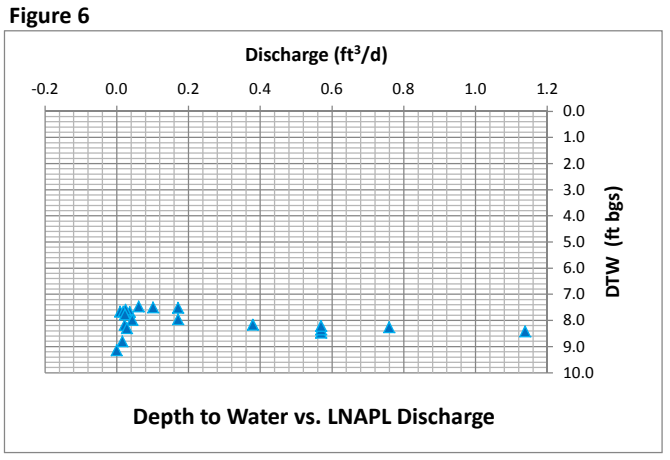


Figure 7

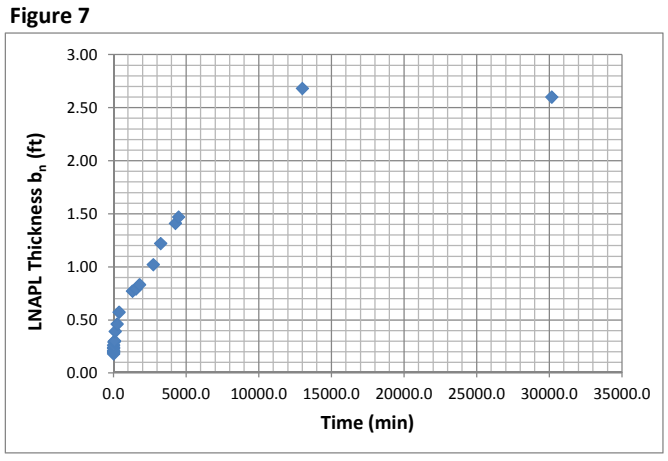


Figure 8

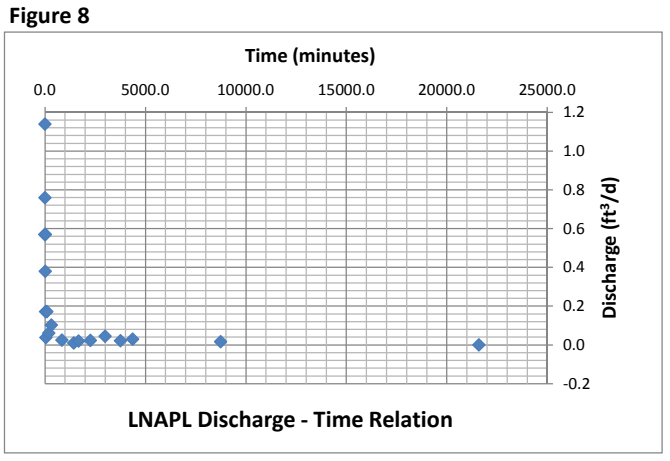


Figure 9

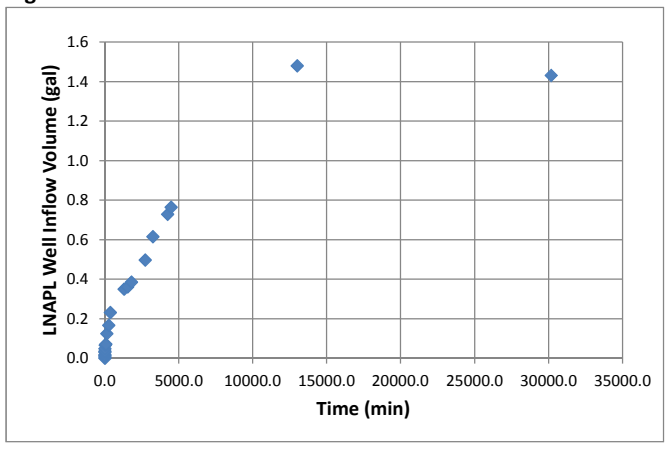
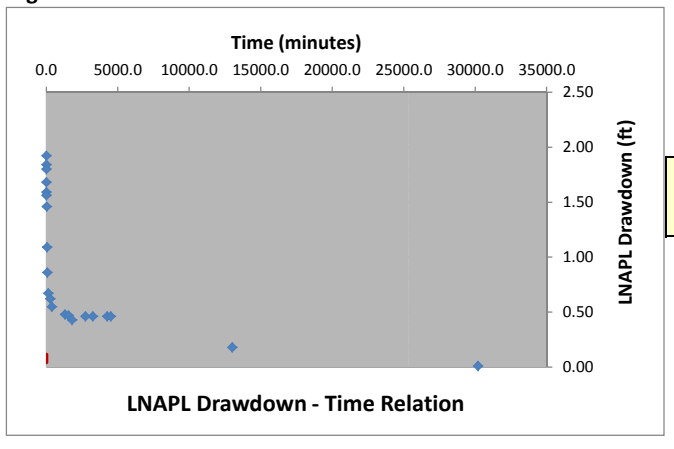


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	AMW-9
Date:	17-Sep-13

$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

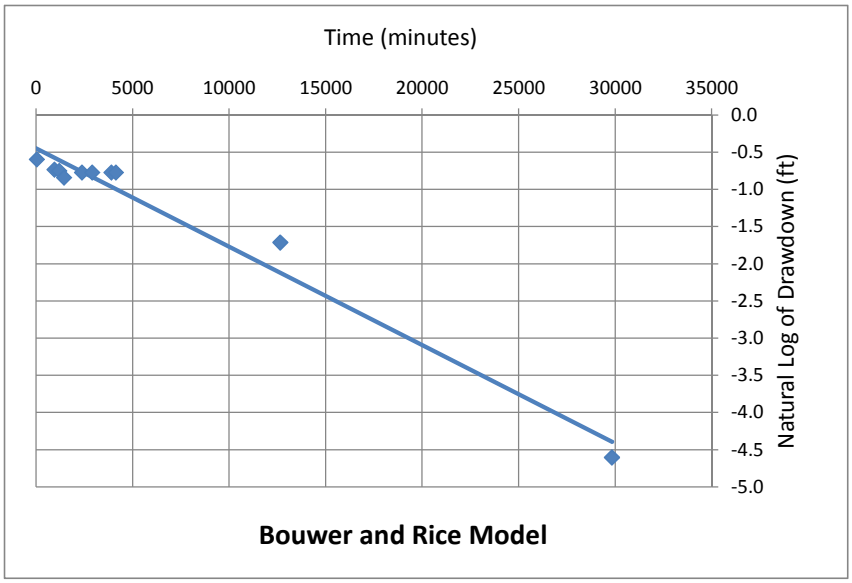
Enter early time cut-off for least-squares model fit

$Time_{cut}$	350	<- Enter or change value here

L_e/r_e
21.1
C
1.64
R/r_e
9.80

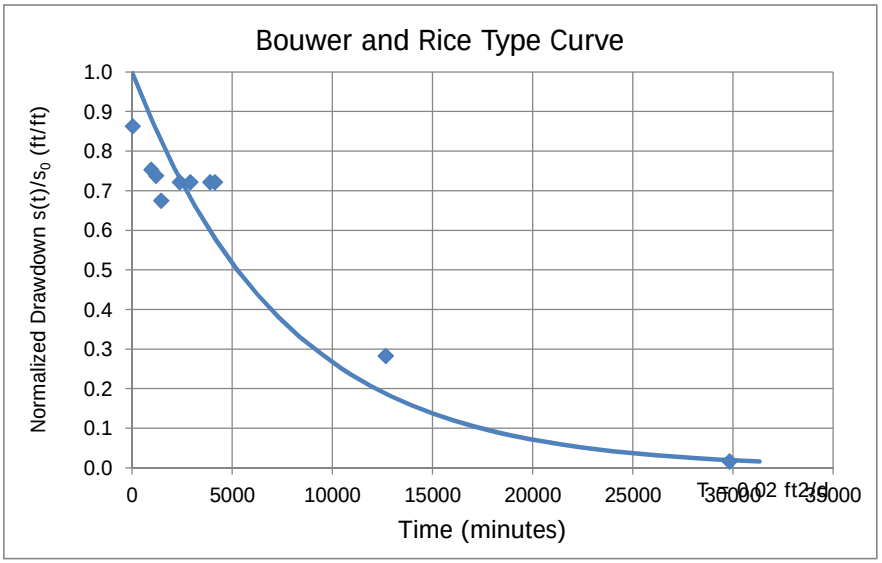
Model Results: T_n (ft^2/d) = 0.02 +/- 0.00 ft^2/d

J-Ratio
-0.233



Coef. Of Variation
0.06

C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	AMW-9
Date:	17-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^{\,2} S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	350	<- Enter or change values here
Time Adjustment (min):	233.3333	

Trial S_n: d <-- Enter d for default or enter S_n value

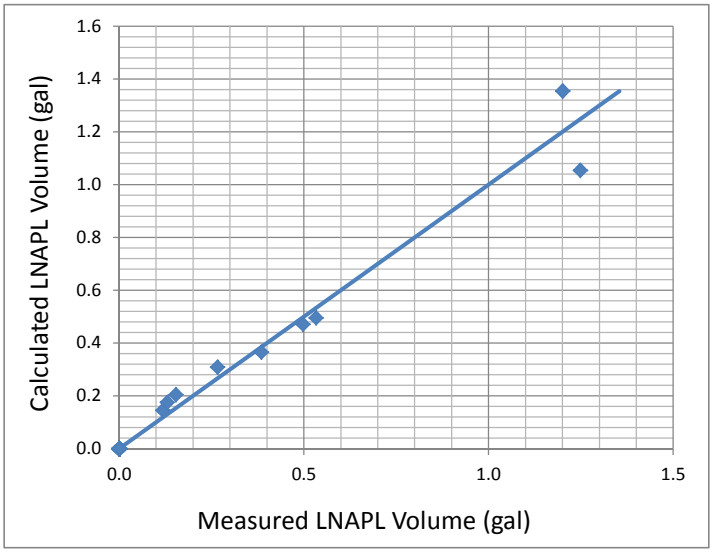
Root-Mean-Square Error: 0.266 <-- Minimize this using "Solver"

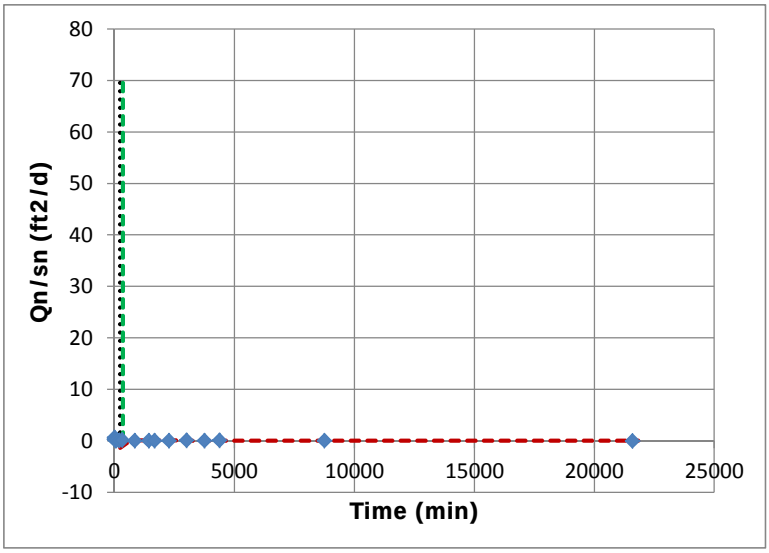
0.004 <-- Working S_n

Trial T_n (ft^2/d): 0.025 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.03**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	AMW-9
Date:	17-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	350	<- Enter or change values here
Initial Drawdown s_n (ft):	0.55	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.308 <-- Minimize this using "Solver"

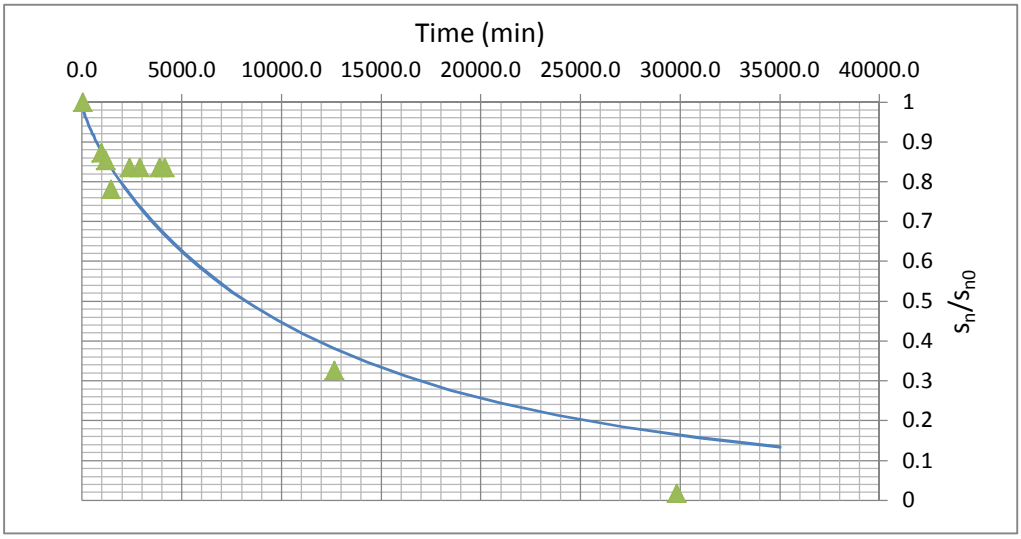
Trial T_n (ft^2/d): 0.020 <-- By changing T_n through "Solver"

0.004 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.02**

T_{min}	0.1
T_{max}	35000



J-Ratio
-0.233

Well Designation:	BMW-5	Beckett and Lyverse (2002)
Date:	20-Sep-13	

Ground Surface Elev (ft msl)	388.0	Enter These Data
Top of Casing Elev (ft msl)	389.6	
Well Casing Radius, r_c (ft):	0.083	r_{e1}
Well Radius, r_w (ft):	0.333	
LNAPL Specific Yield, S_y:	0.175	
LNAPL Density Ratio, ρ_r:	0.758	
Top of Screen (ft bgs):	5.0	
Bottom of Screen (ft bgs):	26.7	
LNAPL Baildown Vol. (gal.):	0.5	
Effective Radius, r_{e3} (ft):	0.159	Calculated Parameters
Effective Radius, r_{e2} (ft):	0.144	
Initial Casing LNAPL Vol. (gal.):	0.21	
Initial Filter LNAPL Vol. (gal.):	0.55	

Drawdown Adjustment (ft)
0.22

	Enter Data Here											
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	25.64	26.93	24.10	25.39	24.41					1.29	
Enter Test Data:	9.0	26.90	26.90	25.36	25.36	25.36	0.09				0.00	
	13.00	26.8	26.81	25.26	25.27	25.26	0.09	11.0	0.285	0.09	0.01	0.159
	15.0	26.74	26.80	25.20	25.26	25.21	0.08	14.0	2.847	0.08	0.06	0.159
	17.0	26.68	26.76	25.14	25.22	25.16	0.07	16.0	1.139	0.08	0.08	0.159
	152.0	26.07	26.16	24.53	24.62	24.55	0.07	84.5	0.008	0.07	0.09	0.159
	246.0	25.96	26.06	24.42	24.52	24.44	0.07	199.0	0.012	0.07	0.10	0.159
	4526.0	25.9	26.06	24.36	24.52	24.40	0.05	2386.0	0.002	0.06	0.16	0.159
	25951.00	25.95	26.20	24.41	24.66	24.47	0.03	15238.5	0.000	0.04	0.25	0.159
	37756.00	25.97	26.33	24.43	24.79	24.52	0.00	31853.5	0.001	0.02	0.36	0.159

Figure 1

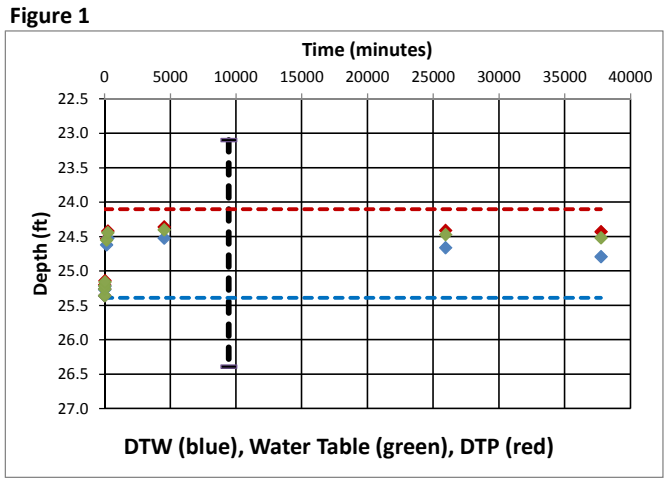
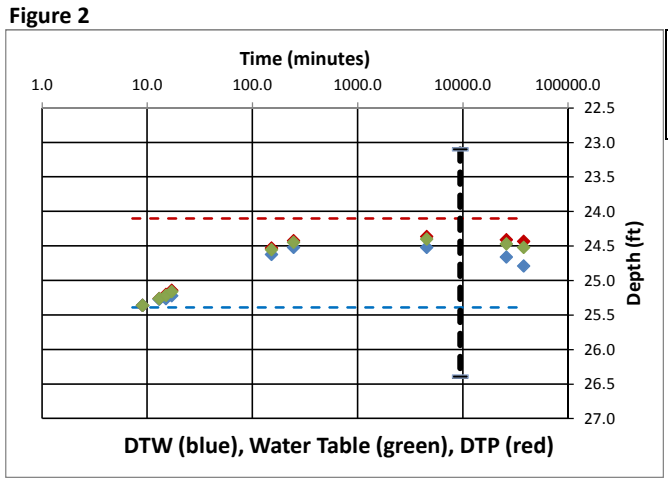


Figure 2



7.2	24.10	
37756	24.10	
7.2	25.39	
37756	25.39	
9439.0	23.1	23.1
9439.0	26.4	26.4

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.1	0.1

Drawdown Adjust.	
Δs_n (ft)	0.22

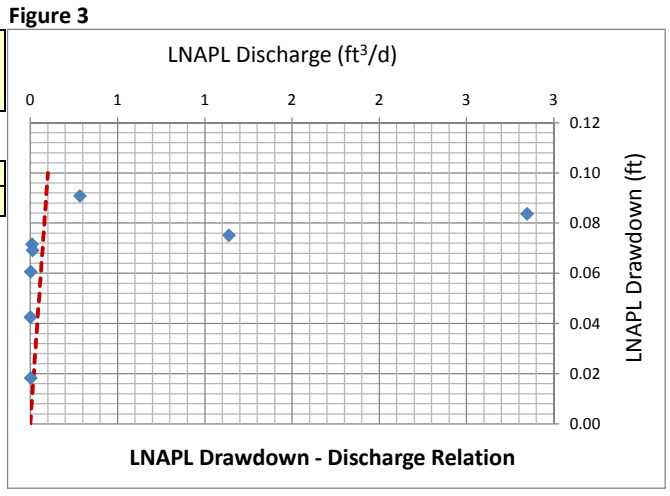
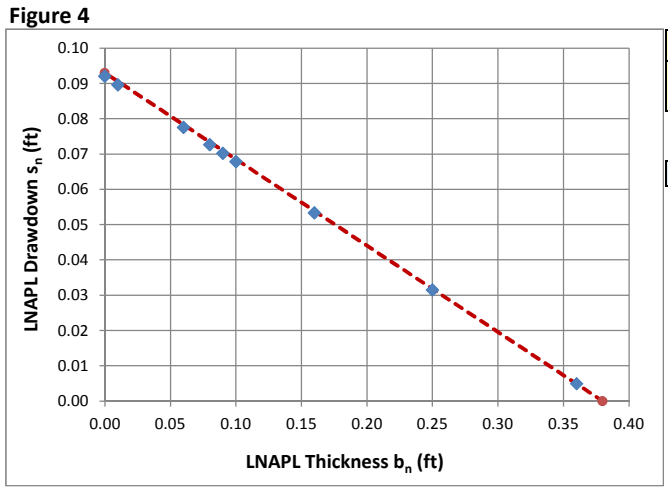


Figure 4



b_n	s_n
0.38	0
0	0.093

J-ratio	-0.245

Figure 5

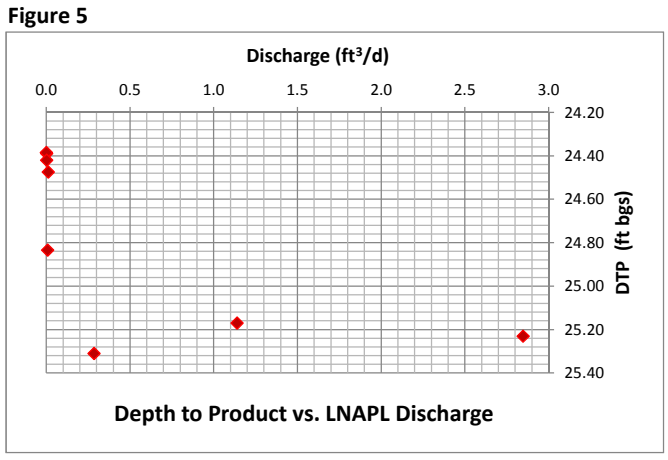


Figure 6

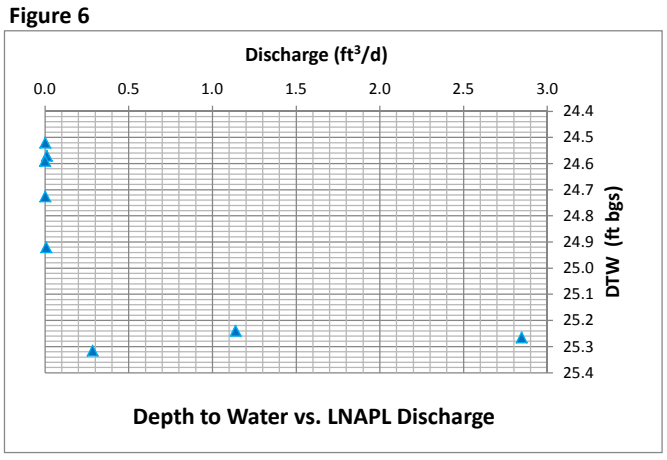


Figure 7

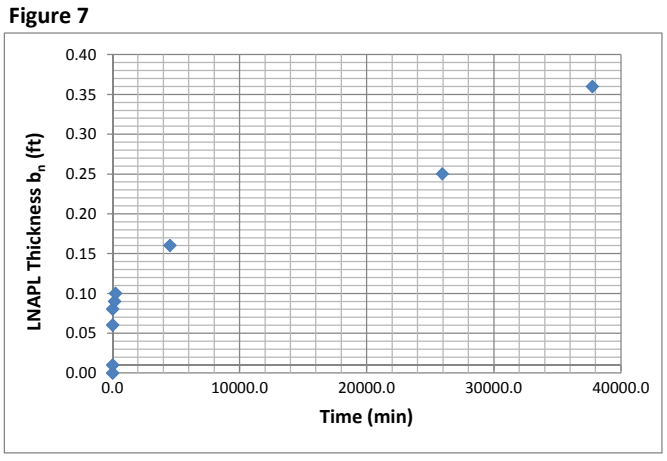


Figure 8

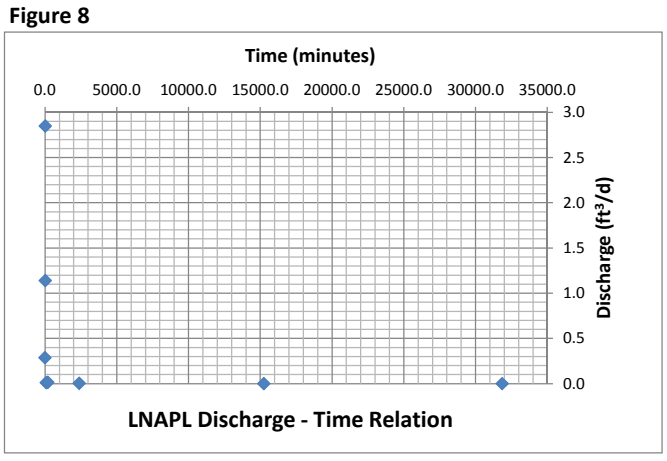


Figure 9

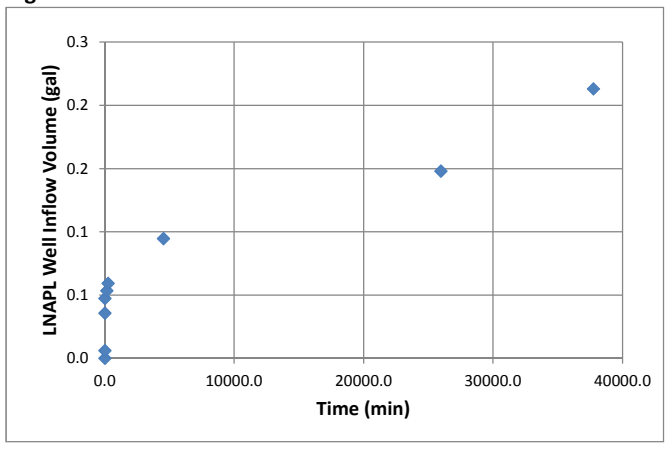
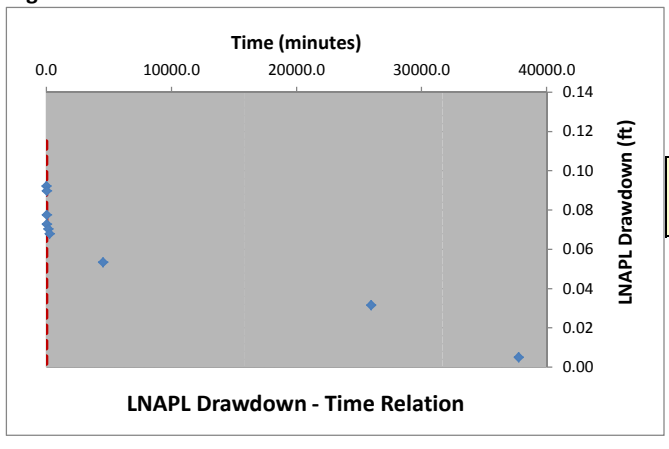


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	BMW-5
Date:	20-Sep-13

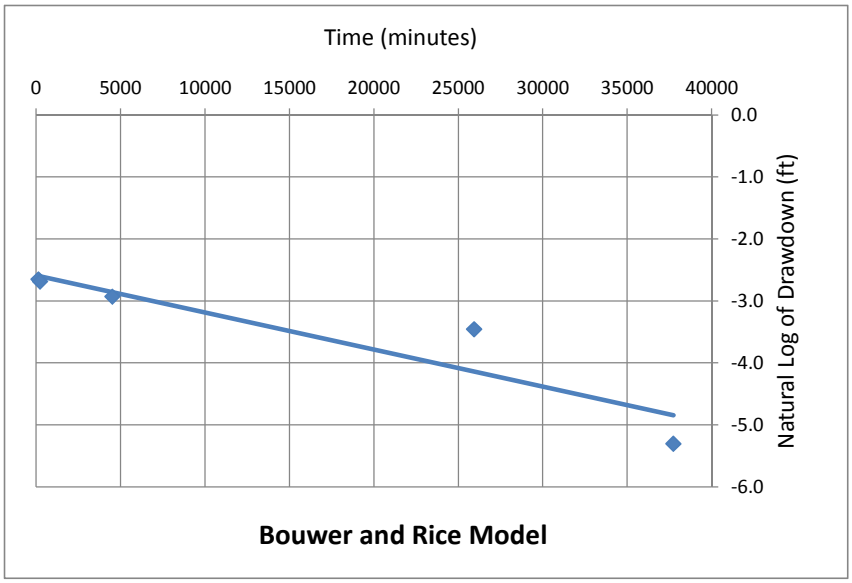
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

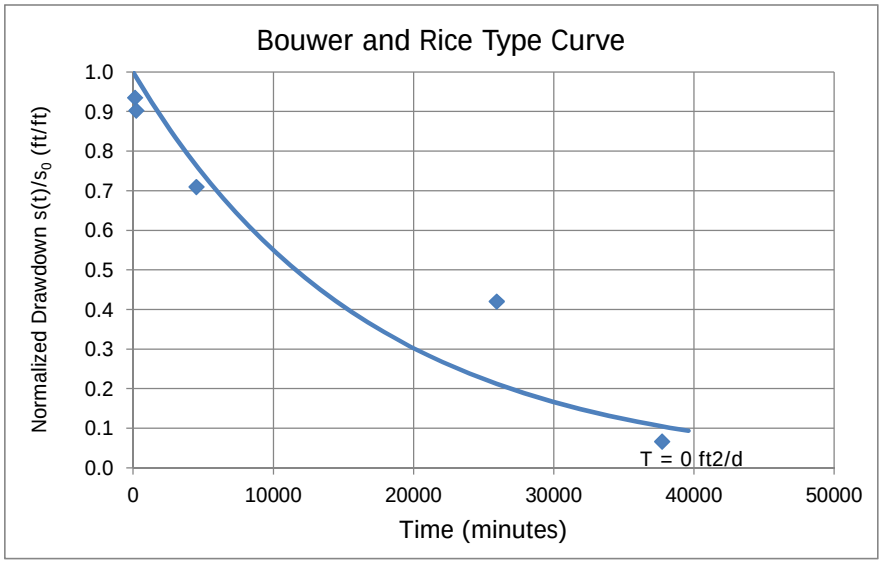
$Time_{cut}$	20	<- Enter or change value here

Model Results:	T_n (ft^2/d) = 0.01	+/-	0.00	ft^2/d

L_e/r_e	8.1
C	1.12
R/r_e	4.53
J-Ratio	-0.245
Coef. Of Variation	0.23



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	BMW-5
Date:	20-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	20	<- Enter or change values here
Time Adjustment (min):	13.33333	

Trial S_n: d <-- Enter d for default or enter S_n value

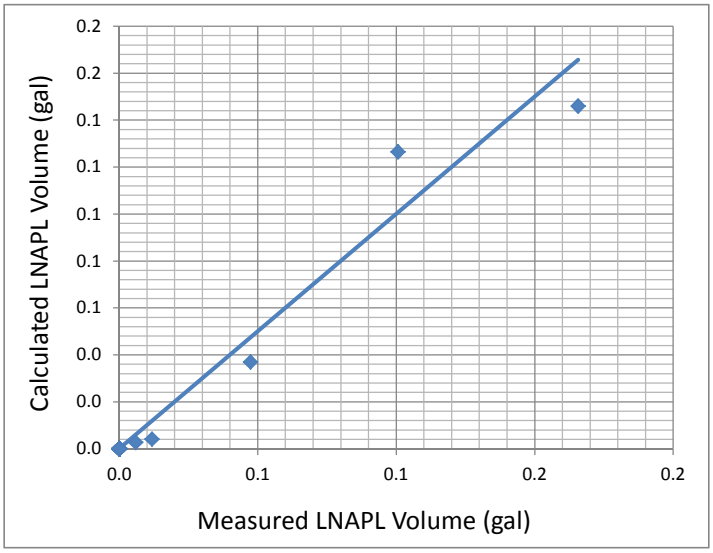
Root-Mean-Square Error: 0.035 <-- Minimize this using "Solver"

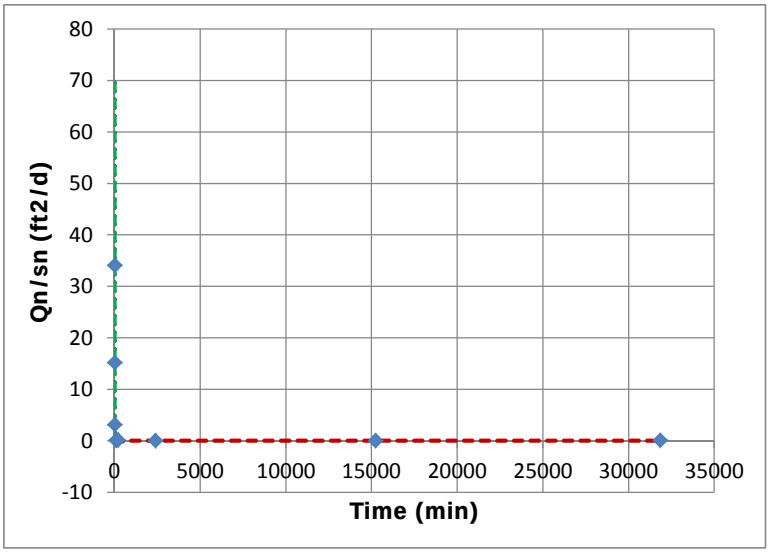
0.003 <-- Working S_n

Trial T_n (ft^2/d): 0.013 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.01**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	BMW-5
Date:	20-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	20	<- Enter or change values here
Initial Drawdown s_n (ft):	0.09	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.330 <-- Minimize this using "Solver"

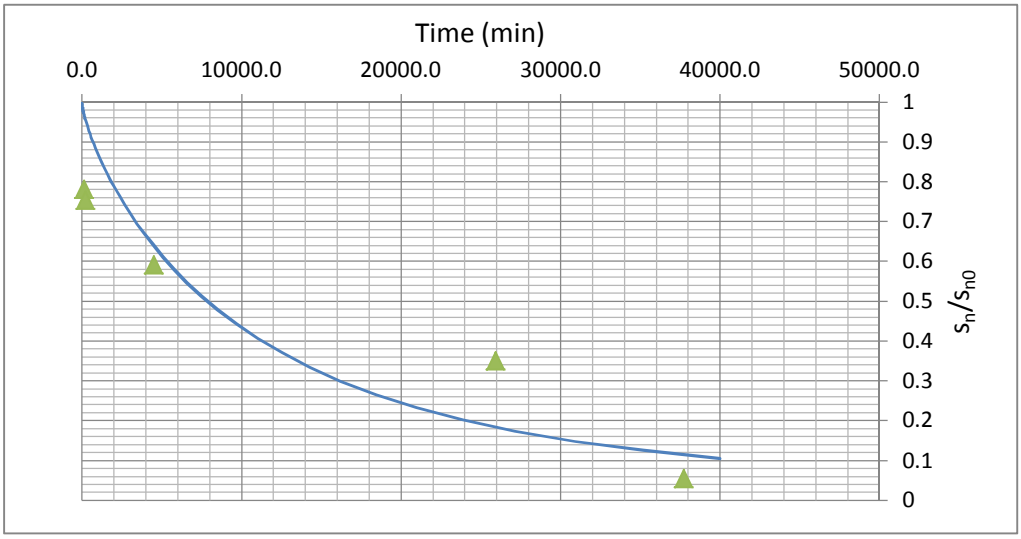
Trial T_n (ft^2/d): 0.020 <-- By changing T_n through "Solver"

0.004 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.02**

T_{min}	0.1
T_{max}	40000



J-Ratio
-0.245

Well Designation:	S-1	Beckett and Lyverse (2002)
Date:	16-Sep-13	

Ground Surface Elev (ft msl)	377.5	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	375.6		
Well Casing Radius, r_c (ft):	0.167	r_{e1}	
Well Radius, r_w (ft):	0.417		0.1
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.780		
Top of Screen (ft bgs):	5.0		
Bottom of Screen (ft bgs):	17.9		
LNAPL Baildown Vol. (gal.):	2.3		
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.115		
Initial Casing LNAPL Vol. (gal.):	0.74		
Initial Filter LNAPL Vol. (gal.):	0.68		

	Enter Data Here											
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	12.09	13.22	13.99	15.12	14.24					1.13	
Enter Test Data:	32.0	13.21	13.22	15.11	15.12	15.11	1.02				0.01	
	33.0	13.19	13.21	15.09	15.11	15.09	1.00	32.5	2.411	1.01	0.02	0.231
	35.0	13.16	13.19	15.06	15.09	15.07	0.97	34.0	1.206	0.99	0.03	0.231
	37.00	13.13	13.17	15.03	15.07	15.04	0.94	36.0	1.206	0.96	0.04	0.231
	38.00	13.11	13.16	15.01	15.06	15.02	0.92	37.5	2.411	0.93	0.05	0.231
	40.00	13.09	13.15	14.99	15.05	15.00	0.90	39.0	1.206	0.91	0.06	0.231
	44.0	13.04	13.11	14.94	15.01	14.96	0.85	42.0	0.603	0.88	0.07	0.231
	46.0	13.01	13.10	14.91	15.00	14.93	0.82	45.0	2.411	0.84	0.09	0.231
	53.0	12.95	13.06	14.85	14.96	14.87	0.76	49.5	0.689	0.79	0.11	0.231
	78.0	12.8	12.92	14.70	14.82	14.73	0.61	65.5	0.096	0.69	0.12	0.231
	88.0	12.72	12.86	14.62	14.76	14.65	0.53	83.0	0.482	0.57	0.14	0.231
	140.0	12.53	12.68	14.43	14.58	14.46	0.34	114.0	0.046	0.44	0.15	0.231
	247.00	12.42	12.58	14.32	14.48	14.36	0.23	193.5	0.023	0.29	0.16	0.231
	1450.0	12.45	12.62	14.35	14.52	14.39	0.26	848.5	0.002	0.25	0.17	0.231
	2710.0	12.41	12.60	14.31	14.50	14.35	0.22	2080.0	0.004	0.24	0.19	0.231
	4135.00	12.4	12.61	14.30	14.51	14.35	0.21	3422.5	0.003	0.22	0.21	0.231
	5630.00	12.43	12.66	14.33	14.56	14.38	0.24	4882.5	0.003	0.23	0.23	0.231
	10170	12.25	12.50	14.15	14.40	14.21	0.06	7900.0	0.001	0.15	0.25	0.231
	31550	12.20	12.50	14.10	14.40	14.17	0.01	20860.0	0.001	0.04	0.30	0.231
	43372	12.35	12.67	14.25	14.57	14.32	0.16	37461.0	0.000	0.09	0.32	0.231

Figure 1

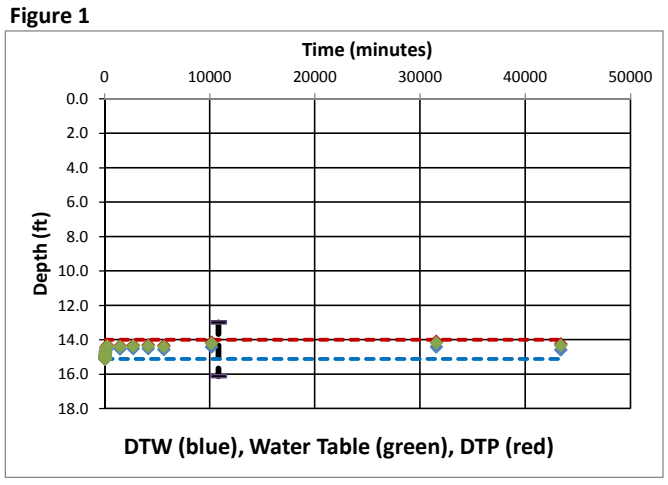
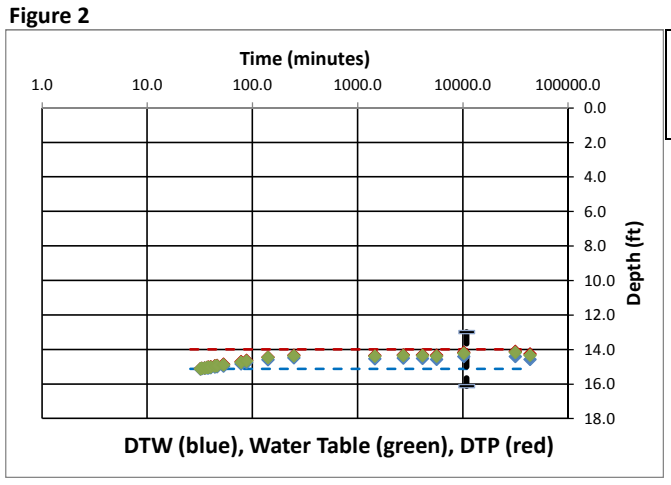


Figure 2



25.6	13.99	
43372	13.99	
25.6	15.12	
43372	15.12	
10843.0	12.99	13.0
10843.0	16.1	16.1

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.1	0.75

Drawdown Adjust.	
Δs_n (ft)	0.1

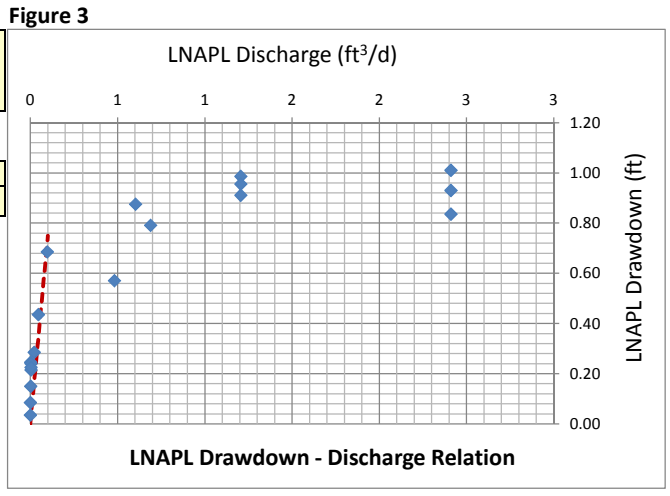


Figure 4

b_n	s_n
0.35	0
0	0.55

J-ratio	-1.571

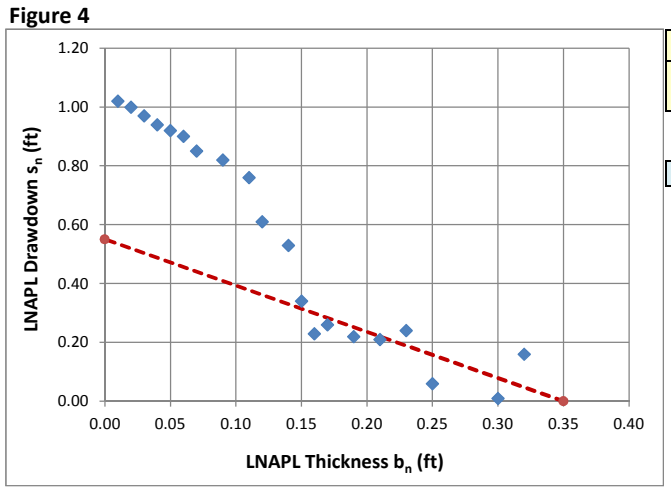


Figure 5

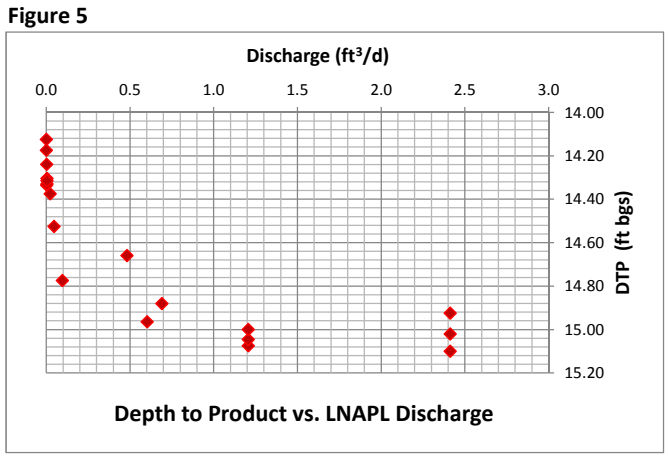


Figure 6

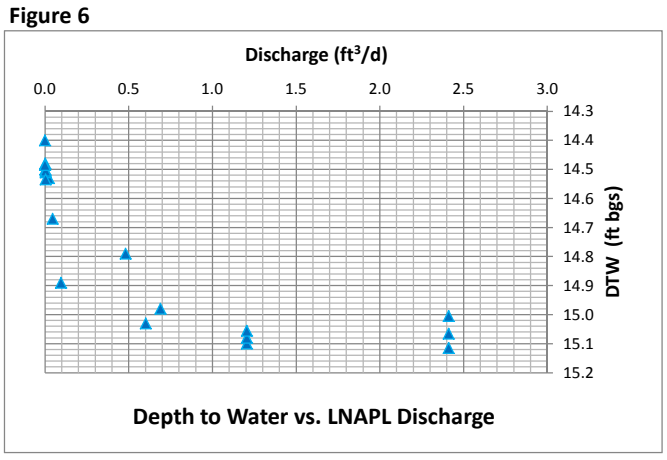


Figure 7

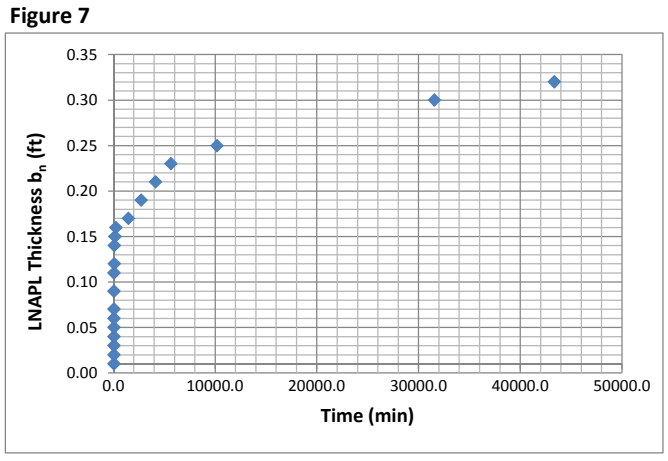


Figure 8

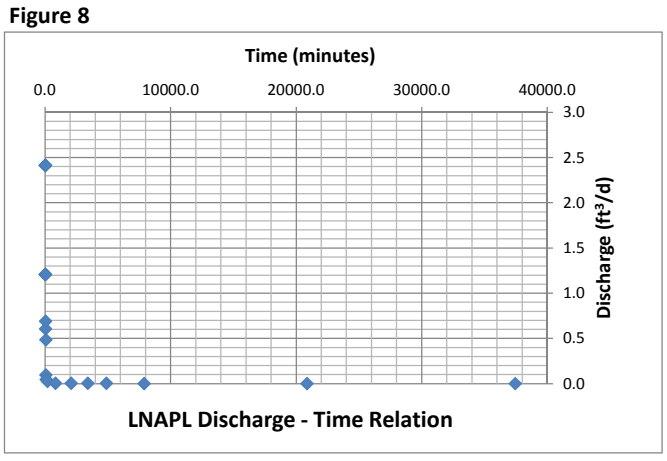


Figure 9

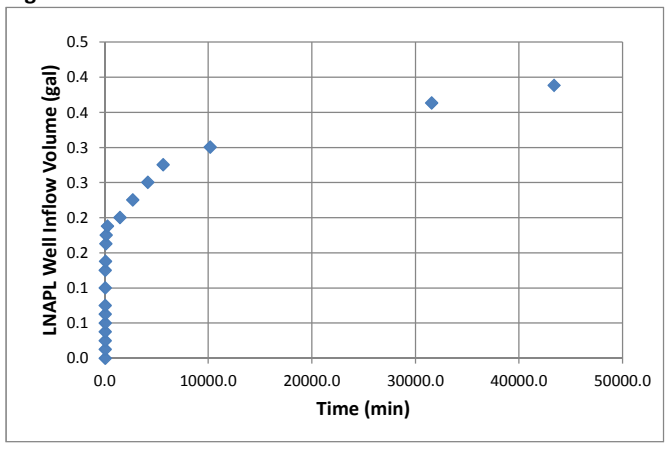
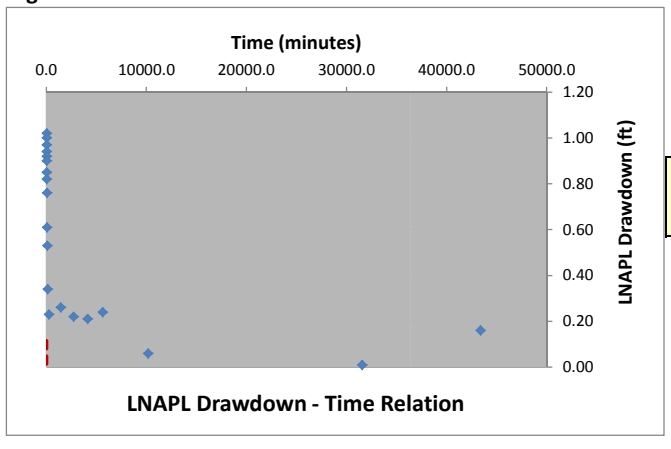


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	S-1
Date:	16-Sep-13

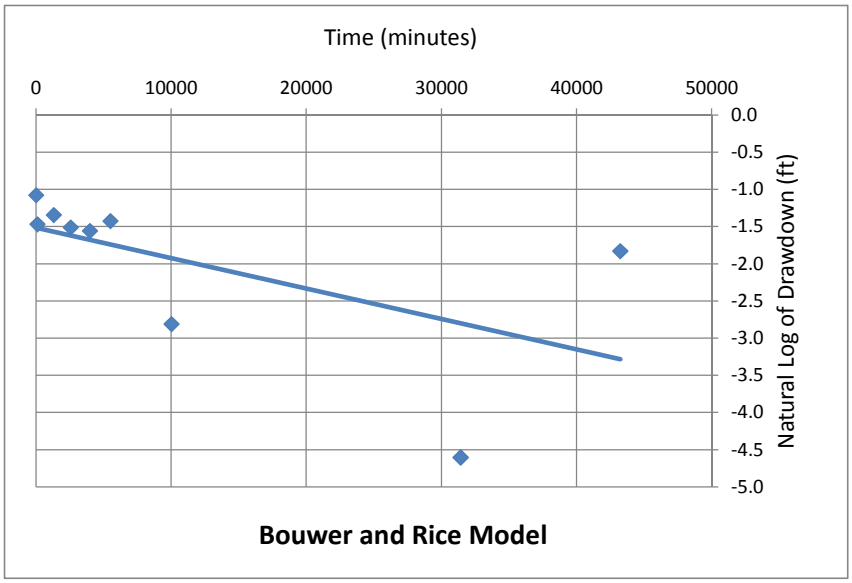
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

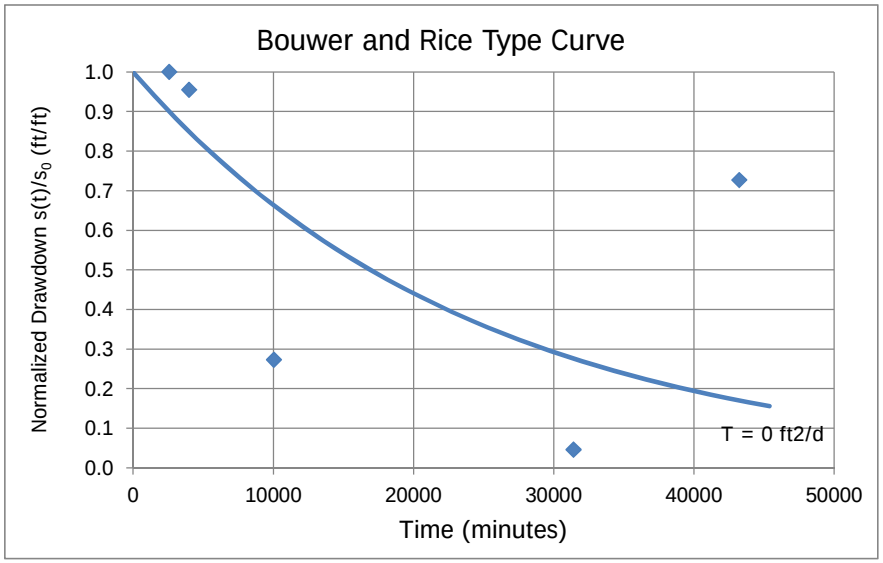
$Time_{cut}$	140	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.00 +/- 0.00 ft^2/d

L_e/r_e	4.9
C	0.99
R/r_e	3.06
J-Ratio	-1.571
Coef. Of Variation	0.53



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	S-1
Date:	16-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	140	<- Enter or change values here
Time Adjustment (min):	93.33333	

Trial S_n: d <-- Enter d for default or enter S_n value

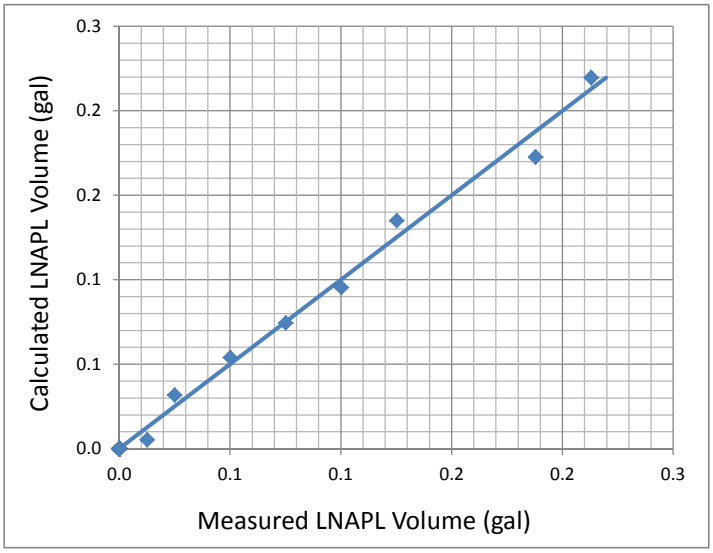
Root-Mean-Square Error: 0.023 <-- Minimize this using "Solver"

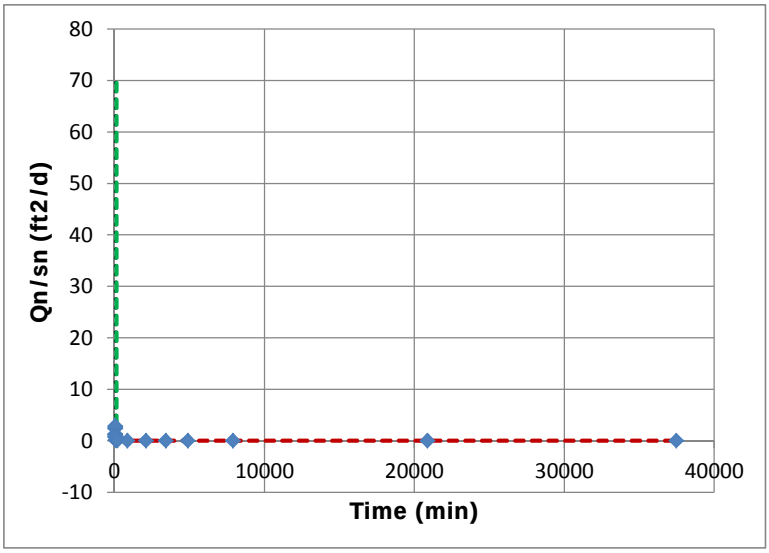
0.002 <-- Working S_n

Trial T_n (ft^2/d): 0.006 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.01**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	S-1
Date:	16-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	140	<- Enter or change values here
Initial Drawdown s_n (ft):	0.34	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.574 <-- Minimize this using "Solver"

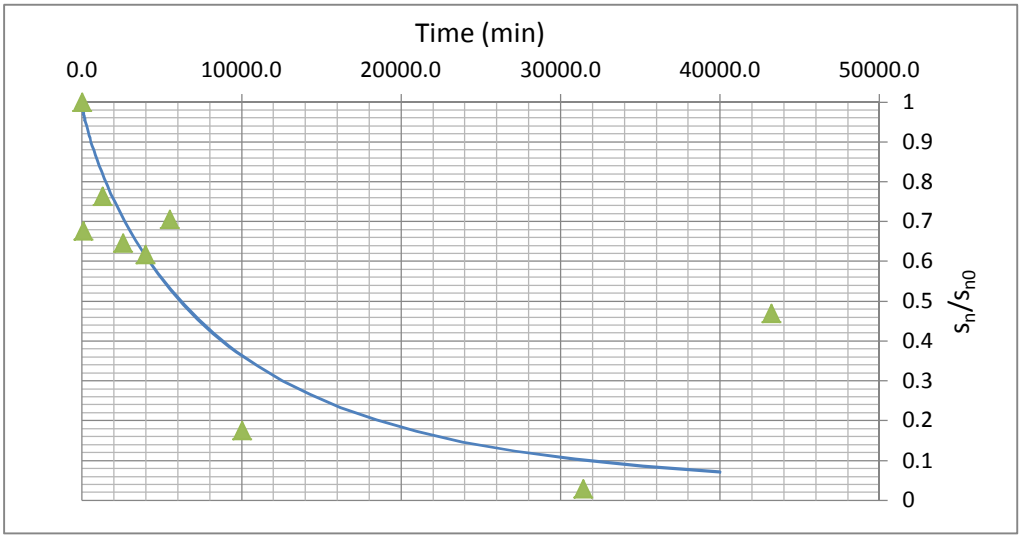
Trial T_n (ft^2/d): 0.009 <-- By changing T_n through "Solver"

0.002 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.01**

T_{min}	0.1
T_{max}	40000



J-Ratio
-1.571

Well Designation:	S-2	Beckett and Lyverse (2002)
Date:	18-Sep-13	

Ground Surface Elev (ft msl)	376.8	Enter These Data
Top of Casing Elev (ft msl)	375.0	
Well Casing Radius, r_c (ft):	0.167	r_{e1}
Well Radius, r_w (ft):	0.417	
LNAPL Specific Yield, S_y:	0.175	
LNAPL Density Ratio, ρ_r:	0.773	
Top of Screen (ft bgs):	5.0	
Bottom of Screen (ft bgs):	16.5	
LNAPL Baildown Vol. (gal.):	2.8	
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters
Effective Radius, r_{e2} (ft):	0.202	
Initial Casing LNAPL Vol. (gal.):	1.01	
Initial Filter LNAPL Vol. (gal.):	0.92	

Drawdown Adjustment (ft)
0

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	11.50	13.04	13.30	14.84	13.65					1.54	
Enter Test Data:	19.0	12.19	12.20	13.99	14.00	13.99	0.69				0.01	
	30.00	12.11	12.13	13.91	13.93	13.91	0.61	24.5	0.219	0.65	0.02	0.231
	50.00	12.01	12.04	13.81	13.84	13.82	0.51	40.0	0.121	0.56	0.03	0.231
	101.00	11.89	11.93	13.69	13.73	13.70	0.39	75.5	0.047	0.45	0.04	0.231
	218.0	11.81	11.88	13.61	13.68	13.63	0.31	159.5	0.062	0.35	0.07	0.231
	368.0	11.80	11.90	13.60	13.70	13.62	0.30	293.0	0.048	0.31	0.10	0.231
	1843.0	11.85	12.03	13.65	13.83	13.69	0.35	1105.5	0.013	0.33	0.18	0.231
	3068.0	11.9	12.10	13.70	13.90	13.75	0.40	2455.5	0.004	0.38	0.20	0.231
	7343.00	11.68	11.98	13.48	13.78	13.55	0.18	5205.5	0.006	0.29	0.30	0.231
	11560.00	11.8	12.18	13.60	13.98	13.69	0.30	9451.5	0.005	0.24	0.38	0.231
	28740.00	11.55	12.00	13.35	13.80	13.45	0.05	20150.0	0.001	0.18	0.45	0.231
	40552.00	11.65	12.45	13.45	14.25	13.63	0.15	34646.0	0.007	0.10	0.80	0.231

Figure 1

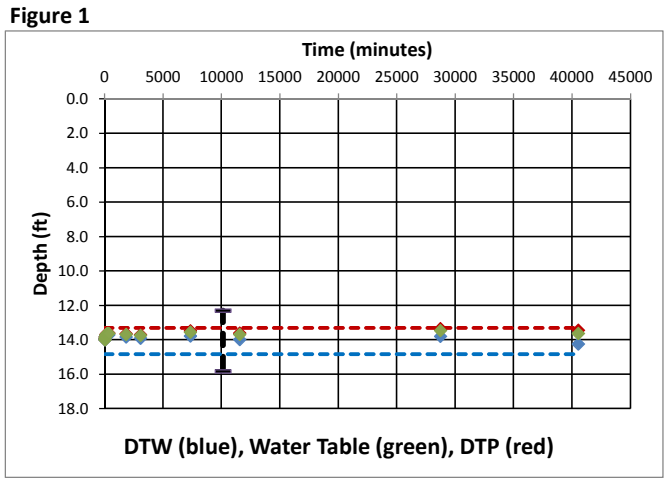
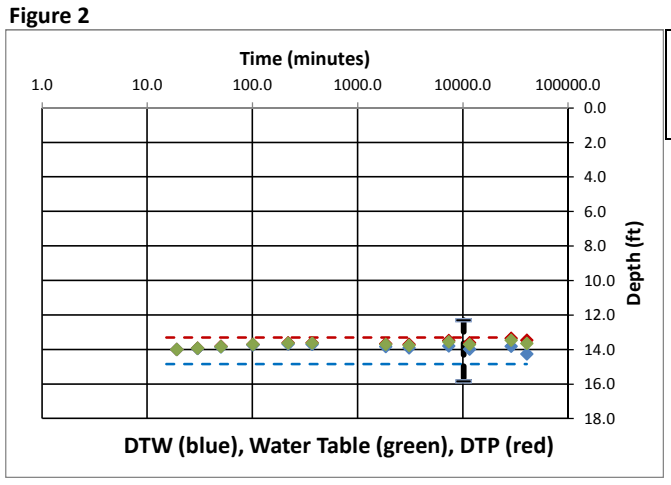


Figure 2



15.2	13.30	
40552	13.30	
15.2	14.84	
40552	14.84	
10138.0	12.3	12.3
10138.0	15.8	15.8

Figure 3

Q_n (ft^3/d)	s_n (ft)
0	0
0.01	0.5

Drawdown Adjust.	
Δs_n (ft)	0

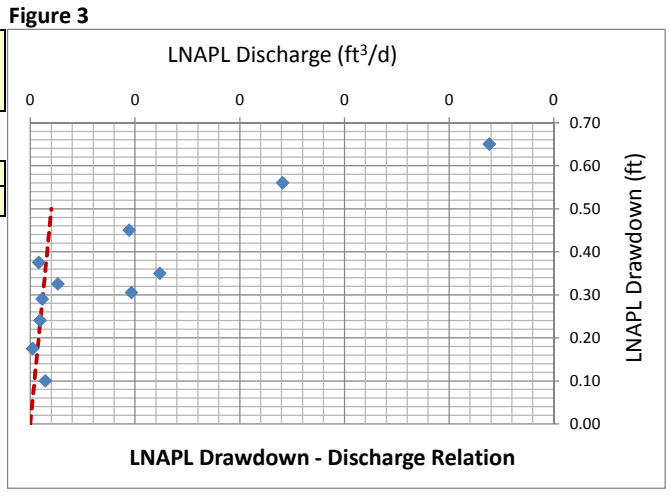
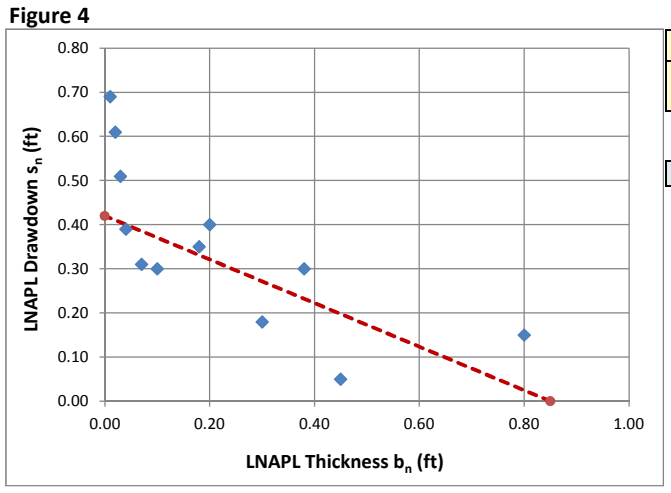


Figure 4



b_n	s_n
0.85	0
0	0.42

J-ratio	-0.494

Figure 5

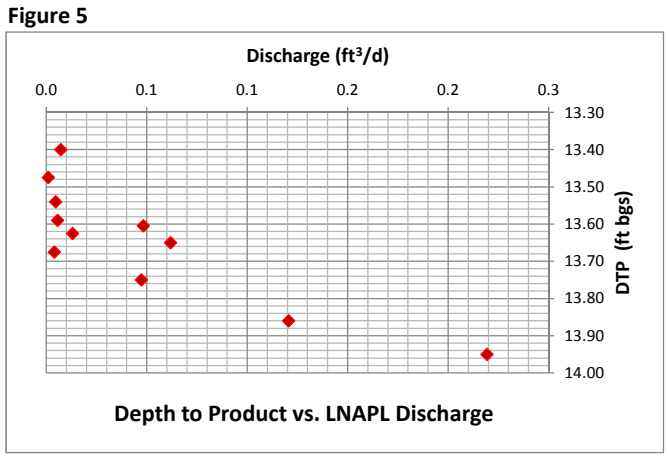


Figure 6

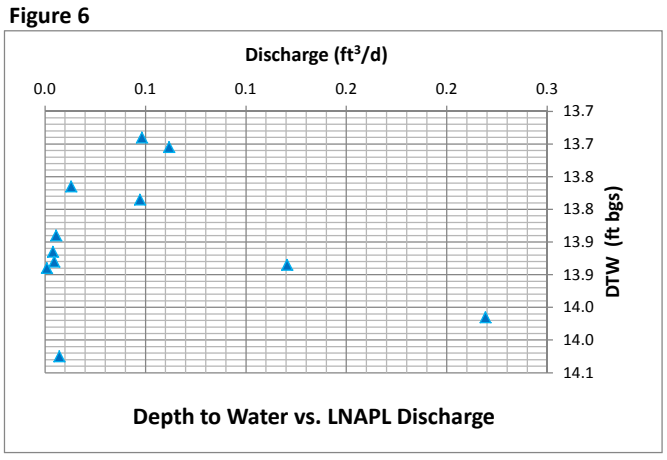


Figure 7

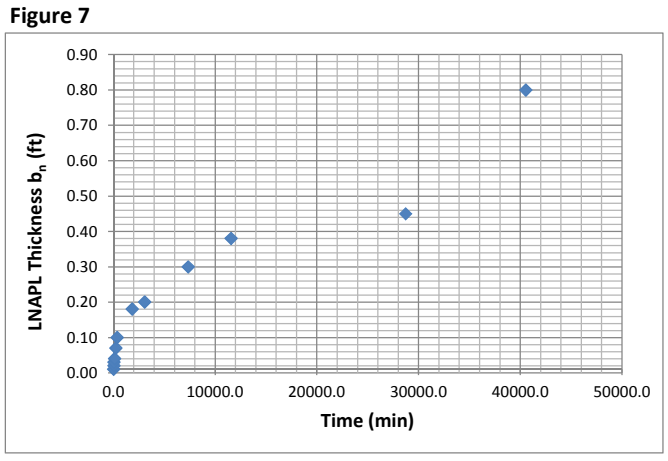


Figure 8

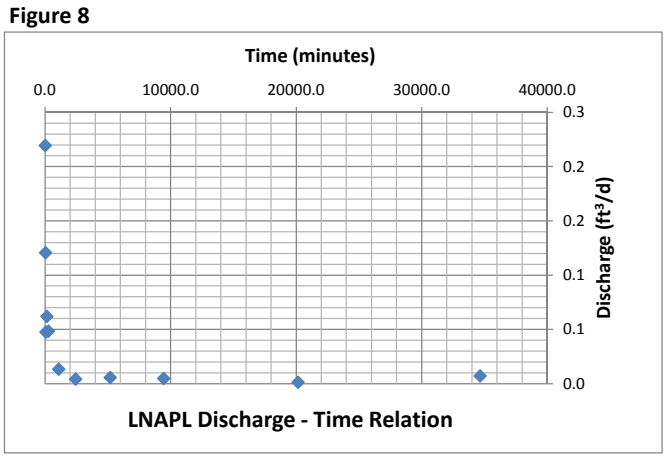


Figure 9

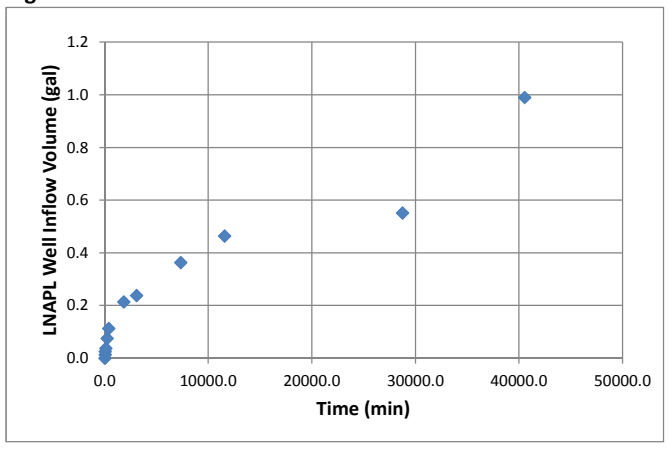
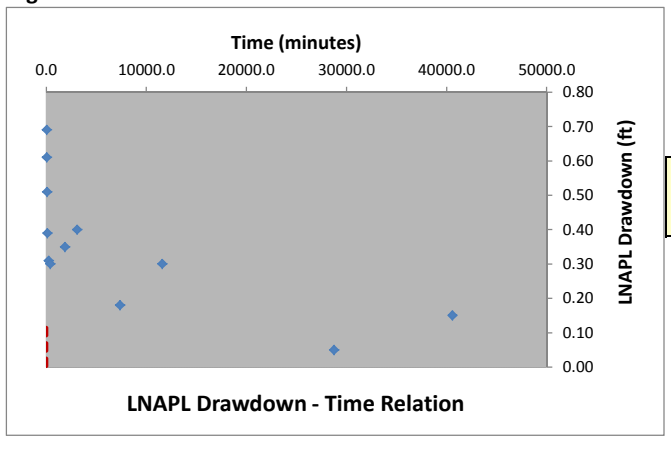


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	S-2
Date:	18-Sep-13

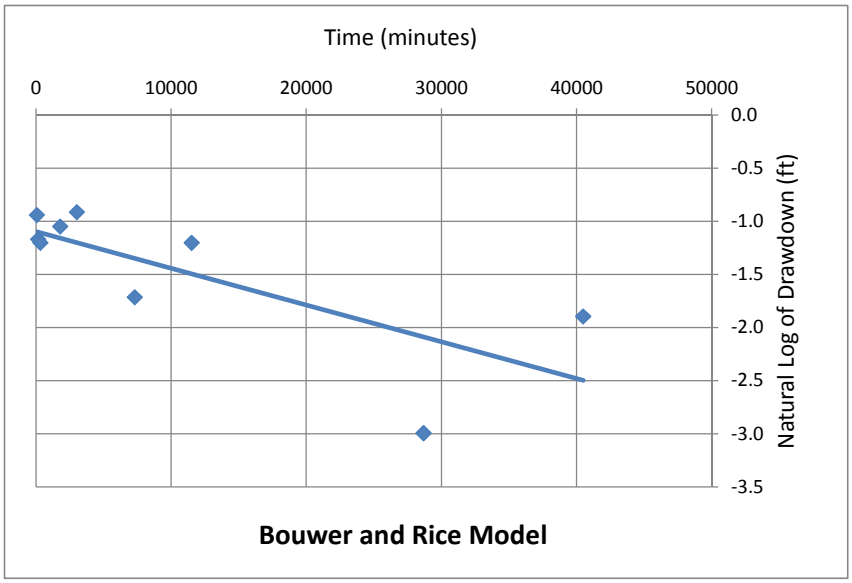
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

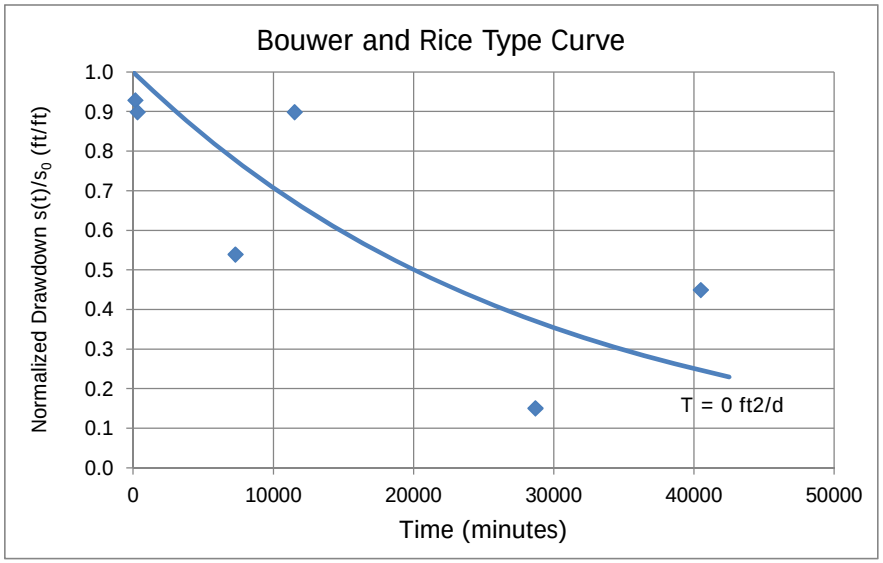
$Time_{cut}$	55	<- Enter or change value here

Model Results:	T_n (ft^2/d) = 0.00	+/-	0.00	ft^2/d

L_e/r_e	6.7
C	1.06
R/r_e	3.87
J-Ratio	-0.494
Coef. Of Variation	0.33



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	S-2
Date:	18-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

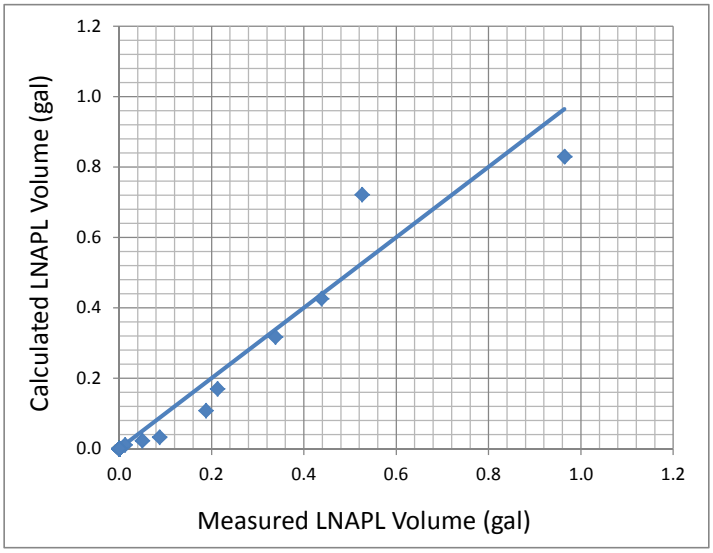
Enter early time cut-off for least-squares model fit

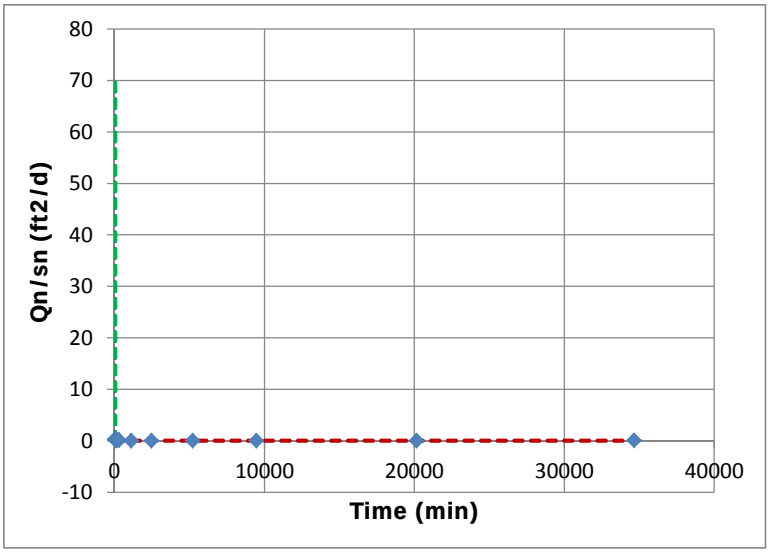
$Time_{cut}$ (min):	55	<- Enter or change values here
Time Adjustment (min):	36.66667	

Trial S_n:	d	<-- Enter d for default or enter S_n value
Root-Mean-Square Error:	0.263	<-- Minimize this using "Solver"
	0.003	<-- Working S_n
Trial T_n (ft^2/d):	0.012	<-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.01**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	S-2
Date:	18-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	55	<- Enter or change values here
Initial Drawdown s_n (ft):	0.51	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.652 <-- Minimize this using "Solver"

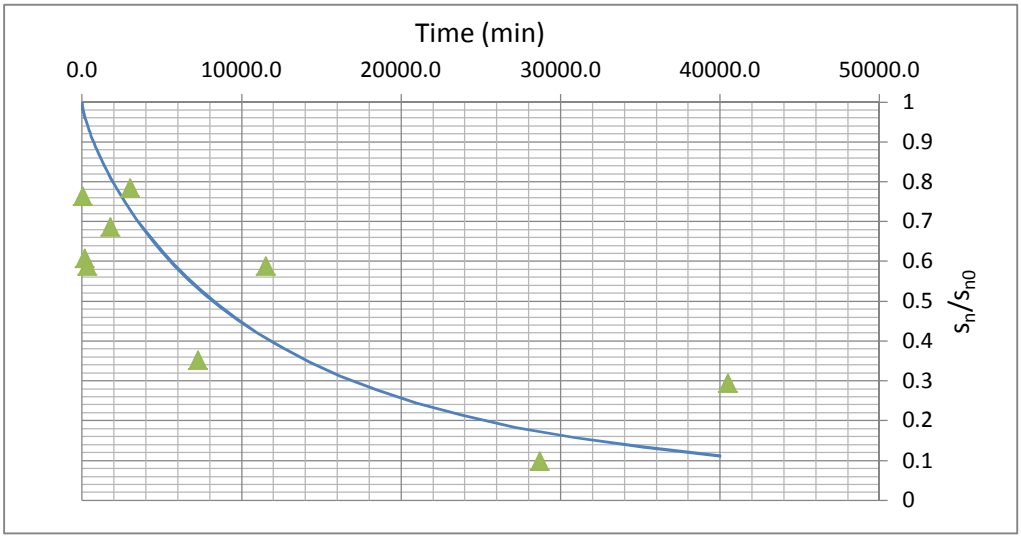
Trial T_n (ft^2/d): 0.020 <-- By changing T_n through "Solver"

0.004 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.02**

T_{min}	0.1
T_{max}	40000



J-Ratio
-0.494

Well Designation:	S-3
Date:	19-Sep-13

Beckett and Lyverse (2002)

Ground Surface Elev (ft msl)	374.8	Enter These Data
Top of Casing Elev (ft msl)	373.2	
Well Casing Radius, r_c (ft):	0.167	r_{e1}
Well Radius, r_w (ft):	0.417	
LNAPL Specific Yield, S_y:	0.175	
LNAPL Density Ratio, ρ_r:	0.803	
Top of Screen (ft bgs):	5.0	
Bottom of Screen (ft bgs):	15.9	
LNAPL Baildown Vol. (gal.):	1.8	
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters
Effective Radius, r_{e2} (ft):	0.218	
Initial Casing LNAPL Vol. (gal.):	1.04	
Initial Filter LNAPL Vol. (gal.):	0.96	

Drawdown Adjustment (ft)
0.2

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	8.65	10.25	10.27	11.87	10.59					1.60	
Enter Test Data:	3.0	9.64	9.66	11.26	11.28	11.26	0.79				0.02	
	5.0	9.55	9.58	11.17	11.20	11.18	0.70	4.0	1.206	0.75	0.03	0.231
	7.0	9.48	9.52	11.10	11.14	11.11	0.63	6.0	1.206	0.67	0.04	0.231
	8.0	9.44	9.49	11.06	11.11	11.07	0.59	7.5	2.411	0.61	0.05	0.231
	14.0	9.3	9.36	10.92	10.98	10.93	0.45	11.0	0.402	0.52	0.06	0.231
	16.0	9.25	9.32	10.87	10.94	10.88	0.40	15.0	1.206	0.43	0.07	0.231
	18.00	9.22	9.30	10.84	10.92	10.86	0.37	17.0	1.206	0.39	0.08	0.231
	23.00	9.16	9.26	10.78	10.88	10.80	0.31	20.5	0.964	0.34	0.10	0.231
	28.00	9.11	9.23	10.73	10.85	10.75	0.26	25.5	0.964	0.29	0.12	0.231
	45.0	9.02	9.19	10.64	10.81	10.67	0.17	36.5	0.709	0.22	0.17	0.231
	53.0	9	9.19	10.62	10.81	10.66	0.15	49.0	0.603	0.16	0.19	0.231
	58.0	8.99	9.19	10.61	10.81	10.65	0.14	55.5	0.482	0.15	0.20	0.231
	97.00	8.95	9.20	10.57	10.82	10.62	0.10	77.5	0.309	0.12	0.25	0.231
	107.00	8.92	9.22	10.54	10.84	10.60	0.07	102.0	1.206	0.09	0.30	0.231
	338.0	8.90	9.32	10.52	10.94	10.60	0.05	222.5	0.125	0.06	0.42	0.231
	463.0	8.90	9.41	10.52	11.03	10.62	0.05	400.5	0.174	0.05	0.51	0.231
	39174.0	8.85	9.40	10.47	11.02	10.58	0.00	19818.5	0.000	0.03	0.55	0.231

Figure 1

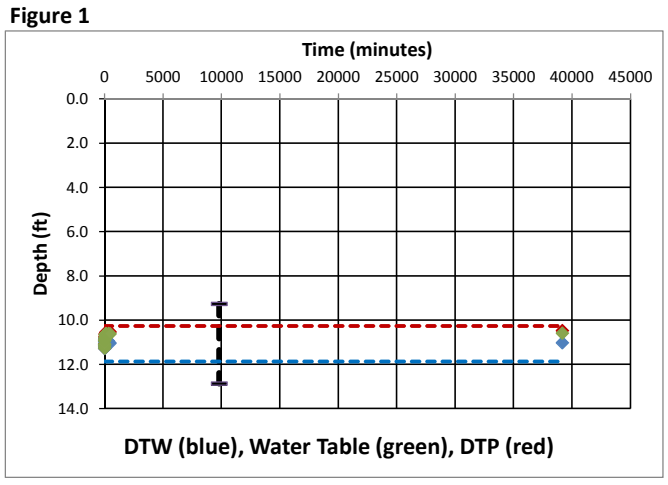
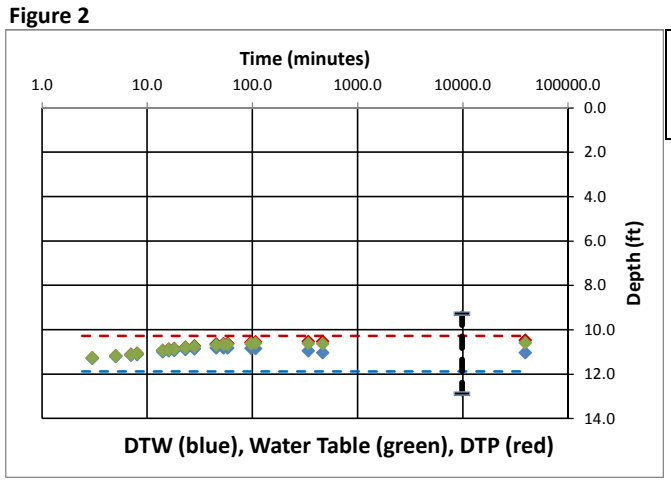


Figure 2



2.4	10.27
39174	10.27
2.4	11.87
39174	11.87

9793.5	9.27	9.3
9793.5	12.9	12.9

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
1	0.33

Drawdown Adjust.	
Δs_n (ft)	0.2

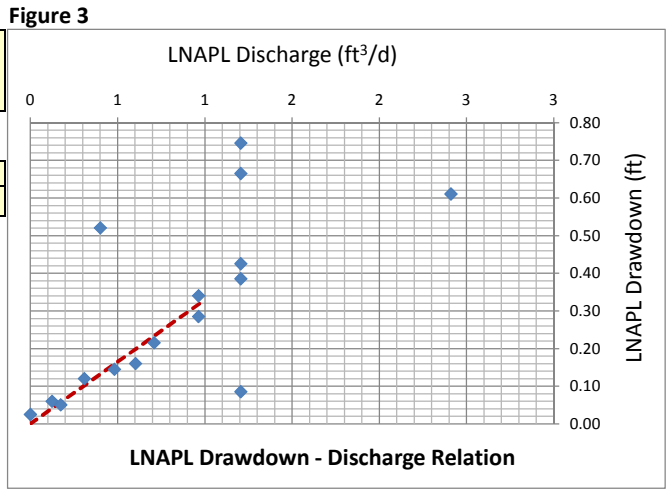
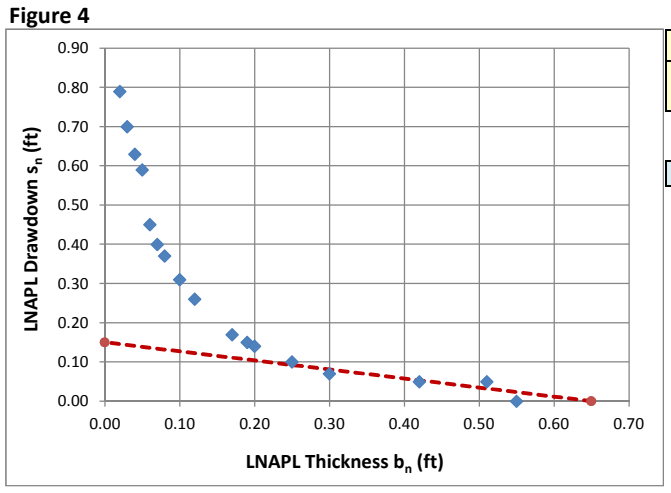


Figure 4



b_n	s_n
0.65	0
0	0.15

J-ratio	-0.231

Figure 5

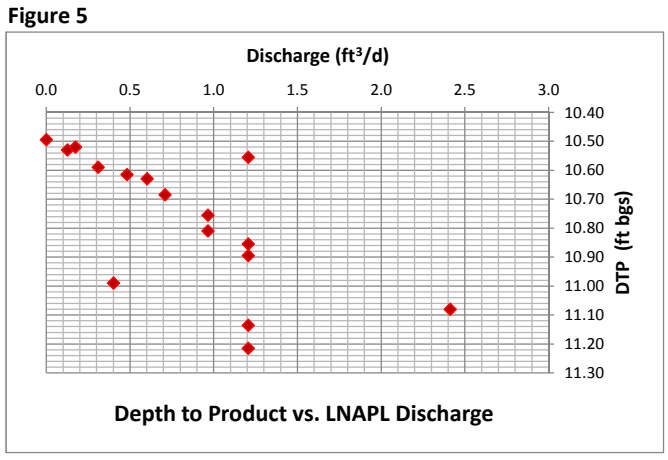


Figure 6

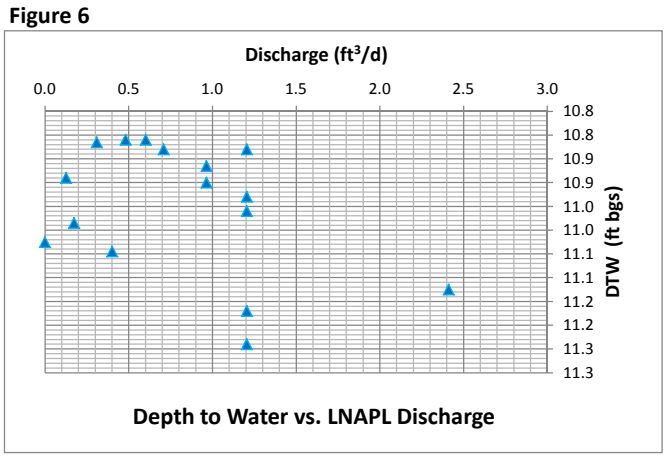


Figure 7

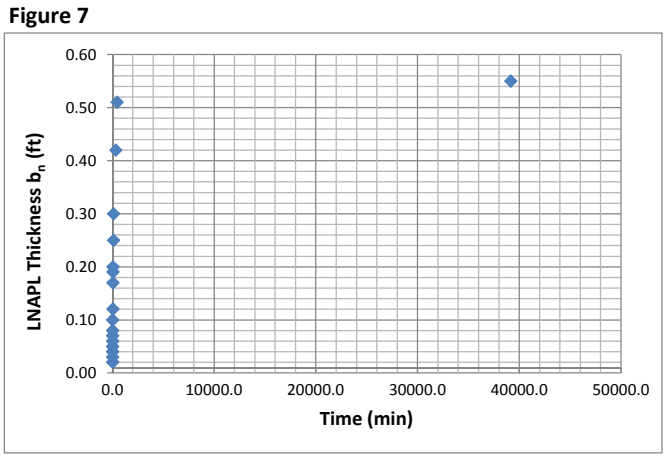


Figure 8

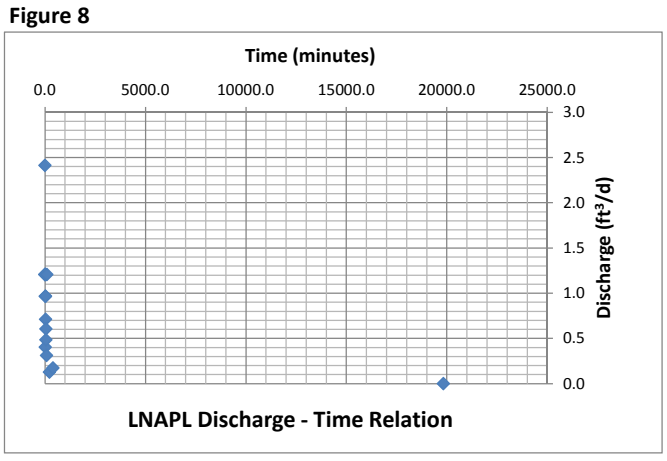


Figure 9

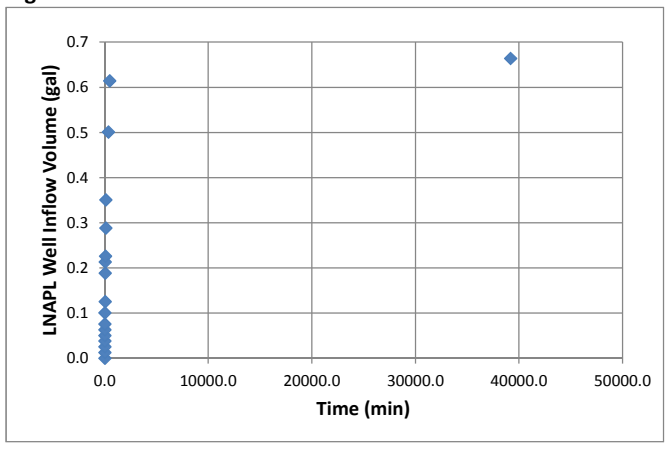
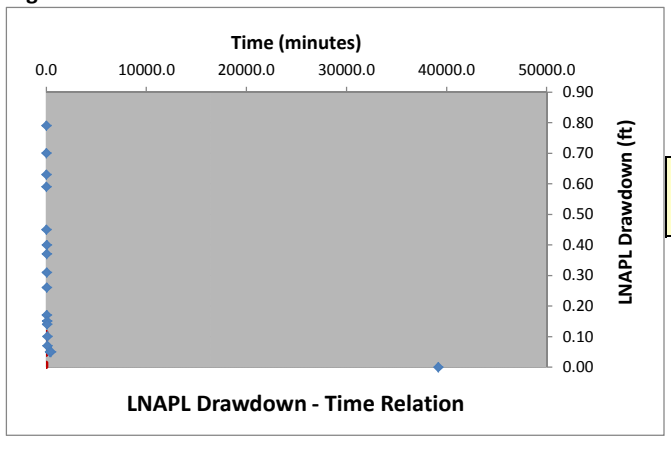


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	S-3
Date:	19-Sep-13

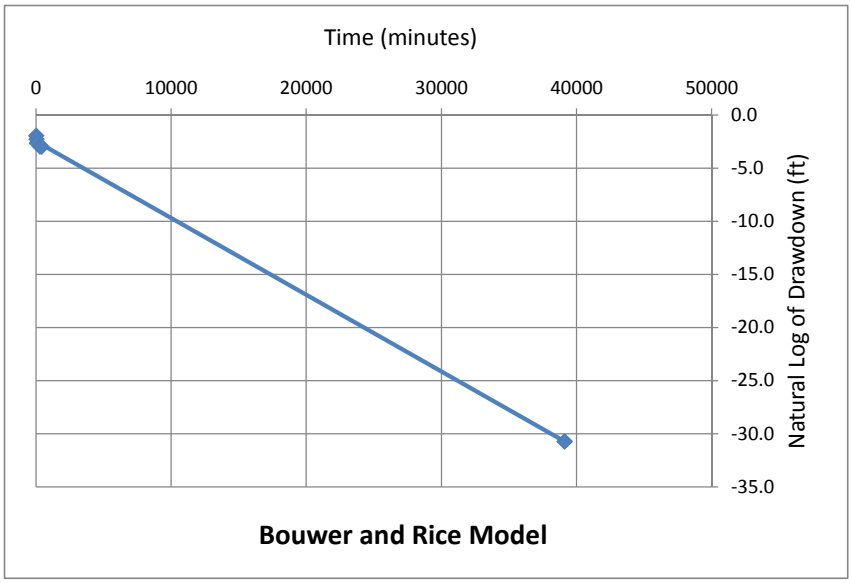
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

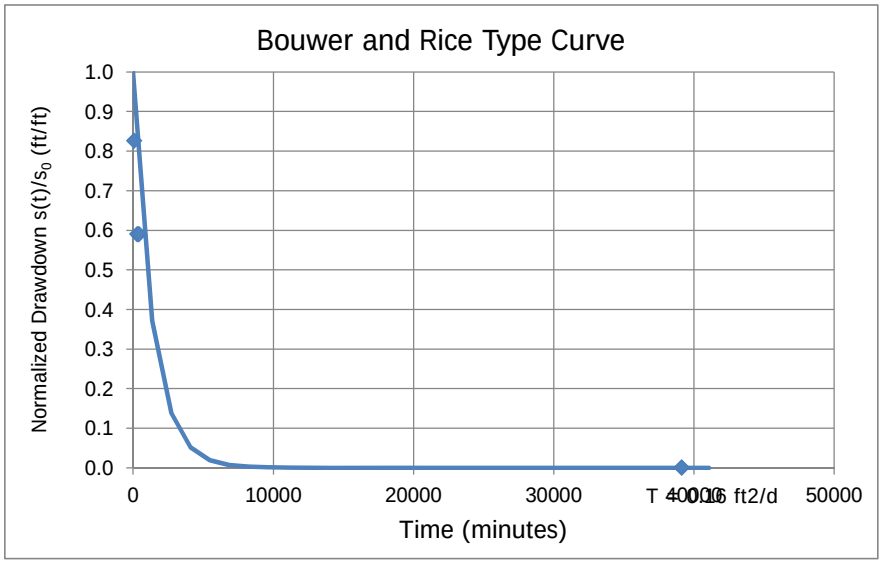
$Time_{cut}$	54	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.17 +/- 0.00 ft^2/d

L_e/r_e	6.9
C	1.07
R/r_e	3.99
J-Ratio	-0.231
Coef. Of Variation	0.01



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	S-3
Date:	19-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^{\,2} S_n}\right)} \Delta t_j$$

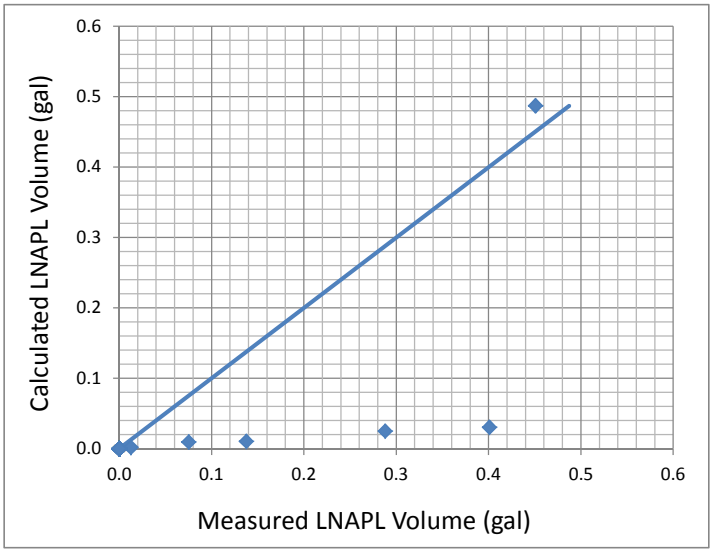
Enter early time cut-off for least-squares model fit

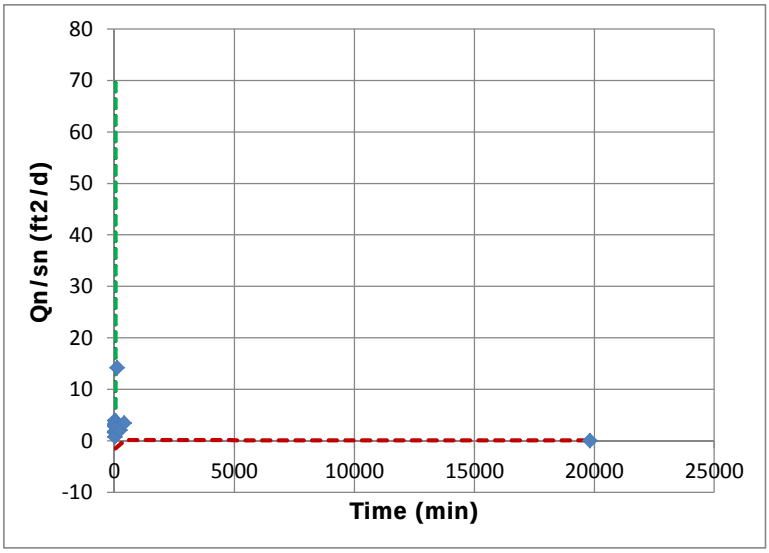
$Time_{cut}$ (min):	54	<- Enter or change values here
Time Adjustment (min):	36	

Trial S_n:	d	<-- Enter d for default or enter S_n value
Root-Mean-Square Error:	0.478	<-- Minimize this using "Solver"
	0.006	<-- Working S_n
Trial T_n (ft^2/d):	0.063	<-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.06**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	S-3
Date:	19-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	54	<- Enter or change values here
Initial Drawdown s_n (ft):	0.15	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.469 <-- Minimize this using "Solver"

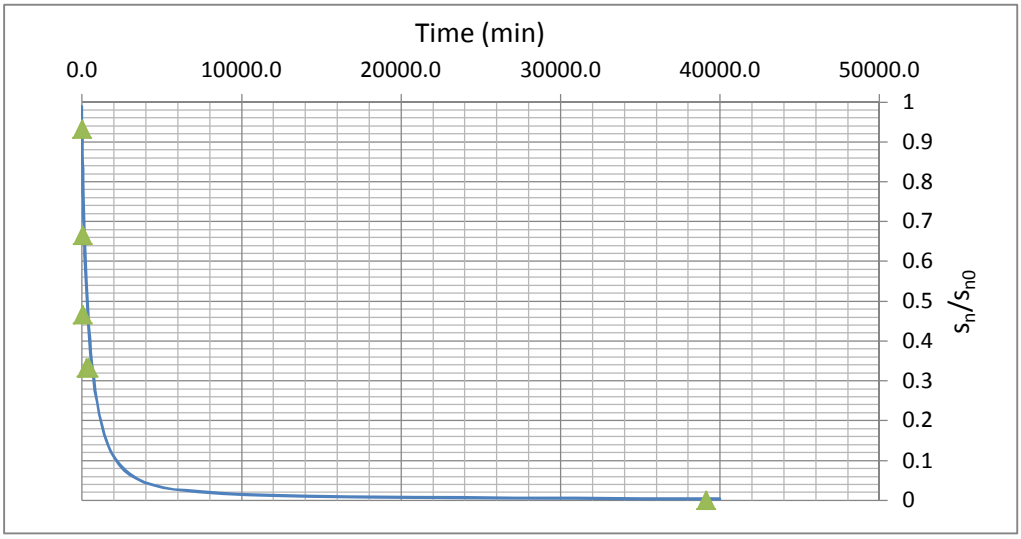
Trial T_n (ft^2/d): 0.700 <-- By changing T_n through "Solver"

0.021 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.70**

T_{min}	0.1
T_{max}	40000



J-Ratio
-0.231

Well Designation:	S-5	Beckett and Lyverse (2002)
Date:	19-Sep-13	

Ground Surface Elev (ft msl)	375.1	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	373.4		
Well Casing Radius, r_c (ft):	0.167	r_{e1}	0.57
Well Radius, r_w (ft):	0.417		
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.780		
Top of Screen (ft bgs):	5.0		
Bottom of Screen (ft bgs):	14.3		
LNAPL Baildown Vol. (gal.):	2.9		
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters	
Effective Radius, r_{e2} (ft):	#NUM!		
Initial Casing LNAPL Vol. (gal.):	0.38		
Initial Filter LNAPL Vol. (gal.):	0.35		

	Enter Data Here											
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	9.93	10.51	11.71	12.29	11.84					0.58	
Enter Test Data:	6.0	10.76	10.77	12.54	12.55	12.54	0.26				0.01	
	13.0	10.72	10.74	12.50	12.52	12.50	0.22	9.5	0.344	0.24	0.02	0.231
	17.0	10.7	10.73	12.48	12.51	12.49	0.20	15.0	0.603	0.21	0.03	0.231
	19.0	10.69	10.73	12.47	12.51	12.48	0.19	18.0	1.206	0.19	0.04	0.231
	24.0	10.67	10.72	12.45	12.50	12.46	0.17	21.5	0.482	0.18	0.05	0.231
	29.00	10.65	10.71	12.43	12.49	12.44	0.15	26.5	0.482	0.16	0.06	0.231
	39.00	10.6	10.67	12.38	12.45	12.40	0.10	34.0	0.241	0.12	0.07	0.231
	49.0	10.57	10.65	12.35	12.43	12.37	0.07	44.0	0.241	0.09	0.08	0.231
	69.0	10.51	10.60	12.29	12.38	12.31	0.01	59.0	0.121	0.04	0.09	0.231

Figure 1

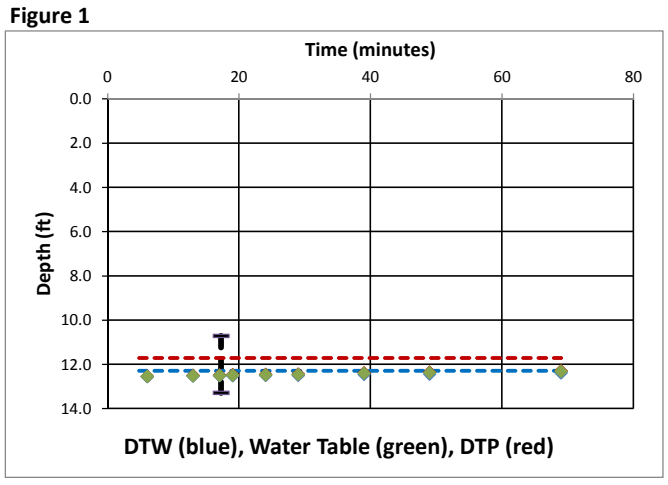
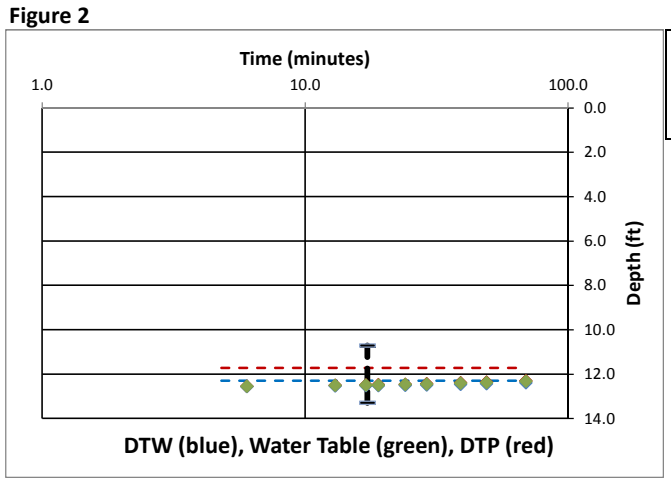


Figure 2



4.8	11.71
69	11.71
4.8	12.29
69	12.29

17.2	10.71	10.7
17.2	13.3	13.3

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.75	0.25

Drawdown Adjust.	
Δs_n (ft)	0.57

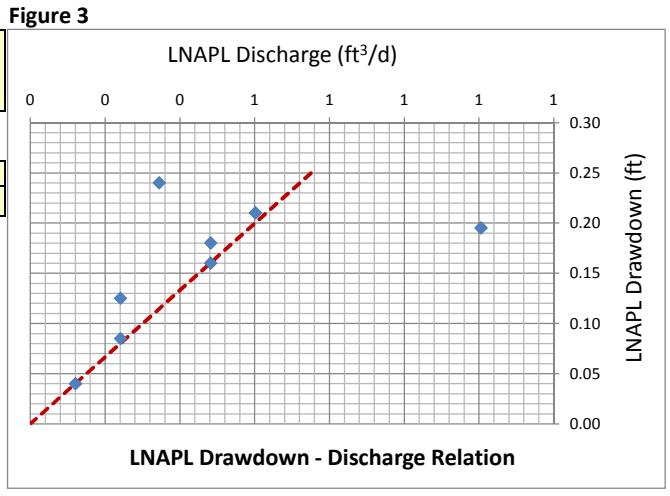
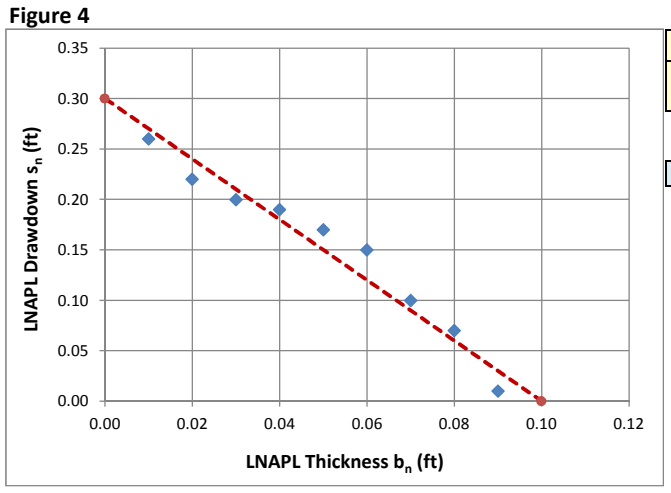


Figure 4



b_n	s_n
0.1	0
0	0.3

J-ratio	-3.000

Figure 5

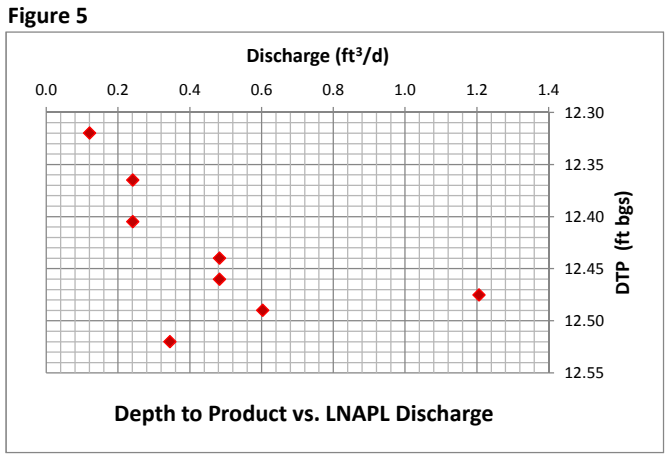


Figure 6

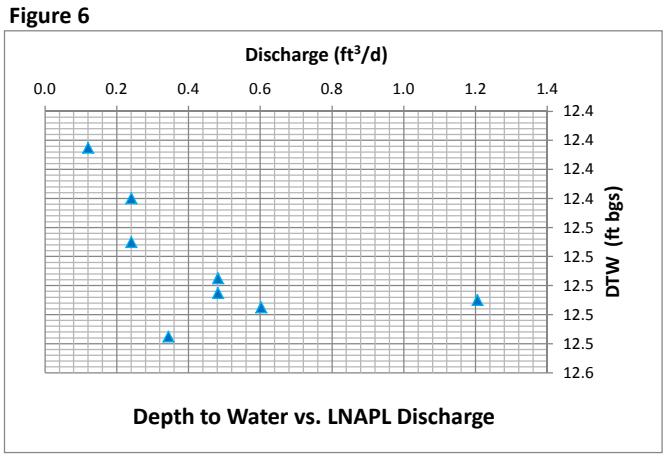


Figure 7

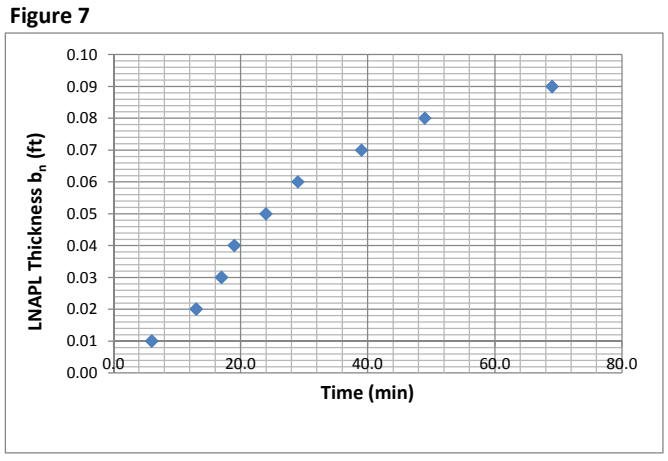


Figure 8

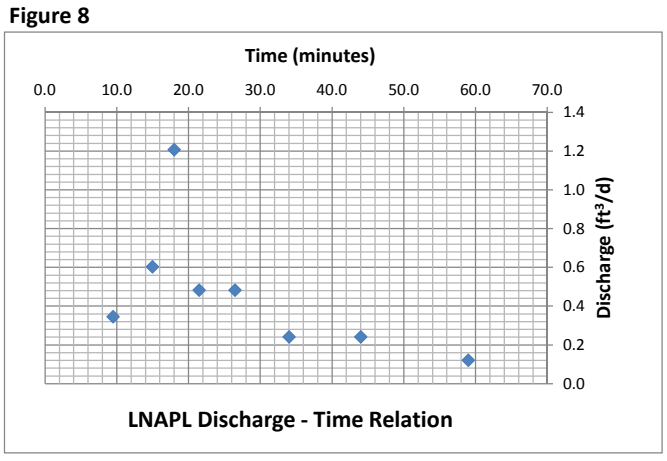


Figure 9

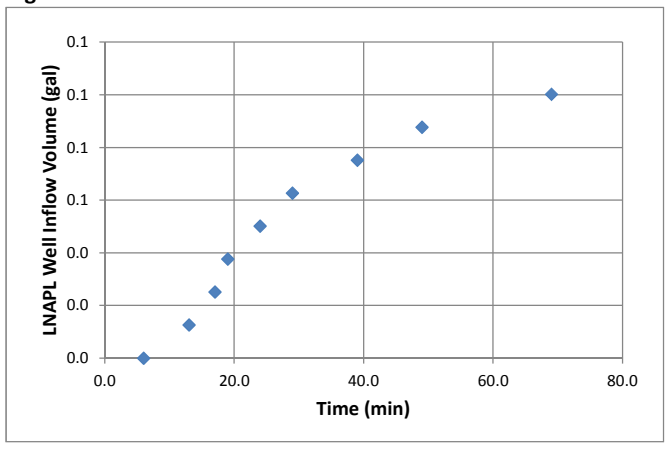
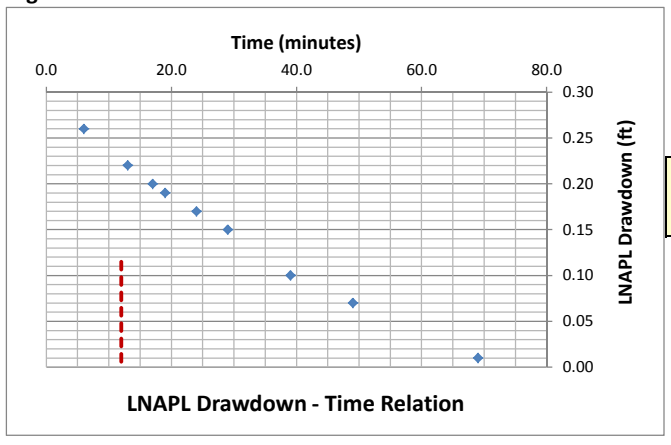


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	S-5
Date:	19-Sep-13

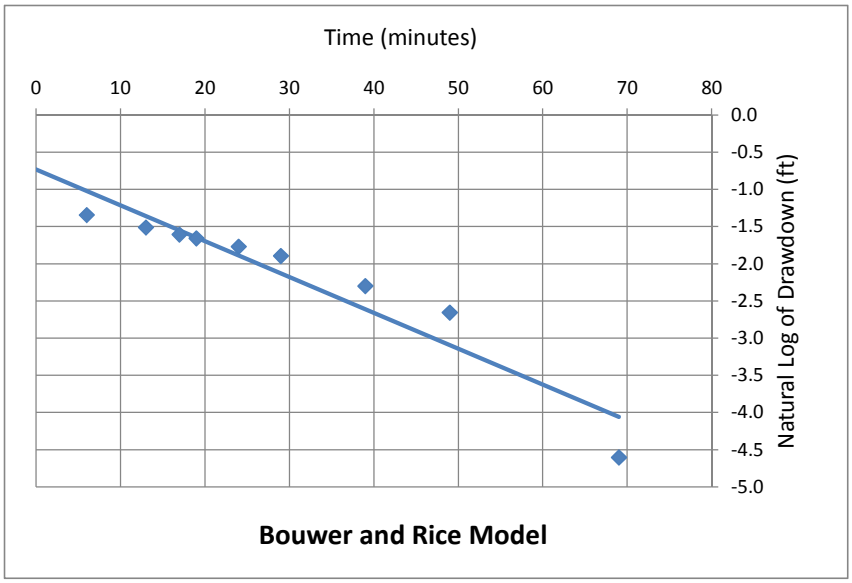
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

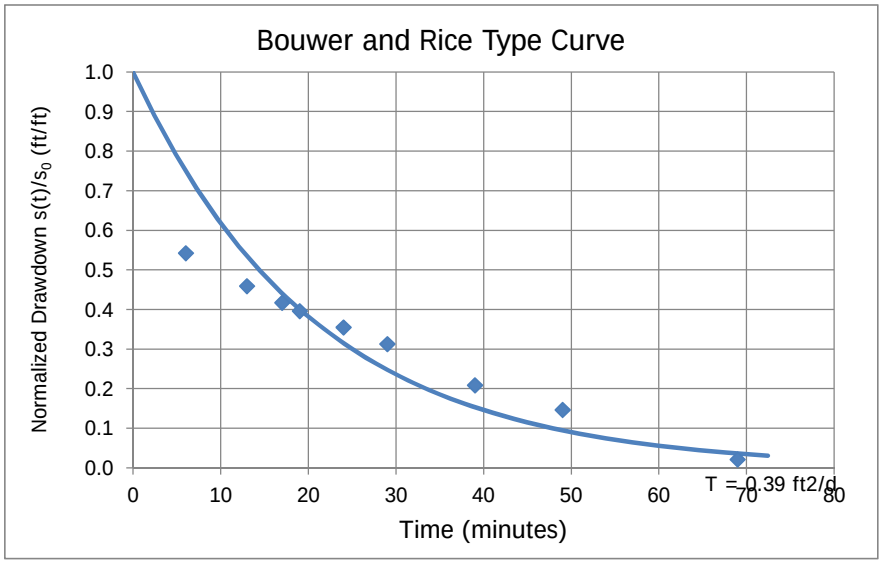
$Time_{cut}$	0	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.40 +/- 0.05 ft^2/d

L_e/r_e	2.5
C	0.89
R/r_e	1.91
J-Ratio	-3.000
Coef. Of Variation	0.12



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	S-5
Date:	19-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	0	<- Enter or change values here
Time Adjustment (min):	0	

Trial S_n: d <-- Enter d for default or enter S_n value

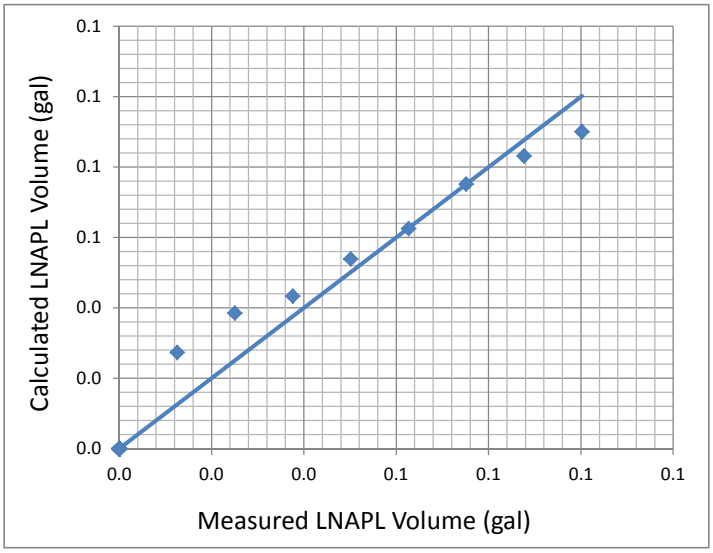
Root-Mean-Square Error: 0.024 <-- Minimize this using "Solver"

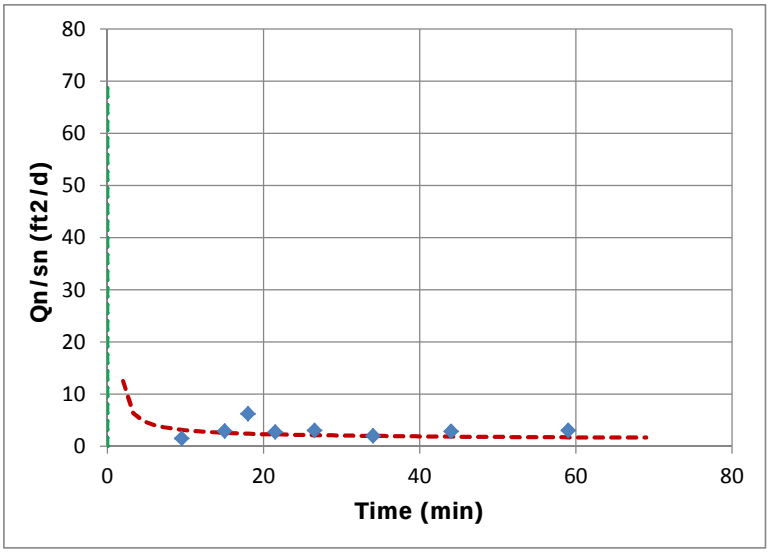
0.018 <-- Working S_n

Trial T_n (ft^2/d): 0.518 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.52**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	S-5
Date:	19-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	0	<- Enter or change values here
Initial Drawdown s_n (ft):	0.26	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.436 <-- Minimize this using "Solver"

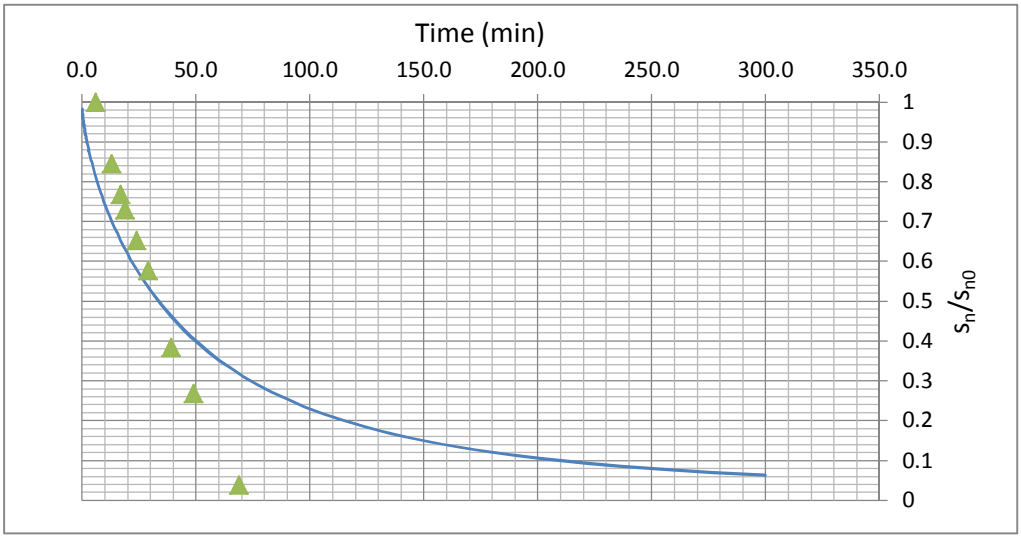
Trial T_n (ft^2/d): 0.560 <-- By changing T_n through "Solver"

0.019 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.56**

T_{min}	0.1
T_{max}	300



J-Ratio
-3.000

Well Designation:	S-9	Beckett and Lyverse (2002)
Date:	18-Sep-13	

Ground Surface Elev (ft msl)	372.9	Enter These Data
Top of Casing Elev (ft msl)	372.2	
Well Casing Radius, r_c (ft):	0.083	r_{e1}
Well Radius, r_w (ft):	0.333	
LNAPL Specific Yield, S_y:	0.175	
LNAPL Density Ratio, ρ_r:	0.797	
Top of Screen (ft bgs):	5.0	
Bottom of Screen (ft bgs):	18.0	
LNAPL Baildown Vol. (gal.):	0.5	
Effective Radius, r_{e3} (ft):	0.159	Calculated Parameters
Effective Radius, r_{e2} (ft):	#NUM!	
Initial Casing LNAPL Vol. (gal.):	0.23	
Initial Filter LNAPL Vol. (gal.):	0.61	

Drawdown Adjustment (ft)
-0.11

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	8.60	10.02	9.32	10.74	9.61					1.42	
Enter Test Data:	1.0	10.61	10.68	11.33	11.40	11.34	2.12				0.07	
	2.0	10.56	10.66	11.28	11.38	11.30	2.07	1.5	3.416	2.09	0.10	0.159
	3.0	10.52	10.63	11.24	11.35	11.26	2.03	2.5	1.139	2.05	0.11	0.159
	4.0	10.50	10.62	11.22	11.34	11.24	2.01	3.5	1.139	2.02	0.12	0.159
	6.0	10.4	10.57	11.12	11.29	11.15	1.91	5.0	2.847	1.96	0.17	0.159
	7.0	10.37	10.55	11.09	11.27	11.13	1.88	6.5	1.139	1.89	0.18	0.159
	11.0	10.3	10.50	11.02	11.22	11.06	1.81	9.0	0.569	1.84	0.20	0.159
	13.0	10.26	10.48	10.98	11.20	11.02	1.77	12.0	1.139	1.79	0.22	0.159
	17.0	10.2	10.44	10.92	11.16	10.97	1.71	15.0	0.569	1.74	0.24	0.159
	27.0	10.10	10.35	10.82	11.07	10.87	1.61	22.0	0.114	1.66	0.25	0.159
	32.00	10.05	10.33	10.77	11.05	10.83	1.56	29.5	0.683	1.58	0.28	0.159
	57.0	9.96	10.26	10.68	10.98	10.74	1.47	44.5	0.091	1.51	0.30	0.159
	87.00	9.9	10.23	10.62	10.95	10.69	1.41	72.0	0.114	1.44	0.33	0.159
	97.00	9.87	10.21	10.59	10.93	10.66	1.38	92.0	0.114	1.39	0.34	0.159
	106.0	9.86	10.25	10.58	10.97	10.66	1.37	101.5	0.633	1.37	0.39	0.159
	1586.00	8.9	9.48	9.62	10.20	9.74	0.41	846.0	0.015	0.89	0.58	0.159
	2540.00	8.94	9.56	9.66	10.28	9.79	0.45	2063.0	0.005	0.43	0.62	0.159
	2811.0	9	9.64	9.72	10.36	9.85	0.51	2675.5	0.008	0.48	0.64	0.159
	11300.0	8.85	9.50	9.57	10.22	9.70	0.36	7055.5	0.000	0.43	0.65	0.159
	28486.00	8.5	9.20	9.22	9.92	9.36	0.01	19893.0	0.000	0.18	0.70	0.159
	40296.00	8.76	9.49	9.48	10.21	9.63	0.27	34391.0	0.000	0.14	0.73	0.159

Figure 1

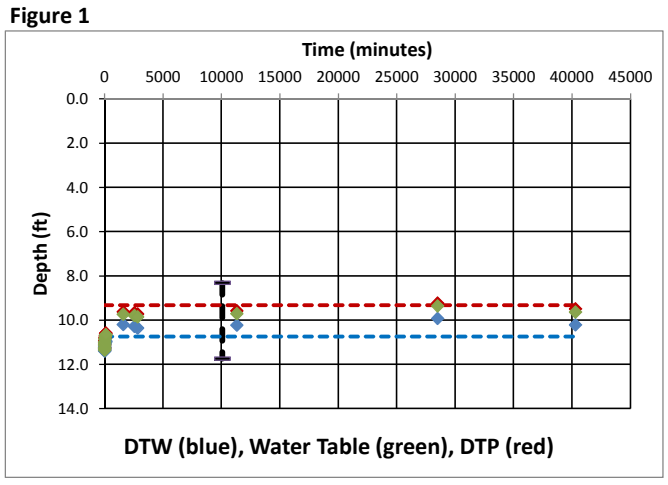
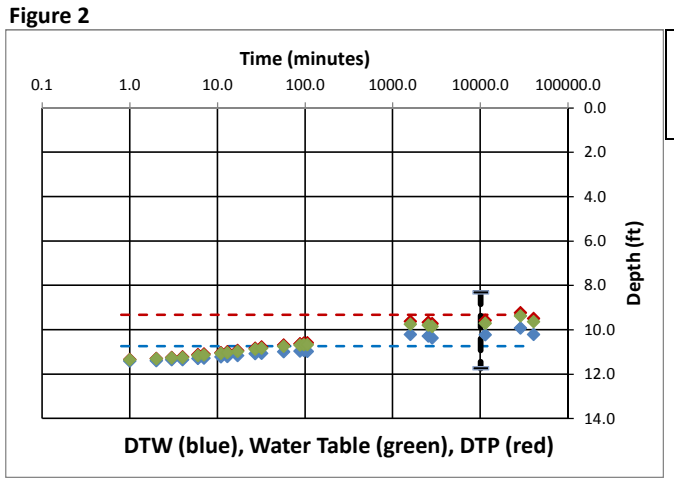


Figure 2



0.8	9.32
40296	9.32
0.8	10.74
40296	10.74

10074.0	8.32	8.3
10074.0	11.7	11.7

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.15	2

Drawdown Adjust.	
Δs_n (ft)	-0.11

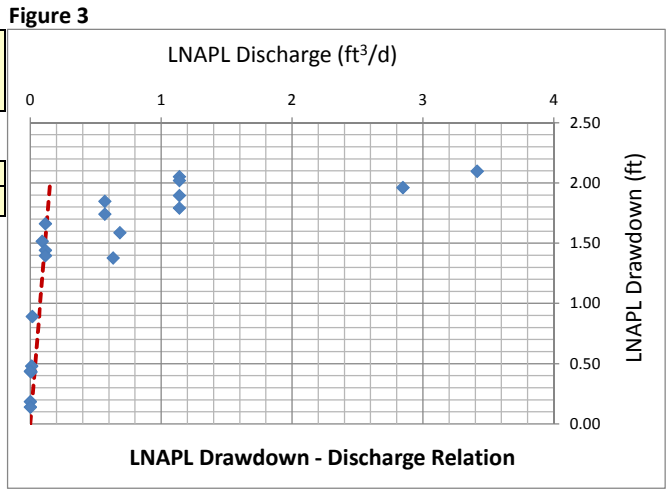
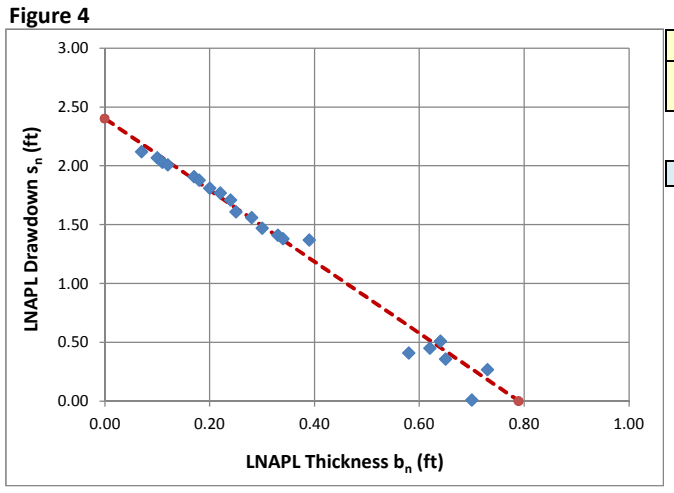


Figure 4



b_n	s_n
0.79	0
0	2.4

J-ratio	-3.038

Figure 5

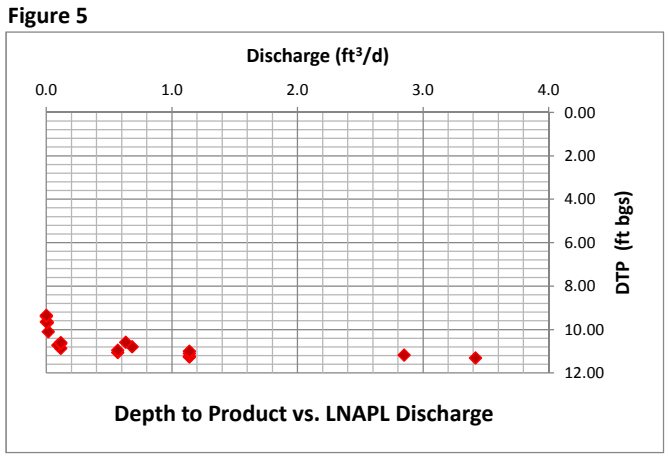


Figure 6

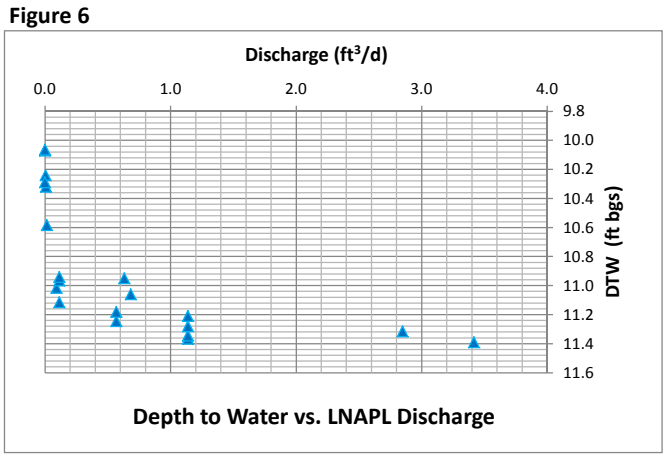


Figure 7

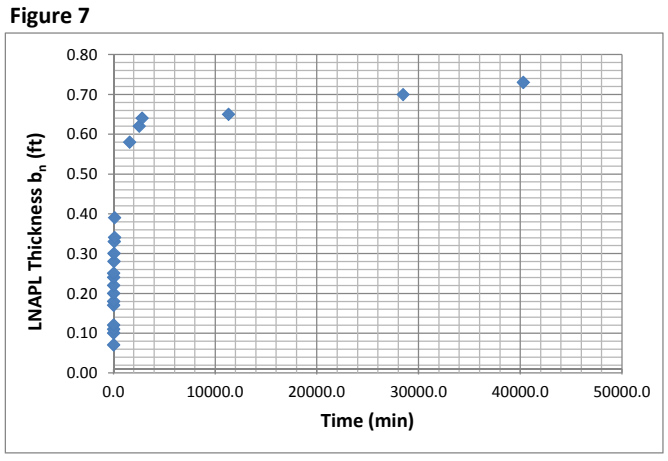


Figure 8

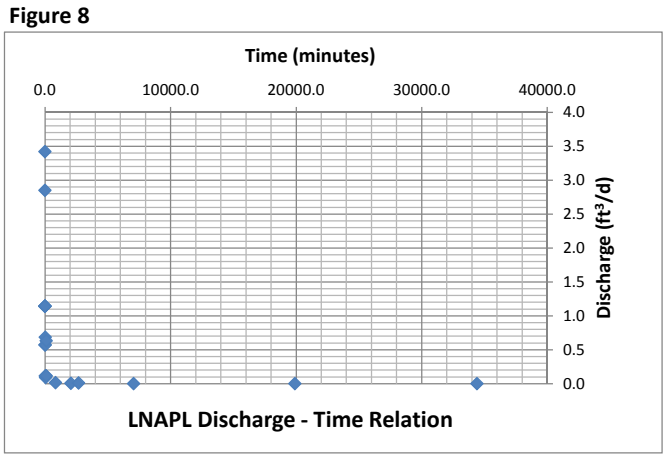


Figure 9

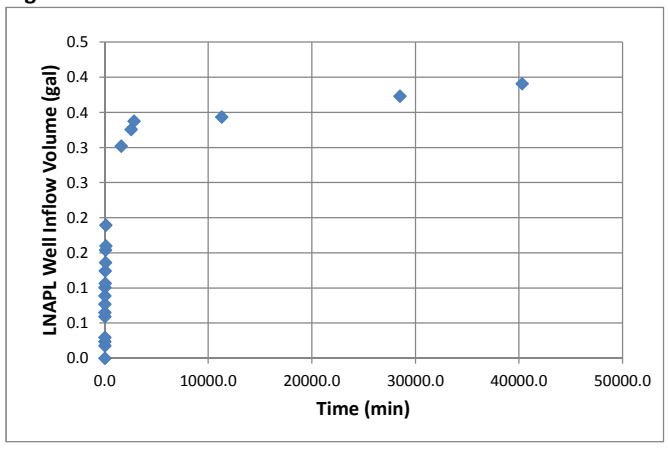
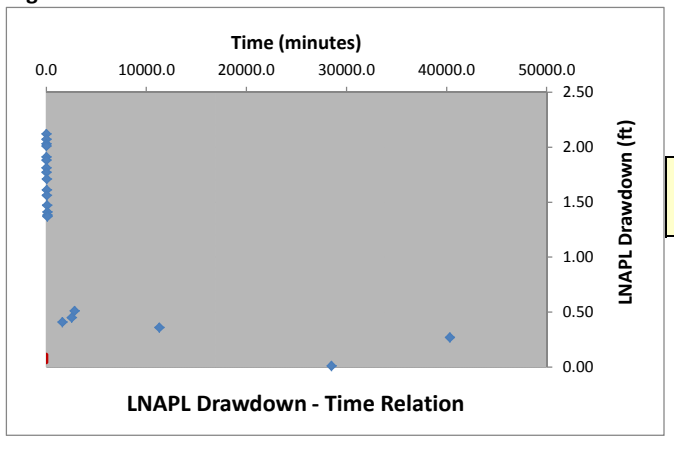


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	S-9
Date:	18-Sep-13

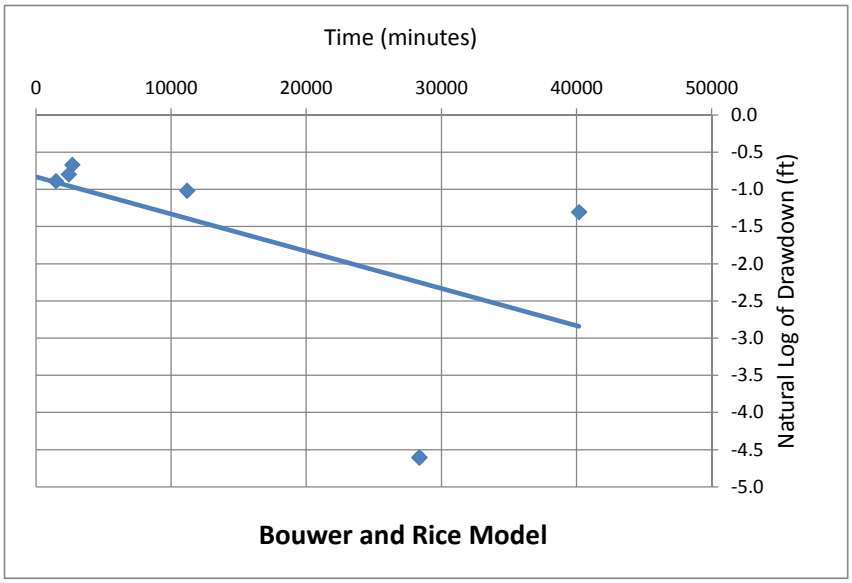
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

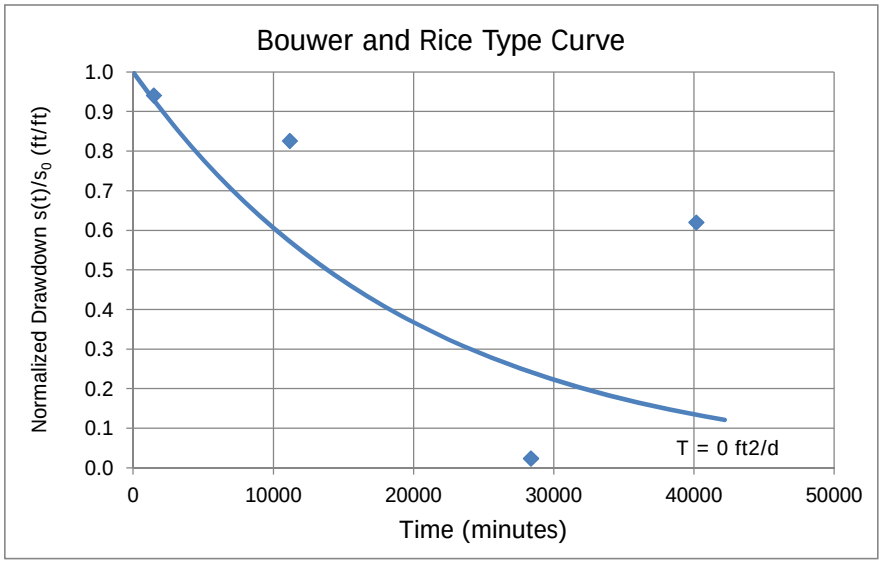
$Time_{cut}$	120	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.00 +/- 0.00 ft^2/d

L_e/r_e	8.9
C	1.15
R/r_e	4.89
J-Ratio	-3.038
Coef. Of Variation	0.79



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	S-9
Date:	18-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	120	<- Enter or change values here
Time Adjustment (min):	80	

Trial S_n: d <-- Enter d for default or enter S_n value

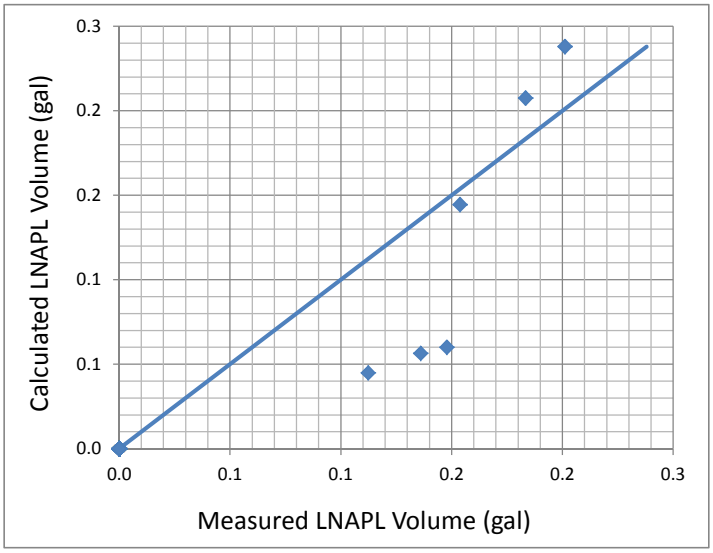
Root-Mean-Square Error: 0.144 <-- Minimize this using "Solver"

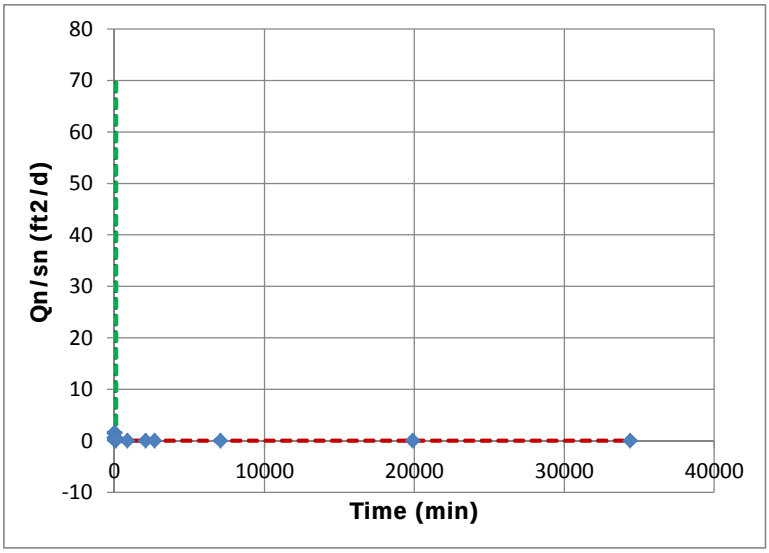
0.001 <-- Working S_n

Trial T_n (ft^2/d): 0.002 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.00**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	S-9
Date:	18-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	120	<- Enter or change values here
Initial Drawdown s_n (ft):	0.41	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.742 <-- Minimize this using "Solver"

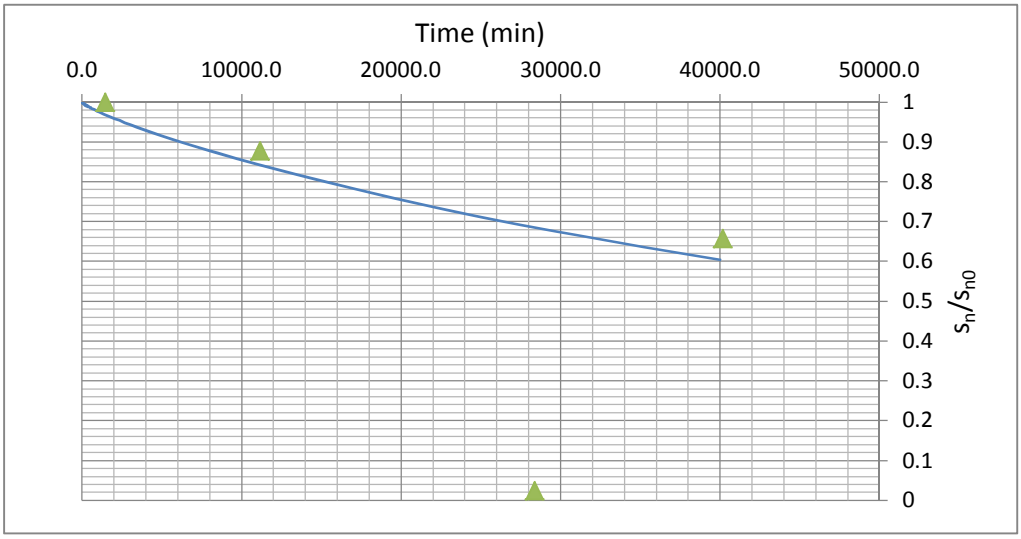
Trial T_n (ft^2/d): 0.000 <-- By changing T_n through "Solver"

0.000 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.00**

T_{min}	0.1
T_{max}	40000



J-Ratio
-3.038

Well Designation:	S-12	Beckett and Lyverse (2002)
Date:	19-Sep-13	

Ground Surface Elev (ft msl)	370.1	Enter These Data
Top of Casing Elev (ft msl)	372.7	
Well Casing Radius, r_c (ft):	0.167	r_{e1}
Well Radius, r_w (ft):	0.417	
LNAPL Specific Yield, S_y:	0.175	
LNAPL Density Ratio, ρ_r:	0.761	
Top of Screen (ft bgs):	5.0	
Bottom of Screen (ft bgs):	12.7	
LNAPL Baildown Vol. (gal.):	0.1	
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters
Effective Radius, r_{e2} (ft):	#NUM!	
Initial Casing LNAPL Vol. (gal.):	0.22	
Initial Filter LNAPL Vol. (gal.):	0.20	

Drawdown Adjustment (ft)
0.11

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	9.46	9.79	6.86	7.19	6.94					0.33	
Enter Test Data:	4.0	10.00	10.00	7.40	7.40	7.40	0.43				0.00	
	20.0	9.61	9.62	7.01	7.02	7.01	0.04	12.0	0.151	0.24	0.01	0.231
	10208.00	9.58	9.60	6.98	7.00	6.98	0.01	5114.0	0.000	0.03	0.02	0.231

Figure 1

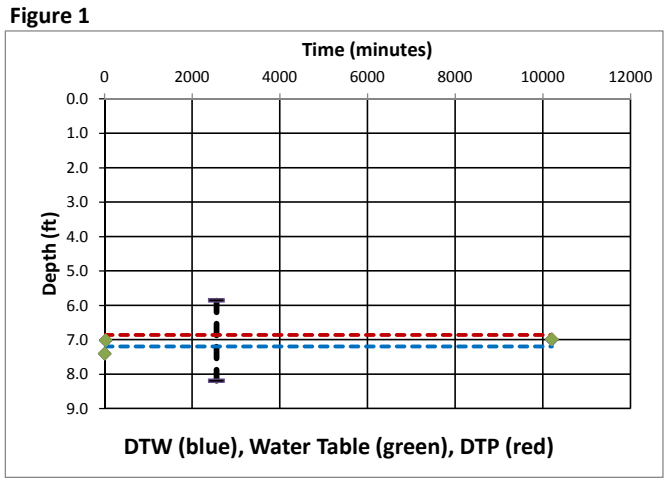
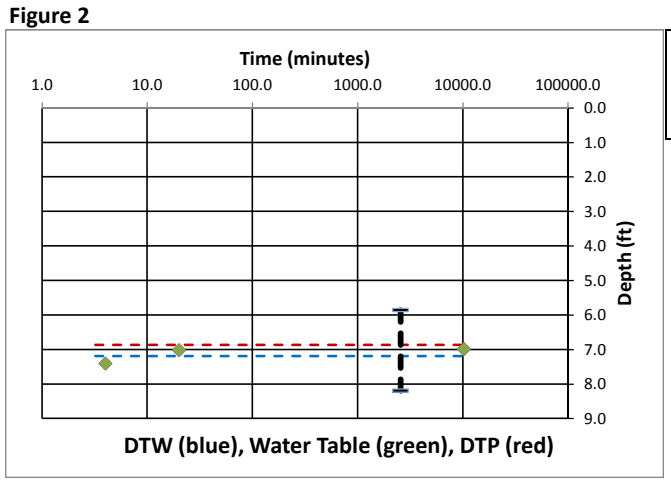


Figure 2



3.2	6.86
10208	6.86
3.2	7.19
10208	7.19

2552.0	5.86	5.9
2552.0	8.2	8.2

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.25	0.38

Drawdown Adjust.	
Δs_n (ft)	0.11

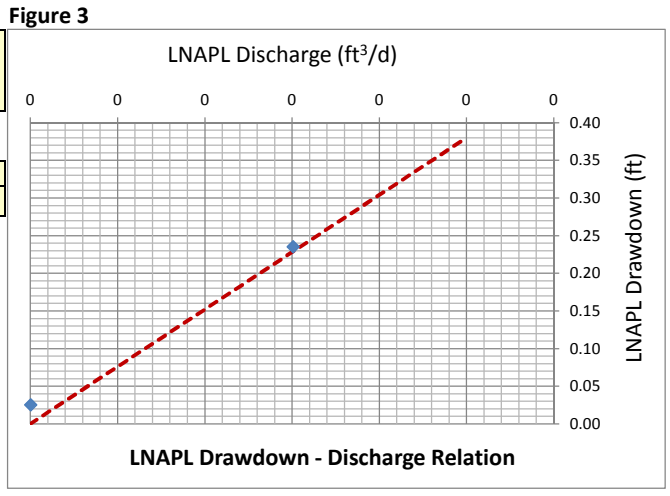
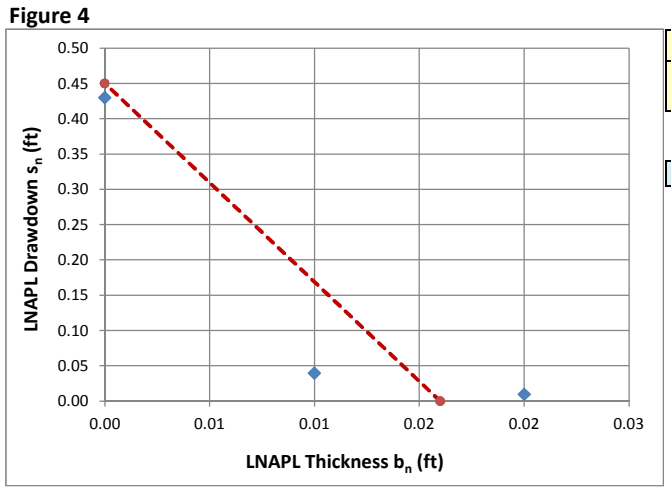


Figure 4



b_n	s_n
0.016	0
0	0.45

J-ratio	-28.125

Figure 5

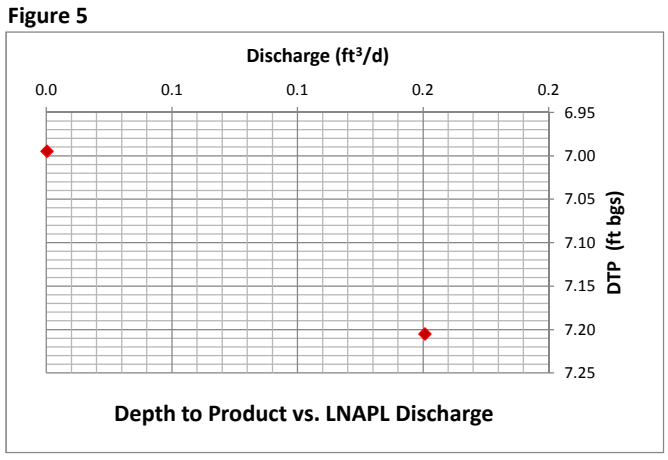


Figure 6

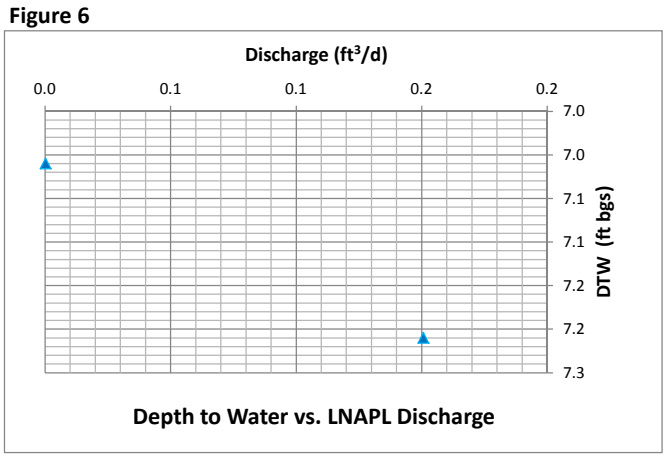


Figure 7

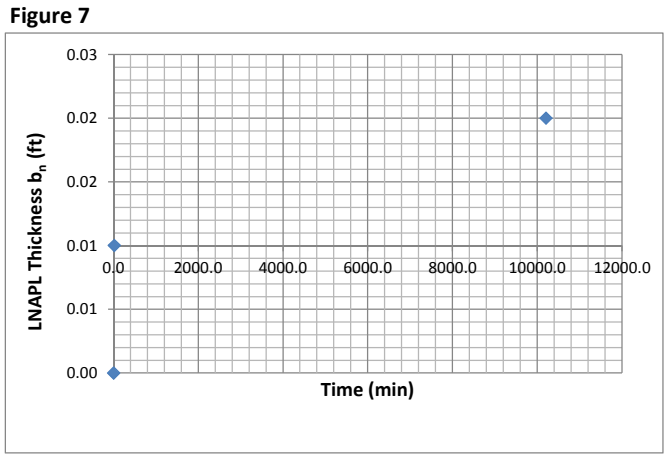


Figure 8

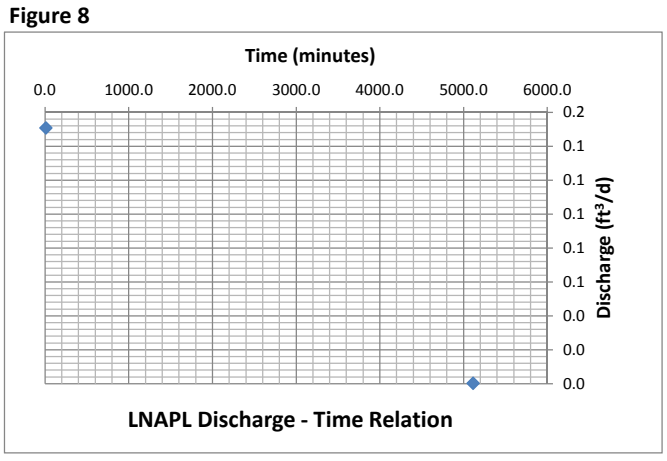


Figure 9

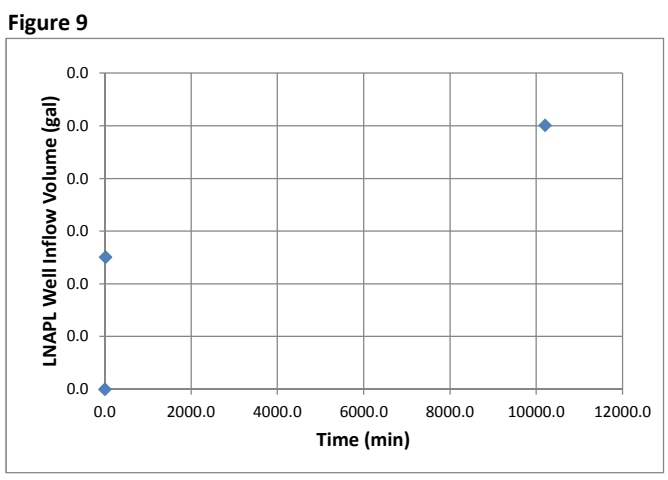
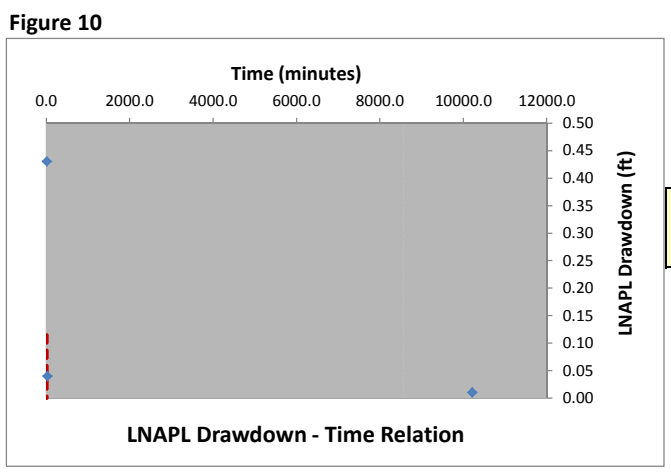


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	S-12
Date:	19-Sep-13

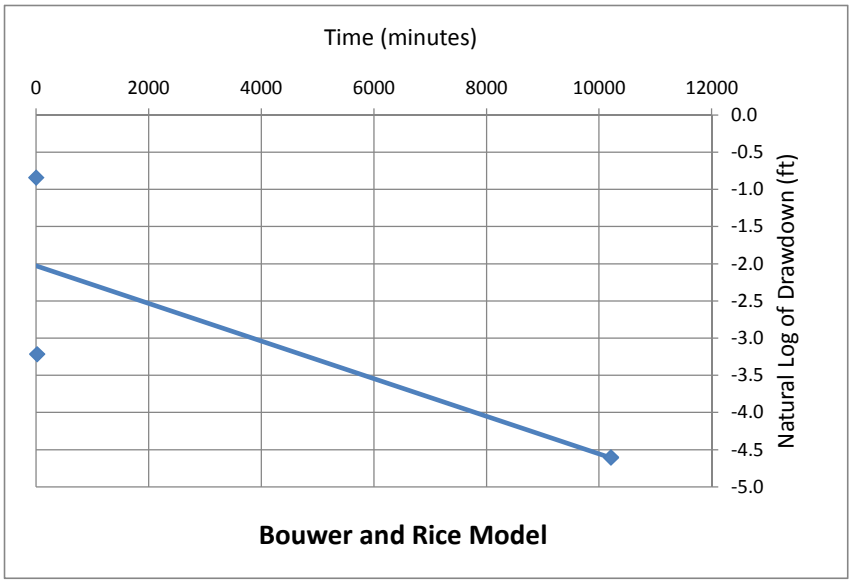
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

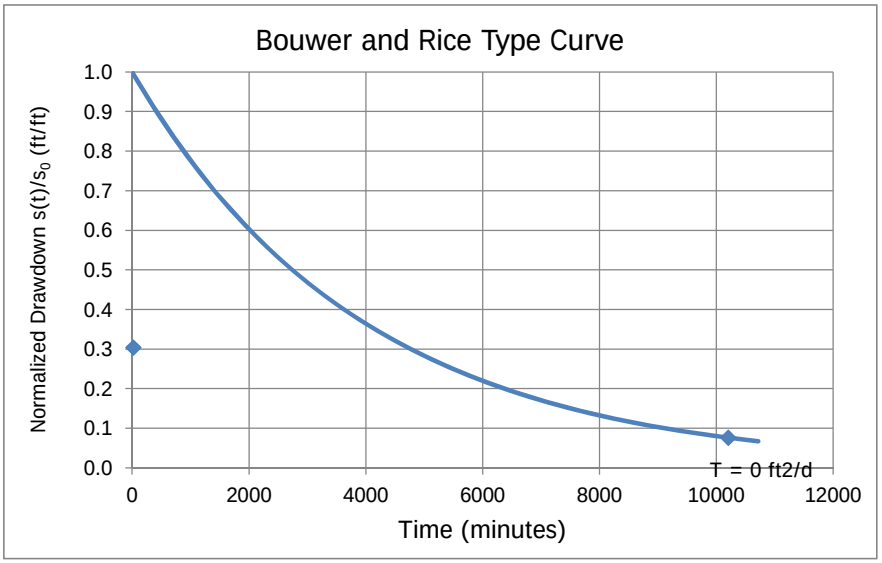
$Time_{cut}$	0	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.00 +/- 0.00 ft^2/d

L_e/r_e	1.4
C	0.85
R/r_e	1.31
J-Ratio	-28.125
Coef. Of Variation	0.80



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	S-12
Date:	19-Sep-13

$$V_n(t_i) = \sum_{j}^{i} \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^{\,2} S_n}\right)} \Delta t_j$$

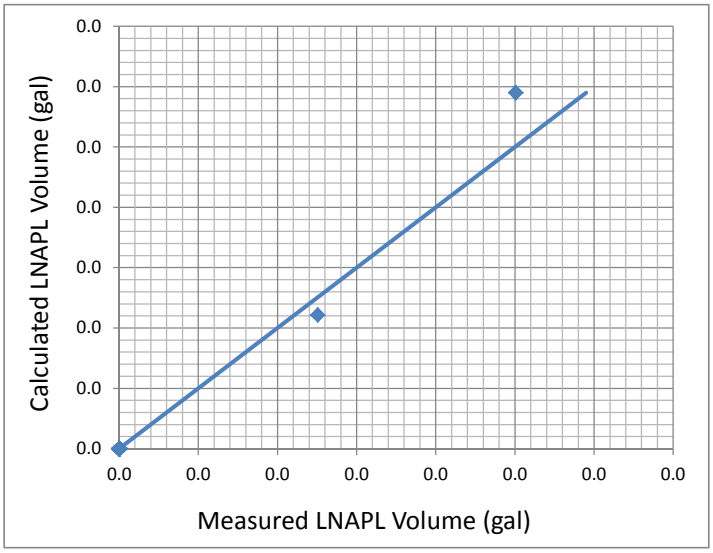
Enter early time cut-off for least-squares model fit

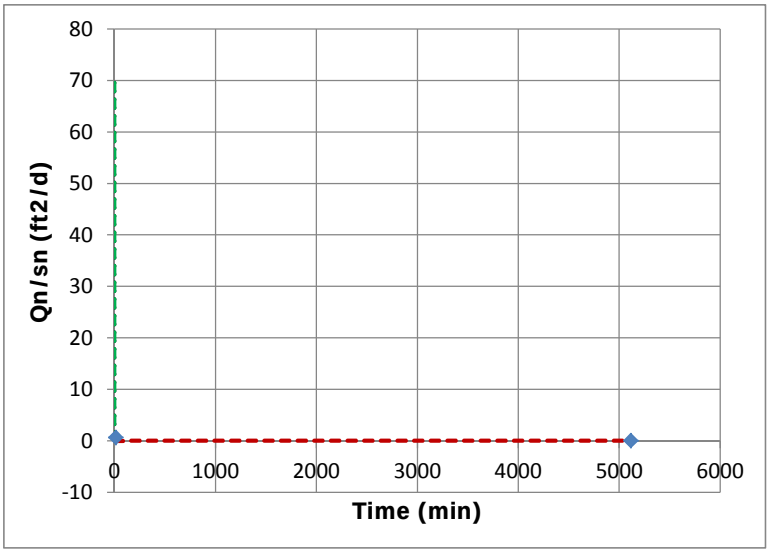
$Time_{cut}$ (min):	0	<- Enter or change values here
Time Adjustment (min):	0	

Trial S_n:	d	<-- Enter d for default or enter S_n value
Root-Mean-Square Error:	0.005	<-- Minimize this using "Solver"
	0.002	<-- Working S_n
Trial T_n (ft^2/d):	0.007	<-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.01**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	S-12
Date:	19-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	0	<- Enter or change values here
Initial Drawdown s_n (ft):	0.54	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.903 <-- Minimize this using "Solver"

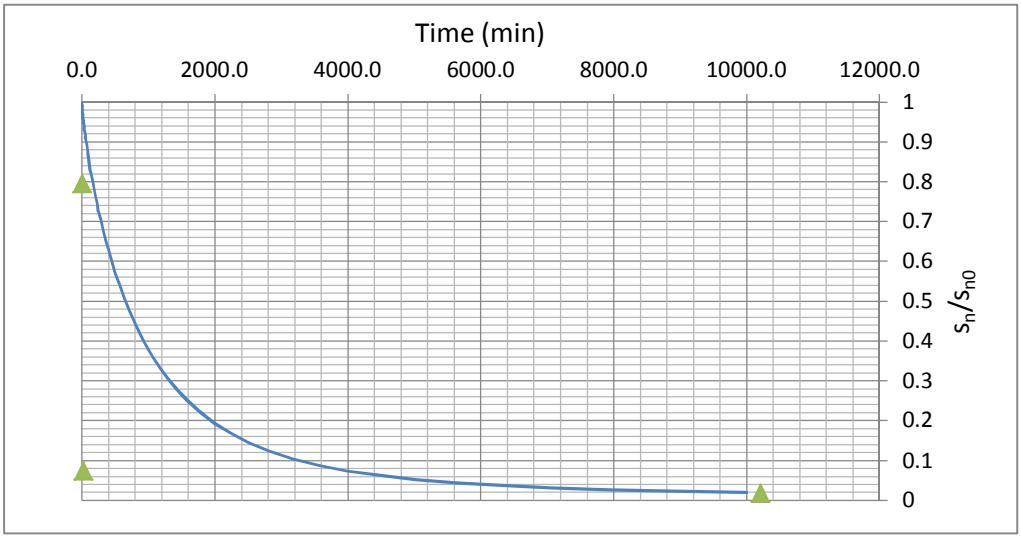
Trial T_n (ft^2/d): 0.005 <-- By changing T_n through "Solver"

0.002 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.01**

T_{min}	0.1
T_{max}	10000



J-Ratio
-28.125

Well Designation:	S-13
Date:	19-Sep-13

Beckett and Lyverse (2002)

Ground Surface Elev (ft msl)	373.9	Enter These Data
Top of Casing Elev (ft msl)	372.8	
Well Casing Radius, r_c (ft):	0.167	r_{e1}
Well Radius, r_w (ft):	0.417	
LNAPL Specific Yield, S_y:	0.175	
LNAPL Density Ratio, ρ_r:	0.807	
Top of Screen (ft bgs):	5.5	
Bottom of Screen (ft bgs):	15.0	
LNAPL Baildown Vol. (gal.):	7.0	
Effective Radius, r_{e3} (ft):	0.231	Calculated Parameters
Effective Radius, r_{e2} (ft):	#NUM!	
Initial Casing LNAPL Vol. (gal.):	2.27	
Initial Filter LNAPL Vol. (gal.):	2.09	

Drawdown Adjustment (ft)
0.28

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	8.75	12.23	9.87	13.35	10.54					3.48	
Enter Test Data:	3.0	12.25	12.28	13.37	13.40	13.38	3.22				0.03	
	5.0	12.14	12.18	13.26	13.30	13.27	3.11	4.0	1.206	3.16	0.04	0.231
	6.0	12.05	12.10	13.17	13.22	13.18	3.02	5.5	2.411	3.07	0.05	0.231
	7.0	12.02	12.08	13.14	13.20	13.15	2.99	6.5	2.411	3.01	0.06	0.231
	9.0	11.95	12.02	13.07	13.14	13.08	2.92	8.0	1.206	2.95	0.07	0.231
	11.0	11.84	11.95	12.96	13.07	12.98	2.81	10.0	4.822	2.86	0.11	0.231
	13.0	11.77	11.91	12.89	13.03	12.92	2.74	12.0	3.617	2.77	0.14	0.231
	15.0	11.7	11.85	12.82	12.97	12.85	2.67	14.0	1.206	2.70	0.15	0.231
	17.0	11.62	11.78	12.74	12.90	12.77	2.59	16.0	1.206	2.63	0.16	0.231
	87.0	10.32	10.51	11.44	11.63	11.48	1.29	52.0	0.103	1.94	0.19	0.231
	97.0	10.24	10.45	11.36	11.57	11.40	1.21	92.0	0.482	1.25	0.21	0.231
	107.0	10.15	10.39	11.27	11.51	11.32	1.12	102.0	0.723	1.16	0.24	0.231
	117.0	10.08	10.33	11.20	11.45	11.25	1.05	112.0	0.241	1.08	0.25	0.231
	1235.0	9.51	9.91	10.63	11.03	10.71	0.48	676.0	0.032	0.76	0.40	0.231
	5596.00	9.17	9.66	10.29	10.78	10.38	0.14	3415.5	0.005	0.31	0.49	0.231
	26992.00	9.1	9.65	10.22	10.77	10.33	0.07	16294.0	0.001	0.11	0.55	0.231

Figure 1

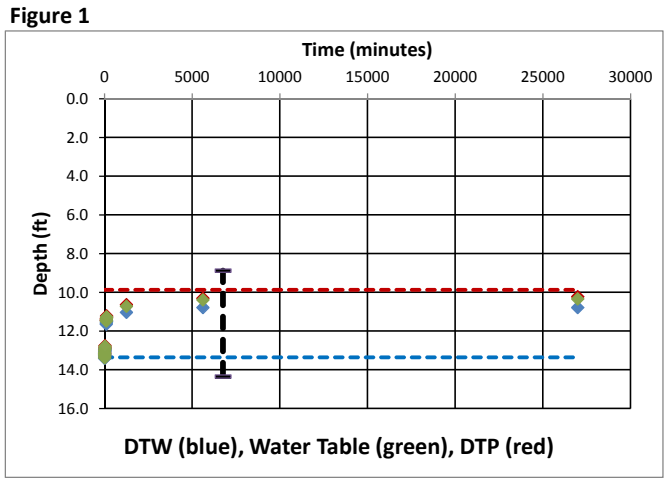
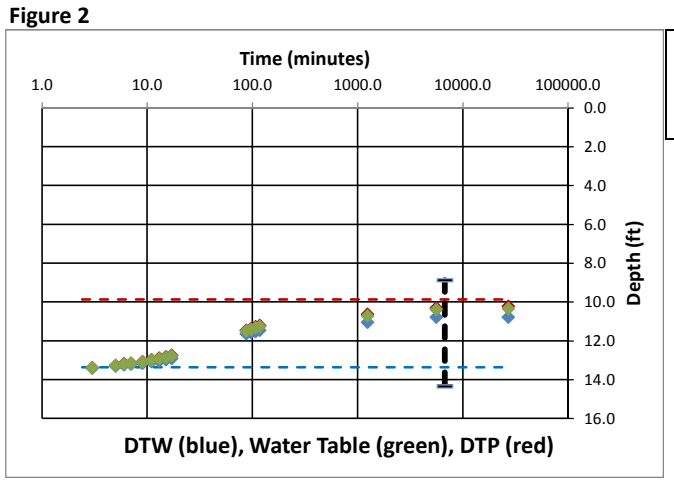


Figure 2



2.4	9.87
26992	9.87
2.4	13.35
26992	13.35

6748.0	8.87	8.9
6748.0	14.4	14.4

Figure 3

Q_n (ft^3/d)	s_n (ft)
0	0
0.2	1.5

Drawdown Adjust.	
Δs_n (ft)	0.28

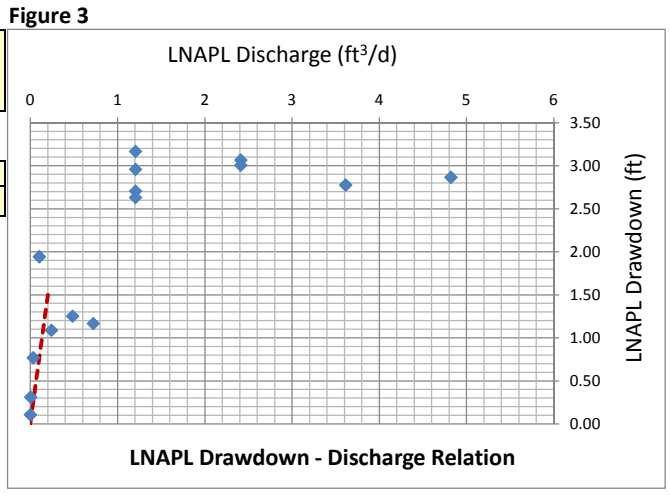
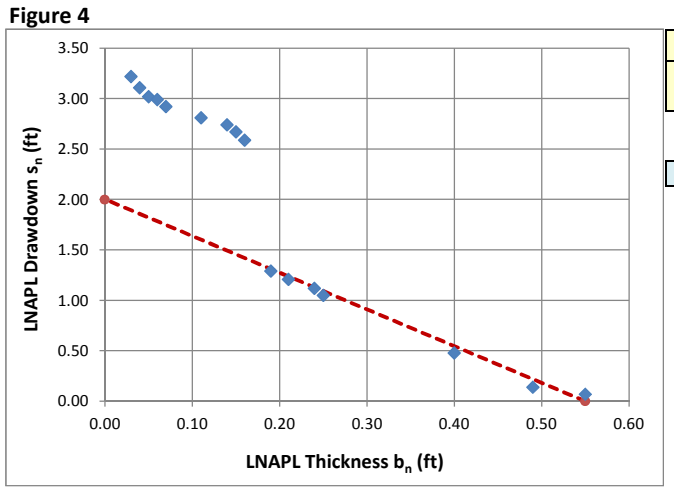


Figure 4



b_n	s_n
0.55	0
0	2

J-ratio	-3.636

Figure 5

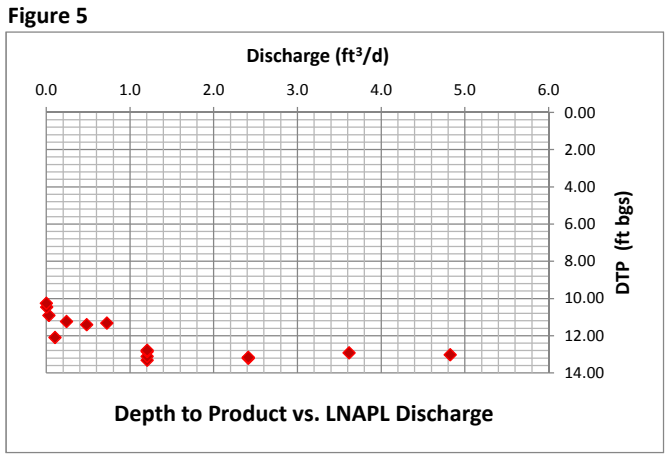


Figure 6

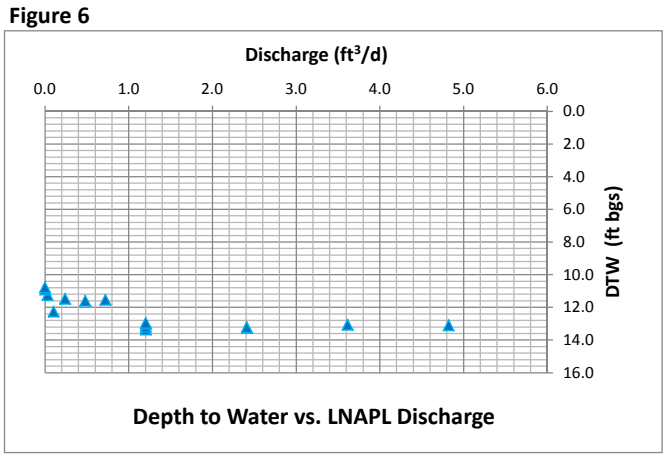


Figure 7

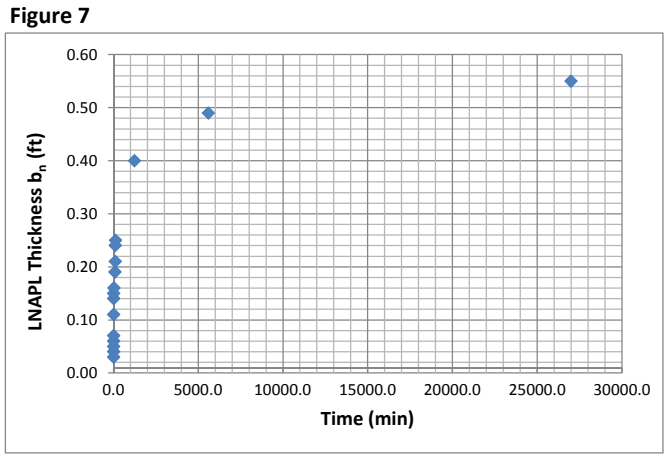


Figure 8

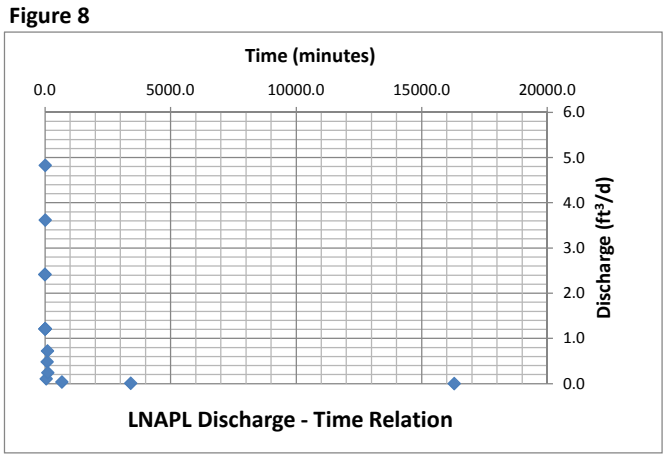


Figure 9

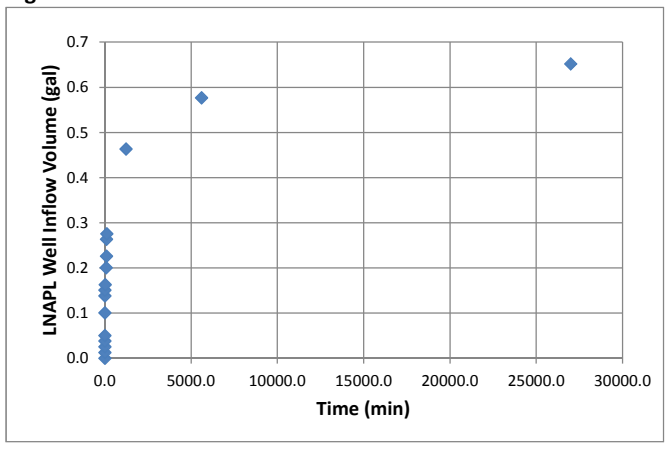
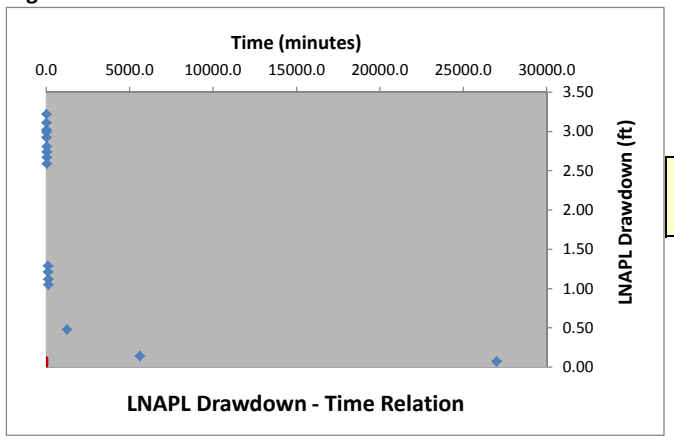


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	S-13
Date:	19-Sep-13

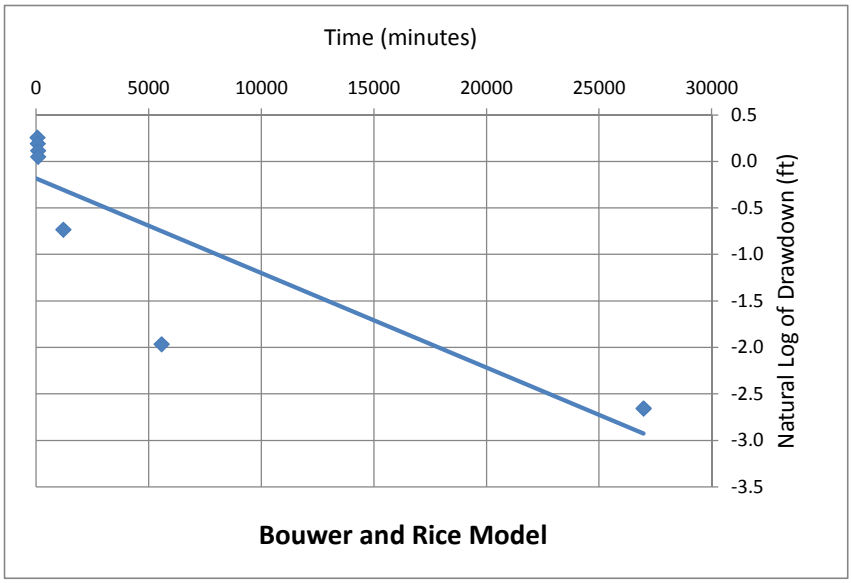
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

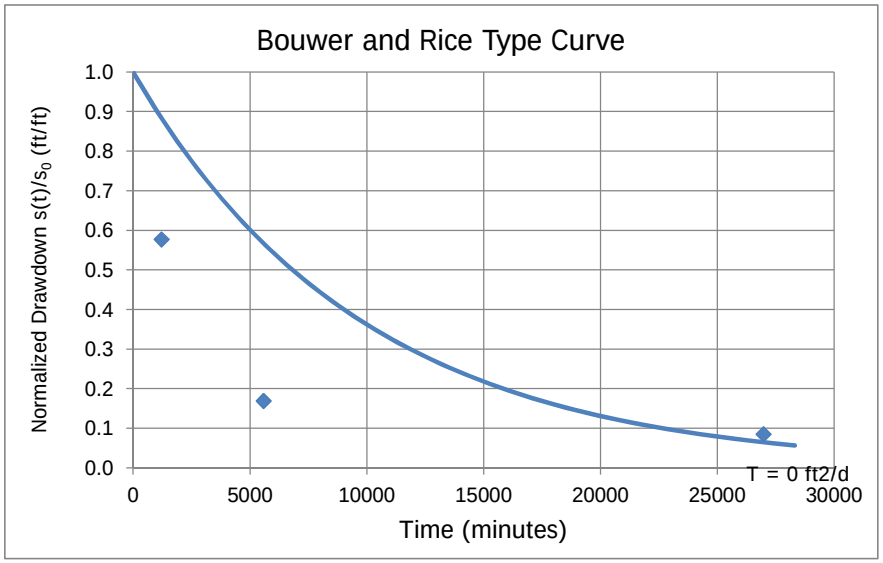
$Time_{cut}$	20	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.00 +/- 0.00 ft^2/d

L_e/r_e	15.1
C	1.39
R/r_e	7.45
J-Ratio	-3.636
Coef. Of Variation	0.27



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	S-13
Date:	19-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	20	<- Enter or change values here
Time Adjustment (min):	13.33333	

Trial S_n: d <-- Enter d for default or enter S_n value

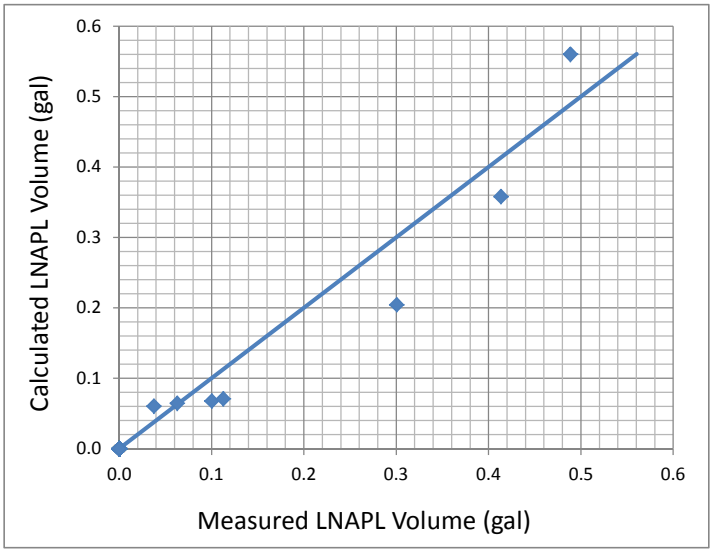
Root-Mean-Square Error: 0.145 <-- Minimize this using "Solver"

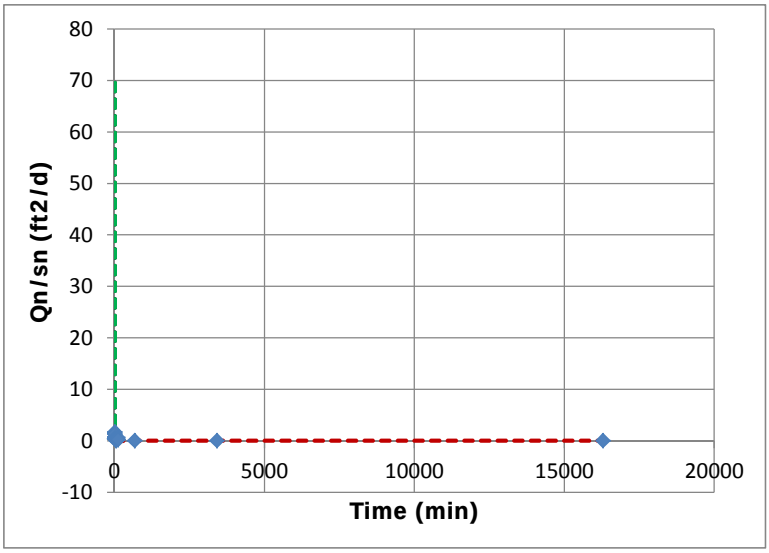
0.003 <-- Working S_n

Trial T_n (ft^2/d): 0.010 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.01**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	S-13
Date:	19-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	20	<- Enter or change values here
Initial Drawdown s_n (ft):	1.29	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.168 <-- Minimize this using "Solver"

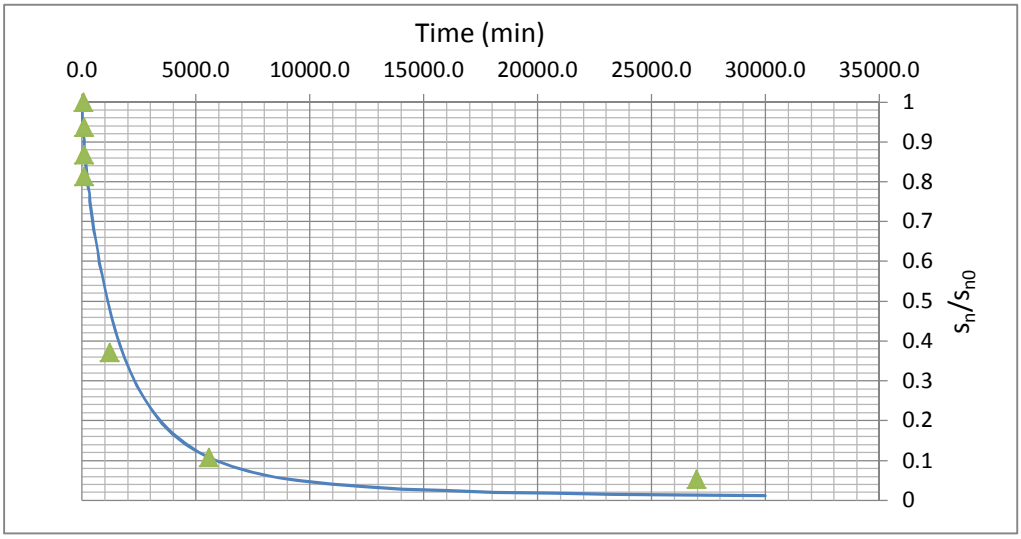
Trial T_n (ft^2/d): 0.020 <-- By changing T_n through "Solver"

0.004 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.02**

T_{min}	0.1
T_{max}	30000



J-Ratio
-3.636

Well Designation:	S-16	Beckett and Lyverse (2002)
Date:	18-Sep-13	

Ground Surface Elev (ft msl)	368.6	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	370.1		
Well Casing Radius, r_c (ft):	0.083	r_{e1}	
Well Radius, r_w (ft):	0.333		0.6
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.760		
Top of Screen (ft bgs):	5.0		
Bottom of Screen (ft bgs):	13.7		
LNAPL Baildown Vol. (gal.):	1.0		
Effective Radius, r_{e3} (ft):	0.159	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.134		
Initial Casing LNAPL Vol. (gal.):	0.44		
Initial Filter LNAPL Vol. (gal.):	0.97		

	Enter Data Here											
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	6.05	8.76	4.56	7.27	5.21					2.71	
Enter Test Data:	1.0	7.97	7.98	6.48	6.49	6.48	1.32				0.01	
	2.0	7.93	7.95	6.44	6.46	6.44	1.28	1.5	1.139	1.30	0.02	0.159
	5.0	7.71	7.74	6.22	6.25	6.23	1.06	3.5	0.380	1.17	0.03	0.159
	10.0	7.43	7.47	5.94	5.98	5.95	0.78	7.5	0.228	0.92	0.04	0.159
	14.00	7.32	7.37	5.83	5.88	5.84	0.67	12.0	0.285	0.72	0.05	0.159
	18.0	7.20	7.27	5.71	5.78	5.73	0.55	16.0	0.569	0.61	0.07	0.159
	28.0	7.02	7.11	5.53	5.62	5.55	0.37	23.0	0.228	0.46	0.09	0.159
	33.0	6.98	7.08	5.49	5.59	5.51	0.33	30.5	0.228	0.35	0.10	0.159
	38.0	6.95	7.09	5.46	5.60	5.49	0.30	35.5	0.911	0.31	0.14	0.159
	48.0	6.90	7.08	5.41	5.59	5.45	0.25	43.0	0.456	0.27	0.18	0.159
	58.0	6.89	7.09	5.40	5.60	5.45	0.24	53.0	0.228	0.24	0.20	0.159
	74.0	6.88	7.11	5.39	5.62	5.45	0.23	66.0	0.214	0.23	0.23	0.159
	117.00	6.84	7.15	5.35	5.66	5.42	0.19	95.5	0.212	0.21	0.31	0.159
	152.00	6.83	7.18	5.34	5.69	5.42	0.18	134.5	0.130	0.18	0.35	0.159
	168.00	6.82	7.19	5.33	5.70	5.42	0.17	160.0	0.142	0.17	0.37	0.159
	189.00	6.82	7.20	5.33	5.71	5.42	0.17	178.5	0.054	0.17	0.38	0.159
	199.00	6.81	7.20	5.32	5.71	5.41	0.16	194.0	0.114	0.16	0.39	0.159
	226.0	6.81	7.22	5.32	5.73	5.42	0.16	212.5	0.084	0.16	0.41	0.159
	1469.0	6.82	7.38	5.33	5.89	5.46	0.17	847.5	0.014	0.16	0.56	0.159
	1699.0	6.82	7.41	5.33	5.92	5.47	0.17	1584.0	0.015	0.17	0.59	0.159
	2924.0	6.88	7.53	5.39	6.04	5.55	0.23	2311.5	0.006	0.20	0.65	0.159
	40414.00	6.68	7.34	5.19	5.85	5.35	0.03	21669.0	0.000	0.13	0.66	0.159

Figure 1

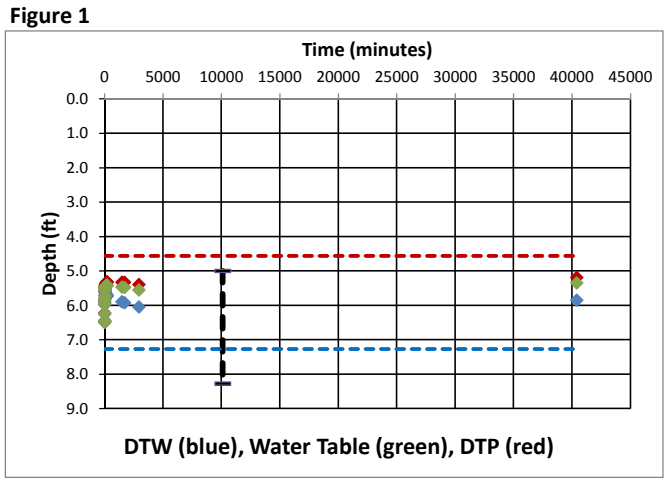
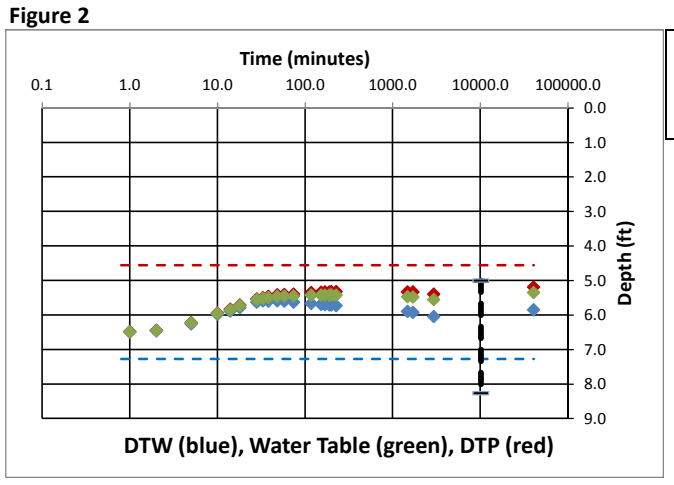


Figure 2



0.8	4.56
40414	4.56
0.8	7.27
40414	7.27

10103.5	5	5.0
10103.5	8.3	8.3

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.02	0.4

Drawdown Adjust.	
Δs_n (ft)	0.6

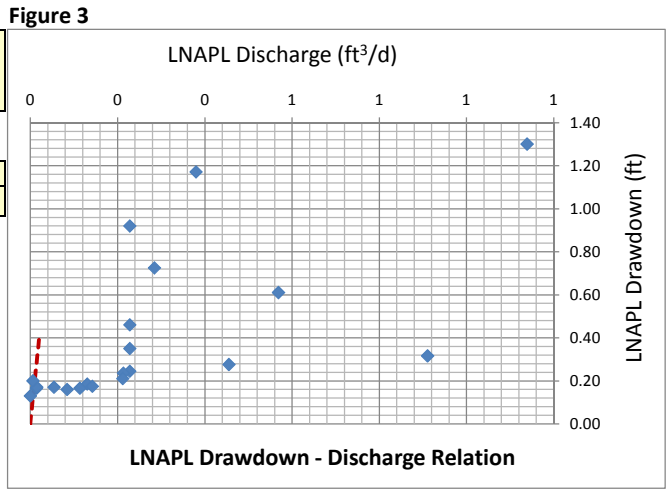
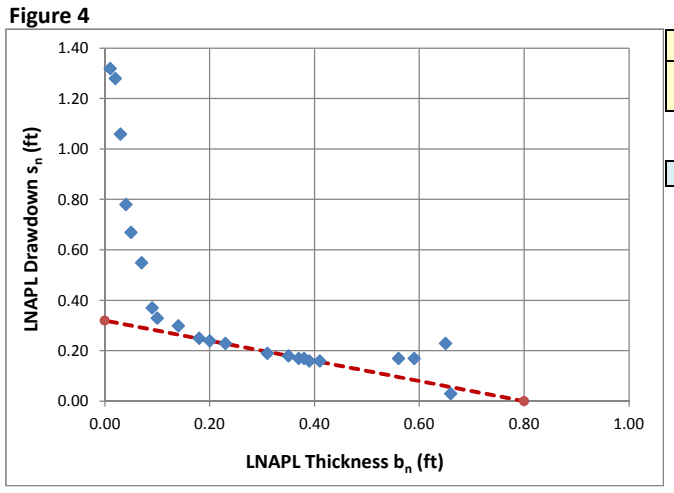


Figure 4



b_n	s_n
0.8	0
0	0.32

J-ratio	-0.400

Figure 5

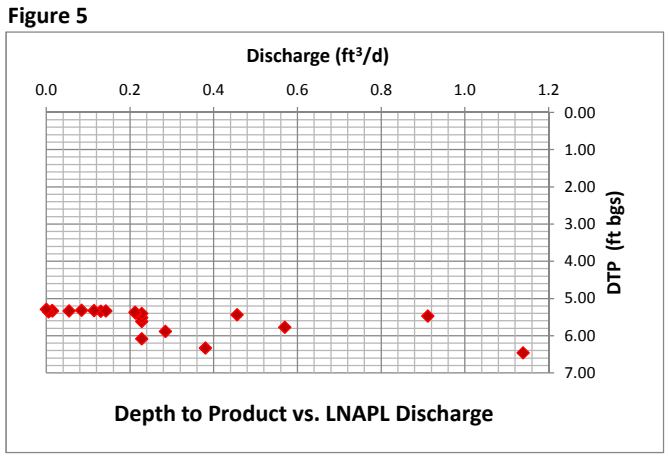


Figure 6

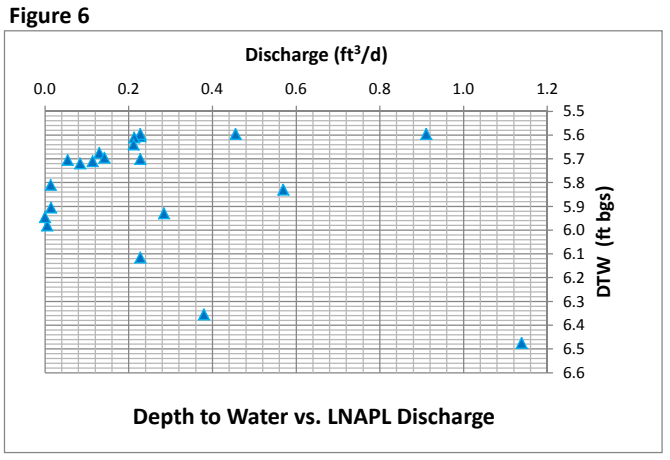


Figure 7

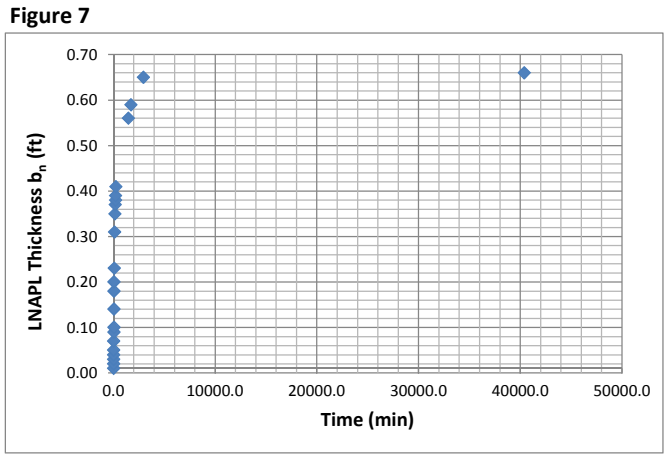


Figure 8

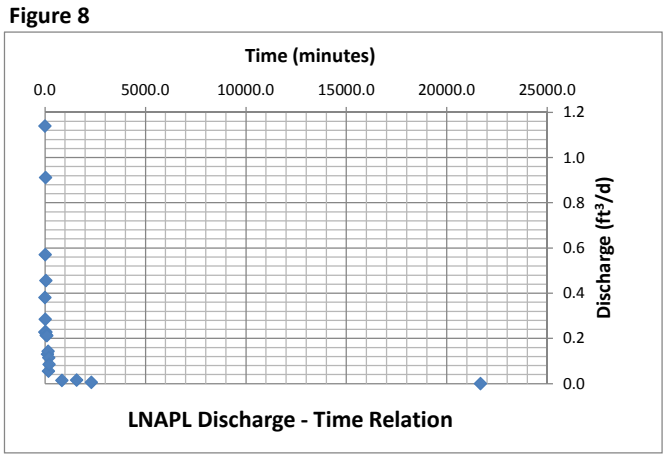


Figure 9

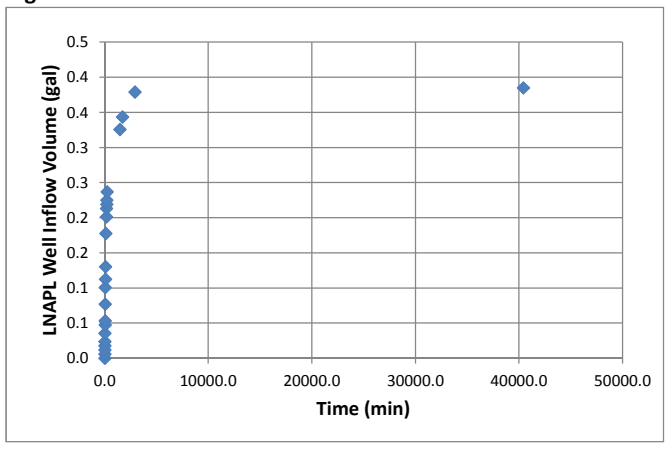
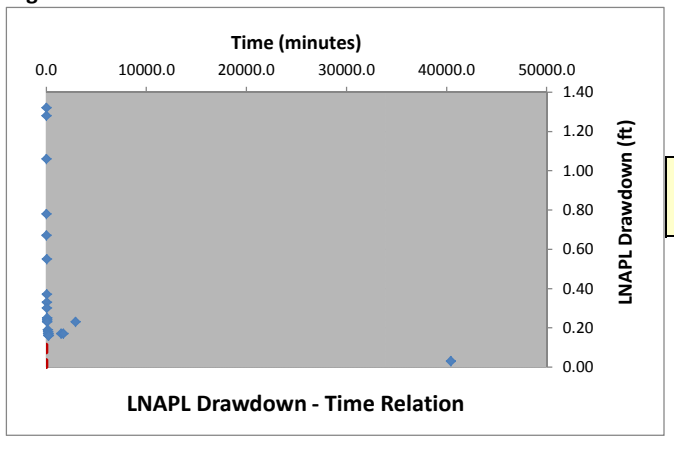


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	S-16
Date:	18-Sep-13

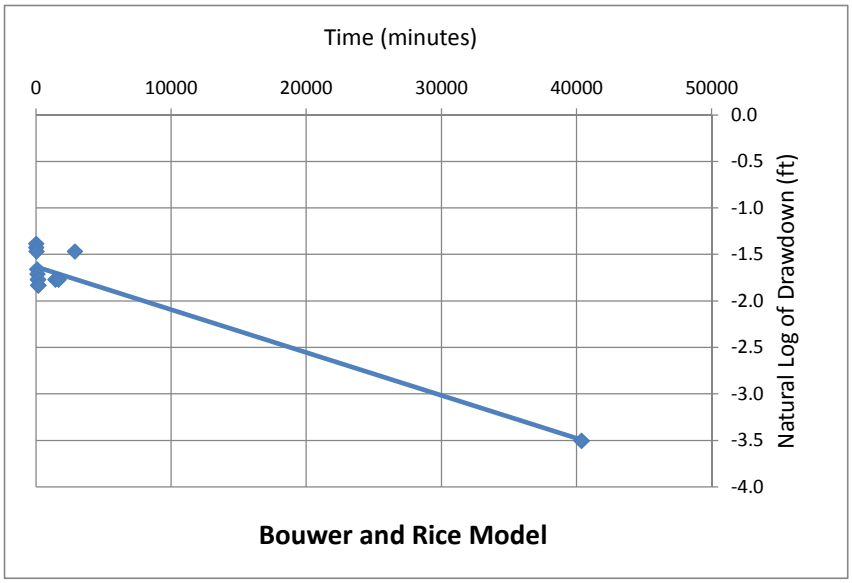
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

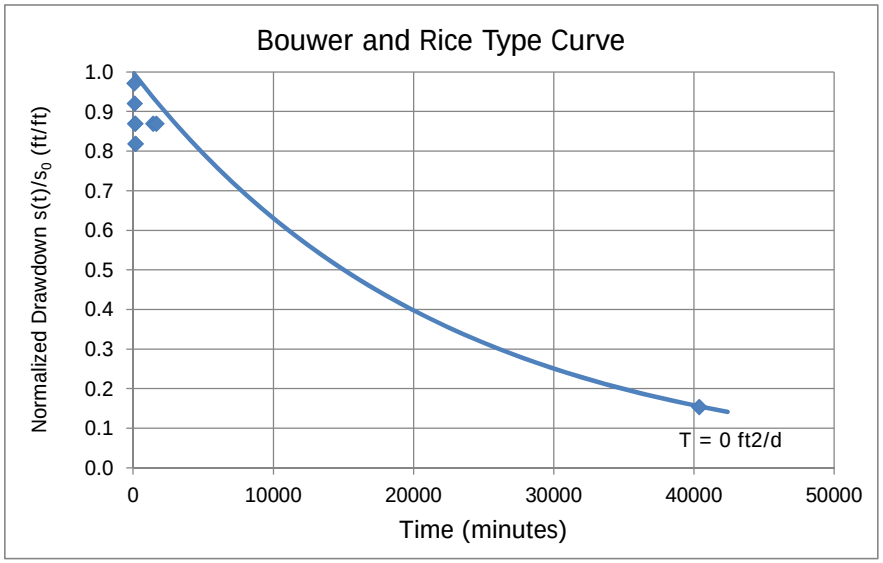
$Time_{cut}$	40	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.00 +/- 0.00 ft^2/d

L_e/r_e	14.3
C	1.36
R/r_e	7.14
J-Ratio	-0.400
Coef. Of Variation	0.10



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	S-16
Date:	18-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^{\,2} S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	40	<- Enter or change values here
Time Adjustment (min):	26.66667	

Trial S_n: d <-- Enter d for default or enter S_n value

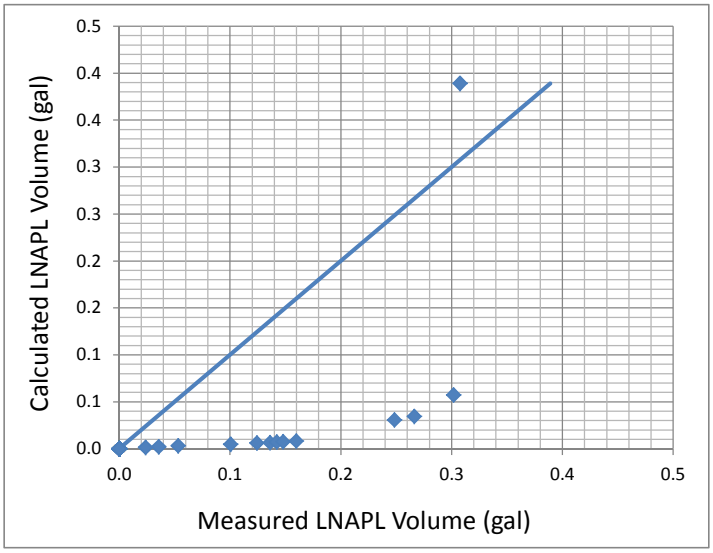
Root-Mean-Square Error: 0.522 <-- Minimize this using "Solver"

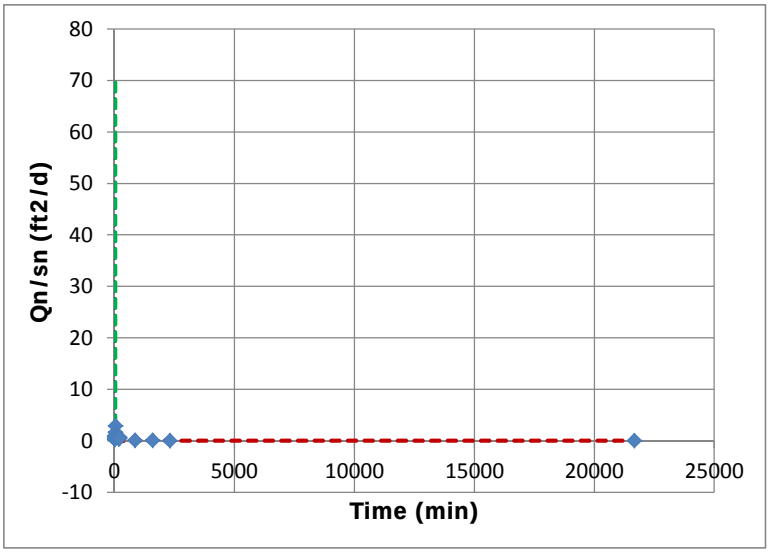
0.002 <-- Working S_n

Trial T_n (ft^2/d): 0.009 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.01**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	S-16
Date:	18-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	40	<- Enter or change values here
Initial Drawdown s_n (ft):	0.3	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.962 <-- Minimize this using "Solver"

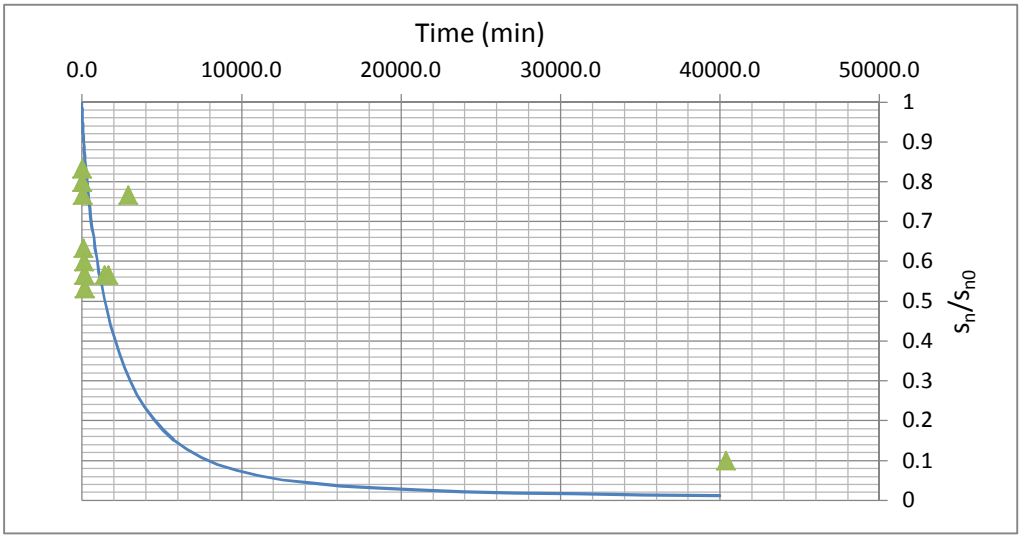
Trial T_n (ft^2/d): 0.060 <-- By changing T_n through "Solver"

0.006 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.06**

T_{min}	0.1
T_{max}	40000



J-Ratio
-0.400

Well Designation:	S-17	Beckett and Lyverse (2002)
Date:	18-Sep-13	

Ground Surface Elev (ft msl)	368.1	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	369.4		
Well Casing Radius, r_c (ft):	0.083	r_{e1}	
Well Radius, r_w (ft):	0.333		0.07
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.767		
Top of Screen (ft bgs):	4.0		
Bottom of Screen (ft bgs):	10.8	19.00	
LNAPL Baildown Vol. (gal.):	4.5		
Effective Radius, r_{e3} (ft):	0.159	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.083		
Initial Casing LNAPL Vol. (gal.):	0.04		
Initial Filter LNAPL Vol. (gal.):	0.11		

	Enter Data Here											
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	5.98	6.23	4.74	4.99	4.80					0.25	
Enter Test Data:	169.0	6.21	6.21	4.97	4.97	4.97	0.16				0.00	
	196.0	6.21	6.22	4.97	4.98	4.97	0.16	182.5	0.042	0.16	0.01	0.159
	1662.0	6.32	6.34	5.08	5.10	5.08	0.27	929.0	0.001	0.21	0.02	0.159
	2601.0	6.37	6.40	5.13	5.16	5.14	0.32	2131.5	0.001	0.29	0.03	0.159
	2887.0	6.38	6.42	5.14	5.18	5.15	0.33	2744.0	0.004	0.32	0.04	0.159
	7142.0	6.06	6.15	4.82	4.91	4.84	0.01	5014.5	0.001	0.17	0.09	0.159
	11379.00	6.26	6.40	5.02	5.16	5.05	0.21	9260.5	0.001	0.11	0.14	0.159

Figure 1

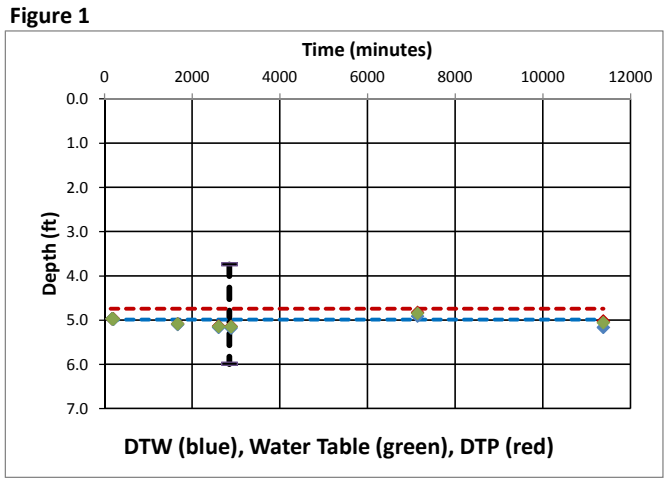
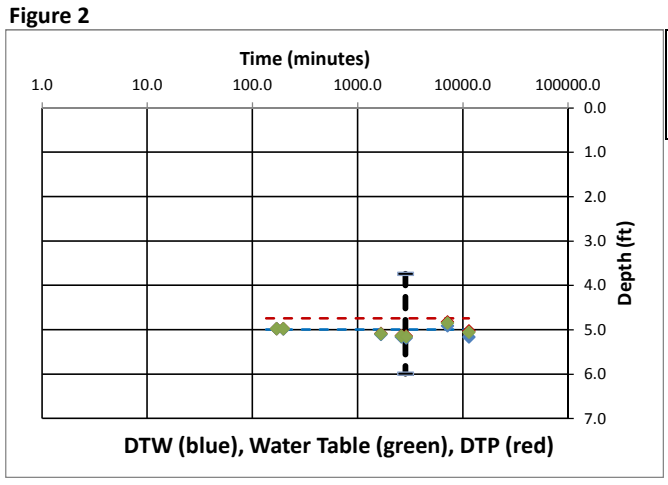


Figure 2



135.2	4.74
11379	4.74
135.2	4.99
11379	4.99

2844.8	3.74	3.7
2844.8	6.0	6.0

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.004	0.38

Drawdown Adjust.	
Δs_n (ft)	0.07

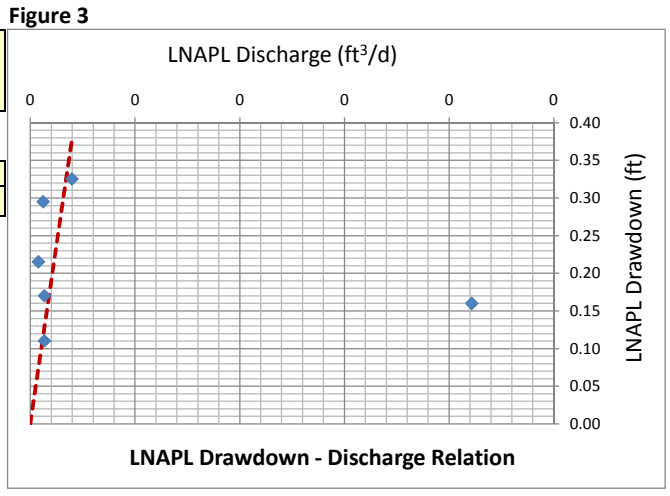
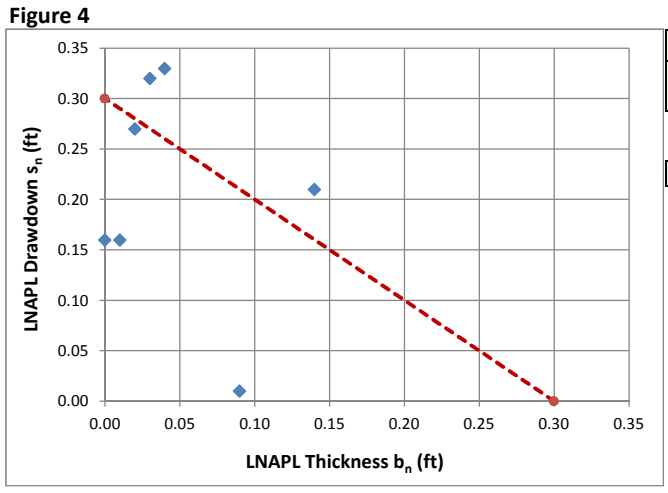


Figure 4



b_n	s_n
0.3	0
0	0.3

J-ratio	-1.000

Figure 5

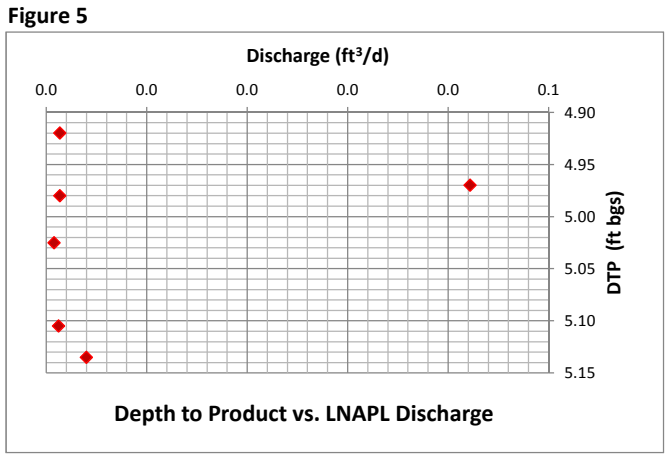


Figure 6

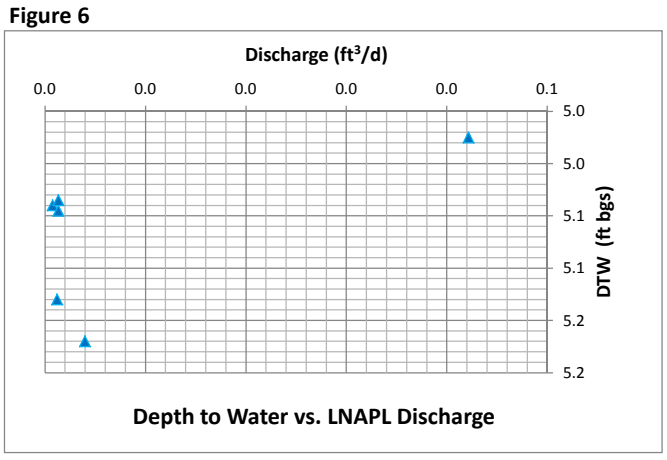


Figure 7

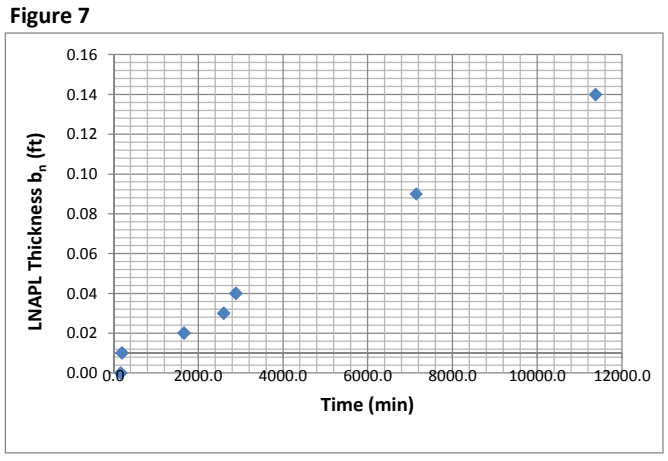


Figure 8

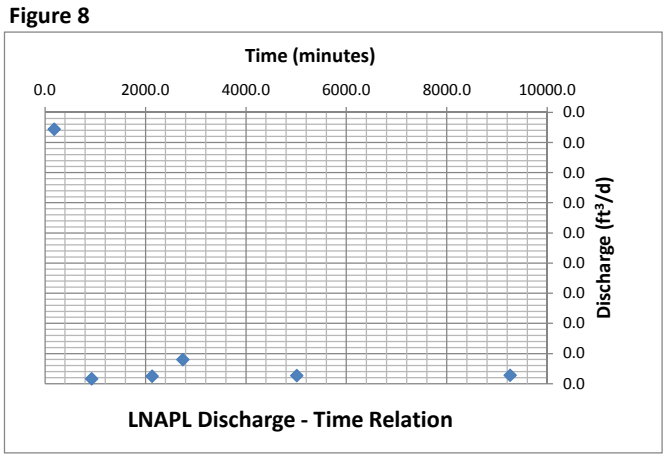


Figure 9

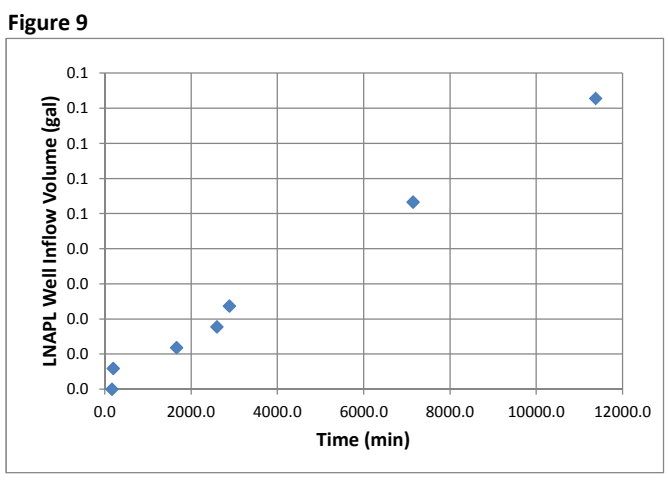
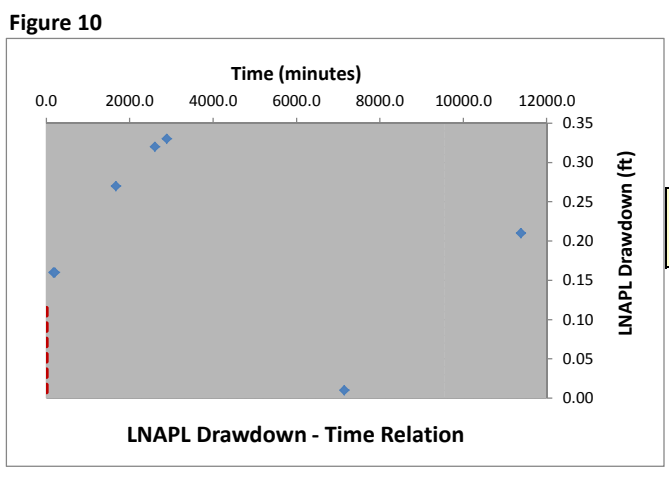


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	S-17
Date:	18-Sep-13

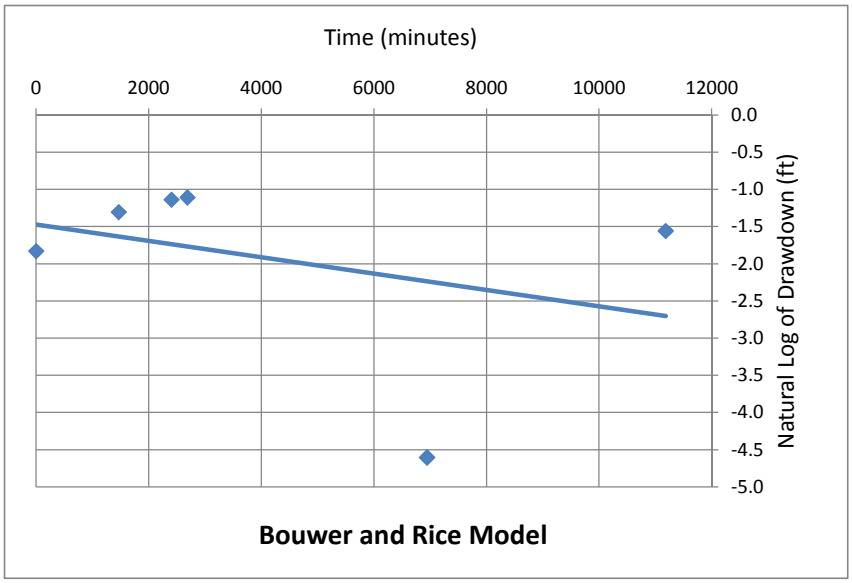
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

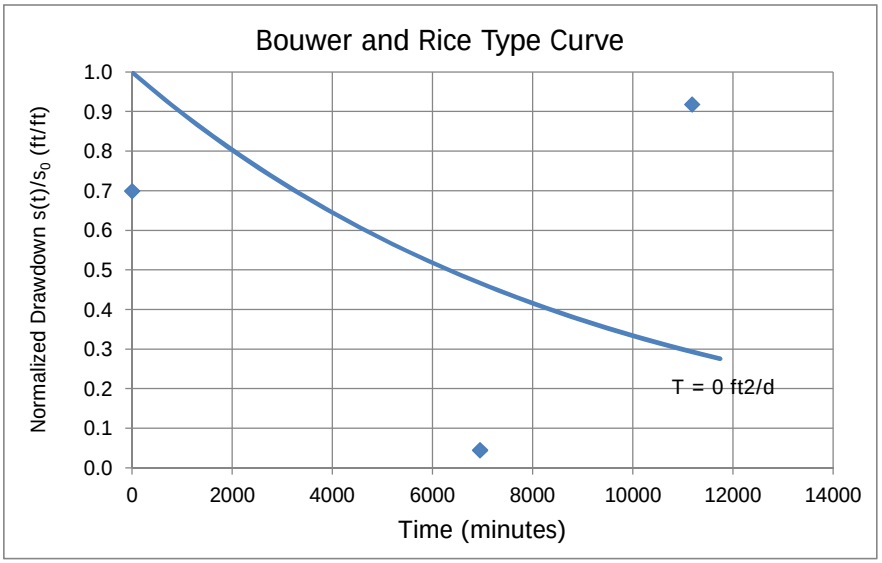
$Time_{cut}$	195	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.00 +/- 0.00 ft^2/d

L_e/r_e	1.6
C	0.85
R/r_e	1.40
J-Ratio	-1.000
Coef. Of Variation	1.38



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	S-17
Date:	18-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^{\,2} S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	195	<- Enter or change values here
Time Adjustment (min):	130	

Trial S_n: d <-- Enter d for default or enter S_n value

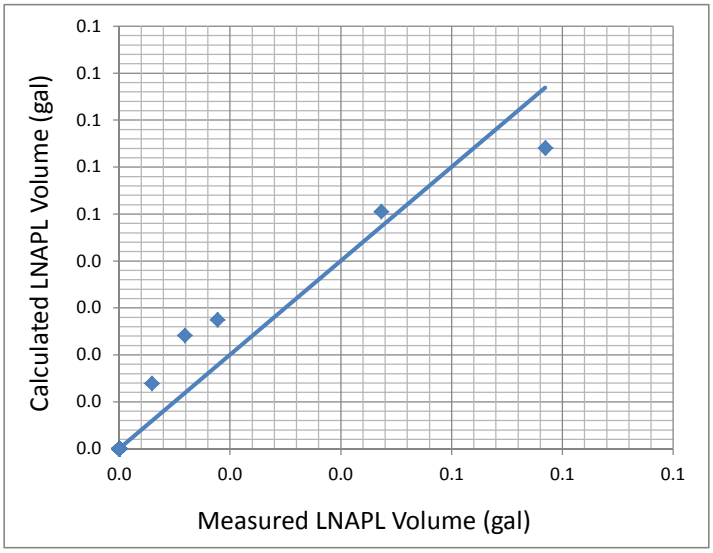
Root-Mean-Square Error: 0.022 <-- Minimize this using "Solver"

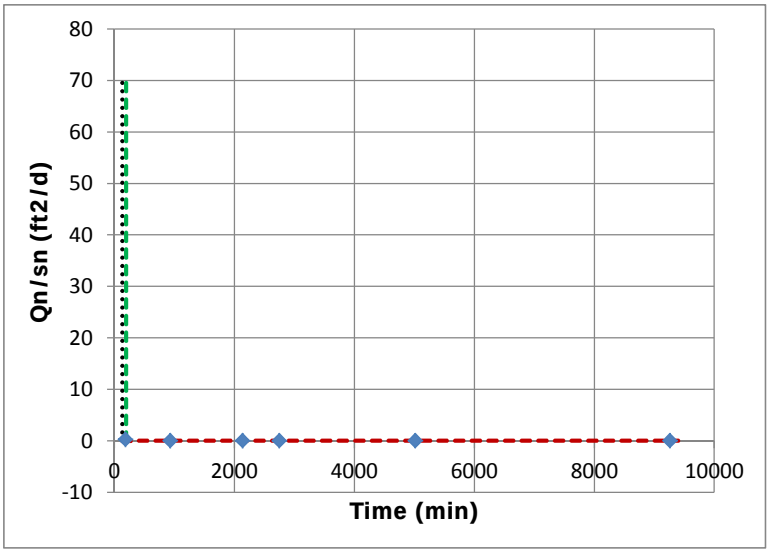
0.001 <-- Working S_n

Trial T_n (ft^2/d): 0.003 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.00**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	S-17
Date:	18-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	195	<- Enter or change values here
Initial Drawdown s_n (ft):	0.16	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 3.152 <-- Minimize this using "Solver"

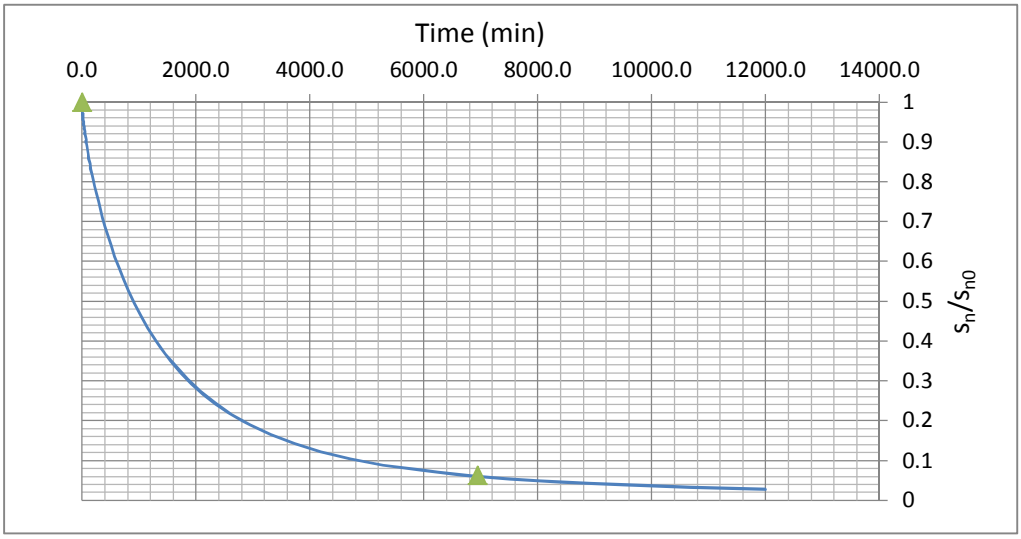
Trial T_n (ft^2/d): 0.040 <-- By changing T_n through "Solver"

0.005 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.04**

T_{min}	0.1
T_{max}	12000



J-Ratio
-1.000

Well Designation:	S-24
Date:	18-Sep-13

Beckett and Lyverse (2002)

Ground Surface Elev (ft msl)	368.9
Top of Casing Elev (ft msl)	371.2
Well Casing Radius, r_c (ft):	0.083
Well Radius, r_w (ft):	0.333
LNAPL Specific Yield, S_y:	0.175
LNAPL Density Ratio, ρ_r:	0.870
Top of Screen (ft bgs):	3.0
Bottom of Screen (ft bgs):	10.3
LNAPL Baildown Vol. (gal.):	0.5
Effective Radius, r_{e3} (ft):	0.159
Effective Radius, r_{e2} (ft):	#NUM!
Initial Casing LNAPL Vol. (gal.):	0.12
Initial Filter LNAPL Vol. (gal.):	0.24

Enter These Data

r_{e1}

Calculated Parameters

Drawdown Adjustment (ft)
-0.21

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	5.10	5.86	2.80	3.56	2.90					0.76	
Enter Test Data:	16.0	5.6	5.60	3.30	3.30	3.30	0.71				0.00	
	28.0	5.4	5.41	3.10	3.11	3.10	0.51	22.0	0.095	0.61	0.01	0.159
	48.0	5.21	5.28	2.91	2.98	2.92	0.32	38.0	0.094	0.41	0.07	0.083
	58.0	5.16	5.25	2.86	2.95	2.87	0.27	53.0	0.063	0.29	0.09	0.083
	132.00	5.07	5.20	2.77	2.90	2.79	0.18	95.0	0.017	0.22	0.13	0.083
	252.00	5.06	5.20	2.76	2.90	2.78	0.17	192.0	0.003	0.17	0.14	0.083
	342.0	5.05	5.20	2.75	2.90	2.77	0.16	297.0	0.003	0.16	0.15	0.083
	402.0	5.05	5.22	2.75	2.92	2.77	0.16	372.0	0.010	0.16	0.17	0.083
	7358.00	4.9	5.10	2.60	2.80	2.63	0.01	3880.0	0.000	0.08	0.20	0.083

Figure 1

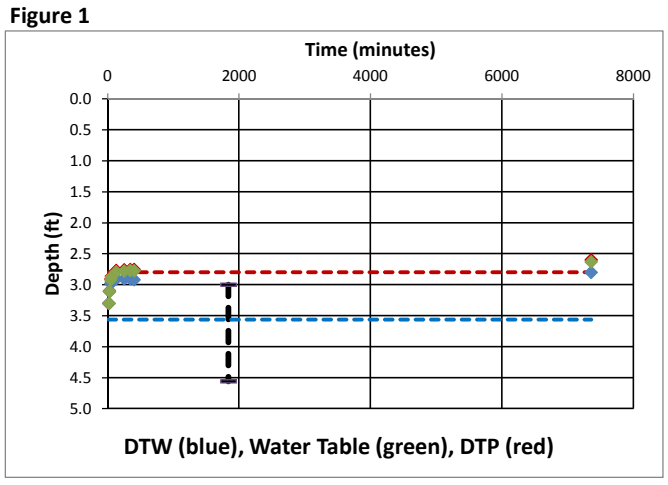
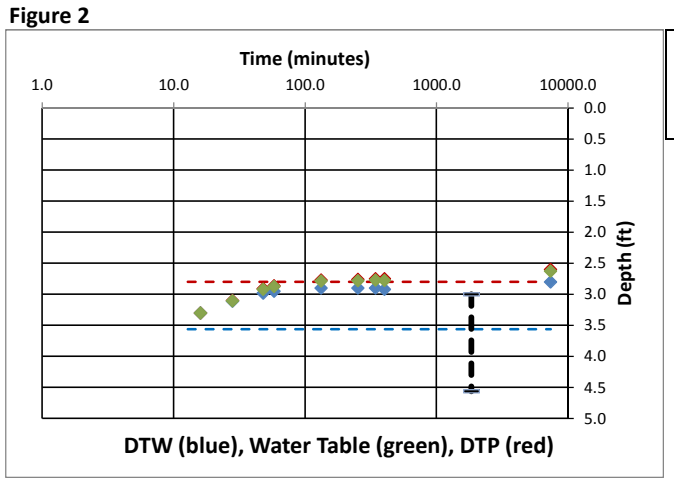


Figure 2



12.8	2.80
7358	2.80
12.8	3.56
7358	3.56

1839.5	3	3.0
1839.5	4.6	4.6

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.01	0.38

Drawdown Adjust.	
Δs_n (ft)	-0.21

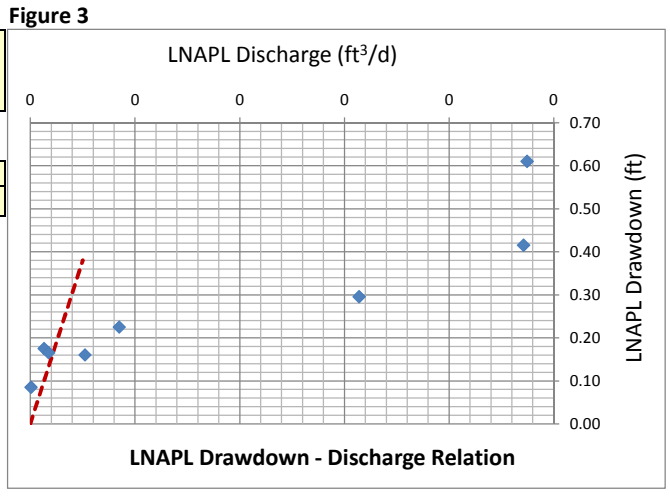
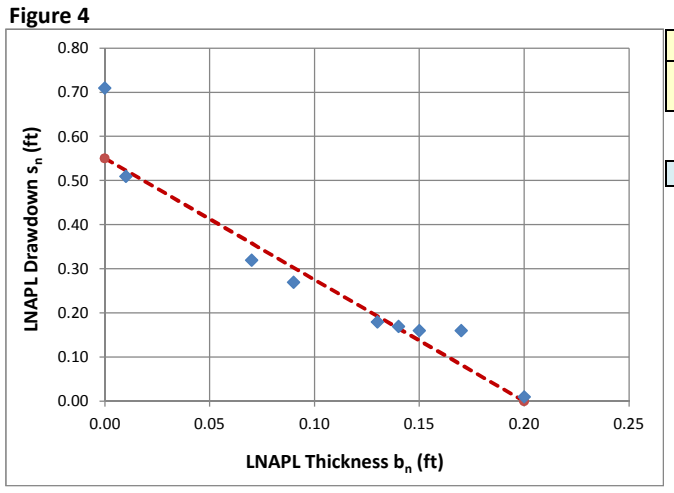


Figure 4



b_n	s_n
0.2	0
0	0.55

J-ratio	-2.750

Figure 5

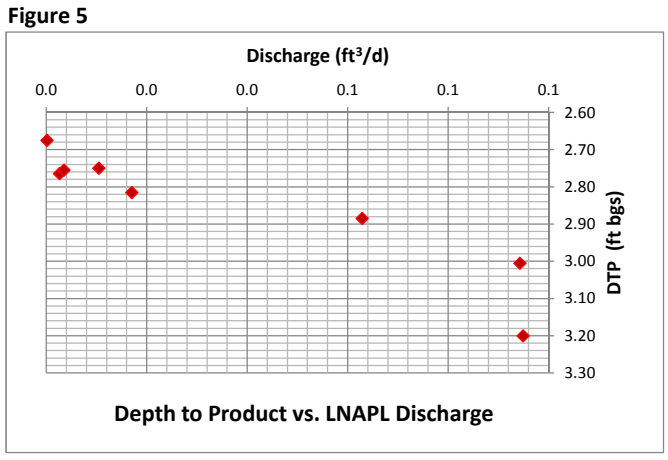


Figure 6

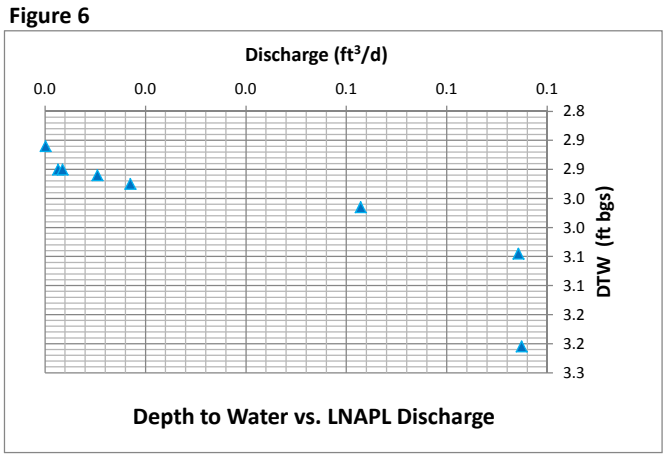


Figure 7

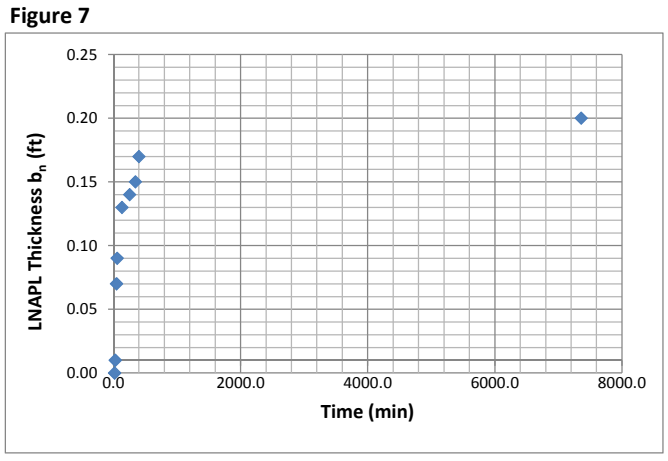


Figure 8

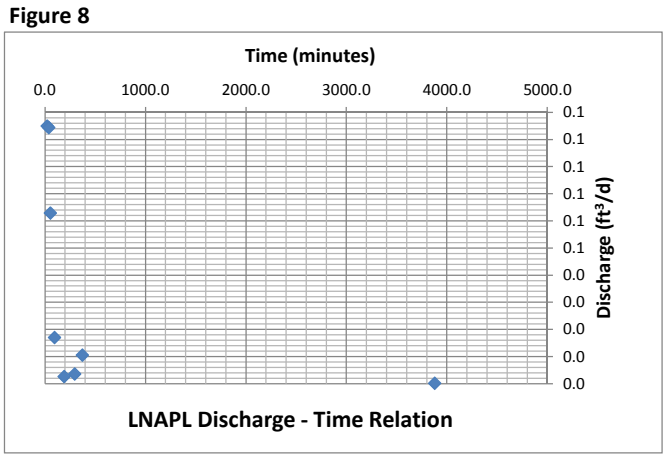


Figure 9

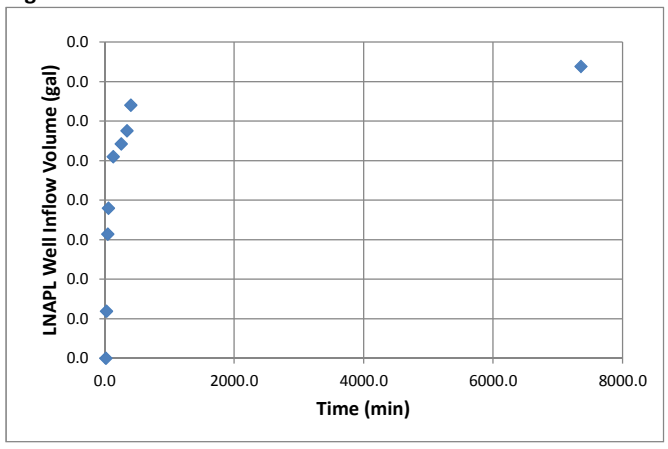
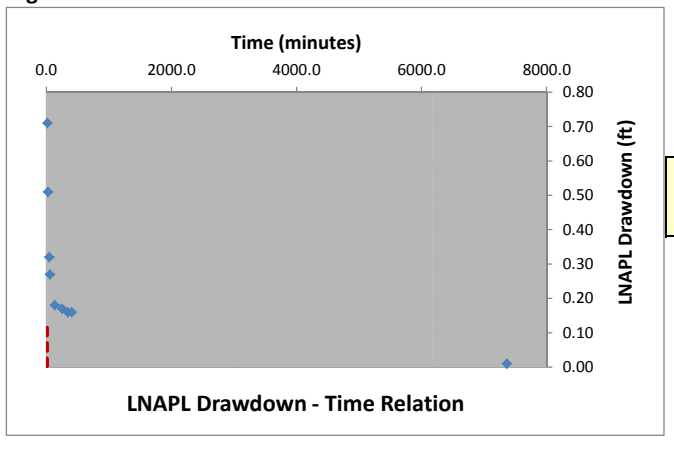


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	S-24
Date:	18-Sep-13

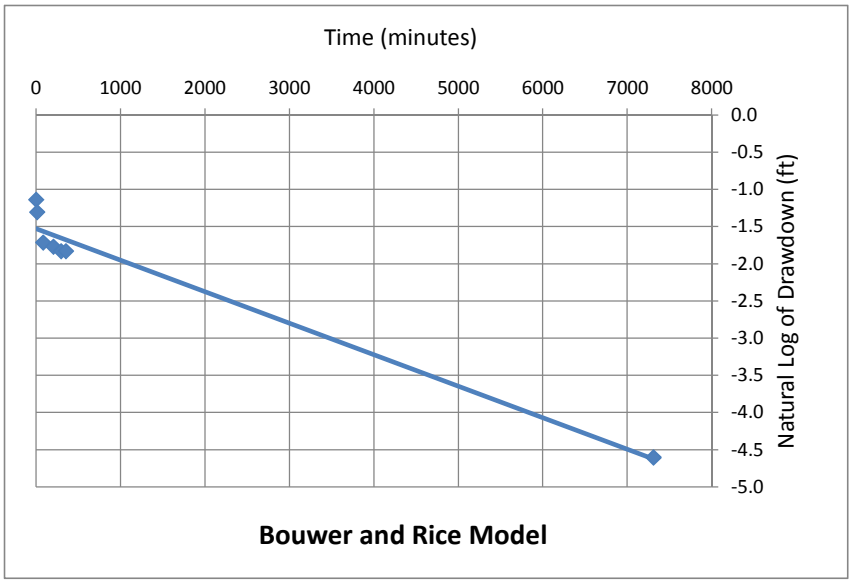
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

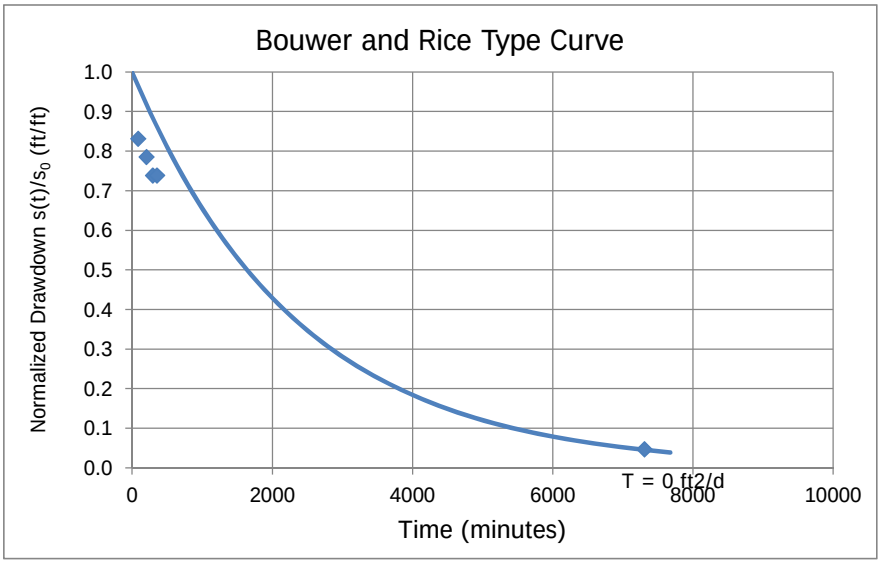
$Time_{cut}$	47	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.00 +/- 0.00 ft^2/d

L_e/r_e	3.5
C	0.93
R/r_e	2.41
J-Ratio	-2.750
Coef. Of Variation	0.09



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	S-24
Date:	18-Sep-13

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	47	<- Enter or change values here
Time Adjustment (min):	31.33333	

Trial S_n: d <-- Enter d for default or enter S_n value

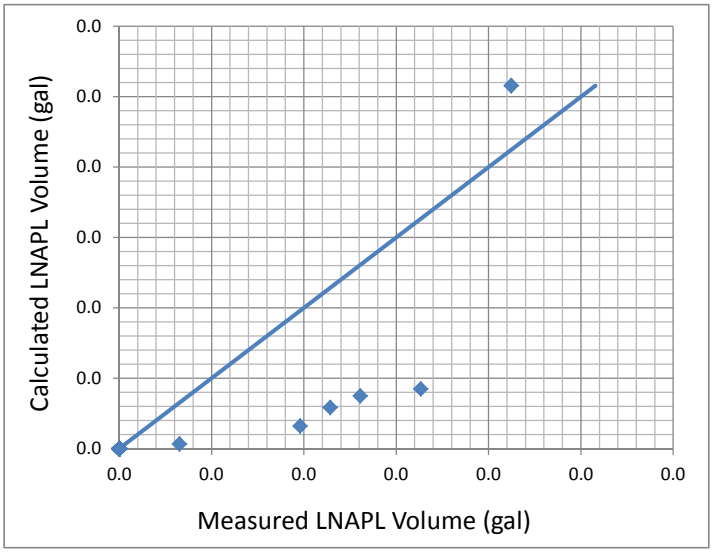
Root-Mean-Square Error: 0.020 <-- Minimize this using "Solver"

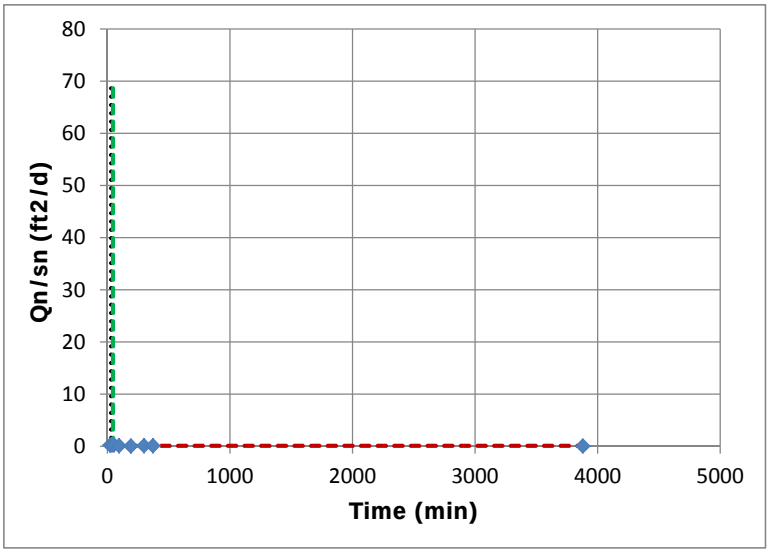
0.002 <-- Working S_n

Trial T_n (ft^2/d): 0.004 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.00**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	S-24
Date:	18-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	47	<- Enter or change values here
Initial Drawdown s_n (ft):	0.32	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.264 <-- Minimize this using "Solver"

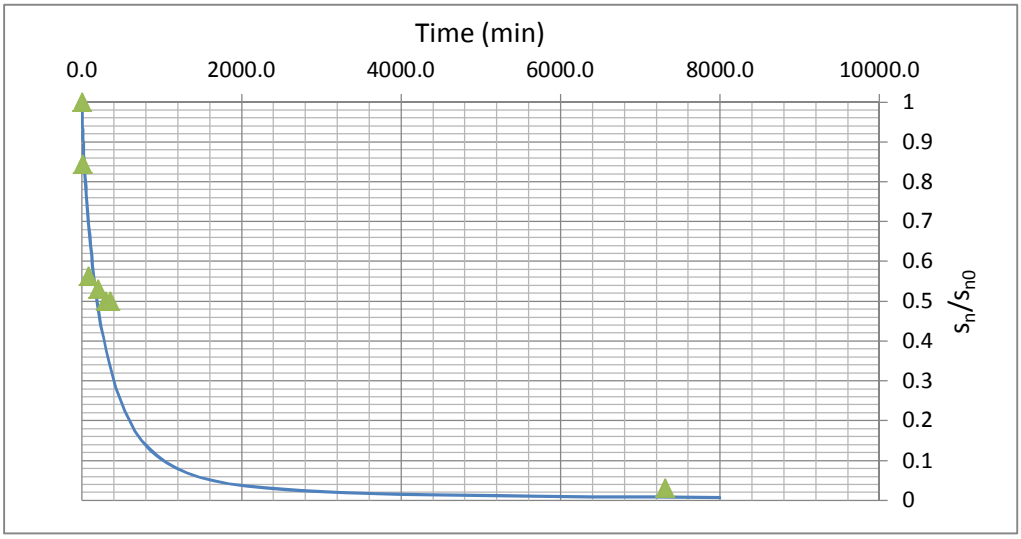
Trial T_n (ft^2/d): 0.020 <-- By changing T_n through "Solver"

0.004 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.02**

T_{min}	0.1
T_{max}	8000



J-Ratio
-2.750

Well Designation:	SMW-5	Beckett and Lyverse (2002)
Date:	18-Sep-13	

Ground Surface Elev (ft msl)	369.1	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	371.3		
Well Casing Radius, r_c (ft):	0.083	r_{e1}	0
Well Radius, r_w (ft):	0.333		
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.807		
Top of Screen (ft bgs):	5.0		
Bottom of Screen (ft bgs):	12.8		
LNAPL Baildown Vol. (gal.):	4.0		
Effective Radius, r_{e3} (ft):	0.159	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.140		
Initial Casing LNAPL Vol. (gal.):	0.07		
Initial Filter LNAPL Vol. (gal.):	0.18		

	Enter Data Here										
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	7.43	7.85	5.18	5.6	5.26					0.42	
Enter Test Data:	39.0	10.30	10.31	8.05	8.06	8.05	2.87				0.01	
	75.0	9.83	9.85	7.58	7.60	7.58	2.40	57.0	0.032	2.63	0.02	0.159
	96.0	9.62	9.66	7.37	7.41	7.38	2.19	85.5	0.108	2.29	0.04	0.159
	133.00	9.29	9.34	7.04	7.09	7.05	1.86	114.5	0.031	2.03	0.05	0.159
	1062.00	9.08	9.17	6.83	6.92	6.85	1.65	597.5	0.005	1.76	0.09	0.159
	2822.0	8.15	8.25	5.90	6.00	5.92	0.72	1942.0	0.001	1.18	0.10	0.159
	7079.0	7.75	8.20	5.50	5.95	5.59	0.32	4950.5	0.009	0.52	0.45	0.159
	11318.0	7.95	8.55	5.70	6.30	5.82	0.52	9198.5	0.004	0.42	0.60	0.159
	28511.00	7.55	8.73	5.30	6.48	5.53	0.12	19914.5	0.004	0.32	1.18	0.159
	40325.00	7.51	9.54	5.26	7.29	5.65	0.08	34418.0	0.008	0.10	2.03	0.159

Figure 1

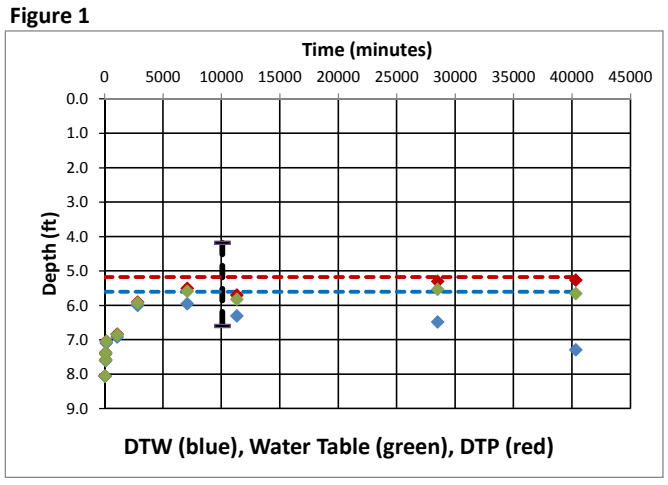
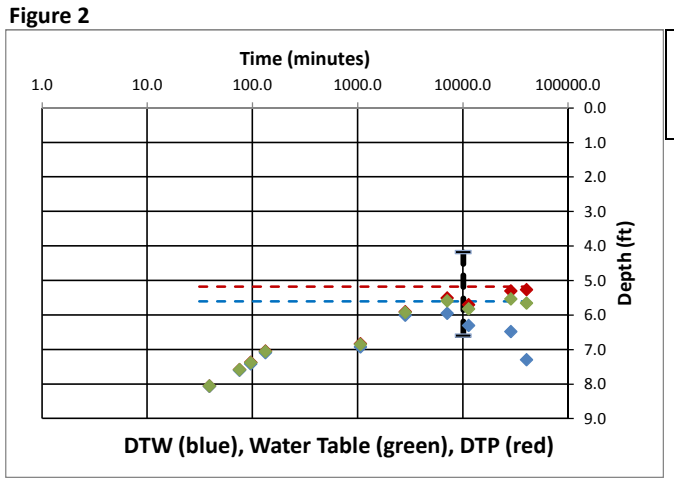


Figure 2



31.2	5.18
40325	5.18
31.2	5.6
40325	5.6

10081.3	4.18	4.2
10081.3	6.6	6.6

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.01	1

Drawdown Adjust.	
Δs_n (ft)	0

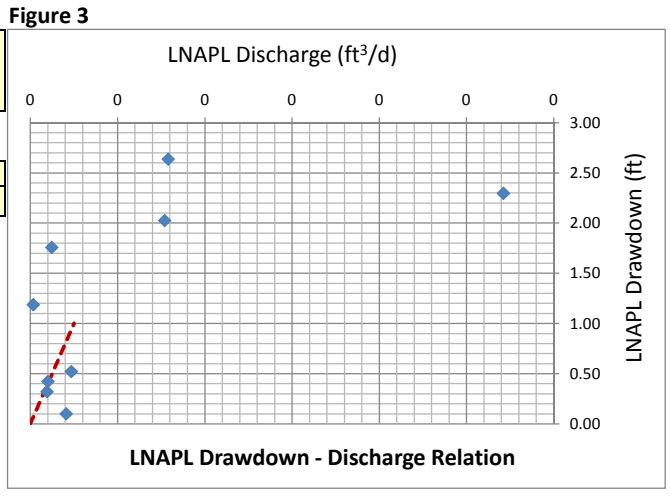
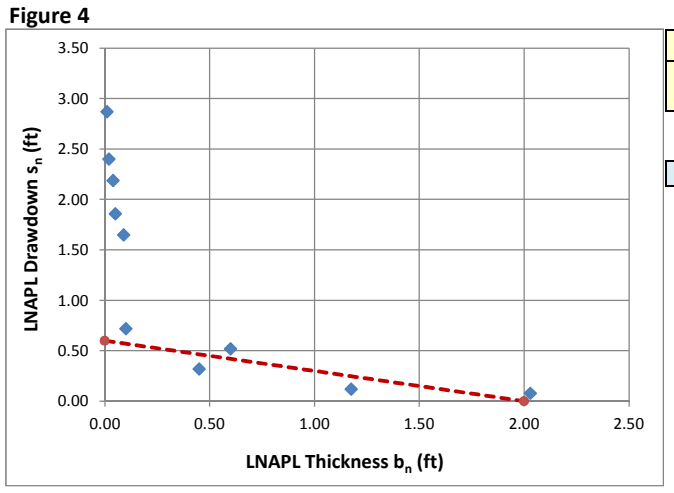


Figure 4



b_n	s_n
2	0
0	0.6

J-ratio	-0.300

Figure 5

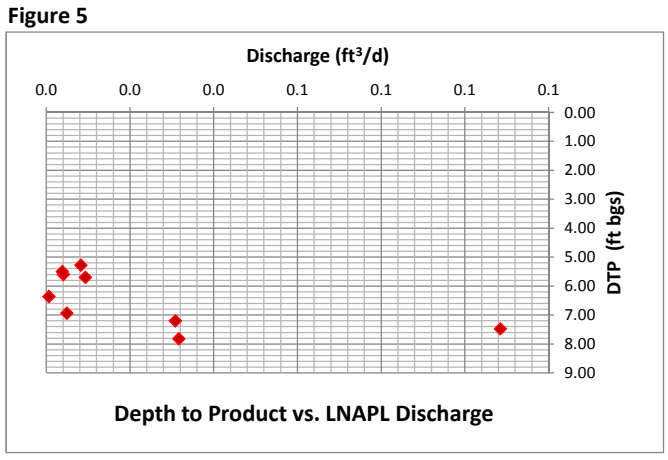


Figure 6

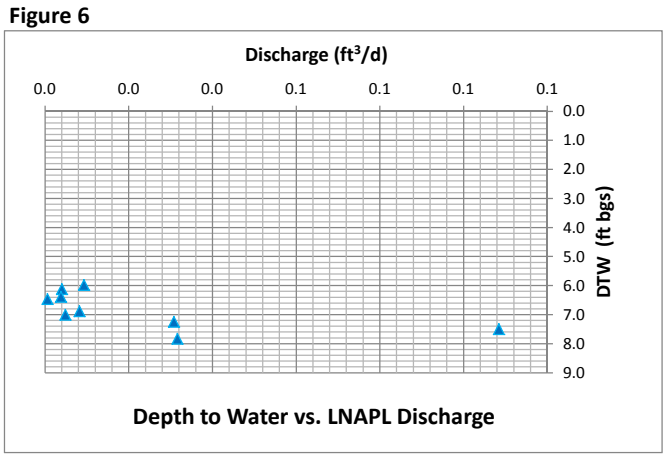


Figure 7

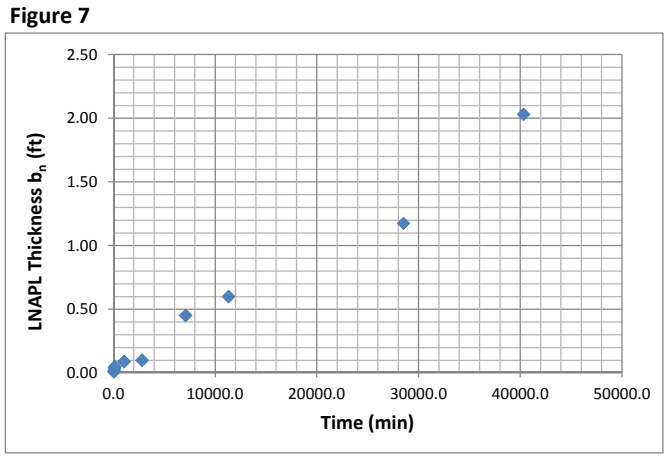


Figure 8

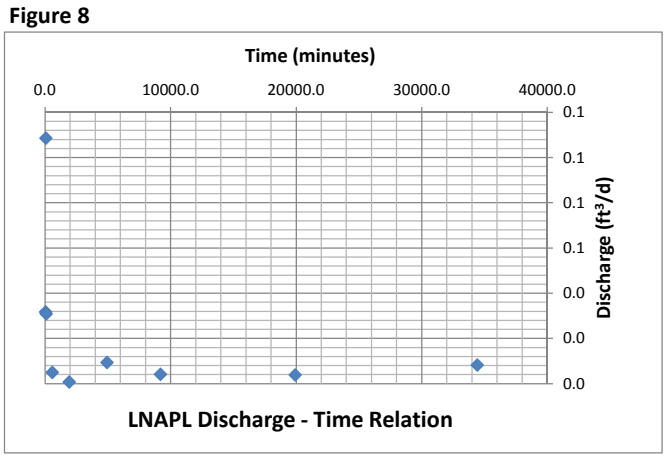


Figure 9

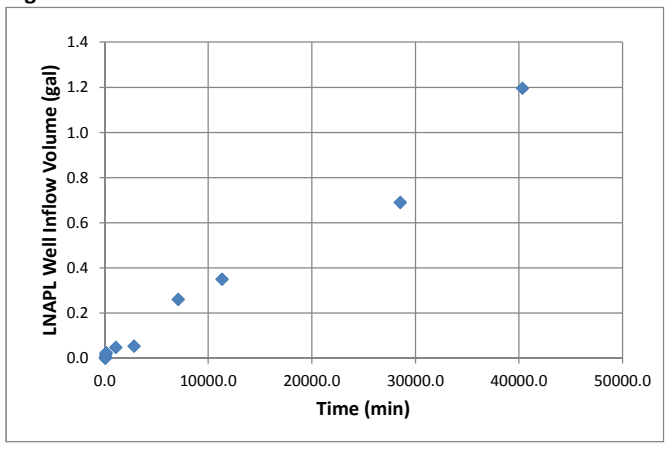
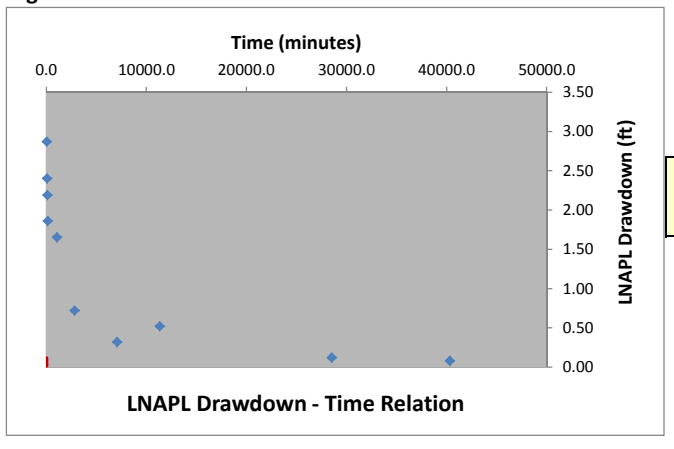


Figure 10



t (min)	s_n (ft)
12	0.115
12	0

Generalized Bouwer and Rice (1976)

Well Designation:	SMW-5
Date:	18-Sep-13

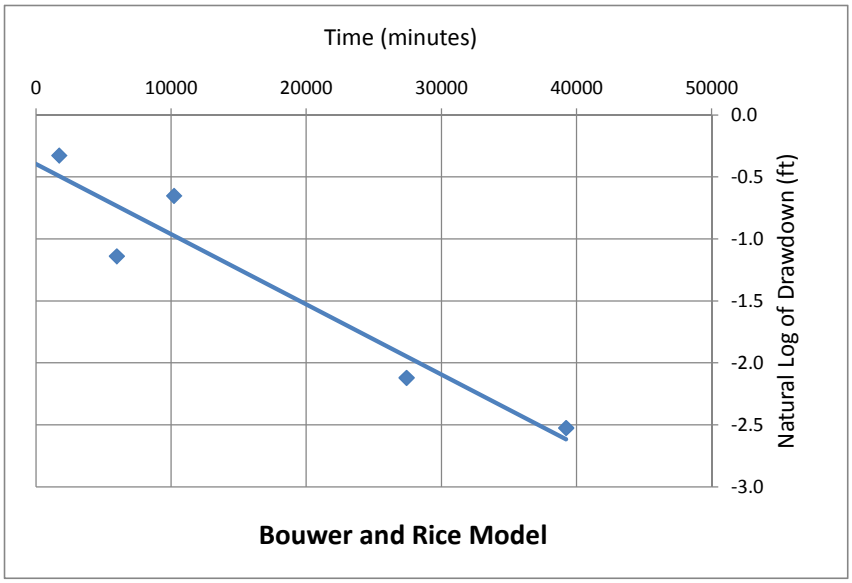
$$T_n = \frac{r_e^{\,2}\ln(R/r_e)\ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

Enter early time cut-off for least-squares model fit

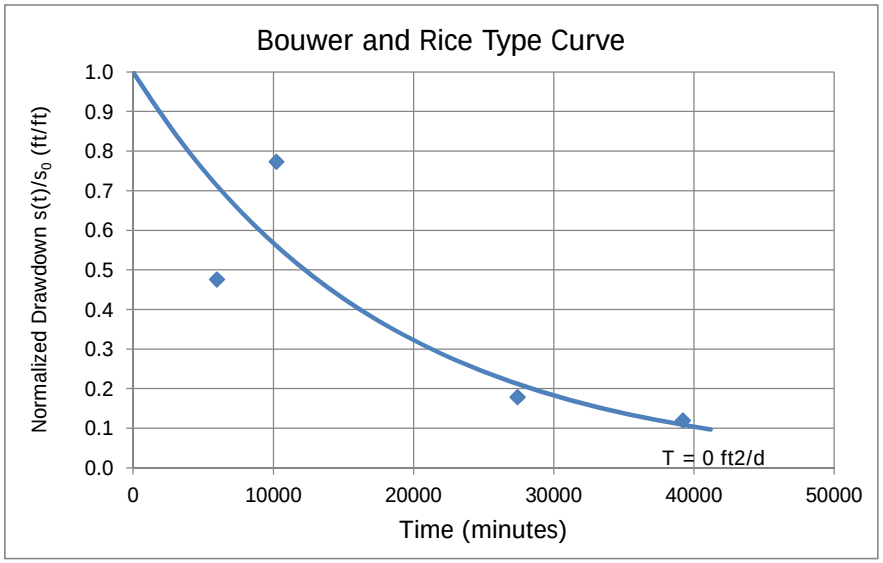
$Time_{cut}$	1100	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.00 +/- 0.00 ft^2/d

L_e/r_e	2.6
C	0.90
R/r_e	1.98
J-Ratio	-0.300
Coef. Of Variation	0.19



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	SMW-5
Date:	18-Sep-13

$$V_n(t_i) = \sum_{j}^{i} \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^{\,2} S_n}\right)} \Delta t_j$$

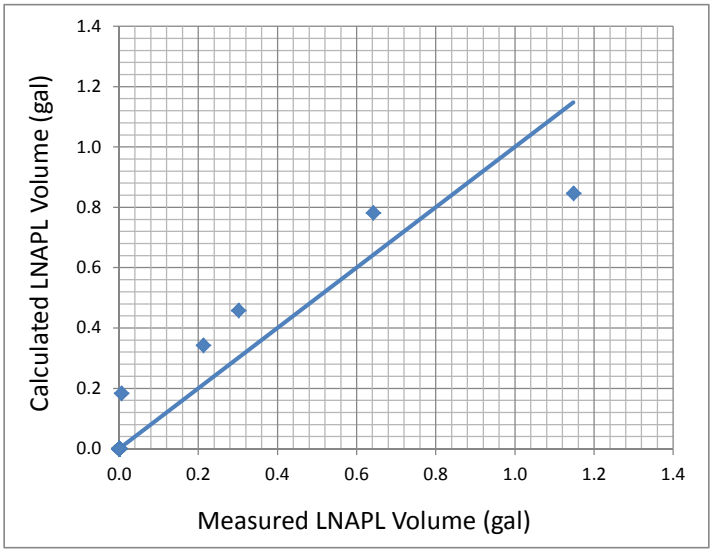
Enter early time cut-off for least-squares model fit

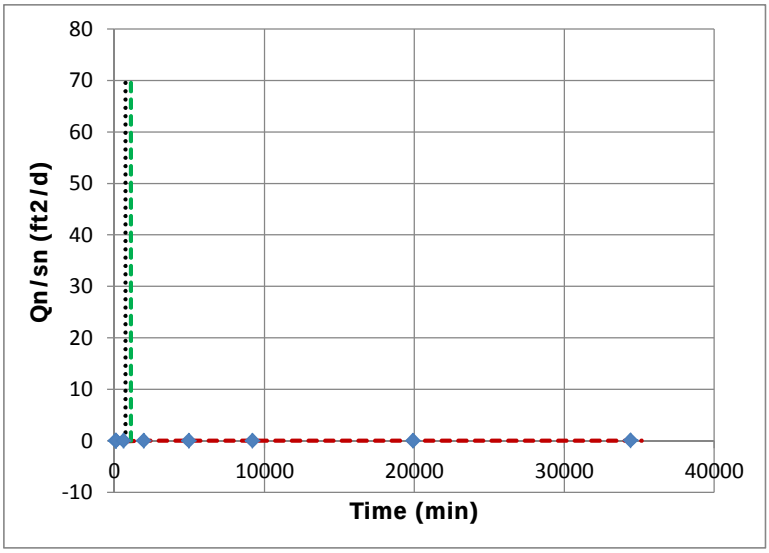
$Time_{cut}$ (min):	1100	<- Enter or change values here
Time Adjustment (min):	733.3333	

Trial S_n:	d	<-- Enter d for default or enter S_n value
Root-Mean-Square Error:	0.428	<-- Minimize this using "Solver"
	0.002	<-- Working S_n
Trial T_n (ft^2/d):	0.007	<-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.01**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	SMW-5
Date:	18-Sep-13

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	1100	<- Enter or change values here
Initial Drawdown s_n (ft):	0.72	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.340 <-- Minimize this using "Solver"

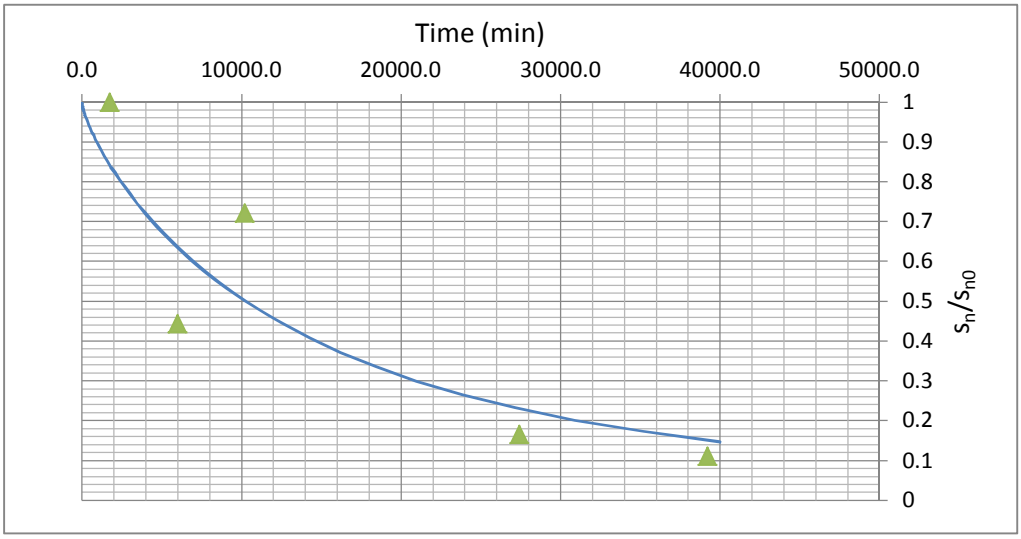
Trial T_n (ft^2/d): 0.013 <-- By changing T_n through "Solver"

0.003 <-- Working S_n

Add constraint Tn > 0.00001

T_{min}	0.1
T_{max}	40000

Model Result: T_n (ft^2/d) = **0.01**



J-Ratio
-0.300

Appendix F

Summary of MPE Pilot Testing Well S-5

Appendix F
Summary of MPE Pilot Test – S-5
Cold Springs Terminal
7431 Hillside Road
Baldswinsville, NY
June 23, 2014

The following major equipment was utilized for MPE testing on S-5

- A 7.5 horsepower (HP) Roots positive displacement blower with a variable frequency drive (VFD) capable of directly controlling the vacuum and flow applied to the extraction wellhead. By changing the frequency at which the motor was operated, the applied vacuum and blower operational flow rate could also be changed. This allowed the test to be conducted without introducing dilution air; therefore, collecting additional data (e.g. dilution air flowrate) to be evaluated was not required.
- A moisture separator allowed condensate (when present) in the soil vapor stream to accumulate, and pumped to a storage tank for treatment (when necessary). Piping from the blower was connected to the extraction wellhead, which had flow measurement and sample ports.
- A hose connected the inlet to the positive displacement blower, used to apply a vacuum to the formation, to the Test Well wellhead utilizing various 2 inch diameter hose fittings and valves and a wellhead adapter.
- For this test the Test Well wellhead was fitted with a well seal, which allowed for the installation of an adjustable “drop tube”. The “drop tube” was a solid section of 1 inch diameter PVC, which was constructed of various lengths, and allowed the inlet to the “drop tube” to be adjusted as necessary.
- Volatile organic compounds (VOCs) concentrations in extracted vapors were monitored using either a MiniRae Photon Ionization Detector (PID) or a MiniRae 5-gas meter (MiniRae) calibrated with isobutylene. The MiniRae was also used to measure oxygen (O2), carbon dioxide (CO2), and Lower Explosive Level (LEL), in the extracted vapors and monitoring point/wellhead readings. Two digital manometers, with various pressure/vacuum ranges, and a hot-wire anemometer were used to collect the soil vapor temperature extracted from the Test Wells and various operating parameters discussed below.
- The monitoring points/wells at various radial distances from the Test Well were fitted with removable caps equipped with sample ports to allow for the collection of observed pressure measurements (vacuum influence), depth to NAPL and groundwater using an Electronic Interface Probe (EIP), and soil vapor concentration with a PID. Soil vapor samples were collected for lab analysis by EPA TO-15, using 6 Liter SUMMA canisters, and were collected as grab samples from the sample ports located on the 4 inch PVC piping following the blower output. Groundwater samples were collected for lab analysis by Metals, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), and VOCs at a sample port before the Oil water separator

Appendix F
Summary of MPE Pilot Testing - S-5
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 23, 2014

	Drop Tube	Interstitial	Blower Effluent					S-5							DTB 15.0 ft	
Time (min)	Vac ("Hg)	Vac ("Hg)	Pressure (" H_20)	Vapor Flow Rate (scfm)	VOC (ppm_v)	O2 (%)	LEL (%)	Water Collected (gals)	Δ Water (gals)	NAPL Collected (gals)	Flow Rate (gals/min)	DTW (ft)	Δ DTW (ft)	DTP (ft)	Thickness (ft)	Corrected Water Depth (ft)
Pumping Only																
0	NA	NA	NM	NA	NM	NM	NM	0	NA	ND	NA	9.75	NA	9.30	0.45	9.40
30	NA	NA	NM	NA	NM	NM	NM	12	11.66	ND	0.39	NM	NM	NM	NM	NM
60	NA	NA	NM	NA	NM	NM	NM	25	13.32	ND	0.44	NM	NM	NM	NM	NM
MPE Step 1																
90	6.50	App. 5	2.00	28.88	340	NM	NM	37	11.66	ND	0.39	NM	NM	NM	NM	NM
120	8.00	App. 5	NM	28.62	332	NM	NM	57	19.98	ND	0.67	NM	NM	NM	NM	NM
150	8.00	App. 5	NM	30.02	329	NM	NM	72	14.99	ND	0.50	NM	NM	NM	NM	NM
180	8.00	App. 5	NM	31.32	345	NM	NM	85	13.32	ND	0.44	NM	NM	NM	NM	NM
MPE Step 2																
210	13.00	App. 8	3.00	31.32	360	NM	NM	100	14.99	ND	0.50	NM	NM	NM	NM	NM
240	13.00	App. 8	NM	31.93	367	NM	NM	127	26.64	ND	0.89	NM	NM	NM	NM	NM
270	13.00	App. 8	NM	31.76	365	NM	NM	148	21.77	ND	0.73	NM	NM	NM	NM	NM
300	NM	App. 8	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MPE Step 3																
330	15.60	App. 13	5.00	31.32	360	NM	NM	173	24.98	ND	0.83	NM	NM	NM	NM	NM
360	14.90	App. 13	5.00	33.15	391	NM	NM	190	16.65	ND	0.56	NM	NM	NM	NM	NM
390	14.20	App. 13	NM	34.02	289	NM	NM	213	23.31	ND	0.78	NM	NM	NM	NM	NM
Recovery																
420	NA	NA	NA	NA	NM	NM	NM	NA	NA	NA	NA	11.25	-1.85	ND	NM	NA
425	NA	NA	NA	NA	NM	NM	NM	NA	NA	NA	NA	11.00	-1.60	ND	NM	NA
430	NA	NA	NA	NA	NM	NM	NM	NA	NA	NA	NM	10.80	-1.40	ND	NM	NA
435	NA	NA	NA	NA	NM	NM	NM	NA	NA	NA	NM	10.67	-1.27	ND	NM	NA
440	NA	NA	NA	NA	NM	NM	NM	NA	NA	NA	NM	10.55	-1.15	ND	NM	NA
445	NA	NA	NA	NA	NM	NM	NM	NA	NA	NA	NM	10.45	-1.05	ND	NM	NA
450	NA	NA	NA	NA	NM	NM	NM	NA	NA	NA	NM	10.31	-0.91	ND	NM	NA

Notes: Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to S-5 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

Appendix F

Summary of MPE Pilot Testing - S-5
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 23, 2014

Time (min)	A-5 Screen Int. 4.5'-19.5' Distance to S-5 63 feet						AMW-1 Screen Int. 5.0'-20.0' Distance to S-5 51 feet						A-13 Screen Int. 4.0'-19.5' Distance to S-5 48 feet					
	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)
Pumping Only																		
0	NM	NM	13.01	NA	ND	NA	NM	NM	13.25	NA	ND	NA	NM	NM	11.02	NA	10.53	0.49
30	NM	NM	13.00	0.01	ND	NA	NM	NM	13.26	-0.01	ND	NA	NM	NM	11.04	-0.02	10.55	0.49
60	NM	NM	13.00	0.01	ND	NA	NM	NM	13.25	0.00	ND	NA	NM	NM	11.05	-0.03	10.55	0.50
MPE Step 1																		
90	0.00	NM	13.00	0.01	ND	NA	0.00	NM	13.26	-0.01	ND	NA	0.00	NM	11.05	-0.03	10.57	0.48
120	0.00	NM	13.00	0.01	ND	NA	0.00	NM	13.25	0.00	ND	NA	0.00	NM	11.05	-0.03	10.55	0.50
150	0.00	NM	13.00	0.01	ND	NA	0.00	NM	13.25	0.00	ND	NA	0.00	NM	11.01	0.01	10.54	0.47
180	0.00	NM	13.00	0.01	ND	NA	0.00	NM	13.25	0.00	ND	NA	0.00	NM	11.00	0.02	10.52	0.48
MPE Step 2																		
210	0.00	NM	12.99	0.02	ND	NA	0.00	NM	13.25	0.00	ND	NA	0.00	NM	11.00	0.02	10.53	0.47
240	0.00	NM	13.00	0.01	ND	NA	0.00	NM	13.25	0.00	ND	NA	0.00	NM	11.00	0.02	10.52	0.48
270	0.00	NM	13.00	0.01	ND	NA	0.00	NM	13.25	0.00	ND	NA	0.00	NM	11.00	0.02	10.52	0.48
300	0.00	NM	NM	NM	NM	NA	0.00	NM	NM	NM	NM	NM	0.00	NM	NM	NM	NM	NM
MPE Step 3																		
330	0.00	NM	13.00	0.01	ND	NA	0.00	NM	13.25	0.00	ND	NA	0.00	NM	10.98	0.04	10.51	0.47
360	0.00	NM	13.00	0.01	ND	NA	0.00	NM	13.25	0.00	ND	NA	0.00	NM	11.00	0.02	10.50	0.50
390	0.00	NM	13.00	0.01	ND	NA	0.00	NM	13.25	0.00	ND	NA	0.00	NM	11.00	0.02	10.50	0.50
Recovery																		
420	NM	NM	13.00	0.01	ND	NA	NM	NM	13.25	0.00	ND	NA	NM	NM	10.91	0.11	10.45	0.46
450	NM	NM	13.00	0.01	ND	NA	NM	NM	13.20	0.05	ND	NA	NM	NM	10.86	0.16	10.42	0.44

Notes:
Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to S-5 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

Appendix F

Summarry of MPE Pilot Testing - S-5
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 23, 2014

Time (min)	A-18						A-14						S-18					
	Screen Int. 7.5'-22.5'		Distance to S-5 61 feet				Screen Int. 7.0'-22.5'		Distance to S-5 32 feet				Screen Int. 5.0'-20.0'		Distance to S-5 82 feet			
	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)
Pumping Only																		
0	NM	NM	10.58	NA	10.30	0.28	NM	NM	12.02	NA	10.20	1.82	NM	NM	9.15	NA	ND	NA
30	NM	NM	10.60	-0.02	10.30	0.30	NM	NM	11.65	0.37	10.49	1.16	NM	NM	9.15	0.00	ND	NA
60	NM	NM	10.65	-0.07	10.30	0.35	NM	NM	11.65	0.37	10.42	1.23	NM	NM	9.13	0.02	ND	NA
MPE Step 1																		
90	0.00	NM	10.67	-0.09	10.30	0.37	0.00	NM	11.52	0.50	10.40	1.12	0.00	NM	9.15	0.00	ND	NA
120	0.00	NM	10.57	0.01	10.27	0.30	0.00	NM	11.53	0.49	10.39	1.14	0.00	NM	9.15	0.00	ND	NA
150	0.00	NM	10.55	0.03	10.27	0.28	0.00	NM	11.51	0.51	10.37	1.14	0.00	NM	9.16	-0.01	ND	NA
180	0.00	NM	10.55	0.03	10.25	0.30	0.00	NM	11.50	0.52	10.35	1.15	0.00	NM	9.15	0.00	ND	NA
MPE Step 2																		
210	0.00	NM	10.55	0.03	10.25	0.30	0.00	NM	11.50	0.52	10.36	1.14	0.00	NM	9.15	0.00	ND	NA
240	0.00	NM	10.53	0.05	10.23	0.30	0.00	NM	11.51	0.51	10.36	1.15	0.00	NM	9.15	0.00	ND	NA
270	0.00	NM	10.53	0.05	10.23	0.30	0.00	NM	11.50	0.52	10.35	1.15	0.00	NM	9.15	0.00	ND	NA
300	0.00	NM	NM	NM	NM	NM	0.00	NM	NM	NM	NM	NM	0.00	NM	NM	NM	NM	NM
MPE Step 3																		
330	0.00	NM	10.52	0.06	10.23	0.29	0.00	NM	11.49	0.53	10.35	1.14	0.00	NM	9.14	0.01	ND	NA
360	0.00	NM	10.50	0.08	10.22	0.28	0.00	NM	11.49	0.53	10.33	1.16	0.00	NM	9.12	0.03	ND	NA
390	0.00	NM	10.50	0.08	10.20	0.30	0.00	NM	11.47	0.55	10.32	1.15	0.00	NM	9.12	0.03	ND	NA
Recovery																		
420	NM	NM	10.45	0.13	10.15	0.30	NM	NM	11.45	0.57	10.20	1.25	NM	NM	9.10	0.05	ND	NA
450	NM	NM	10.42	0.16	10.12	0.30	NM	NM	11.46	0.56	10.15	1.31	NM	NM	9.11	0.04	ND	NA

Notes:
Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to S-5 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

Appendix F
Summary of MPE Pilot Testing - S-5
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 23, 2014

Time (min)	A-24 Screen Int. 4.0'-14.0' Distance to S-5 105 feet						AMW-3 Screen Int. 5.0'-20.0' Distance to S-5 44 feet						S-13 Screen Int. 5.0'-20.0' Distance to S-5 51 feet					
	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)
Pumping Only																		
0	NM	NM	8.62	NA	ND	NA	NM	NM	10.98	NA	9.52	1.46	NM	NM	10.41	NA	8.81	1.60
30	NM	NM	8.65	-0.03	ND	NA	-0.73	NM	10.97	0.01	9.51	1.46	-0.08	NM	10.42	-0.01	8.83	1.59
60	NM	NM	8.65	-0.03	ND	NA	NM	NM	11.00	-0.02	9.55	1.45	-0.12	NM	10.45	-0.04	8.85	1.60
MPE Step 1																		
90	0.00	NM	8.62	0.00	ND	NA	-1.40	NM	11.01	-0.03	9.60	1.41	-0.13	NM	10.45	-0.04	8.89	1.56
120	0.00	NM	8.65	-0.03	ND	NA	-1.45	NM	10.98	0.00	9.60	1.38	-0.12	NM	10.45	-0.04	8.86	1.59
150	0.00	NM	8.61	0.01	ND	NA	-1.42	NM	10.98	0.00	9.61	1.37	-0.11	NM	10.45	-0.04	8.89	1.56
180	0.00	NM	8.61	0.01	ND	NA	-1.42	NM	10.92	0.06	9.55	1.37	-0.14	NM	10.45	-0.04	8.86	1.59
MPE Step 2																		
210	0.00	NM	8.59	0.03	ND	NA	-1.84	NM	10.94	0.04	9.58	1.36	-0.11	NM	10.45	-0.04	8.88	1.57
240	0.00	NM	8.58	0.04	ND	NA	-1.92	NM	10.95	0.03	9.58	1.37	-0.17	NM	10.45	-0.04	8.88	1.57
270	0.00	NM	8.58	0.04	ND	NA	-1.98	NM	10.97	0.01	9.60	1.37	-0.20	NM	10.43	-0.02	8.87	1.56
300	0.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MPE Step 3																		
330	0.00	NM	8.55	0.07	ND	NA	-2.98	NM	10.81	0.17	9.50	1.31	-0.35	NM	10.43	-0.02	8.87	1.56
360	0.00	NM	8.55	0.07	ND	NA	-2.90	NM	10.80	0.18	9.45	1.35	-0.23	NM	10.44	-0.03	8.88	1.56
390	0.00	NM	8.55	0.07	ND	NA	-2.91	NM	10.84	0.14	9.45	1.39	-0.21	NM	10.44	-0.03	8.88	1.56
Recovery																		
420	NM	NM	8.55	0.07	ND	NA	NM	NM	10.80	0.18	9.42	1.38	NM	NM	10.39	0.02	8.85	1.54
450	NM	NM	8.55	0.07	ND	NA	NM	NM	10.81	0.17	9.43	1.38	NM	NM	10.35	0.06	8.82	1.53

Notes:
Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to S-5 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

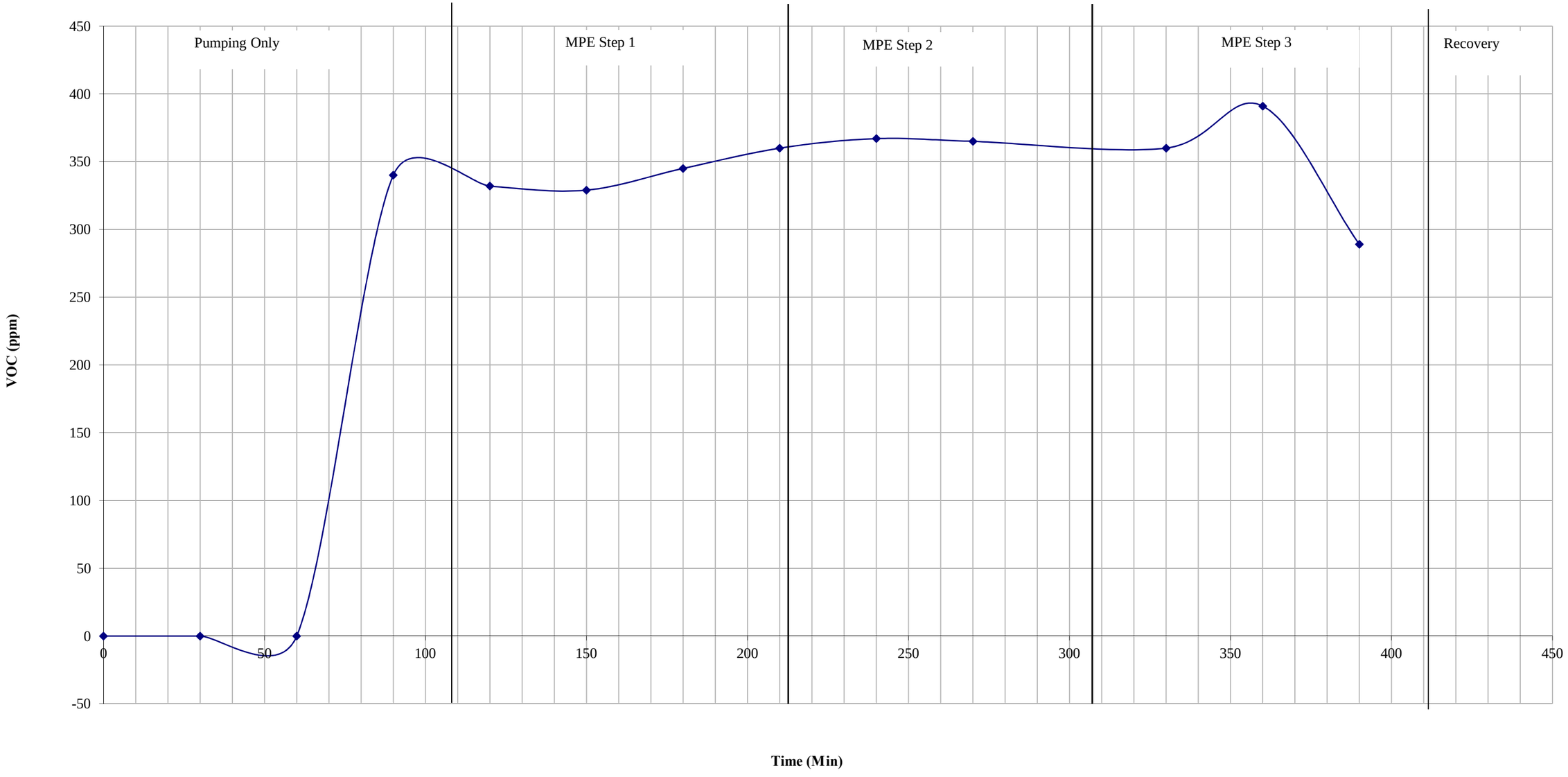
Appendix F

Summary of MPE Pilot Testing - S-5
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 23, 2014

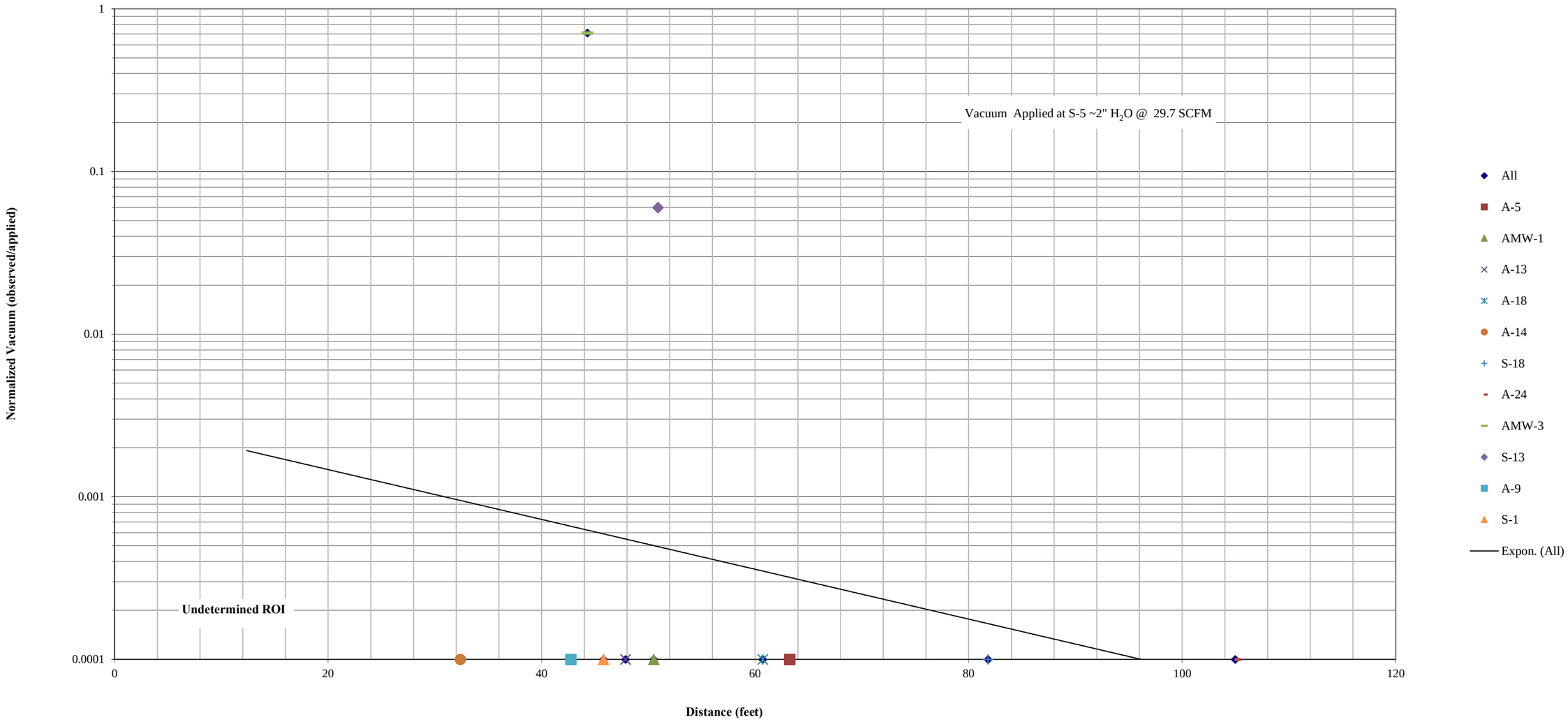
Time (min)	A-9 Screen Int. 4.0'-19.0' Distance to S-5 43 feet						S-1 Screen Int. 5.0'-20.0' Distance to S-5 46 feet					
	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)
Pumping Only												
0	NM	NM	12.52	NA	ND	NA	NM	NM	NM	NM	NM	NA
30	NM	NM	12.52	0.00	ND	NA	NM	NM	13.57	0.00	11.07	2.50
60	NM	NM	12.52	0.00	ND	NA	NM	NM	13.50	0.07	11.08	2.42
MPE Step 1												
90	0.00	NM	12.53	-0.01	ND	NA	-0.11	NM	13.50	0.07	11.09	2.41
120	0.00	NM	12.56	-0.04	ND	NA	0.00	NM	13.50	0.07	11.10	2.40
150	0.00	NM	12.55	-0.03	ND	NA	0.00	NM	13.49	0.08	11.09	2.40
180	0.00	NM	12.55	-0.03	ND	NA	0.00	NM	13.49	0.08	11.09	2.40
MPE Step 2												
210	0.00	NM	12.57	-0.05	ND	NA	0.00	NM	13.48	0.09	11.07	2.41
240	0.00	NM	12.57	-0.05	ND	NA	0.00	NM	13.48	0.09	11.07	2.41
270	0.00	NM	12.57	-0.05	ND	NA	0.00	NM	13.48	0.09	11.07	2.41
300	0.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MPE Step 3												
330	0.00	NM	12.57	-0.05	ND	NA	0.00	NM	13.48	0.09	11.07	2.41
360	0.00	NM	12.60	-0.08	ND	NA	0.00	NM	13.49	0.08	11.06	2.43
390	0.00	NM	12.59	-0.07	ND	NA	0.00	NM	13.49	0.08	11.05	2.44
Recovery												
420	NM	NM	12.57	-0.05	ND	NA	NM	NM	13.48	0.09	11.06	2.42
450	NM	NM	12.51	0.01	ND	NA	NM	NM	13.47	0.10	11.05	2.42

Notes:
Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to S-5 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

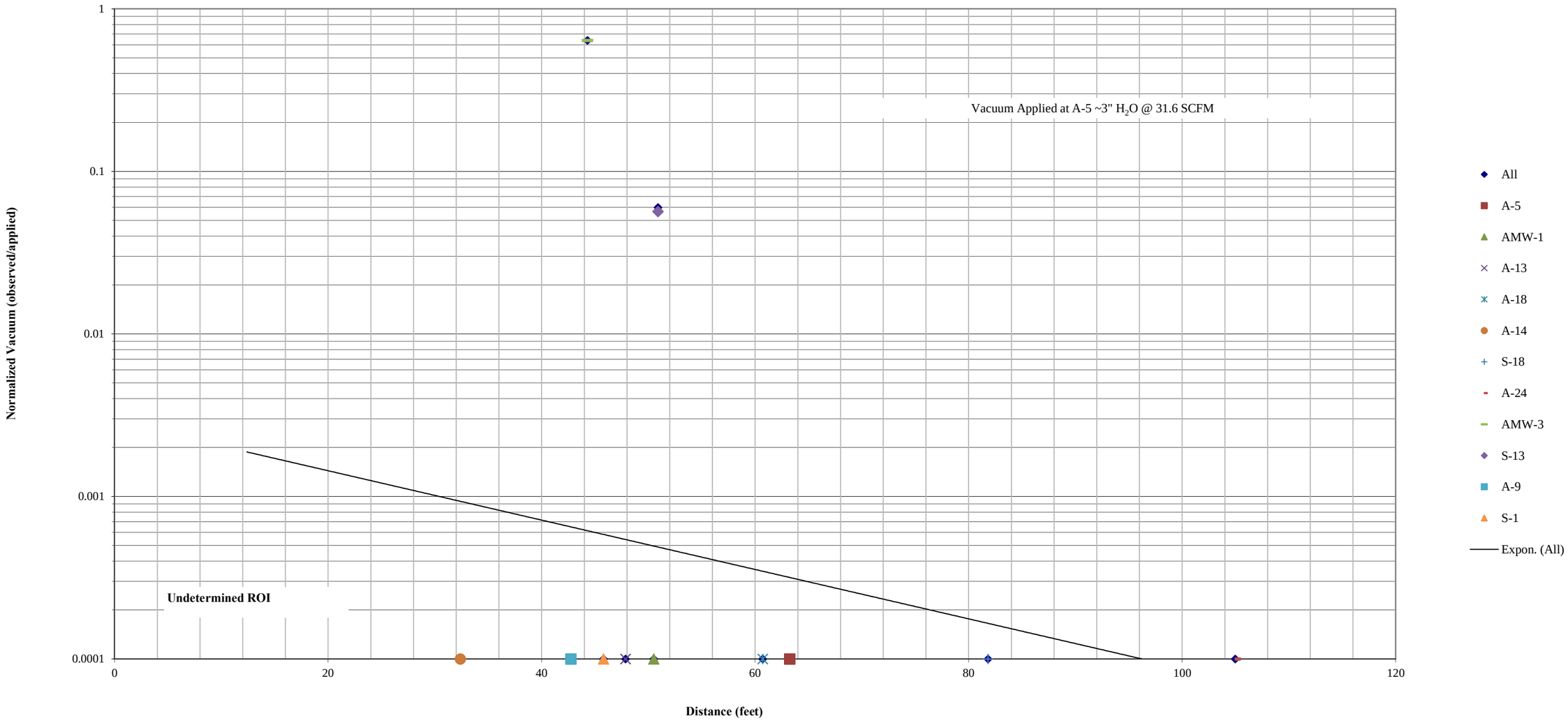
Appendix F
MPE Pilot Testing S-5 VOC Concentration vs. Time
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 23, 2014



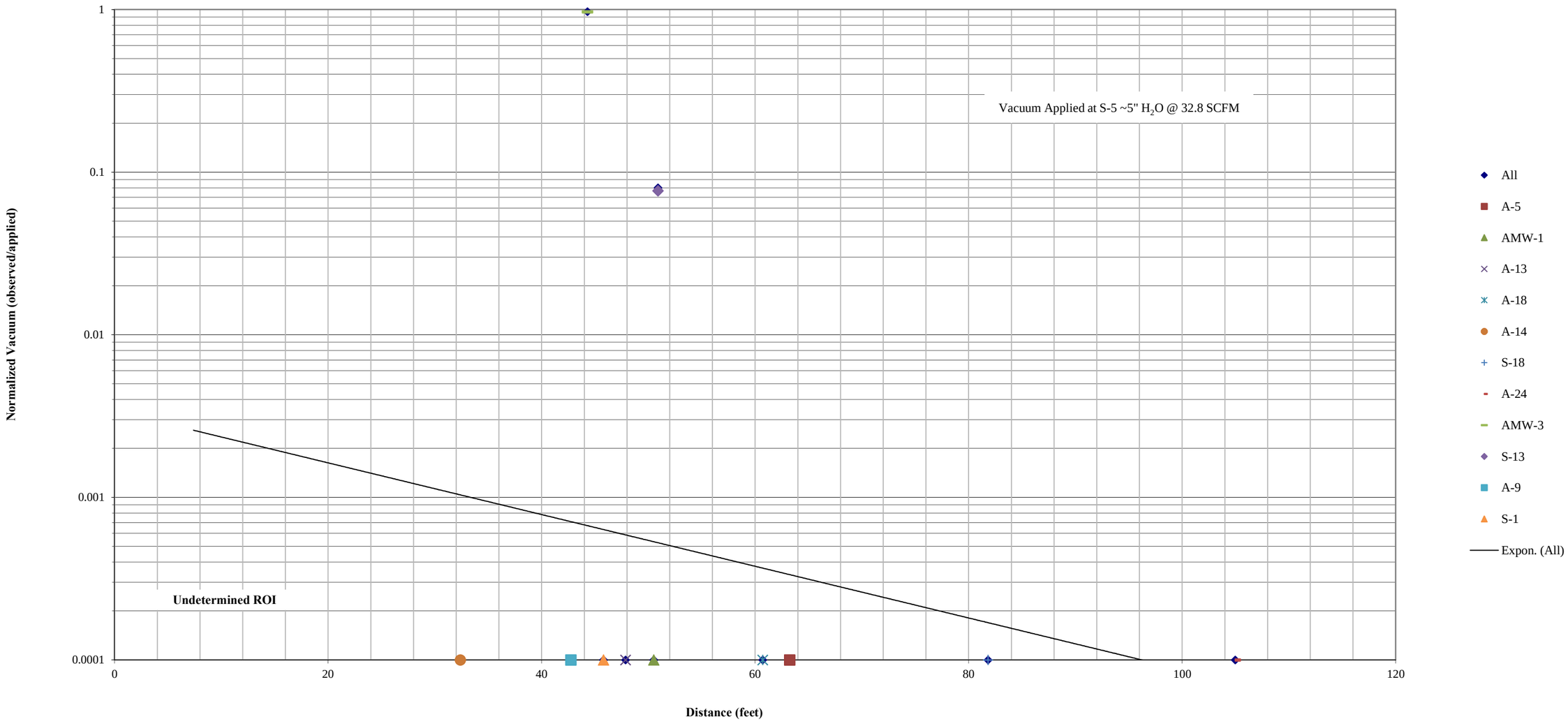
Appendix F
MPE Pilot Testing - S-5: Step 1 Normalized Vacuum vs. Distance from S-5
Cold Springs Terminal
7431 Hillside Road
Baldwinsvile, NY
June 23, 2014



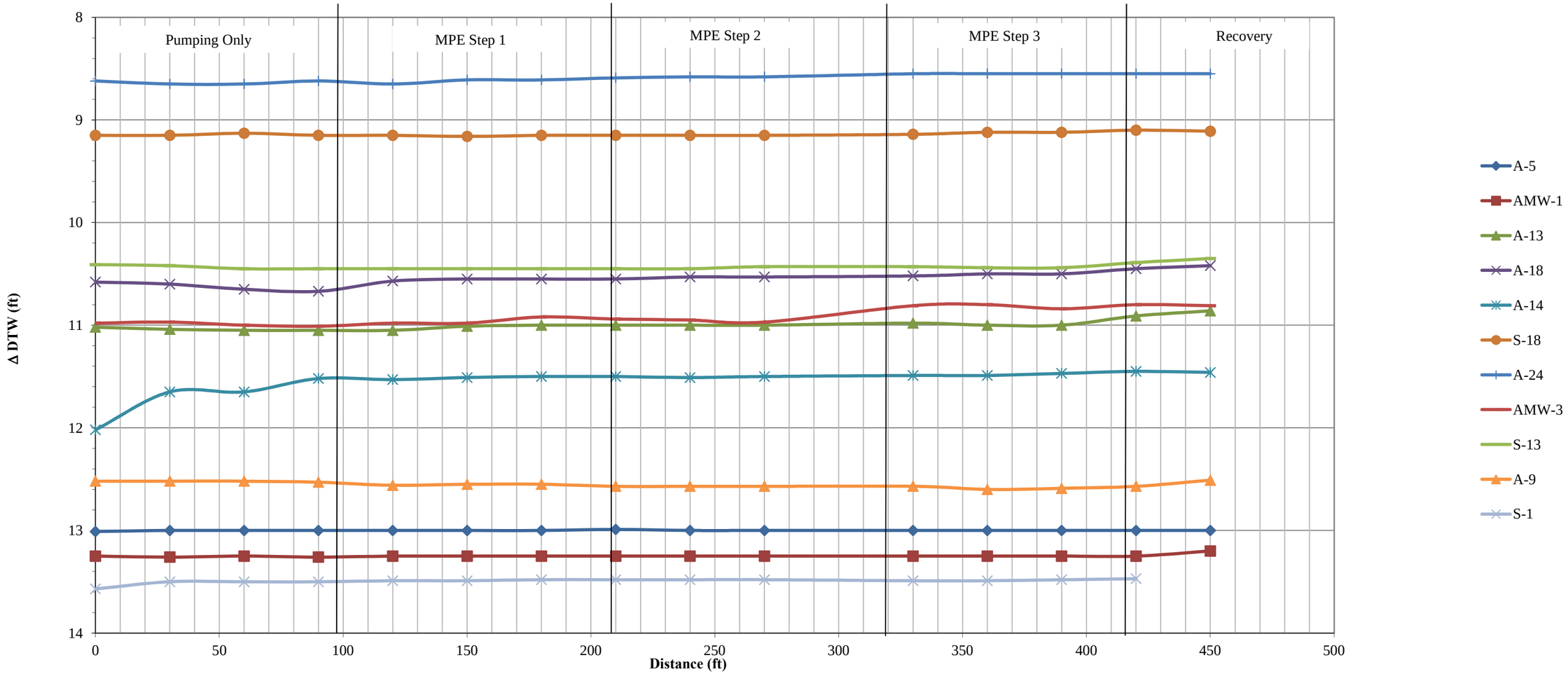
Appendix F
MPE Pilot Testing - S-5: Step 2 Normalized Vacuum vs. Distance from S-5
Cold Springs Terminal
7431 Hillside Road
Baldwinsvile, NY
June 23, 2014



Appendix F
MPE Pilot Testing - S-5: Step 3 Normalized Vacuum vs. Distance from S-5
Cold Springs Terminal
7431 Hillside Road
Baldwinsvile, NY
June 23, 2014



Appendix F
MPE Pilot Testing - S-5: Depth to Water vs. Time
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 23, 2014



Appendix F

MPE Pilot Testing - S-5: Lab Data
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY

Air Vapor Data

Parameter	ppbv	ug/mg^3	lbs/year
1,2,4-Trimehtylbenzene	5,240	25,800	27.93
1,3,5-Trimethylbenzene	2,000	9,830	10.64
Benzene	173,000	55,200	59.76
Ethylbenzene	5,320	23,100	25.01
Toluene	29,300	110,000	119.09
Xylenes (m&p)	18,200	78,900	85.42
Xylenes (o)	5,440	23,600	25.55
Total	**238,500**	**326,430**	353.42

ug/m^3 * 525600 min/year * 2.20E^9 lbs/ug * 0.02831685 m^3/ft^3 * 33 ft^3/min = lbs/year

Groundwater Data

Parameter	Concetration ug/l	lbs/year
Acetone	310	0.94
Benzene	21.2	0.06
Toluene	30.7	0.09
m&p-Xylene	72.5	0.22
o-Xylene	41.9	0.13
1,3,5-Trimethylbenzene	44.1	0.13
2-Chlorotoluene	19.2	0.06
Total	**540**	1.64

0.7 (gpm) * conc (ug/l) * 2.02462*10-9 lb/ug * 3.78413 L/gal * 525,600 min/year = lbs/year

Total lbs/year **355.06**

Appendix G

Pilot Test Groundwater and Air Data Reports

Date Issued: July 09, 2014

Pace Analytical e-Report

Report prepared for:
AECOM
40 BRITISH AMERICAN BLVD
LATHAM, NY 12110
CONTACT: JOHN SANTACROCE

Project ID: COLD SPRINGS TERMINALS 60248522
Sampling Date(s): June 23, 2014, June 24, 2014, June 25, 2014, June 26, 2014
Lab Report ID: 14070225
Client Service Contact: Chelsea Farmer (518) 346-4592 ext. 3843

Analysis Included:
EPA TO-15

Test results meet all National Environmental Laboratory Accreditation Conference (NELAC) requirements unless noted in the case narrative. The results contained within this document relate only to the samples included in this report. Pace Analytical is responsible only for the certified testing and is not directly responsible for the integrity of the sample before laboratory receipt. This report shall not be reproduced, except in full, without the written consent of Pace Analytical Services, Inc.

Dan Pfalzer
Laboratory Director

Certifications: New York (EPA: NY00906, ELAP: 11078), New Jersey (NY026), Connecticut (PH-0337), Massachusetts (M-NY906), Virginia (1884)

Pace Analytical Services, Inc.| 2190 Technology Drive | Schenectady, NY 12308
Phone: 518.346.4592 | internet: www.pacelabs.com

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CASE NARRATIVE

July 09, 2014

CASE NARRATIVE

This data package (SDG ID: 14070225) consists of 4 air samples received on 06/27/2014. The samples are from Project Name: COLD SPRINGS TERMINALS 60248522.

This sample delivery group consists of the following samples:

Lab Sample ID	Client ID	Collection Date
AR21086	S-5 (1730)	06/23/2014 17:30
AR21087	A-16 (1710)	06/24/2014 17:10
AR21088	S-3 (1445)	06/25/2014 14:45
AR21089	S-15 (1430)	06/26/2014 14:30

Sample Delivery and Receipt Conditions

(1.) Lab provided sample pickup service on 06/27/2014.

(2.) All samples were received at the laboratory intact and within holding times.
a. Samples shipped directly to Pace-LI.

Subcontract Analysis

(1.) Please see the PACE-LI Laboratory report for quality assurance details relating to the TO-15 analysis.

Respectfully submitted,



Nicole D. Johnson
Program Coordinator

QUALIFIERS

Qualifier Definitions

Organic Laboratory Qualifiers

B - Denotes analyte observed in associated method blank or extraction blank. Analyte concentration should be considered as estimated.

D - Surrogate recovery not evaluated against control limits due to sample dilution.

E - Denotes analyte concentration exceeded calibration range of instrument. Sample could not be re-analyzed at secondary dilution due to insufficient sample amount, quick turn-around request, sample matrix interference or hold time excursion. Concentration result should be considered as estimated.

J - Denotes an estimated concentration. The concentration result is greater than or equal to the Method Detection Limit (MDL) but less than the Practical Quantitation Limit (PQL).

P - Indicates relative percent difference (RPD) between primary and secondary gas chromatograph (GC) column analysis exceeds 40 % or indicates percent difference (PD) between primary and secondary gas chromatograph (GC) column analysis exceeds 25 %.

U - Denotes analyte not detected at concentration greater than the Practical Quantitation Limit (PQL). PQLs are adjusted for sample weight/volume and dilution factors.

Z - Chromatographic interference due to polychlorinated biphenyl (PCB) co-elution.

* - Value not within control limits.

Inorganic Laboratory Qualifiers

B - Denotes analyte observed in associated method blank or digestion blank. Analyte concentration should be considered as estimated.

E - Denotes analyte concentration exceeded calibration range of instrument. Sample could not be re-analyzed at secondary dilution due to insufficient sample amount, quick turn-around request, sample matrix interference or hold time excursion. Concentration result should be considered as estimated.

J - Denotes an estimated concentration. The concentration result is greater than or equal to the Method Detection Limit (MDL) but less than the Practical Quantitation Limit (PQL).

U - Denotes analyte not detected at concentration greater than the Practical Quantitation Limit (PQL). PQLs are adjusted for sample weight/volume and dilution factors.

* - Value not within control limits.

SAMPLE CHAIN OF CUSTODY

PACE ANALYTICAL

~~H2M LABS, INC.~~

575 Broad Hollow Rd., Melville, NY 11747
Tel: (631) 694-3040 Fax:(631) 420-8436

0726

<14070225P1>

140702251

AIR CANISTER CHAIN OF CUSTODY

Client Contact Information	Project Manager: JOHN SANTACROCE	CLIENT: ~~AECOM~~ COLD SPRINGS	H2M SDG NO.:
Company: AECOM	Phone: 518-951-2265	Samplers Name(s) MATT PEARSALL	
Address: 40 BRITISH AMERICAN BLVD	Site Contact: MATT PEARSALL		GAUGE #122
City/State/Zip ~~BALDWINSVI~~ LATHAM NY, ~~13212~~ 12110	978-430-9293		
Phone: 518-951-2200			
FAX: 518-951-2306			
Project Name: COLD SPRINGS	Analysis Turnaround Time		
Site: 60248522	Standard (Specify) 7 DAY		
PO #	Rush (Specify)		

Canister Pressure: FIELD / LAB — 1406K66

Sample Identification	Date Collected	Time Collected	Temp. (F)	Initial("Hg) (Start)	("Hg) / PSI (Stop)	Outgoing ("Hg) (Lab)	Incoming ("Hg) (Lab)	Flow Controller ID	Canister ID	Can Size (L)	LAB ID No.	Analysis: TO-15	Analysis: OTHER	Matrix: Indoor / Ambient Air	Matrix: Soil Gas	Matrix: Source Level
S-5 (1730)	6/23/14	1730	78	-30"	-07"	-30"		QTO-4	3401	6	-001	X				
A-16 (1710)	6/24/14	1710	80	-30"	-5"	-30"		QTO-11	3406	6	-002	X				
~~S-3 MP (1445)~~	~~6/25/14~~	~~1445~~	~~60~~	~~-30"~~	~~-10"~~	~~-30"~~		QTO-16	3421	6		X				
S-3 (1445)	6/25/14	1445	60	-30"	-10"	-30"		QTO-18	3426	6	-003	X				
S-15 (1430)	6/26/14	1430	80	-30"	-05"	-30"		QTO-16	3421	6	-004	X				

Pressure	Ambient	Maximum	Minimum
Start			
Stop			

Temperature (Fahrenheit)	Ambient	Maximum	Minimum
Start			
Stop			

Special Instructions/QC Requirements & Comments:

7800 095889CC

8030 22730177

Samples Relinquished by:	Date/Time: 6/26/14	Received by: PHIL PLANO PACE	Date/Time: 6/26/14 1330
Relinquished by: PHIL PLANO	Date/Time: 6/26/14 1800	Received by:	Date/Time: 6/27/14 1030

WHITE COPY - ORIGINAL YELLOW COPY - CLIENT PINK COPY - LABORATORY

* Notify lab if equipment is damaged upon receipt. Client is responsible for damage to equipement

SAMPLE RECEIPT

SAMPLE RECEIPT REPORT
14070225

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

CLIENT: AECOM
PROJECT: COLD SPRINGS TERMINALS 60248522
LRF: 14070225
REPORT: ANALYTICAL REPORT
EDD: YES
LRF TAT: 7 DAYS

RECEIVED DATE: 06/27/2014 10:30
SHIPPED VIA: PICK UP
SHIPPING ID:
NUMBER OF COOLERS: 1
CUSTODY SEAL INTACT: NA
COOLER STATUS: CHILLED
TEMPERATURE(S): [5] N/A °C

SAMPLE SEALS INTACT: NA
[1,2] SAMPLES PRESERVED PER METHOD GUIDANCE: NA
[3] SAMPLES REC'D IN HOLDTIME: YES
DISPOSAL: BY LAB (45 DAYS)
COC DISCREPANCY: NO

COMMENTS:
SAMPLES SHIPPED DIRECT TO PACE-LI

CLIENT ID (LAB ID)	TAT-DUE Date[4]	DATE-TIME SAMPLED	MATRIX	METHOD	TEST DESCRIPTION	QC REQUEST
S-5 (1730) (AR21086)	7 DAYS 07-09-14	06/23/2014 17:30	Air	EPA TO-15	EPA TO-15	
A-16 (1710) (AR21087)	7 DAYS 07-09-14	06/24/2014 17:10	Air	EPA TO-15	EPA TO-15	
S-3 (1445) (AR21088)	7 DAYS 07-09-14	06/25/2014 14:45	Air	EPA TO-15	EPA TO-15	
S-15 (1430) (AR21089)	7 DAYS 07-09-14	06/26/2014 14:30	Air	EPA TO-15	EPA TO-15	

[1]The pH preservation check of Oil and Grease (Method 1664) is performed as soon as possible after sample receipt and may not be included in this report.
[2]The pH preservation check of aqueous volatile samples is not performed until after the analysis of the sample to maintain zero headspace and is not included in this report.
[3]Samples received for pH analysis are not marked as a hold time exceedance here. SW-846 methods suggests analysis to be done within 15 minutes of sample collection. Because of transportation time it is not possible for the laboratory to perform the test in that time. Sample Certificates of Analysis reports are noted as such.
[4]Samples arriving at the laboratory after 4:00 pm are assigned a due date as if they arrived the following business day unless other arrangements have been made.
[5]All samples which require thermal preservation shall be considered acceptable when received greater than 6 degrees Celsius if they are collected on the same day as received and there is evidence that the chilling process has begun, such as arrival on ice.Control limits are between 0-6 Degrees Celsius. Control limits do not apply for metals analysis.

Reporting Parameters and Lists

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Subcontract Analysis

Pace Analytical
575 Broad Hollow Road , Melville, NY 11747
TEL: (631) 694-3040 FAX: (631) 420-8436
NYSDOH ID#10478 www.pacelabs.com

LABORATORY RESULTS

Results for the samples and analytes requested

The lab is not directly responsible for the integrity of the sample before receipt at the lab and is responsible only for the certified tests requested.

Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/23/2014 5:30:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-001
Client Sample ID: S-5

Sample Information:
Type : Air

Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier	D.F.	Result	Units	Date Analyzed
1,1,1-Trichloroethane	< 800	ppbv	D	4000	< 4370	µg/m³	07/02/2014 8:29 PM
1,1,2,2-Tetrachloroethane	< 800	ppbv	D	4000	< 5490	µg/m³	07/02/2014 8:29 PM
1,1,2-Trichloro-1,2,2-trifluoroethane	< 800	ppbv	D	4000	< 6130	µg/m³	07/02/2014 8:29 PM
1,1,2-Trichloroethane	< 800	ppbv	D	4000	< 4370	µg/m³	07/02/2014 8:29 PM
1,1-Dichloroethane	< 800	ppbv	D	4000	< 3240	µg/m³	07/02/2014 8:29 PM
1,1-Dichloroethene	< 800	ppbv	D	4000	< 3170	µg/m³	07/02/2014 8:29 PM
1,2,4-Trichlorobenzene	< 800	ppbv	DcS	4000	< 5940	µg/m³	07/02/2014 8:29 PM
1,2,4-Trimethylbenzene	5,240	ppbv	D	4000	25800	µg/m³	07/02/2014 8:29 PM
1,2-Dibromoethane	< 800	ppbv	D	4000	< 6150	µg/m³	07/02/2014 8:29 PM
1,2-Dichlorobenzene	< 800	ppbv	D	4000	< 4810	µg/m³	07/02/2014 8:29 PM
1,2-Dichloroethane	< 800	ppbv	D	4000	< 3240	µg/m³	07/02/2014 8:29 PM
1,2-Dichloroethene (cis)	< 800	ppbv	D	4000	< 3170	µg/m³	07/02/2014 8:29 PM
1,2-Dichloroethene (trans)	< 800	ppbv	D	4000	< 3170	µg/m³	07/02/2014 8:29 PM
1,2-Dichloropropane	< 800	ppbv	D	4000	< 3700	µg/m³	07/02/2014 8:29 PM
1,2-Dichlorotetrafluoroethane	< 800	ppbv	D	4000	< 5590	µg/m³	07/02/2014 8:29 PM
1,3,5-Trimethylbenzene	2,000	ppbv	D	4000	9830	µg/m³	07/02/2014 8:29 PM
1,3-Dichlorobenzene	< 800	ppbv	D	4000	< 4810	µg/m³	07/02/2014 8:29 PM
1,3-Dichloropropene (cis)	< 800	ppbv	D	4000	< 3630	µg/m³	07/02/2014 8:29 PM
1,3-Dichloropropene (trans)	< 800	ppbv	D	4000	< 3630	µg/m³	07/02/2014 8:29 PM
1,3-Hexachlorobutadiene	< 800	ppbv	D	4000	< 8530	µg/m³	07/02/2014 8:29 PM
1,4-Dichlorobenzene	< 800	ppbv	D	4000	< 4810	µg/m³	07/02/2014 8:29 PM
Acetone	< 800	ppbv	D	4000	< 1900	µg/m³	07/02/2014 8:29 PM
Benzene	17,300	ppbv	D	4000	55200	µg/m³	07/02/2014 8:29 PM
Bromodichloromethane	< 800	ppbv	D	4000	< 5360	µg/m³	07/02/2014 8:29 PM
Bromoform	< 800	ppbv	D	4000	< 8270	µg/m³	07/02/2014 8:29 PM
Bromomethane	< 800	ppbv	D	4000	< 3110	µg/m³	07/02/2014 8:29 PM
Carbon disulfide	< 800	ppbv	D	4000	< 2490	µg/m³	07/02/2014 8:29 PM
Carbon tetrachloride	< 800	ppbv	D	4000	< 5030	µg/m³	07/02/2014 8:29 PM
Chlorobenzene	< 800	ppbv	D	4000	< 3680	µg/m³	07/02/2014 8:29 PM
Chloroethane	< 800	ppbv	D	4000	< 2110	µg/m³	07/02/2014 8:29 PM
Chloroform	< 800	ppbv	D	4000	< 3910	µg/m³	07/02/2014 8:29 PM
Chloromethane	< 800	ppbv	D	4000	< 1650	µg/m³	07/02/2014 8:29 PM
Dibromochloromethane	< 800	ppbv	D	4000	< 6810	µg/m³	07/02/2014 8:29 PM
Dichlorodifluoromethane	< 800	ppbv	D	4000	< 3960	µg/m³	07/02/2014 8:29 PM
Ethylbenzene	5,320	ppbv	D	4000	23100	µg/m³	07/02/2014 8:29 PM

Qualifiers: E = Value above quantitation range, Value estimated.
B = Found in Blank
D.F. = Dilution Factor D = Results for Dilution
H = Received/analyzed outside of analytical holding time
+ = NYSDOH ELAP does not offer certification for this analyte / matrix / method
c = Calibration acceptability criteria exceeded for this analyte
r = Reporting limit > MDL and < LOQ, Value estimated.
J = Estimated value - below calibration range
S = Recovery exceeded control limits for this analyte
N = Indicates presumptive evidence of compound

Project Manager

Test results meet the requirements of NELAC unless otherwise noted.

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Date Reported : 7/8/2014

Pace Analytical
575 Broad Hollow Road , Melville, NY 11747
TEL: (631) 694-3040 FAX: (631) 420-8436
NYSDOH ID#10478 www.pacelabs.com

LABORATORY RESULTS

Results for the samples and analytes requested

The lab is not directly responsible for the integrity of the sample before receipt at the lab and is responsible only for the certified tests requested.

Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/23/2014 5:30:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-001
Client Sample ID: S-5

Sample Information:
Type : Air

Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier	D.F.	Result	Units	Date Analyzed
Methyl butyl ketone	< 800	ppbv	D +	4000	< 3280	µg/m³	07/02/2014 8:29 PM
Methyl ethyl ketone	< 800	ppbv	D	4000	< 2360	µg/m³	07/02/2014 8:29 PM
Methyl isobutyl ketone	< 800	ppbv	D	4000	< 3280	µg/m³	07/02/2014 8:29 PM
Methyl tert-butyl ether	< 800	ppbv	D	4000	< 2880	µg/m³	07/02/2014 8:29 PM
Methylene chloride	< 800	ppbv	D	4000	< 3110	µg/m³	07/02/2014 8:29 PM
Styrene	< 800	ppbv	D	4000	< 3410	µg/m³	07/02/2014 8:29 PM
Tetrachloroethene	< 800	ppbv	D	4000	< 5430	µg/m³	07/02/2014 8:29 PM
Toluene	29,300	ppbv	D	4000	110000	µg/m³	07/02/2014 8:29 PM
Trichloroethene	< 800	ppbv	D	4000	< 4300	µg/m³	07/02/2014 8:29 PM
Trichlorofluoromethane	< 800	ppbv	D	4000	< 4500	µg/m³	07/02/2014 8:29 PM
Vinyl acetate	< 800	ppbv	D	4000	< 2820	µg/m³	07/02/2014 8:29 PM
Vinyl chloride	< 800	ppbv	D	4000	< 2040	µg/m³	07/02/2014 8:29 PM
Xylenes (m&p)	18,200	ppbv	D	4000	78900	µg/m³	07/02/2014 8:29 PM
Xylenes (o)	5,440	ppbv	D	4000	23600	µg/m³	07/02/2014 8:29 PM
Surr: 4-Bromofluorobenzene	113	%REC	D Limit	70-130	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Branched (10.11)	49,200	ppbv	D	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Branched (10.37)	48,400	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Branched (4)	146,000	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Branched (5.13)	572,000	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Branched (6.38)	22,000	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Branched (7.13)	101,000	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Branched (7.23)	264,000	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Branched (7.63)	152,000	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Branched (9)	23,600	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Cyclic	110,000	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Straight-Chain (4.24)	271,000	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: (DEL) Alkane: Straight-Chain (5.59)	326,000	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: Cyclohexane, methyl-	37,600	ppbv	DN +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: unknown (5.5)	50,800	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM

Qualifiers: E = Value above quantitation range, Value estimated.
B = Found in Blank
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+ = NYSDOH ELAP does not offer certification for this analyte / matrix / method
c = Calibration acceptability criteria exceeded for this analyte
r = Reporting limit > MDL and < LOQ, Value estimated.
J = Estimated value - below calibration range
S = Recovery exceeded control limits for this analyte
N = Indicates presumptive evidence of compound

Project Manager

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Date Reported : 7/8/2014

Pace Analytical
575 Broad Hollow Road , Melville, NY 11747
TEL: (631) 694-3040 FAX: (631) 420-8436
NYSDOH ID#10478 www.pacelabs.com

LABORATORY RESULTS

Results for the samples and analytes requested

The lab is not directly responsible for the integrity of the sample before receipt at the lab and is responsible only for the certified tests requested.

Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/23/2014 5:30:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-001
Client Sample ID: S-5

Sample Information:
Type : Air
Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier	D.F.	Result	Units	Date Analyzed
TIC: unknown (5.73)	55,600	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: unknown (5.9)	28,000	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: unknown (6.01)	93,600	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: unknown (8.4)	19,200	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: unknown alkene (4.32)	25,600	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM
TIC: unknown alkene (8.3)	23,200	ppbv	D +	4000	No M.W. Data		07/02/2014 8:29 PM

5

Qualifiers: E = Value above quantitation range, Value estimated.
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J = Estimated value - below calibration range
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NYSDOH ID#10478 www.pacelabs.com

LABORATORY RESULTS

Results for the samples and analytes requested

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Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/24/2014 5:10:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-002
Client Sample ID: A-16

Sample Information:
Type : Air
Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier	D.F.	Result	Units	Date Analyzed
1,1,1-Trichloroethane	< 400	ppbv	D	2000	< 2180	µg/m³	07/02/2014 9:12 PM
1,1,2,2-Tetrachloroethane	< 400	ppbv	D	2000	< 2750	µg/m³	07/02/2014 9:12 PM
1,1,2-Trichloro-1,2,2-trifluoroethane	< 400	ppbv	D	2000	< 3070	µg/m³	07/02/2014 9:12 PM
1,1,2-Trichloroethane	< 400	ppbv	D	2000	< 2180	µg/m³	07/02/2014 9:12 PM
1,1-Dichloroethane	< 400	ppbv	D	2000	< 1620	µg/m³	07/02/2014 9:12 PM
1,1-Dichloroethene	< 400	ppbv	D	2000	< 1590	µg/m³	07/02/2014 9:12 PM
1,2,4-Trichlorobenzene	< 400	ppbv	DcS	2000	< 2970	µg/m³	07/02/2014 9:12 PM
1,2,4-Trimethylbenzene	32,300	ppbv	D	2000	159000	µg/m³	07/02/2014 9:12 PM
1,2-Dibromoethane	< 400	ppbv	D	2000	< 3070	µg/m³	07/02/2014 9:12 PM
1,2-Dichlorobenzene	< 400	ppbv	D	2000	< 2400	µg/m³	07/02/2014 9:12 PM
1,2-Dichloroethane	< 400	ppbv	D	2000	< 1620	µg/m³	07/02/2014 9:12 PM
1,2-Dichloroethene (cis)	< 400	ppbv	D	2000	< 1590	µg/m³	07/02/2014 9:12 PM
1,2-Dichloroethene (trans)	< 400	ppbv	D	2000	< 1590	µg/m³	07/02/2014 9:12 PM
1,2-Dichloropropane	< 400	ppbv	D	2000	< 1850	µg/m³	07/02/2014 9:12 PM
1,2-Dichlorotetrafluoroethane	< 400	ppbv	D	2000	< 2800	µg/m³	07/02/2014 9:12 PM
1,3,5-Trimethylbenzene	12,300	ppbv	D	2000	60500	µg/m³	07/02/2014 9:12 PM
1,3-Dichlorobenzene	< 400	ppbv	D	2000	< 2400	µg/m³	07/02/2014 9:12 PM
1,3-Dichloropropene (cis)	< 400	ppbv	D	2000	< 1820	µg/m³	07/02/2014 9:12 PM
1,3-Dichloropropene (trans)	< 400	ppbv	D	2000	< 1820	µg/m³	07/02/2014 9:12 PM
1,3-Hexachlorobutadiene	< 400	ppbv	D	2000	< 4270	µg/m³	07/02/2014 9:12 PM
1,4-Dichlorobenzene	< 400	ppbv	D	2000	< 2400	µg/m³	07/02/2014 9:12 PM
Acetone	< 400	ppbv	D	2000	< 950	µg/m³	07/02/2014 9:12 PM
Benzene	12,200	ppbv	D	2000	39000	µg/m³	07/02/2014 9:12 PM
Bromodichloromethane	< 400	ppbv	D	2000	< 2680	µg/m³	07/02/2014 9:12 PM
Bromoform	< 400	ppbv	D	2000	< 4130	µg/m³	07/02/2014 9:12 PM
Bromomethane	< 400	ppbv	D	2000	< 1550	µg/m³	07/02/2014 9:12 PM
Carbon disulfide	< 400	ppbv	D	2000	< 1250	µg/m³	07/02/2014 9:12 PM
Carbon tetrachloride	< 400	ppbv	D	2000	< 2520	µg/m³	07/02/2014 9:12 PM
Chlorobenzene	< 400	ppbv	D	2000	< 1840	µg/m³	07/02/2014 9:12 PM
Chloroethane	< 400	ppbv	D	2000	< 1060	µg/m³	07/02/2014 9:12 PM
Chloroform	< 400	ppbv	D	2000	< 1950	µg/m³	07/02/2014 9:12 PM
Chloromethane	< 400	ppbv	D	2000	< 826	µg/m³	07/02/2014 9:12 PM
Dibromochloromethane	< 400	ppbv	D	2000	< 3410	µg/m³	07/02/2014 9:12 PM
Dichlorodifluoromethane	< 400	ppbv	D	2000	< 1980	µg/m³	07/02/2014 9:12 PM
Ethylbenzene	13,600	ppbv	D	2000	59000	µg/m³	07/02/2014 9:12 PM

Qualifiers: E = Value above quantitation range, Value estimated.
B = Found in Blank
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Project Manager

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575 Broad Hollow Road , Melville, NY 11747
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NYSDOH ID#10478 www.pacelabs.com

LABORATORY RESULTS

Results for the samples and analytes requested

The lab is not directly responsible for the integrity of the sample before receipt at the lab and is responsible only for the certified tests requested.

Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/24/2014 5:10:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-002
Client Sample ID: A-16

Sample Information:
Type : Air

Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier	D.F.	Result	Units	Date Analyzed
Methyl butyl ketone	< 400	ppbv	D +	2000	< 1640	µg/m³	07/02/2014 9:12 PM
Methyl ethyl ketone	< 400	ppbv	D	2000	< 1180	µg/m³	07/02/2014 9:12 PM
Methyl isobutyl ketone	< 400	ppbv	D	2000	< 1640	µg/m³	07/02/2014 9:12 PM
Methyl tert-butyl ether	< 400	ppbv	D	2000	< 1440	µg/m³	07/02/2014 9:12 PM
Methylene chloride	< 400	ppbv	D	2000	< 1550	µg/m³	07/02/2014 9:12 PM
Styrene	< 400	ppbv	D	2000	< 1700	µg/m³	07/02/2014 9:12 PM
Tetrachloroethene	< 400	ppbv	D	2000	< 2710	µg/m³	07/02/2014 9:12 PM
Toluene	35,200	ppbv	D	2000	133000	µg/m³	07/02/2014 9:12 PM
Trichloroethene	< 400	ppbv	D	2000	< 2150	µg/m³	07/02/2014 9:12 PM
Trichlorofluoromethane	< 400	ppbv	D	2000	< 2250	µg/m³	07/02/2014 9:12 PM
Vinyl acetate	< 400	ppbv	D	2000	< 1410	µg/m³	07/02/2014 9:12 PM
Vinyl chloride	< 400	ppbv	D	2000	< 1020	µg/m³	07/02/2014 9:12 PM
Xylenes (m&p)	61,100	ppbv	D	2000	265000	µg/m³	07/02/2014 9:12 PM
Xylenes (o)	22,500	ppbv	D	2000	97600	µg/m³	07/02/2014 9:12 PM
Surr: 4-Bromofluorobenzene	125	%REC	D Limit	70-130	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Branched (10.13)	188,000	ppbv	D	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Branched (10.2)	84,800	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Branched (10.39)	203,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Branched (4)	146,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Branched (5.12)	625,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Branched (6.38)	68,200	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Branched (7.15)	311,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Branched (7.25)	596,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Branched (7.64)	430,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Branched (9.02)	107,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Cyclic (10.7)	71,800	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Cyclic (8.94)	365,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: (DEL) Alkane: Straight-Chain (4.23)	258,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:12 PM

Qualifiers: E = Value above quantitation range, Value estimated.
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Project Manager

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NYSDOH ID#10478 www.pacelabs.com

LABORATORY RESULTS

Results for the samples and analytes requested

The lab is not directly responsible for the integrity of the sample before receipt at the lab and is responsible only for the certified tests requested.

Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/24/2014 5:10:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-002
Client Sample ID: A-16

Sample Information:
Type : Air
Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier		D.F.	Result	Units	Date Analyzed
TIC: (DEL) Alkane: Straight-Chain (5.59)	444,000	ppbv	D	+	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: Cyclohexane, methyl-	148,000	ppbv	DN	+	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: unknown (5.5)	71,800	ppbv	D	+	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: unknown (5.74)	68,200	ppbv	D	+	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: unknown (6.01)	162,000	ppbv	D	+	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: unknown (8.31)	80,400	ppbv	D	+	2000	No M.W. Data		07/02/2014 9:12 PM
TIC: unknown (8.7)	73,600	ppbv	D	+	2000	No M.W. Data		07/02/2014 9:12 PM

5

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H = Received/analyzed outside of analytical holding time
+ = NYSDOH ELAP does not offer certification for this analyte / matrix / method
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J = Estimated value - below calibration range
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Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/25/2014 2:45:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-003
Client Sample ID: S-3

Sample Information:
Type : Air

Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier	D.F.	Result	Units	Date Analyzed
1,1,1-Trichloroethane	< 400	ppbv	D	2000	< 2180	µg/m³	07/02/2014 9:55 PM
1,1,2,2-Tetrachloroethane	< 400	ppbv	D	2000	< 2750	µg/m³	07/02/2014 9:55 PM
1,1,2-Trichloro-1,2,2-trifluoroethane	< 400	ppbv	D	2000	< 3070	µg/m³	07/02/2014 9:55 PM
1,1,2-Trichloroethane	< 400	ppbv	D	2000	< 2180	µg/m³	07/02/2014 9:55 PM
1,1-Dichloroethane	< 400	ppbv	D	2000	< 1620	µg/m³	07/02/2014 9:55 PM
1,1-Dichloroethene	< 400	ppbv	D	2000	< 1590	µg/m³	07/02/2014 9:55 PM
1,2,4-Trichlorobenzene	< 400	ppbv	DcS	2000	< 2970	µg/m³	07/02/2014 9:55 PM
1,2,4-Trimethylbenzene	7,320	ppbv	D	2000	36000	µg/m³	07/02/2014 9:55 PM
1,2-Dibromoethane	< 400	ppbv	D	2000	< 3070	µg/m³	07/02/2014 9:55 PM
1,2-Dichlorobenzene	< 400	ppbv	D	2000	< 2400	µg/m³	07/02/2014 9:55 PM
1,2-Dichloroethane	< 400	ppbv	D	2000	< 1620	µg/m³	07/02/2014 9:55 PM
1,2-Dichloroethene (cis)	< 400	ppbv	D	2000	< 1590	µg/m³	07/02/2014 9:55 PM
1,2-Dichloroethene (trans)	< 400	ppbv	D	2000	< 1590	µg/m³	07/02/2014 9:55 PM
1,2-Dichloropropane	< 400	ppbv	D	2000	< 1850	µg/m³	07/02/2014 9:55 PM
1,2-Dichlorotetrafluoroethane	< 400	ppbv	D	2000	< 2800	µg/m³	07/02/2014 9:55 PM
1,3,5-Trimethylbenzene	2,920	ppbv	D	2000	14400	µg/m³	07/02/2014 9:55 PM
1,3-Dichlorobenzene	< 400	ppbv	D	2000	< 2400	µg/m³	07/02/2014 9:55 PM
1,3-Dichloropropene (cis)	< 400	ppbv	D	2000	< 1820	µg/m³	07/02/2014 9:55 PM
1,3-Dichloropropene (trans)	< 400	ppbv	D	2000	< 1820	µg/m³	07/02/2014 9:55 PM
1,3-Hexachlorobutadiene	< 400	ppbv	D	2000	< 4270	µg/m³	07/02/2014 9:55 PM
1,4-Dichlorobenzene	< 400	ppbv	D	2000	< 2400	µg/m³	07/02/2014 9:55 PM
Acetone	< 400	ppbv	D	2000	< 950	µg/m³	07/02/2014 9:55 PM
Benzene	26,700	ppbv	D	2000	85200	µg/m³	07/02/2014 9:55 PM
Bromodichloromethane	< 400	ppbv	D	2000	< 2680	µg/m³	07/02/2014 9:55 PM
Bromoform	< 400	ppbv	D	2000	< 4130	µg/m³	07/02/2014 9:55 PM
Bromomethane	< 400	ppbv	D	2000	< 1550	µg/m³	07/02/2014 9:55 PM
Carbon disulfide	< 400	ppbv	D	2000	< 1250	µg/m³	07/02/2014 9:55 PM
Carbon tetrachloride	< 400	ppbv	D	2000	< 2520	µg/m³	07/02/2014 9:55 PM
Chlorobenzene	< 400	ppbv	D	2000	< 1840	µg/m³	07/02/2014 9:55 PM
Chloroethane	< 400	ppbv	D	2000	< 1060	µg/m³	07/02/2014 9:55 PM
Chloroform	< 400	ppbv	D	2000	< 1950	µg/m³	07/02/2014 9:55 PM
Chloromethane	< 400	ppbv	D	2000	< 826	µg/m³	07/02/2014 9:55 PM
Dibromochloromethane	< 400	ppbv	D	2000	< 3410	µg/m³	07/02/2014 9:55 PM
Dichlorodifluoromethane	< 400	ppbv	D	2000	< 1980	µg/m³	07/02/2014 9:55 PM
Ethylbenzene	11,600	ppbv	D	2000	50500	µg/m³	07/02/2014 9:55 PM

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LABORATORY RESULTS

Results for the samples and analytes requested

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Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/25/2014 2:45:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-003
Client Sample ID: S-3

Sample Information:
Type : Air

Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier	D.F.	Result	Units	Date Analyzed
Methyl butyl ketone	< 400	ppbv	D +	2000	< 1640	µg/m³	07/02/2014 9:55 PM
Methyl ethyl ketone	< 400	ppbv	D	2000	< 1180	µg/m³	07/02/2014 9:55 PM
Methyl isobutyl ketone	< 400	ppbv	D	2000	< 1640	µg/m³	07/02/2014 9:55 PM
Methyl tert-butyl ether	< 400	ppbv	D	2000	< 1440	µg/m³	07/02/2014 9:55 PM
Methylene chloride	< 400	ppbv	D	2000	< 1550	µg/m³	07/02/2014 9:55 PM
Styrene	< 400	ppbv	D	2000	< 1700	µg/m³	07/02/2014 9:55 PM
Tetrachloroethene	< 400	ppbv	D	2000	< 2710	µg/m³	07/02/2014 9:55 PM
Toluene	109,000	ppbv	D	4000	410000	µg/m³	07/06/2014 12:50 AM
Trichloroethene	< 400	ppbv	D	2000	< 2150	µg/m³	07/02/2014 9:55 PM
Trichlorofluoromethane	< 400	ppbv	D	2000	< 2250	µg/m³	07/02/2014 9:55 PM
Vinyl acetate	< 400	ppbv	D	2000	< 1410	µg/m³	07/02/2014 9:55 PM
Vinyl chloride	< 400	ppbv	D	2000	< 1020	µg/m³	07/02/2014 9:55 PM
Xylenes (m&p)	45,500	ppbv	D	2000	198000	µg/m³	07/02/2014 9:55 PM
Xylenes (o)	14,400	ppbv	D	2000	62400	µg/m³	07/02/2014 9:55 PM
Surr: 4-Bromofluorobenzene	113	%REC	D Limit	70-130	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Branched (10.12)	86,200	ppbv	D	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Branched (10.19)	41,200	ppbv	D +	4000	No M.W. Data		07/06/2014 12:50 AM
TIC: (DEL) Alkane: Branched (10.2)	30,800	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Branched (10.38)	85,600	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Branched (4)	52,800	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Branched (5.12)	332,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Branched (5.13)	510,000	ppbv	D +	4000	No M.W. Data		07/06/2014 12:50 AM
TIC: (DEL) Alkane: Branched (6.38)	30,400	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Branched (7.13)	127,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Branched (7.24)	305,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Branched (7.63)	203,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Branched (8.3)	47,200	ppbv	D +	4000	No M.W. Data		07/06/2014 12:50 AM

Qualifiers: E = Value above quantitation range, Value estimated.
B = Found in Blank
D.F. = Dilution Factor D = Results for Dilution
H = Received/analyzed outside of analytical holding time
+ = NYSDOH ELAP does not offer certification for this analyte / matrix / method
c = Calibration acceptability criteria exceeded for this analyte
r = Reporting limit > MDL and < LOQ, Value estimated.
J = Estimated value - below calibration range
S = Recovery exceeded control limits for this analyte
N = Indicates presumptive evidence of compound

Project Manager

Test results meet the requirements of NELAC unless otherwise noted.

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Date Reported : 7/8/2014

Pace Analytical
575 Broad Hollow Road , Melville, NY 11747
TEL: (631) 694-3040 FAX: (631) 420-8436
NYSDOH ID#10478 www.pacelabs.com

LABORATORY RESULTS

Results for the samples and analytes requested

The lab is not directly responsible for the integrity of the sample before receipt at the lab and is responsible only for the certified tests requested.

Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/25/2014 2:45:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-003
Client Sample ID: S-3

Sample Information:
Type : Air
Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier	D.F.	Result	Units	Date Analyzed
TIC: (DEL) Alkane: Branched (8.69)	31,400	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Branched (9.01)	42,800	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Cyclic	167,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Cyclic (10.69)	43,600	ppbv	D +	4000	No M.W. Data		07/06/2014 12:50 AM
TIC: (DEL) Alkane: Cyclic (8.93)	233,000	ppbv	D +	4000	No M.W. Data		07/06/2014 12:50 AM
TIC: (DEL) Alkane: Straight-Chain (4.24)	111,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: (DEL) Alkane: Straight-Chain (4.25)	161,000	ppbv	D +	4000	No M.W. Data		07/06/2014 12:50 AM
TIC: (DEL) Alkane: Straight-Chain (5.59)	227,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: cyclic alkane	33,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: Cyclohexane, methyl-	58,000	ppbv	DN +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: unknown (5.5)	30,200	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: unknown (5.73)	33,400	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: unknown (5.74)	46,000	ppbv	D +	4000	No M.W. Data		07/06/2014 12:50 AM
TIC: unknown (6.01)	73,000	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: unknown (8.31)	34,200	ppbv	D +	2000	No M.W. Data		07/02/2014 9:55 PM
TIC: unknown (8.69)	42,400	ppbv	D +	4000	No M.W. Data		07/06/2014 12:50 AM

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Project Manager

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NYSDOH ID#10478 www.pacelabs.com

LABORATORY RESULTS

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Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/26/2014 2:30:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-004
Client Sample ID: S-15

Sample Information:
Type : Air

Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier	D.F.	Result	Units	Date Analyzed
1,1,1-Trichloroethane	< 0.50	ppbv	D	2.5	< 2.73	µg/m³	07/06/2014 1:32 AM
1,1,2,2-Tetrachloroethane	< 0.50	ppbv	D	2.5	< 3.43	µg/m³	07/06/2014 1:32 AM
1,1,2-Trichloro-1,2,2-trifluoroethane	< 0.50	ppbv	D	2.5	< 3.83	µg/m³	07/06/2014 1:32 AM
1,1,2-Trichloroethane	< 0.50	ppbv	D	2.5	< 2.73	µg/m³	07/06/2014 1:32 AM
1,1-Dichloroethane	< 0.50	ppbv	D	2.5	< 2.02	µg/m³	07/06/2014 1:32 AM
1,1-Dichloroethene	< 0.50	ppbv	D	2.5	< 1.98	µg/m³	07/06/2014 1:32 AM
1,2,4-Trichlorobenzene	< 0.50	ppbv	D	2.5	< 3.71	µg/m³	07/06/2014 1:32 AM
1,2,4-Trimethylbenzene	1,360	ppbv	D	2000	6690	µg/m³	07/02/2014 10:37 PM
1,2-Dibromoethane	< 0.50	ppbv	D	2.5	< 3.84	µg/m³	07/06/2014 1:32 AM
1,2-Dichlorobenzene	< 0.50	ppbv	D	2.5	< 3.01	µg/m³	07/06/2014 1:32 AM
1,2-Dichloroethane	< 0.50	ppbv	D	2.5	< 2.02	µg/m³	07/06/2014 1:32 AM
1,2-Dichloroethene (cis)	< 0.50	ppbv	D	2.5	< 1.98	µg/m³	07/06/2014 1:32 AM
1,2-Dichloroethene (trans)	< 0.50	ppbv	D	2.5	< 1.98	µg/m³	07/06/2014 1:32 AM
1,2-Dichloropropane	< 0.50	ppbv	D	2.5	< 2.31	µg/m³	07/06/2014 1:32 AM
1,2-Dichlorotetrafluoroethane	< 0.50	ppbv	D	2.5	< 3.50	µg/m³	07/06/2014 1:32 AM
1,3,5-Trimethylbenzene	440	ppbv	D	2000	2160	µg/m³	07/02/2014 10:37 PM
1,3-Dichlorobenzene	< 0.50	ppbv	D	2.5	< 3.01	µg/m³	07/06/2014 1:32 AM
1,3-Dichloropropene (cis)	< 0.50	ppbv	D	2.5	< 2.27	µg/m³	07/06/2014 1:32 AM
1,3-Dichloropropene (trans)	< 0.50	ppbv	D	2.5	< 2.27	µg/m³	07/06/2014 1:32 AM
1,3-Hexachlorobutadiene	< 0.50	ppbv	D	2.5	< 5.33	µg/m³	07/06/2014 1:32 AM
1,4-Dichlorobenzene	< 0.50	ppbv	D	2.5	< 3.01	µg/m³	07/06/2014 1:32 AM
Acetone	< 0.50	ppbv	D	2.5	< 1.19	µg/m³	07/06/2014 1:32 AM
Benzene	500	ppbv	D	2000	1600	µg/m³	07/02/2014 10:37 PM
Bromodichloromethane	< 0.50	ppbv	D	2.5	< 3.35	µg/m³	07/06/2014 1:32 AM
Bromoform	< 0.50	ppbv	D	2.5	< 5.17	µg/m³	07/06/2014 1:32 AM
Bromomethane	< 0.50	ppbv	D	2.5	< 1.94	µg/m³	07/06/2014 1:32 AM
Carbon disulfide	1.60	ppbv	D	2.5	4.98	µg/m³	07/06/2014 1:32 AM
Carbon tetrachloride	< 0.50	ppbv	D	2.5	< 3.15	µg/m³	07/06/2014 1:32 AM
Chlorobenzene	< 0.50	ppbv	D	2.5	< 2.30	µg/m³	07/06/2014 1:32 AM
Chloroethane	< 0.50	ppbv	D	2.5	< 1.32	µg/m³	07/06/2014 1:32 AM
Chloroform	< 0.50	ppbv	D	2.5	< 2.44	µg/m³	07/06/2014 1:32 AM
Chloromethane	0.60	ppbv	D	2.5	1.24	µg/m³	07/06/2014 1:32 AM
Dibromochloromethane	< 0.50	ppbv	D	2.5	< 4.26	µg/m³	07/06/2014 1:32 AM
Dichlorodifluoromethane	0.53	ppbv	D	2.5	2.60	µg/m³	07/06/2014 1:32 AM
Ethylbenzene	420	ppbv	D	2000	1820	µg/m³	07/02/2014 10:37 PM

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NYSDOH ID#10478 www.pacelabs.com

LABORATORY RESULTS

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Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/26/2014 2:30:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-004
Client Sample ID: S-15

Sample Information:
Type : Air
Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier	D.F.	Result	Units	Date Analyzed
Methyl butyl ketone	< 0.50	ppbv	D +	2.5	< 2.05	µg/m³	07/06/2014 1:32 AM
Methyl ethyl ketone	2.03	ppbv	D	2.5	5.97	µg/m³	07/06/2014 1:32 AM
Methyl isobutyl ketone	< 0.50	ppbv	D	2.5	< 2.05	µg/m³	07/06/2014 1:32 AM
Methyl tert-butyl ether	< 0.50	ppbv	D	2.5	< 1.80	µg/m³	07/06/2014 1:32 AM
Methylene chloride	< 0.50	ppbv	Dc	2.5	< 1.94	µg/m³	07/06/2014 1:32 AM
Styrene	1.65	ppbv	D	2.5	7.03	µg/m³	07/06/2014 1:32 AM
Tetrachloroethene	4.38	ppbv	D	2.5	29.7	µg/m³	07/06/2014 1:32 AM
Toluene	1,120	ppbv	D	2000	4220	µg/m³	07/02/2014 10:37 PM
Trichloroethene	< 0.50	ppbv	D	2.5	< 2.69	µg/m³	07/06/2014 1:32 AM
Trichlorofluoromethane	< 0.50	ppbv	D	2.5	< 2.81	µg/m³	07/06/2014 1:32 AM
Vinyl acetate	< 0.50	ppbv	D	2.5	< 1.76	µg/m³	07/06/2014 1:32 AM
Vinyl chloride	< 0.50	ppbv	D	2.5	< 1.28	µg/m³	07/06/2014 1:32 AM
Xylenes (m&p)	1,940	ppbv	D	2000	8430	µg/m³	07/02/2014 10:37 PM
Xylenes (o)	700	ppbv	D	2000	3040	µg/m³	07/02/2014 10:37 PM
Surr: 4-Bromofluorobenzene	223	%REC	DS Limit	70-130	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Branched (10.13)	240	ppbv	D	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Branched (10.4)	258	ppbv	D +	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Branched (13.17)	131	ppbv	D +	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Branched (4)	257	ppbv	D +	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Branched (5.13)	476	ppbv	D +	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Branched (7.14)	274	ppbv	D +	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Branched (7.25)	553	ppbv	D +	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Branched (7.64)	400	ppbv	D +	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Branched (9.02)	137	ppbv	D +	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Cyclic	498	ppbv	D +	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Straight-Chain	2,200	ppbv	D +	2000	No M.W. Data		07/02/2014 10:37 PM
TIC: (DEL) Alkane: Straight-Chain (13.84)	131	ppbv	D +	2.5	No M.W. Data		07/06/2014 1:32 AM

Qualifiers: E = Value above quantitation range, Value estimated.
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Project Manager

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Pace Analytical
575 Broad Hollow Road , Melville, NY 11747
TEL: (631) 694-3040 FAX: (631) 420-8436
NYSDOH ID#10478 www.pacelabs.com

LABORATORY RESULTS

Results for the samples and analytes requested

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Pace Analytical Services Inc.
2190 Technology Drive
Schenectady, NY 12308
Attn To : William A. Kotas
Collected : 6/26/2014 2:30:00 PM
Received : 6/27/2014 10:30:00 AM
Collected By MP99

Lab No. : 1406K66-004
Client Sample ID: S-15

Sample Information:
Type : Air

Origin:

Method: ETO-15 :

Parameter(s)	Result	Units	Qualifier		D.F.	Result	Units	Date Analyzed
TIC: (DEL) Alkane: Straight-Chain (18.14)	160	ppbv	D	+	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Straight-Chain (4.25)	319	ppbv	D	+	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: (DEL) Alkane: Straight-Chain (5.6)	389	ppbv	D	+	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: c3-subs.benzene	182	ppbv	D	+	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: c4-subs.benzene	126	ppbv	D	+	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: Cyclohexane, methyl-	345	ppbv	DN	+	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: unknown	226	ppbv	D	+	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: unknown alkene (4.17)	127	ppbv	D	+	2.5	No M.W. Data		07/06/2014 1:32 AM
TIC: unknown alkene (4.33)	131	ppbv	D	+	2.5	No M.W. Data		07/06/2014 1:32 AM

5

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H = Received/analyzed outside of analytical holding time
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Date Reported : 7/8/2014

PACE ANALYTICAL
575 Broad Hollow Road
Melville, NY 11747
TEL: (631) 694-3040

Quality Control Report

PACE ANALYTICAL

10478

Analysis: VOCS IN AIR **WorkOrder:** 1406K66

Method: TO-15 **Lab Batch ID:** R58697

Method Blank

RunID: 58697 SeqNo 1250070 Units: ppbv

Analysis Date: 7/2/2014 9:10:00 AM Analyst BL

Analyte	Result	Rep Limit	Rep Qual
Dichlorodifluoromethane	< 0.20	0.20	
1,2-Dichlorotetrafluoroethane	< 0.20	0.20	
Chloromethane	< 0.20	0.20	
Bromomethane	< 0.20	0.20	
Vinyl chloride	< 0.20	0.20	
Chloroethane	< 0.20	0.20	
Methylene chloride	< 0.20	0.20	
Acetone	< 0.20	0.20	
Carbon disulfide	< 0.20	0.20	
1,1,2-Trichloro-1,2,2-trifluoroethane	< 0.20	0.20	
1,1-Dichloroethene	< 0.20	0.20	
1,1-Dichloroethane	< 0.20	0.20	
Trichlorofluoromethane	< 0.20	0.20	
Vinyl acetate	< 0.20	0.20	
Methyl tert-butyl ether	< 0.20	0.20	
1,2-Dichloroethene (trans)	< 0.20	0.20	
1,2-Dichloroethene (cis)	< 0.20	0.20	
Methyl ethyl ketone	< 0.20	0.20	
Chloroform	< 0.20	0.20	
1,2-Dichloroethane	< 0.20	0.20	
1,1,1-Trichloroethane	< 0.20	0.20	
Carbon tetrachloride	< 0.20	0.20	
Bromodichloromethane	< 0.20	0.20	
1,2-Dichloropropane	< 0.20	0.20	
1,3-Dichloropropene (cis)	< 0.20	0.20	
Trichloroethene	< 0.20	0.20	
Benzene	< 0.20	0.20	
Dibromochloromethane	< 0.20	0.20	
1,3-Dichloropropene (trans)	< 0.20	0.20	
1,1,2-Trichloroethane	< 0.20	0.20	
Bromoform	< 0.20	0.20	
Methyl isobutyl ketone	< 0.20	0.20	
Methyl butyl ketone	< 0.20	0.20	
1,2-Dibromoethane	< 0.20	0.20	
Tetrachloroethene	< 0.20	0.20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Dilution was required.	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
M	Manual Integration used to determine area response	N	Tentatively identified compounds
ND	Not Detected at the Reporting Limit	O	RSD is greater than RSDlimit
PL	Permit Limit	RL	Reporting Detection Limit

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PACE ANALYTICAL
575 Broad Hollow Road
Melville, NY 11747
TEL: (631) 694-3040

Quality Control Report

PACE ANALYTICAL

10478

Analysis: VOCS IN AIR **WorkOrder:** 1406K66

Method: TO-15 **Lab Batch ID:** R58697

Method Blank

RunID: 58697 SeqNo 1250070 Units: ppbv

Analysis Date: 7/2/2014 9:10:00 AM Analyst BL

Analyte	Result	Rep Limit	Rep Qual
1,1,2,2-Tetrachloroethane	< 0.20	0.20	
Toluene	< 0.20	0.20	
Chlorobenzene	< 0.20	0.20	
Ethylbenzene	< 0.20	0.20	
Styrene	< 0.20	0.20	
Xylenes (m&p)	< 0.20	0.20	
Xylenes (o)	< 0.20	0.20	
1,3,5-Trimethylbenzene	< 0.20	0.20	
1,2,4-Trimethylbenzene	< 0.20	0.20	
1,3-Dichlorobenzene	< 0.20	0.20	
1,4-Dichlorobenzene	< 0.20	0.20	
1,2-Dichlorobenzene	< 0.20	0.20	
1,3-Hexachlorobutadiene	< 0.20	0.20	
1,2,4-Trichlorobenzene	< 0.20	0.20	
Surr: 4-Bromofluorobenzene	10.5	0.50	

Laboratory Control Sample (LCS/LFB)

RunID: 58697 SeqNo 1250071 Units: ppbv

Analysis Date: 7/2/2014 10:09:00 AM Analyst BL

Analyte	LCS Spike Added	LCS Result	LCS % Recovery	LCSD Spike Added	LCSD Result	LCSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
Dichlorodifluoromethane	10.00	10.4	104						70	130	
1,2-Dichlorotetrafluoroethane	10.00	9.82	98.2						70	130	
Chloromethane	10.00	10.3	103						70	130	
Bromomethane	10.00	11.5	115						70	130	
Vinyl chloride	10.00	10.5	105						70	130	
Chloroethane	10.00	10.2	102						70	130	
Methylene chloride	10.00	7.01	70.1						70	130	
Acetone	10.00	9.41	94.1						70	130	
Carbon disulfide	10.00	12.0	120						70	130	
1,1,2-Trichloro-1,2,2-trifluoroethane	10.00	10.6	106						70	130	
1,1-Dichloroethene	10.00	11.0	110						70	130	
1,1-Dichloroethane	10.00	10.6	106						70	130	

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Dilution was required.	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
M	Manual Integration used to determine area response	N	Tentatively identified compounds
ND	Not Detected at the Reporting Limit	O	RSD is greater than RSDlimit
PL	Permit Limit	RL	Reporting Detection Limit

PACE ANALYTICAL
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Melville, NY 11747
TEL: (631) 694-3040

Quality Control Report

PACE ANALYTICAL

10478

Analysis: VOCS IN AIR **WorkOrder:** 1406K66

Method: TO-15 **Lab Batch ID:** R58697

Laboratory Control Sample (LCS/LFB)

RunID: 58697 SeqNo 1250071 Units: ppbv

Analysis Date: 7/2/2014 10:09:00 AM Analyst BL

Analyte	LCS Spike Added	LCS Result	LCS % Recovery	LCSD Spike Added	LCSD Result	LCSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
Trichlorofluoromethane	10.00	10.8	108						70	130	
Vinyl acetate	10.00	10.2	102						70	130	
Methyl tert-butyl ether	10.00	9.86	98.6						70	130	
1,2-Dichloroethene (trans)	10.00	11.6	116						70	130	
1,2-Dichloroethene (cis)	10.00	10.9	109						70	130	
Methyl ethyl ketone	10.00	9.13	91.3						70	130	
Chloroform	10.00	10.5	105						70	130	
1,2-Dichloroethane	10.00	10.3	103						70	130	
1,1,1-Trichloroethane	10.00	12.1	121						70	130	
Carbon tetrachloride	10.00	12.3	123						70	130	
Bromodichloromethane	10.00	10.8	108						70	130	
1,2-Dichloropropane	10.00	10.7	107						70	130	
1,3-Dichloropropene (cis)	10.00	10.9	109						70	130	
Trichloroethene	10.00	10.8	108						70	130	
Benzene	10.00	11.0	110						70	130	
Dibromochloromethane	10.00	10.3	103						70	130	
1,3-Dichloropropene (trans)	10.00	10.4	104						70	130	
1,1,2-Trichloroethane	10.00	10.3	103						70	130	
Bromoform	10.00	9.75	97.5						70	130	
Methyl isobutyl ketone	10.00	8.52	85.2						70	130	
Methyl butyl ketone	10.00	8.22	82.2						70	130	
1,2-Dibromoethane	10.00	10.3	103						70	130	
Tetrachloroethene	10.00	9.83	98.3						70	130	
1,1,2,2-Tetrachloroethane	10.00	10.2	102						70	130	
Toluene	10.00	11.0	110						70	130	
Chlorobenzene	10.00	10.0	100						70	130	
Ethylbenzene	10.00	10.6	106						70	130	
Styrene	10.00	10.2	102						70	130	
Xylenes (m&p)	20.00	21.3	107						70	130	
Xylenes (o)	10.00	10.7	107						70	130	
1,3,5-Trimethylbenzene	10.00	10.1	101						70	130	
1,2,4-Trimethylbenzene	10.00	10.1	101						70	130	
1,3-Dichlorobenzene	10.00	9.18	91.8						70	130	
1,4-Dichlorobenzene	10.00	8.92	89.2						70	130	

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Dilution was required.	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
M	Manual Integration used to determine area response	N	Tentatively identified compounds
ND	Not Detected at the Reporting Limit	O	RSD is greater than RSDlimit
PL	Permit Limit	RL	Reporting Detection Limit

5

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Quality Control Report

PACE ANALYTICAL

10478

Analysis: VOCS IN AIR **WorkOrder:** 1406K66

Method: TO-15 **Lab Batch ID:** R58697

Laboratory Control Sample (LCS/LFB)

RunID: 58697 SeqNo 1250071 Units: ppbv

Analysis Date: 7/2/2014 10:09:00 AM Analyst BL

Analyte	LCS Spike Added	LCS Result	LCS % Recovery	LCSD Spike Added	LCSD Result	LCSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
1,2-Dichlorobenzene	10.00	8.94	89.4						70	130	
1,3-Hexachlorobutadiene	10.00	8.55	85.5						70	130	
1,2,4-Trichlorobenzene	10.00	6.76	67.6						70	130	S
Surr: 4-Bromofluorobenzene	10.00	11.2	112						70	130	

5

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Dilution was required.	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
M	Manual Integration used to determine area response	N	Tentatively identified compounds
ND	Not Detected at the Reporting Limit	O	RSD is greater than RSDlimit
PL	Permit Limit	RL	Reporting Detection Limit

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Quality Control Report

PACE ANALYTICAL

10478

Analysis: VOCS IN AIR **WorkOrder:** 1406K66

Method: TO-15 **Lab Batch ID:** R58700

Method Blank

RunID: 58700 SeqNo 1250192 Units: ppbv

Analysis Date: 7/5/2014 9:58:00 PM Analyst BL

Analyte	Result	Rep Limit	Rep Qual
Dichlorodifluoromethane	< 0.20	0.20	
1,2-Dichlorotetrafluoroethane	< 0.20	0.20	
Chloromethane	< 0.20	0.20	
Bromomethane	< 0.20	0.20	
Vinyl chloride	< 0.20	0.20	
Chloroethane	< 0.20	0.20	
Methylene chloride	< 0.20	0.20	
Acetone	< 0.20	0.20	
Carbon disulfide	< 0.20	0.20	
1,1,2-Trichloro-1,2,2-trifluoroethane	< 0.20	0.20	
1,1-Dichloroethene	< 0.20	0.20	
1,1-Dichloroethane	< 0.20	0.20	
Trichlorofluoromethane	< 0.20	0.20	
Vinyl acetate	< 0.20	0.20	
Methyl tert-butyl ether	< 0.20	0.20	
1,2-Dichloroethene (trans)	< 0.20	0.20	
1,2-Dichloroethene (cis)	< 0.20	0.20	
Methyl ethyl ketone	< 0.20	0.20	
Chloroform	< 0.20	0.20	
1,2-Dichloroethane	< 0.20	0.20	
1,1,1-Trichloroethane	< 0.20	0.20	
Carbon tetrachloride	< 0.20	0.20	
Bromodichloromethane	< 0.20	0.20	
1,2-Dichloropropane	< 0.20	0.20	
1,3-Dichloropropene (cis)	< 0.20	0.20	
Trichloroethene	< 0.20	0.20	
Benzene	< 0.20	0.20	
Dibromochloromethane	< 0.20	0.20	
1,3-Dichloropropene (trans)	< 0.20	0.20	
1,1,2-Trichloroethane	< 0.20	0.20	
Bromoform	< 0.20	0.20	
Methyl isobutyl ketone	< 0.20	0.20	
Methyl butyl ketone	< 0.20	0.20	
1,2-Dibromoethane	< 0.20	0.20	
Tetrachloroethene	< 0.20	0.20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Dilution was required.	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
M	Manual Integration used to determine area response	N	Tentatively identified compounds
ND	Not Detected at the Reporting Limit	O	RSD is greater than RSDlimit
PL	Permit Limit	RL	Reporting Detection Limit

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Quality Control Report

PACE ANALYTICAL

10478

Analysis: VOCS IN AIR **WorkOrder:** 1406K66

Method: TO-15 **Lab Batch ID:** R58700

Method Blank

RunID: 58700 SeqNo 1250192 Units: ppbv

Analysis Date: 7/5/2014 9:58:00 PM Analyst BL

Analyte	Result	Rep Limit	Rep Qual
1,1,2,2-Tetrachloroethane	< 0.20	0.20	
Toluene	< 0.20	0.20	
Chlorobenzene	< 0.20	0.20	
Ethylbenzene	< 0.20	0.20	
Styrene	< 0.20	0.20	
Xylenes (m&p)	< 0.20	0.20	
Xylenes (o)	< 0.20	0.20	
1,3,5-Trimethylbenzene	< 0.20	0.20	
1,2,4-Trimethylbenzene	< 0.20	0.20	
1,3-Dichlorobenzene	< 0.20	0.20	
1,4-Dichlorobenzene	< 0.20	0.20	
1,2-Dichlorobenzene	< 0.20	0.20	
1,3-Hexachlorobutadiene	< 0.20	0.20	
1,2,4-Trichlorobenzene	< 0.20	0.20	
Surr: 4-Bromofluorobenzene	10.4	0.50	

Laboratory Control Sample (LCS/LFB)

RunID: 58700 SeqNo 1250193 Units: ppbv

Analysis Date: 7/5/2014 10:42:00 PM Analyst BL

Analyte	LCS Spike Added	LCS Result	LCS % Recovery	LCSD Spike Added	LCSD Result	LCSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
Dichlorodifluoromethane	10.00	10.8	108						70	130	
1,2-Dichlorotetrafluoroethane	10.00	10.1	101						70	130	
Chloromethane	10.00	10.7	107						70	130	
Bromomethane	10.00	11.9	119						70	130	
Vinyl chloride	10.00	10.8	108						70	130	
Chloroethane	10.00	10.6	106						70	130	
Methylene chloride	10.00	7.20	72.0						70	130	
Acetone	10.00	8.48	84.8						70	130	
Carbon disulfide	10.00	12.3	123						70	130	
1,1,2-Trichloro-1,2,2-trifluoroethane	10.00	10.8	108						70	130	
1,1-Dichloroethene	10.00	11.3	113						70	130	
1,1-Dichloroethane	10.00	10.8	108						70	130	

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Dilution was required.	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
M	Manual Integration used to determine area response	N	Tentatively identified compounds
ND	Not Detected at the Reporting Limit	O	RSD is greater than RSDlimit
PL	Permit Limit	RL	Reporting Detection Limit

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Quality Control Report

PACE ANALYTICAL

10478

Analysis: VOCS IN AIR **WorkOrder:** 1406K66

Method: TO-15 **Lab Batch ID:** R58700

Laboratory Control Sample (LCS/LFB)

RunID: 58700 SeqNo 1250193 Units: ppbv

Analysis Date: 7/5/2014 10:42:00 PM Analyst BL

Analyte	LCS Spike Added	LCS Result	LCS % Recovery	LCSD Spike Added	LCSD Result	LCSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
Trichlorofluoromethane	10.00	11.2	112						70	130	
Vinyl acetate	10.00	8.63	86.3						70	130	
Methyl tert-butyl ether	10.00	9.98	99.8						70	130	
1,2-Dichloroethene (trans)	10.00	11.8	118						70	130	
1,2-Dichloroethene (cis)	10.00	11.0	110						70	130	
Methyl ethyl ketone	10.00	9.30	93.0						70	130	
Chloroform	10.00	10.7	107						70	130	
1,2-Dichloroethane	10.00	10.5	105						70	130	
1,1,1-Trichloroethane	10.00	11.1	111						70	130	
Carbon tetrachloride	10.00	11.3	113						70	130	
Bromodichloromethane	10.00	10.2	102						70	130	
1,2-Dichloropropane	10.00	9.93	99.3						70	130	
1,3-Dichloropropene (cis)	10.00	9.95	99.5						70	130	
Trichloroethene	10.00	11.9	119						70	130	
Benzene	10.00	10.2	102						70	130	
Dibromochloromethane	10.00	9.66	96.6						70	130	
1,3-Dichloropropene (trans)	10.00	9.63	96.3						70	130	
1,1,2-Trichloroethane	10.00	9.67	96.7						70	130	
Bromoform	10.00	9.13	91.3						70	130	
Methyl isobutyl ketone	10.00	8.43	84.3						70	130	
Methyl butyl ketone	10.00	8.75	87.5						70	130	
1,2-Dibromoethane	10.00	9.70	97.0						70	130	
Tetrachloroethene	10.00	11.1	111						70	130	
1,1,2,2-Tetrachloroethane	10.00	7.11	71.1						70	130	
Toluene	10.00	10.2	102						70	130	
Chlorobenzene	10.00	9.37	93.7						70	130	
Ethylbenzene	10.00	9.73	97.3						70	130	
Styrene	10.00	9.39	93.9						70	130	
Xylenes (m&p)	20.00	19.5	97.4						70	130	
Xylenes (o)	10.00	9.75	97.5						70	130	
1,3,5-Trimethylbenzene	10.00	9.08	90.8						70	130	
1,2,4-Trimethylbenzene	10.00	9.08	90.8						70	130	
1,3-Dichlorobenzene	10.00	8.66	86.6						70	130	
1,4-Dichlorobenzene	10.00	8.39	83.9						70	130	

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Dilution was required.	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
M	Manual Integration used to determine area response	N	Tentatively identified compounds
ND	Not Detected at the Reporting Limit	O	RSD is greater than RSDlimit
PL	Permit Limit	RL	Reporting Detection Limit

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Quality Control Report

PACE ANALYTICAL

10478

Analysis: VOCS IN AIR **WorkOrder:** 1406K66

Method: TO-15 **Lab Batch ID:** R58700

Laboratory Control Sample (LCS/LFB)

RunID: 58700 SeqNo 1250193 Units: ppbv

Analysis Date: 7/5/2014 10:42:00 PM Analyst BL

Analyte	LCS Spike Added	LCS Result	LCS % Recovery	LCSD Spike Added	LCSD Result	LCSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
1,2-Dichlorobenzene	10.00	8.38	83.8						70	130	
1,3-Hexachlorobutadiene	10.00	8.32	83.2						70	130	
1,2,4-Trichlorobenzene	10.00	7.05	70.5						70	130	
Surr: 4-Bromofluorobenzene	10.00	10.6	106						70	130	

5

Qualifiers:				
	*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
	D	Dilution was required.	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
	M	Manual Integration used to determine area response	N	Tentatively identified compounds
	ND	Not Detected at the Reporting Limit	O	RSD is greater than RSDlimit
	PL	Permit Limit	RL	Reporting Detection Limit

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Website: www.pacelabs.com

Sample Receipt Checklist

Client Name **PACE-NY** Date and Time Received: **6/27/2014 10:30:00 AM**

Work Order Number: **1406K66** RcptNo: **1** Received by **JoshLaedke**

Completed by: Reviewed by:

Completed Date: 6/27/2014 12:34:55 PM Reviewed Date: 6/30/2014 3:42:13 PM

Carrier name: FedEx

Chain of custody present?	Yes	☑	No	☐		
Chain of custody signed when relinquished and received?	Yes	☑	No	☐		
Chain of custody agrees with sample labels?	Yes	☑	No	☐		
Are matrices correctly identified on Chain of custody?	Yes	☑	No	☐		
Is it clear what analyses were requested?	Yes	☑	No	☐		
Custody seals intact on sample bottles?	Yes	☐	No	☐	Not Present	☑
Samples in proper container/bottle?	Yes	☑	No	☐		
Were correct preservatives used and noted?	Yes	☑	No	☐	NA	☐
Preservative added to bottles:						
Sample Condition?	Intact	☑	Broken	☐	Leaking	☐
Sufficient sample volume for indicated test?	Yes	☑	No	☐		
Were container labels complete (ID, Pres, Date)?	Yes	☑	No	☐		
All samples received within holding time?	Yes	☑	No	☐		
Was an attempt made to cool the samples?	Yes	☐	No	☐	NA	☑
All samples received at a temp. of > 0° C to 6.0° C?	Yes	☐	No	☐	NA	☑
Response when temperature is outside of range:						
Sample Temp. taken and recorded upon receipt?	Yes	☐	No	☑	To	°
Water - Were bubbles absent in VOC vials?	Yes	☐	No	☐	No Vials	☑
Water - Was there Chlorine Present?	Yes	☐	No	☐	NA	☑
Water - pH acceptable upon receipt?	Yes	☑	No	☐	No Water	☐
Are Samples considered acceptable?	Yes	☑	No	☐		
Custody Seals present?	Yes	☐	No	☑		
Airbill or Sticker?	Air Bil	☑	Sticker	☐	Not Present	☐
Airbill No:	780009588900/803022730177					

Case Number: SDG: SAS:

Any No response should be detailed in the comments section below, if applicable.

Client Contacted? ☐ Yes ☐ No ☑ NA Person Contacted:

Contact Mode: ☐ Phone: ☐ Fax: ☐ Email: ☐ In Person:

Client Instructions:

Date Contacted: Contacted By:

Regarding:

Comments:

sample is air

CorrectiveAction:

5

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~~H2M LABS, INC.~~

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Tel: (631) 694-3040 Fax:(631) 420-8436

0726

AIR CANISTER CHAIN OF CUSTODY

Client Contact Information	**Project Manager:** JOHN SANTACROCE	**CLIENT:** ~~AECOM~~ COLD SPRINGS	**H2M SDG NO.:**
Company: AECOM	**Phone:** 518-951-2265	**Samplers Name(s)** MATT PEARSALL	
Address: 40 BRITISH AMERICAN BLVD	**Site Contact:** MATT PEARSALL		
City/State/Zip ~~BALDWINSVI~~ LATHAM NY, ~~12110~~	978-430-9293		
Phone: 518-951-2200			
FAX: 518-951-2300			
Project Name: COLD SPRINGS	**Analysis Turnaround Time**		
Site: 60248522	Standard (Specify) ~~7 DAY~~		
PO #	Rush (Specify)		

C-AUG-E #122

1406K66

Sample Identification	Date Collected	Time Collected	Temp. (F)	Canister Pressure FIELD Initial("Hg) (Start)	FIELD ("Hg) / PSI (Stop)	LAB Outgoing ("Hg) (Lab)	LAB Incoming ("Hg) (Lab)	Flow Controller ID	Canister ID	Can Size (L)	LAB ID No.	Analysis TO-15	Analysis OTHER	Matrix Indoor / Ambient Air	Matrix Soil Gas	Matrix Source Level
S-5 (1730)	6/23/14	1730	78	-30"	-07"	-30"		QTO-4	3401	6	-001	X				
A-16 (1710)	6/24/14	1710	80	-30"	-5"	-30"		QTO-17	3406	6	-002	X				
~~S-3 MP (1445)~~	~~6/25/14~~	~~1445~~	~~60~~	~~-30"~~	~~-10"~~	~~-30"~~		QTO-16	3421	6		X				
S-3 (1445)	6/25/14	1445	60	-30"	-10"	-30"		QTO-18	3426	6	-003	X				
S-15 (1430)	6/26/14	1430	80	-30"	-05"	-30"		QTO-16	3421	6	-004	X				

	Pressure			Temperature (Fahrenheit)			
	Ambient	Maximum	Minimum		Ambient	Maximum	Minimum
Start				Start			
Stop				Stop			

Special Instructions/QC Requirements & Comments: 7800 0958900 8030 2203017

Samples Relinquished by:	Date/Time: 6/26/14	Received by: PHIL PLANO PACE	Date/Time: 6/26/14 1530
Relinquished by: PHIL PLANO	Date/Time: 6/26/14 1800	Received by:	Date/Time: 6/27/14 1030

WHITE COPY - ORIGINAL YELLOW COPY - CLIENT PINK COPY - LABORATORY

* Notify lab if equipment is damaged upon receipt. Client is responsible for damage to equipement

Date Issued: July 09, 2014

Pace Analytical e-Report

Report prepared for:
AECOM
40 BRITISH AMERICAN BLVD
LATHAM, NY 12110
CONTACT: JOHN SANTACROCE

Project ID: COLD SPRINGS TERMINALS 60248522
Sampling Date(s): December 30, 1899, June 23, 2014, June 24, 2014, June 25, 2014, June 26, 2014
Lab Report ID: 14061033
Client Service Contact: Chelsea Farmer (518) 346-4592 ext. 3843

Analysis Included:
VOCs by GCMS
Mercury Analysis
Metals by ICP (RCRA)
Total Dissolved Solids
Total Suspended Solids

Test results meet all National Environmental Laboratory Accreditation Conference (NELAC) requirements unless noted in the case narrative. The results contained within this document relate only to the samples included in this report. Pace Analytical is responsible only for the certified testing and is not directly responsible for the integrity of the sample before laboratory receipt. This report shall not be reproduced, except in full, without the written consent of Pace Analytical Services, Inc.

Dan Pfalzer
Laboratory Director

Certifications: New York (EPA: NY00906, ELAP: 11078), New Jersey (NY026), Connecticut (PH-0337), Massachusetts (M-NY906), Virginia (1884)

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Phone: 518.346.4592 | internet: www.pacelabs.com

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CASE NARRATIVE

July 09, 2014

CASE NARRATIVE

This data package (SDG ID: 14061033) consists of 5 water samples received on 06/27/2014. The samples are from Project Name: COLD SPRINGS TERMINALS 60248522.

This sample delivery group consists of the following samples:

Lab Sample ID	Client ID	Collection Date
AR19877	S-5	06/23/2014 11:00
AR19878	S-3	06/25/2014 14:15
AR19879	A-16	06/24/2014 10:00
AR19880	S-15	06/26/2014 13:10

Sample Delivery and Receipt Conditions

(1.) All samples were delivered to the laboratory via FEDEX delivery service on 06/27/2014.

(2.) All samples were received at the laboratory intact and within holding times with exceptions listed below:
a. No containers were received for sample "TRIP BLANK".

(3.) All samples were received at the laboratory properly preserved, if applicable.

(4.) The following pH measurements of VOA vials were recorded using pH strips:
AR19877 pH=1, AR19878 pH=1, AR19879 pH=1, AR19880 pH=1.

Volatile Organics Analysis

Analysis for Volatile Organics was performed by method SW-846 8260C. The following technical and administrative items were noted for the analysis:

(1.) Analyte Bromomethane exhibited and RSD lower than the method specified limits.

(2.) Bromomethane was recovered below laboratory established acceptance limits for the associated ICV sample (LAB ID: AR19877 - AR19880). A low analytical bias may be indicated for this analyte.

(3.) Naphthalene was recovered above laboratory established acceptance limits in the associated LCS (LAB ID: AR19877 and AR19880). A high analytical bias may be indicated for this analyte.

(4.) Bromomethane and Chloromethane were recovered below laboratory established acceptance limits for the associated LCS and CCV sample (LAB ID: AR19877 - AR19880). A low analytical bias may be indicated for these analytes.

(5.) Acetone, 1,2-Dibromo-3-chloropropane and Naphthalene were recovered above laboratory established acceptance limits for the associated CCV sample (LAB ID: AR19877 - AR19880). A high analytical bias may be indicated for these analytes.

(6.) Naphthalene was recovered above laboratory established acceptance limits for the associated LCS (LAB ID: AR19877 - AR19880). A high analytical bias may be indicated for this analyte.

Mercury Analysis

Analysis for mercury was performed by method SW-846 7470A. The following technical and administrative items were noted for the analysis:

(1.) All quality assurance parameters were met for the analysis.

Metals Analysis by ICP

Analysis for metals was performed by EPA Method 200.7. The following technical and administrative items were noted for the analysis:

(1.) All quality assurance parameters were met for the analysis.

Total Dissolved Solids

Analysis for Total Dissolved Solids was performed by Standard Methods 2540C. The following technical and administrative items were noted for the analysis:

(1.) All quality assurance parameters were met for the analysis.

Total Suspended Solids by Standard Methods 2540D

Analysis for Total Suspended Solids (TSS) was performed by SM 2540D (PACE SOP NE117). The following technical and administrative items were noted for the analysis:

(1.) All quality assurance parameters were met for the analysis.

Respectfully submitted,



Nicole D. Johnson
Program Coordinator

QUALIFIERS

Qualifier Definitions

Organic Laboratory Qualifiers

B - Denotes analyte observed in associated method blank or extraction blank. Analyte concentration should be considered as estimated.

D - Surrogate recovery not evaluated against control limits due to sample dilution.

E - Denotes analyte concentration exceeded calibration range of instrument. Sample could not be re-analyzed at secondary dilution due to insufficient sample amount, quick turn-around request, sample matrix interference or hold time excursion. Concentration result should be considered as estimated.

J - Denotes an estimated concentration. The concentration result is greater than or equal to the Method Detection Limit (MDL) but less than the Practical Quantitation Limit (PQL).

P - Indicates relative percent difference (RPD) between primary and secondary gas chromatograph (GC) column analysis exceeds 40 % or indicates percent difference (PD) between primary and secondary gas chromatograph (GC) column analysis exceeds 25 %.

U - Denotes analyte not detected at concentration greater than the Practical Quantitation Limit (PQL). PQLs are adjusted for sample weight/volume and dilution factors.

Z - Chromatographic interference due to polychlorinated biphenyl (PCB) co-elution.

* - Value not within control limits.

Inorganic Laboratory Qualifiers

B - Denotes analyte observed in associated method blank or digestion blank. Analyte concentration should be considered as estimated.

E - Denotes analyte concentration exceeded calibration range of instrument. Sample could not be re-analyzed at secondary dilution due to insufficient sample amount, quick turn-around request, sample matrix interference or hold time excursion. Concentration result should be considered as estimated.

J - Denotes an estimated concentration. The concentration result is greater than or equal to the Method Detection Limit (MDL) but less than the Practical Quantitation Limit (PQL).

U - Denotes analyte not detected at concentration greater than the Practical Quantitation Limit (PQL). PQLs are adjusted for sample weight/volume and dilution factors.

* - Value not within control limits.

SAMPLE CHAIN OF CUSTODY

Pace Analytical®
www.pacelabs.com

<14061033P1>

140610331

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 1

1729300

Section A Required Client Information:

Company: AECOM	
Address: 40 BRITISH AMERICAN BLVD. LATHAM NY, 12110	
Email To: john.santacroce@aecom.com	
Phone: 518-951-2265 Fax: 518-951-2380	
Requested Due Date/TAT:	

Section B Required:

Report To: JOHN SANTACROCE	
Copy To:	
Purchase Order No.:	
Project Name: COLD SPRING	
Project Number: 60248522	

Section C Invoice Information:

Attention: SAME	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	
Pace Profile #:	

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER _____

Site Location STATE: NY

Section D Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Matrix Codes (MATRIX / CODE)

Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Tissue	TS
Other	OT

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	METALS BY 200.7	TDS	TSS	VOC BY 8260	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	S-5	WT	G			6/23/14	1100	40	6	X			X						X	X	X	X	N	AR19877
2	S-3	WT	G			6/25/14	1415	40	6	X			X						X	X	X	X	N	AR19878
3	A-16	WT	G			6/24/14	1000	40	6	X			X						X	X	X	X	N	AR19879
4	S-15	WT	G			6/26/14	1310	40	6	X			X						X	X	X	X	N	AR19880
5	TRIP BLANK	OT	G				LAB		1	X												X	N	AR19881
6																								
7																								
8																								
9																								
10																								
11																								
12																								

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	[signature]	6/26/14	1530	PHIL FLANNO / PACE	6/26/14	1530				6/27/14
	PHIL FLANNO	6/26/14	1800	VIA FED EX →						
	VIA FED EX →			J. Britting (PACE)	6/27/14	10:54	1.2	Y	Y	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: MATT PEARSALL

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 6/26/14

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

ORIGINAL

Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

<14061033P2>

Sample Condition Upon Receipt

Pace Analytical 140510332

CLIENT NAME: AECOM

PROJECT: Cold Springs

COURIER: FedEx ☒ UPS ☐ Client ☐ Pace ☐ Other ☐

TRACKING # 8030 2273 0166

CUSTODY SEAL PRESENT: Yes ☒ No ☐ INTACT: Yes ☒ No ☐ N/A ☐

PACKING MATERIAL: Bubble Wrap ☐ Bubble Bags ☒ None ☐ Other ☐

ICE USED: Wet ☒ Blue ☐ None ☐

THERMOMETER USED: #164 ☒ IR Gun 03 ☐ #122087967 ☐

COOLER TEMPERATURE: 1.2

BIOLOGICAL TISSUE IS FROZEN: Yes ☐ No ☐ N/A ☒

Temp should be above freezing to 6°C

Chain of Custody Present:	☒Yes	☐No		
Chain of Custody Filled Out:	☐Yes	☒No		
Chain of Custody Relinquished:	☒Yes	☐No		
Sampler Name / Signature on COC:	☒Yes	☐No		
Samples Arrived within Hold Time:	☒Yes	☐No		
Short Hold Time Analysis (<72hr):	☐Yes	☒No		
Rush Turn Around Time Requested:	☐Yes	☒No		
Sufficient Volume:	☒Yes	☐No		
Correct Containers Used:	☒Yes	☐No		
- Pace Containers Used:	☒Yes	☐No		
Containers Intact:	☒Yes	☐No		
Filtered volume received for Dissolved tests:	☐Yes	☐No	☒N/A	
Sample Labels match COC:	~~☐Yes~~ (Chain)	☒No		
- Includes date/time/ID/Analysis				
All containers needing preservation have been checked:	☒Yes	☐No	☐N/A	
All containers needing preservation are in compliance with EPA recommendation:	☒Yes	☐No	☐N/A	
- Exceptions that are not checked: VOA				
Headspace in VOA Vials (>6mm):	☐Yes	☐No	☒N/A	
Trip Blank Present:	☐Yes	☐No	☒N/A	
Trip Blank Custody Seals Present:	☐Yes	☐No	☒N/A	
Pace Trip Blank Lot #: N/A				

COMMENTS:

1.
2. Missing TaT, Collection date on trip blank
3.
4.
5.
6.
7. Missing TaT
8.
9.
10.
11.
12. Collection date on COC (6/27/14) for sample "S-5" differs from sample container (6/24/14). No containers received for "Trip blank".
13.

Initial when completed: KJP

Lot # of added preservative: N/A

14.
15.

Line-Out (Includes Copying Shipping Documents and verifying sample pH): KJP 6/27/14

Log In (Includes notifying PM of any discrepacies and documenting in LIMS): KAW 6/29/14

Labeling (Includes Scanning Bottles and entering LAB IDs into pH logbook): KJP 6/27/14

SAMPLE RECEIPT

SAMPLE RECEIPT REPORT
14061033

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

CLIENT: AECOM
PROJECT: COLD SPRINGS TERMINALS 60248522
LRF: 14061033
REPORT: ANALYTICAL REPORT
EDD: YES
LRF TAT: 2 WEEK

RECEIVED DATE: 06/27/2014 10:54
SHIPPED VIA: FEDEX [1,2]
SHIPPING ID: 803022730166
NUMBER OF COOLERS: 1
CUSTODY SEAL INTACT: YES
COOLER STATUS: CHILLED
TEMPERATURE(S): [5] 1.2 °C

SAMPLE SEALS INTACT: NA
SAMPLES PRESERVED PER METHOD GUIDANCE: YES
[3] **SAMPLES REC'D IN HOLDTIME:** YES
DISPOSAL: BY LAB (45 DAYS)
COC DISCREPANCY: YES

COMMENTS:
NOT TAT ON COC. NO CONTAINERS RECEIVED FOR SAMPLE "TRIP BLANK".

CLIENT ID (LAB ID)	TAT-DUE Date [4]	DATE-TIME SAMPLED	MATRIX	METHOD	TEST DESCRIPTION	QC REQUEST
S-5 (AR19877)	2 WEEK 07-14-14	06/23/2014 11:00	Water	EPA 200.7	Metals by ICP (RCRA)	
	2 WEEK 07-14-14	06/23/2014 11:00	Water	SM 2540C	Total Dissolved Solids	
	2 WEEK 07-14-14	06/23/2014 11:00	Water	SM 2540D	Total Suspended Solids	
	2 WEEK 07-14-14	06/23/2014 11:00	Water	SW-846 7470A	Mercury Analysis	
	2 WEEK 07-14-14	06/23/2014 11:00	Water	SW-846 8260C	VOCs by GCMS	
S-3 (AR19878)	2 WEEK 07-14-14	06/25/2014 14:15	Water	EPA 200.7	Metals by ICP (RCRA)	
	2 WEEK 07-14-14	06/25/2014 14:15	Water	SM 2540C	Total Dissolved Solids	
	2 WEEK 07-14-14	06/25/2014 14:15	Water	SM 2540D	Total Suspended Solids	
	2 WEEK 07-14-14	06/25/2014 14:15	Water	SW-846 7470A	Mercury Analysis	
	2 WEEK 07-14-14	06/25/2014 14:15	Water	SW-846 8260C	VOCs by GCMS	
A-16 (AR19879)	2 WEEK 07-14-14	06/24/2014 10:00	Water	EPA 200.7	Metals by ICP (RCRA)	
	2 WEEK 07-14-14	06/24/2014 10:00	Water	SM 2540C	Total Dissolved Solids	
	2 WEEK 07-14-14	06/24/2014 10:00	Water	SM 2540D	Total Suspended Solids	
	2 WEEK 07-14-14	06/24/2014 10:00	Water	SW-846 7470A	Mercury Analysis	
	2 WEEK 07-14-14	06/24/2014 10:00	Water	SW-846 8260C	VOCs by GCMS	
S-15 (AR19880)	2 WEEK 07-14-14	06/26/2014 13:10	Water	EPA 200.7	Metals by ICP (RCRA)	
	2 WEEK 07-14-14	06/26/2014 13:10	Water	SM 2540C	Total Dissolved Solids	
	2 WEEK 07-14-14	06/26/2014 13:10	Water	SM 2540D	Total Suspended Solids	
	2 WEEK 07-14-14	06/26/2014 13:10	Water	SW-846 7470A	Mercury Analysis	
	2 WEEK 07-14-14	06/26/2014 13:10	Water	SW-846 8260C	VOCs by GCMS	
TRIP BLANK (AR19881)	-		Water	ON HOLD	Sample On Hold	

[1] The pH preservation check of Oil and Grease (Method 1664) is performed as soon as possible after sample receipt and may not be included in this report.
[2] The pH preservation check of aqueous volatile samples is not performed until after the analysis of the sample to maintain zero headspace and is not included in this report.
[3] Samples received for pH analysis are not marked as a hold time exceedance here. SW-846 methods suggests analysis to be done within 15 minutes of sample collection. Because of transportation time it is not possible for the laboratory to perform the test in that time. Sample Certificates of Analysis reports are noted as such.
[4] Samples arriving at the laboratory after 4:00 pm are assigned a due date as if they arrived the following business day unless other arrangements have been made.
[5] All samples which require thermal preservation shall be considered acceptable when received greater than 6 degrees Celsius if they are collected on the same day as received and there is evidence that the chilling process has begun, such as arrival on ice.Control limits are between 0-6 Degrees Celsius. Control limits do not apply for metals analysis.

Reporting Parameters and Lists

EPA 200.7 - Metals by ICP (RCRA) - (mg/L)
- Arsenic
- Barium
- Cadmium
- Chromium
- Lead
- Selenium
- Silver

SM 2540C - Total Dissolved Solids - (mg/L)
- Total Dissolved Solids

SM 2540D - Total Suspended Solids - (mg/L)
- Total Suspended Solids

SW-846 7470A - Mercury Analysis - (mg/L)
- Mercury

SW-846 8260C - VOCs by GCMS - (ug/L)
- 1,1,1,2-Tetrachloroethane
- 1,1,1-Trichloroethane
- 1,1,2,2-Tetrachloroethane
- 1,1,2-Trichloroethane
- 1,1-Dichloroethane
- 1,1-Dichloroethene
- 1,1-Dichloropropene
- 1,2,3-Trichlorobenzene
- 1,2,3-Trichloropropane
- 1,2,4-Trichlorobenzene
- 1,2,4-Trimethylbenzene
- 1,2-Dibromo-3-chloropropane
- 1,2-Dibromoethane

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Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Continued...

SW-846 8260C - VOCs by GCMS - (ug/L)

1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3,5-Trimethylbenzene
1,3-Dichlorobenzene
1,3-Dichloropropane
1,4-Dichlorobenzene
2,2-Dichloropropane
2-Butanone
2-Chlorotoluene
2-Hexanone
4-Chlorotoluene
4-Isopropyltoluene
4-Methyl-2-pentanone
Acetone
Benzene
Bromobenzene
Bromochloromethane
Bromodichloromethane
Bromoform
Bromomethane
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
cis-1,2-Dichloroethene
cis-1,3-Dichloropropene
Dibromochloromethane
Dibromomethane
Dichlorodifluoromethane
Ethylbenzene
Hexachlorobutadiene
Isopropylbenzene
m&p-Xylene
Methylene chloride
MTBE
Naphthalene
n-Butylbenzene
n-Propylbenzene
o-Xylene
sec-Butylbenzene
Styrene
tert-Butylbenzene
Tetrachloroethene
Toluene
Total Xylenes
trans-1,2-Dichloroethene
trans-1,3-Dichloropropene
Trichloroethene
Trichlorofluoromethane
Vinyl acetate
Vinyl chloride

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GC/MS Volatiles

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-5
Lab Sample ID: 14061033-01 (AR19877)

Collection Date: 06/23/2014 11:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-8	EPA Method 8260C	07/07/2014 12:09	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
1,1,1,2-Tetrachloroethane	630-20-6	ND	10.0	10.0	U	MS08-1762-8
1,1,1-Trichloroethane	71-55-6	ND	10.0	10.0	U	MS08-1762-8
1,1,2,2-Tetrachloroethane	79-34-5	ND	10.0	10.0	U	MS08-1762-8
1,1,2-Trichloroethane	79-00-5	ND	10.0	10.0	U	MS08-1762-8
1,1-Dichloroethane	75-34-3	ND	10.0	10.0	U	MS08-1762-8
1,1-Dichloroethene	75-35-4	ND	10.0	10.0	U	MS08-1762-8
1,1-Dichloropropene	563-58-6	ND	10.0	10.0	U	MS08-1762-8
1,2,3-Trichlorobenzene	87-61-6	ND	10.0	10.0	U	MS08-1762-8
1,2,3-Trichloropropane	96-18-4	ND	10.0	10.0	U	MS08-1762-8
1,2,4-Trichlorobenzene	120-82-1	ND	10.0	10.0	U	MS08-1762-8
1,2,4-Trimethylbenzene	95-63-6	**147**	10.0	10.0		MS08-1762-8
1,2-Dibromo-3-chloropropane	96-12-8	ND	10.0	10.0	U	MS08-1762-8
1,2-Dibromoethane	106-93-4	ND	10.0	10.0	U	MS08-1762-8
1,2-Dichlorobenzene	95-50-1	ND	10.0	10.0	U	MS08-1762-8
1,2-Dichloroethane	107-06-2	ND	10.0	10.0	U	MS08-1762-8
1,2-Dichloropropane	78-87-5	ND	10.0	10.0	U	MS08-1762-8
1,3,5-Trimethylbenzene	108-67-8	**44.1**	10.0	10.0		MS08-1762-8
1,3-Dichlorobenzene	541-73-1	ND	10.0	10.0	U	MS08-1762-8
1,3-Dichloropropane	142-28-9	ND	10.0	10.0	U	MS08-1762-8
1,4-Dichlorobenzene	106-46-7	ND	10.0	10.0	U	MS08-1762-8
2,2-Dichloropropane	594-20-7	ND	10.0	10.0	U	MS08-1762-8
2-Butanone	78-93-3	ND	50.0	10.0	U	MS08-1762-8
2-Chlorotoluene	95-49-8	**19.2**	10.0	10.0		MS08-1762-8
2-Hexanone	591-78-6	ND	50.0	10.0	U	MS08-1762-8
4-Chlorotoluene	106-43-4	ND	10.0	10.0	U	MS08-1762-8
4-Isopropyltoluene	99-87-6	**18.3**	10.0	10.0		MS08-1762-8
4-Methyl-2-pentanone	108-10-1	ND	50.0	10.0	U	MS08-1762-8
Acetone	67-64-1	**310**	100	10.0		MS08-1762-8
Benzene	71-43-2	**21.2**	10.0	10.0		MS08-1762-8
Bromobenzene	108-86-1	ND	10.0	10.0	U	MS08-1762-8
Bromochloromethane	74-97-5	ND	10.0	10.0	U	MS08-1762-8
Bromodichloromethane	75-27-4	ND	10.0	10.0	U	MS08-1762-8
Bromoform	75-25-2	ND	10.0	10.0	U	MS08-1762-8
Bromomethane	74-83-9	ND	10.0	10.0	U	MS08-1762-8
Carbon disulfide	75-15-0	ND	10.0	10.0	U	MS08-1762-8
Carbon tetrachloride	56-23-5	ND	10.0	10.0	U	MS08-1762-8
Chlorobenzene	108-90-7	ND	10.0	10.0	U	MS08-1762-8
Chloroethane	75-00-3	ND	10.0	10.0	U	MS08-1762-8
Chloroform	67-66-3	ND	10.0	10.0	U	MS08-1762-8
Chloromethane	74-87-3	ND	10.0	10.0	U	MS08-1762-8
cis-1,2-Dichloroethene	156-59-2	ND	10.0	10.0	U	MS08-1762-8
cis-1,3-Dichloropropene	10061-01-5	ND	10.0	10.0	U	MS08-1762-8
Dibromochloromethane	124-48-1	ND	10.0	10.0	U	MS08-1762-8
Dibromomethane	74-95-3	ND	10.0	10.0	U	MS08-1762-8
Dichlorodifluoromethane	75-71-8	ND	10.0	10.0	U	MS08-1762-8

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Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-5
Lab Sample ID: 14061033-01 (AR19877)

Collection Date: 06/23/2014 11:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-8	EPA Method 8260C	07/07/2014 12:09	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
Ethylbenzene	100-41-4	ND	10.0	10.0	U	MS08-1762-8
Hexachlorobutadiene	87-68-3	ND	10.0	10.0	U	MS08-1762-8
Isopropylbenzene	98-82-8	ND	10.0	10.0	U	MS08-1762-8
m&p-Xylene	136777-61-2	**72.5**	10.0	10.0		MS08-1762-8
Methylene chloride	75-09-2	ND	10.0	10.0	U	MS08-1762-8
MTBE	1634-04-4	ND	10.0	10.0	U	MS08-1762-8
Naphthalene	91-20-3	**372**	10.0	10.0		MS08-1762-8
n-Butylbenzene	104-51-8	ND	10.0	10.0	U	MS08-1762-8
n-Propylbenzene	103-65-1	ND	10.0	10.0	U	MS08-1762-8
o-Xylene	95-47-6	**41.9**	10.0	10.0		MS08-1762-8
sec-Butylbenzene	135-98-8	ND	10.0	10.0	U	MS08-1762-8
Styrene	100-42-5	ND	10.0	10.0	U	MS08-1762-8
tert-Butylbenzene	98-06-6	ND	10.0	10.0	U	MS08-1762-8
Tetrachloroethene	127-18-4	ND	10.0	10.0	U	MS08-1762-8
Toluene	108-88-3	**30.7**	10.0	10.0		MS08-1762-8
Total Xylenes	1330-20-7	**114**	10.0	10.0		MS08-1762-8
trans-1,2-Dichloroethene	156-60-5	ND	10.0	10.0	U	MS08-1762-8
trans-1,3-Dichloropropene	10061-02-6	ND	10.0	10.0	U	MS08-1762-8
Trichloroethene	79-01-6	ND	10.0	10.0	U	MS08-1762-8
Trichlorofluoromethane	75-69-4	ND	10.0	10.0	U	MS08-1762-8
Vinyl acetate	108-05-4	ND	10.0	10.0	U	MS08-1762-8
Vinyl chloride	75-01-4	ND	10.0	10.0	U	MS08-1762-8

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	102	75.6-128		MS08-1762-8
Dibromofluoromethane	1868-53-7	107	86.3-116		MS08-1762-8
Toluene-d8	2037-26-5	91.8	84.6-115		MS08-1762-8
1,2-Dichloroethane-d4	17060-07-0	104	90.0-111		MS08-1762-8

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-3
Lab Sample ID: 14061033-02 (AR19878)

Collection Date: 06/25/2014 14:15
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-15	EPA Method 8260C	07/07/2014 16:28	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
1,1,1,2-Tetrachloroethane	630-20-6	ND	100	100	U	MS08-1762-15
1,1,1-Trichloroethane	71-55-6	ND	100	100	U	MS08-1762-15
1,1,2,2-Tetrachloroethane	79-34-5	ND	100	100	U	MS08-1762-15
1,1,2-Trichloroethane	79-00-5	ND	100	100	U	MS08-1762-15
1,1-Dichloroethane	75-34-3	ND	100	100	U	MS08-1762-15
1,1-Dichloroethene	75-35-4	ND	100	100	U	MS08-1762-15
1,1-Dichloropropene	563-58-6	ND	100	100	U	MS08-1762-15
1,2,3-Trichlorobenzene	87-61-6	ND	100	100	U	MS08-1762-15
1,2,3-Trichloropropane	96-18-4	ND	100	100	U	MS08-1762-15
1,2,4-Trichlorobenzene	120-82-1	ND	100	100	U	MS08-1762-15
1,2,4-Trimethylbenzene	95-63-6	**1100**	100	100		MS08-1762-15
1,2-Dibromo-3-chloropropane	96-12-8	ND	100	100	U	MS08-1762-15
1,2-Dibromoethane	106-93-4	ND	100	100	U	MS08-1762-15
1,2-Dichlorobenzene	95-50-1	ND	100	100	U	MS08-1762-15
1,2-Dichloroethane	107-06-2	ND	100	100	U	MS08-1762-15
1,2-Dichloropropane	78-87-5	ND	100	100	U	MS08-1762-15
1,3,5-Trimethylbenzene	108-67-8	**315**	100	100		MS08-1762-15
1,3-Dichlorobenzene	541-73-1	ND	100	100	U	MS08-1762-15
1,3-Dichloropropane	142-28-9	ND	100	100	U	MS08-1762-15
1,4-Dichlorobenzene	106-46-7	ND	100	100	U	MS08-1762-15
2,2-Dichloropropane	594-20-7	ND	100	100	U	MS08-1762-15
2-Butanone	78-93-3	ND	500	100	U	MS08-1762-15
2-Chlorotoluene	95-49-8	ND	100	100	U	MS08-1762-15
2-Hexanone	591-78-6	ND	500	100	U	MS08-1762-15
4-Chlorotoluene	106-43-4	ND	100	100	U	MS08-1762-15
4-Isopropyltoluene	99-87-6	ND	100	100	U	MS08-1762-15
4-Methyl-2-pentanone	108-10-1	ND	500	100	U	MS08-1762-15
Acetone	67-64-1	ND	1000	100	U	MS08-1762-15
Benzene	71-43-2	**3700**	100	100		MS08-1762-15
Bromobenzene	108-86-1	ND	100	100	U	MS08-1762-15
Bromochloromethane	74-97-5	ND	100	100	U	MS08-1762-15
Bromodichloromethane	75-27-4	ND	100	100	U	MS08-1762-15
Bromoform	75-25-2	ND	100	100	U	MS08-1762-15
Bromomethane	74-83-9	ND	100	100	U	MS08-1762-15
Carbon disulfide	75-15-0	ND	100	100	U	MS08-1762-15
Carbon tetrachloride	56-23-5	ND	100	100	U	MS08-1762-15
Chlorobenzene	108-90-7	ND	100	100	U	MS08-1762-15
Chloroethane	75-00-3	ND	100	100	U	MS08-1762-15
Chloroform	67-66-3	**116**	100	100		MS08-1762-15
Chloromethane	74-87-3	ND	100	100	U	MS08-1762-15
cis-1,2-Dichloroethene	156-59-2	ND	100	100	U	MS08-1762-15
cis-1,3-Dichloropropene	10061-01-5	ND	100	100	U	MS08-1762-15
Dibromochloromethane	124-48-1	ND	100	100	U	MS08-1762-15
Dibromomethane	74-95-3	ND	100	100	U	MS08-1762-15
Dichlorodifluoromethane	75-71-8	ND	100	100	U	MS08-1762-15

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-3
Lab Sample ID: 14061033-02 (AR19878)

Collection Date: 06/25/2014 14:15
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-15	EPA Method 8260C	07/07/2014 16:28	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
Ethylbenzene	100-41-4	**965**	100	100		MS08-1762-15
Hexachlorobutadiene	87-68-3	ND	100	100	U	MS08-1762-15
Isopropylbenzene	98-82-8	ND	100	100	U	MS08-1762-15
m&p-Xylene	136777-61-2	**3490**	100	100		MS08-1762-15
Methylene chloride	75-09-2	ND	100	100	U	MS08-1762-15
MTBE	1634-04-4	ND	100	100	U	MS08-1762-15
Naphthalene	91-20-3	**873**	100	100		MS08-1762-15
n-Butylbenzene	104-51-8	ND	100	100	U	MS08-1762-15
n-Propylbenzene	103-65-1	**124**	100	100		MS08-1762-15
o-Xylene	95-47-6	**1660**	100	100		MS08-1762-15
sec-Butylbenzene	135-98-8	ND	100	100	U	MS08-1762-15
Styrene	100-42-5	ND	100	100	U	MS08-1762-15
tert-Butylbenzene	98-06-6	ND	100	100	U	MS08-1762-15
Tetrachloroethene	127-18-4	ND	100	100	U	MS08-1762-15
Toluene	108-88-3	**5100**	100	100		MS08-1762-15
Total Xylenes	1330-20-7	**5150**	100	100		MS08-1762-15
trans-1,2-Dichloroethene	156-60-5	ND	100	100	U	MS08-1762-15
trans-1,3-Dichloropropene	10061-02-6	ND	100	100	U	MS08-1762-15
Trichloroethene	79-01-6	ND	100	100	U	MS08-1762-15
Trichlorofluoromethane	75-69-4	ND	100	100	U	MS08-1762-15
Vinyl acetate	108-05-4	ND	100	100	U	MS08-1762-15
Vinyl chloride	75-01-4	ND	100	100	U	MS08-1762-15

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	87.4	75.6-128		MS08-1762-15
Dibromofluoromethane	1868-53-7	103	86.3-116		MS08-1762-15
Toluene-d8	2037-26-5	91.1	84.6-115		MS08-1762-15
1,2-Dichloroethane-d4	17060-07-0	103	90.0-111		MS08-1762-15

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: A-16
Lab Sample ID: 14061033-03 (AR19879)

Collection Date: 06/24/2014 10:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-17	EPA Method 8260C	07/07/2014 17:28	TJH	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm
Analysis 2:	MS10-180-24	EPA Method 8260C	07/08/2014 20:53	TJH	NA	NA	Restek, Rtx-VMS, 40 m, 0.18 mm ID, 1.00 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
1,1,1,2-Tetrachloroethane	630-20-6	ND	100	100	U	MS08-1762-17
1,1,1-Trichloroethane	71-55-6	ND	100	100	U	MS08-1762-17
1,1,2,2-Tetrachloroethane	79-34-5	ND	100	100	U	MS08-1762-17
1,1,2-Trichloroethane	79-00-5	ND	100	100	U	MS08-1762-17
1,1-Dichloroethane	75-34-3	ND	100	100	U	MS08-1762-17
1,1-Dichloroethene	75-35-4	ND	100	100	U	MS08-1762-17
1,1-Dichloropropene	563-58-6	ND	100	100	U	MS08-1762-17
1,2,3-Trichlorobenzene	87-61-6	ND	100	100	U	MS08-1762-17
1,2,3-Trichloropropane	96-18-4	ND	100	100	U	MS08-1762-17
1,2,4-Trichlorobenzene	120-82-1	ND	100	100	U	MS08-1762-17
1,2,4-Trimethylbenzene	95-63-6	**1150**	100	100		MS08-1762-17
1,2-Dibromo-3-chloropropane	96-12-8	ND	100	100	U	MS08-1762-17
1,2-Dibromoethane	106-93-4	ND	100	100	U	MS08-1762-17
1,2-Dichlorobenzene	95-50-1	ND	100	100	U	MS08-1762-17
1,2-Dichloroethane	107-06-2	ND	100	100	U	MS08-1762-17
1,2-Dichloropropane	78-87-5	ND	100	100	U	MS08-1762-17
1,3,5-Trimethylbenzene	108-67-8	**337**	100	100		MS08-1762-17
1,3-Dichlorobenzene	541-73-1	ND	100	100	U	MS08-1762-17
1,3-Dichloropropane	142-28-9	ND	100	100	U	MS08-1762-17
1,4-Dichlorobenzene	106-46-7	ND	100	100	U	MS08-1762-17
2,2-Dichloropropane	594-20-7	ND	100	100	U	MS08-1762-17
2-Butanone	78-93-3	ND	500	100	U	MS08-1762-17
2-Chlorotoluene	95-49-8	ND	100	100	U	MS08-1762-17
2-Hexanone	591-78-6	ND	500	100	U	MS08-1762-17
4-Chlorotoluene	106-43-4	ND	100	100	U	MS08-1762-17
4-Isopropyltoluene	99-87-6	ND	100	100	U	MS08-1762-17
4-Methyl-2-pentanone	108-10-1	ND	500	100	U	MS08-1762-17
Acetone	67-64-1	ND	1000	100	U	MS08-1762-17
Benzene	71-43-2	**5610**	100	100		MS08-1762-17
Bromobenzene	108-86-1	ND	100	100	U	MS08-1762-17
Bromochloromethane	74-97-5	ND	100	100	U	MS08-1762-17
Bromodichloromethane	75-27-4	ND	100	100	U	MS08-1762-17
Bromoform	75-25-2	ND	100	100	U	MS08-1762-17
Bromomethane	74-83-9	ND	100	100	U	MS08-1762-17
Carbon disulfide	75-15-0	ND	100	100	U	MS08-1762-17
Carbon tetrachloride	56-23-5	ND	100	100	U	MS08-1762-17
Chlorobenzene	108-90-7	ND	100	100	U	MS08-1762-17
Chloroethane	75-00-3	ND	100	100	U	MS08-1762-17
Chloroform	67-66-3	**122**	100	100		MS08-1762-17
Chloromethane	74-87-3	ND	100	100	U	MS08-1762-17
cis-1,2-Dichloroethene	156-59-2	ND	100	100	U	MS08-1762-17
cis-1,3-Dichloropropene	10061-01-5	ND	100	100	U	MS08-1762-17
Dibromochloromethane	124-48-1	ND	100	100	U	MS08-1762-17
Dibromomethane	74-95-3	ND	100	100	U	MS08-1762-17

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: A-16
Lab Sample ID: 14061033-03 (AR19879)

Collection Date: 06/24/2014 10:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-17	EPA Method 8260C	07/07/2014 17:28	TJH	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm
Analysis 2:	MS10-180-24	EPA Method 8260C	07/08/2014 20:53	TJH	NA	NA	Restek, Rtx-VMS, 40 m, 0.18 mm ID, 1.00 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
Dichlorodifluoromethane	75-71-8	ND	100	100	U	MS08-1762-17
Ethylbenzene	100-41-4	**1190**	100	100		MS08-1762-17
Hexachlorobutadiene	87-68-3	ND	100	100	U	MS08-1762-17
Isopropylbenzene	98-82-8	ND	100	100	U	MS08-1762-17
m&p-Xylene	136777-61-2	**4240**	100	100		MS08-1762-17
Methylene chloride	75-09-2	ND	100	100	U	MS08-1762-17
MTBE	1634-04-4	ND	100	100	U	MS08-1762-17
Naphthalene	91-20-3	**982**	100	100		MS08-1762-17
n-Butylbenzene	104-51-8	ND	100	100	U	MS08-1762-17
n-Propylbenzene	103-65-1	**138**	100	100		MS08-1762-17
o-Xylene	95-47-6	**1710**	100	100		MS08-1762-17
sec-Butylbenzene	135-98-8	ND	100	100	U	MS08-1762-17
Styrene	100-42-5	ND	100	100	U	MS08-1762-17
tert-Butylbenzene	98-06-6	ND	100	100	U	MS08-1762-17
Tetrachloroethene	127-18-4	ND	100	100	U	MS08-1762-17
Toluene	108-88-3	**10000**	200	200		MS10-180-24
Total Xylenes	1330-20-7	**5950**	100	100		MS08-1762-17
trans-1,2-Dichloroethene	156-60-5	ND	100	100	U	MS08-1762-17
trans-1,3-Dichloropropene	10061-02-6	ND	100	100	U	MS08-1762-17
Trichloroethene	79-01-6	ND	100	100	U	MS08-1762-17
Trichlorofluoromethane	75-69-4	ND	100	100	U	MS08-1762-17
Vinyl acetate	108-05-4	ND	100	100	U	MS08-1762-17
Vinyl chloride	75-01-4	ND	100	100	U	MS08-1762-17

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	97.0	75.6-128		MS08-1762-17
Dibromofluoromethane	1868-53-7	100	86.3-116		MS08-1762-17
Toluene-d8	2037-26-5	98.2	84.6-115		MS08-1762-17
1,2-Dichloroethane-d4	17060-07-0	105	90.0-111		MS08-1762-17

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-15
Lab Sample ID: 14061033-04 (AR19880)

Collection Date: 06/26/2014 13:10
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-10	EPA Method 8260C	07/07/2014 13:23	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm
Analysis 2:	MS08-1762-14	EPA Method 8260C	07/07/2014 15:58	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
1,1,1,2-Tetrachloroethane	630-20-6	ND	10.0	10.0	U	MS08-1762-10
1,1,1-Trichloroethane	71-55-6	ND	10.0	10.0	U	MS08-1762-10
1,1,2,2-Tetrachloroethane	79-34-5	ND	10.0	10.0	U	MS08-1762-10
1,1,2-Trichloroethane	79-00-5	ND	10.0	10.0	U	MS08-1762-10
1,1-Dichloroethane	75-34-3	ND	10.0	10.0	U	MS08-1762-10
1,1-Dichloroethene	75-35-4	ND	10.0	10.0	U	MS08-1762-10
1,1-Dichloropropene	563-58-6	ND	10.0	10.0	U	MS08-1762-10
1,2,3-Trichlorobenzene	87-61-6	ND	10.0	10.0	U	MS08-1762-10
1,2,3-Trichloropropane	96-18-4	ND	10.0	10.0	U	MS08-1762-10
1,2,4-Trichlorobenzene	120-82-1	ND	10.0	10.0	U	MS08-1762-10
1,2,4-Trimethylbenzene	95-63-6	**527**	10.0	10.0		MS08-1762-10
1,2-Dibromo-3-chloropropane	96-12-8	ND	10.0	10.0	U	MS08-1762-10
1,2-Dibromoethane	106-93-4	ND	10.0	10.0	U	MS08-1762-10
1,2-Dichlorobenzene	95-50-1	ND	10.0	10.0	U	MS08-1762-10
1,2-Dichloroethane	107-06-2	**302**	10.0	10.0		MS08-1762-10
1,2-Dichloropropane	78-87-5	ND	10.0	10.0	U	MS08-1762-10
1,3,5-Trimethylbenzene	108-67-8	**181**	10.0	10.0		MS08-1762-10
1,3-Dichlorobenzene	541-73-1	ND	10.0	10.0	U	MS08-1762-10
1,3-Dichloropropane	142-28-9	ND	10.0	10.0	U	MS08-1762-10
1,4-Dichlorobenzene	106-46-7	ND	10.0	10.0	U	MS08-1762-10
2,2-Dichloropropane	594-20-7	ND	10.0	10.0	U	MS08-1762-10
2-Butanone	78-93-3	ND	50.0	10.0	U	MS08-1762-10
2-Chlorotoluene	95-49-8	ND	10.0	10.0	U	MS08-1762-10
2-Hexanone	591-78-6	ND	50.0	10.0	U	MS08-1762-10
4-Chlorotoluene	106-43-4	ND	10.0	10.0	U	MS08-1762-10
4-Isopropyltoluene	99-87-6	**29.0**	10.0	10.0		MS08-1762-10
4-Methyl-2-pentanone	108-10-1	ND	50.0	10.0	U	MS08-1762-10
Acetone	67-64-1	ND	100	10.0	U	MS08-1762-10
Benzene	71-43-2	**3610**	50.0	50.0		MS08-1762-14
Bromobenzene	108-86-1	ND	10.0	10.0	U	MS08-1762-10
Bromochloromethane	74-97-5	ND	10.0	10.0	U	MS08-1762-10
Bromodichloromethane	75-27-4	ND	10.0	10.0	U	MS08-1762-10
Bromoform	75-25-2	ND	10.0	10.0	U	MS08-1762-10
Bromomethane	74-83-9	ND	10.0	10.0	U	MS08-1762-10
Carbon disulfide	75-15-0	ND	10.0	10.0	U	MS08-1762-10
Carbon tetrachloride	56-23-5	ND	10.0	10.0	U	MS08-1762-10
Chlorobenzene	108-90-7	ND	10.0	10.0	U	MS08-1762-10
Chloroethane	75-00-3	ND	10.0	10.0	U	MS08-1762-10
Chloroform	67-66-3	ND	10.0	10.0	U	MS08-1762-10
Chloromethane	74-87-3	ND	10.0	10.0	U	MS08-1762-10
cis-1,2-Dichloroethene	156-59-2	ND	10.0	10.0	U	MS08-1762-10
cis-1,3-Dichloropropene	10061-01-5	ND	10.0	10.0	U	MS08-1762-10
Dibromochloromethane	124-48-1	ND	10.0	10.0	U	MS08-1762-10
Dibromomethane	74-95-3	ND	10.0	10.0	U	MS08-1762-10

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Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-15
Lab Sample ID: 14061033-04 (AR19880)

Collection Date: 06/26/2014 13:10
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-10	EPA Method 8260C	07/07/2014 13:23	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm
Analysis 2:	MS08-1762-14	EPA Method 8260C	07/07/2014 15:58	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
Dichlorodifluoromethane	75-71-8	ND	10.0	10.0	U	MS08-1762-10
Ethylbenzene	100-41-4	**461**	10.0	10.0		MS08-1762-10
Hexachlorobutadiene	87-68-3	ND	10.0	10.0	U	MS08-1762-10
Isopropylbenzene	98-82-8	**47.7**	10.0	10.0		MS08-1762-10
m&p-Xylene	136777-61-2	**1400**	10.0	10.0		MS08-1762-10
Methylene chloride	75-09-2	ND	10.0	10.0	U	MS08-1762-10
MTBE	1634-04-4	**12.8**	10.0	10.0		MS08-1762-10
Naphthalene	91-20-3	**571**	10.0	10.0		MS08-1762-10
n-Butylbenzene	104-51-8	ND	10.0	10.0	U	MS08-1762-10
n-Propylbenzene	103-65-1	**85.3**	10.0	10.0		MS08-1762-10
o-Xylene	95-47-6	**579**	10.0	10.0		MS08-1762-10
sec-Butylbenzene	135-98-8	**11.4**	10.0	10.0		MS08-1762-10
Styrene	100-42-5	ND	10.0	10.0	U	MS08-1762-10
tert-Butylbenzene	98-06-6	ND	10.0	10.0	U	MS08-1762-10
Tetrachloroethene	127-18-4	ND	10.0	10.0	U	MS08-1762-10
Toluene	108-88-3	**1350**	50.0	50.0		MS08-1762-14
Total Xylenes	1330-20-7	**1980**	10.0	10.0		MS08-1762-10
trans-1,2-Dichloroethene	156-60-5	ND	10.0	10.0	U	MS08-1762-10
trans-1,3-Dichloropropene	10061-02-6	ND	10.0	10.0	U	MS08-1762-10
Trichloroethene	79-01-6	ND	10.0	10.0	U	MS08-1762-10
Trichlorofluoromethane	75-69-4	ND	10.0	10.0	U	MS08-1762-10
Vinyl acetate	108-05-4	ND	10.0	10.0	U	MS08-1762-10
Vinyl chloride	75-01-4	ND	10.0	10.0	U	MS08-1762-10

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	101	75.6-128		MS08-1762-10
Dibromofluoromethane	1868-53-7	104	86.3-116		MS08-1762-10
Toluene-d8	2037-26-5	93.1	84.6-115		MS08-1762-10
1,2-Dichloroethane-d4	17060-07-0	106	90.0-111		MS08-1762-10

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

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Mercury

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Analytical Sample Results

Job Number: 14061033

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Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-5
Lab Sample ID: 14061033-01 (AR19877)

Collection Date: 06/23/2014 11:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MER1-1609-56	SW-846 7470A	07/03/2014 14:27	CYC	NA	NA	NA
Prep 1:	4732	EPA 7470A	07/03/2014 09:30	CYC	40.0 mL	40.0 mL	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Mercury	7439-97-6	ND	0.000200	1.00	U	MER1-1609-56

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-3
Lab Sample ID: 14061033-02 (AR19878)

Collection Date: 06/25/2014 14:15
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MER1-1609-57	SW-846 7470A	07/03/2014 14:29	CYC	NA	NA	NA
Prep 1:	4732	EPA 7470A	07/03/2014 09:30	CYC	40.0 mL	40.0 mL	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Mercury	7439-97-6	**0.000257**	0.000200	1.00		MER1-1609-57

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: A-16
Lab Sample ID: 14061033-03 (AR19879)

Collection Date: 06/24/2014 10:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MER1-1609-58	SW-846 7470A	07/03/2014 14:30	CYC	NA	NA	NA
Prep 1:	4732	EPA 7470A	07/03/2014 09:30	CYC	40.0 mL	40.0 mL	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Mercury	7439-97-6	ND	0.000200	1.00	U	MER1-1609-58

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-15
Lab Sample ID: 14061033-04 (AR19880)

Collection Date: 06/26/2014 13:10
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MER1-1609-59	SW-846 7470A	07/03/2014 14:32	CYC	NA	NA	NA
Prep 1:	4732	EPA 7470A	07/03/2014 09:30	CYC	40.0 mL	40.0 mL	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Mercury	7439-97-6	**0.000210**	0.000200	1.00		MER1-1609-59

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Metals - ICP

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-5
Lab Sample ID: 14061033-01 (AR19877)

Collection Date: 06/23/2014 11:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	ICP2-1172-42	EPA 200.7	07/07/2014 11:20	LMS	NA	NA	NA
Prep 1:	4733	EPA 200.7	07/03/2014 09:00	CYC	50.0 mL	50.0 mL	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Arsenic	7440-38-2	**0.00974**	0.00500	1.00		ICP2-1172-42
Barium	7440-39-3	**0.125**	0.00500	1.00		ICP2-1172-42
Cadmium	7440-43-9	ND	0.00400	1.00	U	ICP2-1172-42
Chromium	7440-47-3	**0.111**	0.00500	1.00		ICP2-1172-42
Lead	7439-92-1	**0.151**	0.00500	1.00		ICP2-1172-42
Selenium	7782-49-2	ND	0.0100	1.00	U	ICP2-1172-42
Silver	7440-22-4	ND	0.00700	1.00	U	ICP2-1172-42

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Job Number: 14061033

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-3
Lab Sample ID: 14061033-02 (AR19878)

Collection Date: 06/25/2014 14:15
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	ICP2-1172-43	EPA 200.7	07/07/2014 11:22	LMS	NA	NA	NA
Prep 1:	4733	EPA 200.7	07/03/2014 09:00	CYC	50.0 mL	50.0 mL	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Arsenic	7440-38-2	**0.00951**	0.00500	1.00		ICP2-1172-43
Barium	7440-39-3	**0.0594**	0.00500	1.00		ICP2-1172-43
Cadmium	7440-43-9	ND	0.00400	1.00	U	ICP2-1172-43
Chromium	7440-47-3	ND	0.00500	1.00	U	ICP2-1172-43
Lead	7439-92-1	**0.00864**	0.00500	1.00		ICP2-1172-43
Selenium	7782-49-2	ND	0.0100	1.00	U	ICP2-1172-43
Silver	7440-22-4	ND	0.00700	1.00	U	ICP2-1172-43

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: A-16
Lab Sample ID: 14061033-03 (AR19879)

Collection Date: 06/24/2014 10:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	ICP2-1172-44	EPA 200.7	07/07/2014 11:25	LMS	NA	NA	NA
Prep 1:	4733	EPA 200.7	07/03/2014 09:00	CYC	50.0 mL	50.0 mL	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Arsenic	7440-38-2	**0.0207**	0.00500	1.00		ICP2-1172-44
Barium	7440-39-3	**0.117**	0.00500	1.00		ICP2-1172-44
Cadmium	7440-43-9	ND	0.00400	1.00	U	ICP2-1172-44
Chromium	7440-47-3	**0.0120**	0.00500	1.00		ICP2-1172-44
Lead	7439-92-1	**0.0652**	0.00500	1.00		ICP2-1172-44
Selenium	7782-49-2	ND	0.0100	1.00	U	ICP2-1172-44
Silver	7440-22-4	ND	0.00700	1.00	U	ICP2-1172-44

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-15
Lab Sample ID: 14061033-04 (AR19880)

Collection Date: 06/26/2014 13:10
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	ICP2-1172-45	EPA 200.7	07/07/2014 11:27	LMS	NA	NA	NA
Prep 1:	4733	EPA 200.7	07/03/2014 09:00	CYC	50.0 mL	50.0 mL	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Arsenic	7440-38-2	**0.0100**	0.00500	1.00		ICP2-1172-45
Barium	7440-39-3	**0.0706**	0.00500	1.00		ICP2-1172-45
Cadmium	7440-43-9	ND	0.00400	1.00	U	ICP2-1172-45
Chromium	7440-47-3	ND	0.00500	1.00	U	ICP2-1172-45
Lead	7439-92-1	**0.0123**	0.00500	1.00		ICP2-1172-45
Selenium	7782-49-2	ND	0.0100	1.00	U	ICP2-1172-45
Silver	7440-22-4	ND	0.00700	1.00	U	ICP2-1172-45

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Wet Chemistry - TSS

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Analytical Sample Results

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-5
Lab Sample ID: 14061033-01 (AR19877)

Collection Date: 06/23/2014 11:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	1799	SM 2540D	06/30/2014 16:15	RF	NA	NA	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Total Suspended Solids	WQ001	**160**	7.14	7.14		1799

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Analytical Sample Results

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-3
Lab Sample ID: 14061033-02 (AR19878)

Collection Date: 06/25/2014 14:15
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	1799	SM 2540D	06/30/2014 16:15	RF	NA	NA	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Total Suspended Solids	WQ001	**67.4**	3.70	3.70		1799

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: A-16
Lab Sample ID: 14061033-03 (AR19879)

Collection Date: 06/24/2014 10:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	1799	SM 2540D	06/30/2014 16:15	RF	NA	NA	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Total Suspended Solids	WQ001	**158**	5.26	5.26		1799

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Client Sample ID: S-15
Lab Sample ID: 14061033-04 (AR19880)

Collection Date: 06/26/2014 13:10
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	1799	SM 2540D	06/30/2014 16:15	RF	NA	NA	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Total Suspended Solids	WQ001	**533**	9.09	9.09		1799

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Wet Chemistry - TDS

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-5
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Collection Date: 06/23/2014 11:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	181	SM 2540C	06/30/2014 07:20	ACB	NA	NA	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Total Dissolved Solids	NA	**559**	62.5	12.50		181

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Client Sample ID: S-3
Lab Sample ID: 14061033-02 (AR19878)

Collection Date: 06/25/2014 14:15
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	181	SM 2540C	06/30/2014 07:20	ACB	NA	NA	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Total Dissolved Solids	NA	**638**	50.0	10.00		181

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: A-16
Lab Sample ID: 14061033-03 (AR19879)

Collection Date: 06/24/2014 10:00
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	181	SM 2540C	06/30/2014 07:20	ACB	NA	NA	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Total Dissolved Solids	NA	**458**	100	20.00		181

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: S-15
Lab Sample ID: 14061033-04 (AR19880)

Collection Date: 06/26/2014 13:10
Sample Matrix: WATER
Received Date: 06/27/2014 10:54
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	181	SM 2540C	06/30/2014 07:20	ACB	NA	NA	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Total Dissolved Solids	NA	**584**	100	20.00		181

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Quality Control Samples (Lab)

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Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AR19077L)
Lab Sample ID: LCS-93

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-3	EPA Method 8260C	07/07/2014 09:38	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm

Analyte Spiked	CAS No.	Added (ug/L)	LCS (ug/L)	LCS % Rec.	Q[1]	Limits (%)
1,1,1,2-Tetrachloroethane	630-20-6	40.0	37.7	94.2		70.0-130
1,1,1-Trichloroethane	71-55-6	40.0	33.9	84.7		70.0-130
1,1,2,2-Tetrachloroethane	79-34-5	40.0	38.4	96.1		70.0-130
1,1,2-Trichloroethane	79-00-5	40.0	36.1	90.2		70.0-130
1,1-Dichloroethane	75-34-3	40.0	40.7	102		70.0-130
1,1-Dichloroethene	75-35-4	40.0	39.8	99.4		70.0-130
1,1-Dichloropropene	563-58-6	40.0	36.3	90.8		70.0-130
1,2,3-Trichlorobenzene	87-61-6	40.0	46.9	117		70.0-130
1,2,3-Trichloropropane	96-18-4	40.0	44.7	112		70.0-130
1,2,4-Trichlorobenzene	120-82-1	40.0	42.7	107		70.0-130
1,2,4-Trimethylbenzene	95-63-6	40.0	34.3	85.7		70.0-130
1,2-Dibromo-3-chloropropane	96-12-8	40.0	51.9	130		70.0-130
1,2-Dibromoethane	106-93-4	40.0	35.7	89.2		70.0-130
1,2-Dichlorobenzene	95-50-1	40.0	40.8	102		70.0-130
1,2-Dichloroethane	107-06-2	40.0	40.0	100		70.0-130
1,2-Dichloropropane	78-87-5	40.0	37.8	94.5		70.0-130
1,3,5-Trimethylbenzene	108-67-8	40.0	36.0	90.0		70.0-130
1,3-Dichlorobenzene	541-73-1	40.0	38.9	97.2		70.0-130
1,3-Dichloropropane	142-28-9	40.0	37.9	94.7		70.0-130
1,4-Dichlorobenzene	106-46-7	40.0	39.3	98.2		70.0-130
2,2-Dichloropropane	594-20-7	40.0	40.7	102		70.0-130
2-Butanone	78-93-3	40.0	35.9	89.7		70.0-130
2-Chlorotoluene	95-49-8	40.0	35.7	89.2		70.0-130
2-Hexanone	591-78-6	40.0	41.0	102		70.0-130
4-Chlorotoluene	106-43-4	40.0	32.4	80.9		70.0-130
4-Isopropyltoluene	99-87-6	40.0	33.3	83.2		70.0-130
4-Methyl-2-pentanone	108-10-1	40.0	42.6	107		70.0-130
Acetone	67-64-1	40.0	51.3	128		70.0-130
Benzene	71-43-2	40.0	36.9	92.4		70.0-130
Bromobenzene	108-86-1	40.0	34.8	87.1		70.0-130
Bromochloromethane	74-97-5	40.0	38.5	96.2		70.0-130
Bromodichloromethane	75-27-4	40.0	38.2	95.6		70.0-130
Bromoform	75-25-2	40.0	50.9	127		70.0-130
Bromomethane	74-83-9	40.0	7.83	19.6	*	70.0-130
Carbon disulfide	75-15-0	40.0	41.5	104		70.0-130
Carbon tetrachloride	56-23-5	40.0	33.1	82.8		70.0-130
Chlorobenzene	108-90-7	40.0	38.8	97.0		70.0-130
Chloroethane	75-00-3	40.0	40.7	102		70.0-130
Chloroform	67-66-3	40.0	34.6	86.5		70.0-130
Chloromethane	74-87-3	40.0	23.0	57.4	*	70.0-130
cis-1,2-Dichloroethene	156-59-2	40.0	35.9	89.7		70.0-130
cis-1,3-Dichloropropene	10061-01-5	40.0	36.9	92.2		70.0-130
Dibromochloromethane	124-48-1	40.0	36.6	91.5		70.0-130
Dibromomethane	74-95-3	40.0	34.5	86.3		70.0-130
Dichlorodifluoromethane	75-71-8	40.0	39.1	97.9		70.0-130
Ethylbenzene	100-41-4	40.0	36.8	92.1		70.0-130
Hexachlorobutadiene	87-68-3	40.0	39.5	98.7		70.0-130
Isopropylbenzene	98-82-8	40.0	35.6	88.9		70.0-130
m&p-Xylene	136777-61-2	80.0	69.0	86.2		70.0-130
Methylene chloride	75-09-2	40.0	36.9	92.3		70.0-130
MTBE	1634-04-4	40.0	44.4	111		70.0-130
Naphthalene	91-20-3	40.0	52.9	132	*	70.0-130
n-Butylbenzene	104-51-8	40.0	38.9	97.2		70.0-130

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AR19077L)
Lab Sample ID: LCS-93

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-3	EPA Method 8260C	07/07/2014 09:38	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm

Analyte Spiked	CAS No.	Added (ug/L)	LCS (ug/L)	LCS % Rec.	Q[1]	Limits (%)
n-Propylbenzene	103-65-1	40.0	33.3	83.4		70.0-130
o-Xylene	95-47-6	40.0	36.9	92.2		70.0-130
sec-Butylbenzene	135-98-8	40.0	34.4	86.1		70.0-130
Styrene	100-42-5	40.0	41.7	104		70.0-130
tert-Butylbenzene	98-06-6	40.0	35.8	89.4		70.0-130
Tetrachloroethene	127-18-4	40.0	31.9	79.9		70.0-130
Toluene	108-88-3	40.0	35.1	87.7		70.0-130
Total Xylenes	1330-20-7	120	106	88.2		70.0-130
trans-1,2-Dichloroethene	156-60-5	40.0	38.8	96.9		70.0-130
trans-1,3-Dichloropropene	10061-02-6	40.0	40.5	101		70.0-130
Trichloroethene	79-01-6	40.0	37.4	93.4		70.0-130
Trichlorofluoromethane	75-69-4	40.0	33.7	84.3		70.0-130
Vinyl acetate	108-05-4	40.0	37.7	94.3		70.0-130
Vinyl chloride	75-01-4	40.0	35.4	88.5		70.0-130

[1]Qualifier column where '*' denotes value outside the control limits. Note: RPD criteria does not apply if either the sample and duplicate sample are not detected.

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	88.2	75.6-128		MS08-1762-3
Dibromofluoromethane	1868-53-7	98.7	86.3-116		MS08-1762-3
Toluene-d8	2037-26-5	93.1	84.6-115		MS08-1762-3
1,2-Dichloroethane-d4	17060-07-0	97.9	90.0-111		MS08-1762-3

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Phone: 518.346.4592
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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AR19399B)
Lab Sample ID: VBLK-92

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS10-180-20	EPA Method 8260C	07/08/2014 19:08	TJH	NA	NA	Restek, Rtx-VMS, 40 m, 0.18 mm ID, 1.00 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
1,1,1,2-Tetrachloroethane	630-20-6	ND	1.00	1.00	U	MS10-180-20
1,1,1-Trichloroethane	71-55-6	ND	1.00	1.00	U	MS10-180-20
1,1,2,2-Tetrachloroethane	79-34-5	ND	1.00	1.00	U	MS10-180-20
1,1,2-Trichloroethane	79-00-5	ND	1.00	1.00	U	MS10-180-20
1,1-Dichloroethane	75-34-3	ND	1.00	1.00	U	MS10-180-20
1,1-Dichloroethene	75-35-4	ND	1.00	1.00	U	MS10-180-20
1,1-Dichloropropene	563-58-6	ND	1.00	1.00	U	MS10-180-20
1,2,3-Trichlorobenzene	87-61-6	ND	1.00	1.00	U	MS10-180-20
1,2,3-Trichloropropane	96-18-4	ND	1.00	1.00	U	MS10-180-20
1,2,4-Trichlorobenzene	120-82-1	ND	1.00	1.00	U	MS10-180-20
1,2,4-Trimethylbenzene	95-63-6	ND	1.00	1.00	U	MS10-180-20
1,2-Dibromo-3-chloropropane	96-12-8	ND	1.00	1.00	U	MS10-180-20
1,2-Dibromoethane	106-93-4	ND	1.00	1.00	U	MS10-180-20
1,2-Dichlorobenzene	95-50-1	ND	1.00	1.00	U	MS10-180-20
1,2-Dichloroethane	107-06-2	ND	1.00	1.00	U	MS10-180-20
1,2-Dichloropropane	78-87-5	ND	1.00	1.00	U	MS10-180-20
1,3,5-Trimethylbenzene	108-67-8	ND	1.00	1.00	U	MS10-180-20
1,3-Dichlorobenzene	541-73-1	ND	1.00	1.00	U	MS10-180-20
1,3-Dichloropropane	142-28-9	ND	1.00	1.00	U	MS10-180-20
1,4-Dichlorobenzene	106-46-7	ND	1.00	1.00	U	MS10-180-20
2,2-Dichloropropane	594-20-7	ND	1.00	1.00	U	MS10-180-20
2-Butanone	78-93-3	ND	5.00	1.00	U	MS10-180-20
2-Chlorotoluene	95-49-8	ND	1.00	1.00	U	MS10-180-20
2-Hexanone	591-78-6	ND	5.00	1.00	U	MS10-180-20
4-Chlorotoluene	106-43-4	ND	1.00	1.00	U	MS10-180-20
4-Isopropyltoluene	99-87-6	ND	1.00	1.00	U	MS10-180-20
4-Methyl-2-pentanone	108-10-1	ND	5.00	1.00	U	MS10-180-20
Acetone	67-64-1	ND	10.0	1.00	U	MS10-180-20
Benzene	71-43-2	ND	1.00	1.00	U	MS10-180-20
Bromobenzene	108-86-1	ND	1.00	1.00	U	MS10-180-20
Bromochloromethane	74-97-5	ND	1.00	1.00	U	MS10-180-20
Bromodichloromethane	75-27-4	ND	1.00	1.00	U	MS10-180-20
Bromoform	75-25-2	ND	1.00	1.00	U	MS10-180-20
Bromomethane	74-83-9	ND	1.00	1.00	U	MS10-180-20
Carbon disulfide	75-15-0	ND	1.00	1.00	U	MS10-180-20
Carbon tetrachloride	56-23-5	ND	1.00	1.00	U	MS10-180-20
Chlorobenzene	108-90-7	ND	1.00	1.00	U	MS10-180-20
Chloroethane	75-00-3	ND	1.00	1.00	U	MS10-180-20
Chloroform	67-66-3	ND	1.00	1.00	U	MS10-180-20
Chloromethane	74-87-3	ND	1.00	1.00	U	MS10-180-20
cis-1,2-Dichloroethene	156-59-2	ND	1.00	1.00	U	MS10-180-20
cis-1,3-Dichloropropene	10061-01-5	ND	1.00	1.00	U	MS10-180-20
Dibromochloromethane	124-48-1	ND	1.00	1.00	U	MS10-180-20
Dibromomethane	74-95-3	ND	1.00	1.00	U	MS10-180-20
Dichlorodifluoromethane	75-71-8	ND	1.00	1.00	U	MS10-180-20

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Quality Control Results
Method Blank

Job Number: 14061033

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Phone: 518.346.4592
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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AR19399B)
Lab Sample ID: VBLK-92

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS10-180-20	EPA Method 8260C	07/08/2014 19:08	TJH	NA	NA	Restek, Rtx-VMS, 40 m, 0.18 mm ID, 1.00 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
Ethylbenzene	100-41-4	ND	1.00	1.00	U	MS10-180-20
Hexachlorobutadiene	87-68-3	ND	1.00	1.00	U	MS10-180-20
Isopropylbenzene	98-82-8	ND	1.00	1.00	U	MS10-180-20
m&p-Xylene	136777-61-2	ND	1.00	1.00	U	MS10-180-20
Methylene chloride	75-09-2	ND	1.00	1.00	U	MS10-180-20
MTBE	1634-04-4	ND	1.00	1.00	U	MS10-180-20
Naphthalene	91-20-3	ND	1.00	1.00	U	MS10-180-20
n-Butylbenzene	104-51-8	ND	1.00	1.00	U	MS10-180-20
n-Propylbenzene	103-65-1	ND	1.00	1.00	U	MS10-180-20
o-Xylene	95-47-6	ND	1.00	1.00	U	MS10-180-20
sec-Butylbenzene	135-98-8	ND	1.00	1.00	U	MS10-180-20
Styrene	100-42-5	ND	1.00	1.00	U	MS10-180-20
tert-Butylbenzene	98-06-6	ND	1.00	1.00	U	MS10-180-20
Tetrachloroethene	127-18-4	ND	1.00	1.00	U	MS10-180-20
Toluene	108-88-3	ND	1.00	1.00	U	MS10-180-20
Total Xylenes	1330-20-7	ND	1.00	1.00	U	MS10-180-20
trans-1,2-Dichloroethene	156-60-5	ND	1.00	1.00	U	MS10-180-20
trans-1,3-Dichloropropene	10061-02-6	ND	1.00	1.00	U	MS10-180-20
Trichloroethene	79-01-6	ND	1.00	1.00	U	MS10-180-20
Trichlorofluoromethane	75-69-4	ND	1.00	1.00	U	MS10-180-20
Vinyl acetate	108-05-4	ND	1.00	1.00	U	MS10-180-20
Vinyl chloride	75-01-4	ND	1.00	1.00	U	MS10-180-20

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	94.5	75.6-128		MS10-180-20
Dibromofluoromethane	1868-53-7	98.5	86.3-116		MS10-180-20
Toluene-d8	2037-26-5	102	84.6-115		MS10-180-20
1,2-Dichloroethane-d4	17060-07-0	96.1	90.0-111		MS10-180-20

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AR19399L)
Lab Sample ID: LCS-92

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS10-180-18	EPA Method 8260C	07/08/2014 18:16	TJH	NA	NA	Restek, Rtx-VMS, 40 m, 0.18 mm ID, 1.00 µm

Analyte Spiked	CAS No.	Added (ug/L)	LCS (ug/L)	LCS % Rec.	Q[1]	Limits (%)
1,1,1,2-Tetrachloroethane	630-20-6	40.0	43.7	109		70.0-130
1,1,1-Trichloroethane	71-55-6	40.0	39.3	98.3		70.0-130
1,1,2,2-Tetrachloroethane	79-34-5	40.0	41.5	104		70.0-130
1,1,2-Trichloroethane	79-00-5	40.0	43.2	108		70.0-130
1,1-Dichloroethane	75-34-3	40.0	39.3	98.2		70.0-130
1,1-Dichloroethene	75-35-4	40.0	36.2	90.6		70.0-130
1,1-Dichloropropene	563-58-6	40.0	39.8	99.6		70.0-130
1,2,3-Trichlorobenzene	87-61-6	40.0	49.4	124		70.0-130
1,2,3-Trichloropropane	96-18-4	40.0	42.1	105		70.0-130
1,2,4-Trichlorobenzene	120-82-1	40.0	48.5	121		70.0-130
1,2,4-Trimethylbenzene	95-63-6	40.0	42.7	107		70.0-130
1,2-Dibromo-3-chloropropane	96-12-8	40.0	44.9	112		70.0-130
1,2-Dibromoethane	106-93-4	40.0	44.8	112		70.0-130
1,2-Dichlorobenzene	95-50-1	40.0	43.1	108		70.0-130
1,2-Dichloroethane	107-06-2	40.0	38.1	95.1		70.0-130
1,2-Dichloropropane	78-87-5	40.0	40.6	102		70.0-130
1,3,5-Trimethylbenzene	108-67-8	40.0	42.3	106		70.0-130
1,3-Dichlorobenzene	541-73-1	40.0	43.8	109		70.0-130
1,3-Dichloropropane	142-28-9	40.0	43.7	109		70.0-130
1,4-Dichlorobenzene	106-46-7	40.0	42.0	105		70.0-130
2,2-Dichloropropane	594-20-7	40.0	36.2	90.4		70.0-130
2-Butanone	78-93-3	40.0	45.1	113		70.0-130
2-Chlorotoluene	95-49-8	40.0	41.1	103		70.0-130
2-Hexanone	591-78-6	40.0	48.9	122		70.0-130
4-Chlorotoluene	106-43-4	40.0	41.8	105		70.0-130
4-Isopropyltoluene	99-87-6	40.0	43.9	110		70.0-130
4-Methyl-2-pentanone	108-10-1	40.0	47.3	118		70.0-130
Acetone	67-64-1	40.0	45.0	113		70.0-130
Benzene	71-43-2	40.0	39.9	99.7		70.0-130
Bromobenzene	108-86-1	40.0	42.8	107		70.0-130
Bromochloromethane	74-97-5	40.0	38.6	96.6		70.0-130
Bromodichloromethane	75-27-4	40.0	39.7	99.3		70.0-130
Bromoform	75-25-2	40.0	49.4	124		70.0-130
Bromomethane	74-83-9	40.0	41.8	105		70.0-130
Carbon disulfide	75-15-0	40.0	36.7	91.7		70.0-130
Carbon tetrachloride	56-23-5	40.0	41.2	103		70.0-130
Chlorobenzene	108-90-7	40.0	41.8	105		70.0-130
Chloroethane	75-00-3	40.0	39.8	99.6		70.0-130
Chloroform	67-66-3	40.0	38.8	97.1		70.0-130
Chloromethane	74-87-3	40.0	37.7	94.3		70.0-130
cis-1,2-Dichloroethene	156-59-2	40.0	38.7	96.8		70.0-130
cis-1,3-Dichloropropene	10061-01-5	40.0	41.8	104		70.0-130
Dibromochloromethane	124-48-1	40.0	44.3	111		70.0-130
Dibromomethane	74-95-3	40.0	37.9	94.8		70.0-130
Dichlorodifluoromethane	75-71-8	40.0	38.5	96.2		70.0-130
Ethylbenzene	100-41-4	40.0	41.9	105		70.0-130
Hexachlorobutadiene	87-68-3	40.0	48.3	121		70.0-130
Isopropylbenzene	98-82-8	40.0	42.1	105		70.0-130
m&p-Xylene	136777-61-2	80.0	82.1	103		70.0-130
Methylene chloride	75-09-2	40.0	35.9	89.8		70.0-130
MTBE	1634-04-4	40.0	39.3	98.3		70.0-130
Naphthalene	91-20-3	40.0	47.1	118		70.0-130
n-Butylbenzene	104-51-8	40.0	43.5	109		70.0-130

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Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AR19399L)
Lab Sample ID: LCS-92

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS10-180-18	EPA Method 8260C	07/08/2014 18:16	TJH	NA	NA	Restek, Rtx-VMS, 40 m, 0.18 mm ID, 1.00 µm

Analyte Spiked	CAS No.	Added (ug/L)	LCS (ug/L)	LCS % Rec.	Q[1]	Limits (%)
n-Propylbenzene	103-65-1	40.0	42.2	106		70.0-130
o-Xylene	95-47-6	40.0	43.0	107		70.0-130
sec-Butylbenzene	135-98-8	40.0	42.8	107		70.0-130
Styrene	100-42-5	40.0	44.0	110		70.0-130
tert-Butylbenzene	98-06-6	40.0	42.6	106		70.0-130
Tetrachloroethene	127-18-4	40.0	45.1	113		70.0-130
Toluene	108-88-3	40.0	40.7	102		70.0-130
Total Xylenes	1330-20-7	120	125	104		70.0-130
trans-1,2-Dichloroethene	156-60-5	40.0	34.2	85.4		70.0-130
trans-1,3-Dichloropropene	10061-02-6	40.0	42.3	106		70.0-130
Trichloroethene	79-01-6	40.0	39.7	99.2		70.0-130
Trichlorofluoromethane	75-69-4	40.0	37.4	93.4		70.0-130
Vinyl acetate	108-05-4	40.0	37.9	94.7		70.0-130
Vinyl chloride	75-01-4	40.0	38.8	97.0		70.0-130

[1]Qualifier column where '*' denotes value outside the control limits. Note: RPD criteria does not apply if either the sample and duplicate sample are not detected.

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	94.9	75.6-128		MS10-180-18
Dibromofluoromethane	1868-53-7	99.2	86.3-116		MS10-180-18
Toluene-d8	2037-26-5	102	84.6-115		MS10-180-18
1,2-Dichloroethane-d4	17060-07-0	97.5	90.0-111		MS10-180-18

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Quality Control Results
Method Blank

Job Number: 14061033

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AR19877B)
Lab Sample ID: VBLK-93

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-7	EPA Method 8260C	07/07/2014 11:27	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
1,1,1,2-Tetrachloroethane	630-20-6	ND	1.00	1.00	U	MS08-1762-7
1,1,1-Trichloroethane	71-55-6	ND	1.00	1.00	U	MS08-1762-7
1,1,2,2-Tetrachloroethane	79-34-5	ND	1.00	1.00	U	MS08-1762-7
1,1,2-Trichloroethane	79-00-5	ND	1.00	1.00	U	MS08-1762-7
1,1-Dichloroethane	75-34-3	ND	1.00	1.00	U	MS08-1762-7
1,1-Dichloroethene	75-35-4	ND	1.00	1.00	U	MS08-1762-7
1,1-Dichloropropene	563-58-6	ND	1.00	1.00	U	MS08-1762-7
1,2,3-Trichlorobenzene	87-61-6	ND	1.00	1.00	U	MS08-1762-7
1,2,3-Trichloropropane	96-18-4	ND	1.00	1.00	U	MS08-1762-7
1,2,4-Trichlorobenzene	120-82-1	ND	1.00	1.00	U	MS08-1762-7
1,2,4-Trimethylbenzene	95-63-6	ND	1.00	1.00	U	MS08-1762-7
1,2-Dibromo-3-chloropropane	96-12-8	ND	1.00	1.00	U	MS08-1762-7
1,2-Dibromoethane	106-93-4	ND	1.00	1.00	U	MS08-1762-7
1,2-Dichlorobenzene	95-50-1	ND	1.00	1.00	U	MS08-1762-7
1,2-Dichloroethane	107-06-2	ND	1.00	1.00	U	MS08-1762-7
1,2-Dichloropropane	78-87-5	ND	1.00	1.00	U	MS08-1762-7
1,3,5-Trimethylbenzene	108-67-8	ND	1.00	1.00	U	MS08-1762-7
1,3-Dichlorobenzene	541-73-1	ND	1.00	1.00	U	MS08-1762-7
1,3-Dichloropropane	142-28-9	ND	1.00	1.00	U	MS08-1762-7
1,4-Dichlorobenzene	106-46-7	ND	1.00	1.00	U	MS08-1762-7
2,2-Dichloropropane	594-20-7	ND	1.00	1.00	U	MS08-1762-7
2-Butanone	78-93-3	ND	5.00	1.00	U	MS08-1762-7
2-Chlorotoluene	95-49-8	ND	1.00	1.00	U	MS08-1762-7
2-Hexanone	591-78-6	ND	5.00	1.00	U	MS08-1762-7
4-Chlorotoluene	106-43-4	ND	1.00	1.00	U	MS08-1762-7
4-Isopropyltoluene	99-87-6	ND	1.00	1.00	U	MS08-1762-7
4-Methyl-2-pentanone	108-10-1	ND	5.00	1.00	U	MS08-1762-7
Acetone	67-64-1	ND	10.0	1.00	U	MS08-1762-7
Benzene	71-43-2	ND	1.00	1.00	U	MS08-1762-7
Bromobenzene	108-86-1	ND	1.00	1.00	U	MS08-1762-7
Bromochloromethane	74-97-5	ND	1.00	1.00	U	MS08-1762-7
Bromodichloromethane	75-27-4	ND	1.00	1.00	U	MS08-1762-7
Bromoform	75-25-2	ND	1.00	1.00	U	MS08-1762-7
Bromomethane	74-83-9	ND	1.00	1.00	U	MS08-1762-7
Carbon disulfide	75-15-0	ND	1.00	1.00	U	MS08-1762-7
Carbon tetrachloride	56-23-5	ND	1.00	1.00	U	MS08-1762-7
Chlorobenzene	108-90-7	ND	1.00	1.00	U	MS08-1762-7
Chloroethane	75-00-3	ND	1.00	1.00	U	MS08-1762-7
Chloroform	67-66-3	ND	1.00	1.00	U	MS08-1762-7
Chloromethane	74-87-3	ND	1.00	1.00	U	MS08-1762-7
cis-1,2-Dichloroethene	156-59-2	ND	1.00	1.00	U	MS08-1762-7
cis-1,3-Dichloropropene	10061-01-5	ND	1.00	1.00	U	MS08-1762-7
Dibromochloromethane	124-48-1	ND	1.00	1.00	U	MS08-1762-7
Dibromomethane	74-95-3	ND	1.00	1.00	U	MS08-1762-7
Dichlorodifluoromethane	75-71-8	ND	1.00	1.00	U	MS08-1762-7

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AR19877B)
Lab Sample ID: VBLK-93

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MS08-1762-7	EPA Method 8260C	07/07/2014 11:27	CAP	NA	NA	Restek, Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm

Analyte	CAS No.	Result (ug/L)	PQL	Dilution Factor	Flags	File ID
Ethylbenzene	100-41-4	ND	1.00	1.00	U	MS08-1762-7
Hexachlorobutadiene	87-68-3	ND	1.00	1.00	U	MS08-1762-7
Isopropylbenzene	98-82-8	ND	1.00	1.00	U	MS08-1762-7
m&p-Xylene	136777-61-2	ND	1.00	1.00	U	MS08-1762-7
Methylene chloride	75-09-2	ND	1.00	1.00	U	MS08-1762-7
MTBE	1634-04-4	ND	1.00	1.00	U	MS08-1762-7
Naphthalene	91-20-3	ND	1.00	1.00	U	MS08-1762-7
n-Butylbenzene	104-51-8	ND	1.00	1.00	U	MS08-1762-7
n-Propylbenzene	103-65-1	ND	1.00	1.00	U	MS08-1762-7
o-Xylene	95-47-6	ND	1.00	1.00	U	MS08-1762-7
sec-Butylbenzene	135-98-8	ND	1.00	1.00	U	MS08-1762-7
Styrene	100-42-5	ND	1.00	1.00	U	MS08-1762-7
tert-Butylbenzene	98-06-6	ND	1.00	1.00	U	MS08-1762-7
Tetrachloroethene	127-18-4	ND	1.00	1.00	U	MS08-1762-7
Toluene	108-88-3	ND	1.00	1.00	U	MS08-1762-7
Total Xylenes	1330-20-7	ND	1.00	1.00	U	MS08-1762-7
trans-1,2-Dichloroethene	156-60-5	ND	1.00	1.00	U	MS08-1762-7
trans-1,3-Dichloropropene	10061-02-6	ND	1.00	1.00	U	MS08-1762-7
Trichloroethene	79-01-6	ND	1.00	1.00	U	MS08-1762-7
Trichlorofluoromethane	75-69-4	ND	1.00	1.00	U	MS08-1762-7
Vinyl acetate	108-05-4	ND	1.00	1.00	U	MS08-1762-7
Vinyl chloride	75-01-4	ND	1.00	1.00	U	MS08-1762-7

Surrogate	CAS No.	% Recovery	Limits (%)	Q[1]	File ID
Bromofluorobenzene	460-00-4	102	75.6-128		MS08-1762-7
Dibromofluoromethane	1868-53-7	105	86.3-116		MS08-1762-7
Toluene-d8	2037-26-5	93.6	84.6-115		MS08-1762-7
1,2-Dichloroethane-d4	17060-07-0	104	90.0-111		MS08-1762-7

[1]Qualifier column where '*' denotes value outside the control limits or 'D' denotes value was diluted out.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Pace Analytical®

Quality Control Results
Method Blank

Job Number: 14061033

Pace Analytical Services, Inc.
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Phone: 518.346.4592
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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AR20034B)
Lab Sample ID: PBW-01

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MER1-1609-54	SW-846 7470A	07/03/2014 14:23	CYC	NA	NA	NA
Prep 1:	4732	EPA 7470A	07/03/2014 09:30	CYC	40.0 mL	40.0 mL	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Mercury	7439-97-6	ND	0.000200	1.00	U	MER1-1609-54

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Quality Control Results
Lab Control Sample (LCS)

Job Number: 14061033

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AR20034L)
Lab Sample ID: LCS-01

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	MER1-1609-55	SW-846 7470A	07/03/2014 14:25	CYC	NA	NA	NA
Prep 1:	4732	EPA 7470A	07/03/2014 09:30	CYC	40.0 mL	40.0 mL	NA

Analyte Spiked	CAS No.	Added (mg/L)	LCS (mg/L)	LCS % Rec.	Q[1]	Limits (%)
Mercury	7439-97-6	0.00300	0.00324	108		80.0-120

[1]Qualifier column where '*' denotes value outside the control limits. Note: RPD criteria does not apply if either the sample and duplicate sample are not detected.

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PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AR20330B)
Lab Sample ID: PBW-99

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	ICP2-1172-22	EPA 200.7	07/07/2014 09:55	LMS	NA	NA	NA
Prep 1:	4733	EPA 200.7	07/03/2014 09:00	CYC	50.0 mL	50.0 mL	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Arsenic	7440-38-2	ND	0.00500	1.00	U	ICP2-1172-22
Barium	7440-39-3	ND	0.00500	1.00	U	ICP2-1172-22
Cadmium	7440-43-9	ND	0.00400	1.00	U	ICP2-1172-22
Chromium	7440-47-3	ND	0.00500	1.00	U	ICP2-1172-22
Lead	7439-92-1	ND	0.00500	1.00	U	ICP2-1172-22
Selenium	7782-49-2	ND	0.0100	1.00	U	ICP2-1172-22
Silver	7440-22-4	ND	0.00700	1.00	U	ICP2-1172-22

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Quality Control Results
Lab Control Sample (LCS)
Job Number: 14061033

Pace Analytical Services, Inc.
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Phone: 518.346.4592
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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AR20330L)
Lab Sample ID: LCS-99

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	ICP2-1172-23	EPA 200.7	07/07/2014 09:57	LMS	NA	NA	NA
Prep 1:	4733	EPA 200.7	07/03/2014 09:00	CYC	50.0 mL	50.0 mL	NA

Analyte Spiked	CAS No.	Added (mg/L)	LCS (mg/L)	LCS % Rec.	Q[1]	Limits (%)
Arsenic	7440-38-2	0.500	0.502	100		85.0-115
Barium	7440-39-3	0.500	0.537	107		85.0-115
Cadmium	7440-43-9	0.500	0.535	107		85.0-115
Chromium	7440-47-3	0.500	0.519	104		85.0-115
Lead	7439-92-1	0.500	0.543	109		85.0-115
Selenium	7782-49-2	0.500	0.536	107		85.0-115
Silver	7440-22-4	0.250	0.249	99.4		85.0-115

[1]Qualifier column where '*' denotes value outside the control limits. Note: RPD criteria does not apply if either the sample and duplicate sample are not detected.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Quality Control Results
Method Blank

Job Number: 14061033

Pace Analytical Services, Inc.
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Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AR19929B)
Lab Sample ID: BLANK-49

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	1799	SM 2540D	06/30/2014 16:15	RF	NA	NA	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Total Suspended Solids	WQ001	ND	1.00	1.00	U	1799

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Quality Control Results
Lab Control Sample (LCS)

Job Number: 14061033

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Phone: 518.346.4592
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Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AR19929L)
Lab Sample ID: LCS-49

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	1799	SM 2540D	06/30/2014 16:15	RF	NA	NA	NA

Analyte Spiked	CAS No.	Added (mg/L)	LCS (mg/L)	LCS % Rec.	Q[1]	Limits (%)
Total Suspended Solids	WQ001	100	88.8	88.8		85.0-115

[1]Qualifier column where '*' denotes value outside the control limits. Note: RPD criteria does not apply if either the sample and duplicate sample are not detected.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Quality Control Results
Lab Control Sample - Duplicate (LCSD)

Job Number: 14061033

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample - Duplicate (AR19929LCD)
Lab Sample ID: LCSD-49

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	1799	SM 2540D	06/30/2014 16:15	RF	NA	NA	NA

							Precision			
Analyte Spiked	**CAS No.**	**Added (mg/L)**	**LCSD (mg/L)**	**LCSD % Rec.**	**Q[1]**	**Limits (%)**	**LCS % Rec.**	**RPD**	**Q[1]**	**Limits (%)**
Total Suspended Solids	WQ001	100	93.2	93.2		85.0-115	88.8	4.84		20

[1]Qualifier column where '*' denotes value outside the control limits. Note: RPD criteria does not apply if either the sample and duplicate sample are not detected.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

10

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Pace Analytical®

Quality Control Results
Method Blank

Job Number: 14061033

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Method Blank (AR19877B)
Lab Sample ID: BLANK-83

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	181	SM 2540C	06/30/2014 07:20	ACB	NA	NA	NA

Analyte	CAS No.	Result (mg/L)	PQL	Dilution Factor	Flags	File ID
Total Dissolved Solids	NA	ND	50.0	1.00	U	181

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Quality Control Results
Lab Control Sample (LCS)

Job Number: 14061033

Pace Analytical Services, Inc.
2190 Technology Drive
Schenectady, NY 12308
Phone: 518.346.4592
Fax: 518.381.6055

Client: AECOM
Project: COLD SPRINGS TERMINALS 60248522
Client Sample ID: Lab Control Sample (AR19877L)
Lab Sample ID: LCS-83

Collection Date: N/A
Sample Matrix: WATER
Received Date: N/A
Percent Solid: N/A

	Batch ID	Method	Date	Analyst	Init Wt./Vol.	Final Vol.	Column
Analysis 1:	181	SM 2540C	06/30/2014 07:20	ACB	NA	NA	NA

Analyte Spiked	CAS No.	Added (mg/L)	LCS (mg/L)	LCS % Rec.	Q[1]	Limits (%)
Total Dissolved Solids	NA	500	525	105		85.0-115

[1]Qualifier column where '*' denotes value outside the control limits. Note: RPD criteria does not apply if either the sample and duplicate sample are not detected.

ND: Denotes analyte not detected at a concentration greater than the PQL.
PQL (Practical Quantitation Limit). Denotes lowest analyte concentration reportable for the sample.

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Appendix H

Summary of MPE Pilot Testing Well A-16

Appendix H
Summary of VEGE Pilot Test – A-16
Cold Springs Terminal
7431 Hillside Road
Baldswinsville, NY
June 24, 2014

The following major equipment was utilized for VEGE testing on A-16

- A 7.5 horsepower (HP) Roots positive displacement blower with a variable frequency drive (VFD) capable of directly controlling the vacuum and flow applied to the extraction wellhead. By changing the frequency at which the motor was operated, the applied vacuum and blower operational flow rate could also be changed. This allowed the MPE pilot test to be conducted without introducing dilution air; therefore, collecting additional data (e.g. dilution air flowrate) to be evaluated was not required.
- A moisture separator allowed condensate (when present) in the soil vapor stream to accumulate, and pumped to a storage tank for treatment (when necessary). Piping from the blower was connected to the extraction wellhead, which had flow measurement and sample ports.
- A hose connected the inlet to the positive displacement blower, used to apply a vacuum to the formation, to the Test Well wellhead utilizing various 2 inch diameter hose fittings and valves and a wellhead adapter.
- For VEGE testing, the wellhead adapter allowed for insertion of 1" (water/NAPL return) and 3/8" (air supply) hoses connected to the submersible pump. In the DPE testing scenario a 4" T fitting with a 4" by 2" bushing was installed just below the well seal and connected to the positive displacement blower as discussed above.
- The pump used was an AP-4 top loading submersible pump attached to a GAST 2-HP rotary vane air compressor. The piping that connected the compressor to the wellhead included a pressure relief valve, a manual bleed valve, pressure gauges, a control valve, and a rotometer. A discharge air line was also connected to the top of the pump.
- Volatile organic compounds (VOCs) concentrations in extracted vapors were monitored using either a MiniRae Photon Ionization Detector (PID) or a MiniRae 5-gas meter (MiniRae) calibrated with isobutylene. The MiniRae was also used to measure oxygen (O2), carbon dioxide (CO2), and Lower Explosive Level (LEL), in the extracted vapors and monitoring point/wellhead readings. Two digital manometers, with various pressure/vacuum ranges, and a hot-wire anemometer were used to collect the soil vapor temperature extracted from the Test Wells and various operating parameters discussed below.
- The monitoring points/wells at various radial distances from the Test Well were fitted with removable caps equipped with sample ports to allow for the collection of observed pressure measurements (vacuum influence), depth to NAPL and groundwater using an Electronic Interface Probe (EIP), and soil vapor concentration with a PID. Soil vapor samples were collected for lab analysis by EPA TO-15, using 6 Liter SUMMA canisters, and were collected as grab samples from the sample ports located on the 4 inch PVC piping following the blower output. Groundwater samples were collected for lab analysis by Metals, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), and VOCs at a sample port before the Oil water separator

Appendix H

Summary of VEGE Pilot Testing - A-16
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 24, 2014

	SVE	Blower Effluent					A-16							DTB 19.0 ft	
Time (min)	Vac ("Hg)	Pressure (" H_20)	Vapor Flow Rate (scfm)	VOC (ppm_v)	O2 (%)	LEL (%)	Water Collected (gals)	Δ Water (gals)	NAPL Collected (gals)	Flow Rate (gals/min)	DTW (ft)	Δ DTW (ft)	DTP (ft)	Thickness (ft)	Corrected Water Depth (ft)
Pumping Only															
0	NM	NM	NA	NM	NM	NM	0	0	NM	NA	13.95	NM	8.79	5.16	9.93
30	NM	NM	NA	NM	NM	NM	20	20	NM	0.67	NM	NM	NM	NM	NM
60	NM	NM	NA	NM	NM	NM	44	24	NM	1.47	NM	NM	NM	NM	NM
90	NM	NM	NA	NM	NM	NM	71	27	NM	2.35	NM	NM	NM	NM	NM
MPE Step 1															
120	5.00	2.00	31.32	260	NM	NM	81	10	NM	2.69	NM	NM	NM	NM	NM
150	5.00	NM	28.71	295	NM	NM	137	57	NM	4.57	NM	NM	NM	NM	NM
180	NM	2.00	30.45	305	NM	NM	166	28	NM	0.95	NM	NM	NM	NM	NM
210	5.24	NM	28.28	344	NM	NM	219	53	NM	1.78	NM	NM	NM	NM	NM
240	5.24	NM	28.97	399	NM	NM	254	35	9.99	1.17	NM	NM	NM	NM	NM
MPE Step 2															
270	8.50	NM	25.23	291	NM	NM	331	77	NM	2.56	NM	NM	NM	NM	NM
300	8.50	3.00	26.97	331	NM	NM	421	90	13.32	3.01	NM	NM	NM	NM	NM
330	8.50	NM	25.23	277	NM	NM	571	150	14.32	5.00	NM	NM	NM	NM	NM
MPE Step 3															
360	13.20	5.00	26.10	367	NM	NM	702	131	14.99	4.38	NM	NM	NM	NM	NM
390	NM	NM	28.71	340	NM	NM	797	95	16.65	3.16	NM	NM	NM	NM	NM
420	NM	NM	31.32	390	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Recovery															
425	NM	NM	NM	NM	NM	NM	NM	NA	ND	NA	14.11	4.18	ND	NM	NA
430	NM	NM	NM	NM	NM	NM	NM	NA	ND	NA	12.18	2.25	ND	NM	NA
435	NM	NM	NM	NM	NM	NM	NM	NA	ND	NA	10.45	0.52	ND	NM	NA
440	NM	NM	NM	NM	NM	NM	NM	NA	ND	NA	9.63	-0.30	ND	NM	NA
445	NM	NM	NM	NM	NM	NM	NM	NA	ND	NA	8.90	-1.03	ND	NM	NA
450	NM	NM	NM	NM	NM	NM	NM	NA	ND	NA	8.48	-1.45	ND	NM	NA
455	NM	NM	NM	NM	NM	NM	NM	NA	ND	NA	8.25	-1.68	ND	NM	NA

Notes: Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to A-16 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

Appendix H

Summary of VEGE Pilot Testing - A-16
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 24, 2014

Time (min)	A-7						A-12						AMW-9					
	Screen Int.	7.0'-12.0'	Distance to A-16		68	feet	Screen Int.	5.0'-20.0'	Distance to A-16		68	feet	Screen Int.	4.0'-19.0'	Distance to A-16		36	feet
	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)
Pumping Only																		
0	NM	NM	11.55	NA	ND	NA	NM	NM	11.20	NA	8.11	3.09	NM	NM	14.94	NA	11.30	3.64
30	NM	NM	11.55	0.00	ND	NA	NM	NM	11.22	-0.02	8.13	3.09	NM	NM	14.92	0.02	11.28	3.64
60	NM	NM	11.55	0.00	ND	NA	NM	NM	11.22	-0.02	8.14	3.08	NM	NM	14.91	0.03	11.29	3.62
90	NM	NM	11.55	0.00	ND	NA	NM	NM	11.24	-0.04	8.16	3.08	NM	NM	14.91	0.03	11.30	3.61
MPE Step 1																		
120	NM	NM	11.55	0.00	ND	NA	NM	NM	11.24	-0.04	8.17	3.07	NM	NM	14.91	0.03	11.30	3.61
150	0.00	NM	11.55	0.00	ND	NA	0.00	NM	11.29	-0.09	8.21	3.08	NM	NM	14.91	0.03	11.42	3.49
180	0.00	NM	11.55	0.00	ND	NA	0.00	NM	11.32	-0.12	8.22	3.10	NM	NM	14.91	0.03	11.43	3.48
210	0.00	NM	11.55	0.00	ND	NA	0.00	NM	11.34	-0.14	8.24	3.10	NM	NM	14.91	0.03	11.46	3.45
240	0.00	NM	11.55	0.00	ND	NA	0.00	NM	11.34	-0.14	8.23	3.11	NM	NM	14.91	0.03	11.47	3.44
MPE Step 2																		
270	0.00	NM	11.55	0.00	ND	NA	0.00	NM	11.32	-0.12	8.22	3.10	NM	NM	14.91	0.03	11.50	3.41
300	0.00	NM	11.55	0.00	ND	NA	0.00	NM	11.30	-0.10	8.24	3.06	NM	NM	14.91	0.03	11.56	3.35
330	0.00	NM	11.55	0.00	ND	NA	0.00	NM	11.42	-0.22	8.29	3.13	NM	NM	14.91	0.03	11.58	3.33
MPE Step 3																		
360	0.00	NM	11.55	0.00	ND	NA	0.00	NM	11.43	-0.23	8.30	3.13	NM	NM	14.91	0.03	11.60	3.31
390	0.00	NM	11.55	0.00	ND	NA	0.00	NM	11.48	-0.28	8.34	3.14	NM	NM	14.91	0.03	11.64	3.27
420	0.00	NM	11.55	0.00	ND	NA	0.00	NM	11.51	-0.31	8.35	3.16	NM	NM	14.91	0.03	11.62	3.29
Recovery																		
425	0.00	NM	11.55	0.00	ND	NA	0.00	NM	11.52	-0.32	8.37	3.15	NM	NM	14.91	0.03	11.68	3.23
455	NM	NM	NM	NM	NM	NM	0.00	NM	11.53	-0.33	8.36	3.17	NM	NM	14.91	0.03	11.71	3.20

Notes:
Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to A-16 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

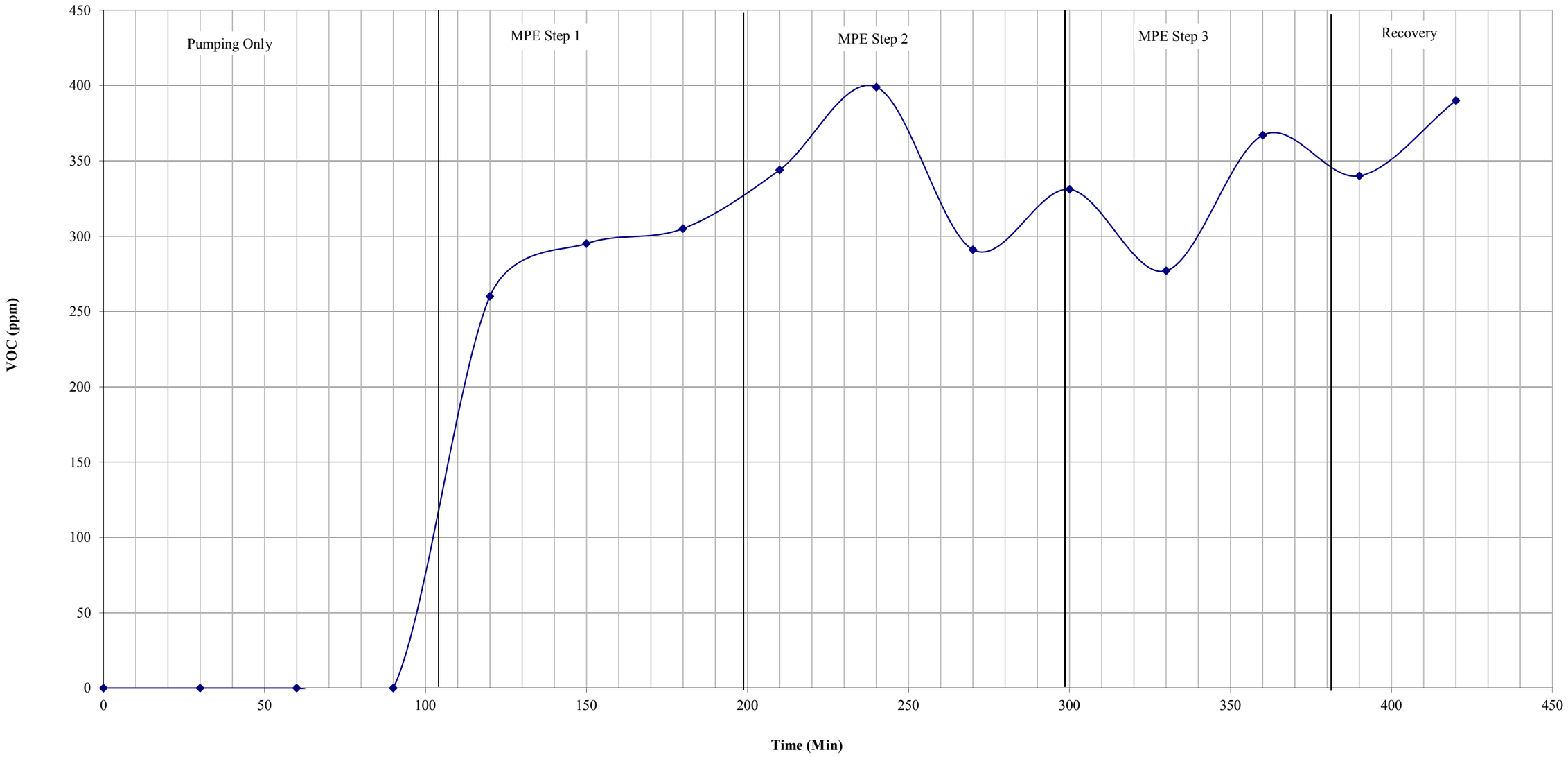
Appendix H

Summary of VEGE Pilot Testing - A-16
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 24, 2014

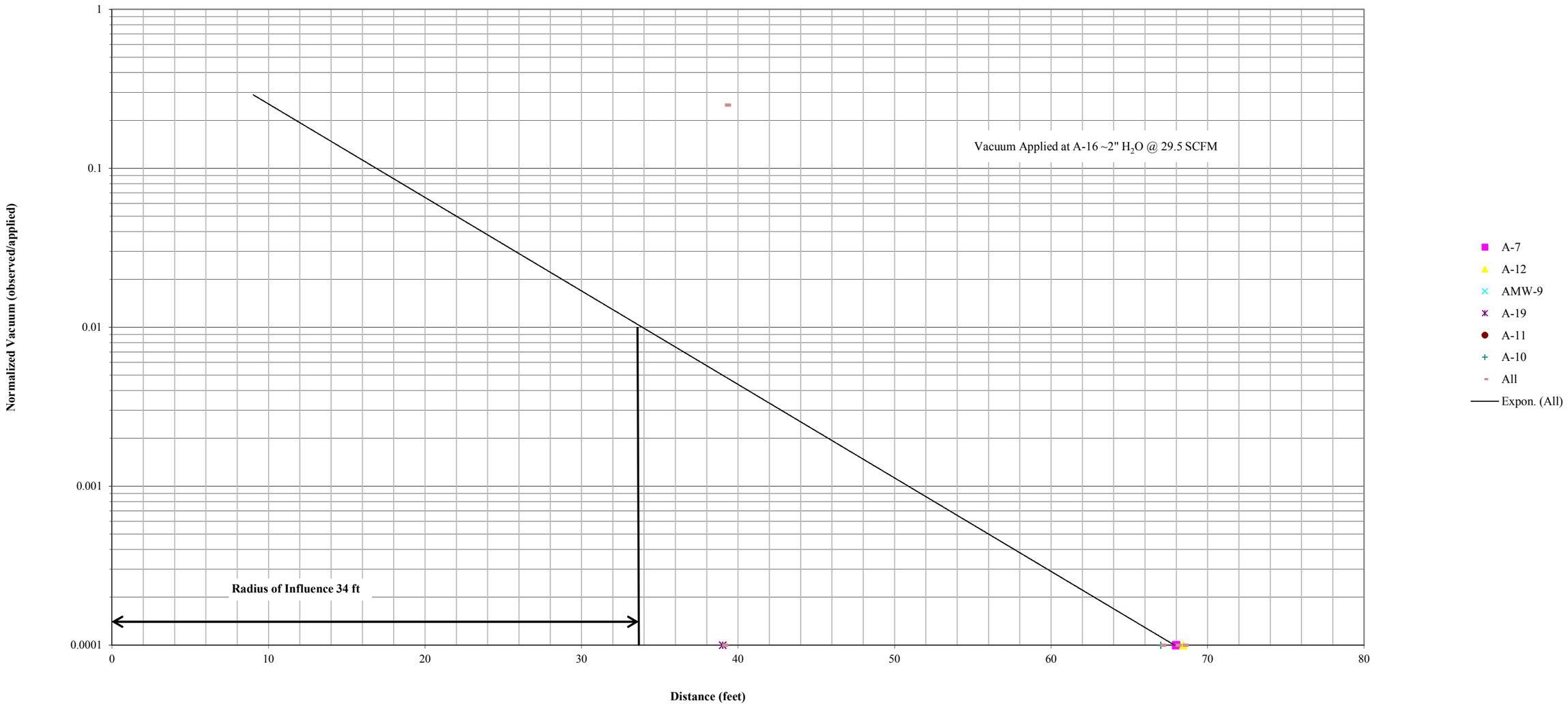
Time (min)	A-19 Screen Int.	4.0'-19.0'	Distance to A-16		39	feet	A-11 Screen Int.	5.0'-15.0'	Distance to A-16		39	feet	A-10 Screen Int.	4.0'-14.0'	Distance to A-16		67	feet
	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)
Pumping Only																		
0	NM	NM	7.79	NA	ND	NA	NM	NM	8.31	NA	ND	NA	NM	NM	11.31	NA	8.57	2.74
30	NM	NM	7.80	-0.01	ND	NA	NM	NM	8.35	-0.04	ND	NA	NM	NM	11.33	-0.02	8.59	2.74
60	NM	NM	7.85	-0.06	ND	NA	NM	NM	8.38	-0.07	ND	NA	NM	NM	11.34	-0.03	8.59	2.75
90	NM	NM	7.88	-0.09	ND	NA	NM	NM	8.42	-0.11	ND	NA	NM	NM	11.37	-0.06	8.61	2.76
MPE Step 1																		
120	NM	NM	7.97	-0.18	ND	NA	NM	NM	8.44	-0.13	ND	NA	NM	NM	11.38	-0.07	8.61	2.77
150	0.00	NM	7.97	-0.18	ND	NA	-0.44	NM	8.52	-0.21	ND	NA	0.00	NM	11.46	-0.15	8.68	2.78
180	0.00	NM	8.01	-0.22	ND	NA	-0.55	NM	8.53	-0.22	ND	NA	0.00	NM	11.48	-0.17	8.69	2.79
210	0.00	NM	8.04	-0.25	ND	NA	-0.61	NM	8.53	-0.22	ND	NA	0.00	NM	11.49	-0.18	8.71	2.78
240	0.00	NM	8.04	-0.25	ND	NA	-0.56	NM	8.50	-0.19	ND	NA	0.00	NM	11.49	-0.18	8.70	2.79
MPE Step 2																		
270	0.00	NM	8.03	-0.24	ND	NA	-1.35	NM	8.46	-0.15	ND	NA	0.00	NM	11.50	-0.19	8.70	2.8
300	0.00	NM	8.10	-0.31	ND	NA	-1.64	NM	8.58	-0.27	ND	NA	0.00	NM	11.56	-0.25	8.75	2.81
330	0.00	NM	8.15	-0.36	ND	NA	-1.35	NM	8.63	-0.32	ND	NA	0.00	NM	11.59	-0.28	8.77	2.82
MPE Step 3																		
360	0.00	NM	8.18	-0.39	ND	NA	-1.65	NM	8.65	-0.34	ND	NA	0.00	NM	11.61	-0.30	8.79	2.82
390	0.00	NM	8.24	-0.45	ND	NA	-2.45	NM	8.68	-0.37	ND	NA	-0.06	NM	11.68	-0.37	8.83	2.85
420	0.00	NM	8.29	-0.50	ND	NA	-2.31	NM	8.71	-0.40	ND	NA	-0.05	NM	11.70	-0.39	8.84	2.86
Recovery																		
425	0.00	NM	8.31	-0.52	ND	NA	-2.26	NM	8.73	-0.42	ND	NA	0.00	NM	11.71	-0.40	8.85	2.86
455	0.00	NM	8.34	-0.55	ND	NA	-2.28	NM	8.71	-0.40	ND	NA	0.00	NM	11.72	-0.41	8.87	2.85

Notes:
Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to A-16 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

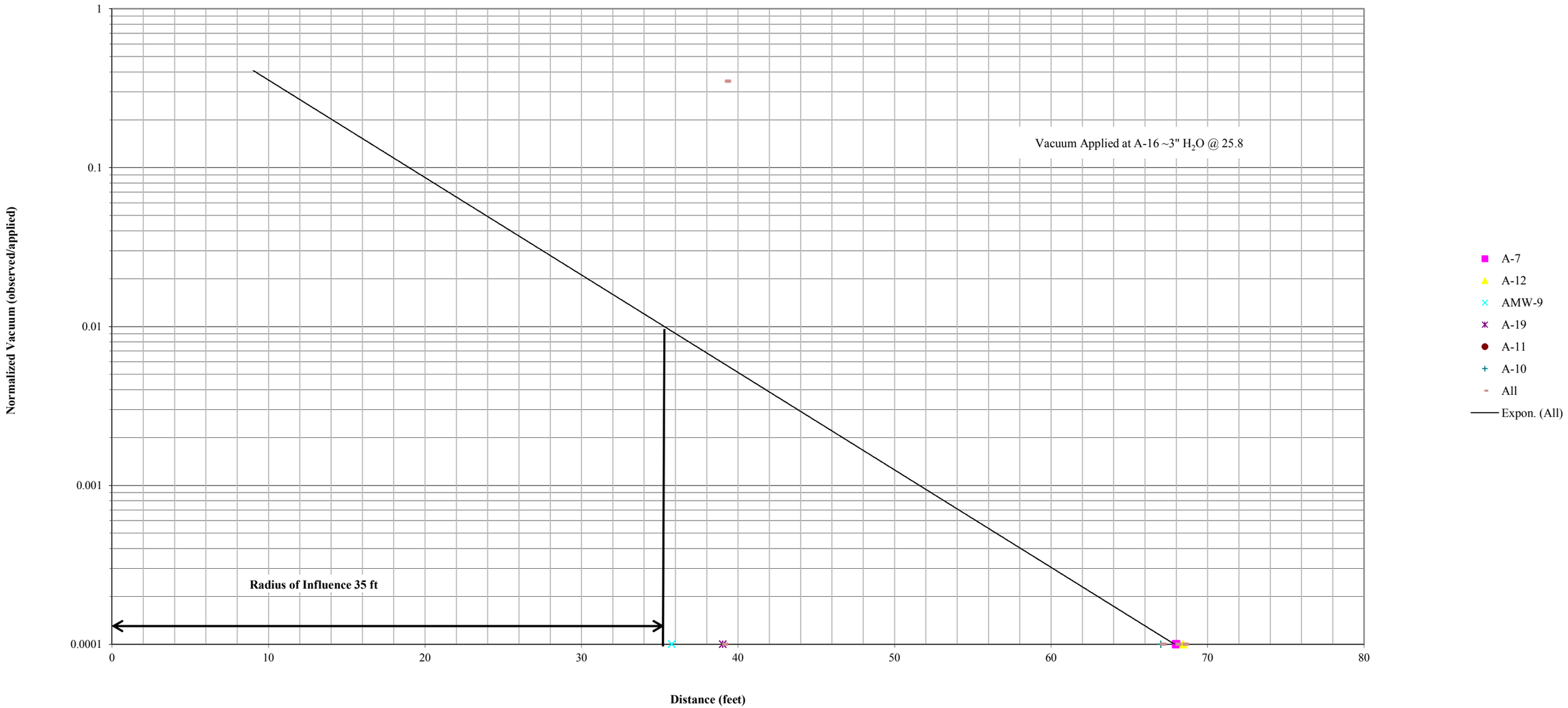
Appendix H
Summary of VEGE Pilot Testing: VOC Concentration vs. Time
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 24, 2014



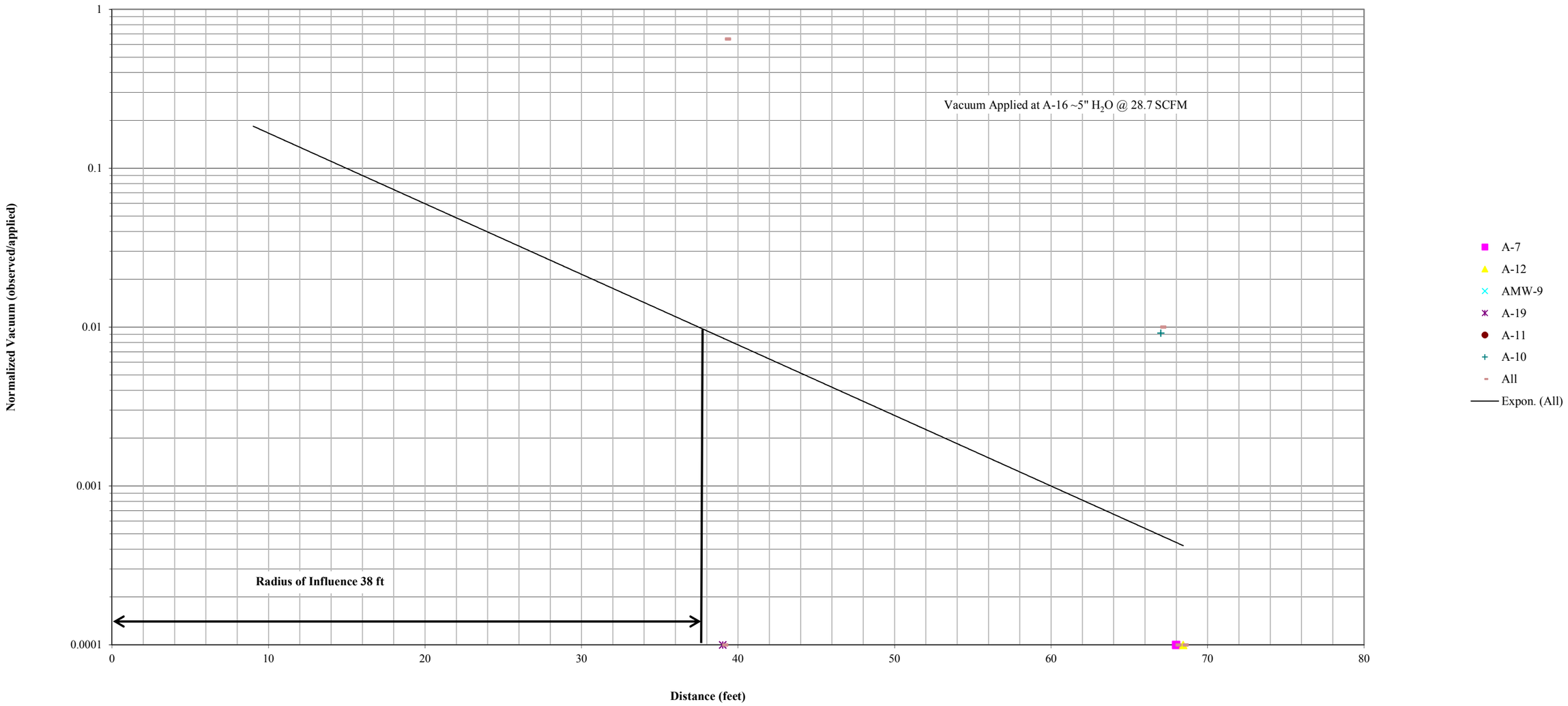
Appendix H
Summary of VEGE Pilot Testing: Step 1 Normalized Vacuum vs. Distance from A-16
Cold Springs Terminal
7431 Hillside Road
Baldwinsvile, NY
June 24, 2014



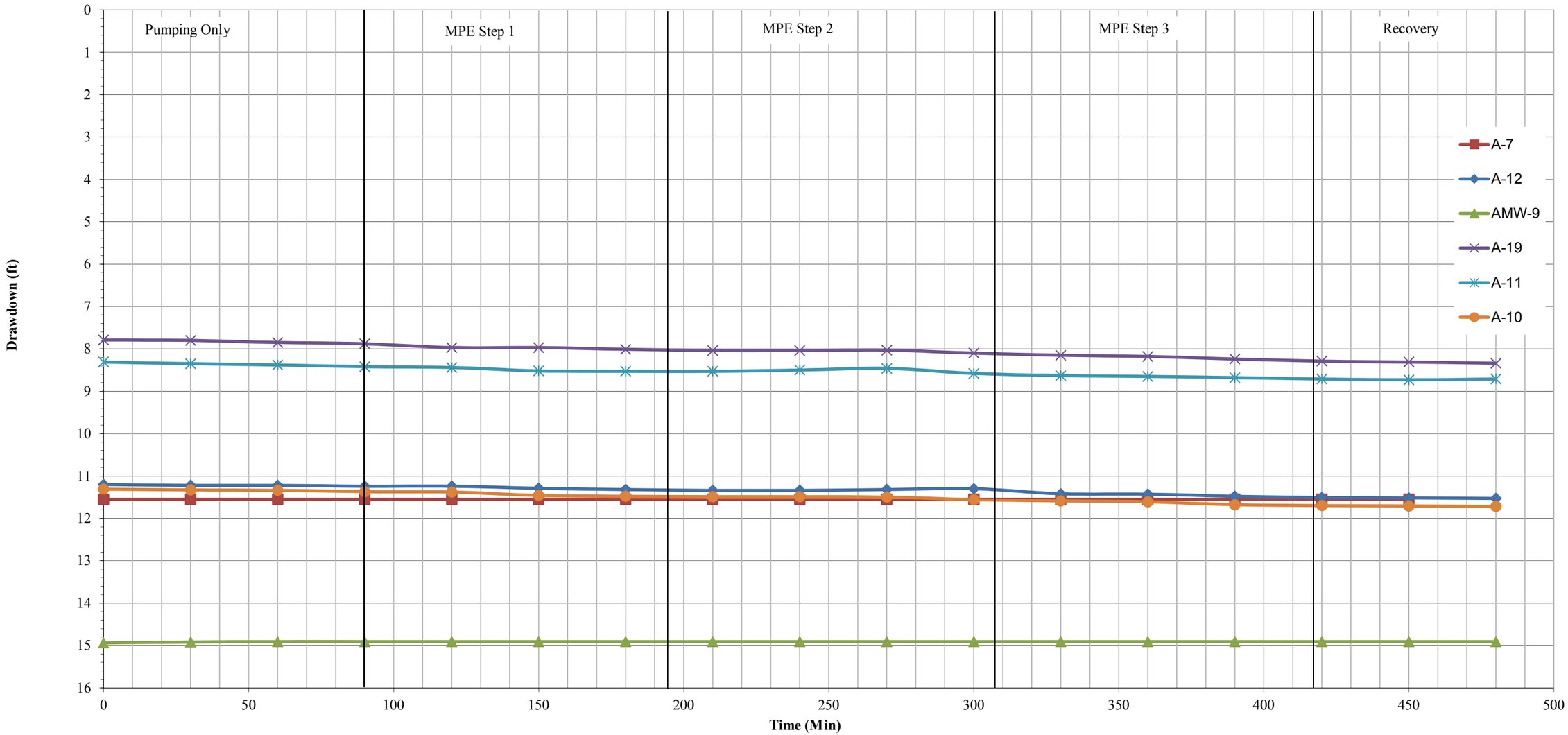
Appendix H
Summary of VEGE Pilot Testing: Step 2 Normalized Vacuum vs. Distance from A-16
Cold Springs Terminal
7431 Hillside Road
Baldwinsvile, NY
June 24, 2014



Appendix H
Summary of VEGE Pilot Testing: Step 3 Normalized Vacuum vs. Distance from A-16
Cold Springs Terminal
7431 Hillside Road
Baldwinsvile, NY
June 24, 2014



Appendix H
Summary of VEGE Pilot Testing: Depth to Water vs. Time
Cold Springs Terminal
7431 Hillside Road
Baldwinsvile, NY
June 24, 2014



Appendix H
Summary of VEGE Pilot Testing- A-16: Lab Data
Cold Springs Terminal
7431 Hillside Road
Baldwinsvile, NY

Air Vapor Sampling

Parameter	ppbv	ug/mg^3	lbs/year
1,2,4-Trimehtylbenzene	32,300	159,000	149.71
1,3,5-Trimethylbenzene	12,300	60,500	56.97
Benzene	12,200	39,000	36.72
Ethylbenzene	13,600	59,000	55.55
Toluene	35,200	133,000	125.23
Xylenes (m&p)	61,100	265,000	249.52
Xylenes (o)	22,500	97,600	91.90
Total	**189,200**	**813,100**	**766**

((ppbv*MW)/24.46)*ug/m^3 * 525600 min/year * 2.20E^9 lbs/ug * 0.02831685 m^3/ft^3 * 30 ft^3/min = lbs/year

Groundwater Sampling

Parameter	Concetration (ug/L)	lbs/yr
Chloroform	116	1.92
Benzene	3700	61.16
Toluene	5100	84.30
Ethylbenzene	965	15.95
m&p-Xylene	3490	57.69
o-Xylene	1660	27.44
n-Propylbenzene	124	2.05
1,3,5-Trimethylbenzene	315	5.21
1,2,4-Trimethylbenzene	1100	18.18
Naphthalene	873	14.43
Total Xylenes	5150	85.12
Total	22593	373.44

3.77 (gpm) * conc (ug/l) * 2.02462*10-9 lb/ug * 3.78413 L/gal * 525,600 min/year = lbs/year

Total lbs/year **1,139.05**

Appendix I

Summary of MPE Pilot Testing Well S-3

Appendix I
Summary of VEGE Pilot Test – S-3
Cold Springs Terminal
7431 Hillside Road
Baldswinsville, NY
June 26, 2014

The following major equipment was utilized for VEGE testing on S-3

- A 7.5 horsepower (HP) Roots positive displacement blower with a variable frequency drive (VFD) capable of directly controlling the vacuum and flow applied to the extraction wellhead. By changing the frequency at which the motor was operated, the applied vacuum and blower operational flow rate could also be changed. This allowed the MPE pilot test to be conducted without introducing dilution air; therefore, collecting additional data (e.g. dilution air flowrate) to be evaluated was not required.
- A moisture separator allowed condensate (when present) in the soil vapor stream to accumulate, and pumped to a storage tank for treatment (when necessary). Piping from the blower was connected to the extraction wellhead, which had flow measurement and sample ports.
- A hose connected the inlet to the positive displacement blower, used to apply a vacuum to the formation, to the Test Well wellhead utilizing various 2 inch diameter hose fittings and valves and a wellhead adapter.
- For VEGE testing, the wellhead adapter allowed for insertion of 1" (water/NAPL return) and 3/8" (air supply) hoses connected to the submersible pump. In the DPE testing scenario a 4" T fitting with a 4" by 2" bushing was installed just below the well seal and connected to the positive displacement blower as discussed above.
- The pump used was an AP-4 top loading submersible pump attached to a GAST 2-HP rotary vane air compressor. The piping that connected the compressor to the wellhead included a pressure relief valve, a manual bleed valve, pressure gauges, a control valve, and a rotometer. A discharge air line was also connected to the top of the pump.
- Volatile organic compounds (VOCs) concentrations in extracted vapors were monitored using either a MiniRae Photon Ionization Detector (PID) or a MiniRae 5-gas meter (MiniRae) calibrated with isobutylene. The MiniRae was also used to measure oxygen (O2), carbon dioxide (CO2), and Lower Explosive Level (LEL), in the extracted vapors and monitoring point/wellhead readings. Two digital manometers, with various pressure/vacuum ranges, and a hot-wire anemometer were used to collect the soil vapor temperature extracted from the Test Wells and various operating parameters discussed below.
- The monitoring points/wells at various radial distances from the Test Well were fitted with removable caps equipped with sample ports to allow for the collection of observed pressure measurements (vacuum influence), depth to NAPL and groundwater using an Electronic Interface Probe (EIP), and soil vapor concentration with a PID. Soil vapor samples were collected for lab analysis by EPA TO-15, using 6 Liter SUMMA canisters, and were collected as grab samples from the sample ports located on the 4 inch PVC piping following the blower output. Groundwater samples were collected for lab analysis by Metals, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), and VOCs at a sample port before the Oil water separator

Appendix I
Summary of VEGE - S-3
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 25, 2014

	SVE	Blower Effluent					S-3							DTB 20.0 ft	
Time (min)	Vac (" Hg)	Pressure (" H_20)	Vapor Flow Rate (scfm)	VOC (ppm_v)	O2 (%)	LEL (%)	Water Collected (gals)	Δ Water Collected (gals)	NAPL Collected (gals)	Flow Rate (gals/min)	DTW (ft)	Δ DTW (ft)	DTP (ft)	Thickness (ft)	Corrected Water Table (ft)
Pumping Only															
0	NA	NM	NA	NM	NM	NM	0.00	NA	NA	NA	8.56	NA	7.42	1.14	7.67
30	NA	NM	NA	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
60	NA	NM	NA	NM	NM	NM	5	5	3.33	0.08	NM	NM	NM	NM	NM
MPE Step 1															
90	5.10	2.00	20.53	577	NM	NM	60	55	NM	1.83	NM	NM	NM	NM	NM
120	5.10	NM	20.88	499	NM	NM	90	35	NM	1.00	NM	NM	NM	NM	NM
150	NM	NM	21.32	478	19.60	62	158	123	NM	2.27	NM	NM	NM	NM	NM
180	NM	NM	19.58	446	19.40	51	204	81	5.00	1.53	NM	NM	NM	NM	NM
MPE Step 2															
210	7.80	3.00	29.23	521	18.80	81	250	46	NM	1.53	NM	NM	NM	NM	NM
240	NM	NM	27.93	489	19.00	97	304	304	NM	1.80	NM	NM	NM	NM	NM
270	NM	NM	28.62	507	19.00	88	355	105	NM	1.70	NM	NM	NM	NM	NM
300	8.20	NM	27.75	481	18.80	92	406	102	6.66	1.70	NM	NM	NM	NM	NM
MPE Step 3															
330	13.00	5.00	30.45	501	18.20	>99	489	83	NM	2.77	NM	NM	NM	NM	NM
360	NM	NM	30.28	498	18.20	>99	560	71	NM	2.37	NM	NM	NM	NM	NM
390	NM	NM	29.49	475	18.10	>99	641	81	NM	2.70	NM	NM	NM	NM	NM
420	NM	NM	29.67	481	17.90	>99	722	81	10.66	2.70	NM	NM	NM	NM	NM
Recovery															
425	NM	NA	NA	NM	NM	NM	NA	NA	NM	NM	14.85	-7.18	ND	NA	NA
430	NM	NA	NA	NM	NM	NM	NA	NA	NM	NM	12.63	-4.96	ND	NA	NA
435	NM	NA	NA	NM	NM	NM	NA	NA	NM	NM	11.30	-3.63	ND	NA	NA
440	NM	NA	NA	NM	NM	NM	NA	NA	NM	NM	10.61	-2.94	ND	NA	NA
445	NM	NA	NA	NM	NM	NM	NA	NA	NM	NM	10.47	-2.80	ND	NA	NA
450	NM	NA	NA	NM	NM	NM	NA	NA	NM	NM	10.36	-2.69	ND	NA	NA
455	NM	NA	NA	NM	NM	NM	NA	NA	NM	NM	10.33	-2.66	ND	NA	NA
460	NM	NA	NA	NM	NM	NM	NA	NA	NM	NM	10.22	-2.55	ND	NA	NA
465	NM	NA	NA	NM	NM	NM	NA	NA	NM	NM	10.12	-2.45	ND	NA	NA
470	NM	NA	NA	NM	NM	NM	NA	NA	NM	NM	10.07	-2.40	ND	NA	NA

Notes: Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to S-3 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

Appendix I
Summary of VEGE Pilot Testing - S-3
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 25, 2014

Time (min)	S-7 Screen Int. 5.0'-20.0' Distance to S-3 44 feet						B-16 Screen Int. 6.5'-21.5' Distance to S-3 24 feet						MW-B Screen Int. NM Distance to S-3 3 feet					
	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)
Pumping Only																		
0	NM	NM	6.75	NA	ND	NA	NM	NM	9.29	NA	ND	NA	NM	NM	9.52	NA	9.49	0.03
30	NM	NM	6.70	0.05	ND	NA	NM	NM	9.07	0.22	ND	NA	NM	NM	9.44	0.08	ND	NA
60	NM	NM	6.69	0.06	ND	NA	NM	NM	9.09	0.20	9.07	0.02	NM	NM	9.43	0.09	9.39	0.04
MPE Step 1																		
90	0.00	NM	6.55	0.20	ND	NA	-0.11	NM	9.52	-0.23	9.49	0.03	-3.96	NM	10.07	-0.55	10.00	0.07
120	0.21	NM	6.40	0.35	ND	NA	0.00	NM	9.53	-0.24	9.49	0.04	-4.16	NM	10.28	-0.76	10.21	0.07
150	1.26	NM	6.43	0.32	ND	NA	0.00	NM	9.54	-0.25	9.51	0.03	-3.27	NM	10.42	-0.90	10.36	0.06
180	2.67	NM	6.34	0.41	ND	NA	0.00	NM	9.64	-0.35	ND	NA	-3.55	NM	10.40	-0.88	ND	NA
MPE Step 2																		
210	4.31	NM	5.54	1.21	ND	NA	0.00	NM	9.46	-0.17	ND	NA	-3.22	NM	10.58	-1.06	ND	NA
240	1.76	NM	4.92	1.83	ND	NA	0.00	NM	9.48	-0.19	9.45	0.03	-4.32	NM	10.79	-1.35	10.64	0.15
270	1.66	87.6	4.88	1.87	ND	NA	0.00	88.90	9.61	-0.32	9.54	0.07	-5.18	332.40	10.73	-1.21	10.65	0.08
300	1.35	NM	4.65	2.10	ND	NA	0.00	NM	9.62	-0.33	9.60	0.02	-5.32	NM	10.80	-1.28	10.78	0.02
MPE Step 3																		
330	-0.14	NM	4.68	2.07	ND	NA	0.00	NM	9.69	-0.40	9.67	0.02	-7.02	NM	11.10	-1.58	11.04	0.06
360	-0.48	NM	4.71	2.04	ND	NA	0.00	NM	9.73	-0.44	9.71	0.02	-8.20	NM	11.57	-2.05	11.51	0.06
390	-0.82	NM	4.73	2.02	ND	NA	0.00	NM	9.77	-0.48	9.75	0.02	-7.35	NM	11.63	-2.19	11.57	0.06
420	-1.13	NM	4.73	2.02	ND	NA	0.00	NM	9.79	-0.50	9.77	0.02	-8.77	NM	11.81	-2.38	11.53	0.28
Recovery																		
435	NM	NM	4.53	2.22	ND	NA	NM	NM	8.60	0.69	ND	NA	NM	NM	11.33	-1.81	NM	NA
445	NM	NM	4.47	2.28	ND	NA	NM	NM	8.54	0.75	ND	NA	NM	NM	11.00	-1.48	10.94	0.06
455	NM	NM	4.38	2.37	ND	NA	NM	NM	8.33	0.96	ND	NA	NM	NM	10.72	-1.20	NM	NA
475	NM	NM	4.36	2.39	ND	NA	NM	NM	7.72	1.57	ND	NA	NM	NM	11.57	-2.05	11.52	0.05

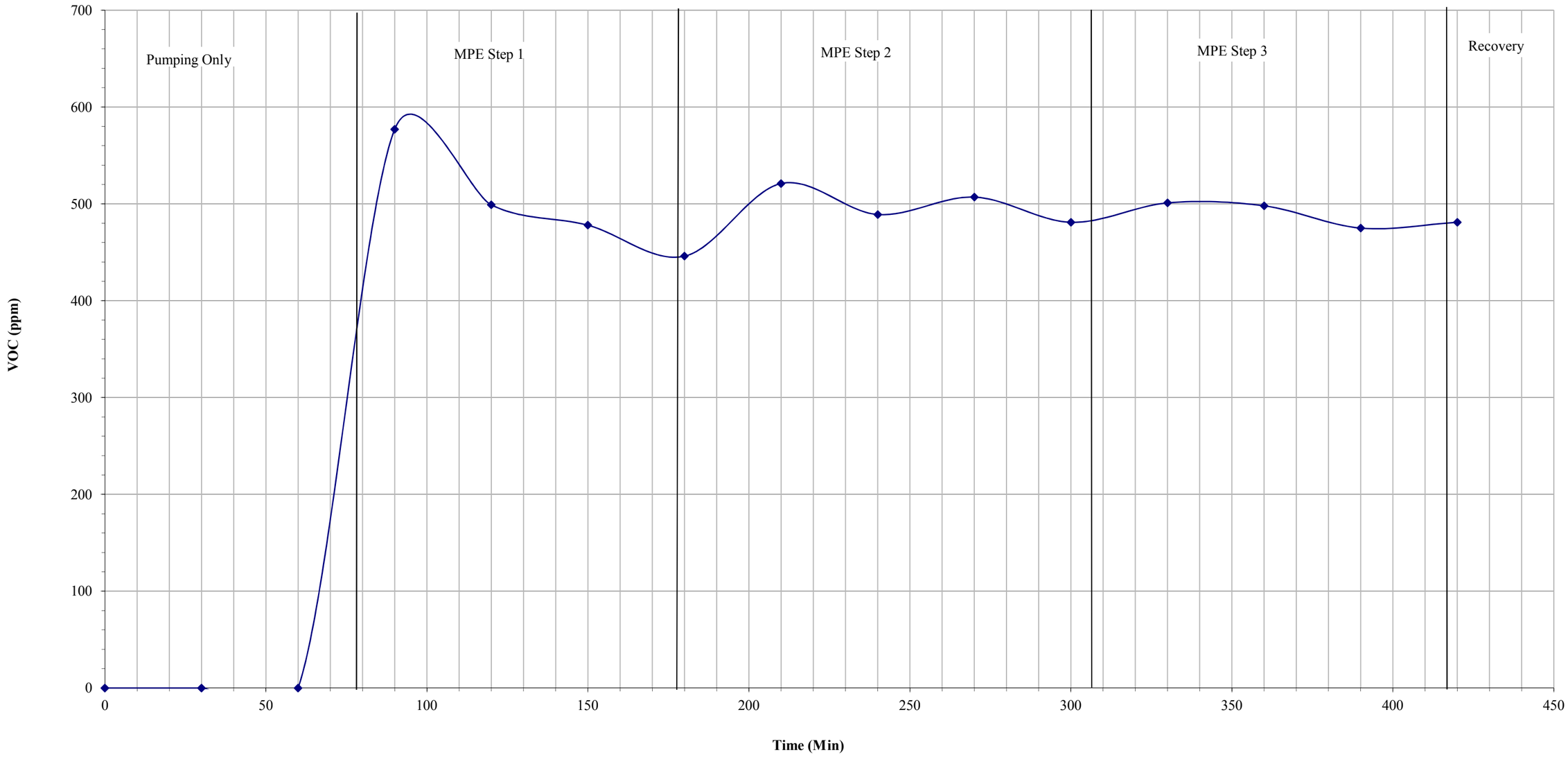
Notes:
Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to S-3 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

Appendix I
Summary of VEGE Pilot Testing - S-3
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 25, 2014

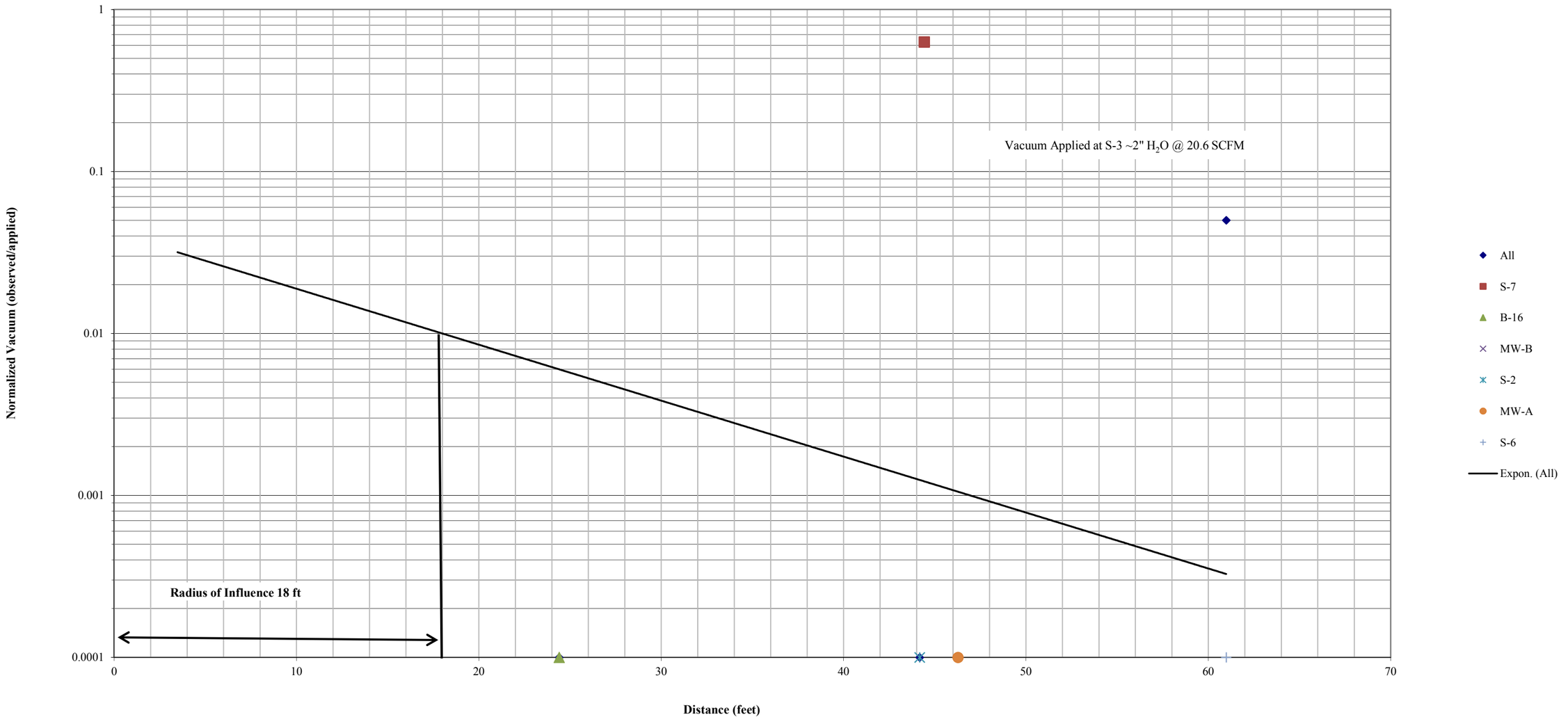
Time (min)	S-2 Screen Int. 5.0'-20.0' Distance to S-3 44 feet						MW-A Screen Int. NM Distance to S-3 46 feet						S-6 Screen Int. 5.0'-20.0' Distance to S-3 61 feet					
	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)
Pumping Only																		
0	NM	NM	10.95	NA	10.46	0.49	NM	NM	12.22	NA	ND	NA	NM	NM	8.00	NA	7.97	0.03
30	NM	NM	10.97	-0.02	**7.46**	3.51	NM	NM	12.21	0.01	ND	NA	NM	NM	6.10	1.90	ND	NA
60	NM	NM	10.89	0.06	**7.40**	3.49	NM	NM	12.25	-0.03	ND	NA	NM	NM	6.22	1.78	6.20	0.02
MPE Step 1																		
90	0.00	NM	10.67	0.28	10.19	0.48	0.00	NM	12.28	-0.06	ND	NA	-0.80	NM	6.68	1.32	6.57	0.11
120	0.00	NM	10.52	0.43	10.03	0.49	0.00	NM	12.30	-0.08	ND	NA	-0.34	NM	6.78	1.22	6.65	0.13
150	0.00	NM	10.43	0.52	9.94	0.49	0.00	NM	12.31	-0.09	ND	NA	-0.10	NM	6.84	1.16	6.74	0.10
180	0.00	NM	10.35	0.60	9.85	0.50	0.00	NM	12.31	-0.09	ND	NA	3.20	NM	5.10	2.90	ND	NA
MPE Step 2																		
210	-0.12	NM	10.19	0.76	9.70	0.49	0.00	NM	12.30	-0.08	ND	NA	0.08	NM	4.45	3.55	4.42	0.03
240	0.00	NM	10.04	0.91	9.56	0.48	0.00	NM	12.30	-0.08	ND	NA	0.06	NM	4.91	3.09	4.79	0.12
270	0.00	489.6	9.86	1.09	9.33	0.53	-0.07	417.9	12.29	-0.07	ND	NA	0.18	230.0	4.89	3.11	4.80	0.09
300	0.00	NM	9.73	1.22	9.24	0.49	-0.11	NM	12.28	-0.06	ND	NA	0.00	NM	4.83	3.17	4.74	0.09
MPE Step 3																		
330	0.00	NM	9.67	1.28	9.15	0.52	-0.15	NM	12.23	-0.01	ND	NA	-0.07	NM	4.92	3.08	4.81	0.11
360	0.00	NM	9.64	1.31	9.18	0.46	-0.18	NM	12.19	0.03	ND	NA	0.00	NM	4.98	3.02	4.87	0.11
390	0.00	371.0	9.66	1.29	9.15	0.51	-0.17	72.90	12.18	0.04	ND	NA	0.00	NM	5.00	3.00	4.91	0.09
420	0.00	NM	9.71	1.24	9.21	0.50	-0.17	NM	12.21	0.01	ND	NA	0.00	NM	5.01	2.99	4.92	0.09
Recovery																		
435	NM	NM	9.71	1.24	9.21	0.50	NM	NM	12.22	0.00	ND	NA	NM	NM	4.10	3.90	3.99	0.11
445	NM	NM	9.69	1.26	9.19	0.50	NM	NM	12.20	0.02	ND	NA	NM	NM	4.10	3.90	4.02	0.08
455	NM	NM	9.67	1.28	9.17	0.50	NM	NM	12.20	0.02	ND	NA	NM	NM	4.04	3.96	3.95	0.09
475	NM	NM	9.63	1.32	9.13	0.50	NM	NM	12.17	0.05	ND	NA	NM	NM	4.29	3.71	4.19	0.10

Notes:
Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to S-3 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

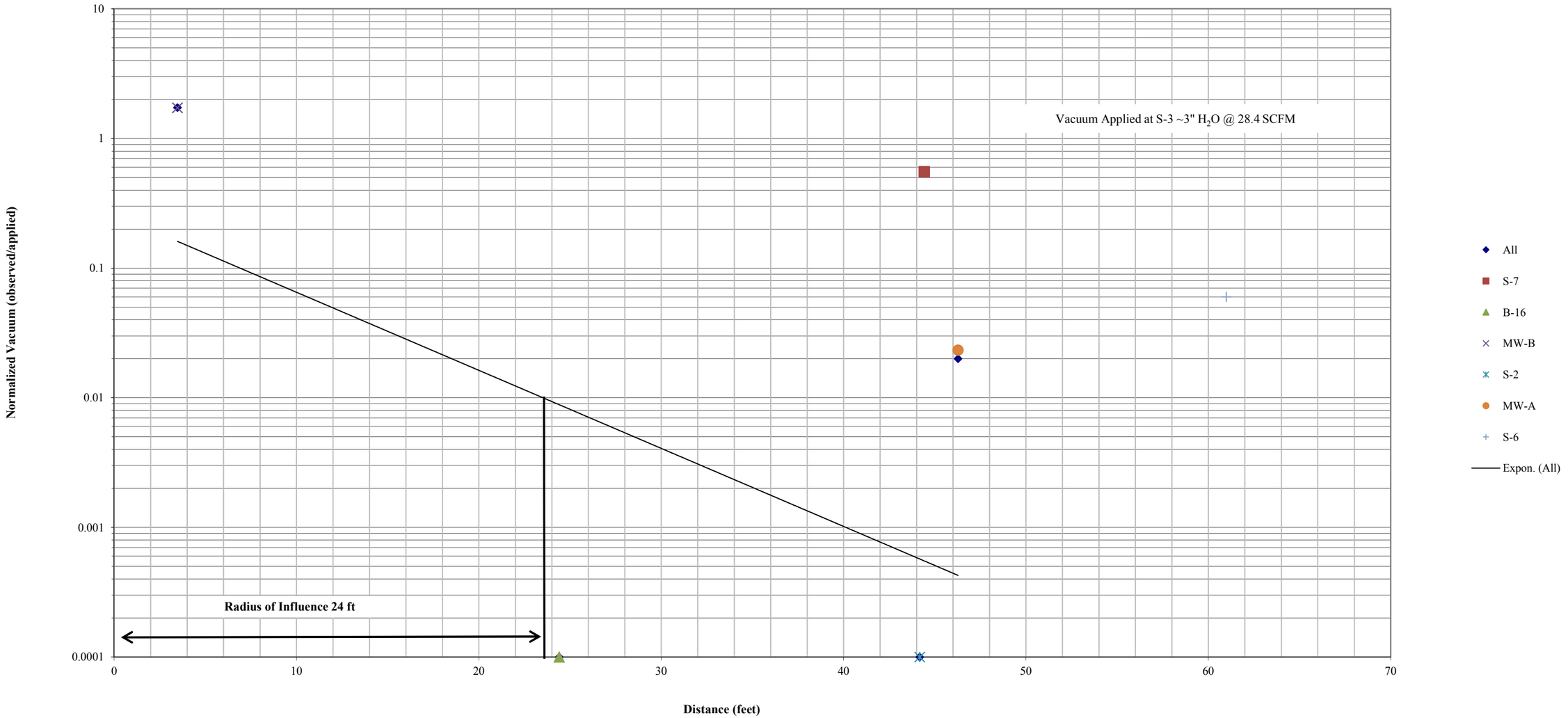
Appendix I
Summary of VEGE Pilot Testing S-3: VOC Concentration vs. Time
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 25, 2014



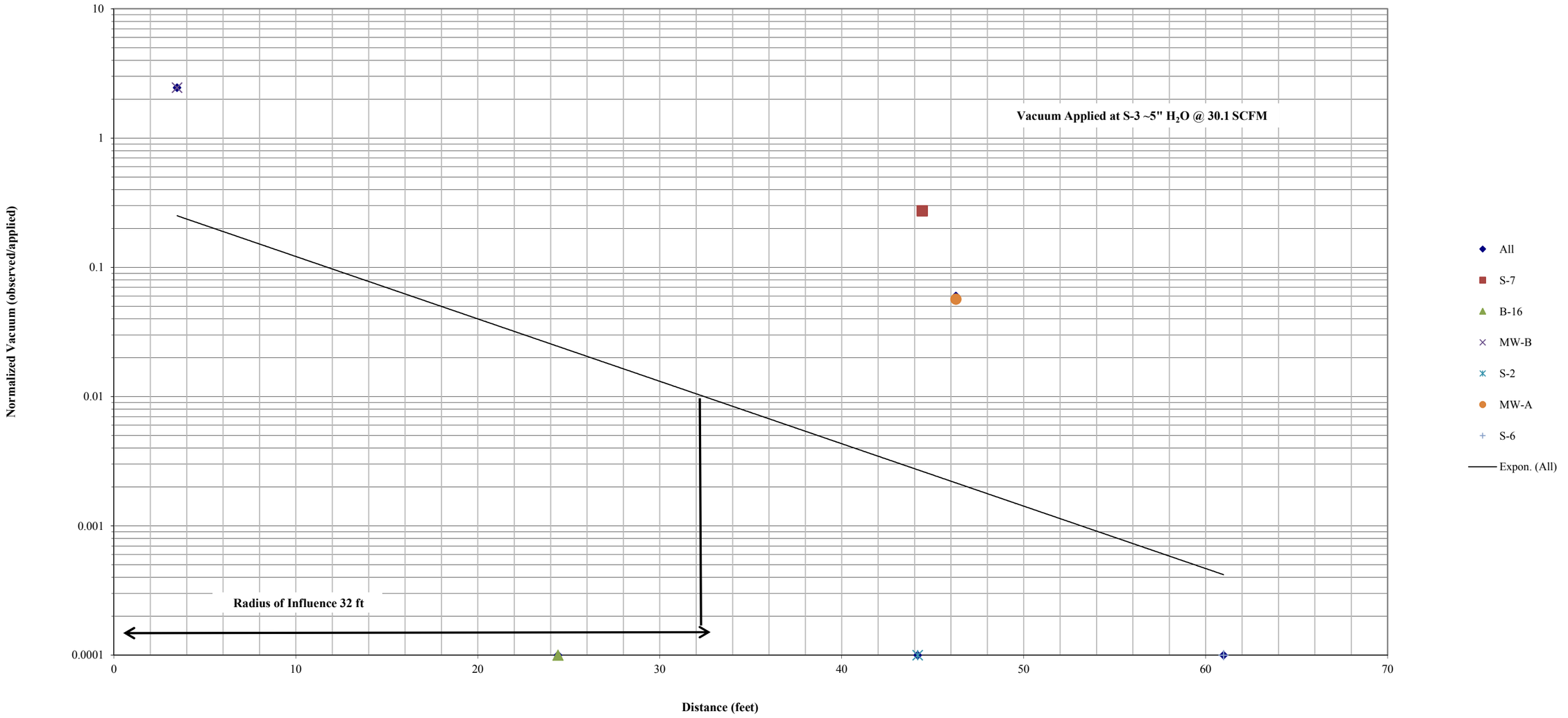
Appendix I
Summary of VEGE Pilot Testing S-3: Step 1 Normalized Vacuum vs. Distance from S-3
Cold Springs Terminal
7431 Hillside Road
Baldwinsvile, NY
June 25, 2014



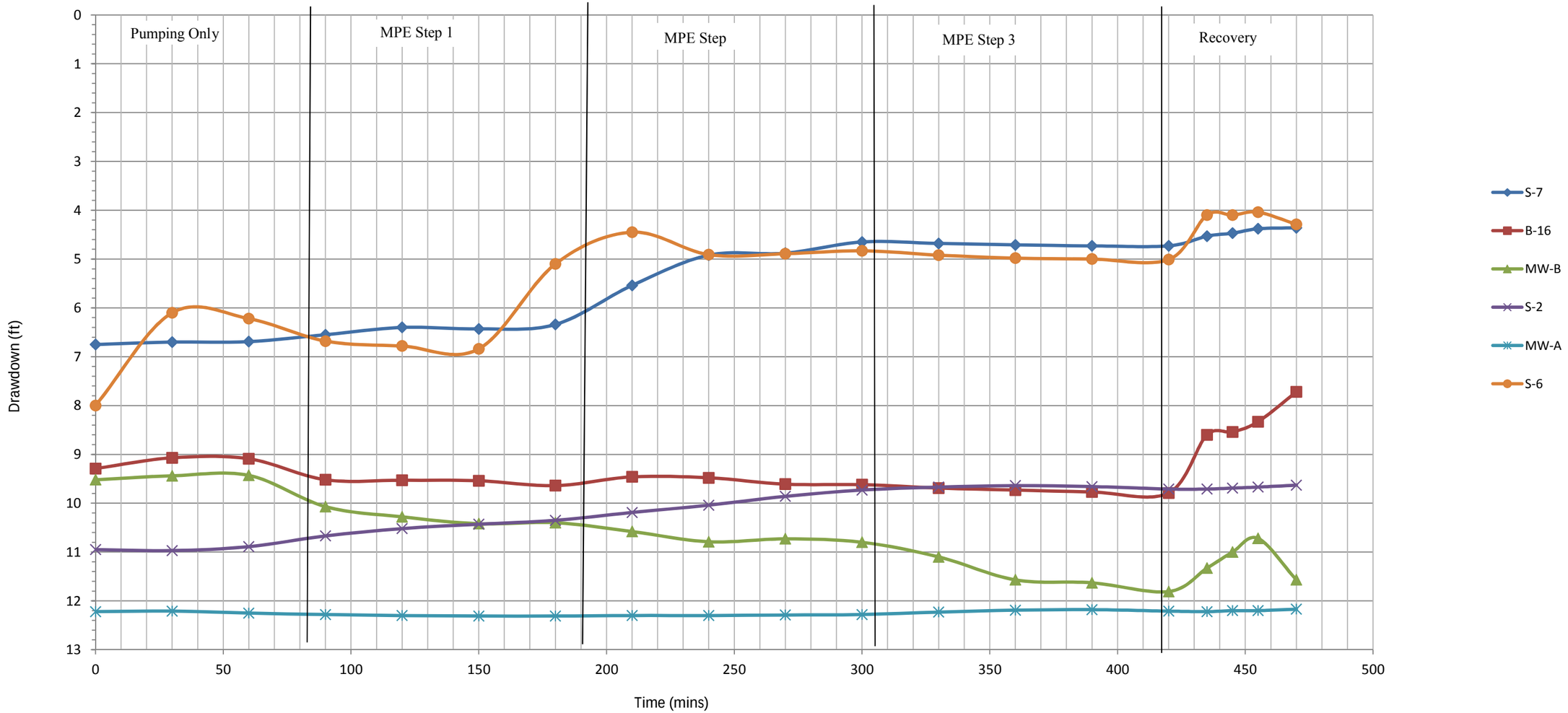
Appendix I
Summary of VEGE Pilot Testing S-3: Step 2 Normalized Vacuum vs. Distance from S-3
Cold Springs Terminal
7431 Hillside Road
Baldwinsvile, NY
June 25, 2014



Appendix I
Summary of VEGE Pilot Testing S-3: Step 3 Normalized Vacuum vs. Distance from S-3
Cold Springs Terminal
7431 Hillside Road
Baldwinsvile, NY
June 25, 2014



Appendix I
Summary of VEGE Pilot Testing S-3: Depth to Water vs. Time
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 25, 2014



Appendix I
Summary of VEGE Pilot Testing S-3: Lab Data
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 25, 2014

Air Vapor Sampling

Parameter	ppbv	ug/mg^3	lbs/year
1,2,4-Trimehtylbenzene	7,320	36,000	34.84
1,3,5-Trimethylbenzene	2,920	14,400	13.94
Benzene	26,700	85,200	82.46
Ethylbenzene	11,600	50,500	48.88
Toluene	109,000	410,000	396.82
Xylenes (m&p)	45,500	198,000	191.63
Xylenes (o)	14,400	62,400	60.39
Total	**217,440**	**856,500**	**829**

((ppbv*MW)/24.46)*ug/m^3 * 525600 min/year * 2.20E^9 lbs/ug * 0.02831685 m^3/ft^3 * 29.9 ft^3/min = lbs/year

Groundwater Sampling

Parameter	Concetration ug/l	lbs/year
Chloroform	122	1.28
Benzene	5610	58.74
Toluene	10000	104.70
Ethylbenzene	1190	12.46
m&p-Xylene	4240	44.39
o-Xylene	1710	17.90
n-Propylbenzene	138	1.44
1,3,5-Trimethylbenzene	337	3.53
1,2,4-Trimethylbenzene	1150	12.04
Naphthalene	982	10.28
Total Xylenes	5950	62.30
Total	**31,429**	329.06

2.6 (gpm) * conc (ug/l) * 2.02462*10-9 lb/ug * 3.78413 L/gal * 525,600 min/year = lbs/year

Total lbs/year **1,158.01**

Appendix J

Summary of MPE Pilot Testing Well S-15

Appendix J
Summary of VEGE Pilot Test – S-15
Cold Springs Terminal
7431 Hillside Road
Baldswinsville, NY
June 26, 2014

The following major equipment was utilized for VEGE testing on S-15

- A 7.5 horsepower (HP) Roots positive displacement blower with a variable frequency drive (VFD) capable of directly controlling the vacuum and flow applied to the extraction wellhead. By changing the frequency at which the motor was operated, the applied vacuum and blower operational flow rate could also be changed. This allowed the MPE pilot test to be conducted without introducing dilution air; therefore, collecting additional data (e.g. dilution air flowrate) to be evaluated was not required.
- A moisture separator allowed condensate (when present) in the soil vapor stream to accumulate, and pumped to a storage tank for treatment (when necessary). Piping from the blower was connected to the extraction wellhead, which had flow measurement and sample ports.
- A hose connected the inlet to the positive displacement blower, used to apply a vacuum to the formation, to the Test Well wellhead utilizing various 2 inch diameter hose fittings and valves and a wellhead adapter.
- For VEGE testing, the wellhead adapter allowed for insertion of 1" (water/NAPL return) and 3/8" (air supply) hoses connected to the submersible pump. In the DPE testing scenario a 4" T fitting with a 4" by 2" bushing was installed just below the well seal and connected to the positive displacement blower as discussed above.
- The pump used was an AP-4 top loading submersible pump attached to a GAST 2-HP rotary vane air compressor. The piping that connected the compressor to the wellhead included a pressure relief valve, a manual bleed valve, pressure gauges, a control valve, and a rotometer. A discharge air line was also connected to the top of the pump.
- Volatile organic compounds (VOCs) concentrations in extracted vapors were monitored using either a MiniRae Photon Ionization Detector (PID) or a MiniRae 5-gas meter (MiniRae) calibrated with isobutylene. The MiniRae was also used to measure oxygen (O2), carbon dioxide (CO2), and Lower Explosive Level (LEL), in the extracted vapors and monitoring point/wellhead readings. Two digital manometers, with various pressure/vacuum ranges, and a hot-wire anemometer were used to collect the soil vapor temperature extracted from the Test Wells and various operating parameters discussed below.
- The monitoring points/wells at various radial distances from the Test Well were fitted with removable caps equipped with sample ports to allow for the collection of observed pressure measurements (vacuum influence), depth to NAPL and groundwater using an Electronic Interface Probe (EIP), and soil vapor concentration with a PID. Soil vapor samples were collected for lab analysis by EPA TO-15, using 6 Liter SUMMA canisters, and were collected as grab samples from the sample ports located on the 4 inch PVC piping following the blower output. Groundwater samples were collected for lab analysis by Metals, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), and VOCs at a sample port before the Oil water separator

Appendix J
Summary of VEGE Pilot Testing - S-15
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 26, 2014

Time (min)	SVE	Blower Effluent					S-15							DTB 19.0 ft	
	Vac (Hg)	Pressure (" H_20)	Vapor Flow Rate (scfm)	VOC (ppm_v)	O2 (%)	LEL (%)	Water Collected (gals)	Δ Water Collected (gals)	NAPL Collected (gals)	Flow Rate (gpm)	DTW (ft)	Δ DTW (ft)	DTP (ft)	Thickness (ft)	Corrected Water Table (ft)
Pumping Only															
0	ND	NM	NM	NA	NA	NA	0	NA	ND	NA	5.15	NA	ND	NA	NA
30	ND	NM	NM	NA	NA	NA	10	10	ND	0.33	NM	NM	ND	NA	NA
60	ND	NM	NM	NA	NA	NA	38	28	ND	0.93	NM	NM	ND	NA	NA
MPE Step 1															
90	4.99	NM	15.66	55	20.9	0.0	66	28	ND	0.93	NM	NM	ND	NA	NA
120	4.88	NM	26.10	49	20.9	0.0	94	28	ND	0.93	NM	NM	ND	NA	NA
150	5.00	NM	24.36	39	20.9	0.0	119	25	ND	0.83	NM	NM	ND	NA	NA
180	5.03	2.00	20.01	44	20.8	0.0	138	19	ND	0.63	NM	NM	ND	NA	NA
MPE Step 2															
210	8.07	3.00	38.28	38	20.7	0.0	170	32	ND	1.07	NM	NM	ND	NA	NA
240	7.9	NM	33.06	32	20.9	0.0	196	26	ND	0.87	NM	NM	ND	NA	NA
270	8.1	NM	33.93	38	20.8	0.0	225	29	ND	0.97	NM	NM	ND	NA	NA
300	8.1	NM	33.50	NM	NM	NM	251	26	1.67	0.87	NM	NM	ND	NA	NA
MPE Step 3															
330	13.1	NM	36.54	45	20.9	0	286	35	NM	1.17	NM	NM	ND	NA	NA
360	NM	5.00	37.15	51	20.8	0	324	38	1.67	1.27	NM	NM	ND	NA	NA
390	12.7	NM	36.63	39	20.9	0	365	41	2.50	1.37	NM	NM	ND	NA	NA
420	NM	NM	35.58	41	20.9	0	403	38	2.50	1.27	NM	NM	ND	NA	NA
Recovery															
425	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	12.41	-7.26	ND	NA	NA
430	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	11.04	-5.89	ND	NA	NA
435	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	9.87	-4.72	ND	NA	NA
440	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	9.18	-4.03	ND	NA	NA
445	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	8.30	-3.15	ND	NA	NA
450	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	7.90	-2.75	ND	NA	NA
455	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	7.60	-2.45	ND	NA	NA
460	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	7.21	-2.06	ND	NA	NA
465	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	7.11	-1.96	ND	NA	NA
470	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	6.99	-1.84	ND	NA	NA
475	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	6.87	-1.72	ND	NA	NA
480	NM	NM	NA	NM	NM	NM	NA	NA	NA	NA	6.79	-1.64	ND	NA	NA

Notes: Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to S-15 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

Appendix J

Summary of VEGE Pilot Testing - S-15
Cold Spring Terminal
7431 Hillside Road
Baldwinsville, NY
June 26, 2014

Time (min)	S-16 Screen Int. 3.0'-18.0' Distance to S-15 44 feet						S-25 Screen Int. 4.0'-19.0' Distance to S-15 50 feet						S-20 Screen Int. 4.0'-9.0' Distance to S-15 21 feet					
	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)	Pressure (" H_2O)	VOC (ppm_v)	DTW (ft)	Δ DTW (ft)	DTP* (ft)	Thickness (ft)
Pumping Only																		
0	NA	NM	7.96	NA	4.52	3.44	NA	NM	7.72	NA	4.72	3.00	NA	NM	2.46	NA	NA	NA
30	NA	NM	7.92	0.04	4.50	3.42	NA	NM	7.75	-0.03	4.78	2.97	NA	NM	2.49	-0.03	NA	NA
60	NA	NM	7.90	0.06	4.49	3.41	NA	NM	7.76	-0.04	4.79	2.97	NA	NM	2.52	-0.06	NA	NA
MPE Step 1																		
90	0.00	NM	7.92	0.04	4.52	3.40	0.00	NM	7.79	-0.07	4.80	2.99	2.60	NM	2.62	-0.16	NA	NA
120	0.00	NM	7.96	0.00	4.56	3.40	0.00	NM	7.79	-0.07	4.82	2.97	0.50	NM	2.69	-0.23	NA	NA
150	0.00	704	8.00	-0.04	4.60	3.40	0.00	516	7.79	-0.07	4.82	2.97	0.67	403	2.73	-0.27	NA	NA
180	0.00	NM	8.01	-0.05	4.61	3.40	0.00	NM	7.81	-0.09	4.83	2.98	0.20	NM	2.67	-0.21	NA	NA
MPE Step 2																		
210	0.00	NM	8.04	-0.08	4.64	3.40	0.00	NM	7.83	-0.11	4.85	2.98	0.53	NM	2.68	-0.22	NA	NA
240	0.00	NM	8.07	-0.11	4.66	3.41	0.00	NM	7.83	-0.11	4.84	2.99	0.19	NM	2.73	-0.27	NA	NA
270	0.00	NM	8.09	-0.13	4.68	3.41	0.00	NM	7.84	-0.12	4.84	3.00	0.78	NM	2.79	-0.33	NA	NA
300	0.00	686	8.10	-0.14	4.70	3.40	0.00	630	7.83	-0.11	4.85	2.98	0.83	373	2.80	-0.34	NA	NA
MPE Step 3																		
330	0.00	NM	8.13	-0.17	4.72	3.41	0.00	NM	7.87	-0.15	4.87	3.00	0.53	NM	2.82	-0.36	NA	NA
360	0.00	NM	8.16	-0.20	4.75	3.41	0.00	NM	7.88	-0.16	4.89	2.99	0.47	NM	2.89	-0.43	NA	NA
390	0.00	663	8.21	-0.25	4.79	3.42	-0.06	598	7.87	-0.15	4.88	2.99	0.73	224	2.95	-0.49	NA	NA
420	0.00	NM	8.23	-0.27	4.82	3.41	0.00	NM	7.87	-0.15	4.88	2.99	0.75	NM	3.04	-0.58	NA	NA
Recovery																		
435	NA	NM	8.22	-0.26	4.82	3.40	NA	NM	7.79	-0.07	4.82	2.97	NA	NM	2.94	-0.48	NA	NA
445	NA	NM	8.22	-0.26	4.82	3.40	NA	NM	7.75	-0.03	4.78	2.97	NA	NM	2.88	-0.42	NA	NA
460	NA	NM	8.20	-0.24	4.81	3.39	NA	NM	7.70	0.02	4.75	2.95	NA	NM	2.81	-0.35	NA	NA
480	NA	NM	8.17	-0.21	4.78	3.39	NA	NM	7.72	0.00	4.72	3.00	NA	NM	2.75	-0.29	NA	NA

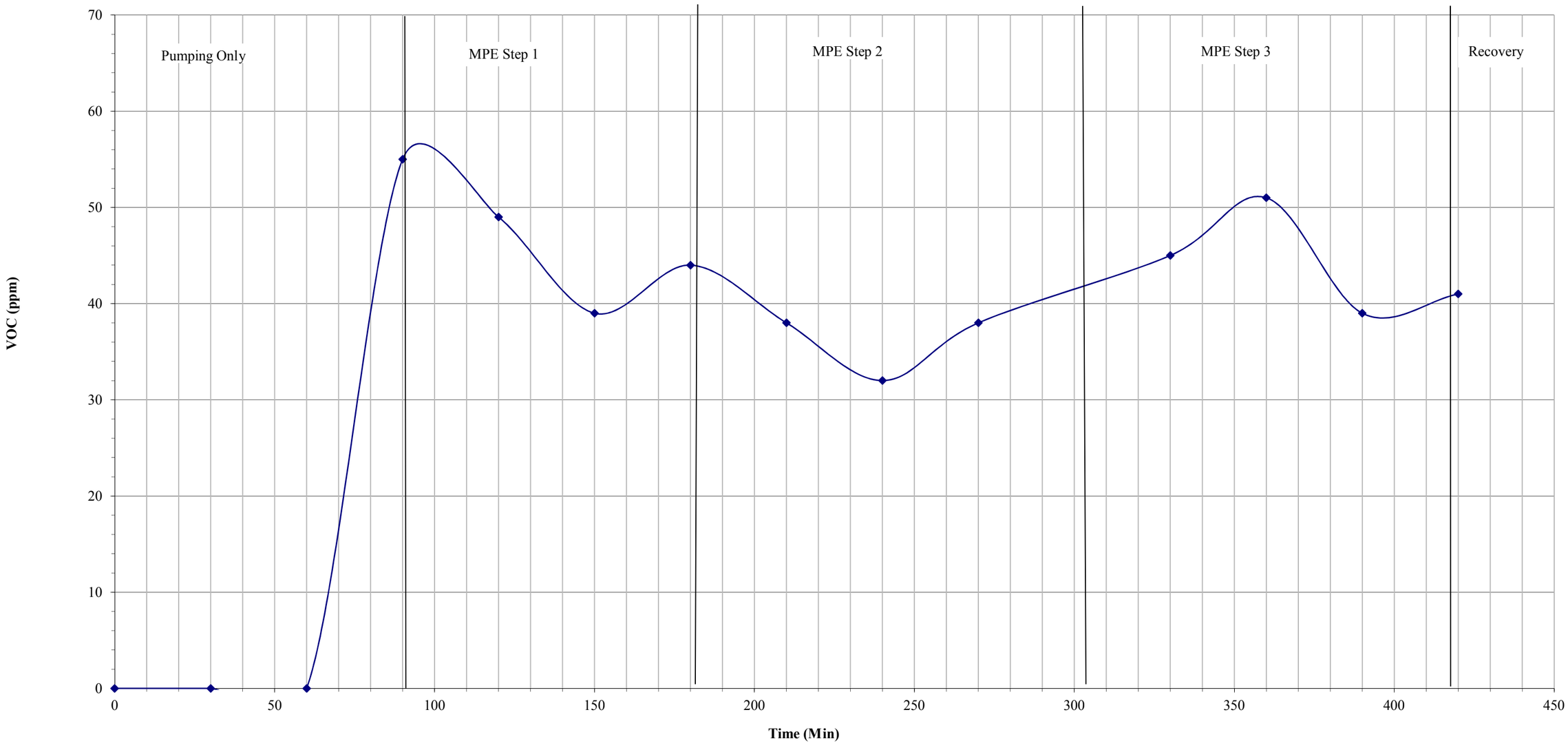
Notes:
Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to S-15 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

Appendix J
Summary of VEGE Pilot Testing - S-15
Cold Spring Terminal
7431 Hillside Road
Baldwinsville, NY
June 26, 2014

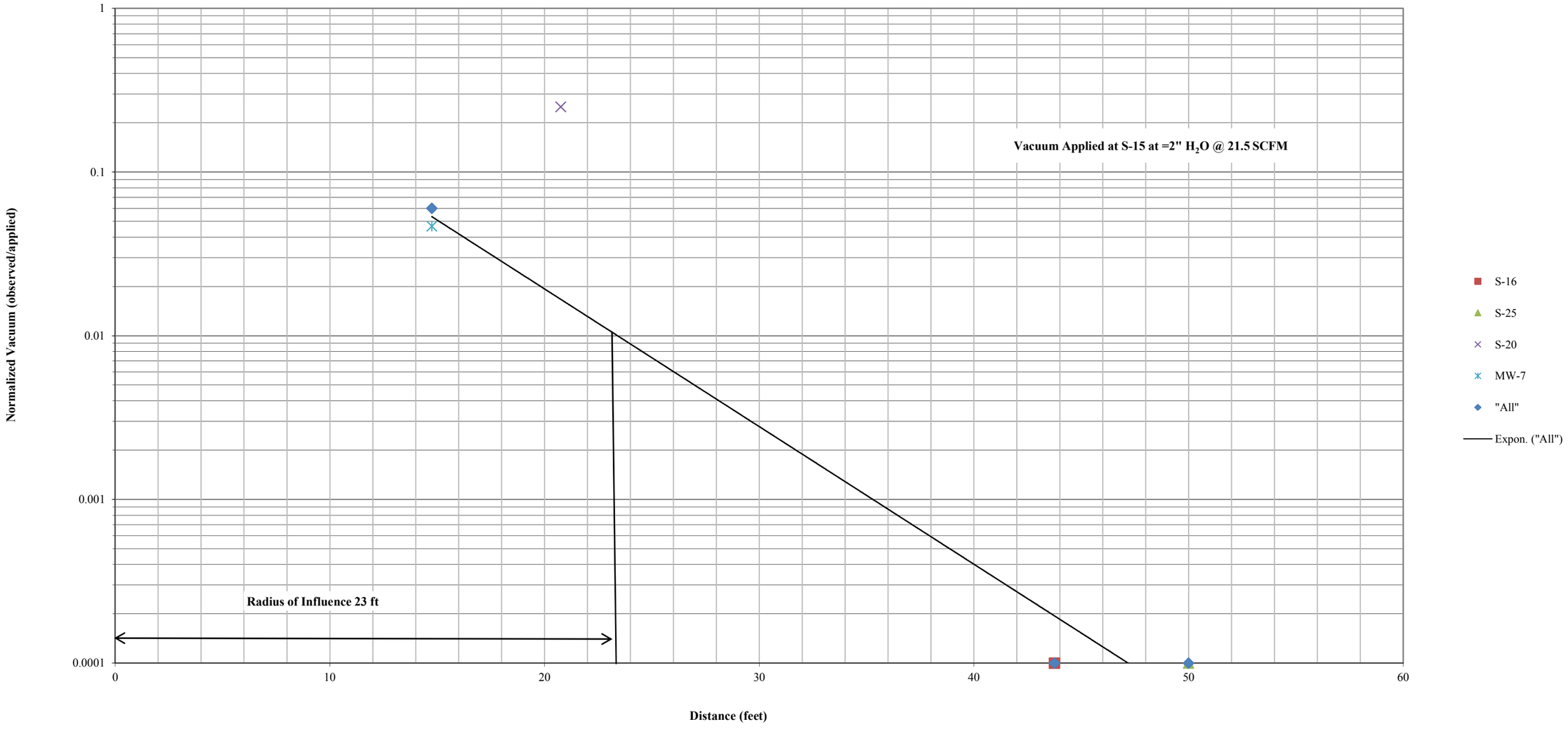
Time (min)	MW-7					
	Screen Int.	4.8'-18.8'	**Distance to S-15**		15	feet
	Pressure (" H_2O)	**VOC (ppm_v)**	**DTW (ft)**	**Δ DTW (ft)**	**DTP* (ft)**	**Thickness (ft)**
Pumping Only						
0	NA	NM	7.97	NA	7.88	0.09
30	NA	NM	8.62	-0.65	8.17	0.45
60	NA	NM	8.37	-0.40	ND	NA
MPE Step 1						
90	NM	NM	8.93	-0.96	8.90	0.03
120	-0.12	NM	9.23	-1.26	9.15	0.08
150	-0.08	91.3	9.36	-1.39	9.29	0.07
180	-0.08	NM	9.41	-1.44	9.35	0.06
MPE Step 2						
210	-0.05	NM	9.60	-1.63	9.52	0.08
240	-0.07	NM	9.70	-1.73	9.64	0.06
270	0.00	NM	9.81	-1.84	9.74	0.07
300	0.00	316	9.87	-1.90	9.82	0.05
MPE Step 3						
330	-0.16	NM	10.14	-2.17	10.08	0.06
360	0.00	NM	10.47	-2.50	10.41	0.06
390	-0.14	118.4	10.58	-2.61	10.52	0.06
420	-0.18	NM	10.60	-2.63	10.54	0.06
Recovery						
435	NA	NM	10.35	-2.38	10.30	0.05
445	NA	NM	10.12	-2.15	10.07	0.05
460	NA	NM	9.96	-1.99	9.91	0.05
480	NA	NM	9.80	-1.83	9.75	0.05

Notes:
Time - time from beginning of pilot test in minutes (min)
Pressure - Pressure observed at monitoring well
Distance to S-15 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
Δ DTW - change in depth to water
DTB - depth to bottom
DTP - depth to product
scfm -standard cubic feet per minute
NA - not applicable
ND - not detected
NM - not measured

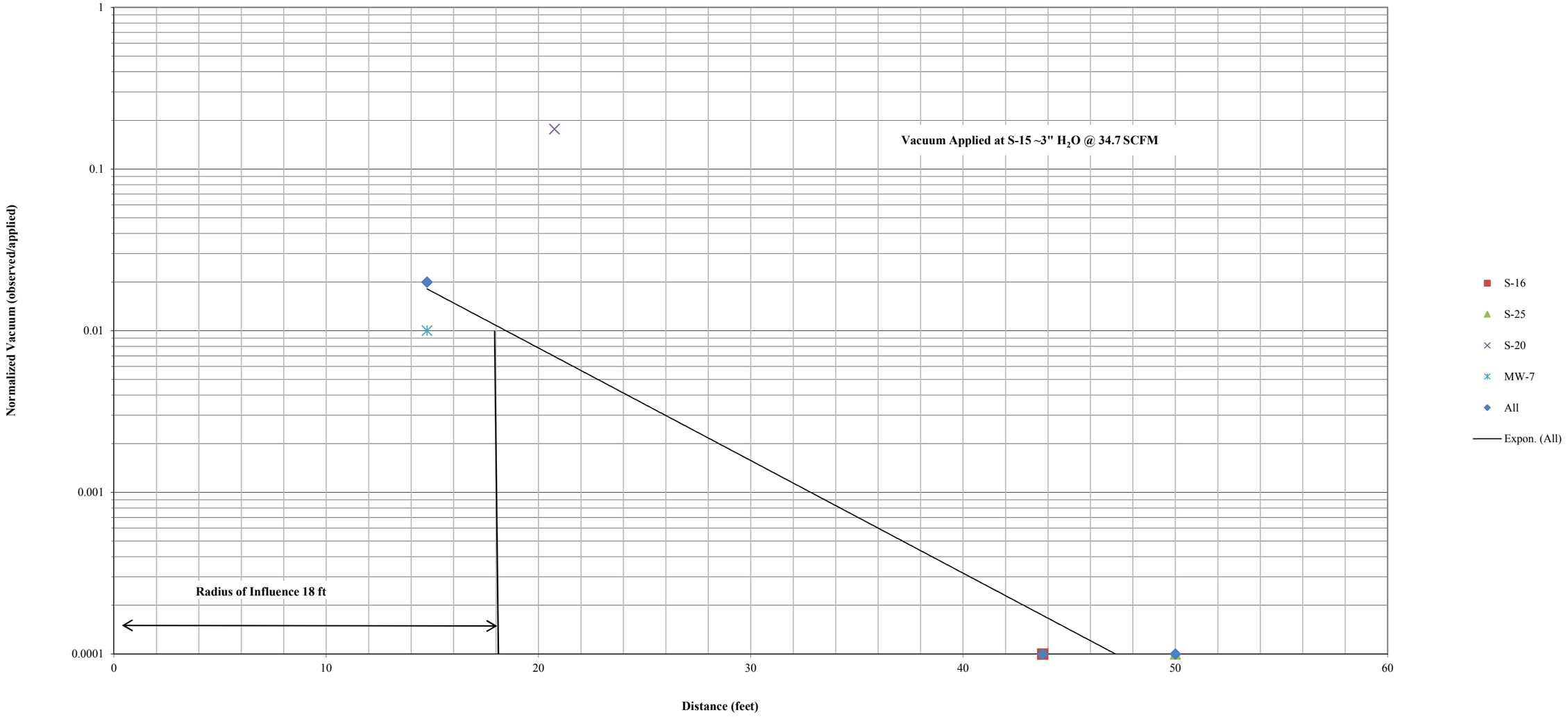
Appendix J
Summary of VEGE Pilot Testing - S-15: VOC Concentrations vs. Time
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 26, 2014



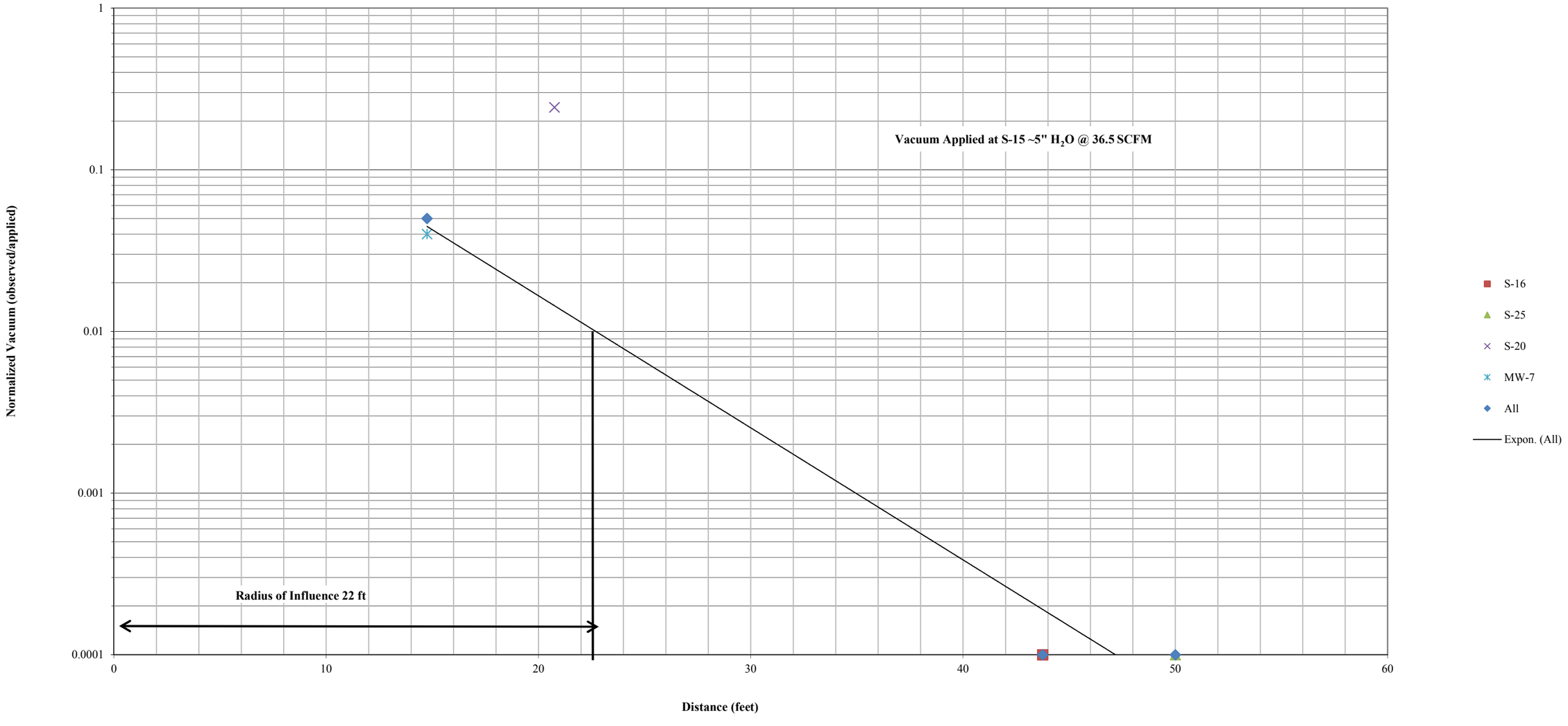
Appendix J
Summary of VEGE Pilot Testing - S-15: Step 1 Normalized Vacuum vs. Distance from S-15
Cold Spring Terminal
7431 Hillside Road
Baldwinsville, NY
June 26, 2014



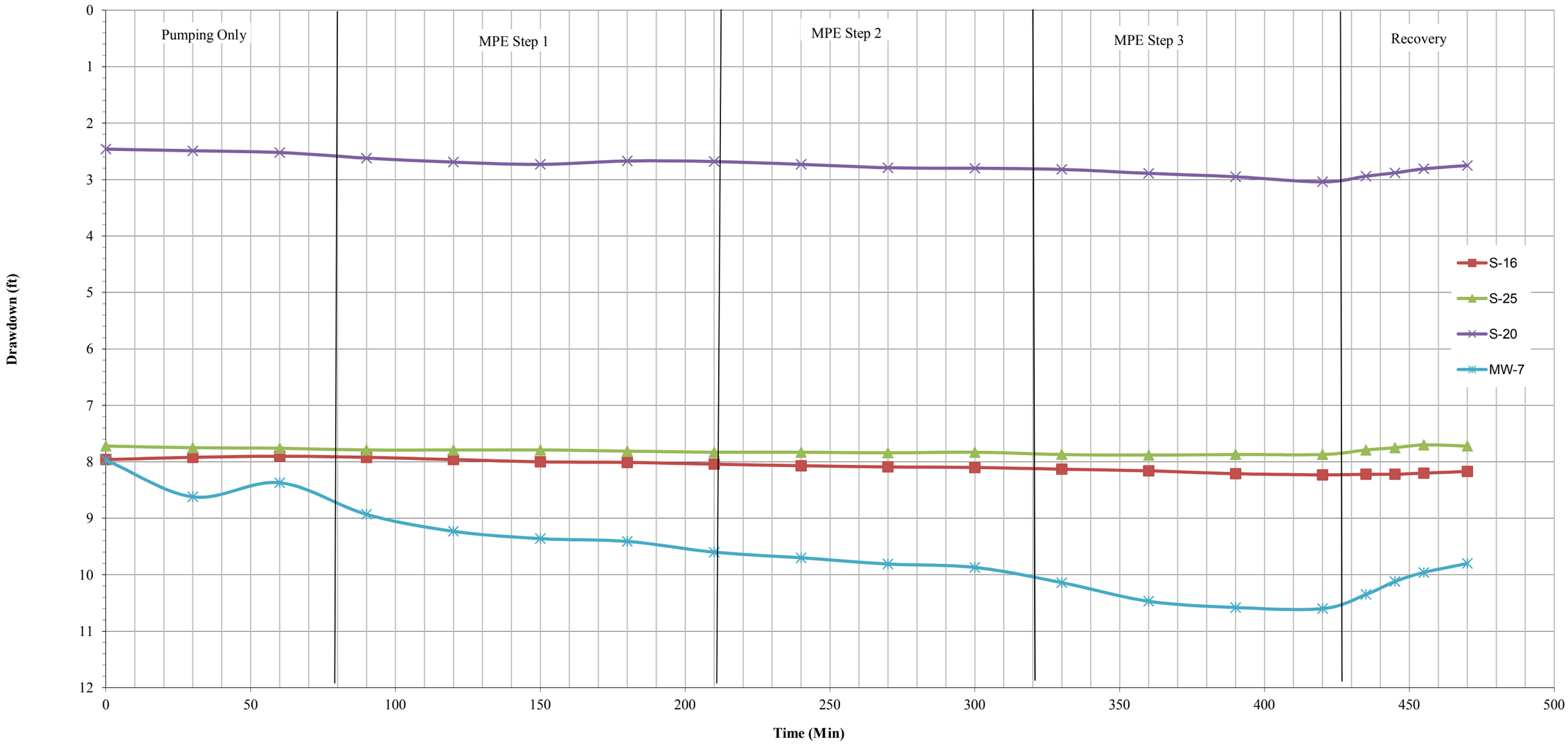
Appendix J
Summary of VEGE Pilot Testing - S-15: Step 2 Normalized Vacuum vs. Distance from S-15
Cold Spring Terminal
7431 Hillside Road
Baldwinsville, NY
June 26, 2014



Appendix J
Summary of VEGE Pilot Testing - S-15: Step 3 Normalized Vacuum vs. Distance from S-15
Cold Spring Terminal
7431 Hillside Road
Baldwinsville, NY
June 26, 2014



Appendix J
Summary of VEGE Pilot Testing - S-15: Depth to Water vs. Time
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 26, 2014



Appendix J
Summary of VEGE Pilot Testing - S-15: Lab Data
Cold Springs Terminal
7431 Hillside Road
Baldwinsville, NY
June 26, 2014

Air Sampling

Parameter	ppbv	ug/mg^3	lbs/year
1,2,4-Trimehtylbenzene	1,360	6,690	8.03
1,3,5-Trimethylbenzene	440	2,160	2.59
Benzene	500	1,600	1.92
Ethylbenzene	420	1,820	2.19
Methyl ethyl Ketone	2	6	0.01
Styrene	2	7	0.01
Tetrachloroethene	4	30	0.04
Toluene	1,120	4,220	5.07
Xylenes (m&p)	1,940	8,430	10.12
Xylenes (o)	700	3,040	3.65
Total	**6,488**	**28,003**	**34**

((ppbv*MW)/24.46)*ug/m^3 * 525600 min/year * 2.20E^9 lbs/ug * 0.02831685 m^3/ft^3 * 36.5 ft^3/min = lbs/year

Groundwater Sampling

Parameter	Concetration (ug/L)	lbs/year
1,2-Dichloroethane	302	1.58
Benzene	3610	18.90
Toluene	1350	7.07
Ethylbenzene	461	2.41
m&p-Xylene	1400	7.33
o-Xylene	579	3.03
Isopropylbenzene	47.7	0.25
n-Propylbenzene	85.3	0.45
1,3,5-Trimethylbenzene	181	0.95
1,2,4-Trimethylbenzene	527	2.76
sec-Butylbenzene	11.4	0.06
4-Isopropyltoluene	29	0.15
Naphthalene	571	2.99
MTBE	12.8	0.07
Total Xylenes	1979	10.36
Total	11146	58.35

1.3 (gpm) * conc (ug/l) * 2.02462*10-9 lb/ug * 3.78413 L/gal * 525,600 min/year = lbs/year

Total lbs/year **91.97**