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FINAL SUPPLEMENTAL INVESTIGATION TECHNICAL MEMORANDUM CHICORA TANK FARM CNC CHARLESTON SC

8/25/2014

RESOLUTION CONSULTANTS

FINAL SUPPLEMENTAL INVESTIGATION TECHNICAL MEMORANDUM

CHICORA TANK FARM; CHARLESTON NAVAL COMPLEX NORTH CHARLESTON, SOUTH CAROLINA

Version Number: 0

Prepared For:

Base Realignment and Closure Act
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Contract Number: N62470-11-D-8013
CTO JM29 and JM62

25 August 2014

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FINAL TECHNICAL MEMORANDUM

To: Art Sanford, Remedial Project Manager
David Criswell, Technical Representative
Base Realignment and Closure Act;
Naval Facilities Engineering Command Southeast

CC: Meredith Amick, Remedial Project Manager
South Carolina Department of Health and Environmental Control

From: Shawn Dolan, Task Order Manager
Resolution Consultants

Subject: Supplemental Investigation Technical Memorandum
Chicora Tank Farm, Former Charleston Naval Complex
North Charleston, South Carolina

Date: 25 August 2014

Resolution Consultants, on behalf of the Navy, has prepared this technical memorandum to present findings of the supplemental investigation for the former Chicora Tank Farm (CTF) associated with the Charleston Naval Complex in North Charleston, South Carolina (Site). Work was performed in accordance with Resolution Consultants' *Tier II Sampling and Analysis Plan, Supplemental Investigation, Chicora Tank Farm, Charleston Naval Complex* (herein after referred to as the SAP), dated 11 July 2013, Revision 1, and under the Comprehensive Long-Term Environmental Action Navy Contract No. N62470-11-D-8013, Contract Task Orders JM29 and JM62.

1.0 INTRODUCTION

Light non-aqueous phase liquid (LNAPL) has been measured at two monitoring wells, MW-34R and MW-33, during long-term monitoring (LTM) activities at the Site. Increasing thicknesses of LNAPL were noted at MW-34R from May 2006 through February 2012. In August 2012, LNAPL was measured for the first time at MW-33, approximately 100 feet to the south of MW-34R.

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Since December 2005, naphthalene has remained the primary constituent above South Carolina Underground Storage Tank Program Risk-Based Screening Levels for groundwater, with exceedances limited to shallow monitoring wells MW2 and MW34R. As of August 2013, naphthalene was above the RBSL at MW-2. Although naphthalene was below the RBSL at MW-34R in August 2013, an increasing trend was observed from 2008 to 2012.

A supplemental investigation was implemented at the Site to determine the extent of LNAPL and evaluate increasing trends of naphthalene. Results of the supplemental investigation, in conjunction with analytical data obtained during 2013 LTM activities, will be used to determine the need for modifications to the current remedy of land use controls and LTM.

2.0 BACKGROUND

2.1 Site Description

The Site is situated on a maintained, vacant 23-acre lot secured by a chain-link fence at 2905 Carner Avenue, North Charleston, South Carolina, and on the western portion of the former Charleston Naval Complex. The Site is bordered to the northwest by the Charleston County Military Magnet School, to the north by undeveloped areas, to the east by Chicora Avenue and residential housing, to the south by Clement Avenue and residential housing, and to the west by Carner Avenue, followed by several industrial facilities (Figure 1). Much of the Site's original topography has been modified by human activities (i.e., buried demolition debris, backfill, grading, etc.). The Site slopes toward a retention pond at the northern end of the property. An earthen drainage ditch along the eastern property boundary, and a subsurface drainage system, discharge to the retention pond.

The Site is underlain by interbedded silty, clayey sand, followed by the Cooper Marl regional aquitard, which is typically in excess of 100 feet thick in this area. Based on results from historical studies and on-going LTM activities, shallow groundwater flows to the east and northeast toward the Cooper River, approximately one-half mile to the east. Depth to groundwater ranges from 3 to 9 feet below ground surface (bgs) across the Site. Potable water in the vicinity is supplied by the City of North Charleston. No public or private groundwater wells exist within 1,000 feet of the Site (Advent 2008).

2.2 Site History

The Site historically consisted of six partially buried, reinforced concrete, bulk storage tanks used to store diesel fuel, Bunker C, F-76 Diesel Fuel Marine, Navy Fuel Oil, Special Navy Fuel Oil, lube oil, oily-waste water, and sludge. Constructed in late 1943, the Site supplied fuel to Charleston Naval Complex, approximately one-half mile to the east via underground piping. A site layout map showing the location of historical tanks/pipelines, subsurface utilities, and the supplemental investigation study area is included as Figure 1.

During decommissioning efforts from 1988 through 1999, residual contents were removed from the tanks and disposed offsite, and tanks and all associated piping and equipment were cleaned. Pumping equipment and aboveground portions of the tanks, pump rooms, and lines were removed and disposed offsite. Underground transfer piping was cleaned and abandoned in place. Underground portions of pump room walls and the deepest eight feet of tank walls and tank bottoms were crushed and buried. Approximately 3,300 tons of petroleum-contaminated soil was excavated from around tanks and underground lines and disposed offsite. The Site was capped with 12 inches of clay to limit infiltration by rainwater, and has remained vacant from 1999 through present.

In early 2000, the Navy transferred the fully decommissioned property to the Charleston County School Board. In June 2010, the property was purchased by the City of North Charleston, for anticipated future recreational use.

2.3 Previous Investigations and Corrective Action

During investigations performed immediately following decommissioning efforts, total petroleum hydrocarbons were not reported above applicable screening guidelines for soil; however, isolated pockets of LNAPL were identified and naphthalene was reported above the applicable screening level for groundwater. Focused soil removal efforts were performed in 1999, 2000, 2003, 2005, and 2010 to remediate petroleum-impacted soil, with confirmatory sampling results satisfying screening guidelines. Most recently in June 2010, approximately 40 cubic yards of petroleum-impacted soil were excavated from a 10 foot by 18 foot by 6 foot deep below ground surface area to the north of groundwater monitoring well MW34R and disposed offsite.

Additional details associated with previous investigations are presented in in the *Preliminary Contamination Assessment Report* (Kemron, 1992), *Corrective Action Plan* (herein after referred to as the CAP) (Advent, 2008), and *Groundwater Long Term Monitoring Report*

(Resolution Consultants, 2013). The 2008 CAP implemented LTM to gauge LNAPL, track naphthalene concentrations in groundwater, and prescribe land use controls to prohibit disturbance to the surface cover and the use of groundwater beneath the Site.

From December 2005 through August 2013, naphthalene remained the primary contaminant above Risk-Based Screening Levels for groundwater, with exceedances limited to samples collected from wells MW-2 and MW-34R. Maximum historical naphthalene concentrations were reported at MW-2 in February 2012 (240 micrograms per liter [µg/L]) and at MW-34R in August 2012 (480 µg/L). Varying levels of LNAPL have been measured in MW-34R from 2005 through 2013, up to 0.58 feet in February 2013. Historically, approximately 0.70 feet LNAPL was measured at MW-33 during a single (August 2012) event. No discernible LNAPL was measured at MW-34R and MW-33 during the August 2013 LTM Event.

Likely sources of contamination are historical releases of marine petroleum products from the CTF system, specifically former Tank L, historically positioned upgradient of impacted wells MW-2, MW-33, and MW-34R, and underground lines in the vicinity. It is expected that the majority of secondary sources, in the form of contaminated soil beneath and surrounding the tank and/or underground transfer lines, were removed during historical excavations; however, based on the presence of LNAPL at MW-34R, residual contaminated soil may remain in place. In accordance with South Carolina Department of Health and Environmental Control (SCDHEC) policy and as documented in the CAP, LTM efforts will continue until LNAPL thickness is reduced to less than 0.01 foot and the applicable screening guideline is achieved for naphthalene in groundwater.

3.0 FIELD ACTIVITIES

Supplemental investigation activities, as documented herein, include the following:

- Subsurface utility survey and clearance using ground penetrating radar
- LNAPL evaluation via Laser Induced Fluorescence (LIF) technology Ultra-Violet Optical Screening Tool (UVOST) and installation, development, gauging, and sampling of temporary monitoring wells using hollow-stem auger drilling
- Naphthalene evaluation via focused soil and groundwater sampling using direct push technology (DPT)

- Capturing horizontal locations of each subsurface utility and boring/sampling location using a Trimble GeoXH Global Positioning System with sub-meter accuracy

- Boring and temporary well abandonment per applicable SCDHEC guidance

3.1 Subsurface Utility Survey and Clearance

To identify subsurface utilities potentially serving as contaminant migration conduits and to safely clear soil borings prior to advancement, West Locating Services Inc., of Hanahan, South Carolina, used ground penetrating radar and industry standard tools to identify subsurface features in the vicinity of MW-2, MW-34R, and MW-33 on 15 October 2013. Two previously undocumented underground pipelines were identified parallel to the decommissioned underground petroleum transfer and power lines, and adjacent to MW-34R: an approximately 8-inch diameter steel pipe and an approximately 12-inch diameter unknown material pipe at approximately 5 feet and 8 feet bgs, respectively. Underground utilities and pipelines are shown on Figure 2.

3.2 LNAPL Evaluation

3.2.1 LIF Evaluation

The horizontal and vertical extent of LNAPL was evaluated using real-time subsurface screening via LIF UVOST and the installation and gauging of temporary monitoring wells. From 22 through 25 October 2013, Resolution Consultants with subcontractors Vironex Inc. and the South Carolina certified driller, Bear Environmental Inc., advanced a LIF probe deployed on a DPT rig at 53 borings from ground surface up to 21 feet bgs adjacent to monitoring wells MW-33 and MW-34R, and near underground features to evaluate their potential as conduits for LNAPL. LIF borings were stepped outward from each well in 10-foot horizontal increments until results indicated LNAPL was delineated horizontally and vertically. Prior to advancement at each location, the LIF system was field calibrated against a reference emitter (RE) using a site-specific blend of fuels developed by the manufacturer for standardizing the tool. Real-time semi-quantitative LIF data, displayed as percent RE (%RE) and waveform graphs, were interpreted by Vironex's trained operator and Resolution Consultants' field engineer, as each boring was advanced. Generally, a response of 10 %RE or higher was interpreted to indicate the presence of all phases of LNAPL, including residual saturation.[1] LIF boring locations are depicted on Figure 2, with specifications summarized in Table 1. Vironex's *UVOST Investigation Report, Chicora Tank Farm* (Vironex, 2013) is included as Attachment A.

[1] Residual saturation is defined as the non-aqueous phase liquid which cannot be mobilized or recovered from a soil due to either entrainment in discontinuous void spaces or immobilization due to capillary forces.

Residual LNAPL was identified at 21 of 41 LIF borings over a 50-foot by 65-foot area in the vicinity of MW-34R. Vertically, residual LNAPL was encountered at depths ranging from 1 to 14.5 feet bgs. Although residual LNAPL was identified as shallow as 1-foot bgs at borings L27 and L31, the majority of LNAPL was identified at depths between 5 and 10 feet bgs, adjacent to and beneath the underground pipelines. The highest %RE, an indicator of LNAPL concentration, of 408.7 %RE was located at boring L30 at 13 feet bgs. Greatest residual LNAPL thicknesses were noted at L26, L30, and L31 (11 feet) and L27 (12 feet). Such borings are adjacent to underground pipelines and approximately 30 feet northeast of MW-34R. Conductivity readings from the LIF sensor indicated a clay layer at approximately 18 feet bgs across the study area.

LNAPL was not identified at the 12 LIF borings advanced over an approximately 30-foot by 30-foot area in the vicinity of MW-33.

3.2.2 Installation of Temporary Monitoring Wells

On 11 and 12 November 2013, South Atlantic Environmental Drilling and Construction Co. Inc., a South Carolina-certified driller, utilized hollow-stem augers to install seven temporary monitoring wells (TW01 through TW07) at the Site. Based on findings of the LIF study, TW07 was positioned to evaluate groundwater in the vicinity of LIF boring L30, where the highest %RE and residual LNAPL thickness was measured. To confirm horizontal delineation of residual LNAPL was achieved, the six remaining temporary monitoring wells (TW01 through TW06) were positioned outside of the residual LNAPL extent defined by the LIF. Temporary monitoring well locations are presented on Figure 3.

Installation activities were performed in accordance with the Temporary Monitoring Well Approval (SCDHEC, 2013), as included in Attachment B. Temporary wells were installed up to 15 feet bgs, with ten foot screens set to intersect the water table and capture LNAPL. Each temporary monitoring well was constructed of 2-inch diameter Schedule 40 polyvinyl chloride (PVC) riser and 0.010-inch slotted PVC screens. A 30/40 silica sand filter pack was placed in the annular space between the well screen and borehole wall, from the bottom of the borehole to approximately 2 feet above the top of the well screen. Bentonite pellets were placed on top of the filter pack and hydrated to form a seal approximately 2 to 3 feet thick. A watertight expansion cap was installed on top of the 2-inch diameter casing and secured using a padlock. Each temporary monitoring well was surrounded by orange safety fencing mounted on steel posts driven into the ground surface.

During well advancement, lithology was recorded on construction logs, as provided in Attachment C. An oily sheen was observed at approximately 3 feet bgs and petroleum odors were noted from 5 to 12 feet bgs at TW07. Field observations did not identify any visual (free-phase) LNAPL; these data suggest that LIF borings identified residual saturation, not mobile product.

3.2.3 Well Development

Following a 24-hour equilibration period, temporary monitoring wells were developed in accordance with the SAP, and as documented on development records provided in Attachment D. Due to the previously confirmed presence of residual LNAPL as noted during the LIF study and to minimize investigation derived waste (IDW), temporary well TW07 was not developed.

3.2.4 Product Gauging and Bail-Down Tests

On 18 November 2013, approximately 5 days after well development, an oil-water interface probe was used to gauge LNAPL thickness and measure depth-to-water at temporary and select existing monitoring wells in the study area. Approximately 0.02 feet of LNAPL was measured in TW07 and existing well MW-34R. No discernible LNAPL was measured in temporary wells TW01 through TW06 and existing wells MW-2 and MW-33, during the 18 November 2013, gauging. To assess the recoverability of free product at TW-07, a bail-down test was performed by removing LNAPL and gauging recovery over a timed duration. Forty-eight hours after initiating the bail-down test, less than 0.01 feet of product had recovered at TW07.

3.3 Naphthalene Evaluation

To evaluate an increasing trend of naphthalene in groundwater at MW-2 and MW-34R, focused soil and groundwater sampling was performed at borings and temporary wells advanced across the residual LNAPL footprint. Field activities and results of the naphthalene evaluation are presented below.

3.3.1 Soil Sampling

On 12 November 2013, 12 soil borings were advanced to the water table at approximately 8 feet bgs via DPT by South Carolina-certified driller South Atlantic Environmental Drilling and Construction Co. Inc., in the vicinity of MW-2 and transecting the thickest portions of the residual LNAPL footprint north of MW-34R. Soil borings were continuously logged for lithology and a photoionization detector was used to screen soil for organic vapors at 2-foot intervals. Petroleum odors and/or elevated organic vapors were noted at borings SB05 through SB12.

An oily sheen was observed on soil collected from approximately 3 feet bgs at SB07. One soil sample was collected at the depth interval exhibiting the highest organic vapors, with an additional soil sample collected from the 2-foot depth interval immediately above the water table at each boring.

Soil samples were submitted to Gulf Coast Analytical Laboratories (GCAL) of Baton Rouge, Louisiana, a SCDHEC and Department of Defense Environmental Laboratory Accreditation Program accredited laboratory for analysis of naphthalene by United States Environmental Protection Agency (U.S. EPA) Method 8260B. Soil Sampling locations are shown on Figure 4. Boring logs are included in Attachment E.

As shown on Figure 4 and summarized on Table 2, naphthalene was reported above the SAP-specific soil project action level (PAL) of 36 micrograms per kilogram (µg/kg) at 8 of 12 borings, with concentrations ranging from 130 to 20,400 µg/kg. Highest naphthalene concentrations (20,400 µg/kg and 18,700 µg/kg) were measured in samples collected from the six foot depth interval at SB06 and SB07, respectively. Soil borings SB06 and SB07 are positioned adjacent to the underground pipelines, TW07, and where residual LNAPL was 11 feet thick. Naphthalene was not detected at four (SB01 through SB04) soil borings positioned immediately upgradient of MW-2 and along the northern extent of the residual LNAPL footprint.

3.3.2 Groundwater Sampling

On 12 and 14 November 2013, to correlate historical elevated naphthalene concentrations in groundwater to residual LNAPL as identified by the LIF study, groundwater samples were collected from four temporary wells (TW01, TW02, TW03, and TW05) positioned 20 feet beyond the residual LNAPL footprint, and temporary well (TW07) and boring (SB09) positioned at the thickest portion of residual LNAPL. Prior to sample collection, groundwater was purged with a peristaltic pump using U.S. EPA's low-flow method. Field measurements for pH, temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, and turbidity were recorded on groundwater sampling sheets, as included in Attachment F.

Once parameters stabilized, representative groundwater samples were collected into laboratory supplied bottles and submitted to GCAL for analysis of naphthalene by U.S. EPA Method 8260B. Groundwater sampling locations are depicted on Figure 5.

As shown on Figure 5 and summarized on Table 3, naphthalene was reported above the SAP-specific groundwater PAL of 25 µg/L at SB09 (437 µg/L) and TW07 (202 µg/L), both positioned adjacent to underground pipelines where residual LNAPL was measured up to 12 feet in thickness during the LIF study. Naphthalene was not detected in groundwater samples collected from TW01, TW02, TW03, and TW05, positioned beyond the extent of residual LNAPL.

3.3.3 Data Validation

Analytical deliverables from GCAL (Attachment G) were validated independently from the laboratory by Resolution Consultants' project chemist to assess data quality in accordance with the SAP. Analytical data met quality assurance and control specifications, as detailed in the data validation report provided in Attachment H.

3.4 Global Positioning

A Trimble GeoXH Global Positioning System with sub-meter accuracy was used to capture the horizontal coordinates of subsurface utilities, LIF borings, temporary wells, and soil and groundwater sampling points. Horizontal coordinates were used to map such features and are recorded on Table 1 and well construction and soil boring logs in Attachments C and E.

3.5 Abandonment

Immediately following sample collection, each boring was abandoned via direct injection of a bentonite grout from bottom to within 6 inches of grade with a tremie pipe, then returned to grade with topsoil. On 22 November 2013, within 10 days of installation and in accordance to the SCDHEC well approval, each temporary well was abandoned by removing the PVC materials and direct injection of a bentonite grout from bottom to within 6 inches of grade with a tremie pipe, then returned to grade with topsoil.

3.6 Investigation Derived Waste

Solid IDW, consisting of soil cuttings, was contained in one 55-gallon drum. Aqueous IDW, including development, purge and decontamination water, was contained in two 55-gallon drums. IDW containers were properly labeled, segregated, and temporarily staged onsite. Characterization samples, including one composite soil sample and one aqueous sample were collected and submitted to GCAL for analysis of Toxicity Characteristic Leaching Procedure volatile organic compounds and Toxicity Characteristic Leaching Procedure semi-volatile organic compounds. Based on characterization results, IDW was transported and disposed offsite at a properly permitted facility as non-hazardous waste by A&D Environmental Services, Inc.

Analytical data and waste disposal manifests are provided in Attachment G and Attachment I, respectively.

4.0 CONCLUSIONS

In October and November 2013, Resolution Consultants implemented innovative technologies to identify sources and delineate the extent of LNAPL petroleum, and evaluate increasing trends of naphthalene in groundwater in the vicinity of MW-33 and MW-34R at the Site.

The investigation generated the following physical findings:

- Ground penetrating radar revealed two previously undocumented underground pipelines at 5 feet and 8 feet bgs in the vicinity of monitoring wells where LNAPL and increasing levels of petroleum contaminants had been measured.

- A LIF study identified residual LNAPL over a 50-foot by 65-foot area at depths ranging from 1 to 14.5 feet bgs adjacent to underground pipelines in the vicinity of MW-34R. The LIF study did not identify residual LNAPL in the vicinity of MW-33.

- The majority of residual LNAPL was identified at intermediate sample depths (between 5 and 10 feet bgs), correlating with underground pipelines.

- Free phase LNAPL was measured in TW07 and MW-34R at a thickness of approximately 0.02 feet. Two days after initiating a LNAPL bail-down test, only a sheen had returned to the wells. Historically up to 0.58 feet of accumulated LNAPL was measured at MW-34R in February 2012, with no discernible product measured in August 2013.

Based on the findings presented herein, the source of historically variable accumulations of LNAPL at MW-34R is residual petroleum product in the soil matrix, most likely originating from the underground pipelines and/or a historical aboveground spill as indicated by residual LNAPL in limited shallow soil. The residual LNAPL is likely entrained in the soil/aquifer matrix and is immobile, based on the minimal thickness of accumulated product, and the low recovery following the bail-down test. However, it is possible that the previously undocumented underground pipelines may hold pockets of petroleum product that redistributes with fluctuations in the water table. The uneven distribution, low in-well accumulation, and lack of saturation of the residual LNAPL will likely render hydraulic product recovery infeasible, but the impacted soil will likely remain a residual source of soil contamination over the long term.

Sampling and chemical analysis was performed to confirm the findings of the LIF study. Analytical findings include:

- Eight borings within the residual LNAPL footprint reported naphthalene up to three orders of magnitude above the soil PAL (35 µg/kg), with highest concentrations adjacent to the underground pipelines and area of thickest residual LNAPL.

- Groundwater samples collected adjacent to the underground pipelines and near the thickest area of residual LNAPL reported naphthalene an order of magnitude above the groundwater PAL of 25 µg/L.

- Naphthalene was not detected in groundwater samples collected from TW01, TW02, TW03, and TW05. These temporary wells are positioned outside of the extent of LNAPL as defined during the LIF study.

Focused soil and groundwater sampling data suggests the source of elevated concentrations of dissolved phase naphthalene is residual LNAPL in soil, as delineated during the LIF study. A generalized cross section of the residual LNAPL and soil contamination is presented in Figure 6.

5.0 RECOMMENDATIONS

In accordance to decision rules established by the SAP, accumulated LNAPL was measured greater than 0.01 feet in temporary and existing monitoring wells and naphthalene was measured above the soil PAL in samples collected in the vicinity of MW-34R; therefore, CAP modification is recommended to address LNAPL and residual contaminated soil contributing to elevated naphthalene concentrations in groundwater at the Site.

Figures

Monitoring Well
Monitoring Well (LTM Network)
Historical Excavation
Underground Transfer Line (abandoned in place)
Underground Power Line
Underground French Drain
Property Boundary
Pump House (demolished)
Petroleum Storage Tank (demolished)
Retention Pond

0 200 400 Feet

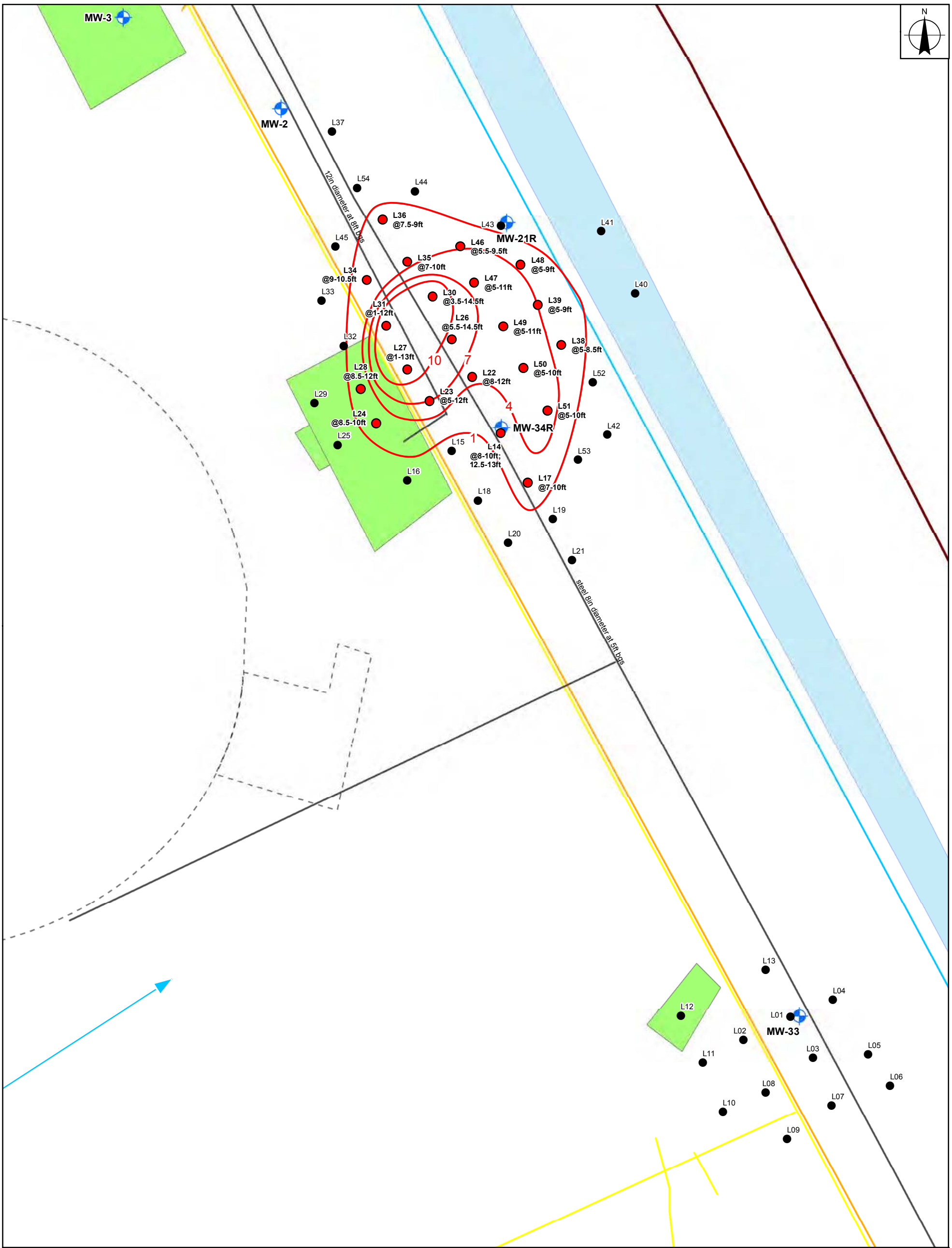
FIGURE 1
SITE LAYOUT MAP
2013 SUPPLEMENTAL INVESTIGATION
CHICORA TANK FARM
CHARLESTON, SOUTH CAROLINA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: C. Tripp	DATE: 6/17/2014
DRAWN BY: N. Rinehart	TASK ORDER NUMBER: JM29

X:\Navy\CNC\ChicoraTankFarm\Report\Figure 1 - Site Layout.mxd

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



LIF Borings and Results

- Residual LNAPL
- No LNAPL
- Residual LNAPL Isopack Contours (1, 4, 7, 10 ft thick)
- Monitoring Wells
- Newly Identified Underground Pipe
- Underground Water Line
- Estimated Groundwater Flow Direction
- Underground Transfer Line (abandoned in place)
- Underground Power Line (abandoned in place)
- Underground French Drain
- Historical Excavation
- Pump House (demolished)
- Petroleum Storage Tank (demolished)
- Retention Pond and Ditch
- Property Boundary

1 inch = 20 feet

0 20 40 Feet

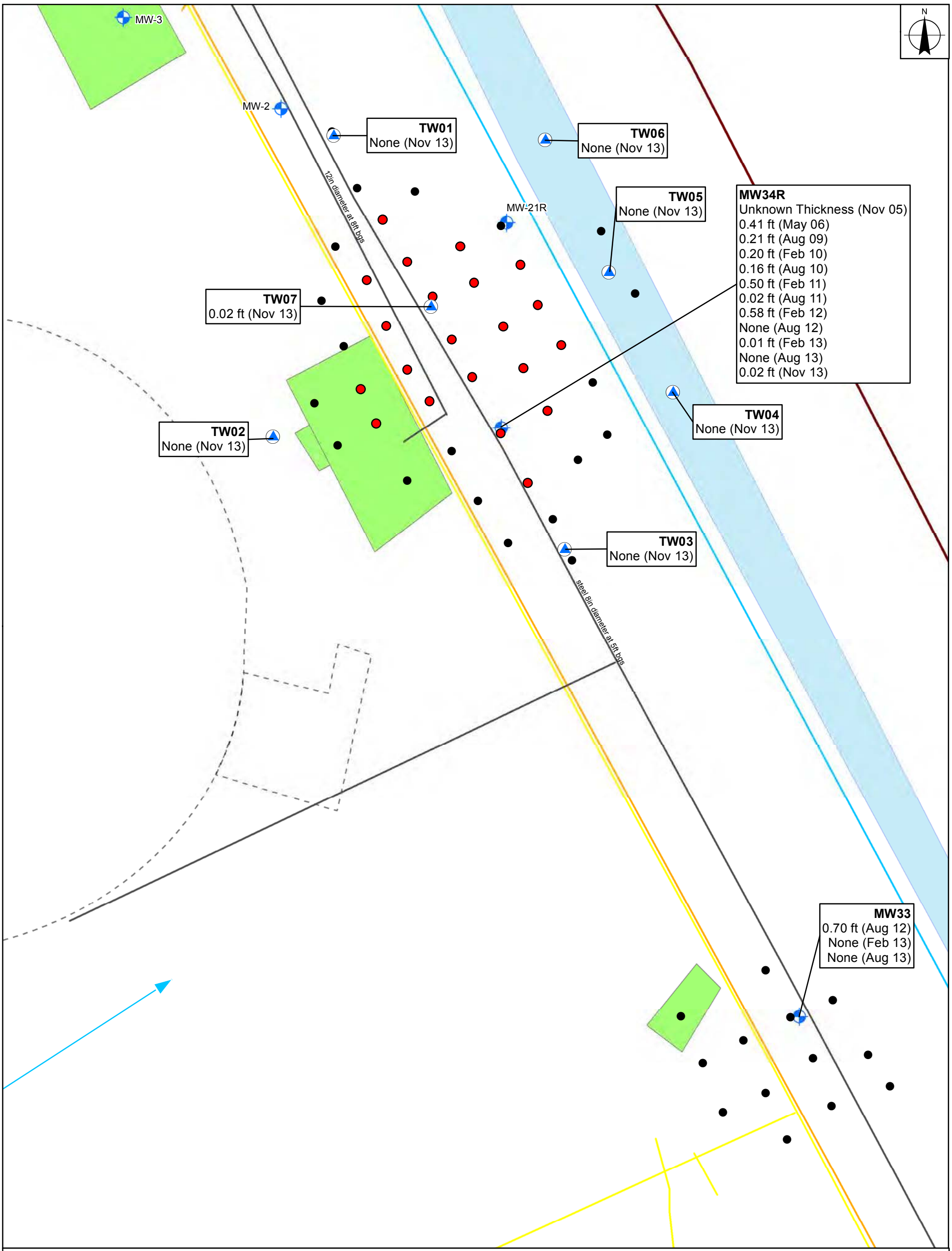
LIF= Laser Induced Fluorescence.
LNAPL= Light Non-Aqueous Phase Liquid.
Ft= Feet Below Ground Surface.
Residual LNAPL Based on LIF Data Greater Than 10% RE.

FIGURE 2
LIF BORINGS AND RESULTS
2013 SUPPLEMENTAL INVESTIGATION
CHICORA TANK FARM
CHARLESTON, SOUTH CAROLINA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: D. WARREN	DATE: 2/7/2014
DRAWN BY: CTRIPP	TASK ORDER NUMBER: JM29

X:\Navy\CNC\ChicoraTankFarm\Report\Figure 2B- Completed LIF Borings.mxd



Temporary Monitoring Wells and Free Product LNAPL Measurements

LIF Borings and Results

- Residual LNAPL
- No LNAPL

- Monitoring Wells
- Newly Identified Underground Pipe
- Underground Water Line
- Estimated Groundwater Flow Direction
- Underground Transfer Line (abandoned in place)
- Underground Power Line (abandoned in place)
- Underground French Drain

- Historical Excavation
- Pump House (demolished)
- Petroleum Storage Tank (demolished)
- Retention Pond and Ditch
- Property Boundary

1 inch = 20 feet

0 20 40 Feet

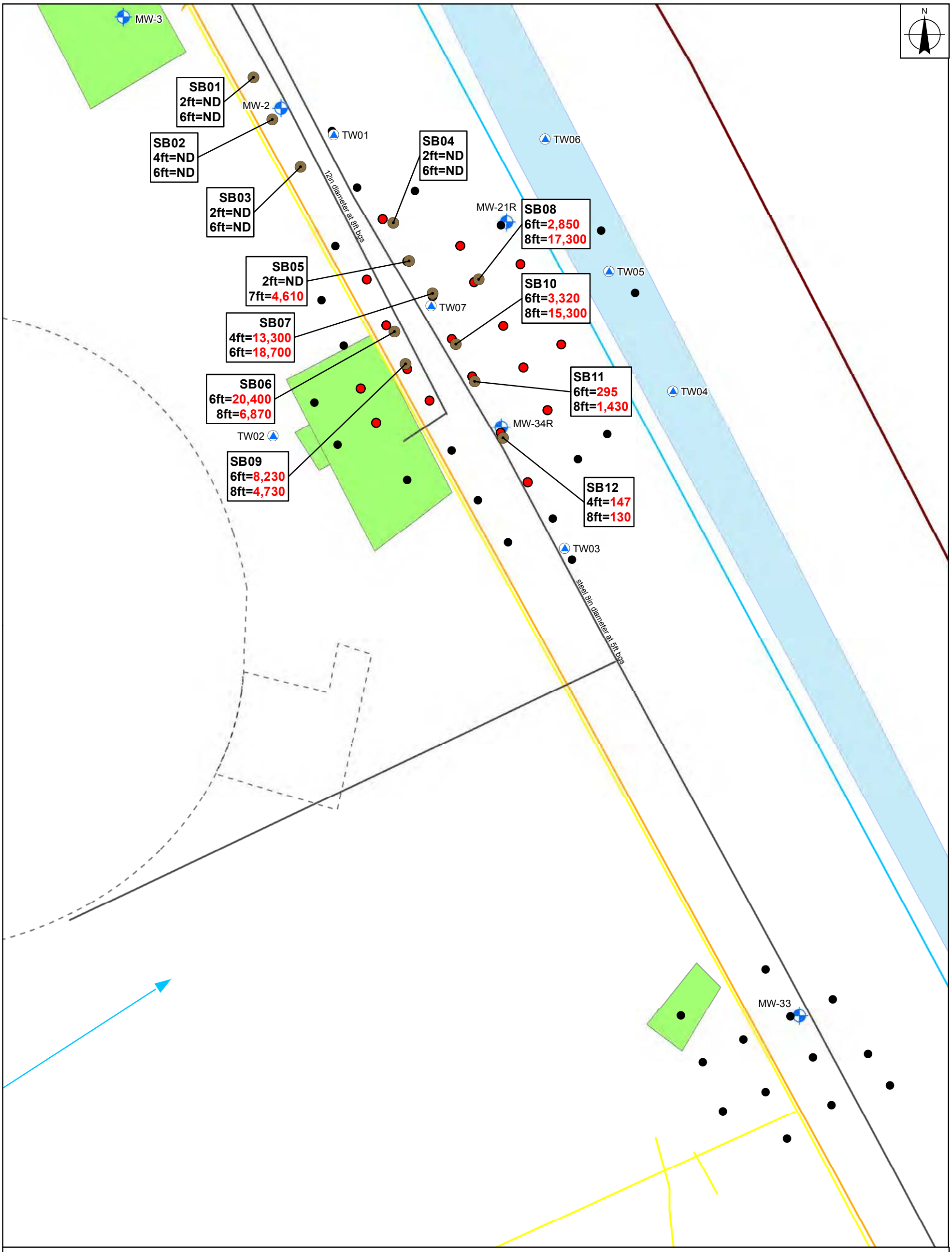
Residual LNAPL Based on LIF Data Greater Than 10% RE.
LIF= Laser Induced Fluorescence.
LNAPL= Light Non-Aqueous Phase Liquid.
Ft= Feet.

FIGURE 3
TEMPORARY MONITORING WELLS
AND IN-WELL LNAPL MEASUREMENTS
2013 SUPPLEMENTAL INVESTIGATION
CHICORA TANK FARM
CHARLESTON, SOUTH CAROLINA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: D. WARREN	DATE: 6/16/2014
DRAWN BY: CTRIPP	TASK ORDER NUMBER: JM29

X:\Navy\CN\Chicora Tank Farm\Report\Figure 3- Temp Wells.mxd



Monitoring Wells
Temporary Wells

LIF Borings and Results

Residual LNAPL
No LNAPL

Soil Sampling Location and Naphthalene Results
Newly Identified Underground Pipe
Underground Water Line
Estimated Groundwater Flow Direction
Underground Transfer Line (abandoned in place)
Underground Power Line (abandoned in place)
Underground French Drain

Historical Excavation
Pump House (demolished)
Petroleum Storage Tank (demolished)
Retention Pond and Ditch
Property Boundary

1 inch = 20 feet

0 20 40 Feet

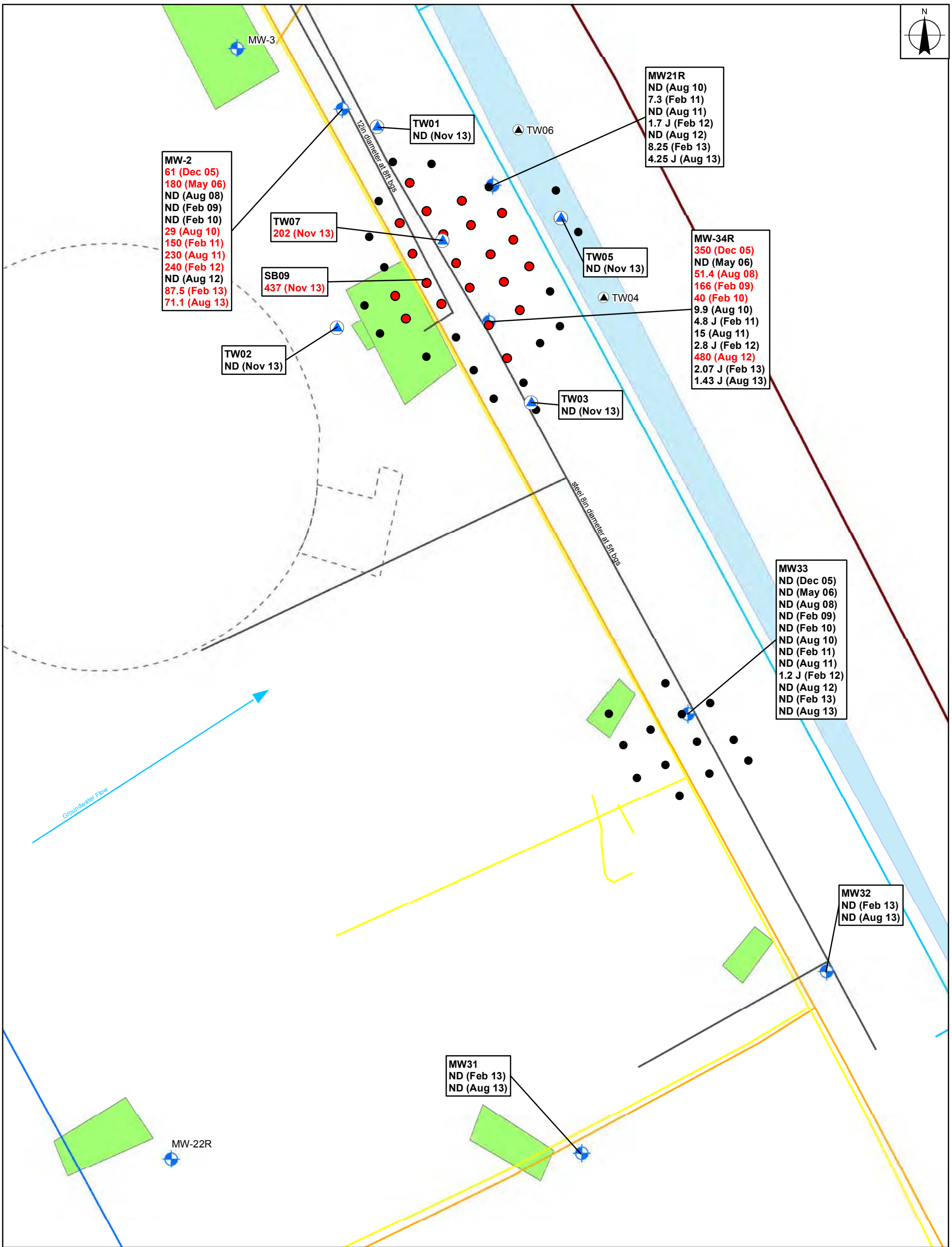
All Concentrations Shown in µg/kg.
Residual LNAPL Based on LIF Data Greater Than 10% RE.
ND = Not Detected (Below Reporting Limits).
LIF= Laser Induced Fluorescence.
LNAPL = Light Non-Aqueous Phase Liquid.
Ft = Feet Below Ground Surface.
Red Font Indicates Results Above Project Action Level.
Project Action Level (PAL) for Naphthalene = 36 µg/kg.

FIGURE 4
SOIL SAMPLING RESULTS
2013 SUPPLEMENTAL INVESTIGATION
CHICORA TANK FARM
CHARLESTON, SOUTH CAROLINA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: D. WARREN	DATE: 2/7/2014
DRAWN BY: CTRIPP	TASK ORDER NUMBER: JM29

X:\Navy\CNC\ChicoraTankFarm\Report\Figure 4- Soil Sampling.mxd



Monitoring Wells
Temporary Wells

LIF Borings and Results

Residual LNAPL
No LNAPL

Groundwater Sampling Location and Naphthalene Results
Newly Identified Underground Pipe
Underground Water Line
Estimated Groundwater Flow Direction
Underground Transfer Line (abandoned in place)
Underground Power Line (abandoned in place)
Underground French Drain

Historical Excavation
Pump House (demolished)
Petroleum Storage Tank (demolished)
Retention Pond and Ditch
Property Boundary

1 inch = 30 feet

0 30 60 Feet

All Concentrations Shown in µg/L.
Residual LNAPL Based on LIF Data Greater Than 10% RE.
J = Estimated Concentration.
ND = Not Detected (Reporting Limits).
LIF= Laser Induced Fluorescence.

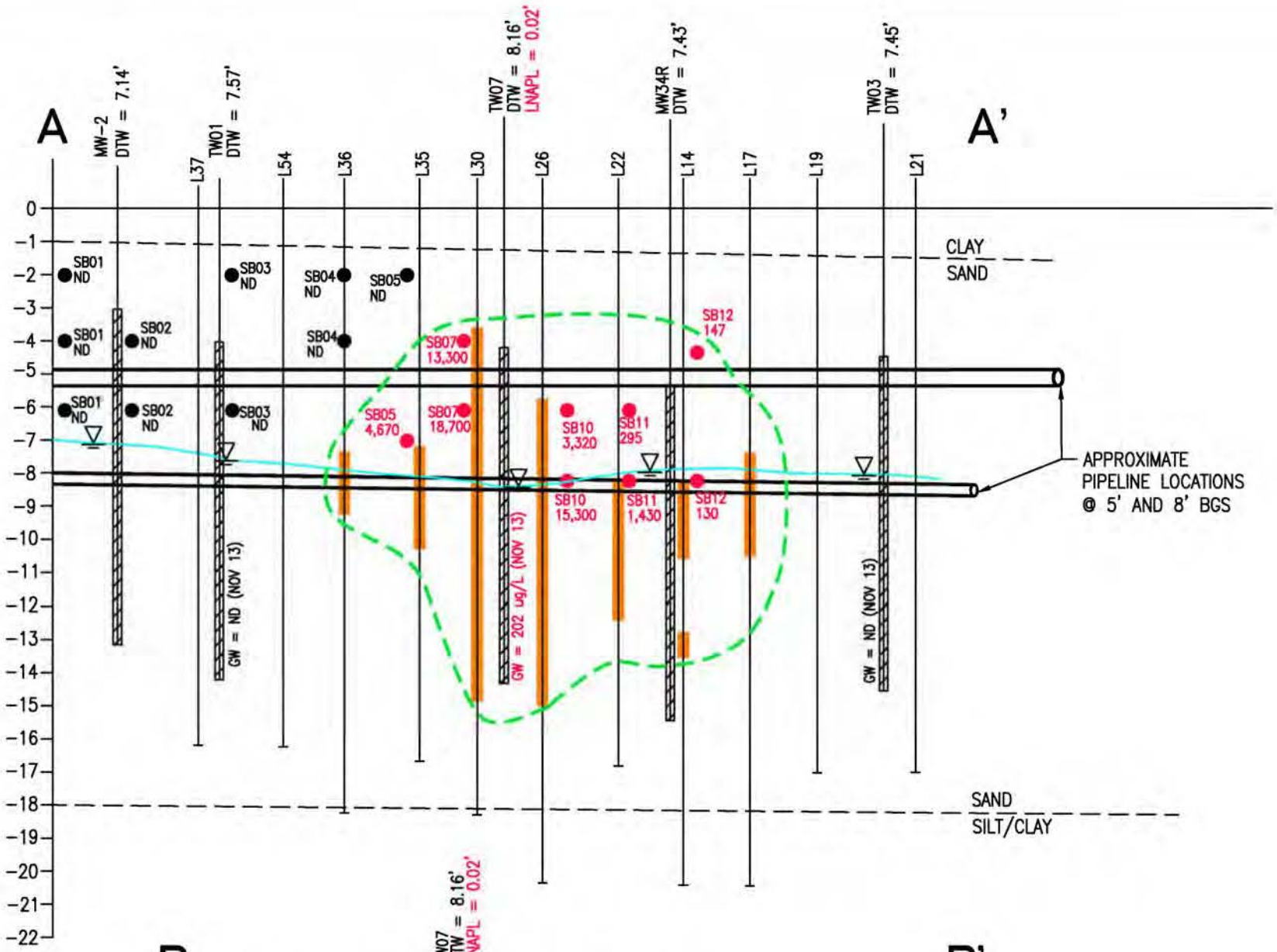
LNAPL= Light Non-Aqueous Phase Liquid.
Ft= Feet Below Ground Surface.
Red Font Indicates Results Above Project Action Level.
Project Action Level (PAL) for Naphthalene = 25 µg/L.

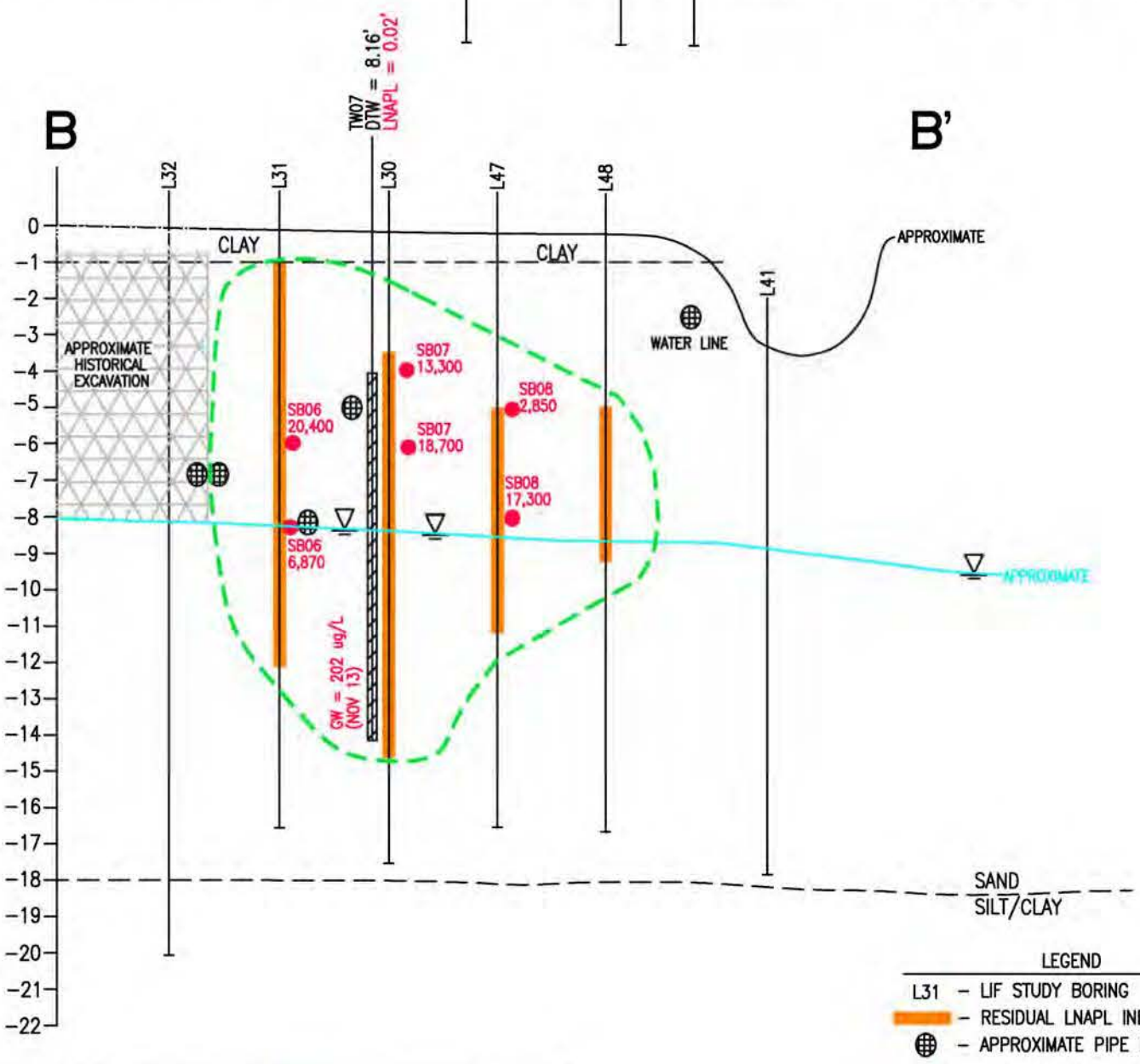
FIGURE 5
GROUNDWATER SAMPLING RESULTS
2013 SUPPLEMENTAL INVESTIGATION
CHICORA TANK FARM
CHARLESTON, SOUTH CAROLINA

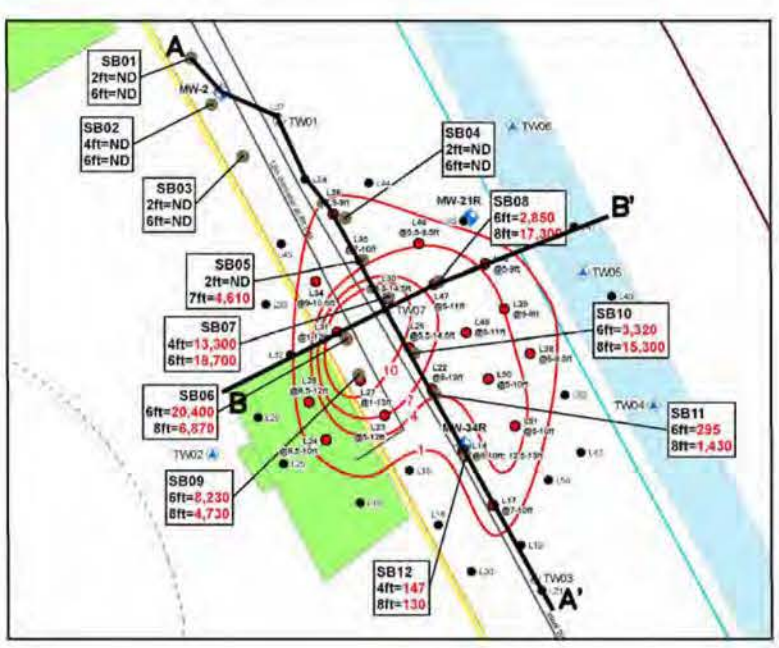
NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: D. WARREN	DATE: 6/16/2014
DRAWN BY: CTRIPP	TASK ORDER NUMBER: JM29

X:\Navy\CN\Chicora Tank Farm\Report\Figure 5- GW Sampling.mxd







LEGEND

- L31 – LIF STUDY BORING
- RESIDUAL LNAPL INDICATED BY LIF BORING
- APPROXIMATE PIPE LOCATIONS
- SOIL SAMPLE EXCEEDING PROJECT ACTION LEVEL (PAL) FOR NAPHTHALENE (36 ug/kg)
- SOIL SAMPLE BELOW PAL FOR NAPHTHALENE
- ND – NOT DETECTED
- GENERALIZED AREA OF RESIDUAL LNAPL AND SOIL CONTAMINATION
- GW = 202 ug/L (NOV 13) – GROUNDWATER SAMPLE EXCEEDING PAL FOR NAPHTHALENE (25 ug/L)

NOT TO SCALE

FIGURE 6
CONCEPTUAL CROSS SECTION OF SOIL CONTAMINANTS
2013 SUPPLEMENTAL INVESTIGATION
CHICORA TANK FARM
CHARLESTON, SOUTH CAROLINA

NAVFAC Naval Facilities Engineering Command

RESOLUTION CONSULTANTS

REQUESTED BY: C.TRIPP	DATE: 08/21/14
DRAWN BY: BRONSON	DWG NAME: 14364_B001

\\ESDATANET\CAD\CAD PROJECTS\14364 NAVY CNC\PLANS\14364_B001_CROSS SEC_SC.DWG

Tables

Table 1
LIF Boring Locations and Results

LIF Boring ID	Date	Northing	Easting	Boring Depth (ft Bgs)	LNAPL Detected above 10% RE	Depths of LNAPL above 10% RE (ft bgs)	Thickness of LNAPL Above 10% RE (ft)	Maximum LNAPL Response (%RE)	Depth of Maximum %RE (ft bgs)
MW33-LIF01	10/22/2013	2317503.512	371477.8177	20.08	No	NA	NA	NA	NA
MW33-LIF02	10/22/2013	2317493.355	371472.8073	20.05	No	NA	NA	NA	NA
MW33-LIF03	10/22/2013	2317508.386	371468.9401	20.18	No	NA	NA	NA	NA
MW33-LIF04	10/22/2013	2317512.659	371481.4122	20.07	No	NA	NA	NA	NA
MW33-LIF06	10/22/2013	2317524.973	371462.8621	20.03	No	NA	NA	NA	NA
MW33-LIF07	10/22/2013	2317512.39	371458.617	20.03	No	NA	NA	NA	NA
MW33-LIF08	10/22/2013	2317498.182	371461.4293	20.04	No	NA	NA	NA	NA
MW33-LIF09	10/22/2013	2317502.768	371451.3946	20.14	No	NA	NA	NA	NA
MW33-LIF10	10/22/2013	2317488.96	371457.2574	20.08	No	NA	NA	NA	NA
MW33-LIF11	10/22/2013	2317484.622	371467.8781	20.06	No	NA	NA	NA	NA
MW33-LIF12	10/22/2013	2317479.89	371477.9992	20.08	No	NA	NA	NA	NA
MW33-LIF13	10/22/2013	2317498.199	371487.8538	20.14	No	NA	NA	NA	NA
MW34R-LIF14	10/23/2013	2317441.121	371603.5954	20.29	Yes	8-10; 12.5-13.0	2.5	85.6	8.2
MW34R-LIF15	10/23/2013	2317430.506	371599.7368	20.23	No	NA	NA	NA	NA
MW34R-LIF16	10/23/2013	2317420.898	371593.4015	20.26	No	NA	NA	NA	NA
MW34R-LIF17	10/23/2013	2317446.955	371592.9543	20.04	Yes	7-10	3	140.6	8.1
MW34R-LIF18	10/23/2013	2317436.186	371589.0741	16.24	No	NA	NA	NA	NA
MW34R-LIF19	10/23/2013	2317452.323	371585.0659	16.27	No	NA	NA	NA	NA
MW34R-LIF20	10/23/2013	2317442.648	371579.9209	17.57	No	NA	NA	NA	NA
MW34R-LIF21	10/23/2013	2317456.434	371576.1991	16.29	No	NA	NA	NA	NA
MW34R-LIF22	10/23/2013	2317434.981	371615.7463	16.43	Yes	8-12	4	25.3	9.6
MW34R-LIF23	10/23/2013	2317425.777	371610.537	19.03	Yes	5-12	7	171.8	8.4
MW34R-LIF24	10/23/2013	2317414.272	371605.7023	16.31	Yes	8.5-10	1.5	58.5	9.1
MW34R-LIF25	10/23/2013	2317405.917	371601.0708	20.35	No	NA	NA	NA	NA
MW34R-LIF26	10/23/2013	2317430.576	371623.7686	20.30	Yes	5.5-14.5	9	355.5	12.7
MW34R-LIF27	10/23/2013	2317420.963	371617.3093	16.40	Yes	1-13	12	176.6	10
MW34R-LIF28	10/23/2013	2317410.927	371613.1406	16.46	Yes	8.5-12	3.5	114.3	9.7
MW34R-LIF29	10/23/2013	2317400.903	371610.0425	19.75	No	NA	NA	NA	NA
MW34R-LIF30	10/23/2013	2317426.426	371633.0422	17.59	Yes	3.5-14.5	11	408.7	13
MW34R-LIF31	10/24/2013	2317416.467	371626.7574	16.36	Yes	1-12	11	223.3	9.2
MW34R-LIF32	10/24/2013	2317407.284	371622.4057	20.30	No	NA	NA	NA	NA
MW34R-LIF33	10/24/2013	2317402.44	371632.1531	16.34	No	NA	NA	NA	NA
MW34R-LIF34	10/24/2013	2317412.262	371636.6242	11.10	Yes	9-10.5	1.5	58.6	9.1
MW34R-LIF35	10/24/2013	2317420.971	371640.4979	16.30	Yes	7-10	3	86.9	8.3
MW34R-LIF36	10/24/2013	2317415.622	371649.6386	17.96	Yes	7.5-9	1.5	51.7	7.7
MW34R-LIF37	10/24/2013	2317404.691	371668.5736	16.08	No	NA	NA	NA	NA
MW34R-LIF38	10/24/2013	2317454.187	371622.5885	16.38	Yes	5-8.5	3.5	247.1	7.2
MW34R-LIF39	10/24/2013	2317449.128	371631.2584	16.41	Yes	5-9	4	301.1	6.2
MW34R-LIF40	10/24/2013	2317470.03	371633.7476	15.08	No	NA	NA	NA	NA
MW34R-LIF41	10/24/2013	2317462.747	371647.1045	14.79	No	NA	NA	NA	NA
MW34R-LIF42	10/24/2013	2317464.082	371603.2345	16.08	No	NA	NA	NA	NA
MW34R-LIF43	10/24/2013	2317441.135	371648.2393	16.32	No	NA	NA	NA	NA
MW34R-LIF44	10/24/2013	2317422.596	371655.7455	16.35	No	NA	NA	NA	NA
MW34R-LIF45	10/24/2013	2317405.487	371643.7794	19.63	No	NA	NA	NA	NA
MW34R-LIF46	10/25/2013	2317432.415	371643.8781	16.43	Yes	5.5-9.5	4	310	6.8
MW34R-LIF47	10/25/2013	2317435.397	371636.0632	16.35	Yes	5-11	6	183.7	8
MW34R-LIF48	10/25/2013	2317445.402	371639.9457	16.40	Yes	5-9	4	168.7	7.1
MW34R-LIF49	10/25/2013	2317441.663	371626.5645	16.39	Yes	5-11	6	219.1	8.2
MW34R-LIF50	10/25/2013	2317445.991	371617.6364	16.27	Yes	5-10	5	230.4	7.5
MW34R-LIF51	10/25/2013	2317451.19	371608.4874	16.32	Yes	5-10	5	156.6	7.6
MW34R-LIF52	10/25/2013	2317460.913	371614.5475	16.32	No	NA	NA	NA	NA
MW34R-LIF53	10/25/2013	2317457.736	371597.8398	16.30	No	NA	NA	NA	NA
MW34R-LIF54	10/25/2013	2317410.116	371656.4772	16.33	No	NA	NA	NA	NA

Notes:

Northing and Eastings are in South Carolina State Plane Coordinate System, North American Datum 1983, US Feet.
Locations surveyed with Trimble GeoXT GPS

Ft bgs = Feet below ground surface
LNAPL = Light non-aqueous phase liquid
NA = Not applicable
%RE = Percent reference emitter

Table 2
Soil Sampling Results

				Parameter Name	Naphthalene
				Analytical Method	8260B
				Units	µg/kg
				Project Action Level	36
Location Code	**Sample Code**	**Sample Depth (ft bgs)**	**Sample Type**	**Sample Date**	**Result**
SB01	CTFSB01-SO02-111213	2	N	11/12/2013	0.512 U
	CTFSB01-SO02-111213-D	2	FD	11/12/2013	0.482 U
	CTFSB01-SO06-111213	6	N	11/12/2013	0.452 U
SB02	CTFSB02-SO04-111213	4	N	11/12/2013	0.439 U
	CTFSB02-SO06-111213	6	N	11/12/2013	0.403 U
SB03	CTFSB03-SO02-111213	2	N	11/12/2013	0.545 U
	CTFSB03-SO02-111213-D	2	FD	11/12/2013	0.556 U
	CTFSB03-SO06-111213	6	N	11/12/2013	0.459 U
SB04	CTFSB04-SO02-111213	2	N	11/12/2013	0.486 U
	CTFSB04-SO06-111213	6	N	11/12/2013	0.45 U
SB05	CTFSB05-SO02-111213	2	N	11/12/2013	0.484 U
	CTFSB05-SO07-111213	7	N	11/12/2013	4610
SB06	CTFSB06-SO06-111213	6	N	11/12/2013	20400
	CTFSB06-SO08-111213	8	N	11/12/2013	6870
SB07	CTFSB07-SO04-111213	4	N	11/12/2013	13300
	CTFSB07-SO06-111213	6	N	11/12/2013	18700
SB08	CTFSB08-SO06-111213	6	N	11/12/2013	2850
	CTFSB08-SO08-111213	8	N	11/12/2013	17300
SB09	CTFSB09-SO06-111213	6	N	11/12/2013	8230
	CTFSB09-SO08-111213	8	N	11/12/2013	4730
SB10	CTFSB10-SO06-111213	6	N	11/12/2013	3320
	CTFSB10-SO08-111213	8	N	11/12/2013	15300
SB11	CTFSB11-SO06-111213	6	N	11/12/2013	295
	CTFSB11-SO08-111213	8	N	11/12/2013	1430
SB12	CTFSB12-SO04-111213	4	N	11/12/2013	147
	CTFSB12-SO08-111213	8	N	11/12/2013	130

Notes:

µg/kg = Micrograms per kilogram
ft bgs = Feet below ground surface
N = Primary sample
FD = Field duplicate
U = Not detected above reporting limit
Yellow highlight indicates result exceeds Project Action Level

Table 3
Groundwater Sampling Results

			Parameter Name	**Naphthalene**
			Analytical Method	**8260B**
			Units	**µg/L**
			Project Action Level	**25**
Location Code	**Sample Code**	**Sample Type**	**Sample Date**	**Result**
SB09	CTFSB09-WG-111213	N	11/12/2013	437
TW01	CTFTW01-WG-111413	N	11/14/2013	0.2 U
TW01	CTFTW01-WG-111413-D	FD	11/14/2013	0.2 U
TW02	CTFTW02-WG-111413	N	11/14/2013	0.2 U
TW03	CTFTW03-WG-111413	N	11/14/2013	0.2 U
TW05	CTFTW05-WG-111413	N	11/14/2013	0.2 U
TW07	CTFTW07-WG-111413	N	11/14/2013	202

Notes:

µg/l = Micrograms per liter
N = Primary sample
FD = Feld duplicate
U = Not detected above
Yellow highlight indicates result exceeds Project Action Level

Attachment A
Vironex UVOST Report

Ultra-Violet Optical Screening Tool Investigation Report

Chicora Tank Farm
Chicora Avenue
North Charleston, South Carolina

Prepared for:

Chad Tripp
Resolution Consultants
313 Wingo Way
Mount Pleasant, South Carolina

Prepared by:

Vironex, Inc.
403 Serendipity Drive
Millersville, Maryland

November 1, 2013

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Project Summary

Project Name: Chicora Tank Farm

Project Dates: Oct 22 – 25, 2013

Equipment/Manpower: Vironex mobilized one Ultra-Violet Optical Screening Tool (UVOST) System, one High Resolution Site Characterization (HRSC) specialist, one direct-push drill rig and one drill rig operator to the project site.

Project Summary: Vironex advanced 53 direct push UVOST borings from the ground surface to between approximately 11 and 21 feet below ground surface (bgs). The UVOST system operates on the principal of laser induced fluoresce (LIF). It utilizes an XeCl Excimer laser to pulse ultra-violet (UV) light through a fiber optic cable to a sapphire window mounted near the tip of a direct-push drilling system. The UV light energizes PAHs in the subsurface, when present, causing them to fluoresce. The PAH emission is transmitted through a separate fiber optic cable, filtered into four separate wavelength-defined channels and observed at an oscilloscope. The oscilloscope output is plotted with respect to depth to show intervals across the boring that have been impacted by fuel/oil related non-aqueous phase liquids (NAPLs). Additionally, the UVOST system allows the user to select callouts that show the distribution of response, at a given depth, across the four wavelength-defined channels. These callouts allow the user to understand the PAH composition, and therefore the type of fuel, from which the NAPL originated.

During the advancement of each boring, the UVOST response, relative to depth, was recorded in accordance with the standard operating procedures for the UVOST system. The details associated with each UVOST boring are presented below.

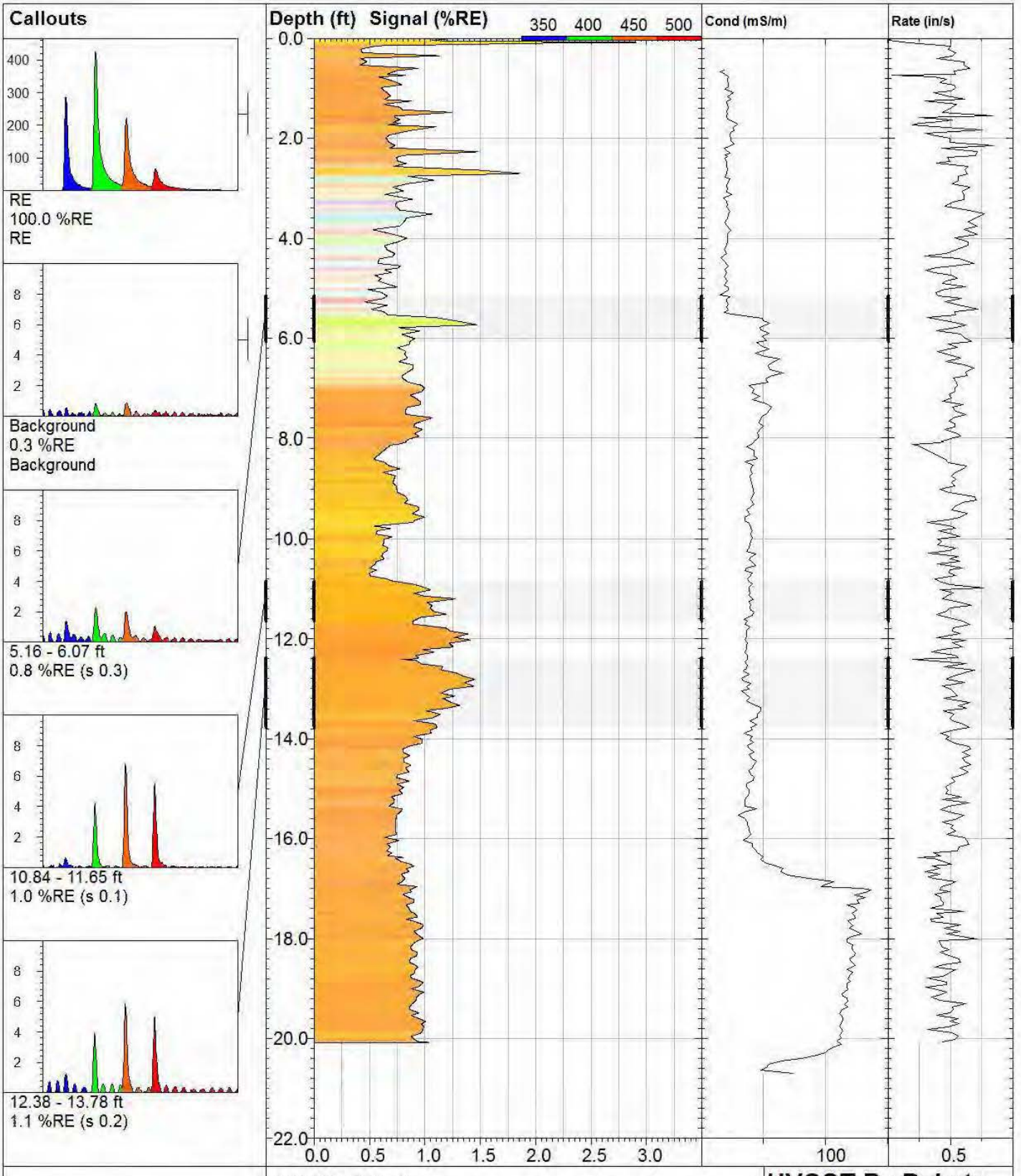
Boring	Date	Time	Total Depth	Notes
MW33-LIF01	10.22.2013	10:57	20.08	Hand-cleared first 4 feet bgs.
MW33-LIF02	10.22.2013	11:27	20.05	Hand-cleared first 4 feet bgs.
MW33-LIF03	10.22.2013	16:57	20.18	Hand-cleared first 4 feet bgs.
MW33-LIF04	10.22.2013	16:31	20.07	Hand-cleared first 4 feet bgs.
MW33-LIF06	10.22.2013	14:00	20.03	Hand-cleared first 4 feet bgs.
MW33-LIF07	10.22.2013	13:26	20.03	Hand-cleared first 4 feet bgs.
MW33-LIF08	10.22.2013	11:57	20.04	Hand-cleared first 4 feet bgs.
MW33-LIF09	10.22.2013	12:30	20.14	Hand-cleared first 4 feet bgs.
MW33-LIF10	10.22.2013	14:34	20.08	Hand-cleared first 4 feet bgs.
MW33-LIF11	10.22.2013	15:05	20.06	Hand-cleared first 4 feet bgs.

MW33-LIF12	10.22.2013	15:33	20.08	Hand-cleared first 4 feet bgs.
MW33-LIF13	10.22.2013	16:04	20.14	Hand-cleared first 4 feet bgs.
MW34R-L14	10.23.13	08:46	20.29	None.
MW34R-L15	10.23.13	09:32	20.23	None.
MW34R-L16	10.23.13	09:50	20.26	None.
MW34R-L17	10.23.13	10:19	20.04	None.
MW34R-L18	10.23.13	10:47	16.24	None.
MW34R-L19	10.23.13	11:17	16.27	None.
MW34R-L20	10.23.13	12:12	17.57	None.
MW34R-L21	10.23.13	12:41	16.29	None.
MW34R-L22	10.23.13	13:12	16.43	None.
MW34R-L23	10.23.13	13:35	19.03	None.
MW34R-L24	10.23.13	13:59	16.31	None.
MW34R-L25	10.23.13	14:27	20.35	None.
MW34R-L26	10.23.13	14:58	20.30	None.
MW34R-L27	10.23.13	15:25	16.40	None.
MW34R-L28	10.23.13	15:54	16.46	None.
MW34R-L29	10.23.13	16:22	19.75	None.
MW34R-L30	10.23.13	16:55	17.59	None.
MW34R-L31	10.24.13	08:54	16.36	None.
MW34R-L32	10.24.13	09:27	20.30	None.
MW34R-L33	10.24.13	09:56	16.34	None.
MW34R-L34	10.24.13	10:25	11.10	Hand-cleared first 4 feet bgs. Refusal at 11.10 feet bgs.
MW34R-L35	10.24.13	10:43	16.30	Hand-cleared first 4 feet bgs.
MW34R-L36	10.24.13	11:08	17.96	Hand-cleared first 4 feet bgs.

MW34R-L37	10.24.13	11:50	16.08	Hand-cleared first 4 feet bgs.
MW34R-L38	10.24.13	13:02	16.38	None.
MW34R-L39	10.24.13	13:32	16.41	None.
MW34R-L40	10.24.13	14:01	15.08	None.
MW34R-L41	10.24.13	14:25	14.79	None.
MW34R-L42	10.24.13	14:50	16.08	None.
MW34R-L43	10.24.13	15:23	16.32	None.
MW34R-L44	10.24.13	15:45	16.35	None.
MW34R-L45	10.24.13	16:13	19.63	None.
MW34R-L46	10.25.13	08:53	16.43	Hand-cleared first 4 feet bgs.
MW34R-L47	10.25.13	09i:24	16.35	None.
MW34R-L48	10.25.13	09i:43	16.40	None.
MW34R-L49	10.25.13	10:05	16.39	None.
MW34R-L50	10.25.13	10:31	16.27	None.
MW34R-L51	10.25.13	11:03	16.32	None.
MW34R-L52	10.25.13	11:30	16.32	None.
MW34R-L53	10.25.13	12:02	16.30	None.
MW34R-L54	10.25.13	12:25	16.33	None.

The UVOST logs are presented in Appendix A and B. The scales for UVOST logs in Appendix A are automatically chosen based on the highest response during each boring. The detector response scales for UVOST logs in Appendix B are set to a common scaled based on the highest UVOST response observed across all borings at the site. Additional information regarding the principals and procedures associated with the UVOST system is presented in Appendix C. Appendix D includes a UVOST log reference guide.

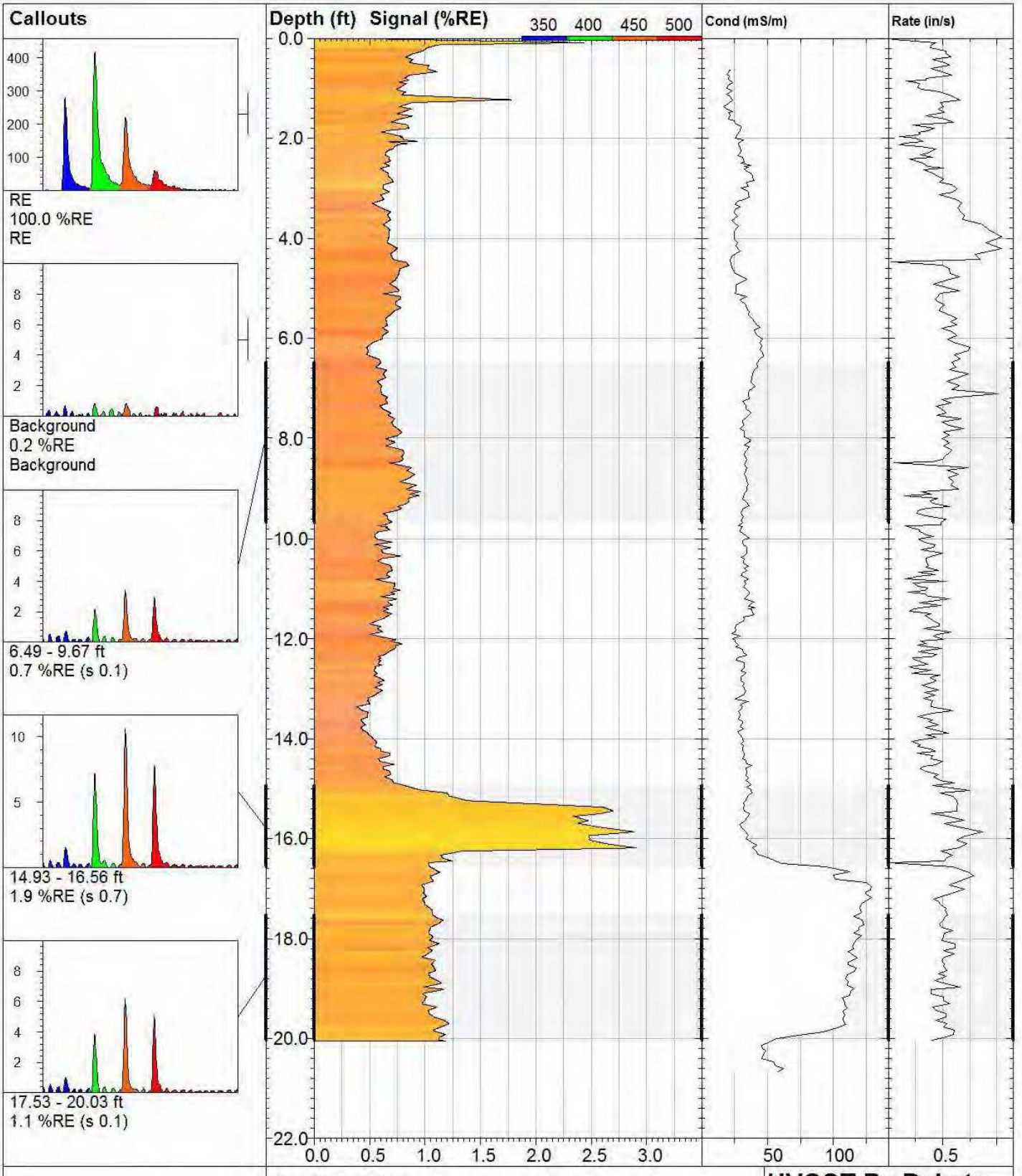
Appendix A – UVOST Boring Logs (Auto-Scale)



MW33-L1

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.08 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.0 %RE @ 0.08 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 08:57 MDT**

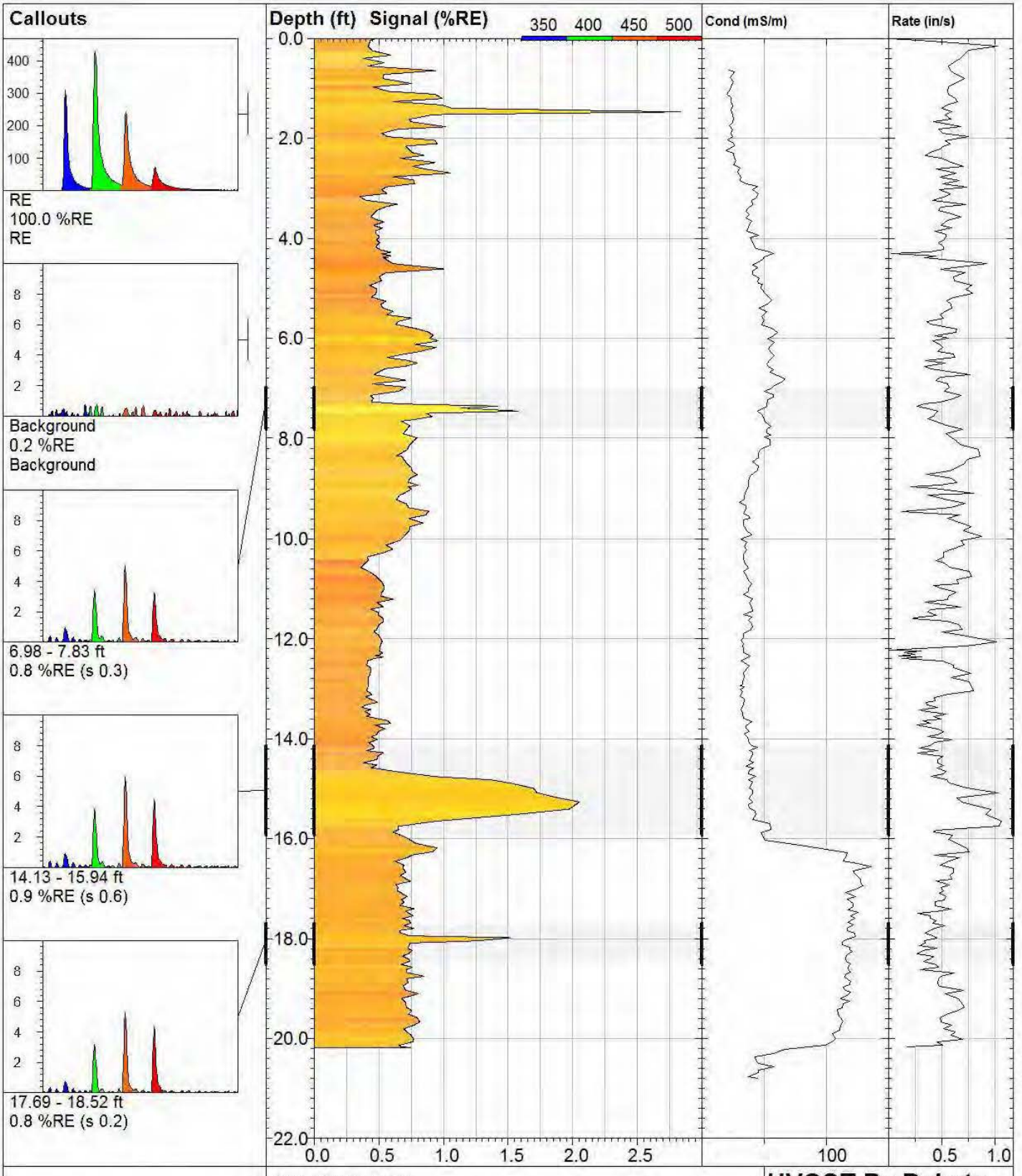


MW33-L2

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.05 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.9 %RE @ 16.19 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 09:27 MDT**

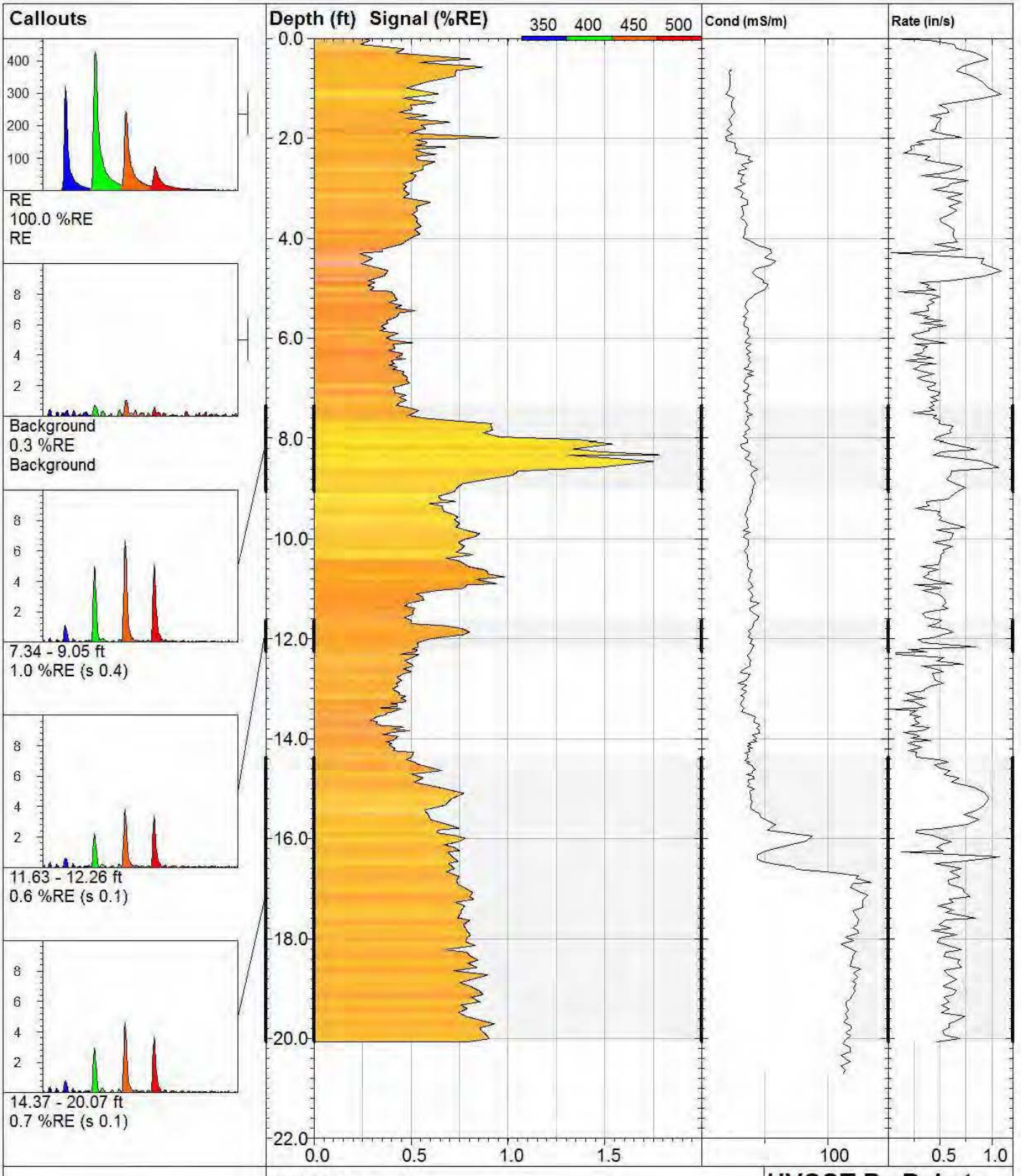


VIRONEX

MW33-L3

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.18 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.8 %RE @ 1.47 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 14:57 MDT**

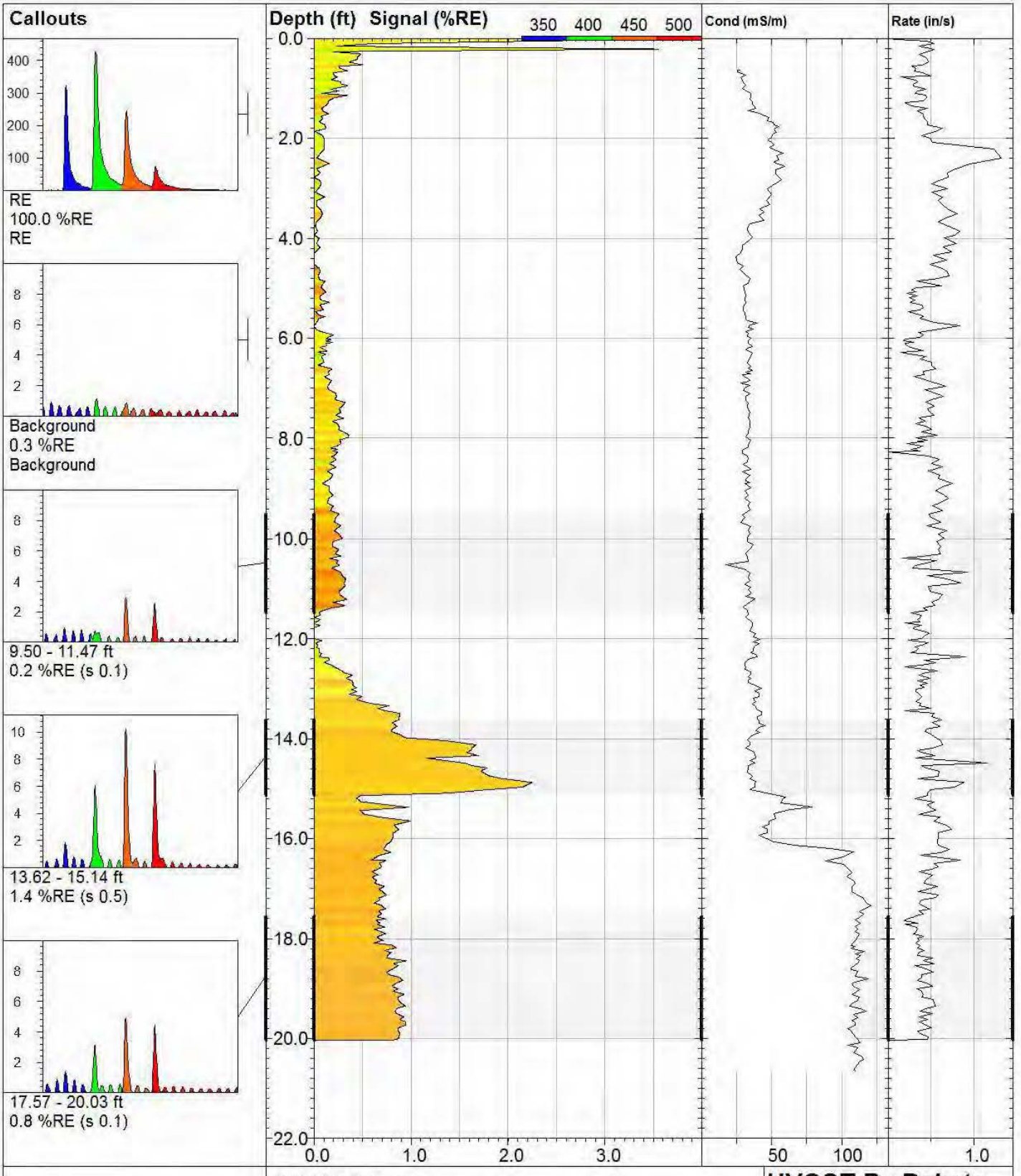


MW33-L4

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

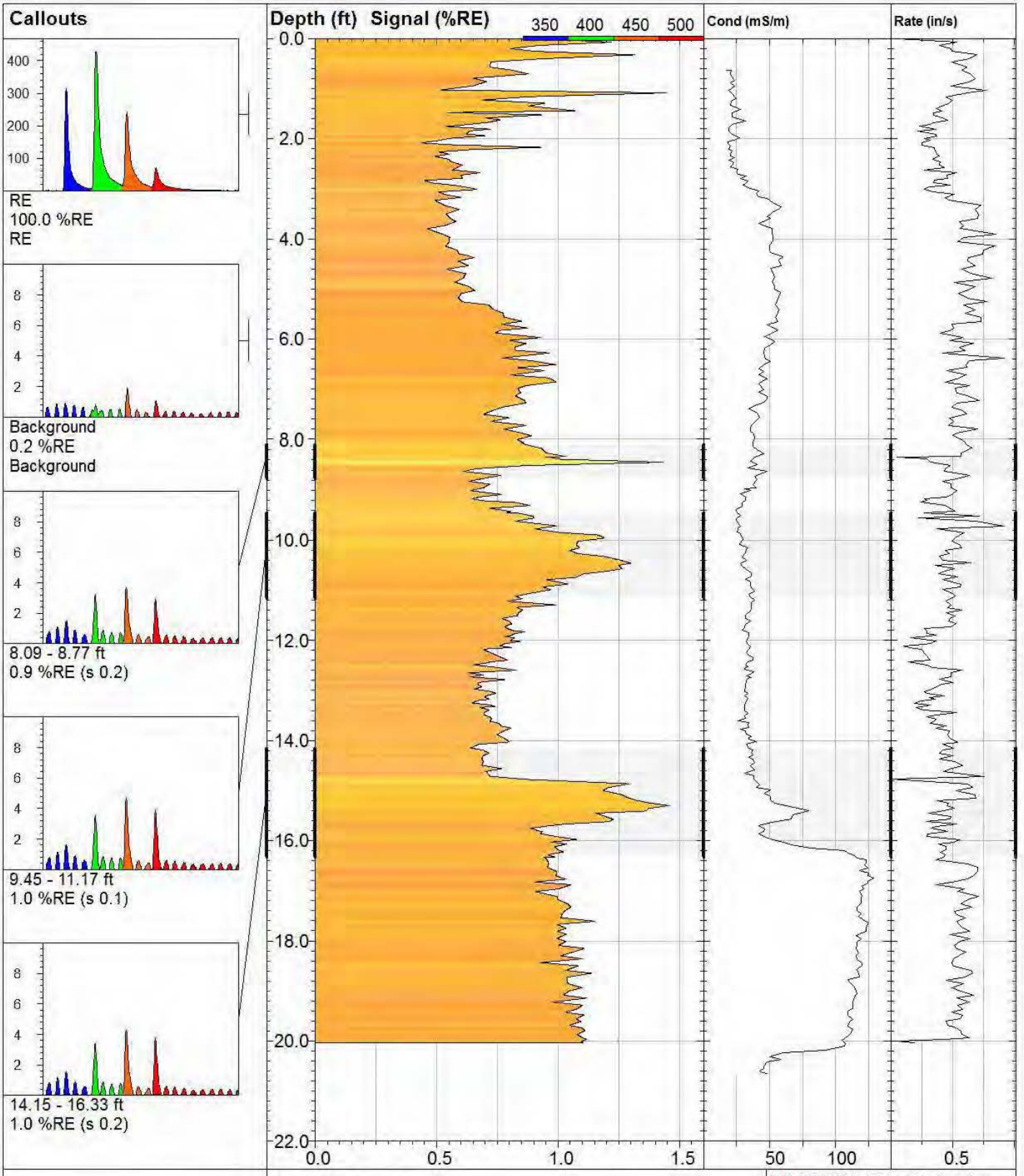
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.07 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.8 %RE @ 8.32 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 14:31 MDT**



MW33-L6

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.03 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.6 %RE @ 0.22 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 12:00 MDT**

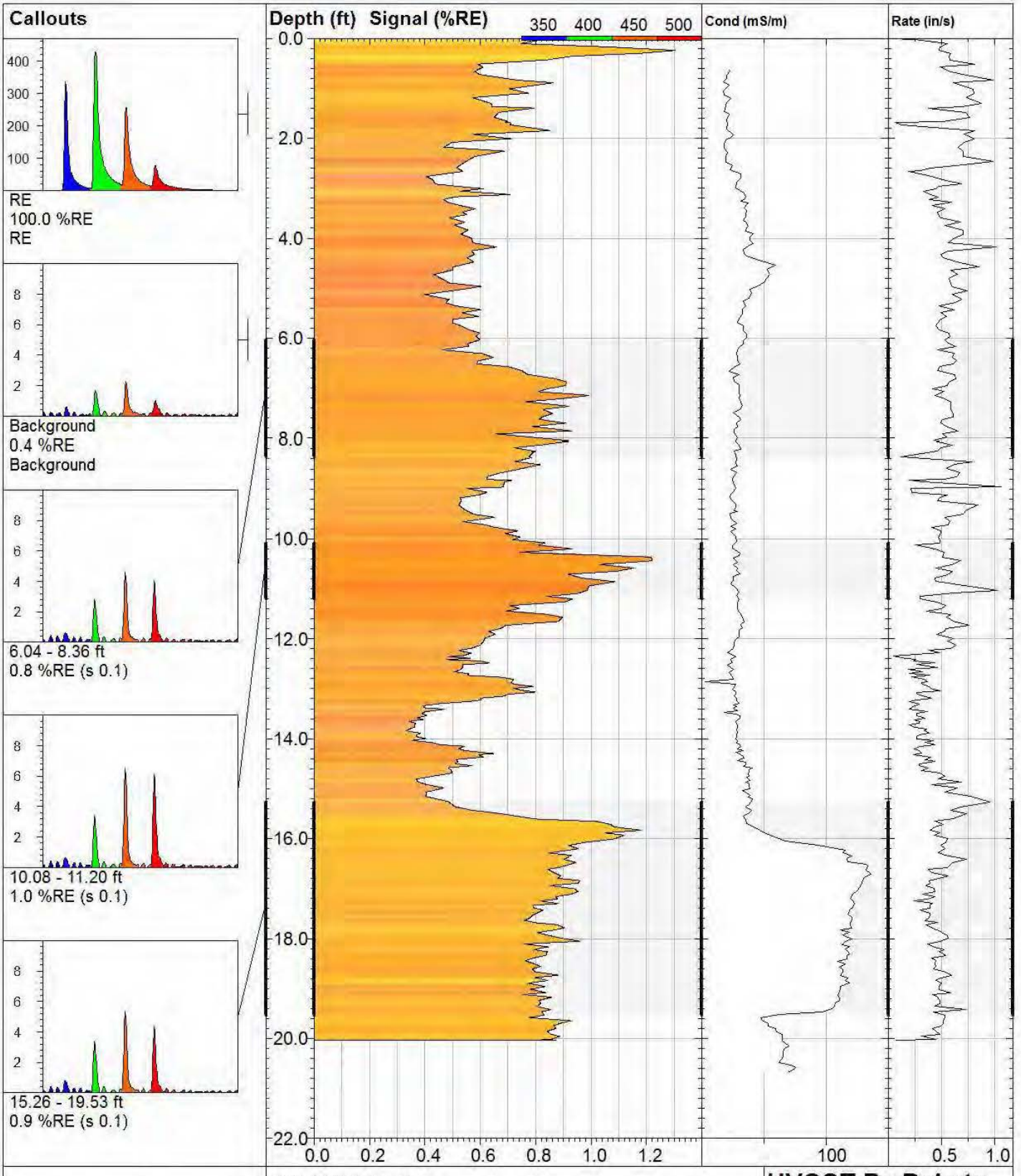


VIRONEX

MW33-L7

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.03 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.5 %RE @ 15.30 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 11:26 MDT**

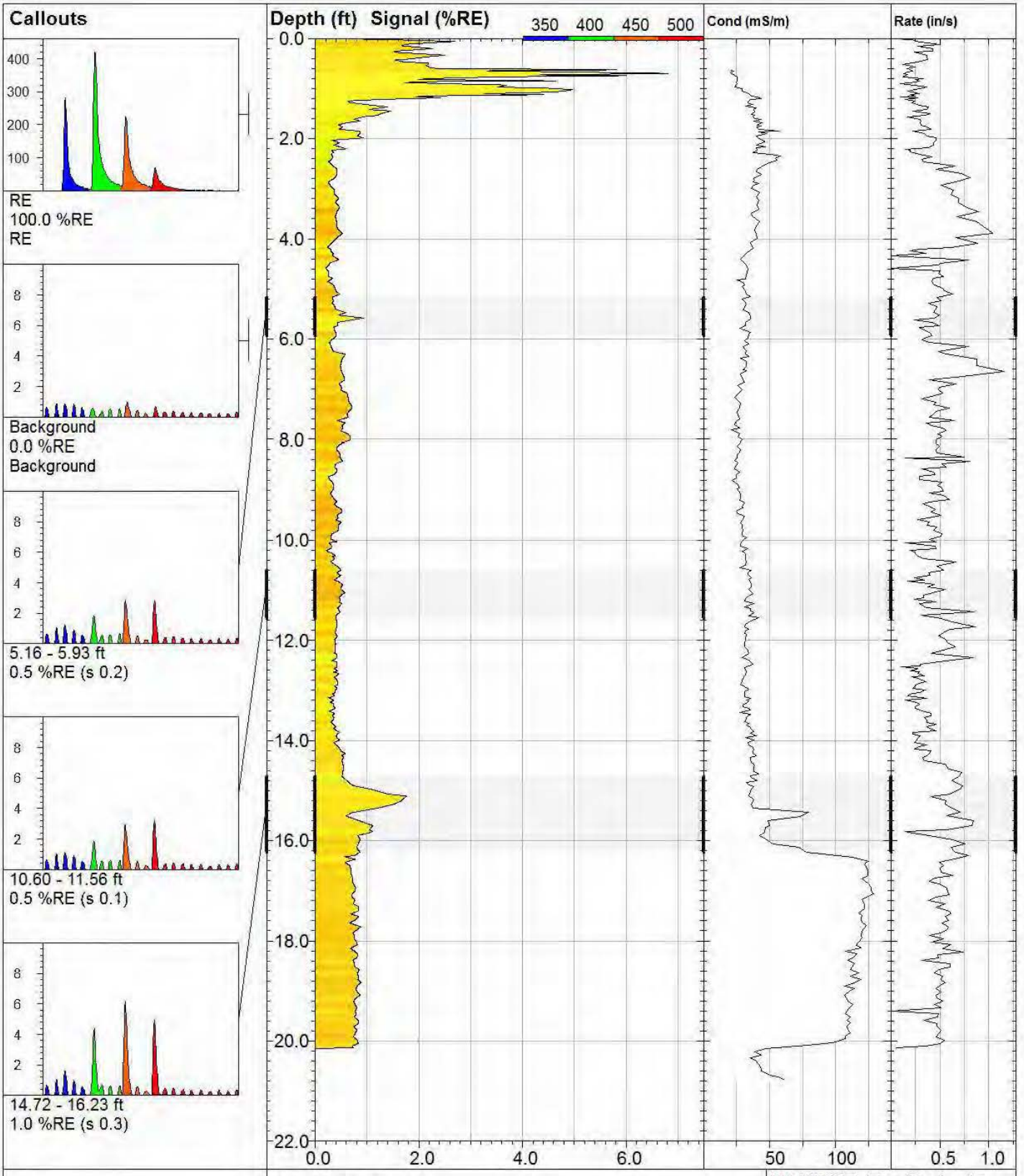


VIRONEX

MW33-L8

UVOST By Dakota
www.DakotaTechnologies.com

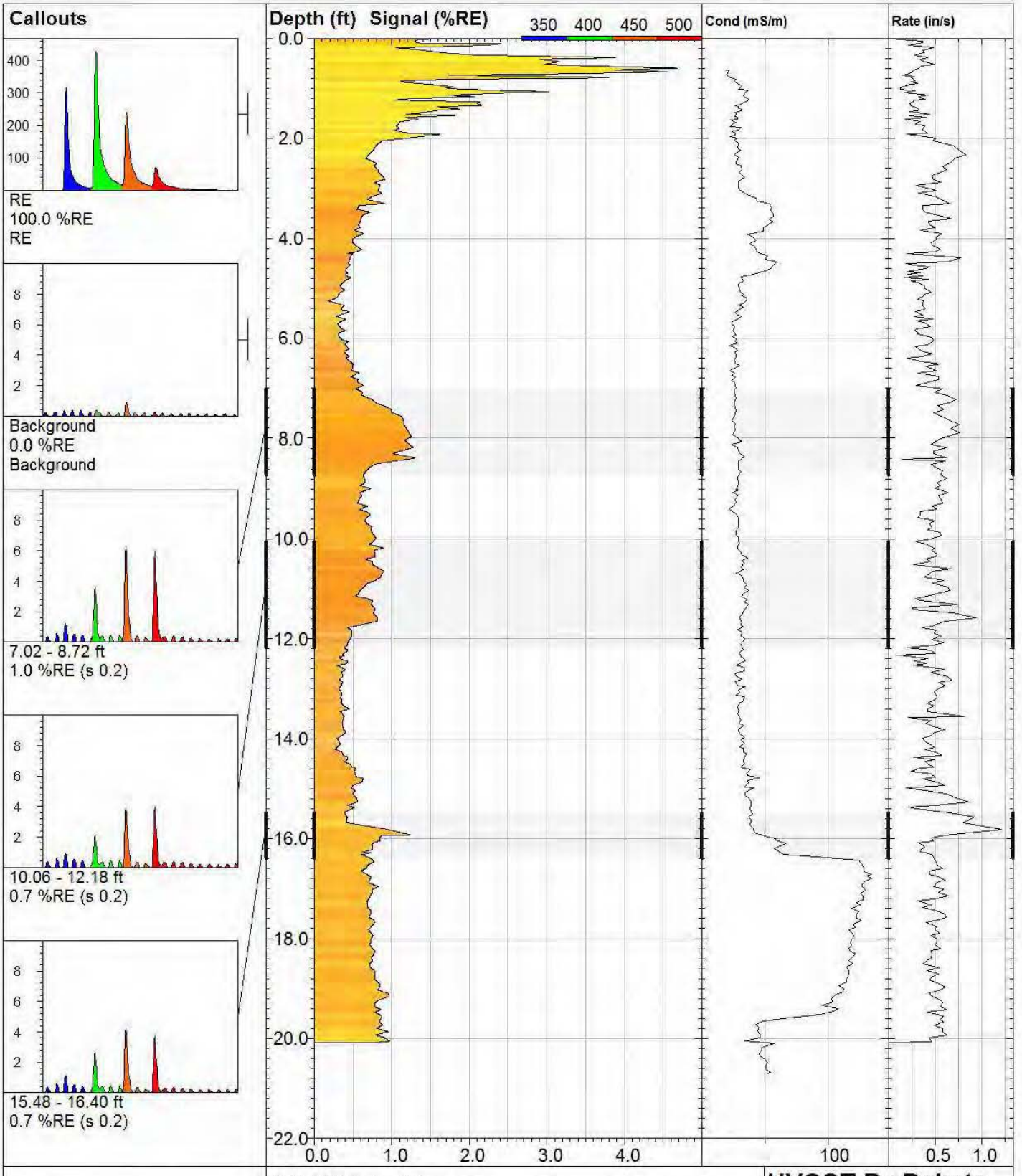
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.04 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.3 %RE @ 0.24 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 09:57 MDT**



MW33-L9

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.14 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **6.9 %RE @ 0.70 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 10:30 MDT**



MW33-L10

UVOST By Dakota
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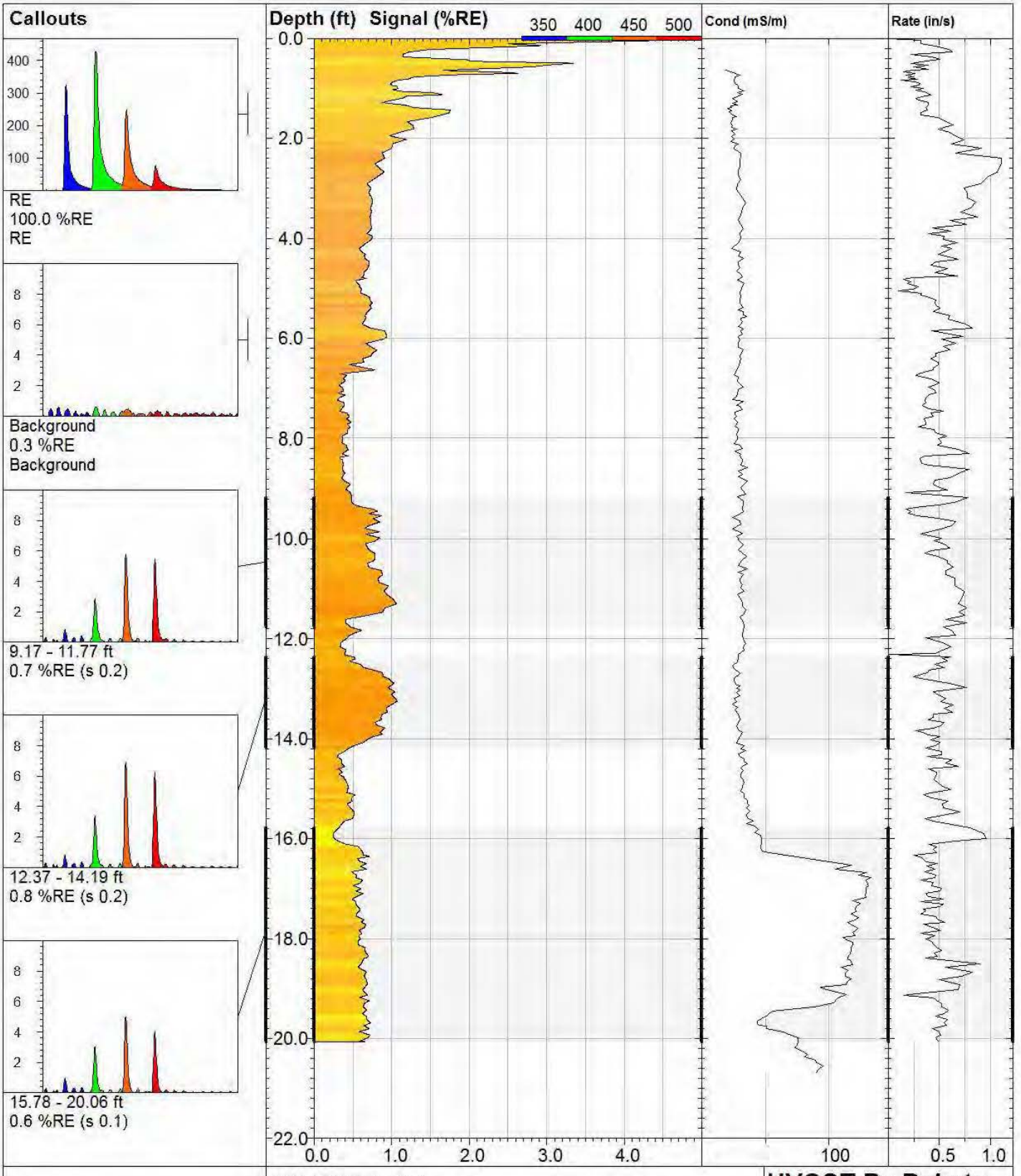
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.08 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.7 %RE @ 0.60 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 12:34 MDT**

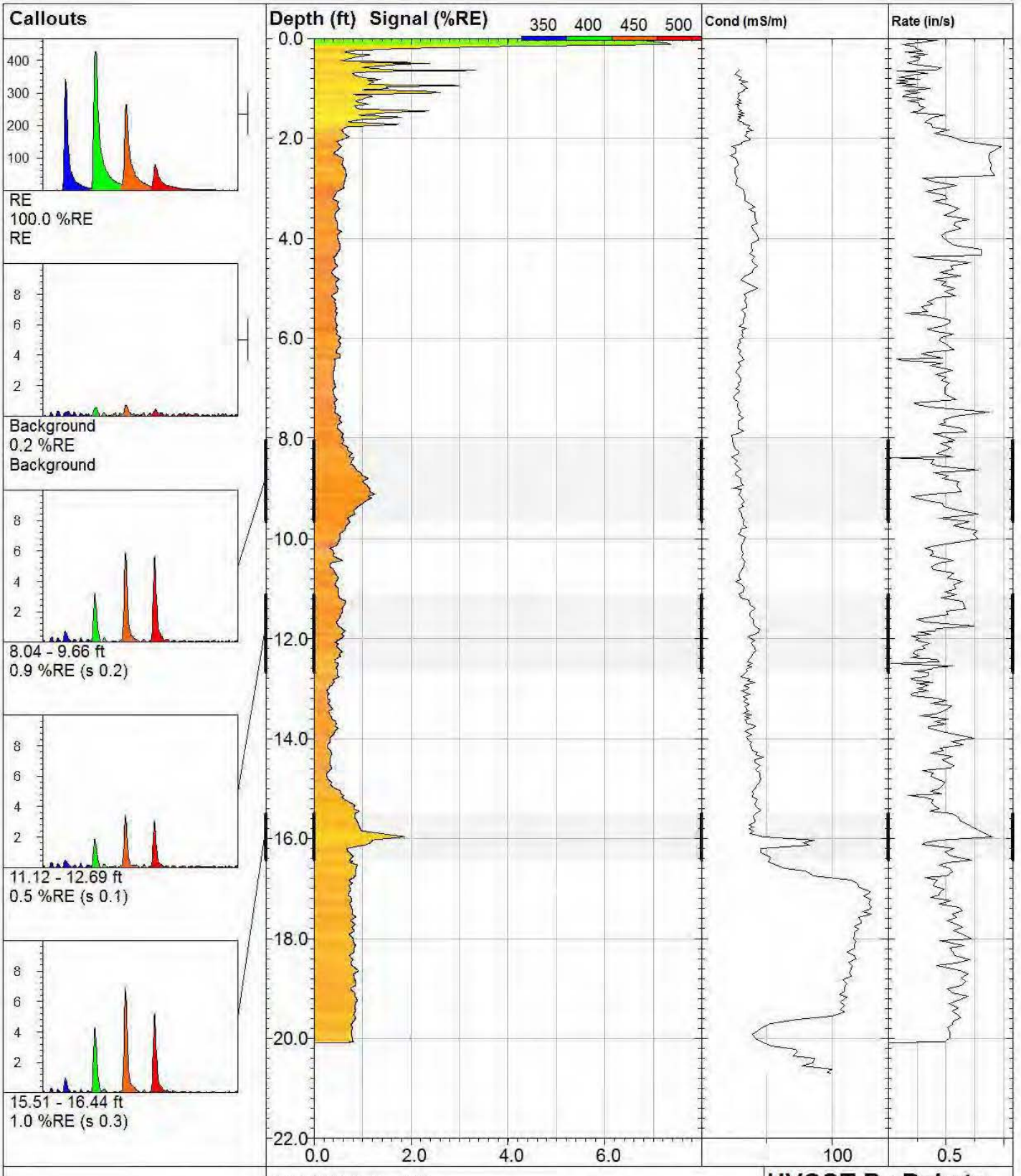


MW33-L11

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.06 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.7 %RE @ 0.04 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 13:05 MDT**

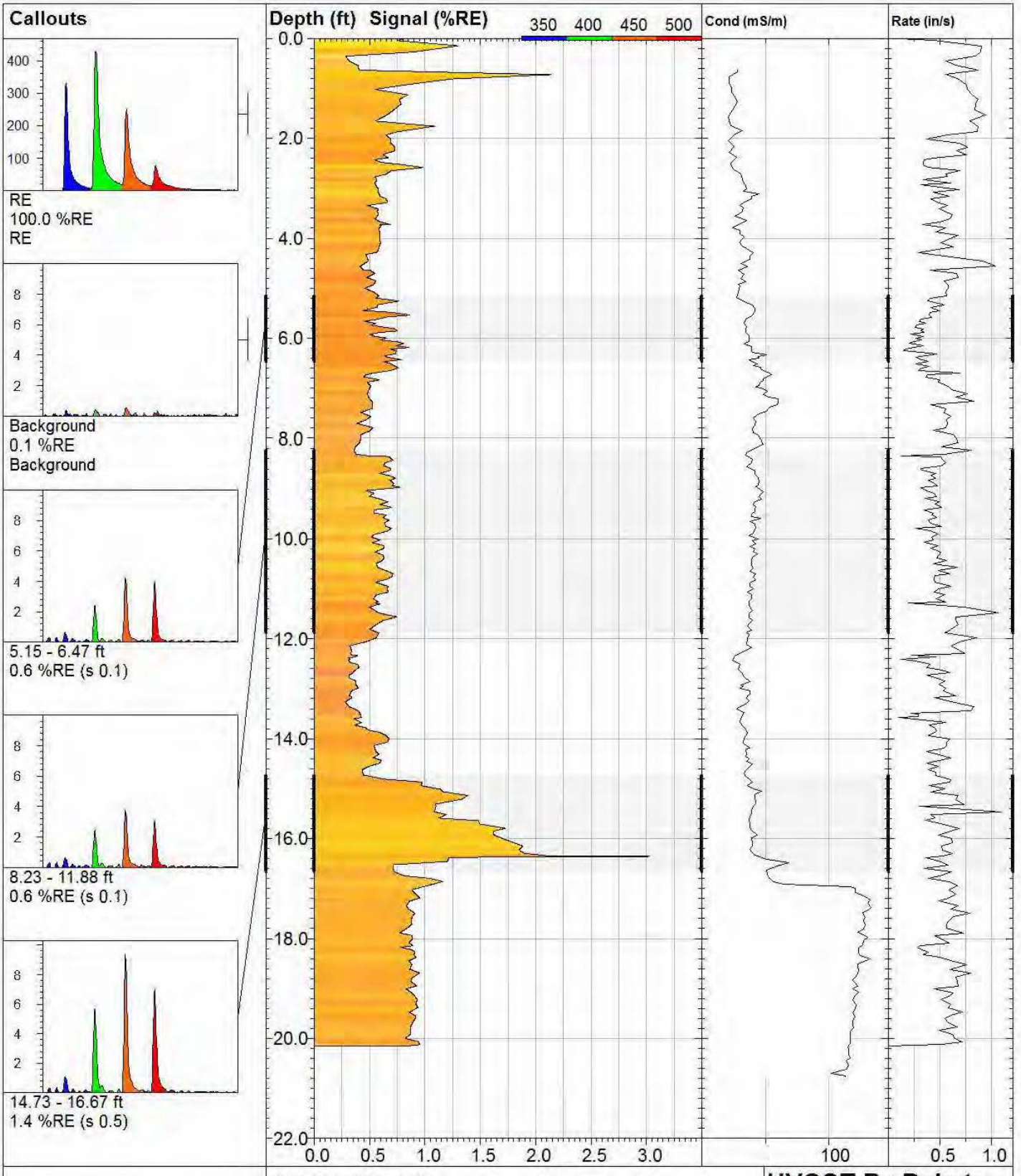


VIRONEX

MW33-L12

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.08 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **7.4 %RE @ 0.12 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 13:33 MDT**

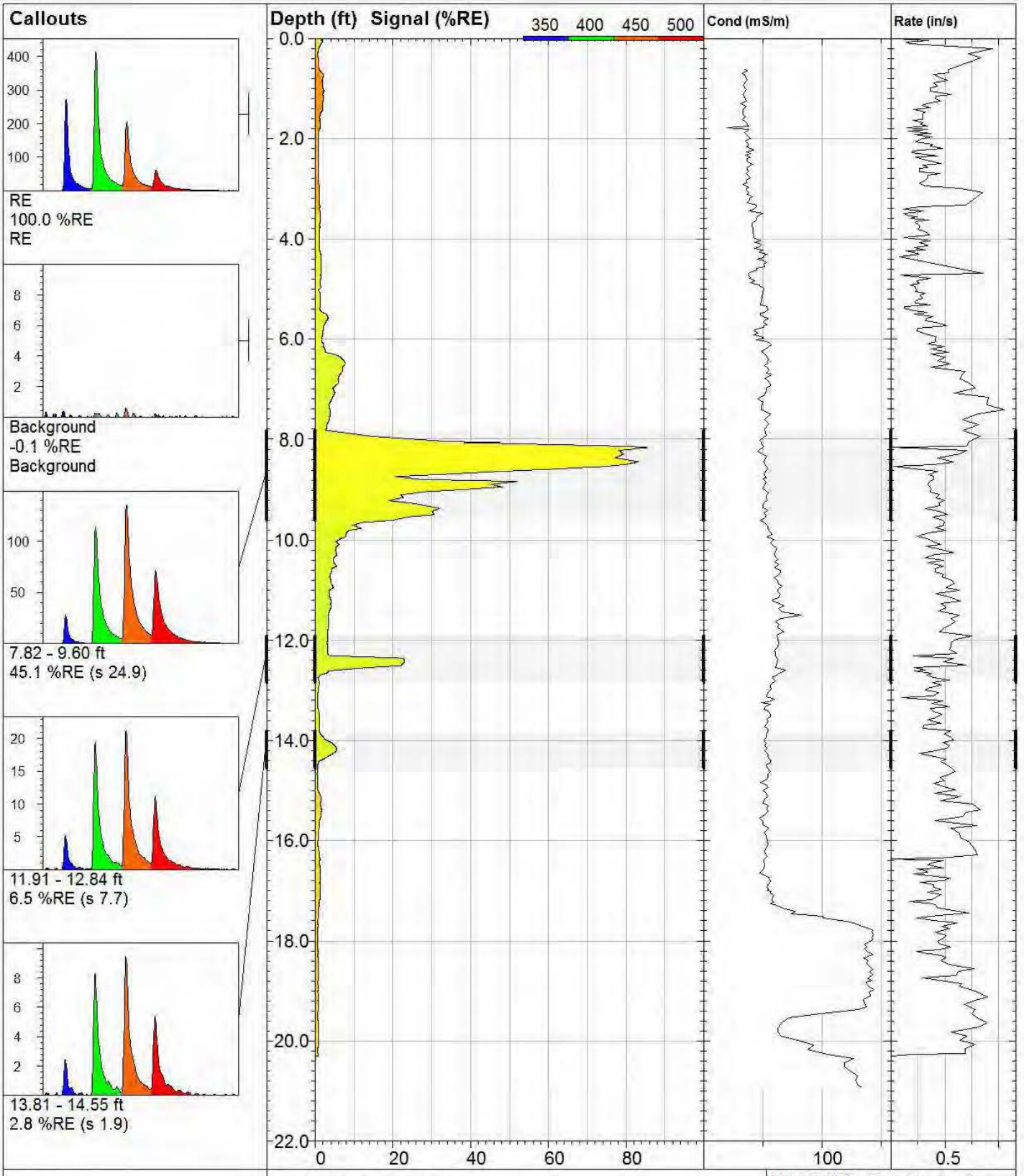


VIRONEX

MW33-L13

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.14 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.2 %RE @ 16.36 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 14:04 MDT**



MW34R-L14

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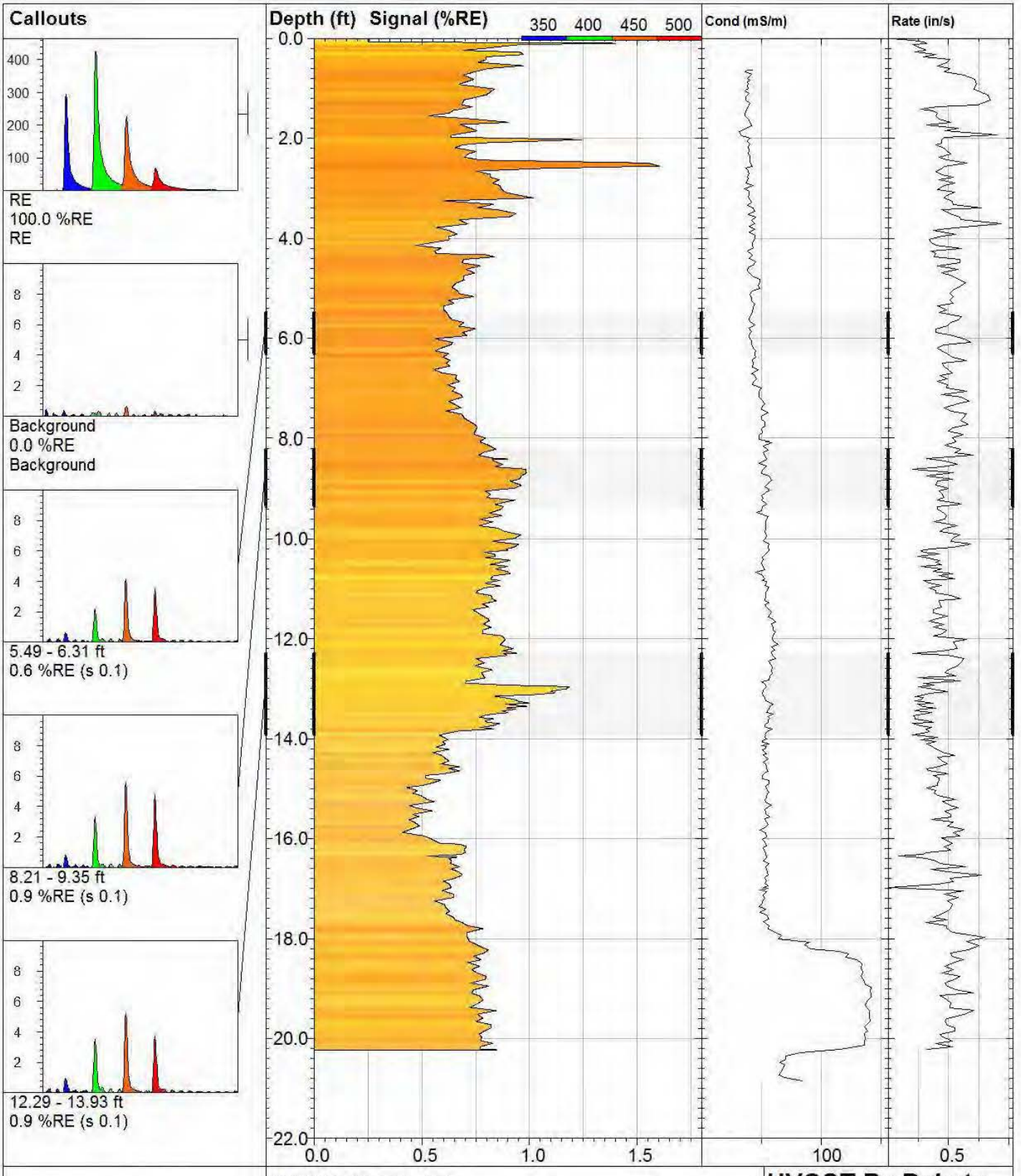
VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.29 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **85.6 %RE @ 8.15 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 06:46 MDT**

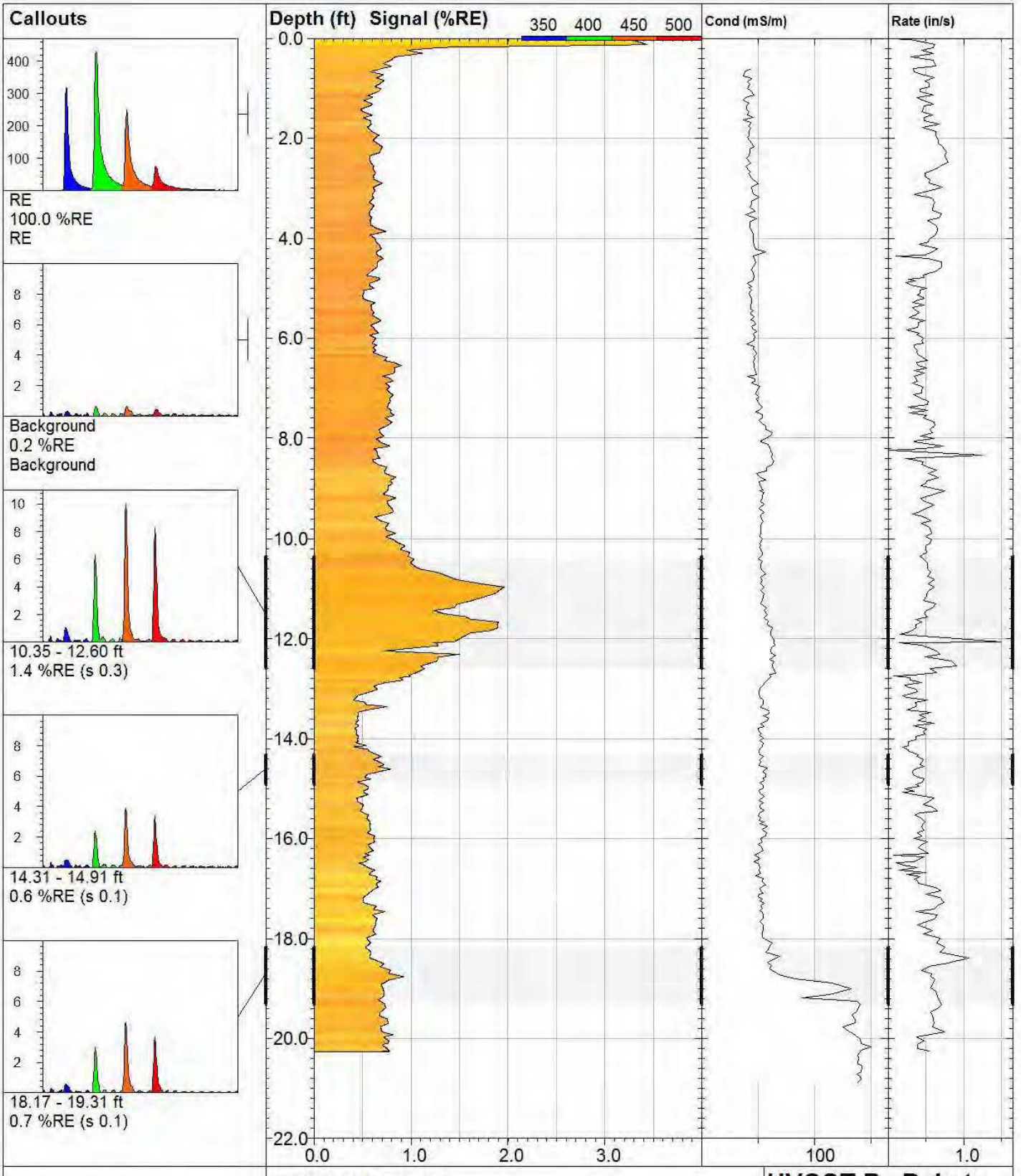


VIRONEX

MW34R-L15

UVOST By Dakota
www.DakotaTechnologies.com

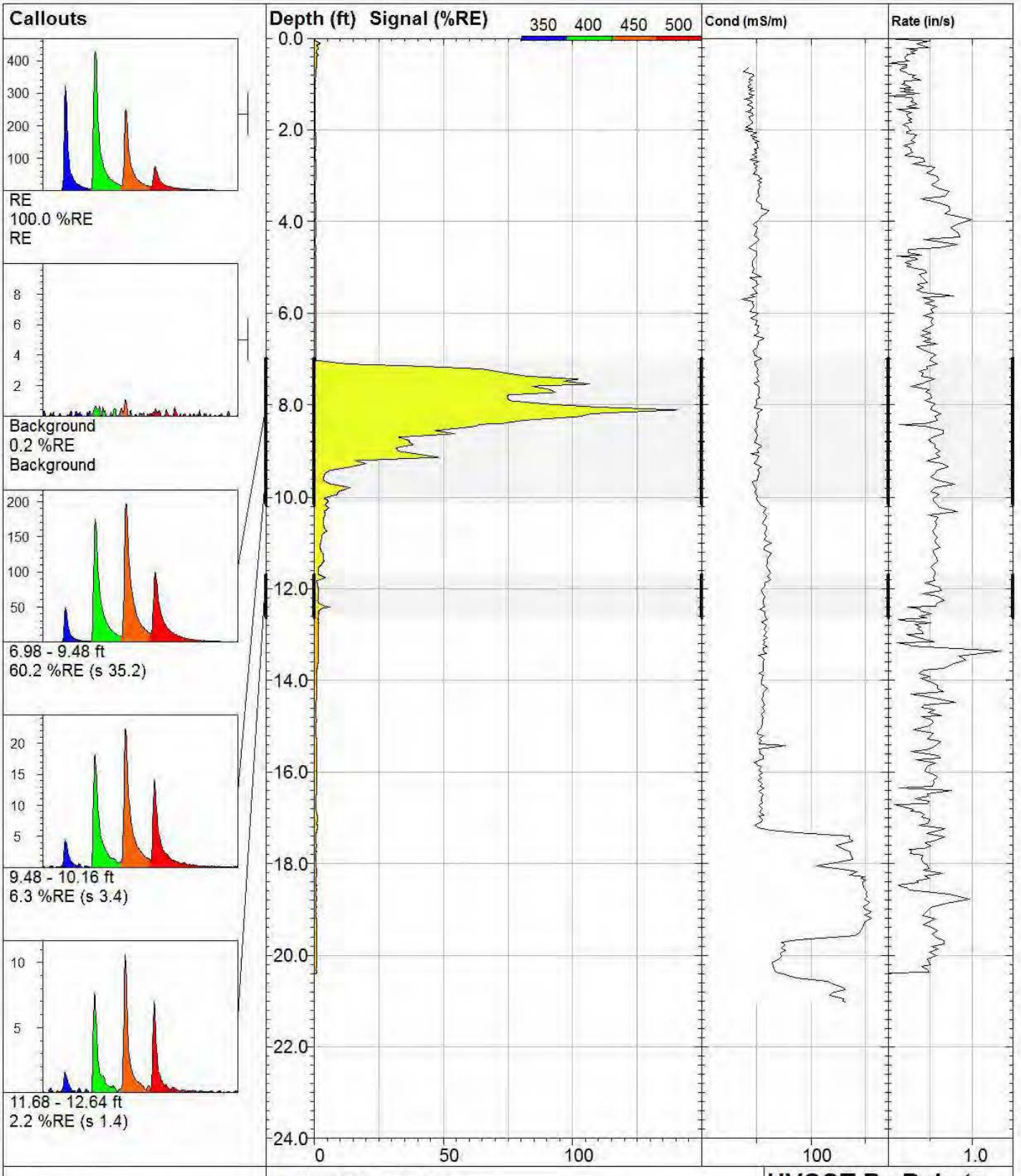
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.23 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.6 %RE @ 2.56 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 07:22 MDT**



MW34R-L16

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.26 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.4 %RE @ 0.13 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 07:50 MDT**



MW34R-L17

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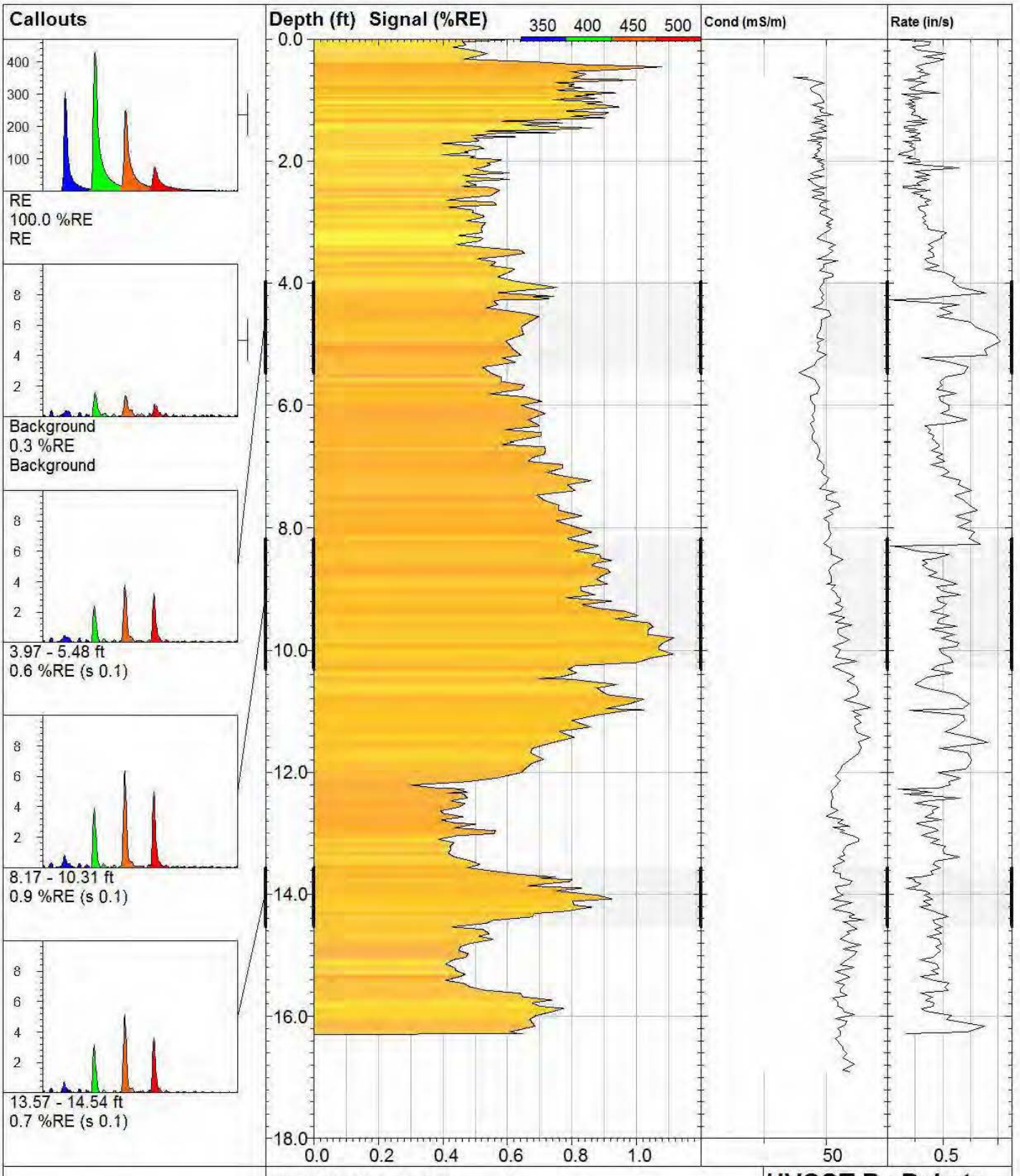
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.40 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **140.6 %RE @ 8.11 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 08:19 MDT**



VIRONEX

MW34R-L18

UVOST By Dakota
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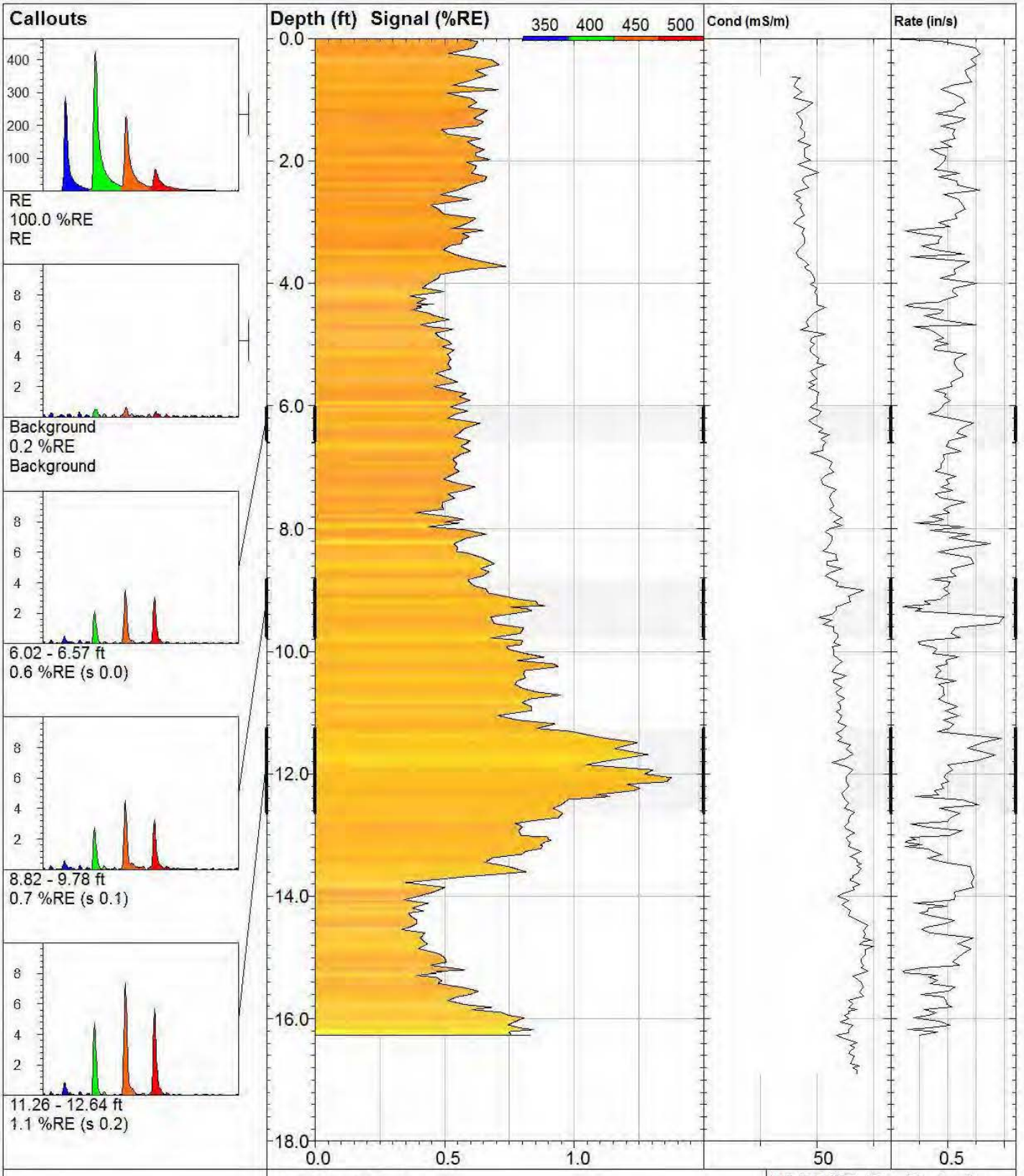
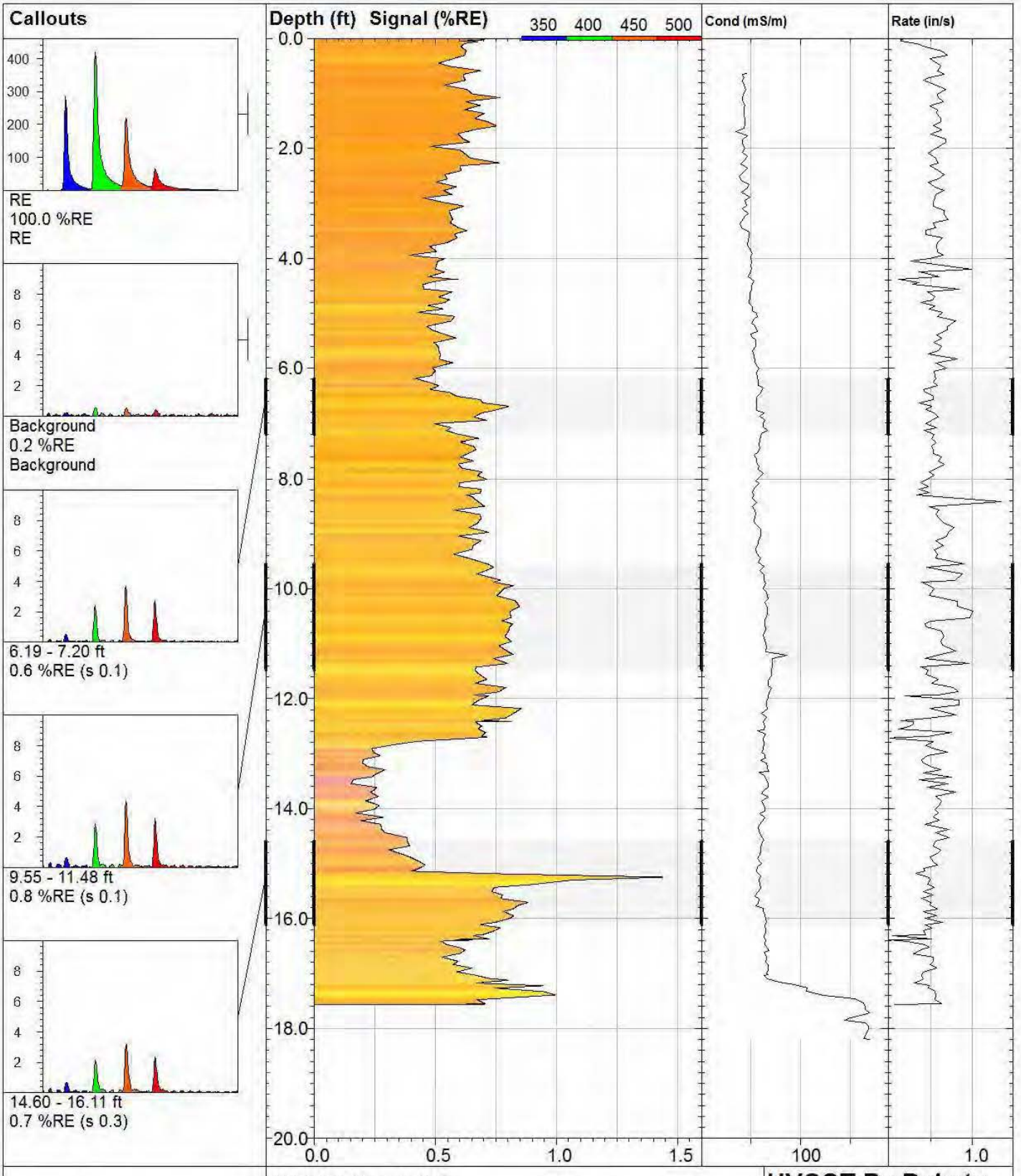
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.29 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.1 %RE @ 9.80 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 08:47 MDT**



MW34R-L19

UVOST By Dakota
www.DakotaTechnologies.com

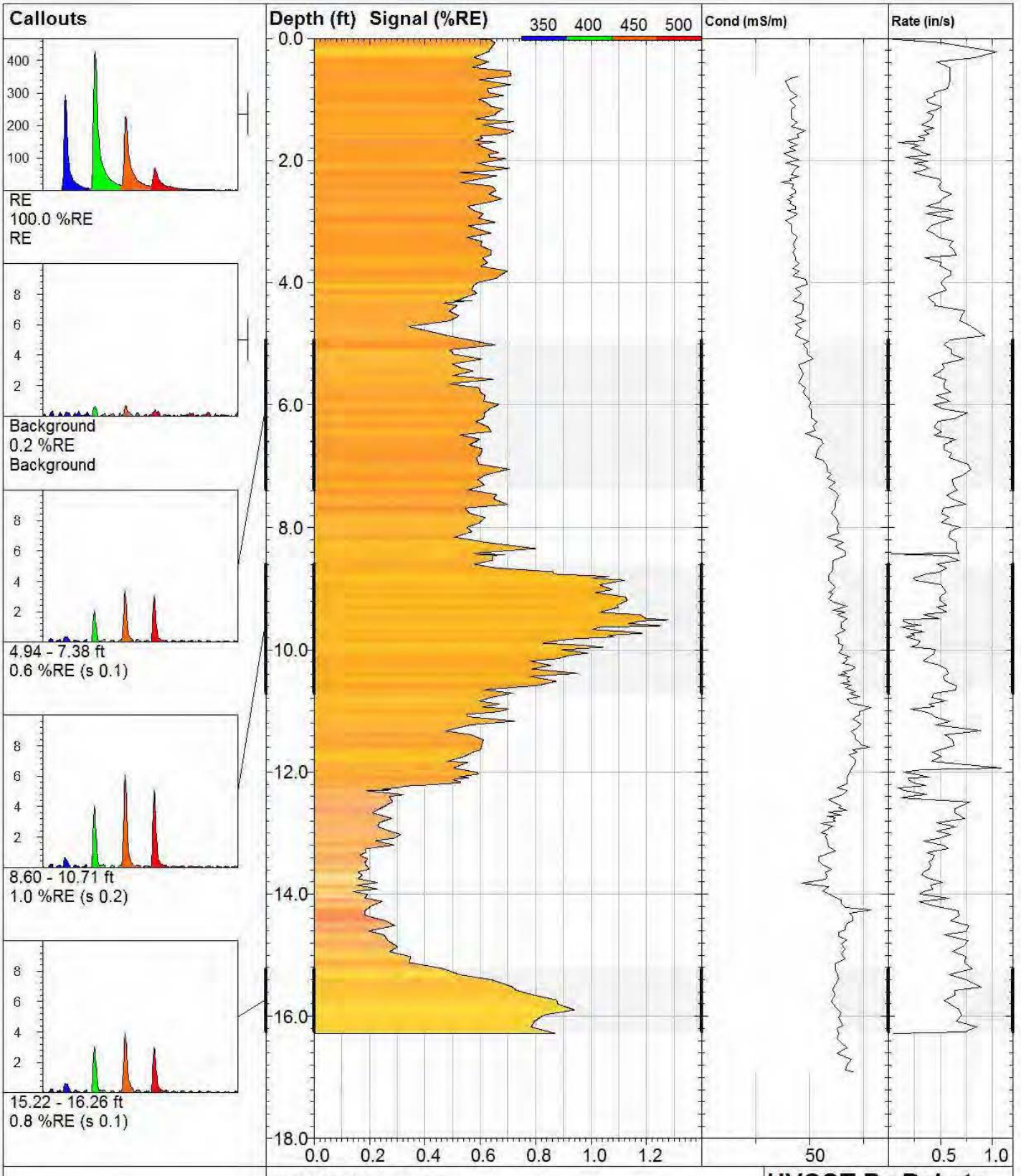
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.27 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.4 %RE @ 12.06 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 09:17 MDT**



MW34R-L20

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **17.57 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.4 %RE @ 15.25 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 10:12 MDT**



MW34R-L21

UVOST By Dakota
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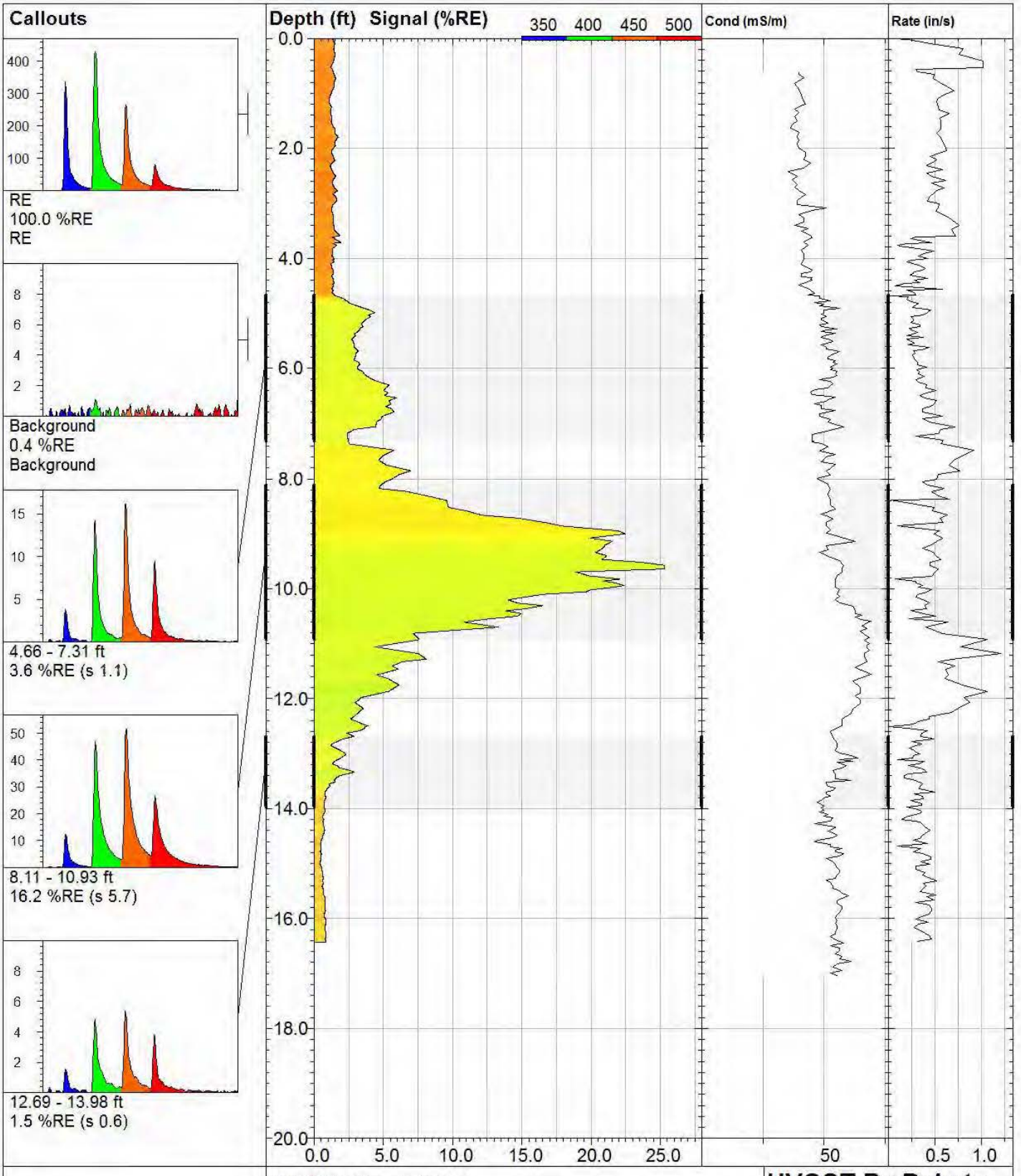
VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.29 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.3 %RE @ 9.51 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 10:41 MDT**



MW34R-L22

UVOST By Dakota
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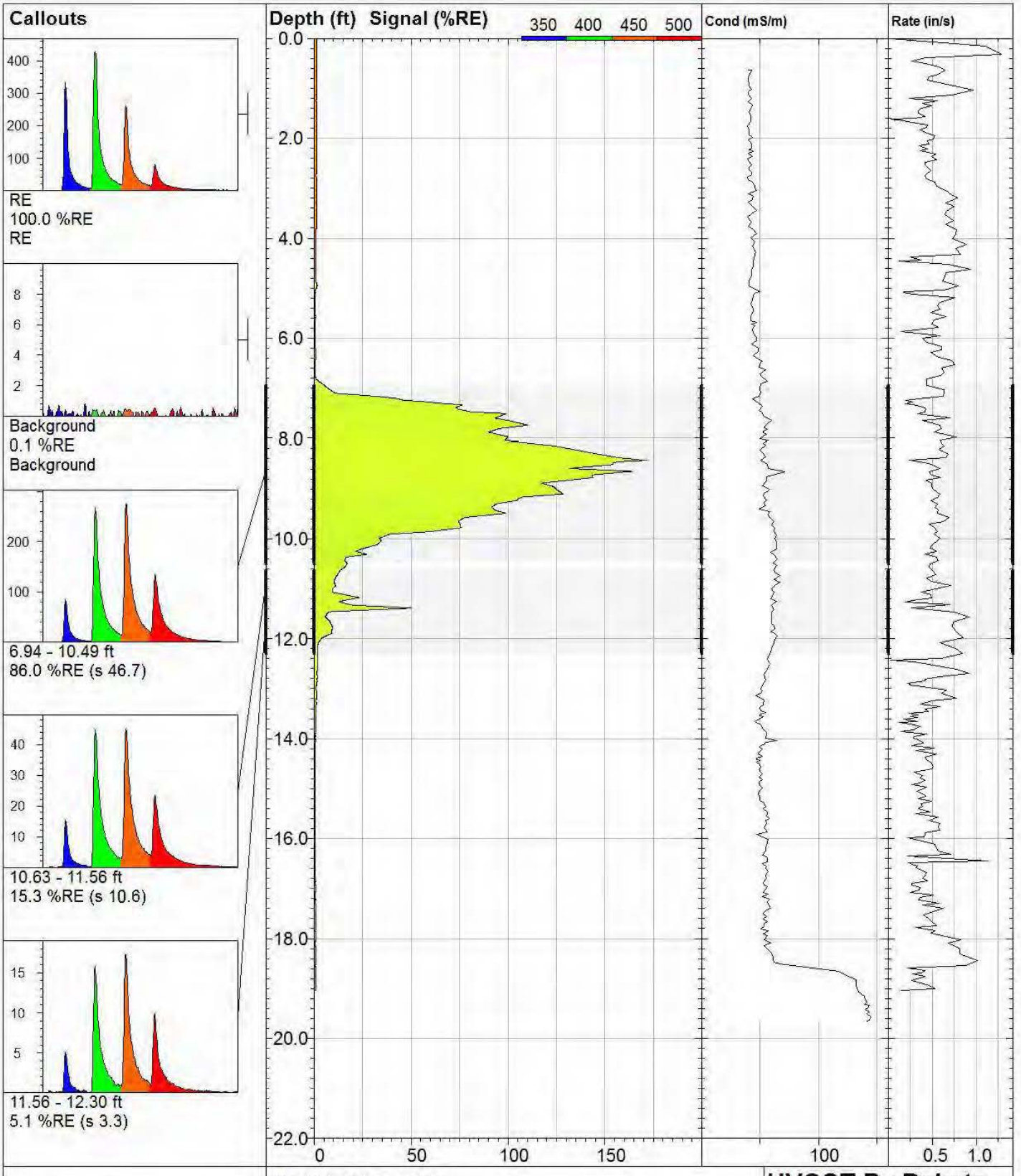
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.43 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **25.3 %RE @ 9.64 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 11:12 MDT**



MW34R-L23

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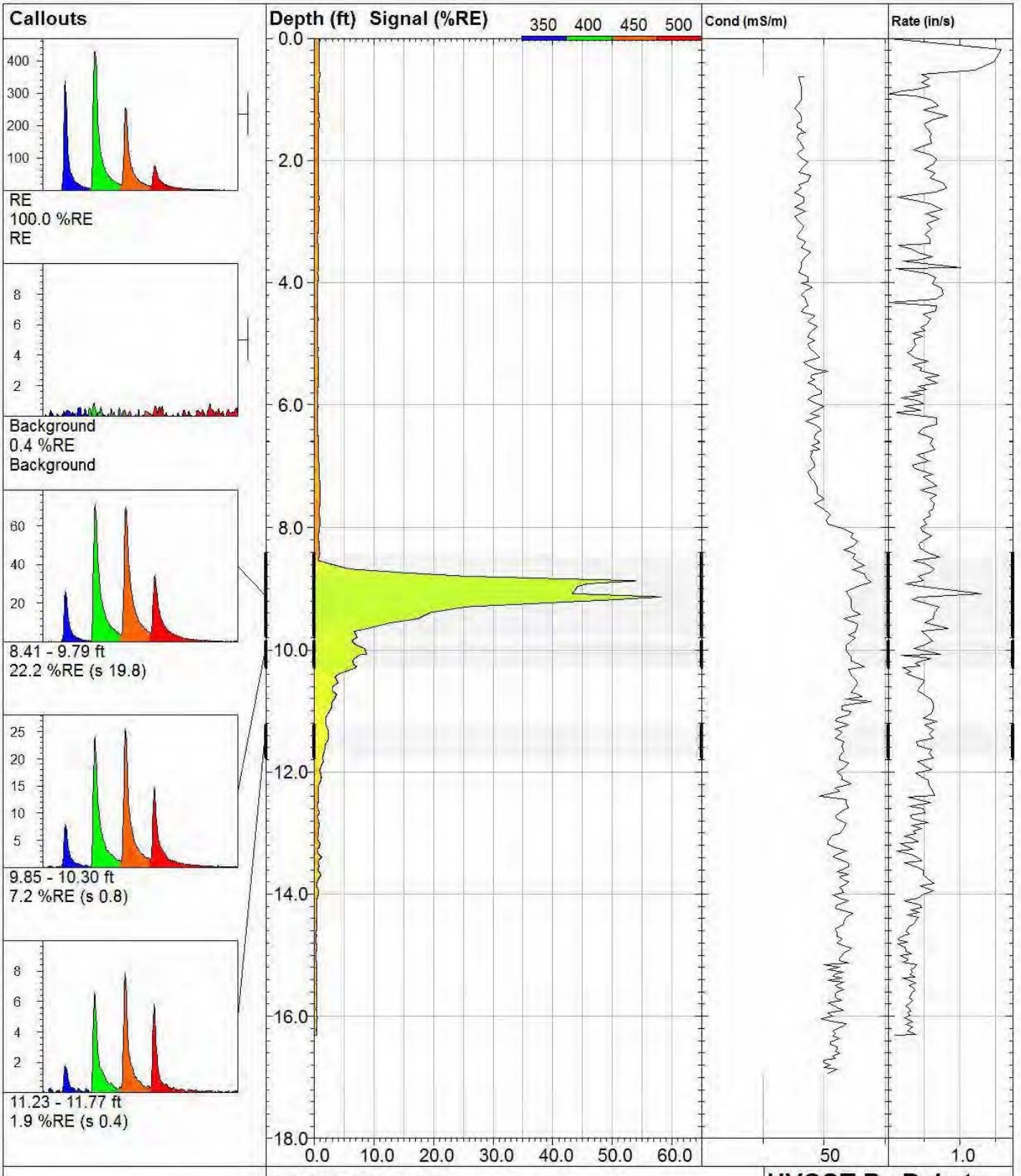
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **19.03 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **171.8 %RE @ 8.43 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 11:35 MDT**



VIRONEX

MW34R-L24

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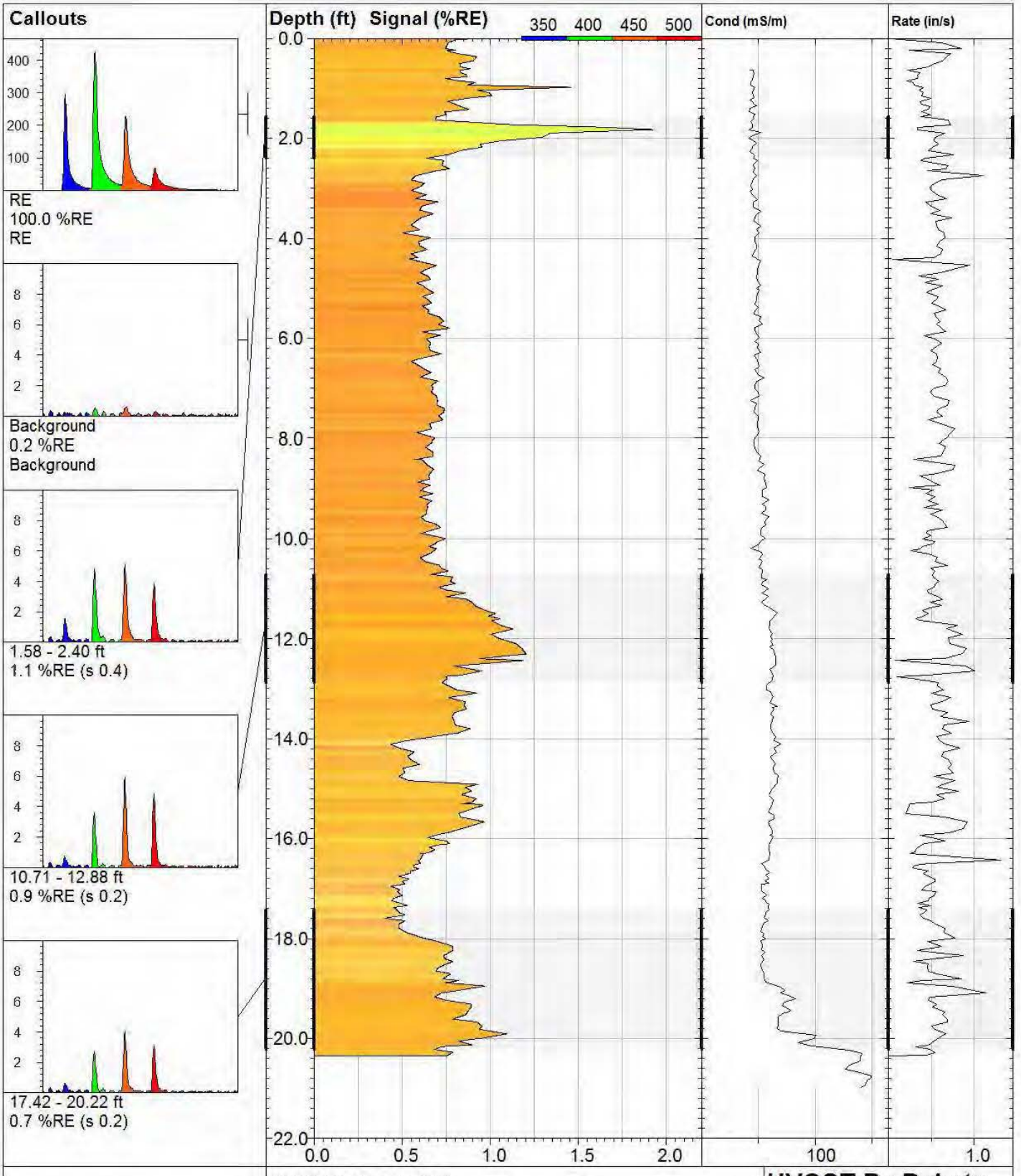
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.31 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **58.5 %RE @ 9.13 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 11:59 MDT**



MW34R-L25

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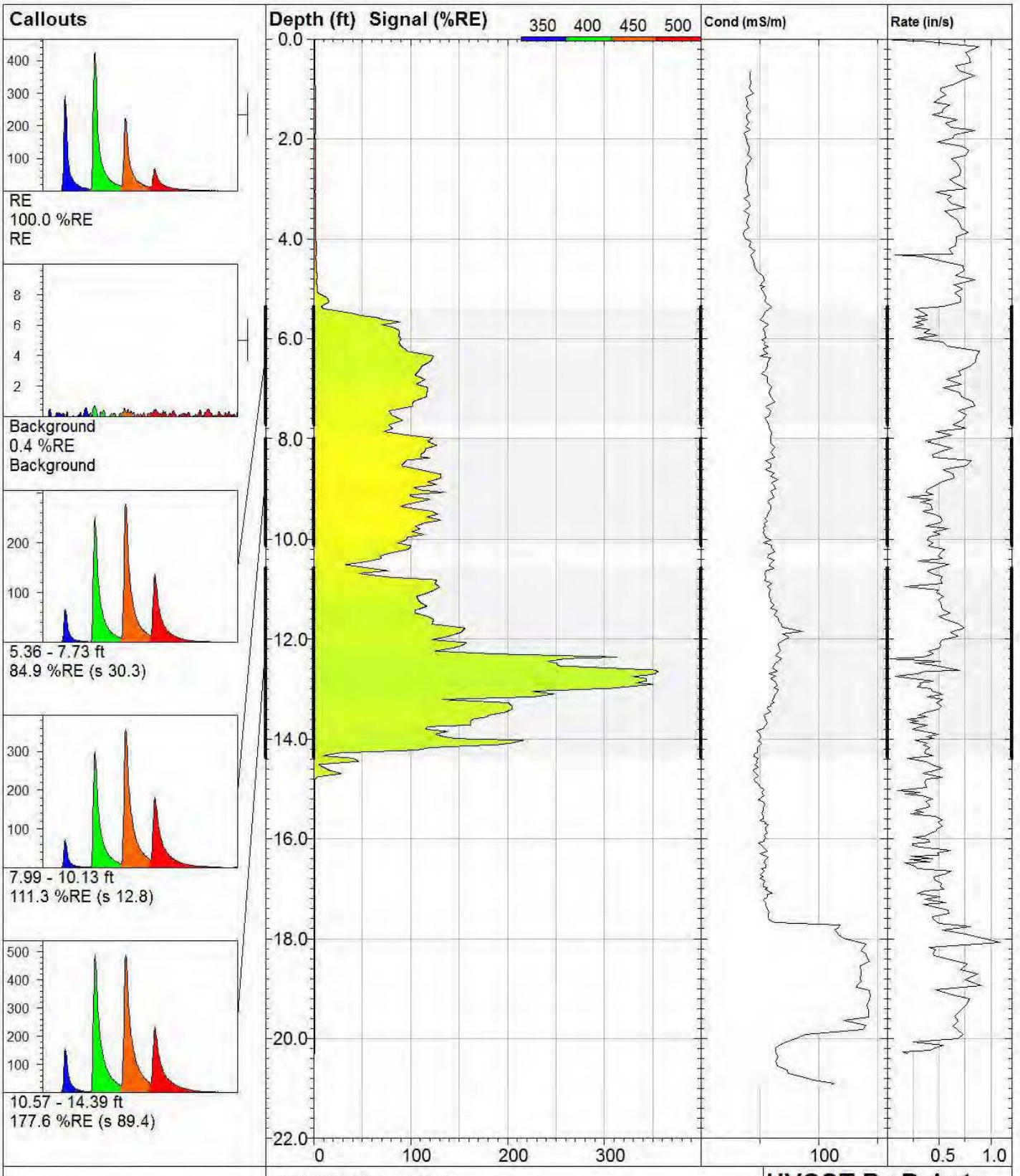
VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.35 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.9 %RE @ 1.83 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 12:27 MDT**



MW34R-L26

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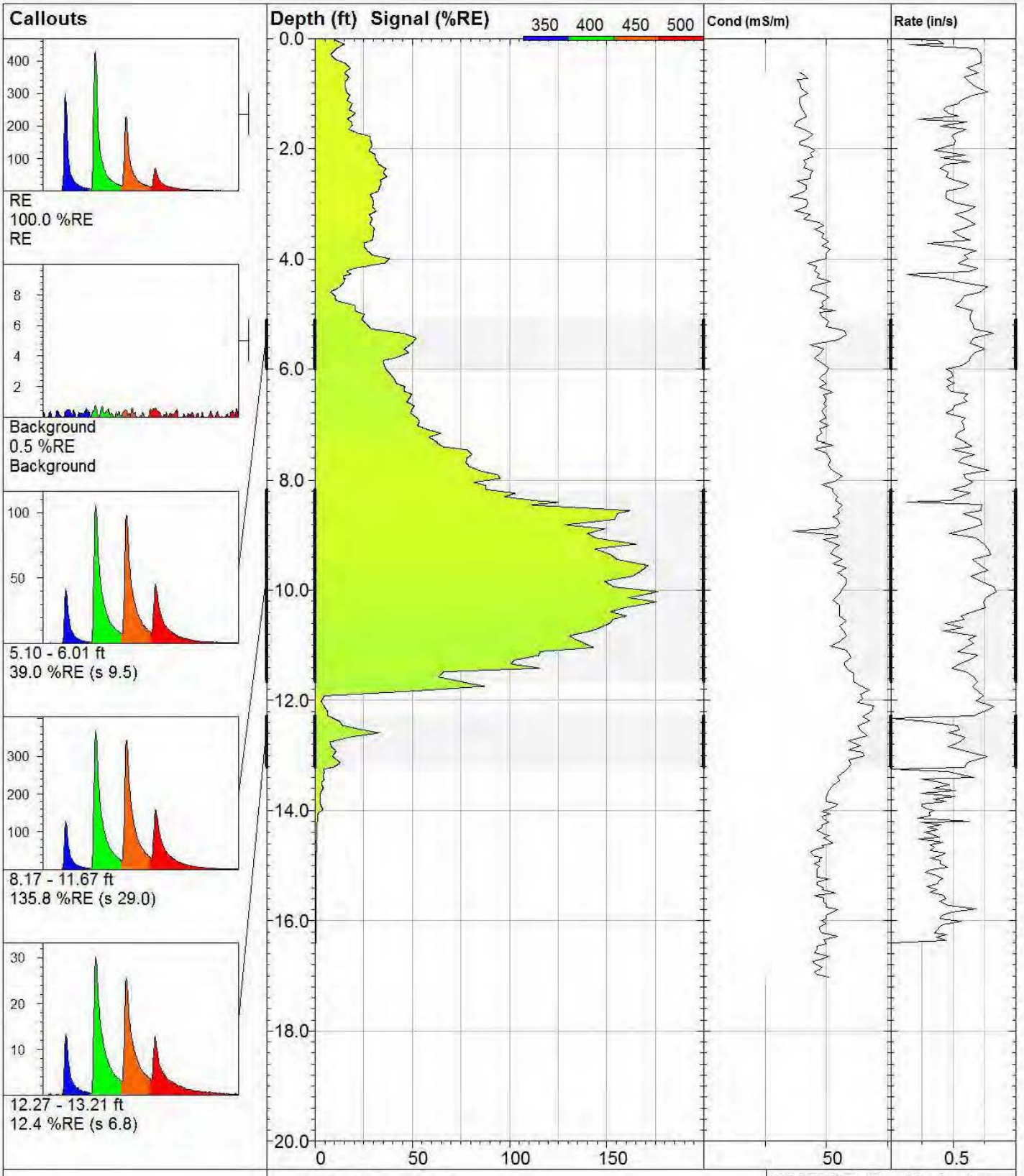
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.30 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **355.5 %RE @ 12.65 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 12:58 MDT**



VIRONEX

MW34R-L27

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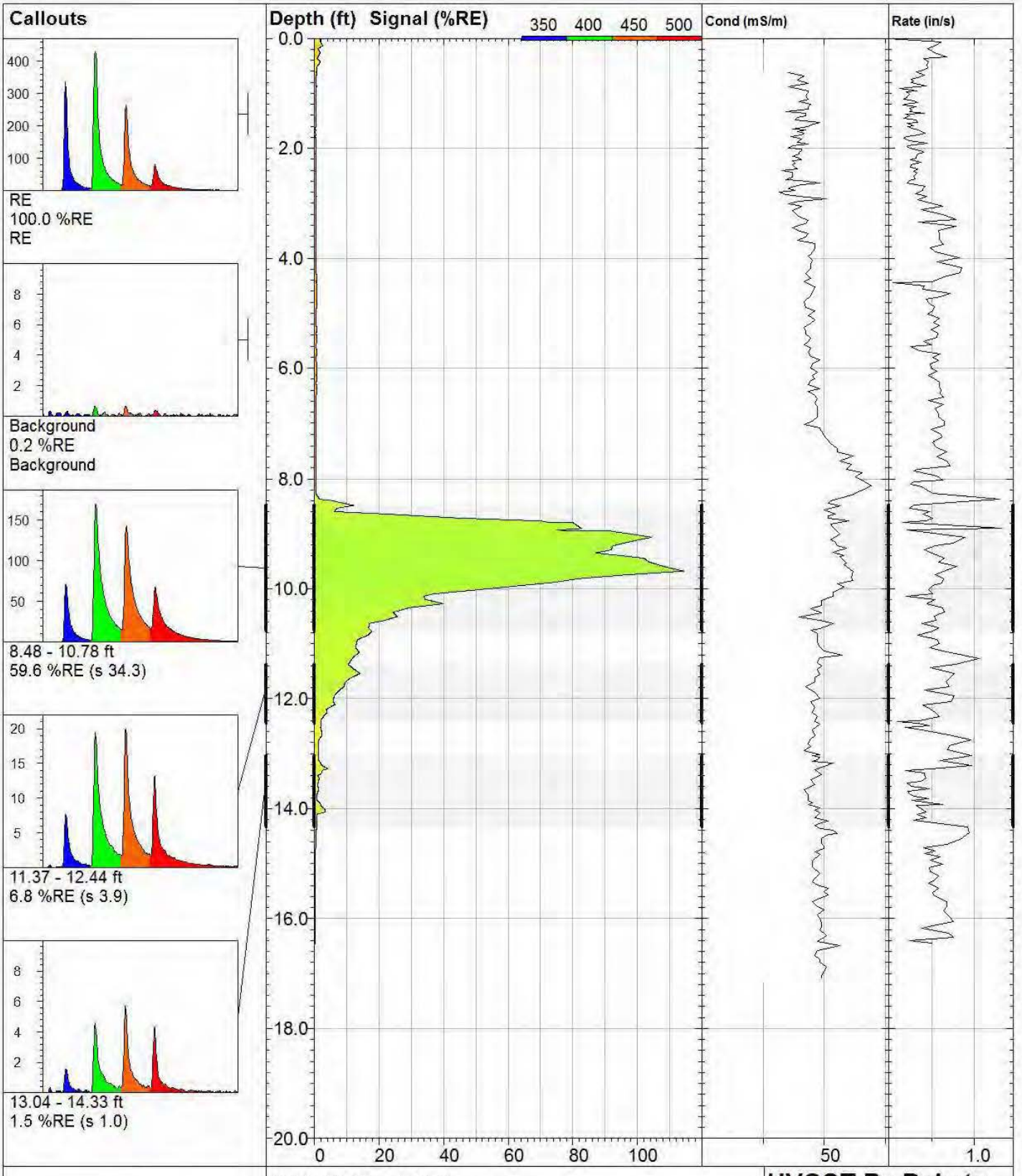
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.40 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **176.6 %RE @ 10.03 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 13:25 MDT**



VIRONEX

MW34R-L28

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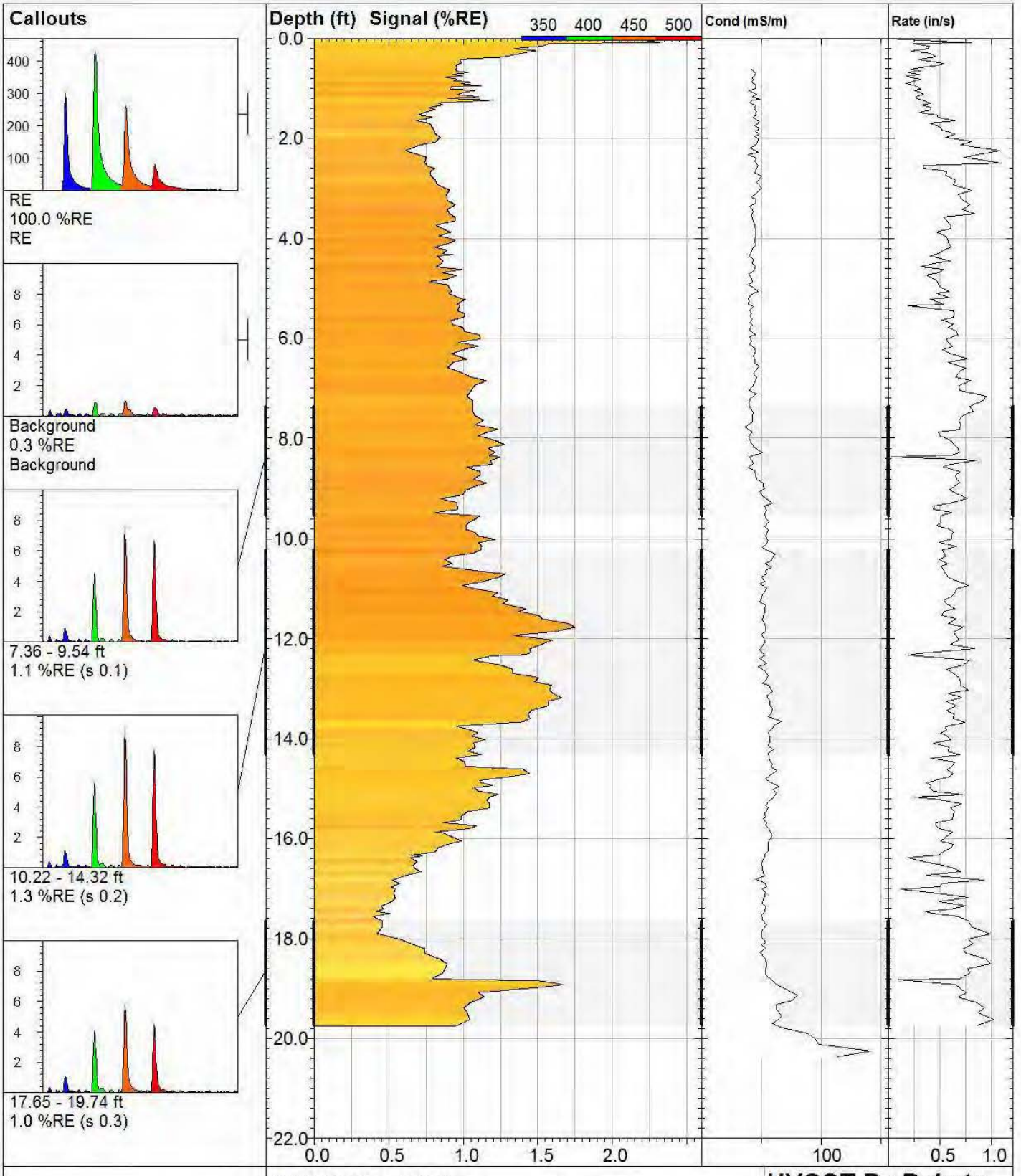
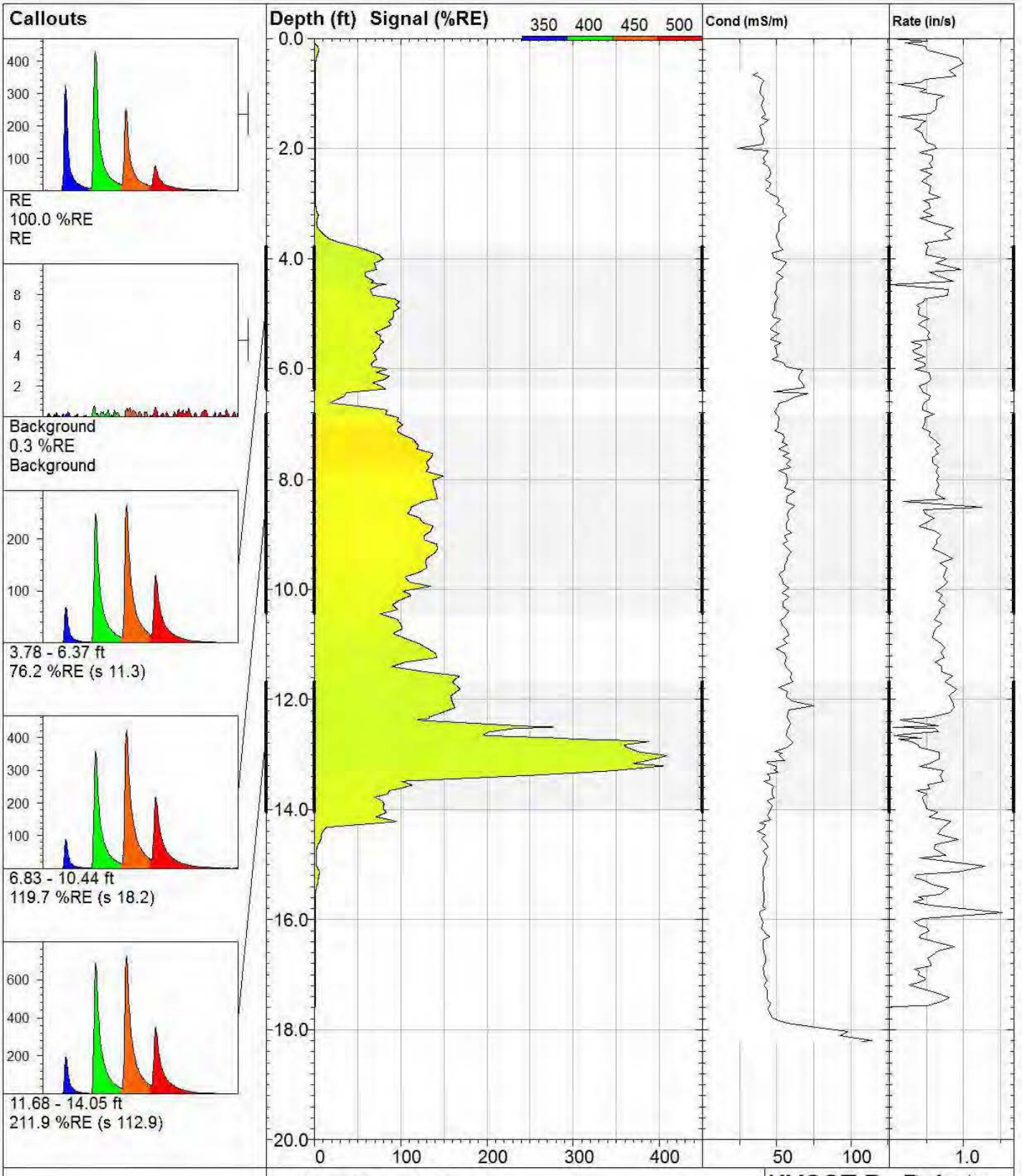
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.46 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **114.3 %RE @ 9.68 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 13:54 MDT**



MW34R-L29

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **19.75 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.3 %RE @ 0.08 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 14:22 MDT**



MW34R-L30

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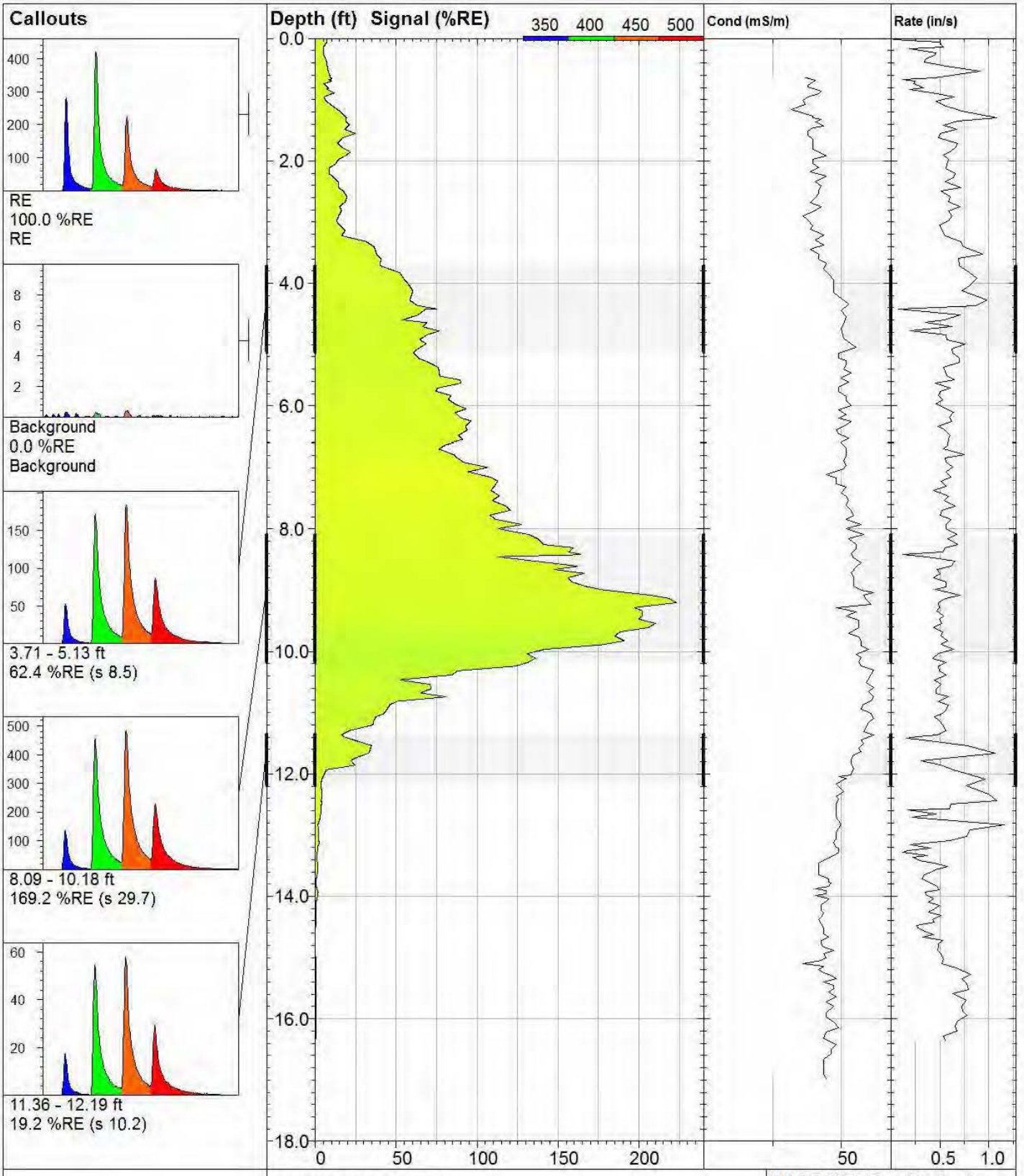
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **17.59 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **408.7 %RE @ 13.02 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 14:55 MDT**



MW34R-L31

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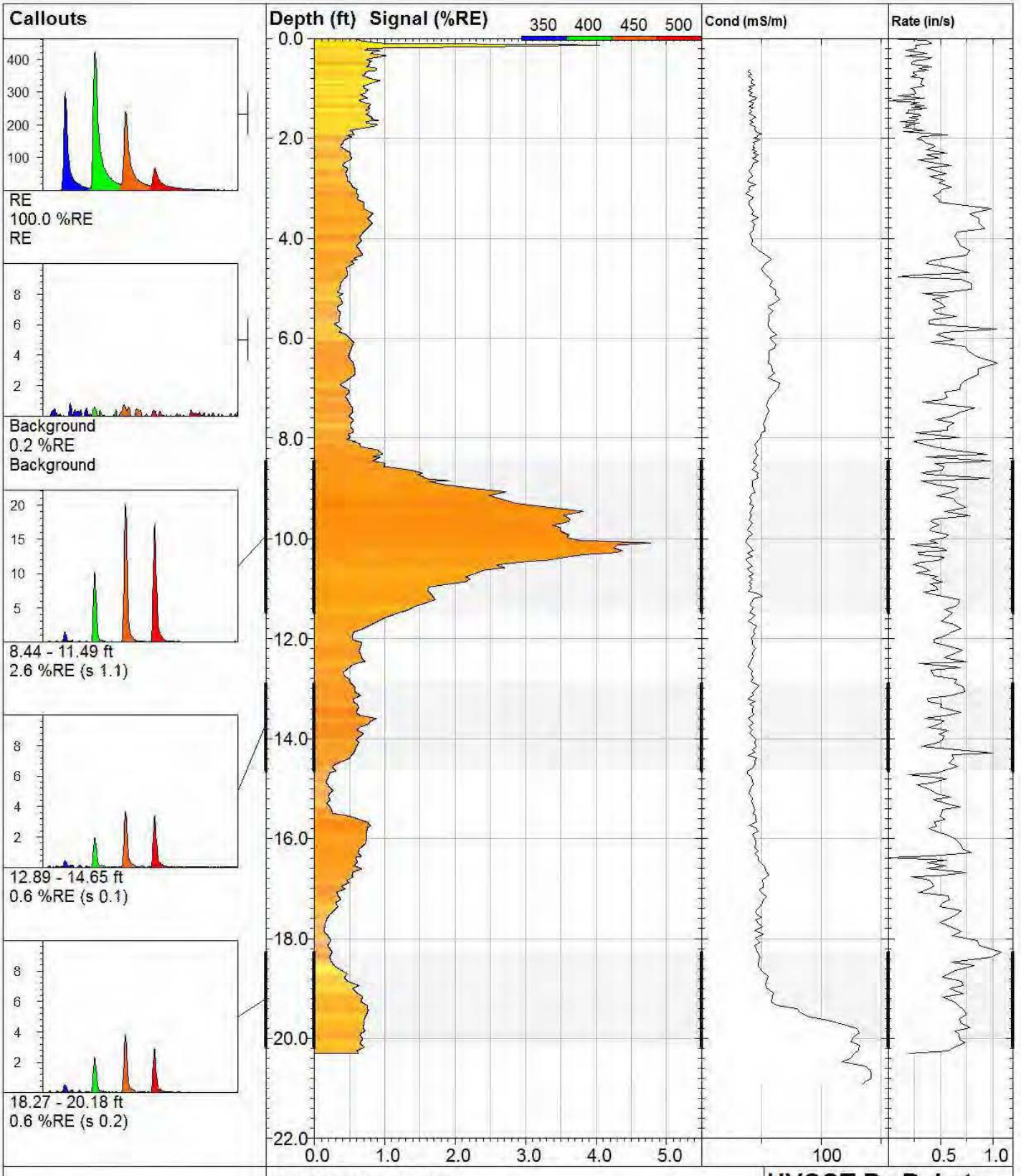
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.36 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **223.3 %RE @ 9.20 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 06:54 MDT**



MW34R-L32

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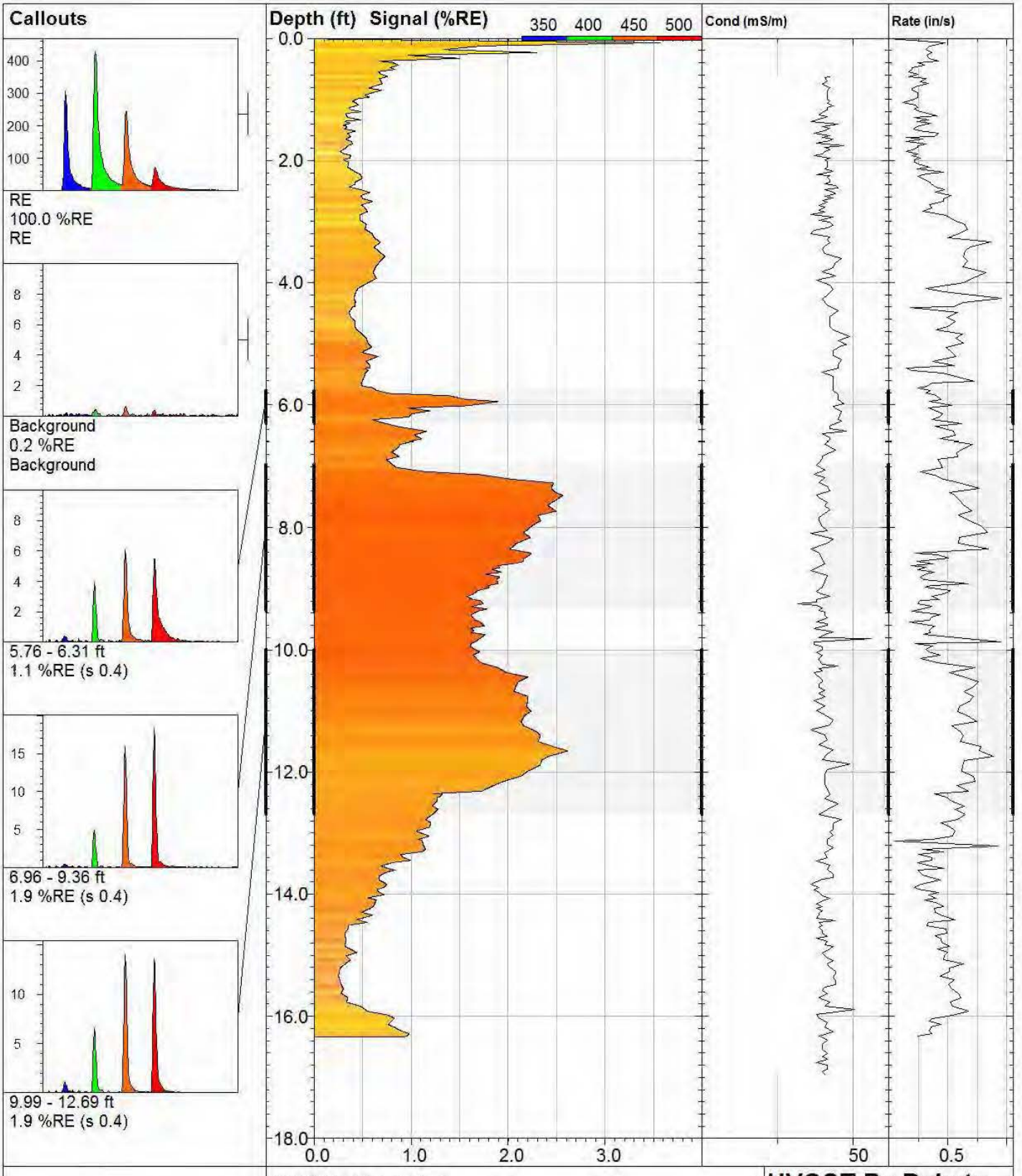
VIRONEX

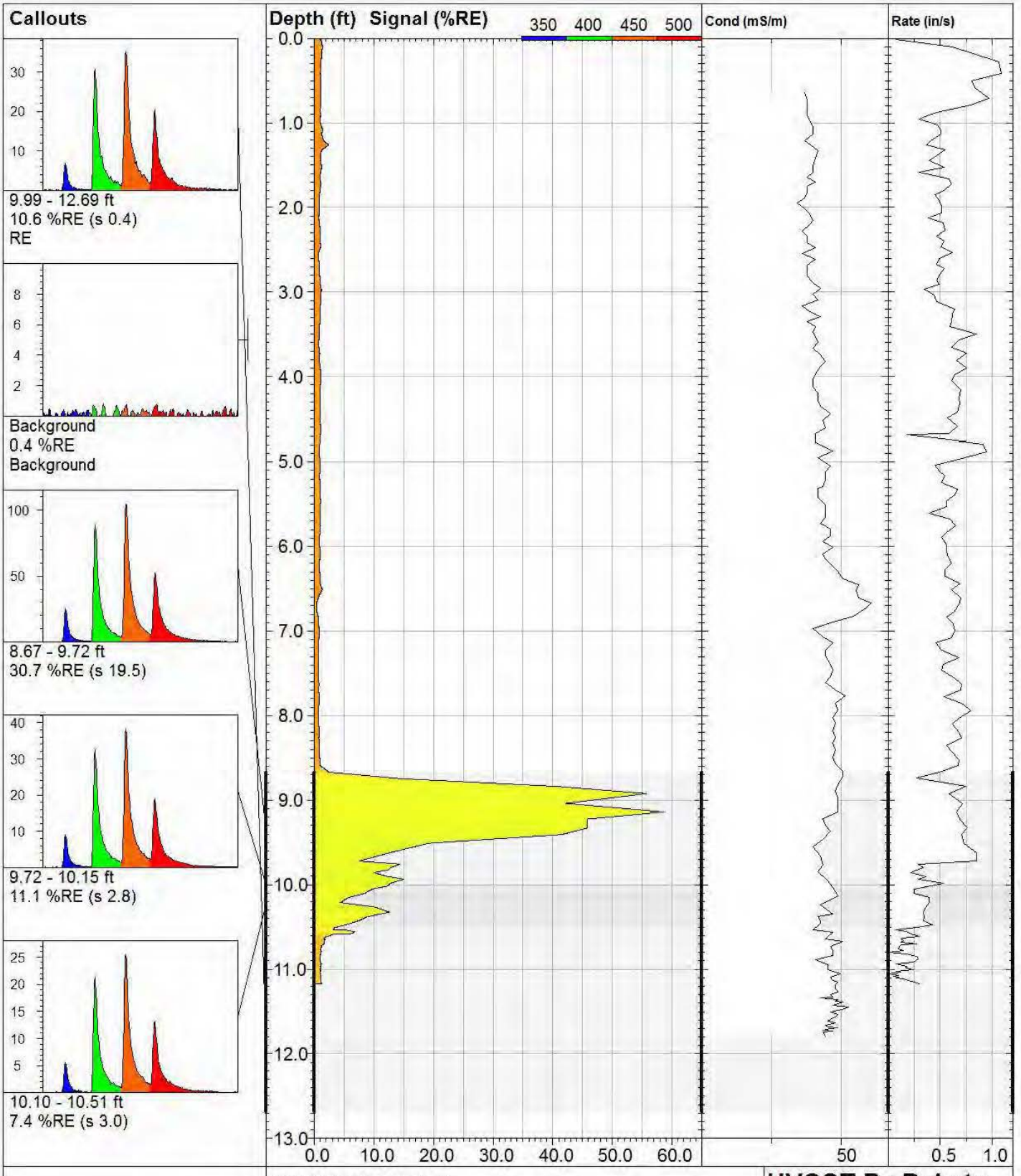
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.30 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.8 %RE @ 10.08 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 07:27 MDT**



MW34R-L33

UVOST By Dakota
www.DakotaTechnologies.com

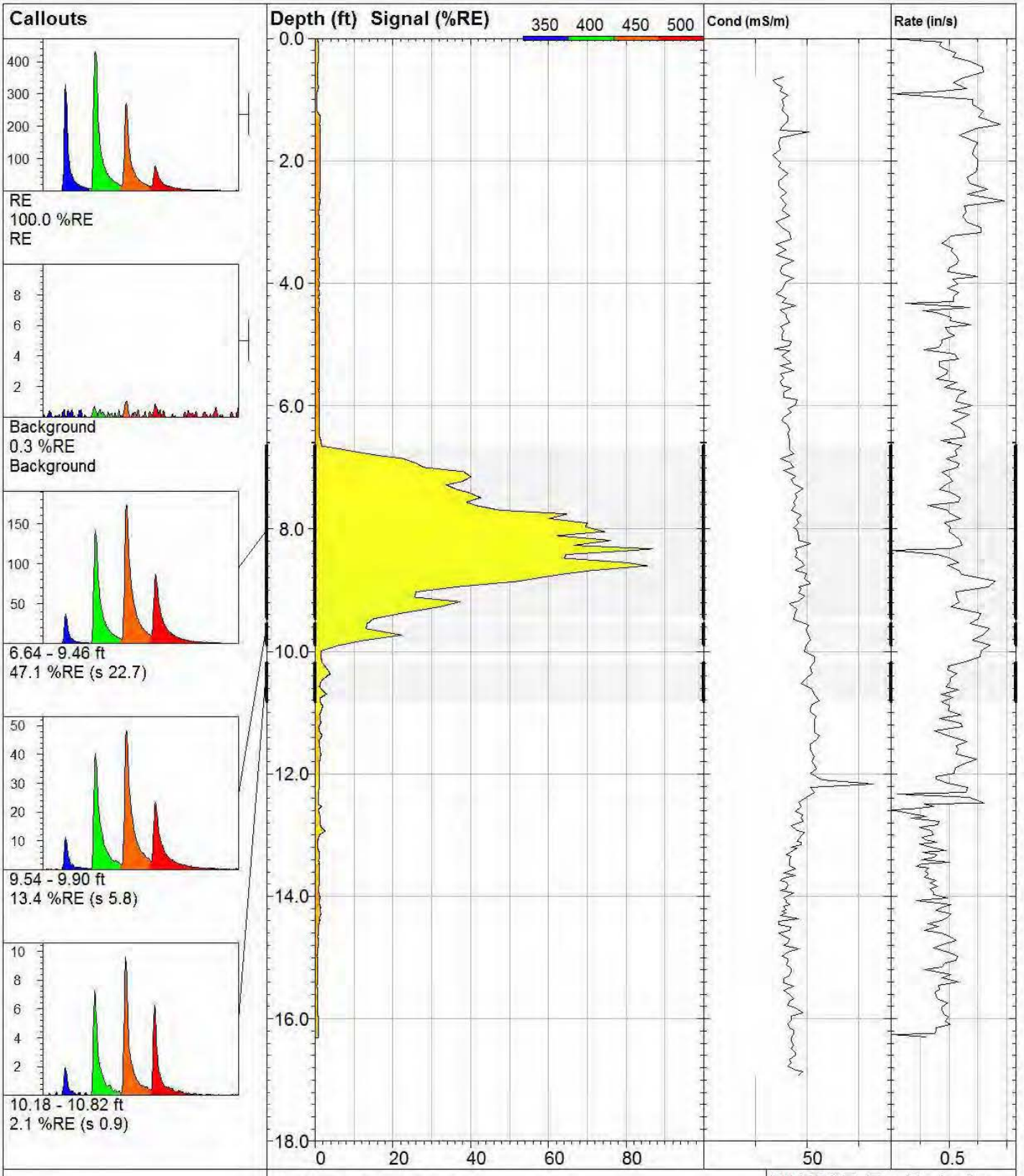
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.34 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.6 %RE @ 0.07 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 07:56 MDT**



MW34R-L34

UVOST By Dakota
www.DakotaTechnologies.com

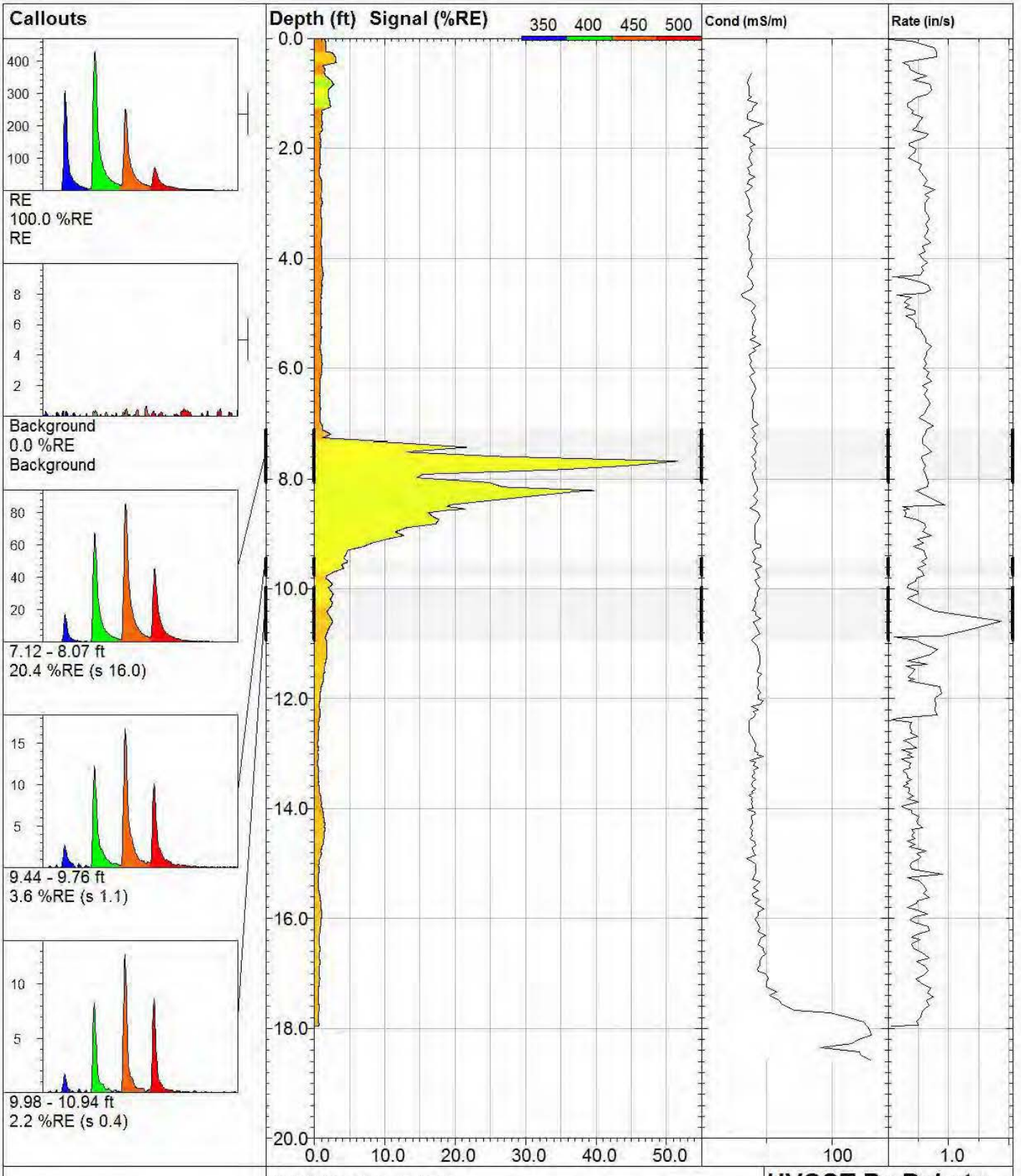
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **11.17 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **58.6 %RE @ 9.14 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 08:21 MDT**



MW34R-L35

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.30 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **86.9 %RE @ 8.32 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 08:43 MDT**

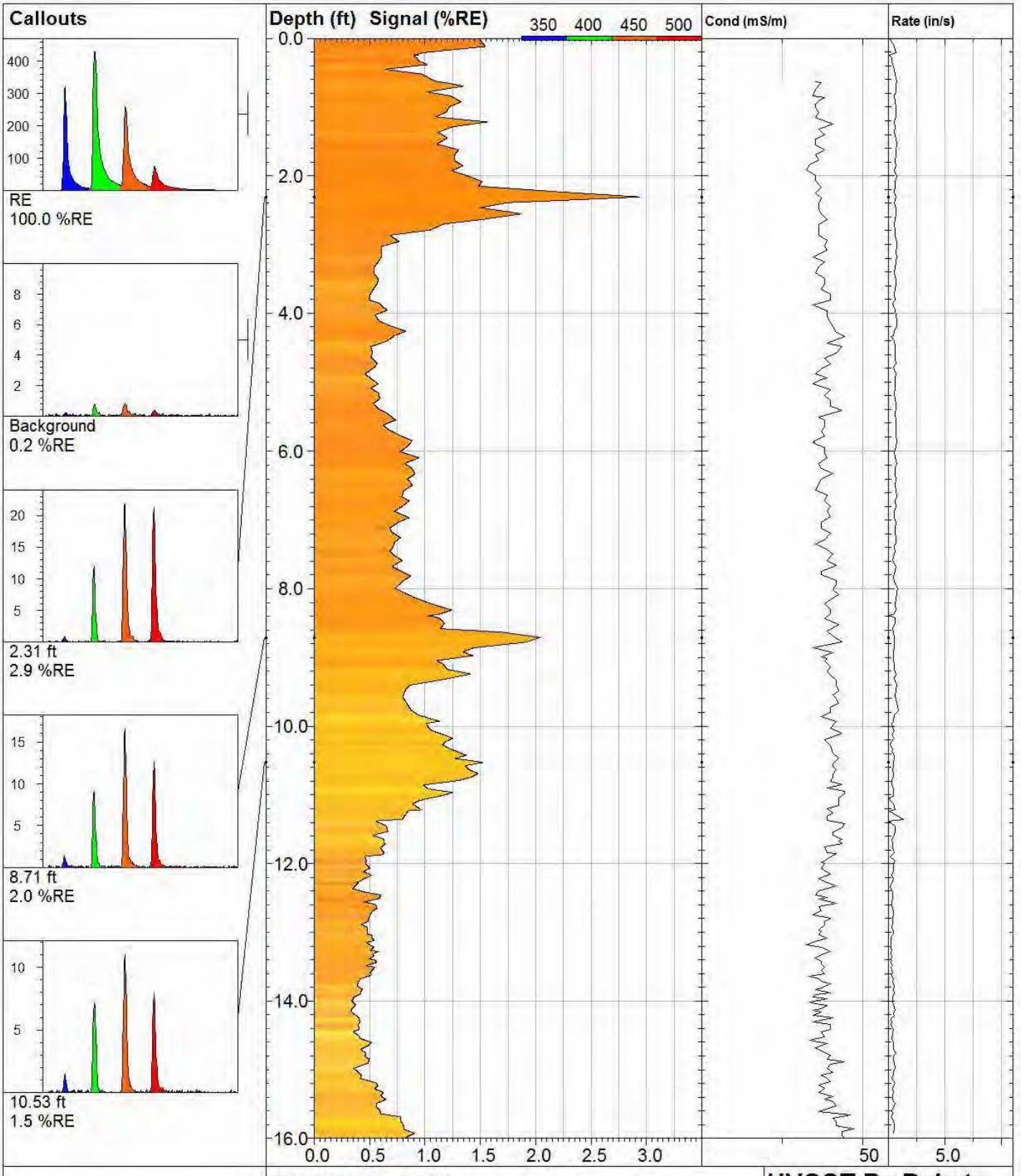


MW34R-L36

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

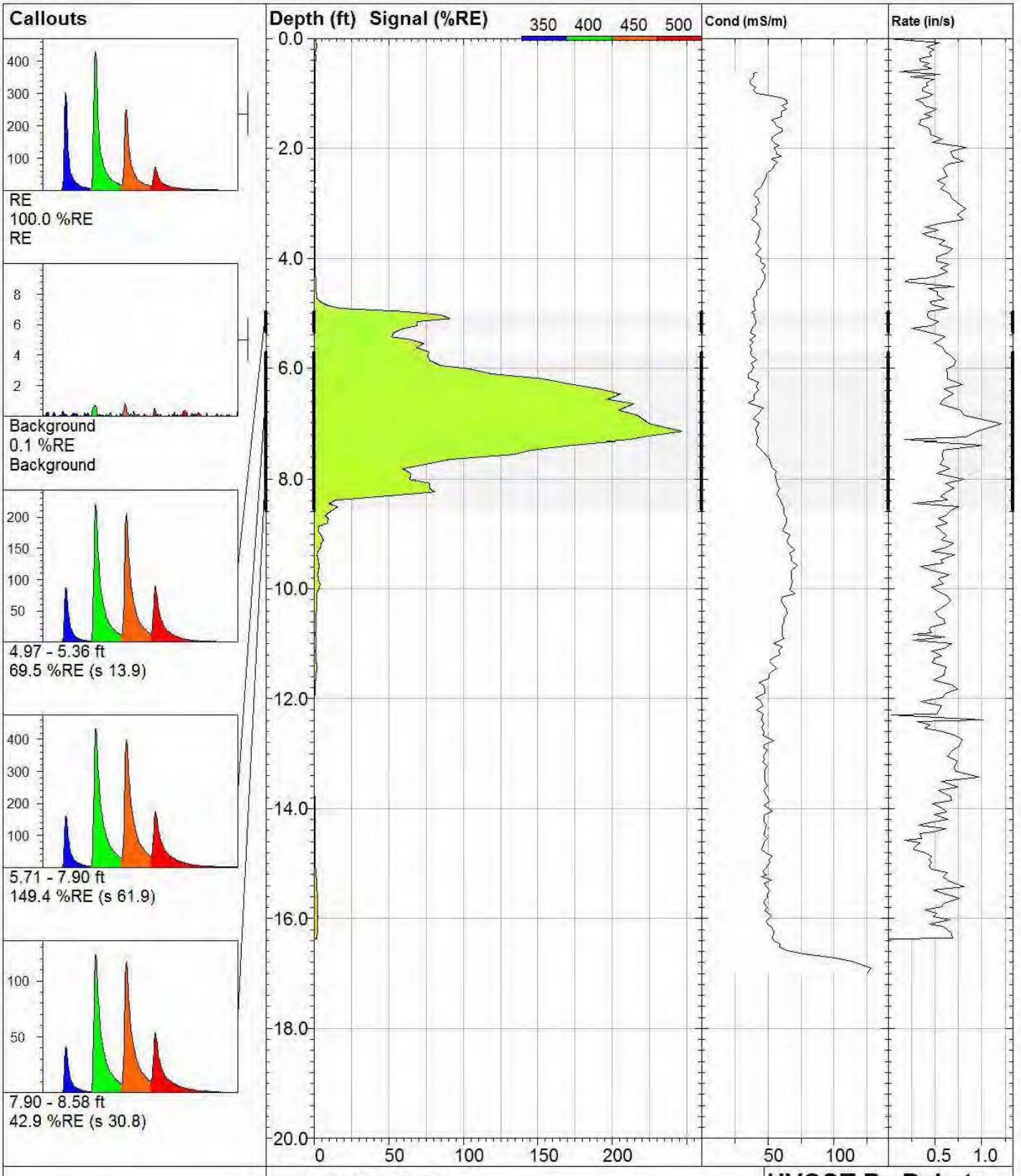
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **17.96 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **51.7 %RE @ 7.68 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 09:03 MDT**



MW34R-L37

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **24.31 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.9 %RE @ 2.31 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 09:47 MDT**

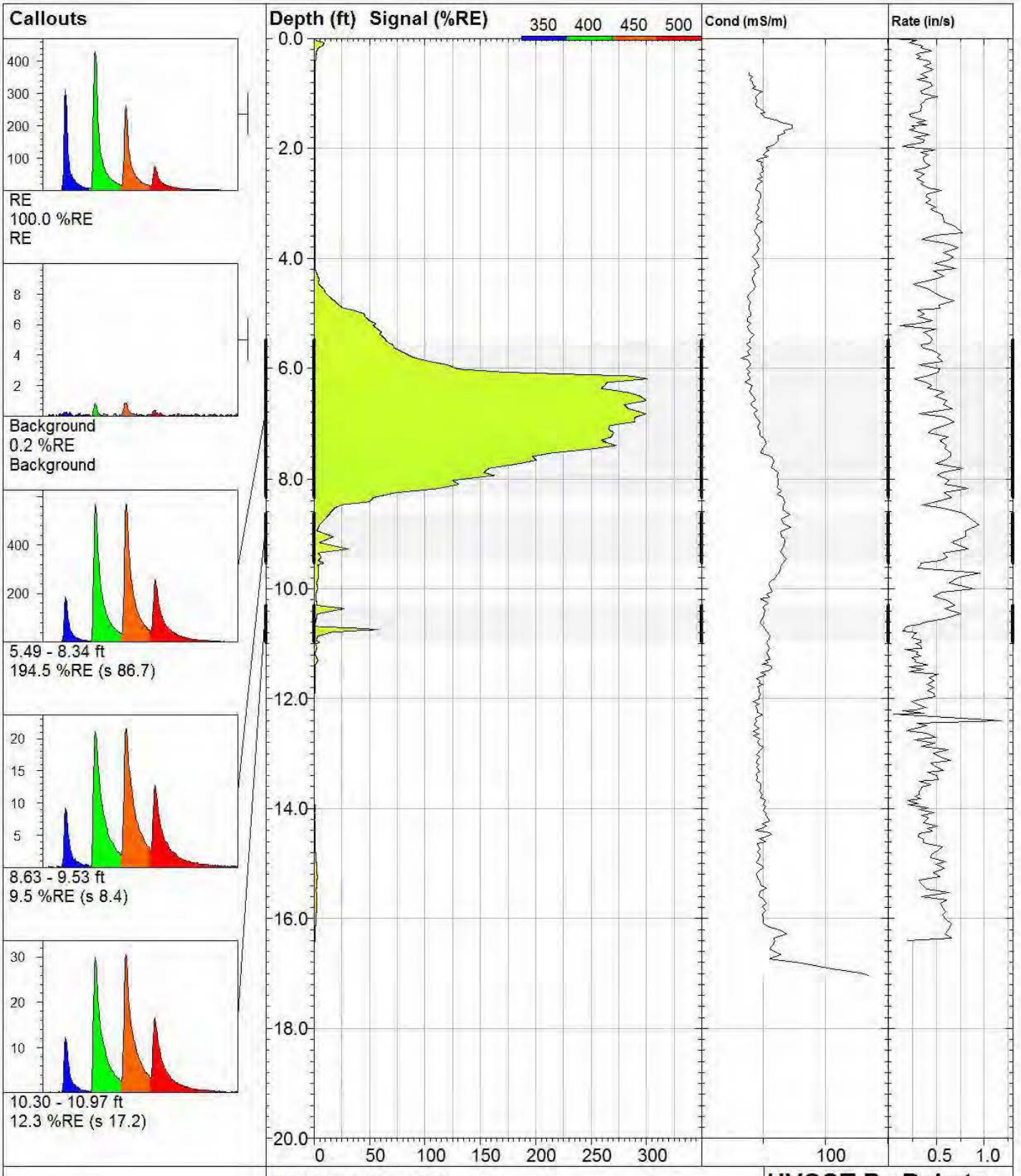


MW34R-L38

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.38 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **247.1 %RE @ 7.15 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 11:02 MDT**

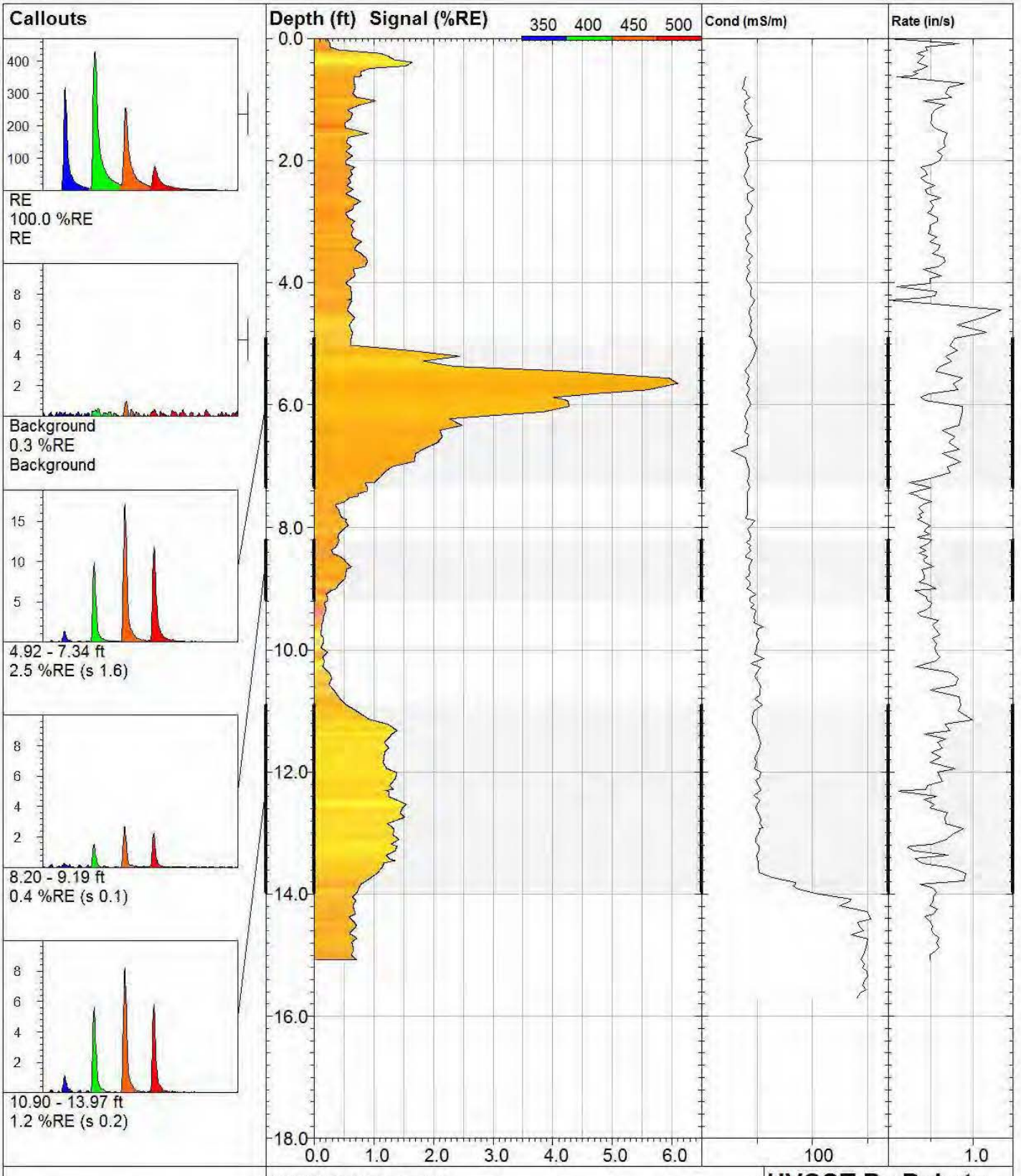


VIRONEX

MW34R-L39

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.41 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **301.1 %RE @ 6.20 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 11:24 MDT**



VIRONEX

MW34R-L40

UVOST By Dakota
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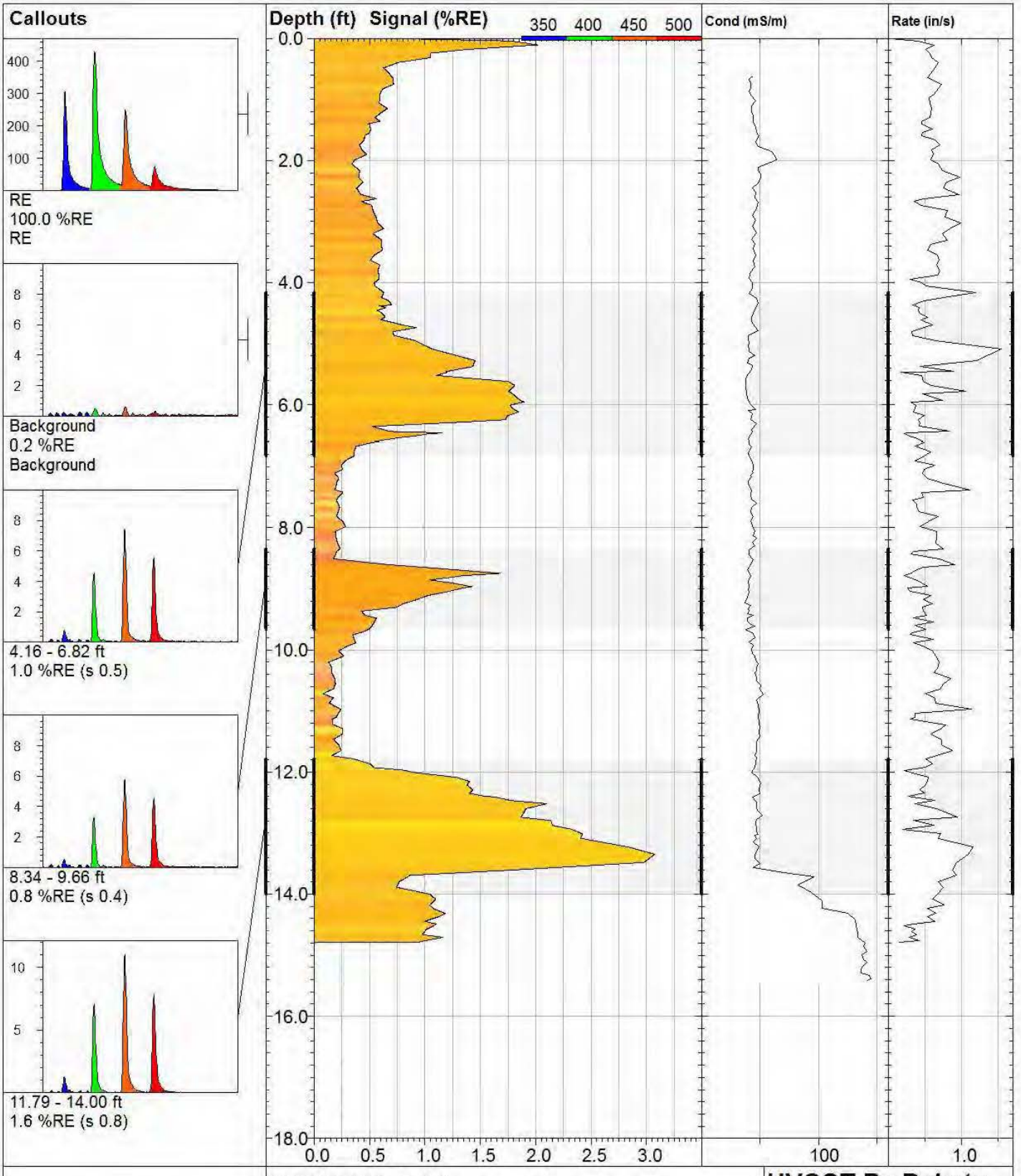
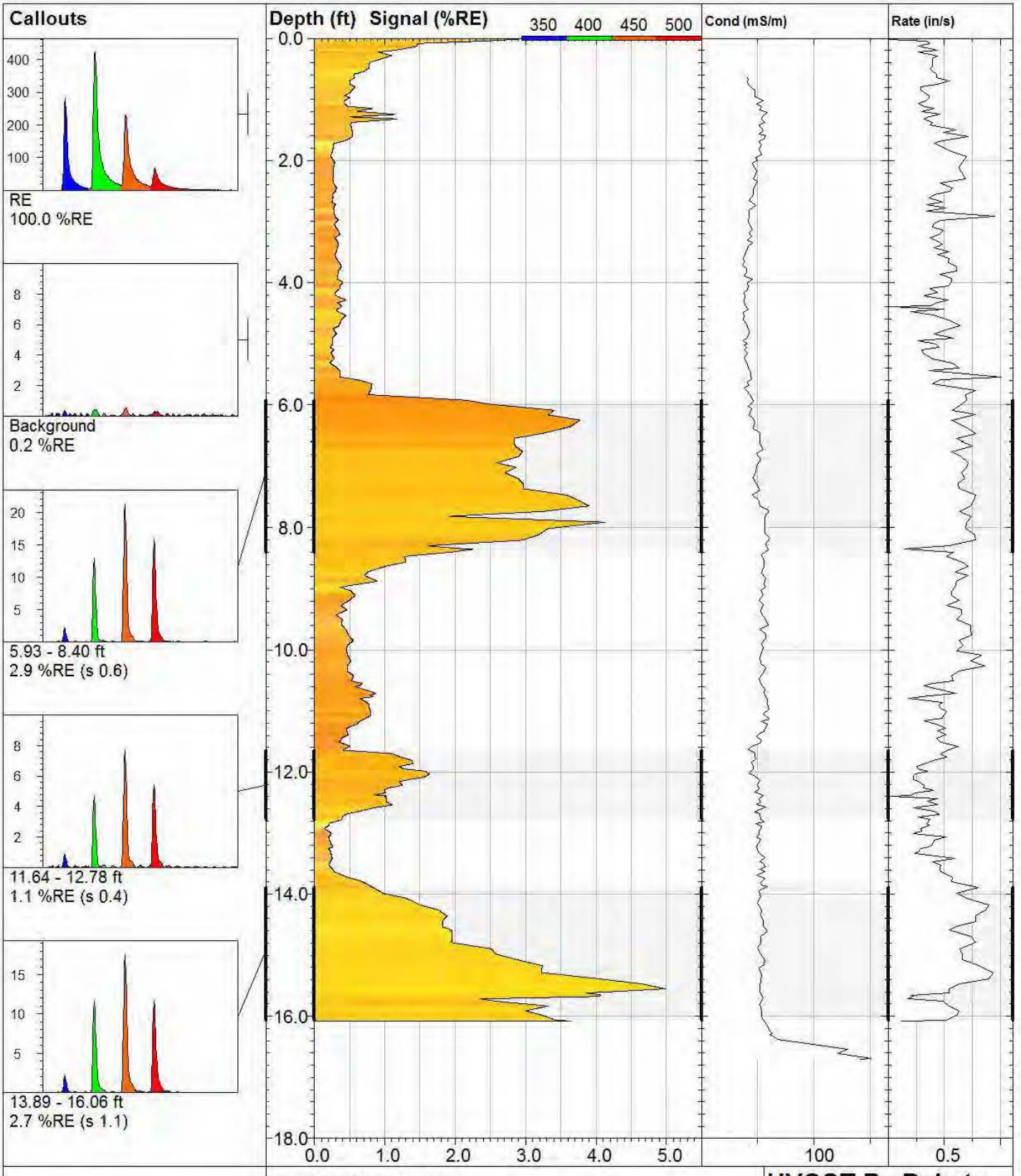
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **15.08 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **6.1 %RE @ 5.65 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 12:00 MDT**



MW34R-L41

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **14.79 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.1 %RE @ 13.35 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 12:23 MDT**

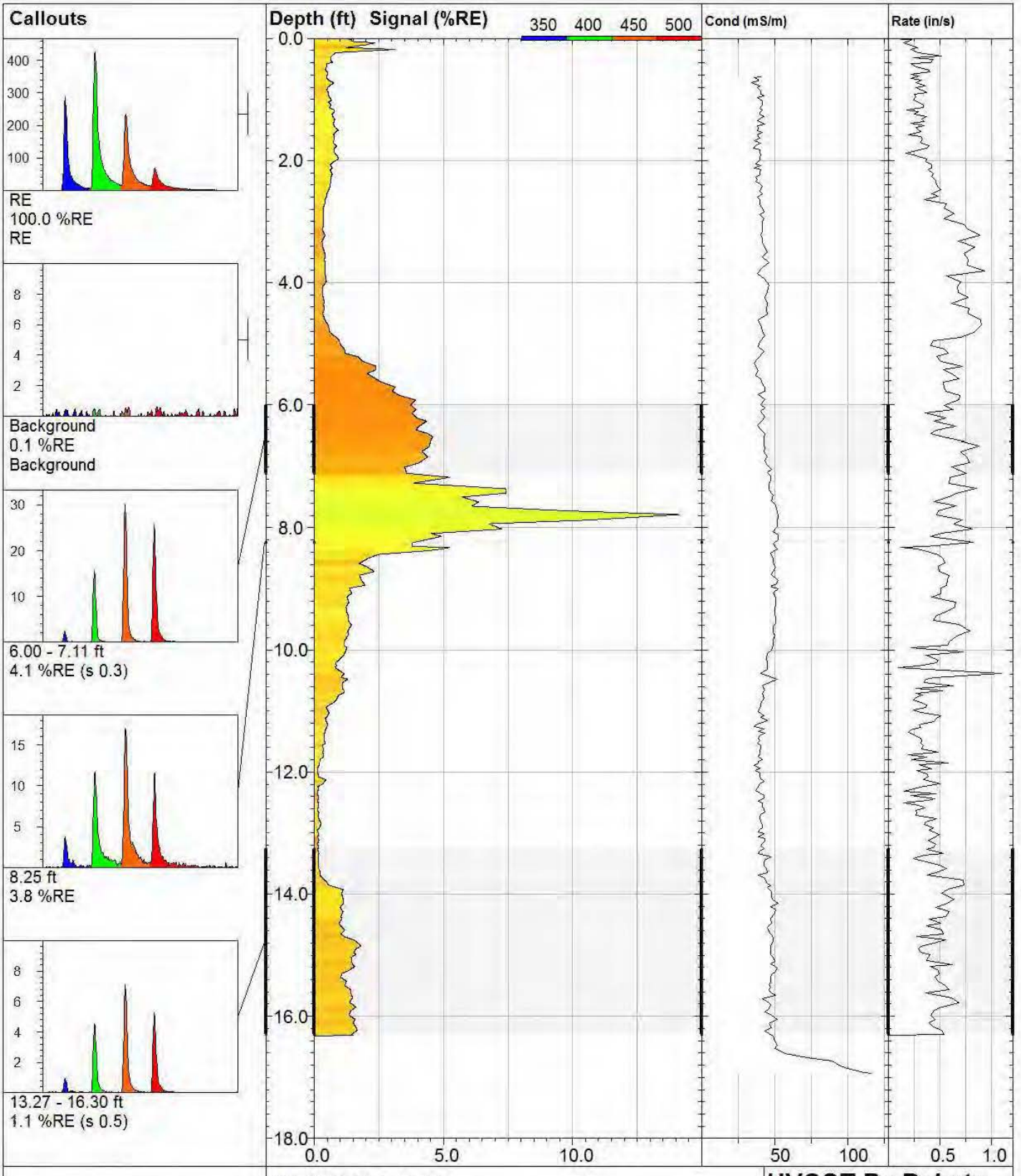


MW34R-L42

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.08 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **5.0 %RE @ 15.55 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 12:51 MDT**

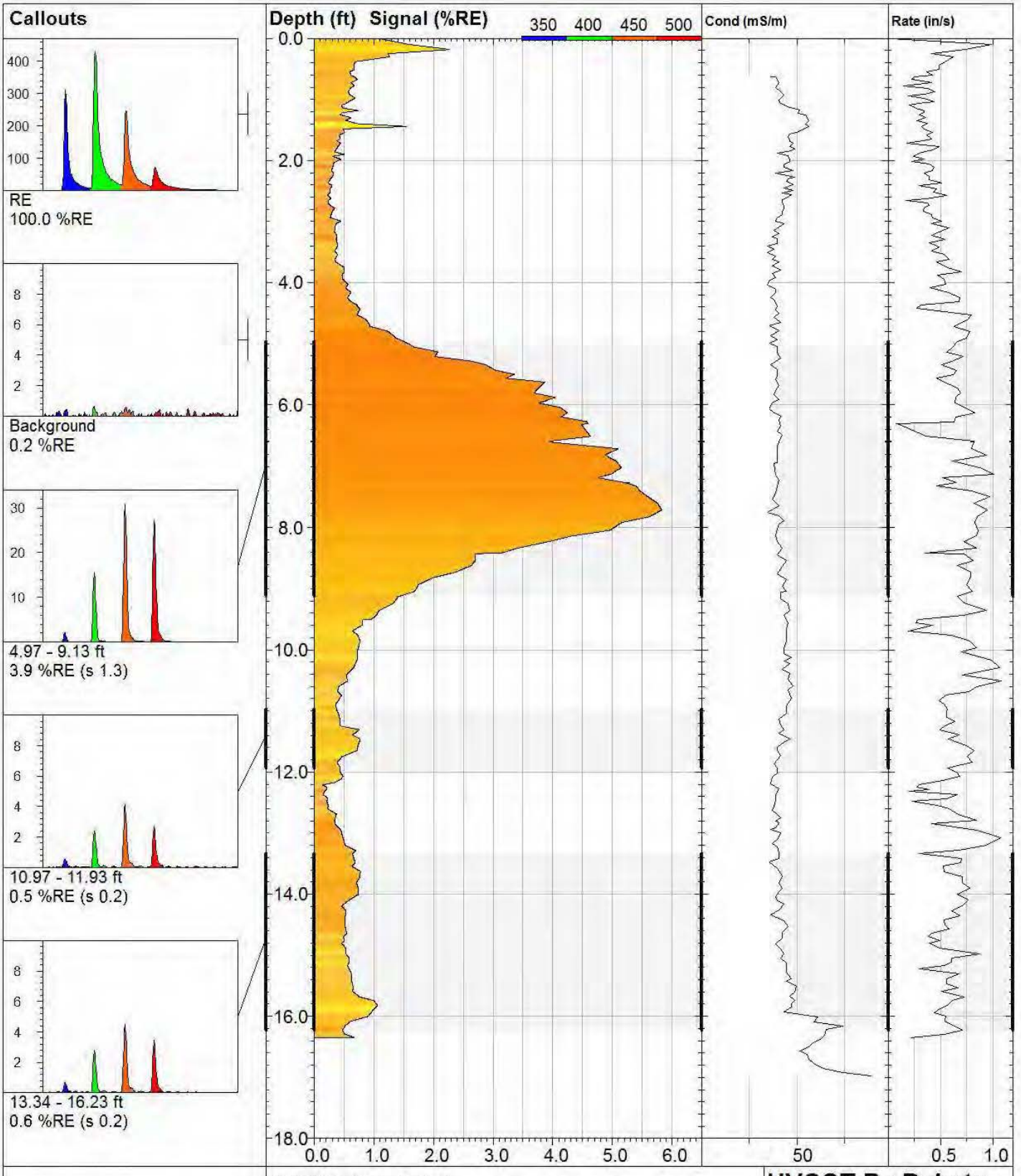


MW34R-L43

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.32 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **14.2 %RE @ 7.78 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 13:18 MDT**

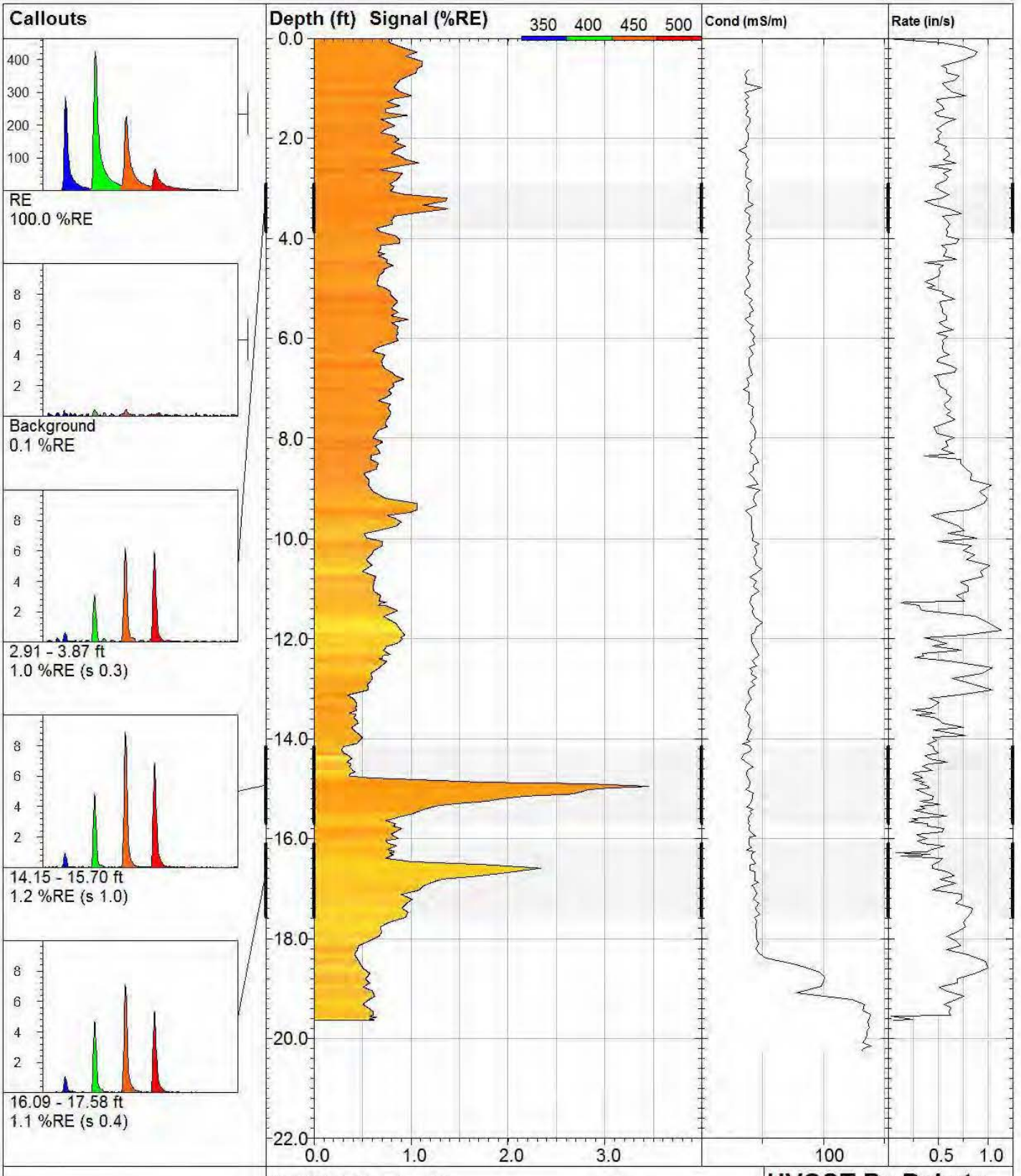


MW34R-L44

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

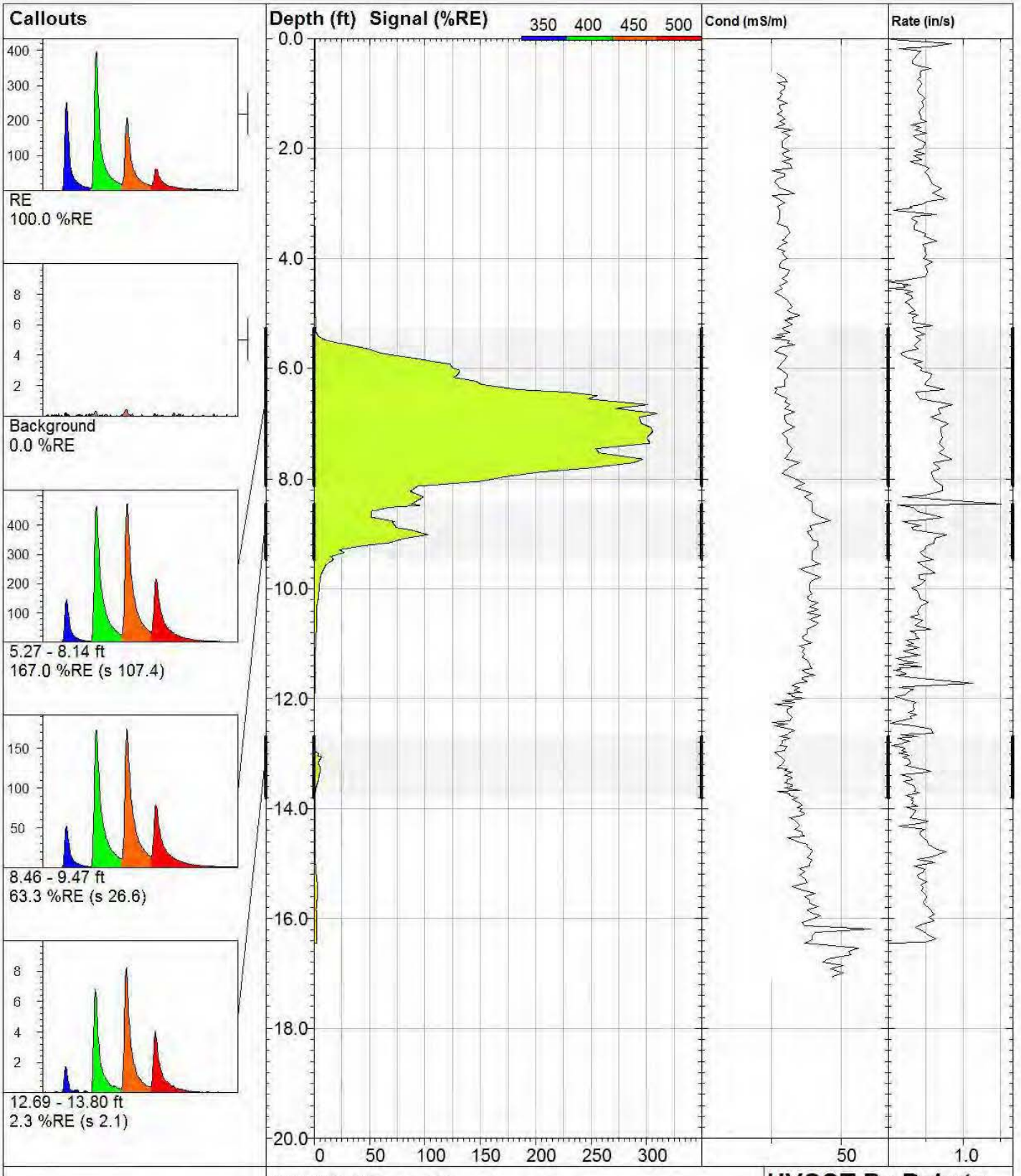
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.35 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **5.8 %RE @ 7.71 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 13:45 MDT**



MW34R-L45

UVOST By Dakota
www.DakotaTechnologies.com

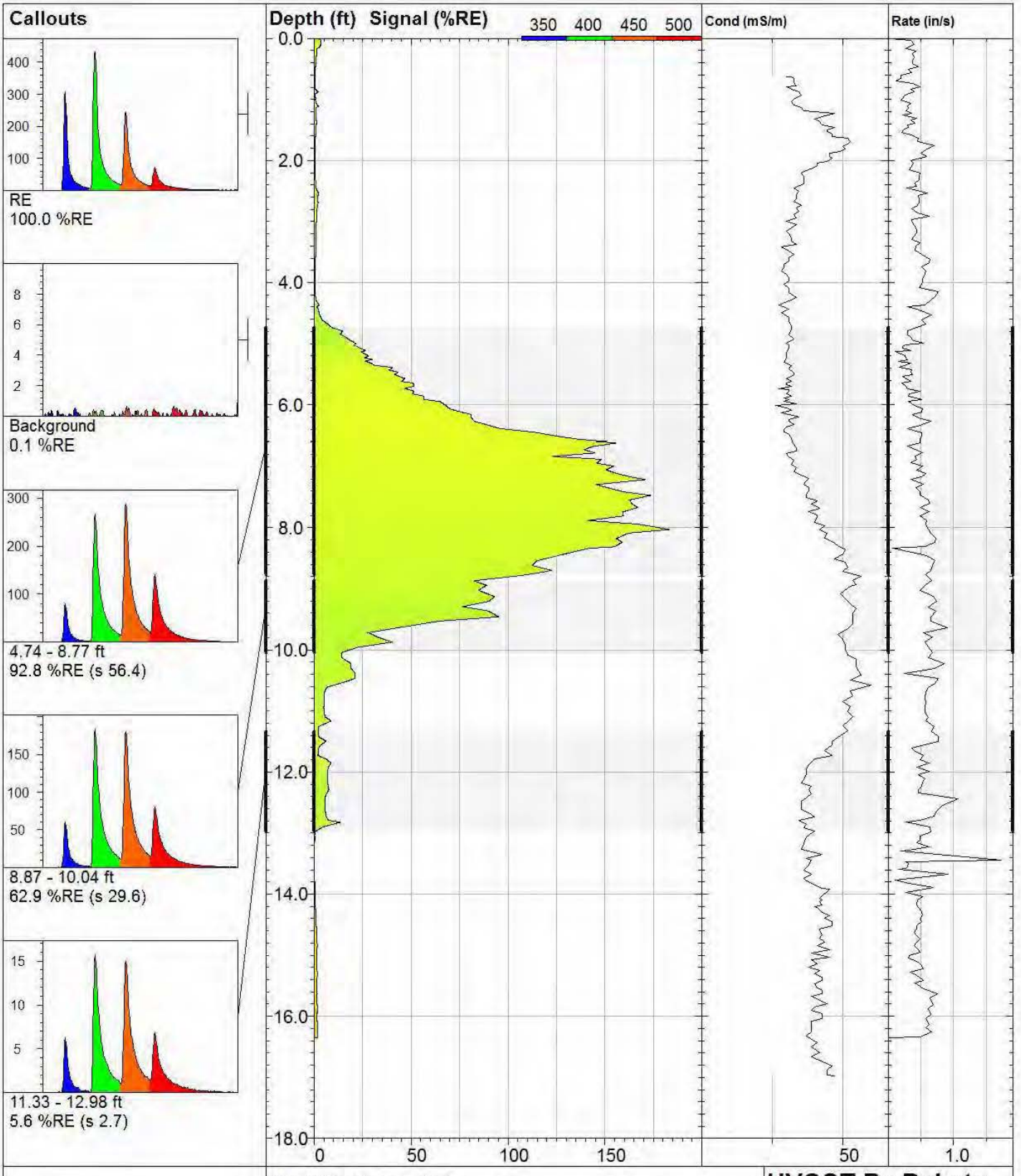
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **19.63 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.5 %RE @ 14.96 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 14:11 MDT**



MW34R-L46

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.44 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **310.0 %RE @ 6.83 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 06:48 MDT**

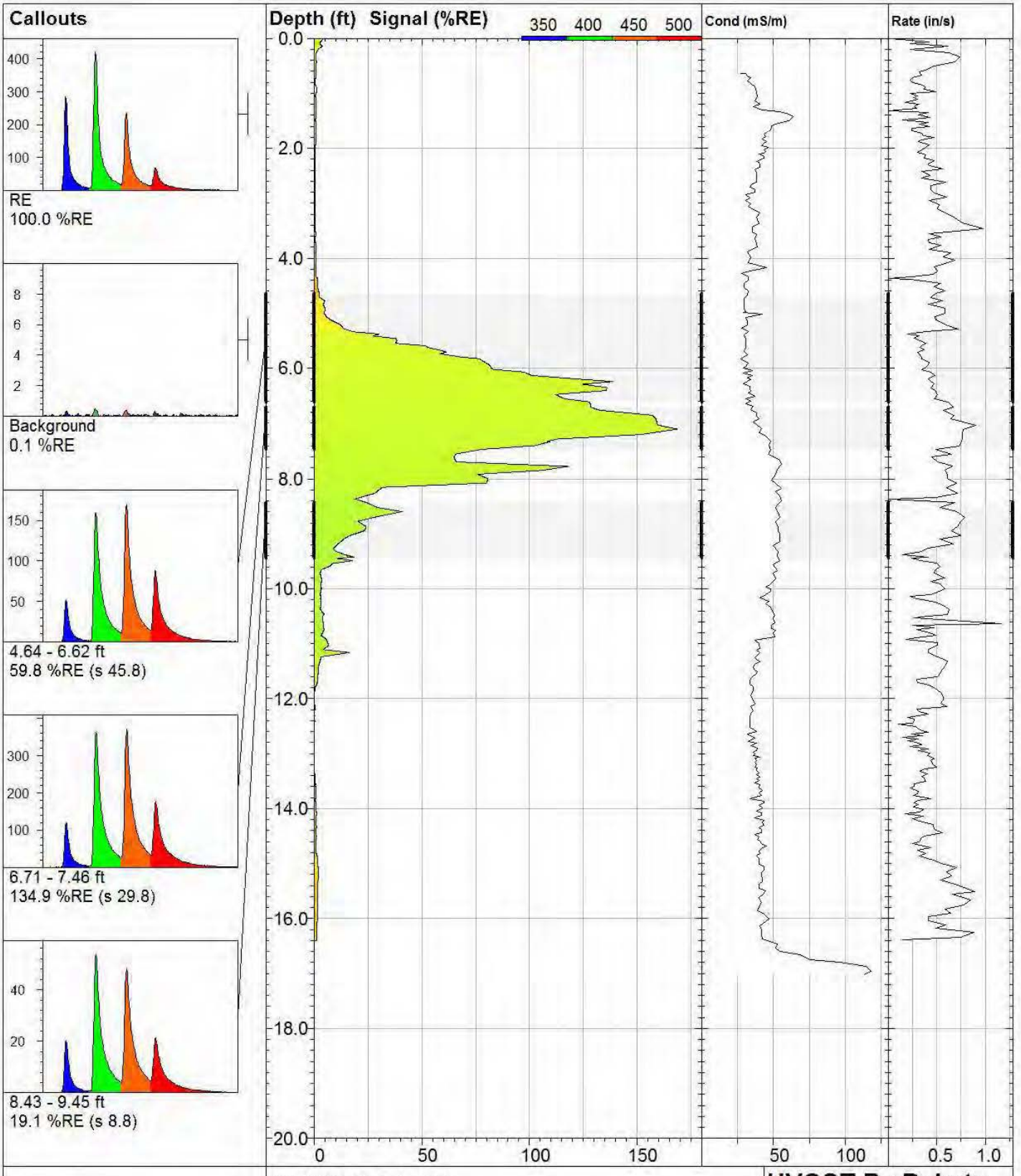


MW34R-L47

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.35 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **183.7 %RE @ 8.03 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 07:19 MDT**

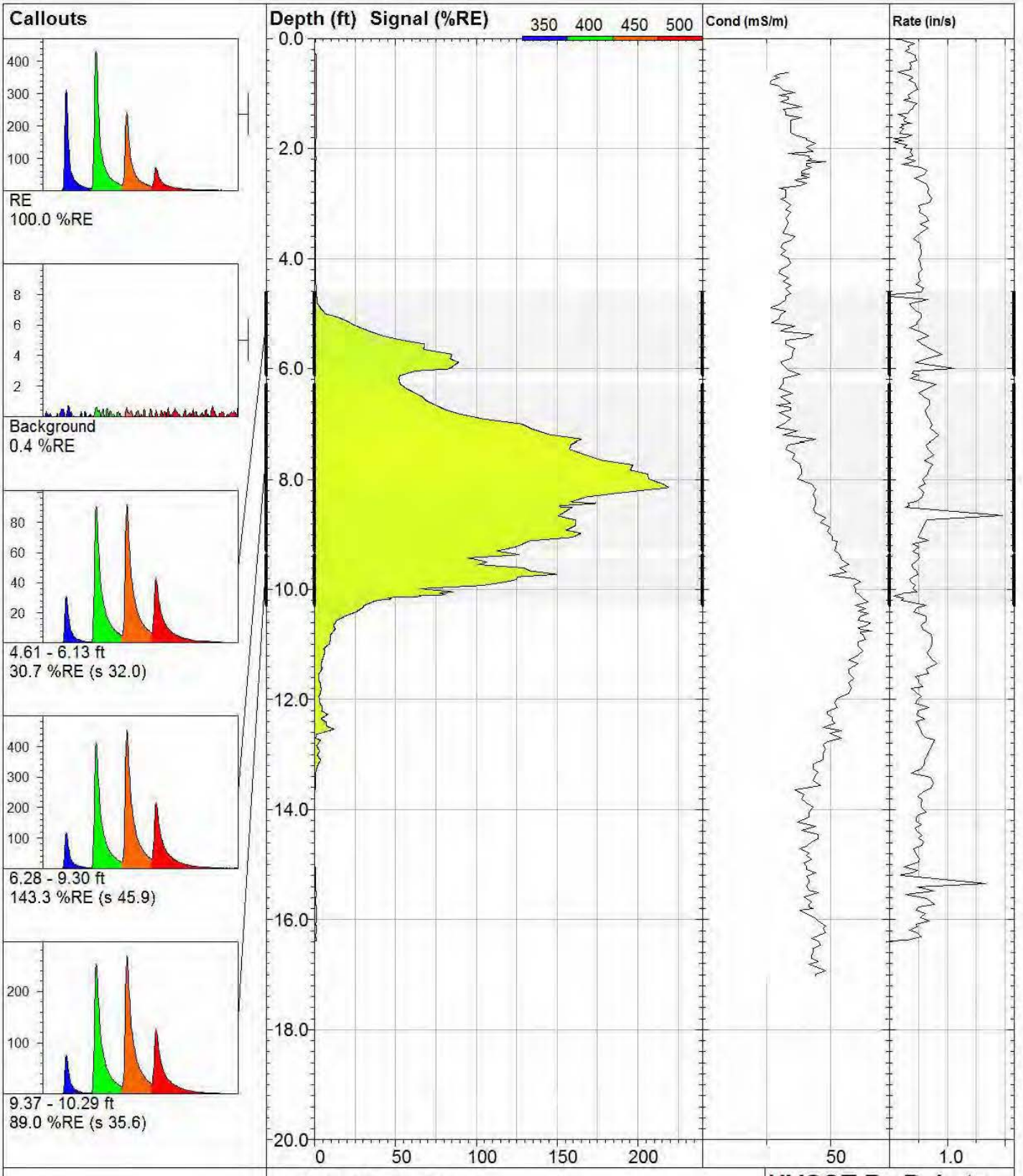


MW34R-L48

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.40 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **168.7 %RE @ 7.11 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 07:38 MDT**

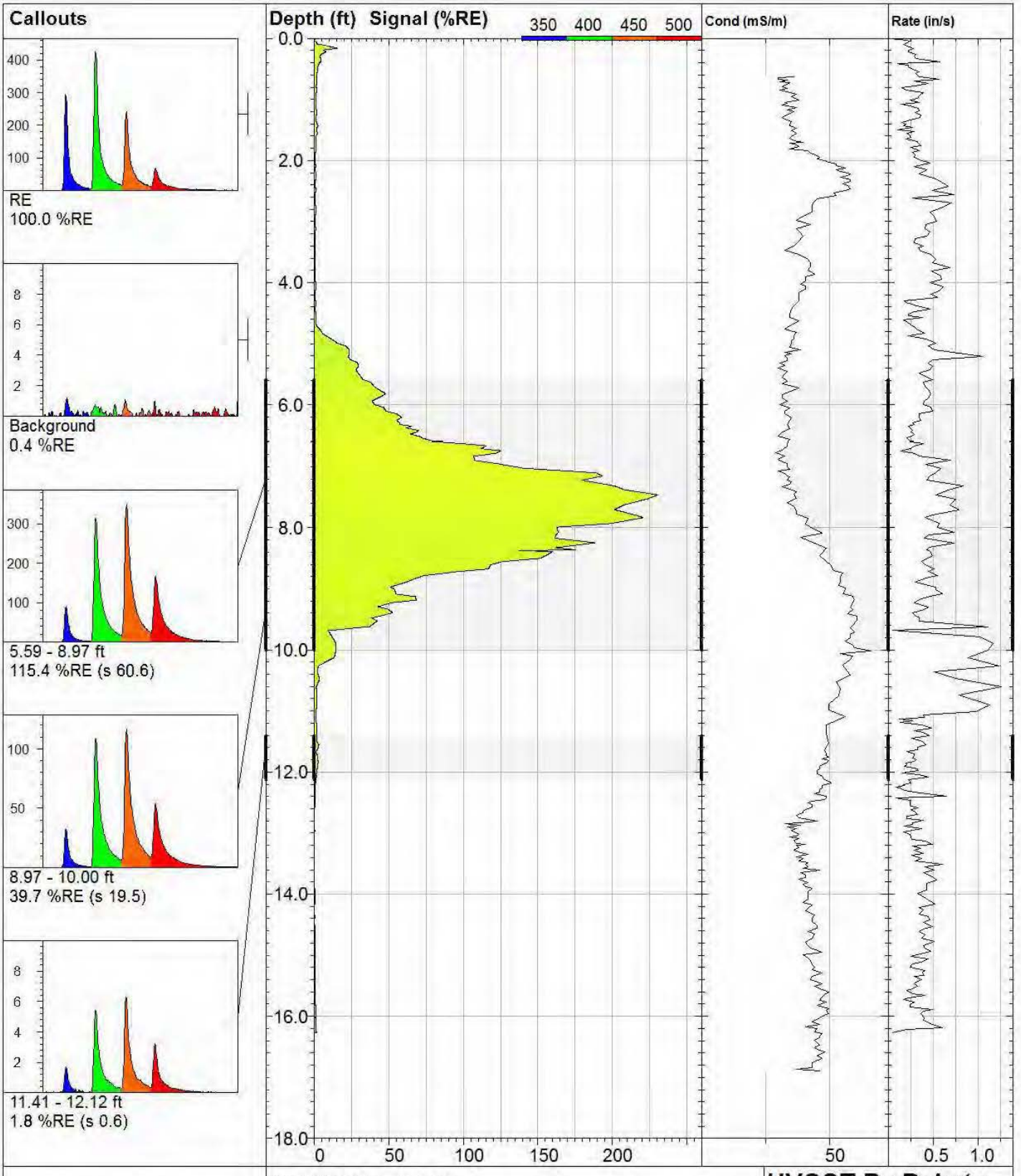


MW34R-L49

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.39 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **219.1 %RE @ 8.15 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 08:02 MDT**

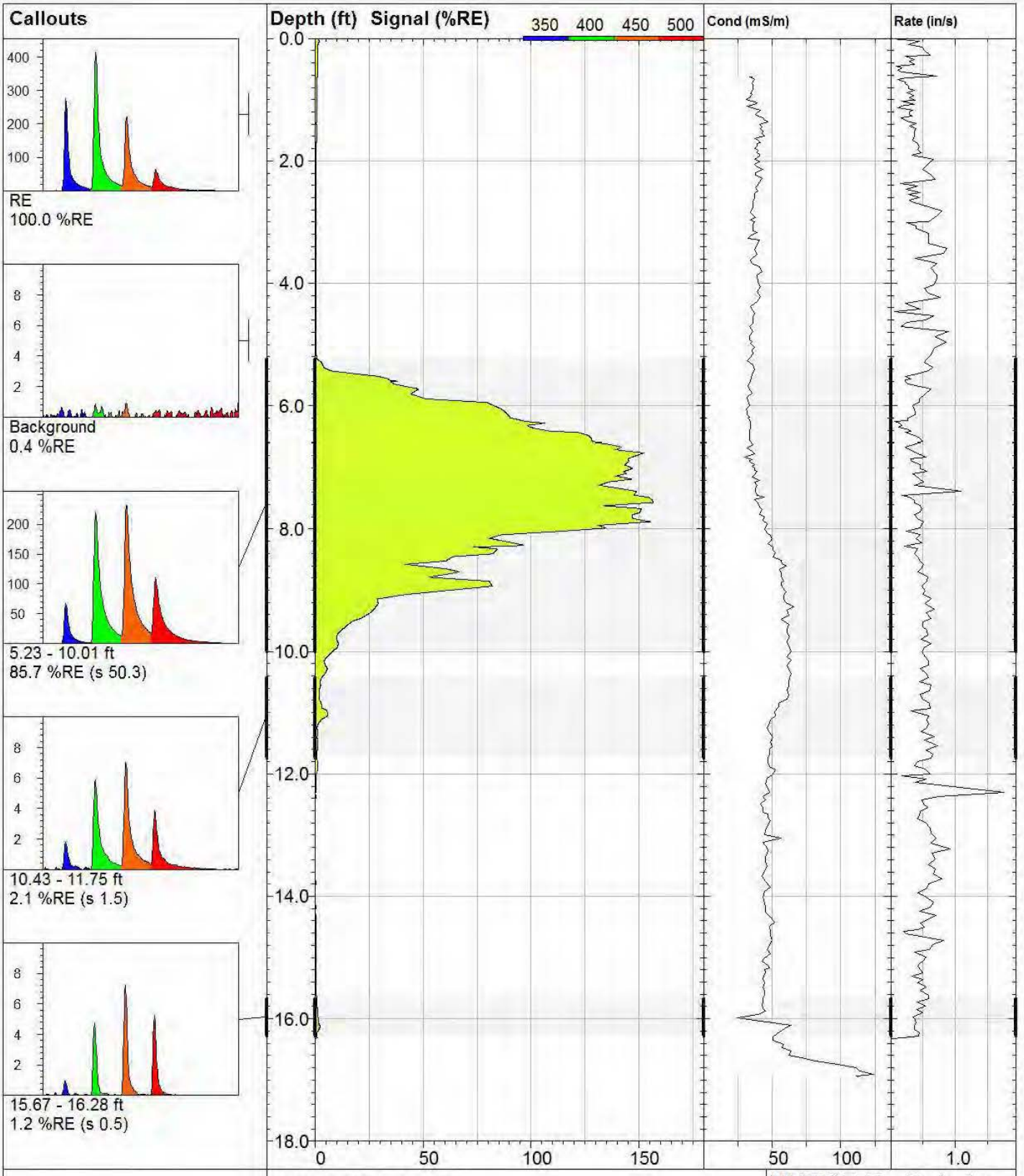


MW34R-L50

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

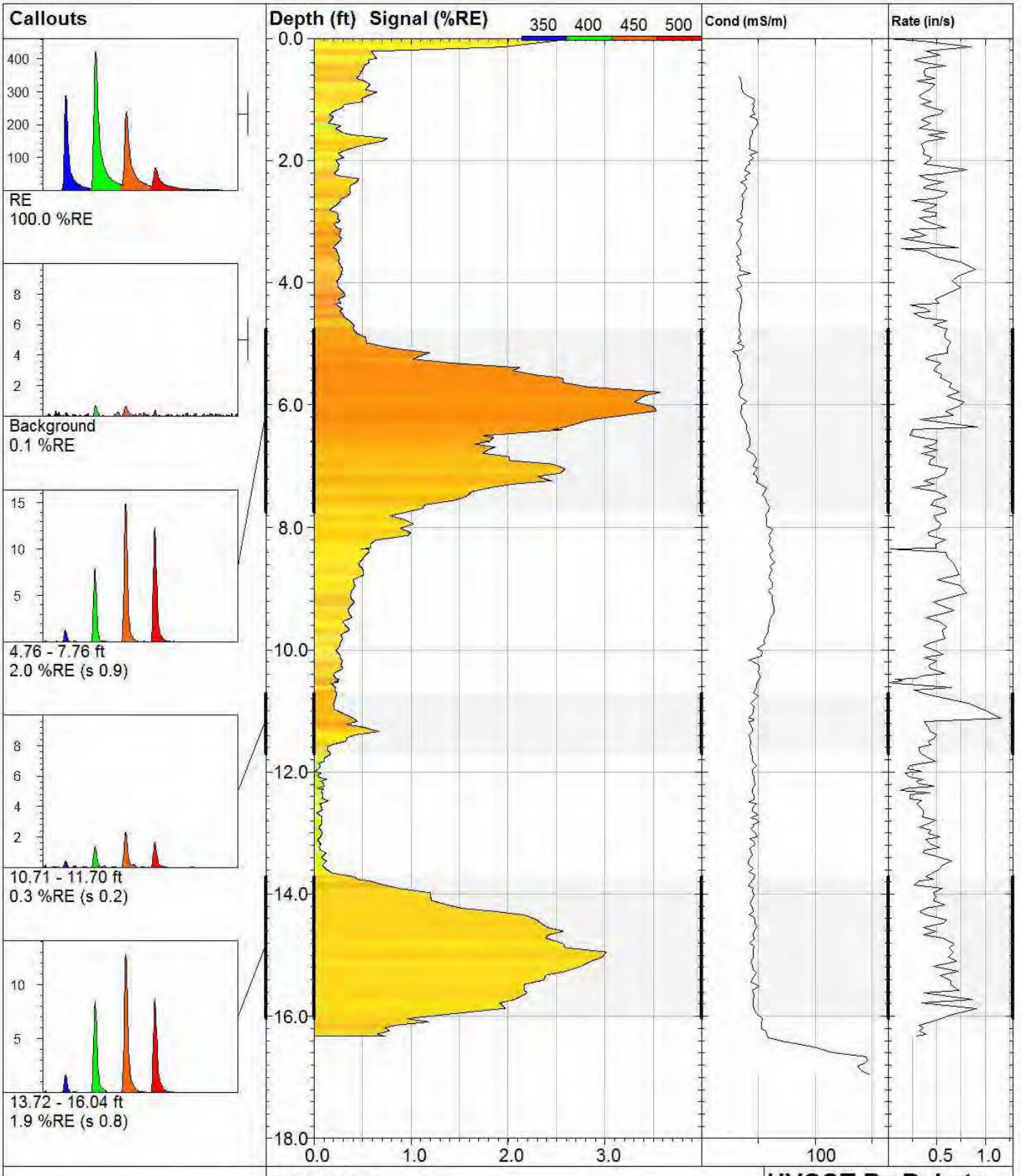
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.27 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **230.4 %RE @ 7.46 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 08:28 MDT**



MW34R-L51

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.32 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **156.6 %RE @ 7.57 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 08:55 MDT**

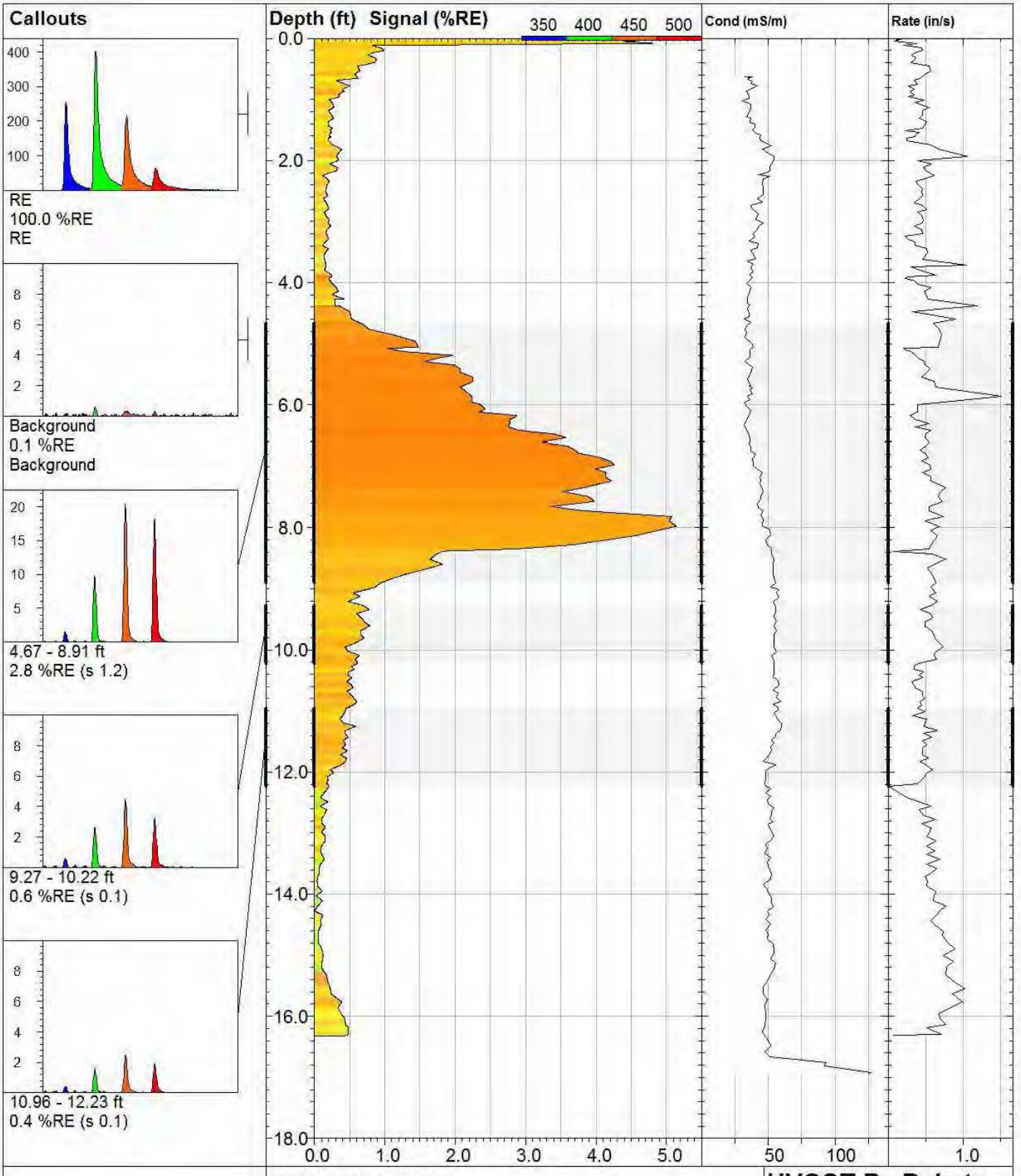


MW34R-L52

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

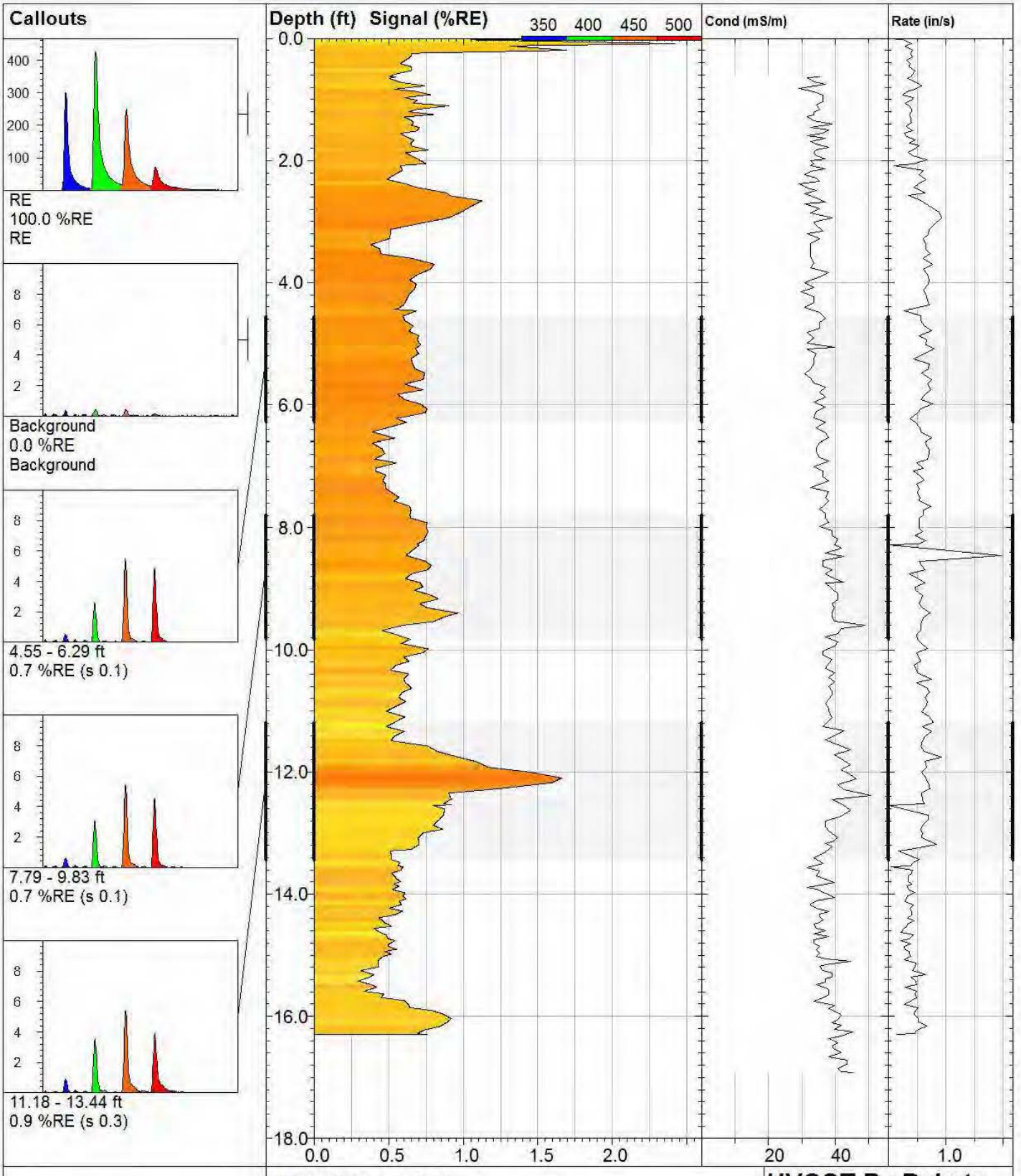
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.33 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.6 %RE @ 5.79 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 09:28 MDT**



MW34R-L53

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.32 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **5.1 %RE @ 7.97 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 09:47 MDT**



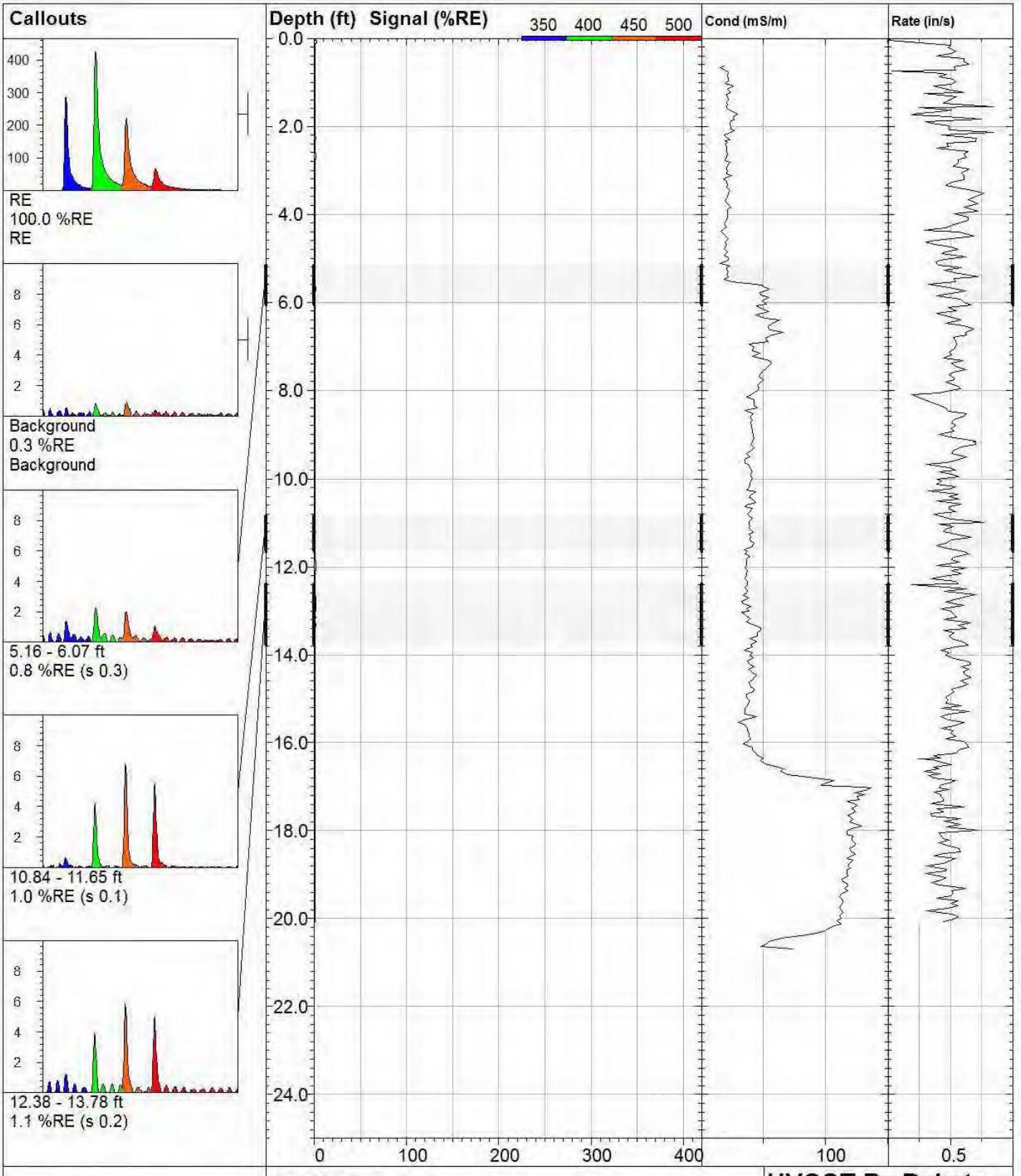
VIRONEX

MW34R-L54

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.30 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.4 %RE @ 0.09 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 10:12 MDT**

Appendix B – UVOST Boring Logs (Common-Scale)

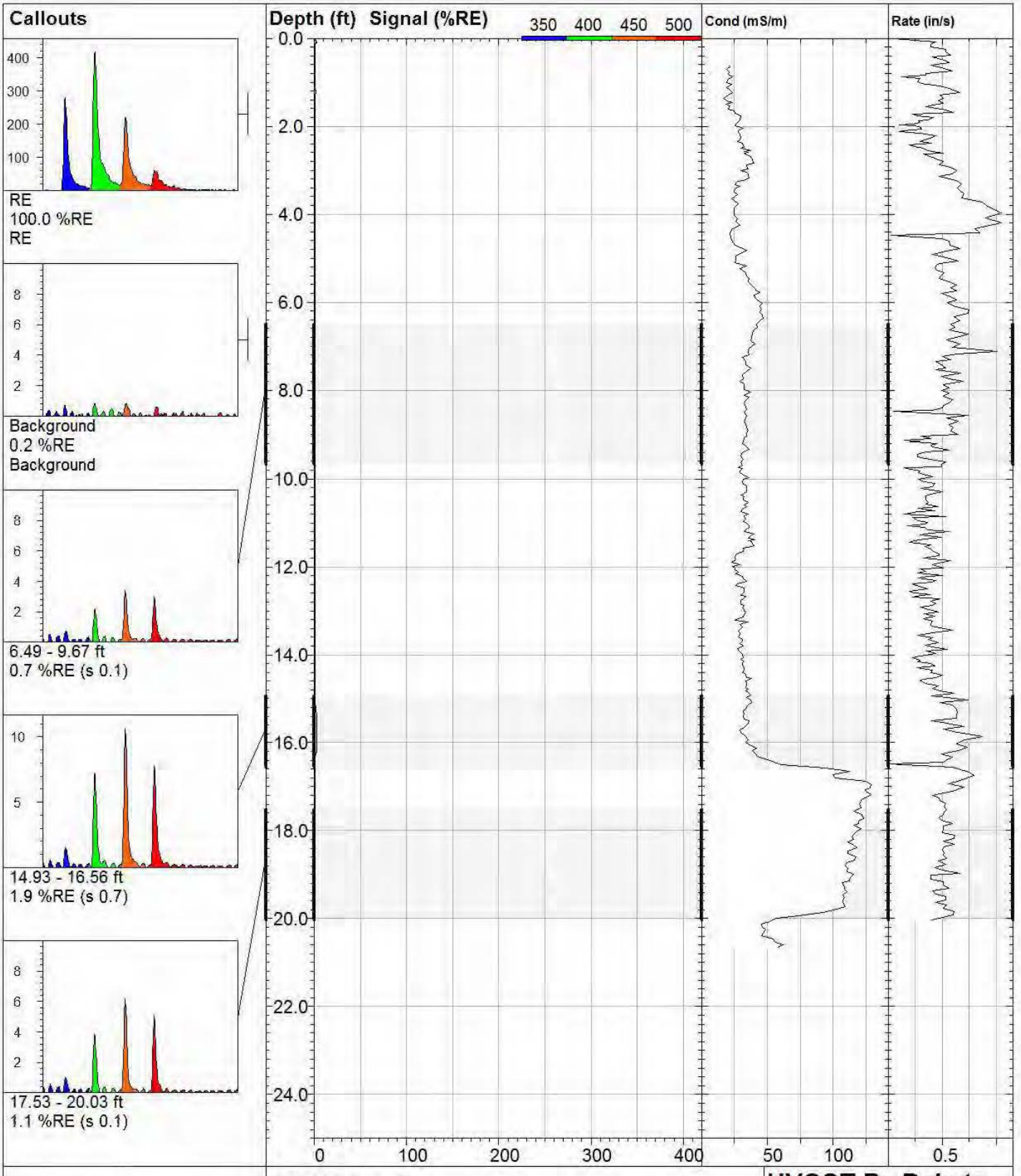


VIRONEX

MW33-L1

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.08 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.0 %RE @ 0.08 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 08:57 MDT**

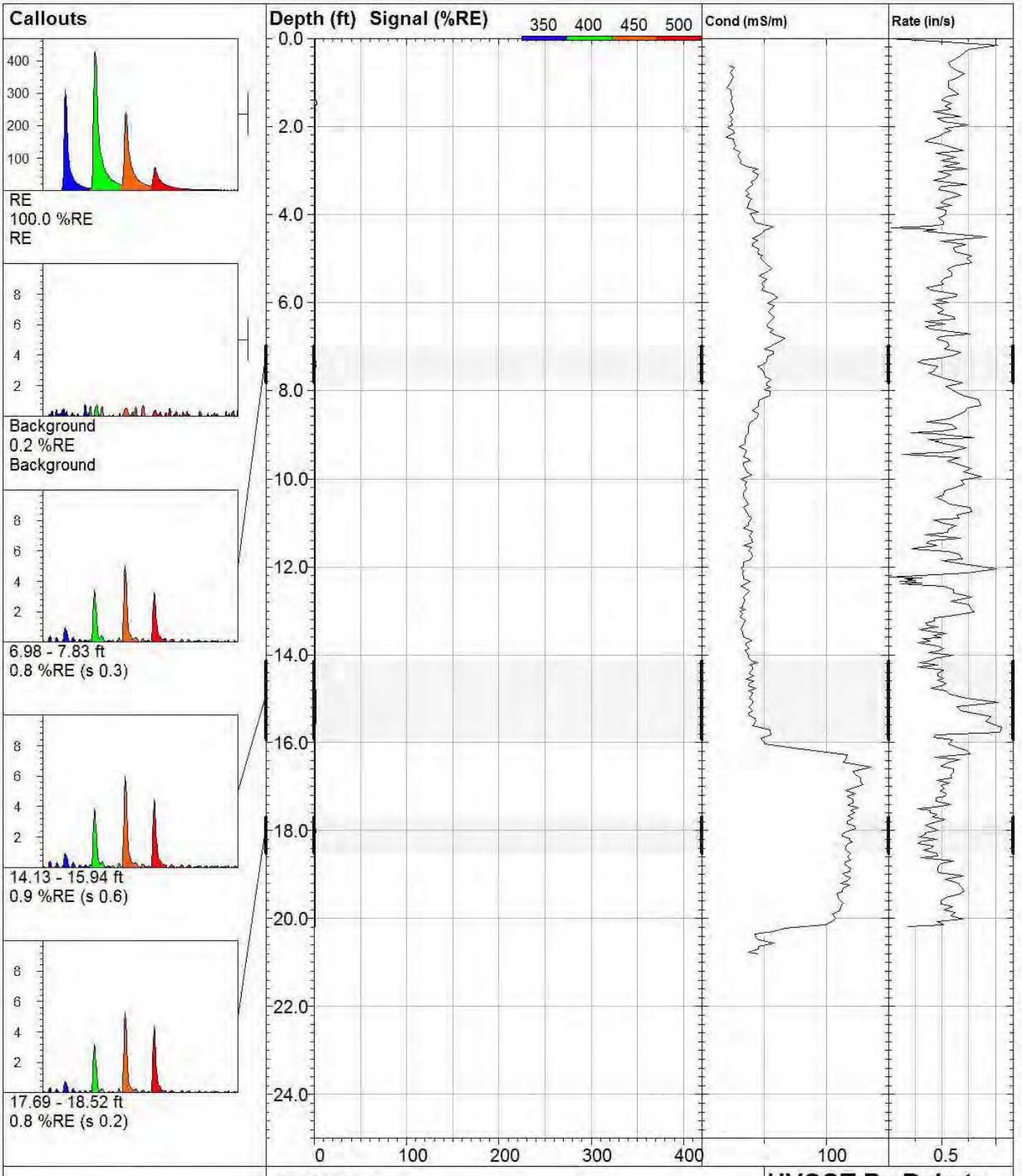


VIRONEX

MW33-L2

UVOST By Dakota
www.DakotaTechnologies.com

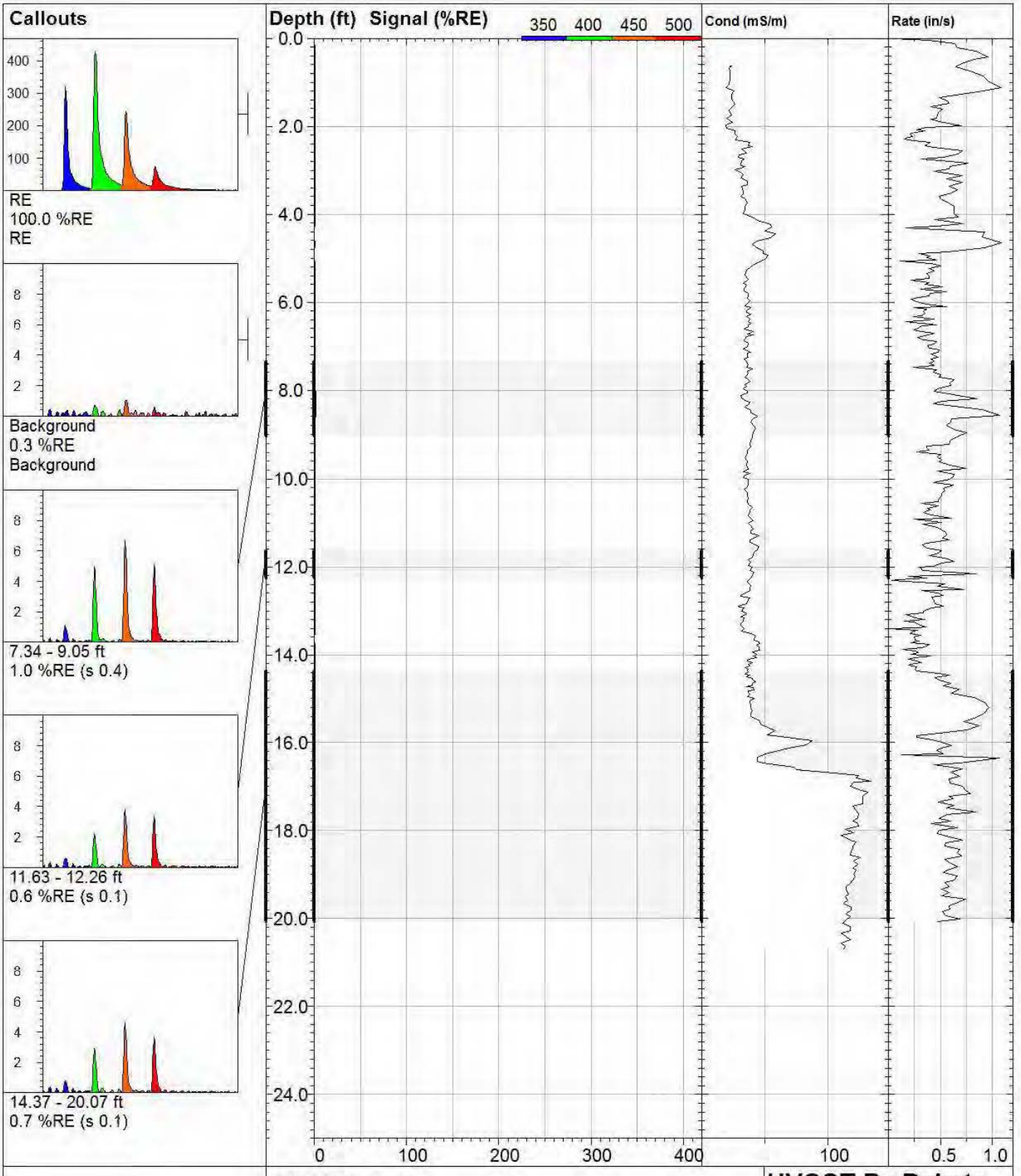
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.05 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.9 %RE @ 16.19 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 09:27 MDT**



MW33-L3

UVOST By Dakota
www.DakotaTechnologies.com

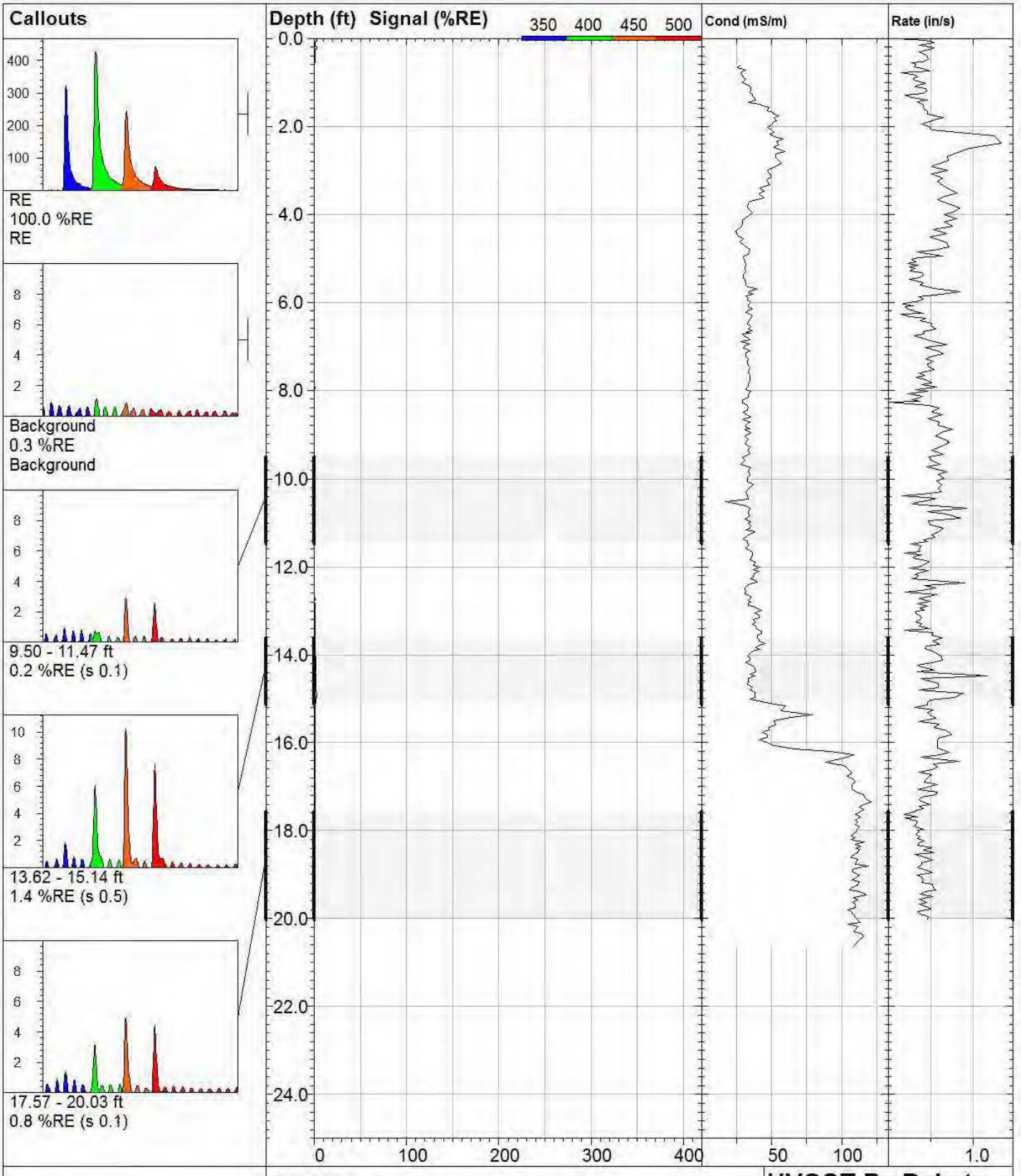
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.18 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.8 %RE @ 1.47 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 14:57 MDT**



MW33-L4

UVOST By Dakota
www.DakotaTechnologies.com

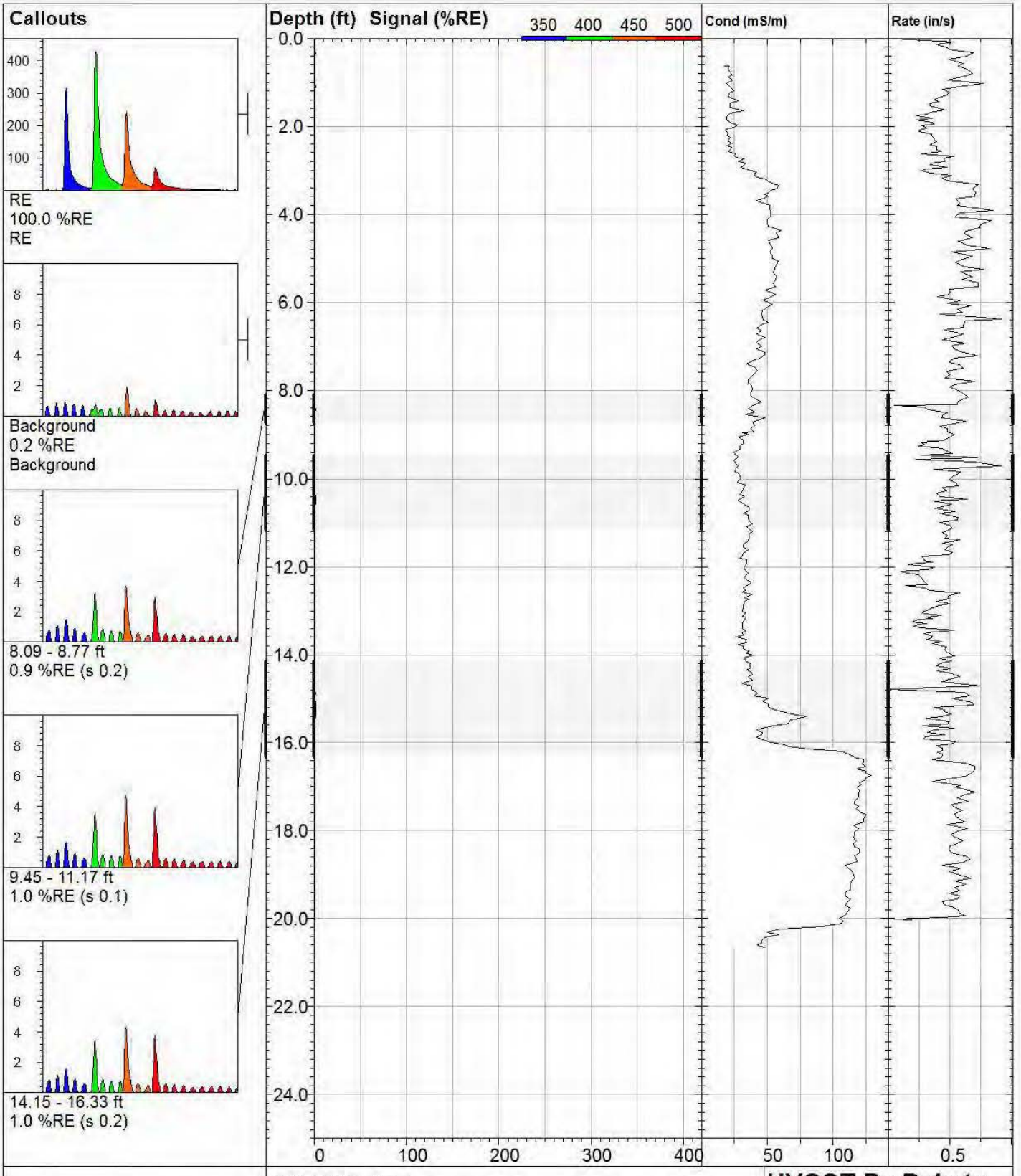
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.07 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.8 %RE @ 8.32 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 14:31 MDT**



MW33-L6

UVOST By Dakota
www.DakotaTechnologies.com

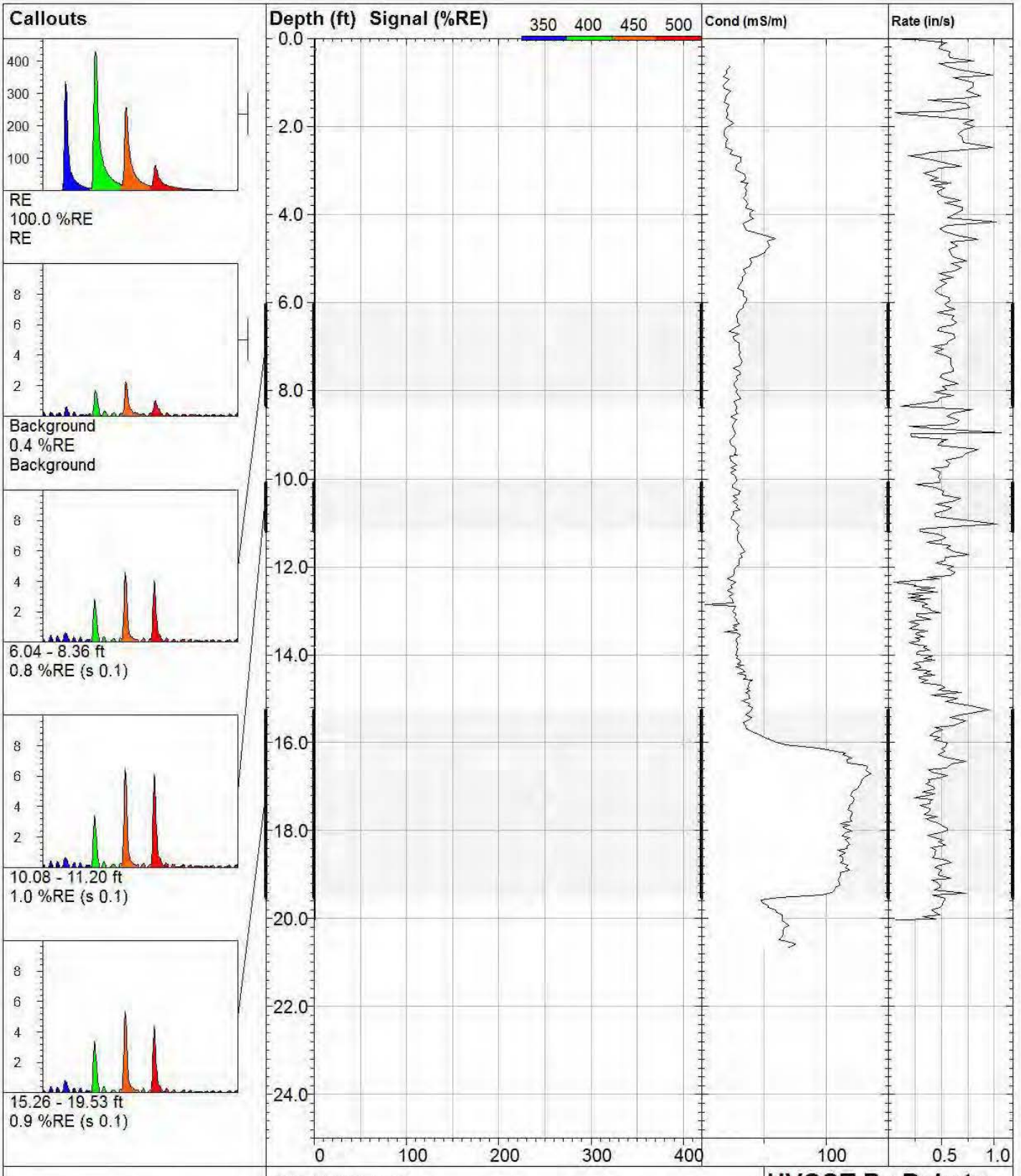
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.03 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.6 %RE @ 0.22 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 12:00 MDT**



MW33-L7

UVOST By Dakota
www.DakotaTechnologies.com

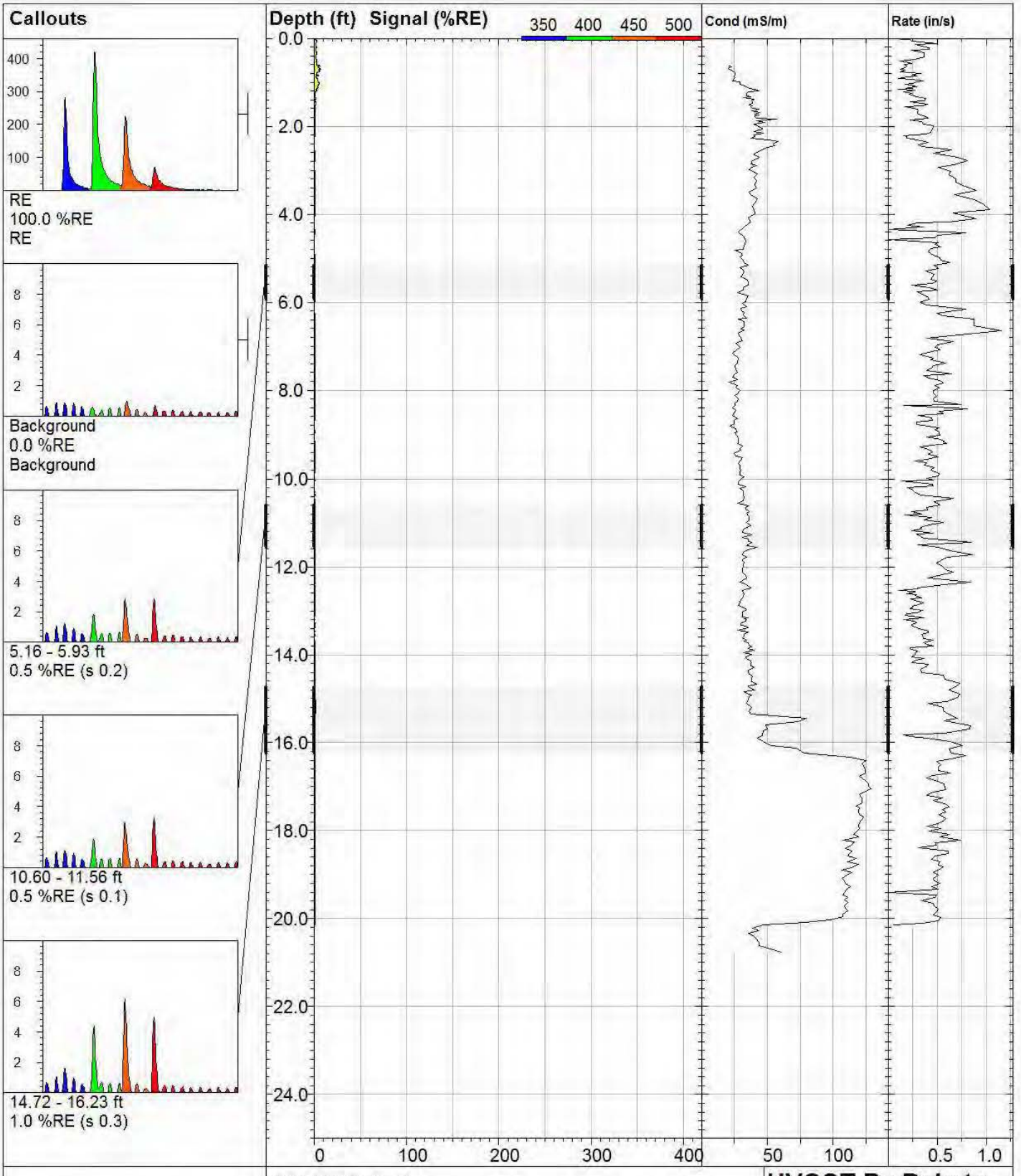
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.03 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.5 %RE @ 15.30 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 11:26 MDT**



MW33-L8

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.04 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.3 %RE @ 0.24 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 09:57 MDT**



MW33-L9

UVOST By Dakota
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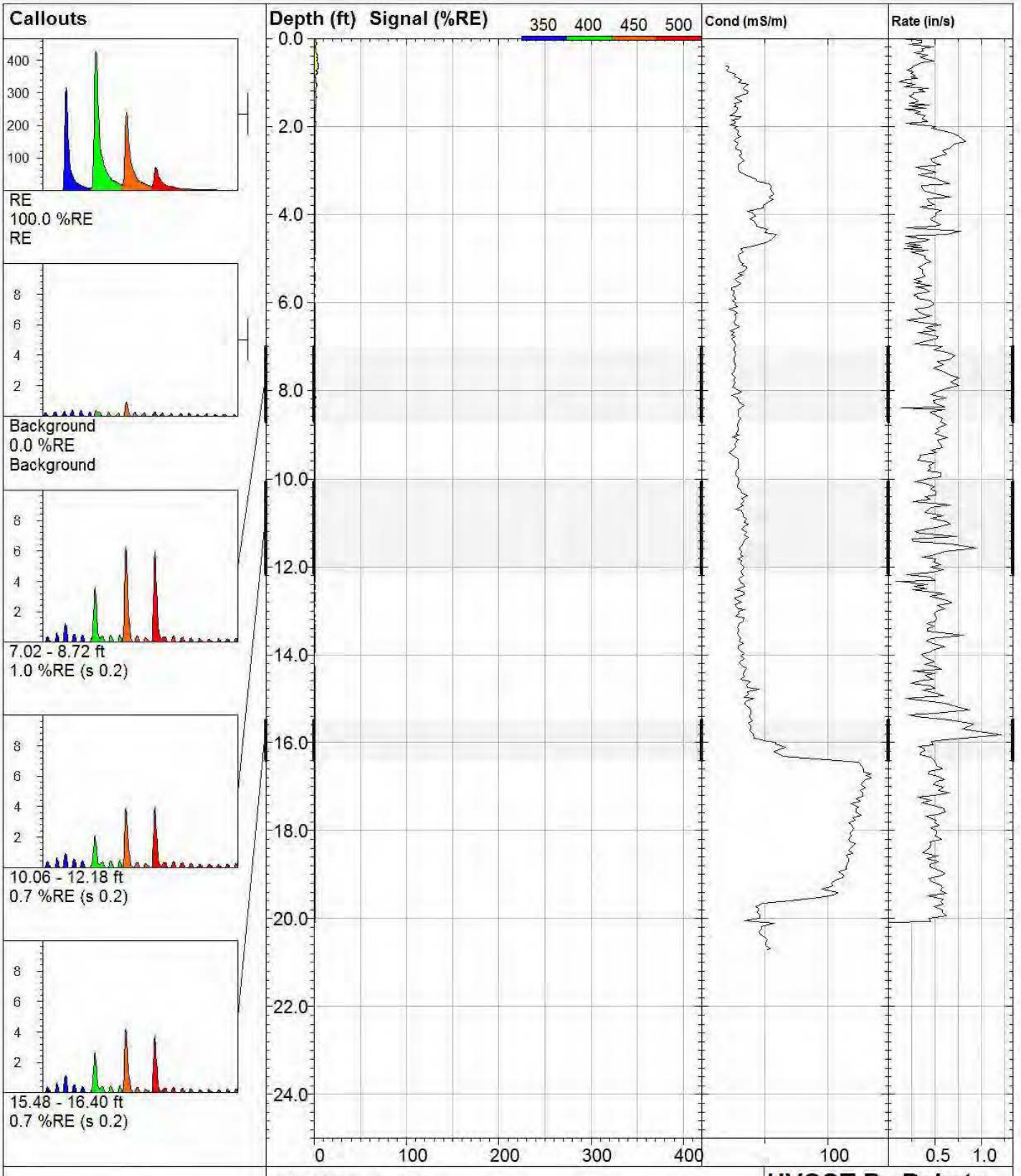
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.14 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **6.9 %RE @ 0.70 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 10:30 MDT**



MW33-L10

UVOST By Dakota
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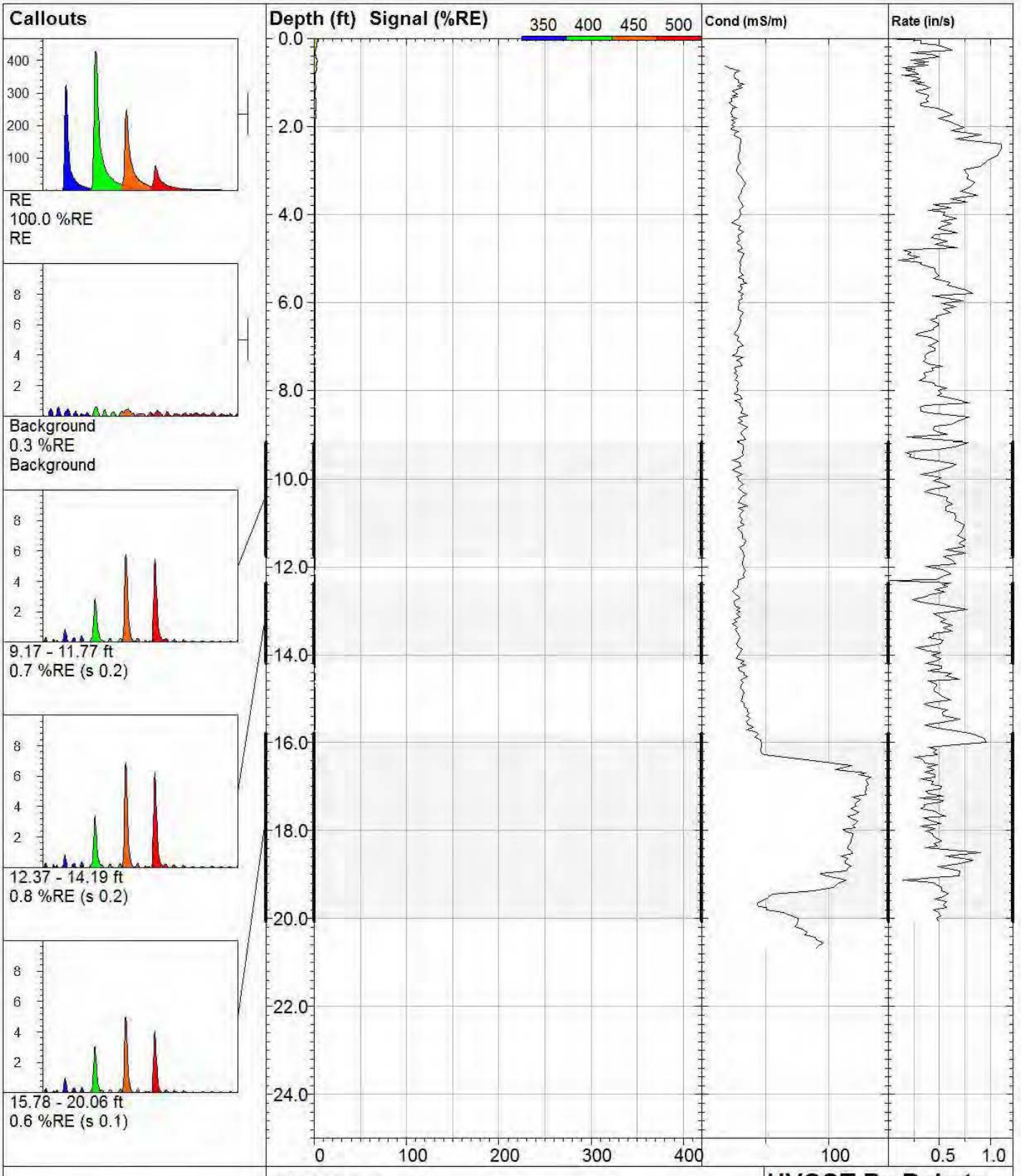
VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.08 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.7 %RE @ 0.60 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 12:34 MDT**



MW33-L11

UVOST By Dakota
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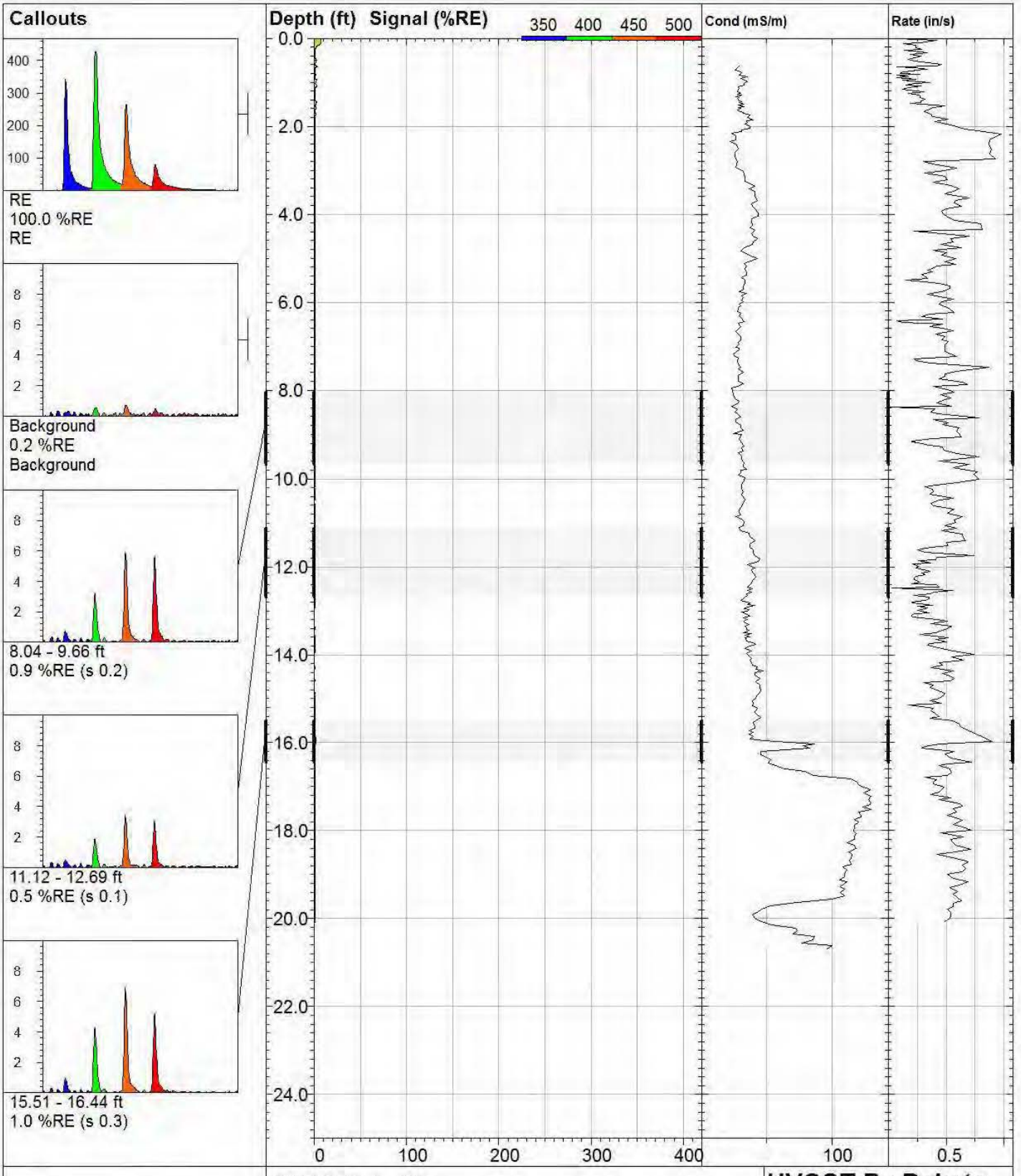
VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.06 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.7 %RE @ 0.04 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 13:05 MDT**



MW33-L12

UVOST By Dakota
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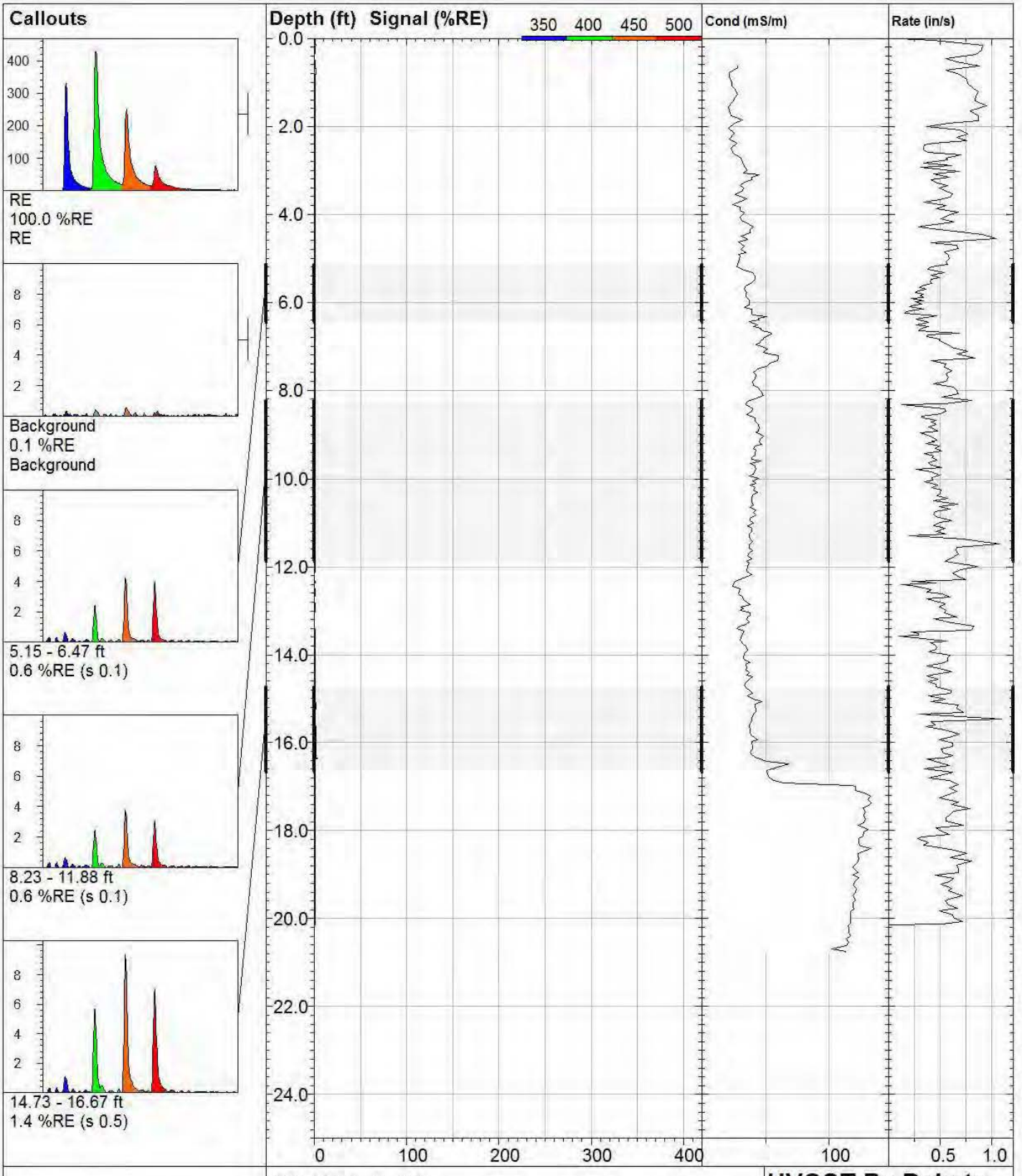
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.08 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **7.4 %RE @ 0.12 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 13:33 MDT**



MW33-L13

UVOST By Dakota
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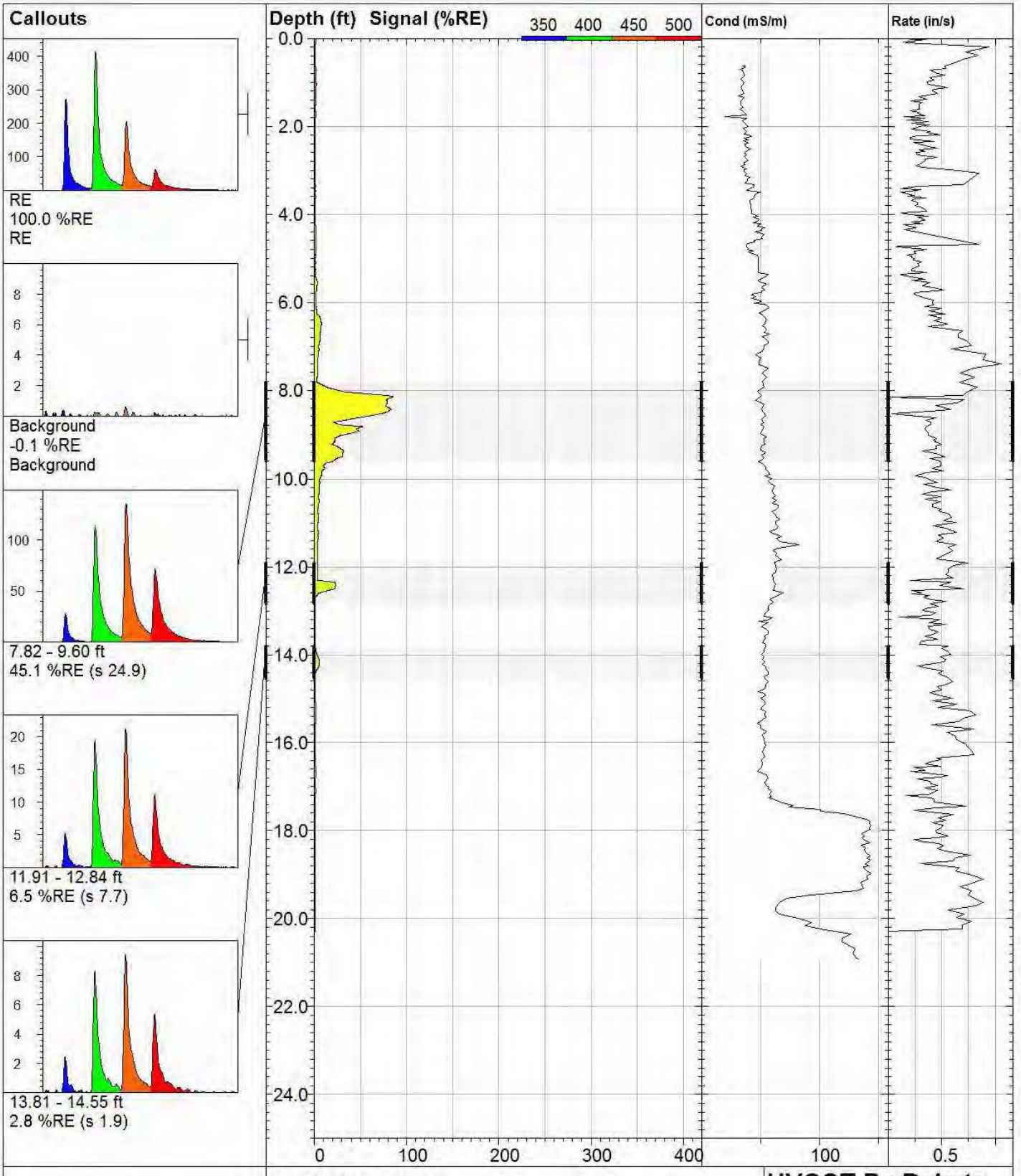
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.14 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.2 %RE @ 16.36 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-22 14:04 MDT**



MW34R-L14

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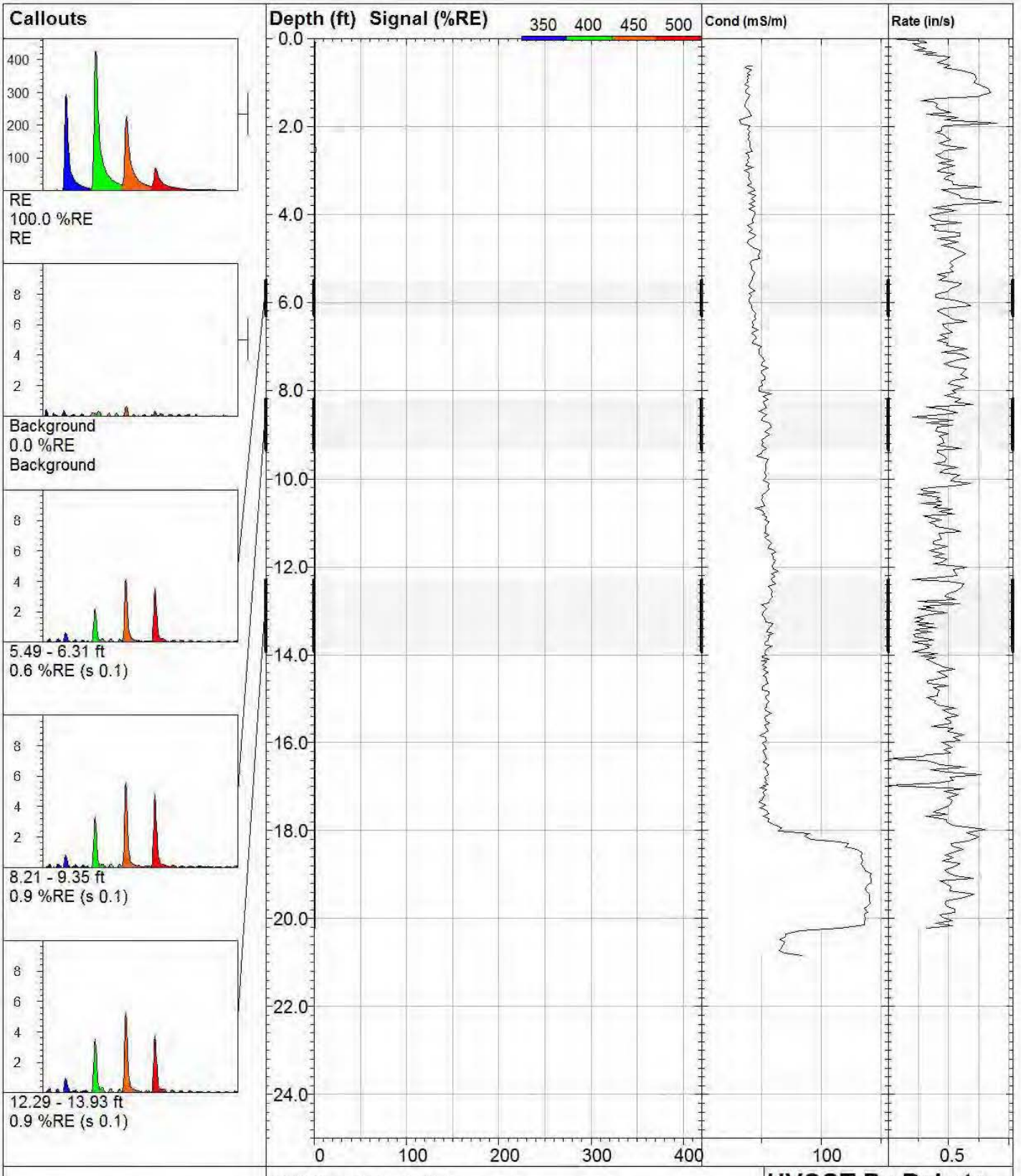
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.29 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **85.6 %RE @ 8.15 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 06:46 MDT**



VIRONEX

MW34R-L15

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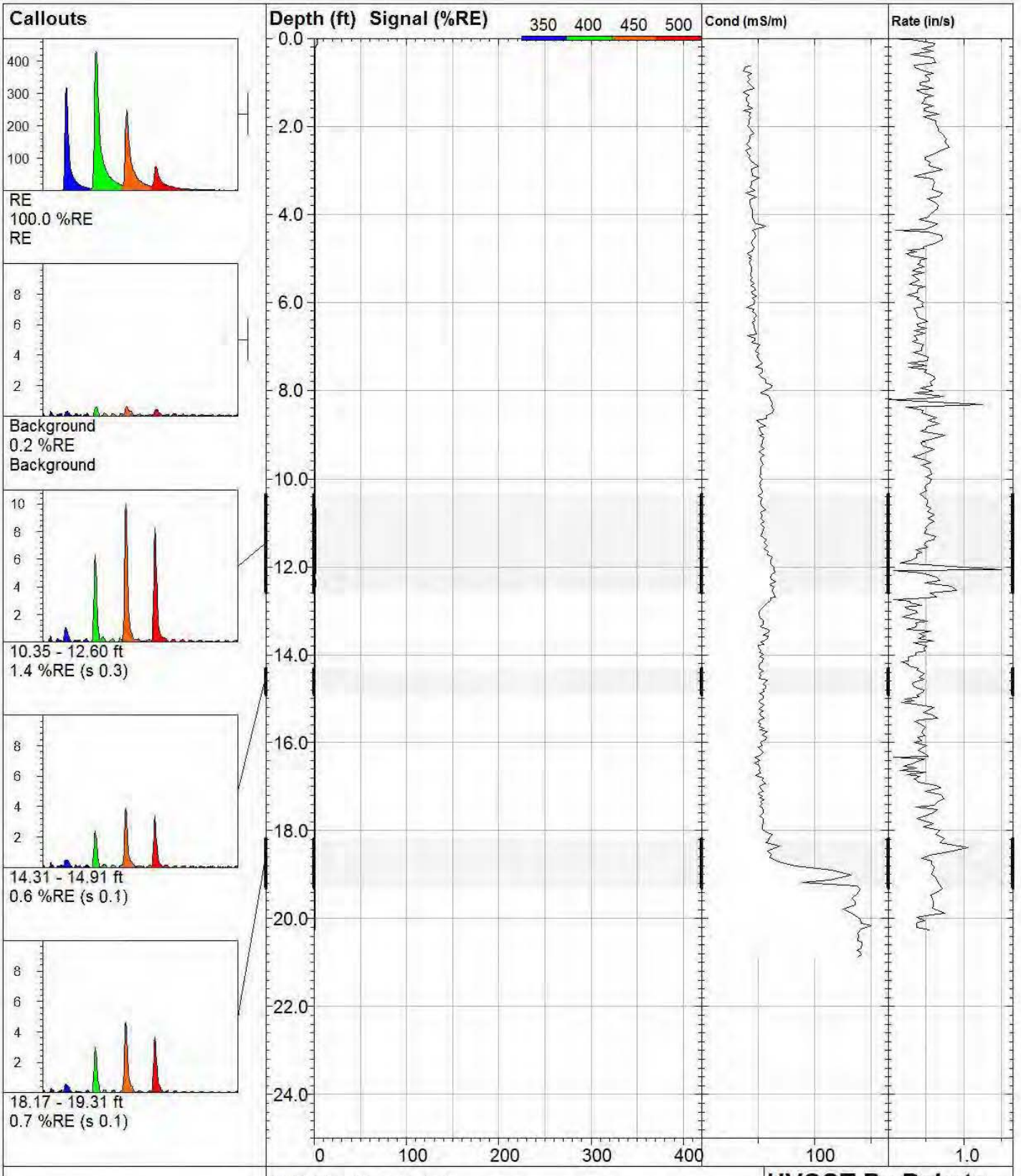
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.23 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.6 %RE @ 2.56 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 07:22 MDT**



MW34R-L16

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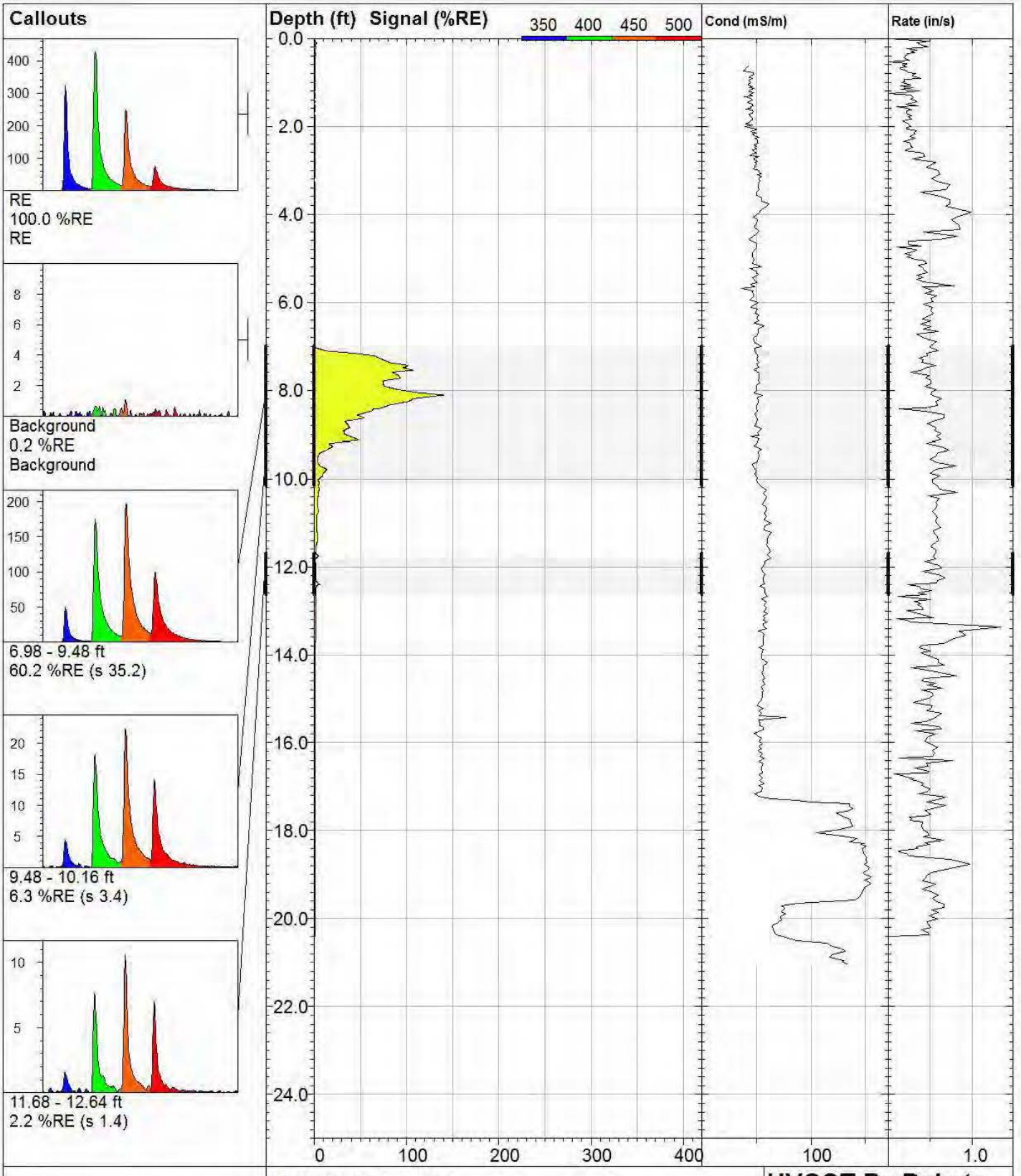
VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.26 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.4 %RE @ 0.13 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 07:50 MDT**



MW34R-L17

UVOST By Dakota
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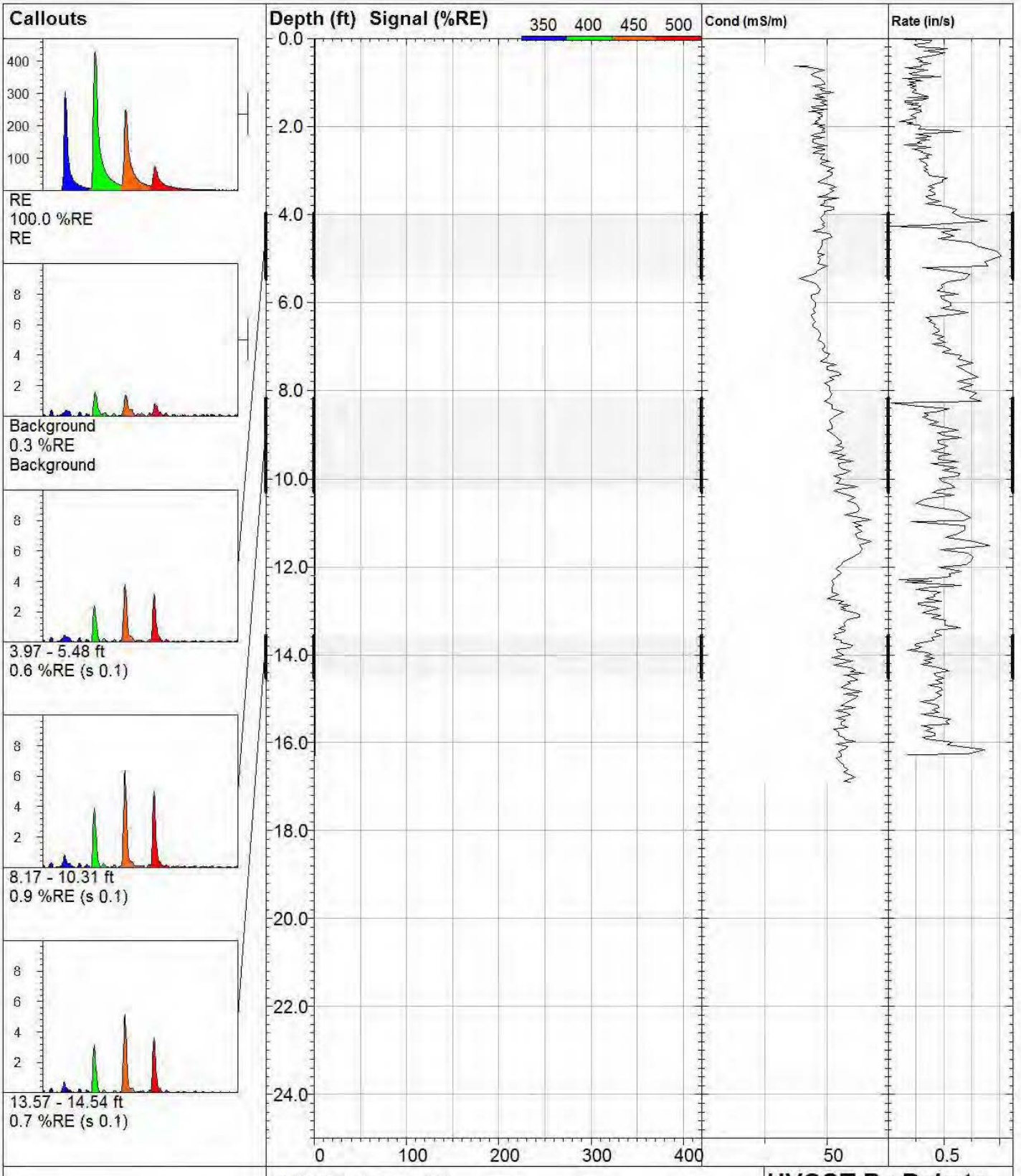
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.40 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **140.6 %RE @ 8.11 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 08:19 MDT**



VIRONEX

MW34R-L18

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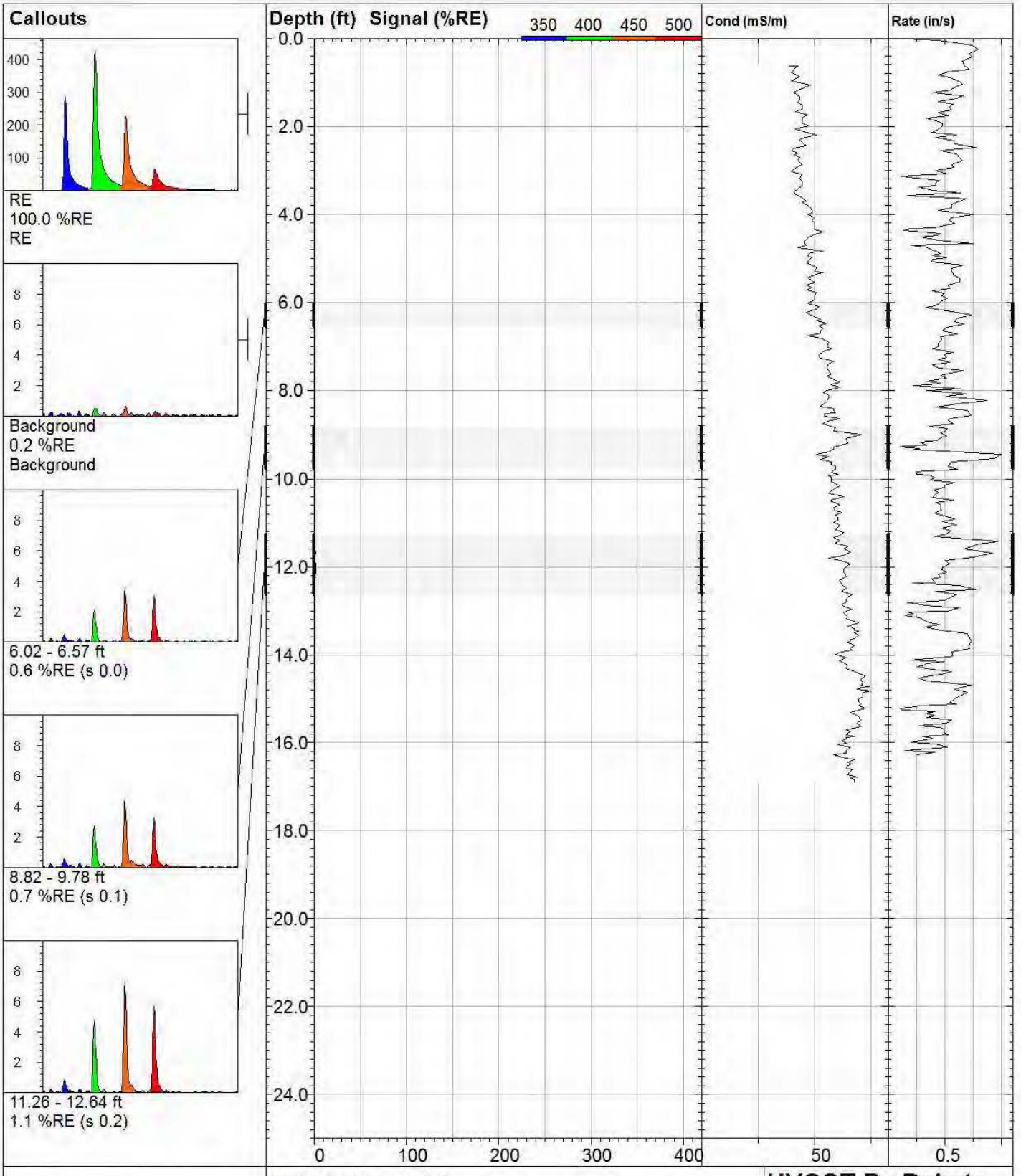
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.29 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.1 %RE @ 9.80 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 08:47 MDT**



MW34R-L19

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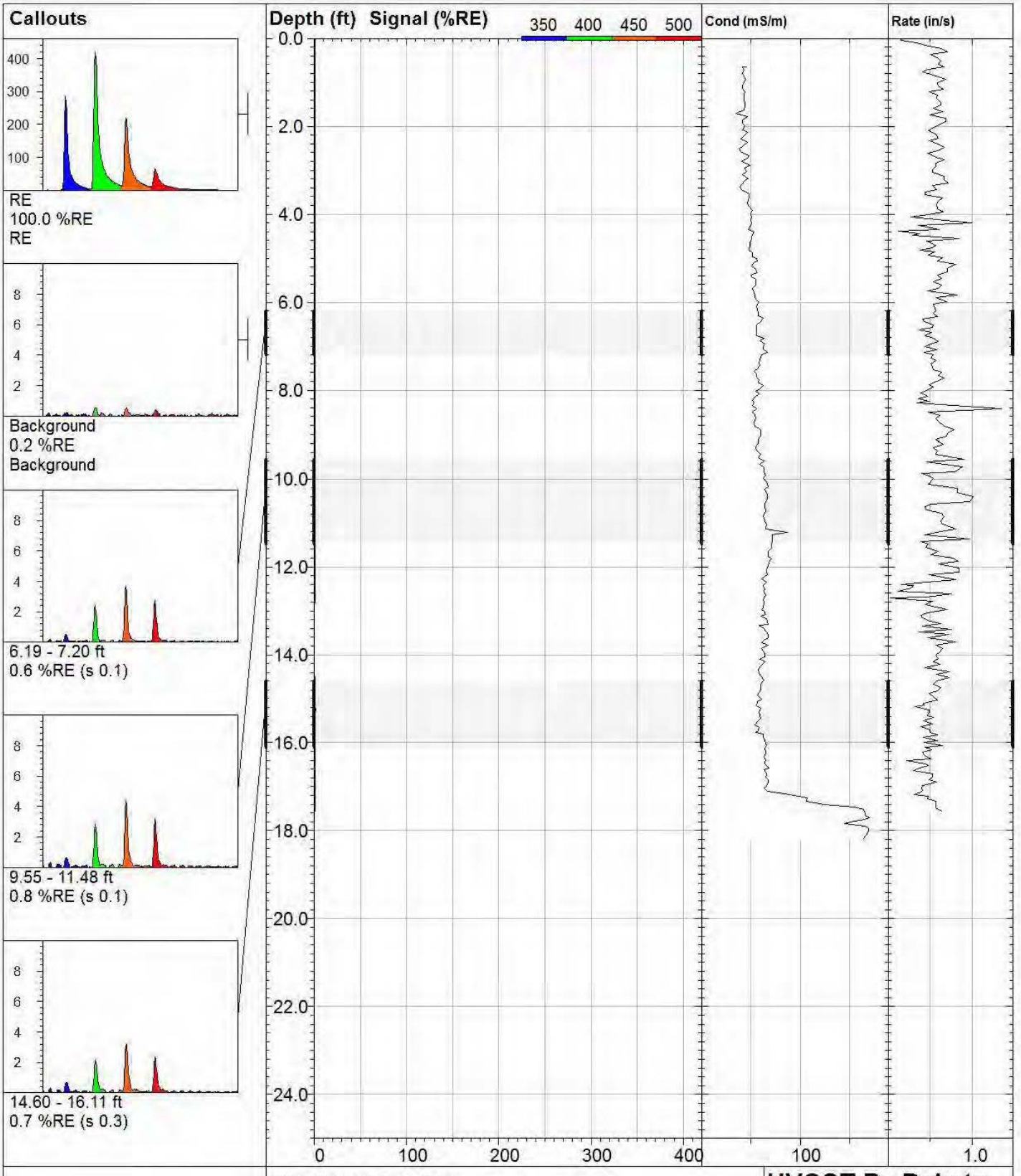
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.27 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.4 %RE @ 12.06 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 09:17 MDT**



MW34R-L20

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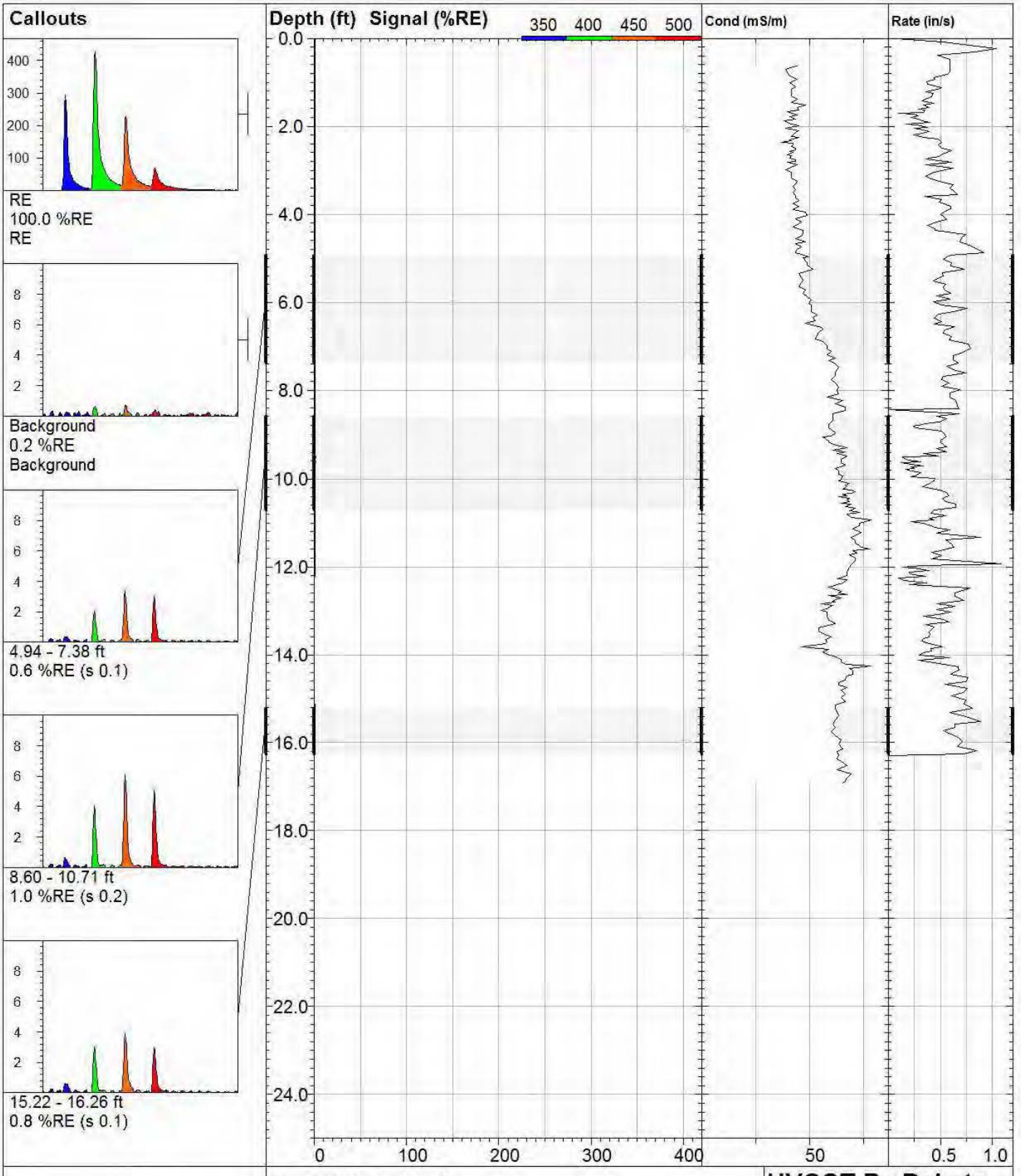
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **17.57 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.4 %RE @ 15.25 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 10:12 MDT**



VIRONEX

MW34R-L21

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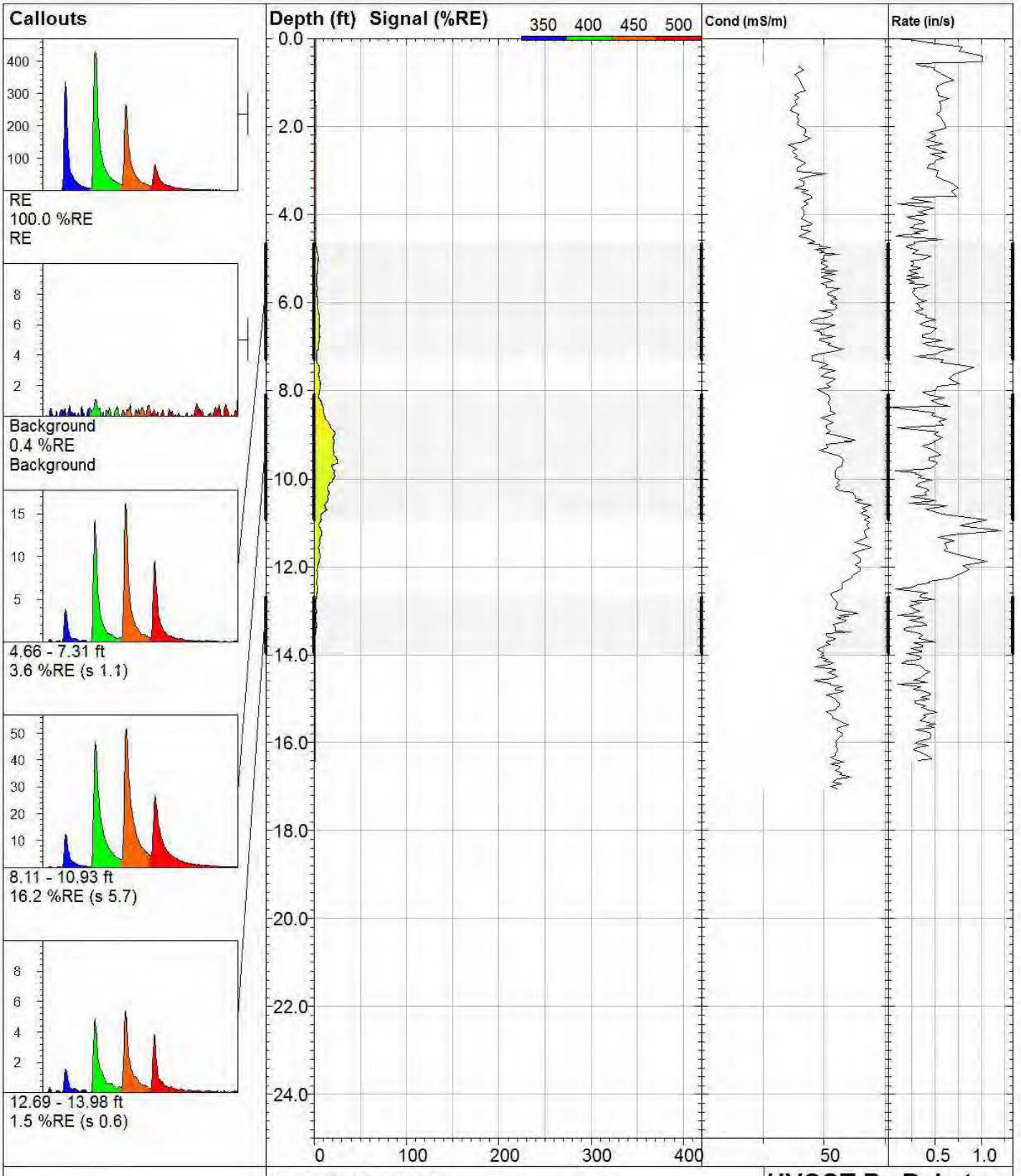
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.29 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.3 %RE @ 9.51 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 10:41 MDT**



MW34R-L22

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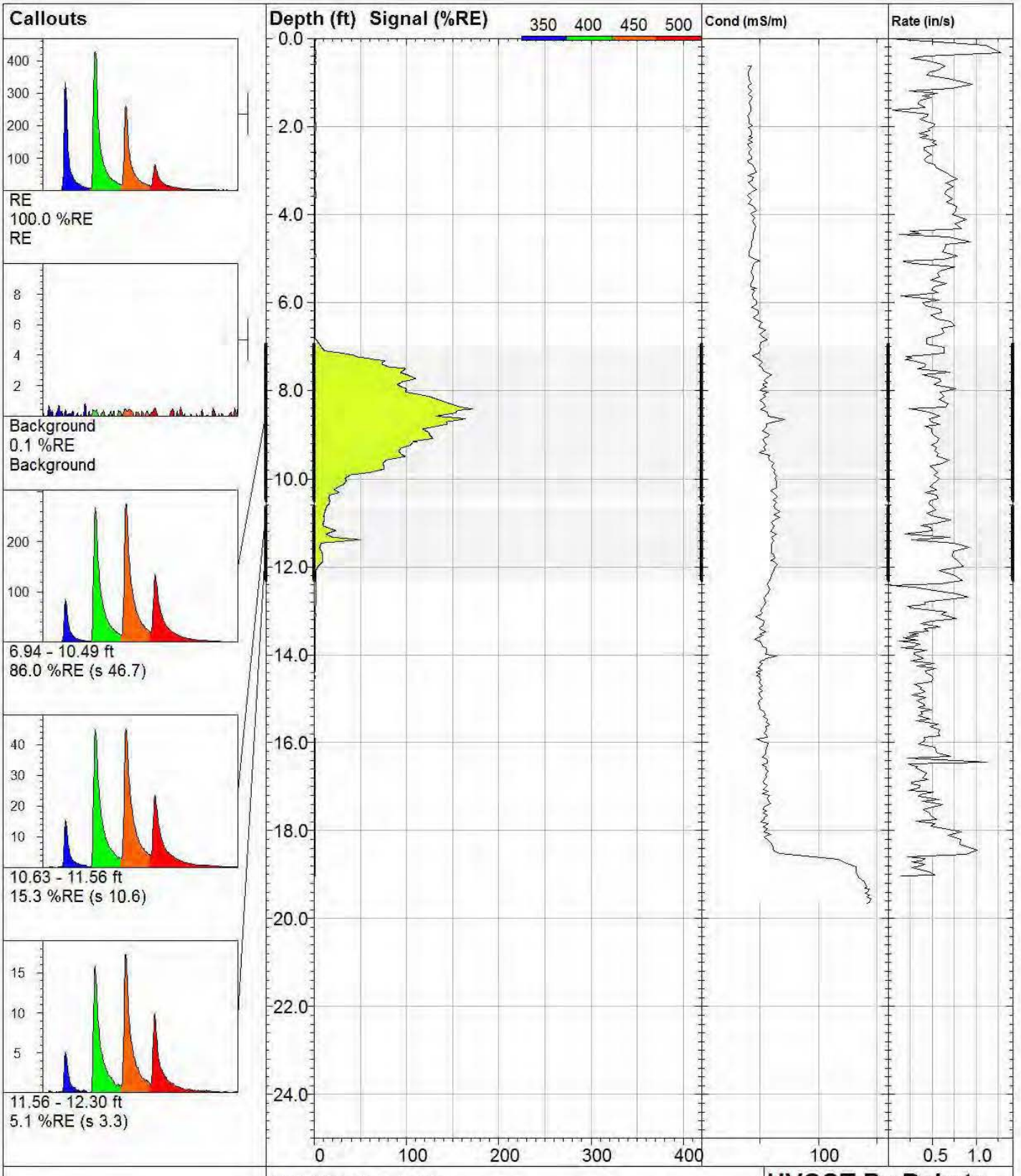
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.43 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **25.3 %RE @ 9.64 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 11:12 MDT**



MW34R-L23

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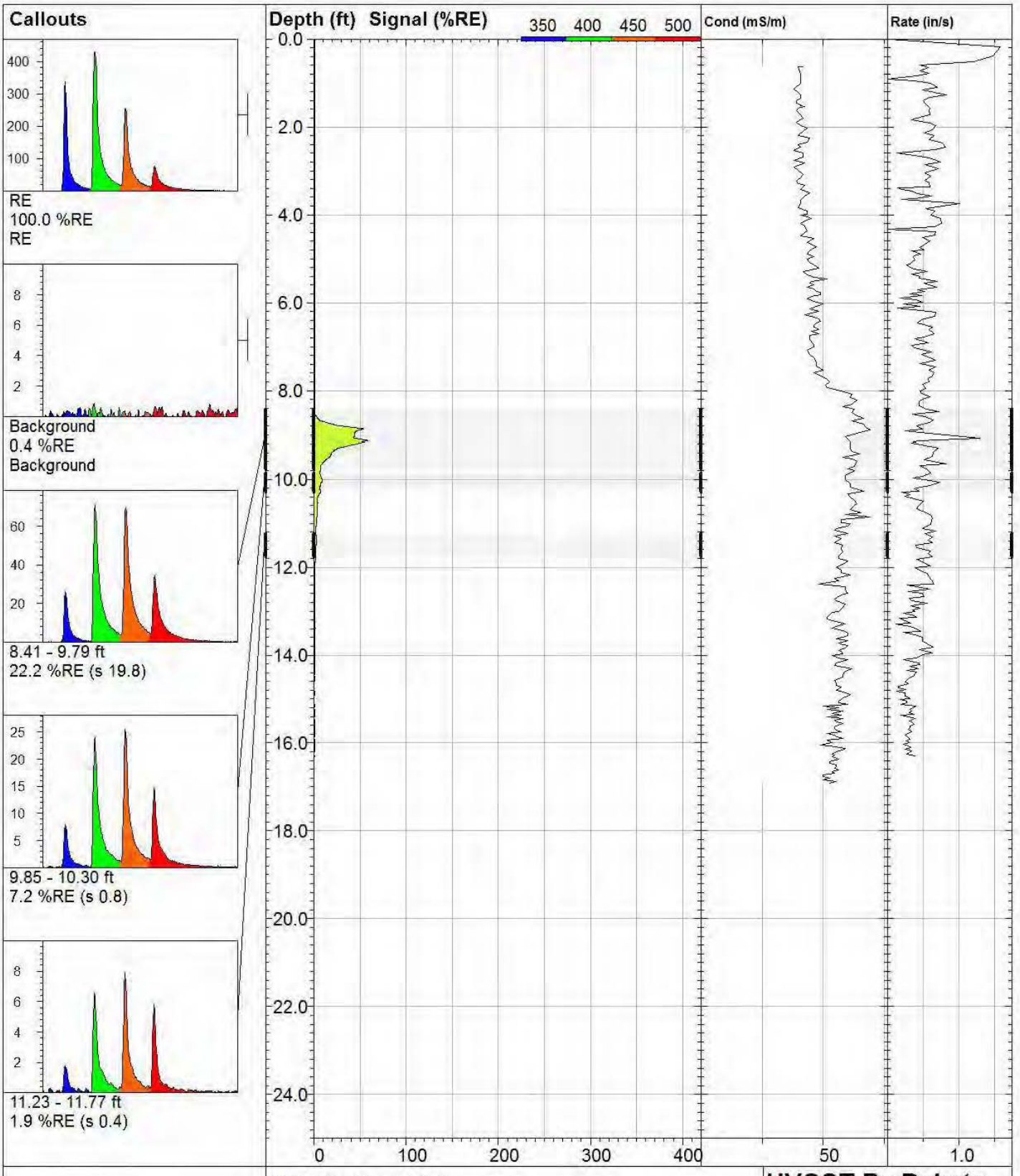
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **19.03 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **171.8 %RE @ 8.43 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 11:35 MDT**



MW34R-L24

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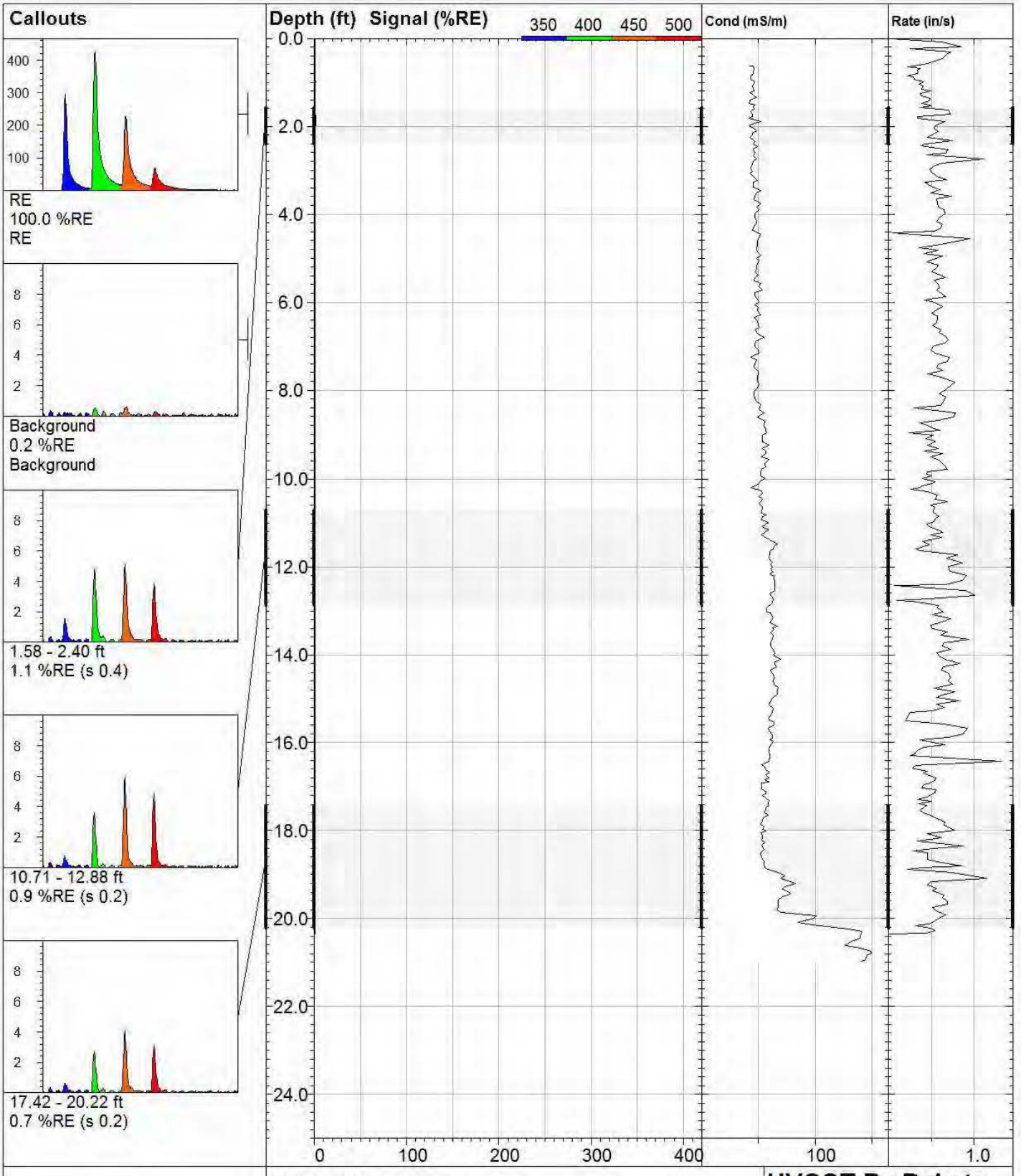
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.31 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **58.5 %RE @ 9.13 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 11:59 MDT**



MW34R-L25

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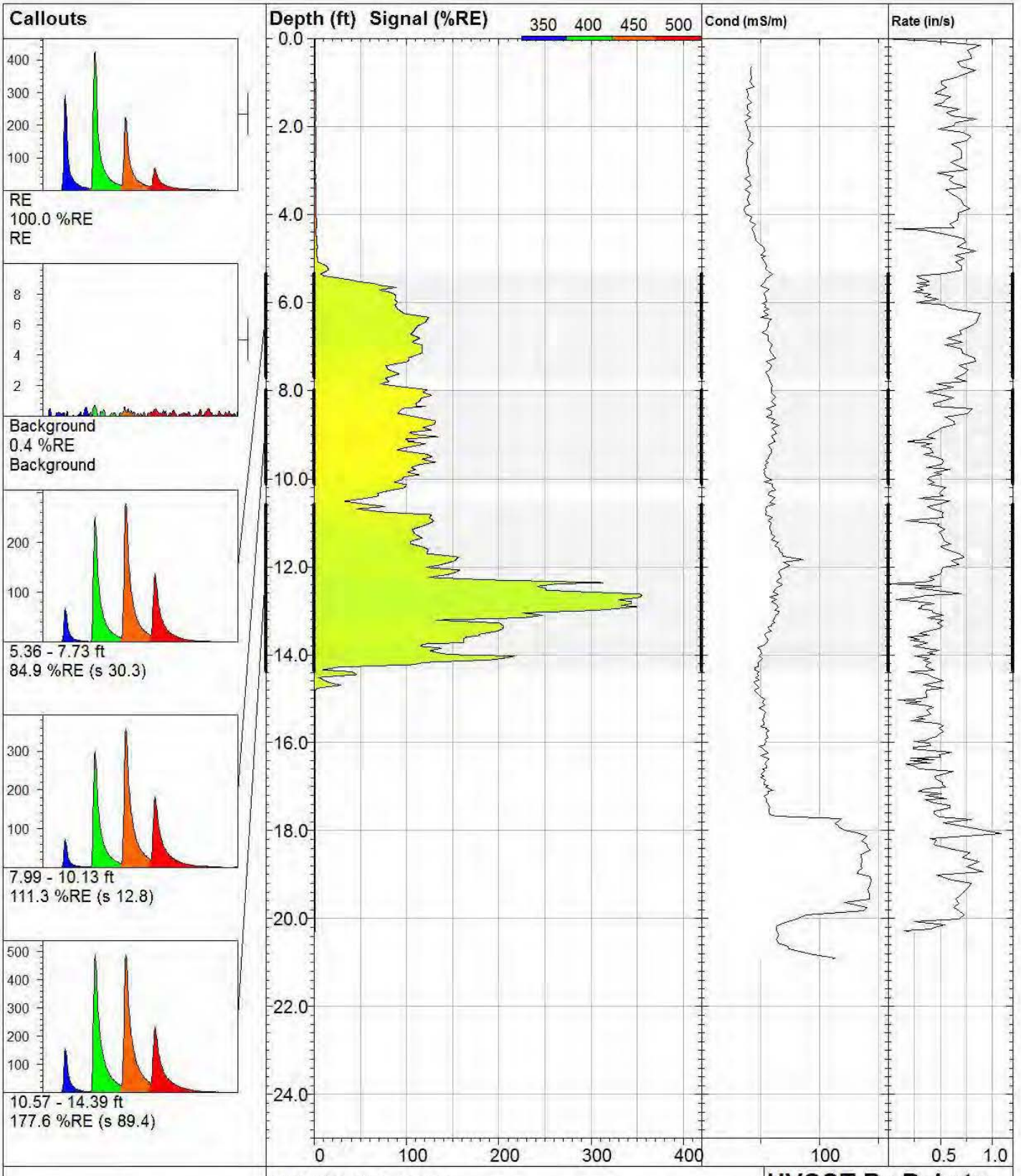
VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.35 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1.9 %RE @ 1.83 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 12:27 MDT**



MW34R-L26

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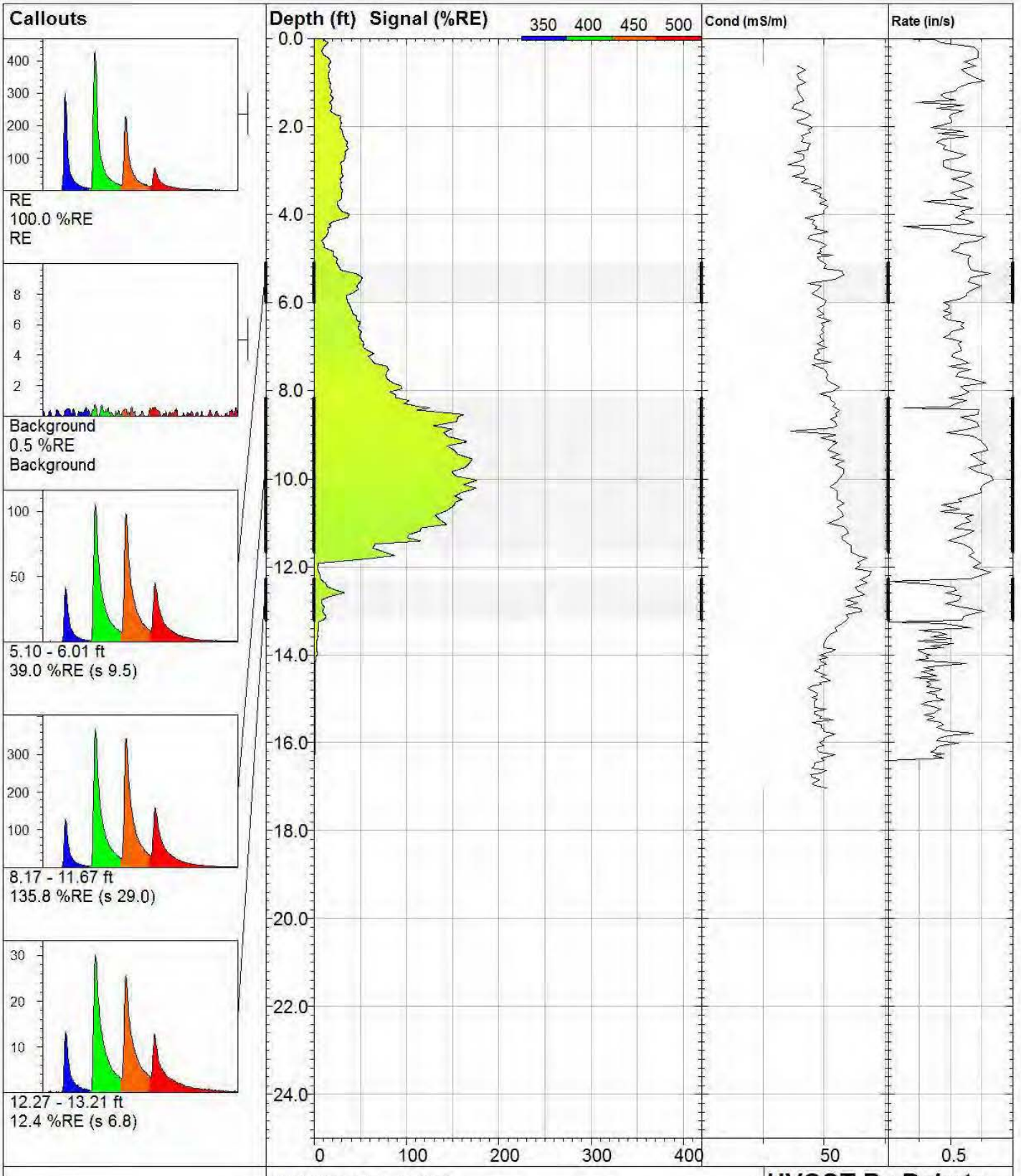
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.30 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **355.5 %RE @ 12.65 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 12:58 MDT**



MW34R-L27

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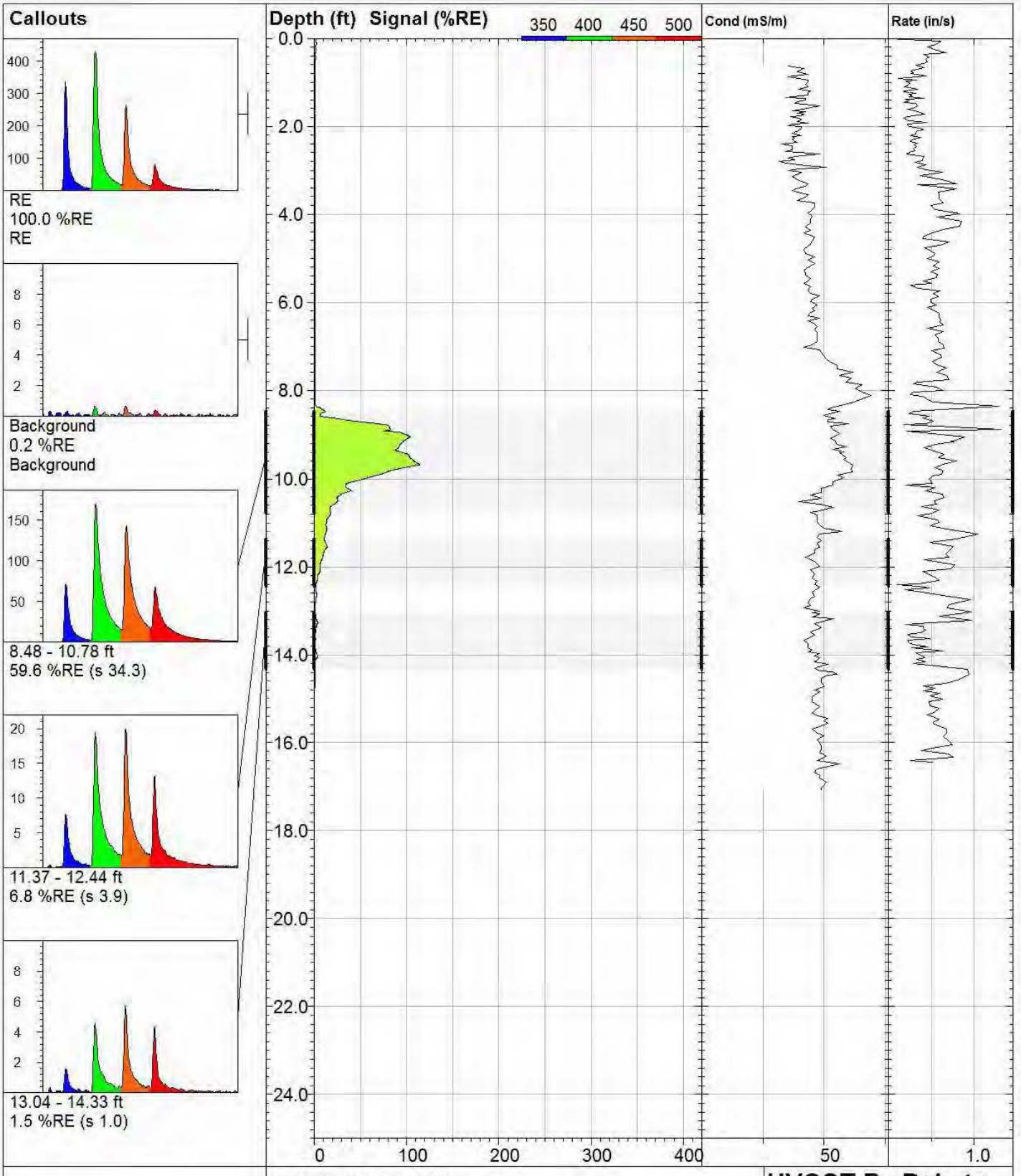
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.40 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **176.6 %RE @ 10.03 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 13:25 MDT**



MW34R-L28

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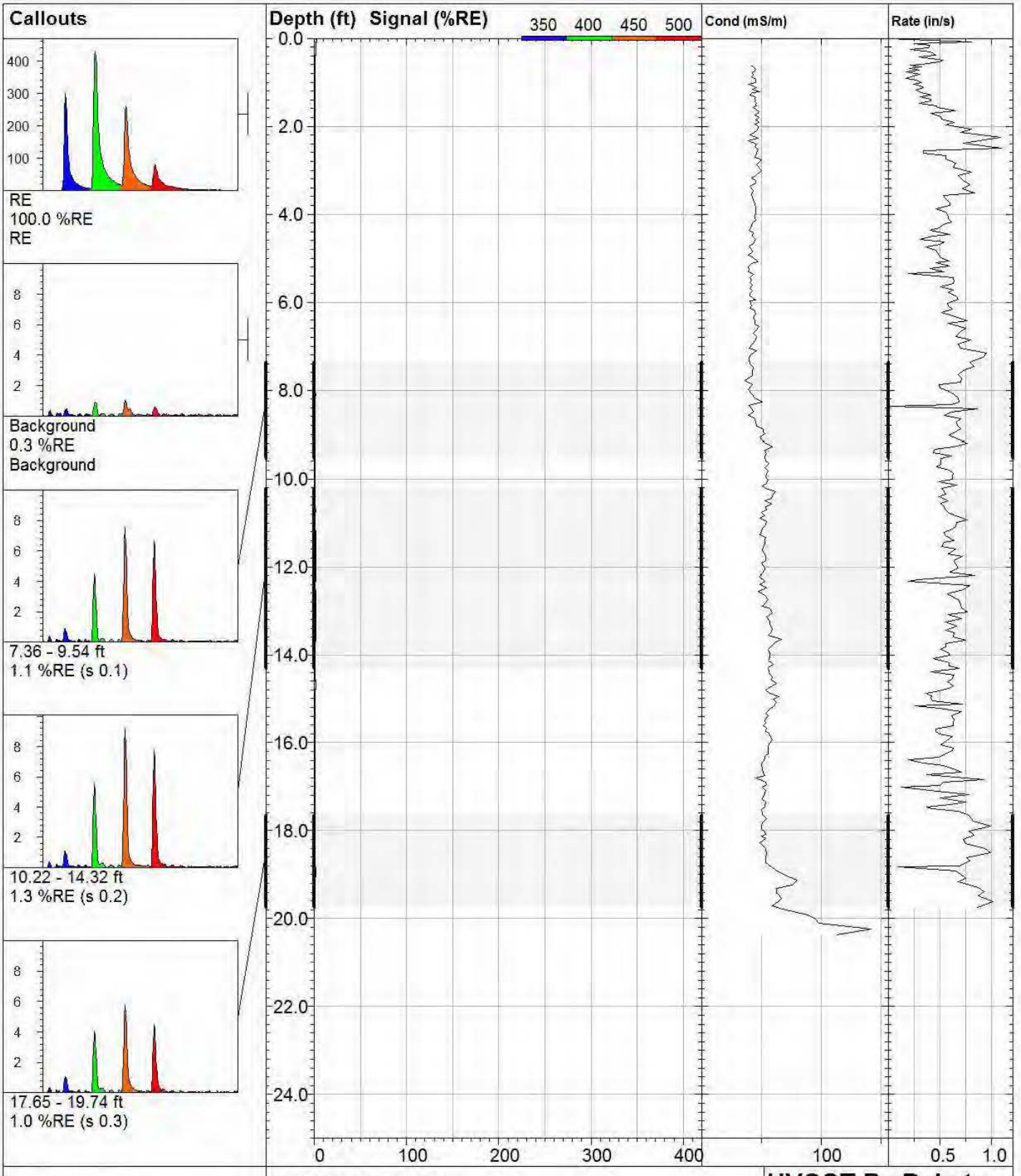
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.46 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **114.3 %RE @ 9.68 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 13:54 MDT**



MW34R-L29

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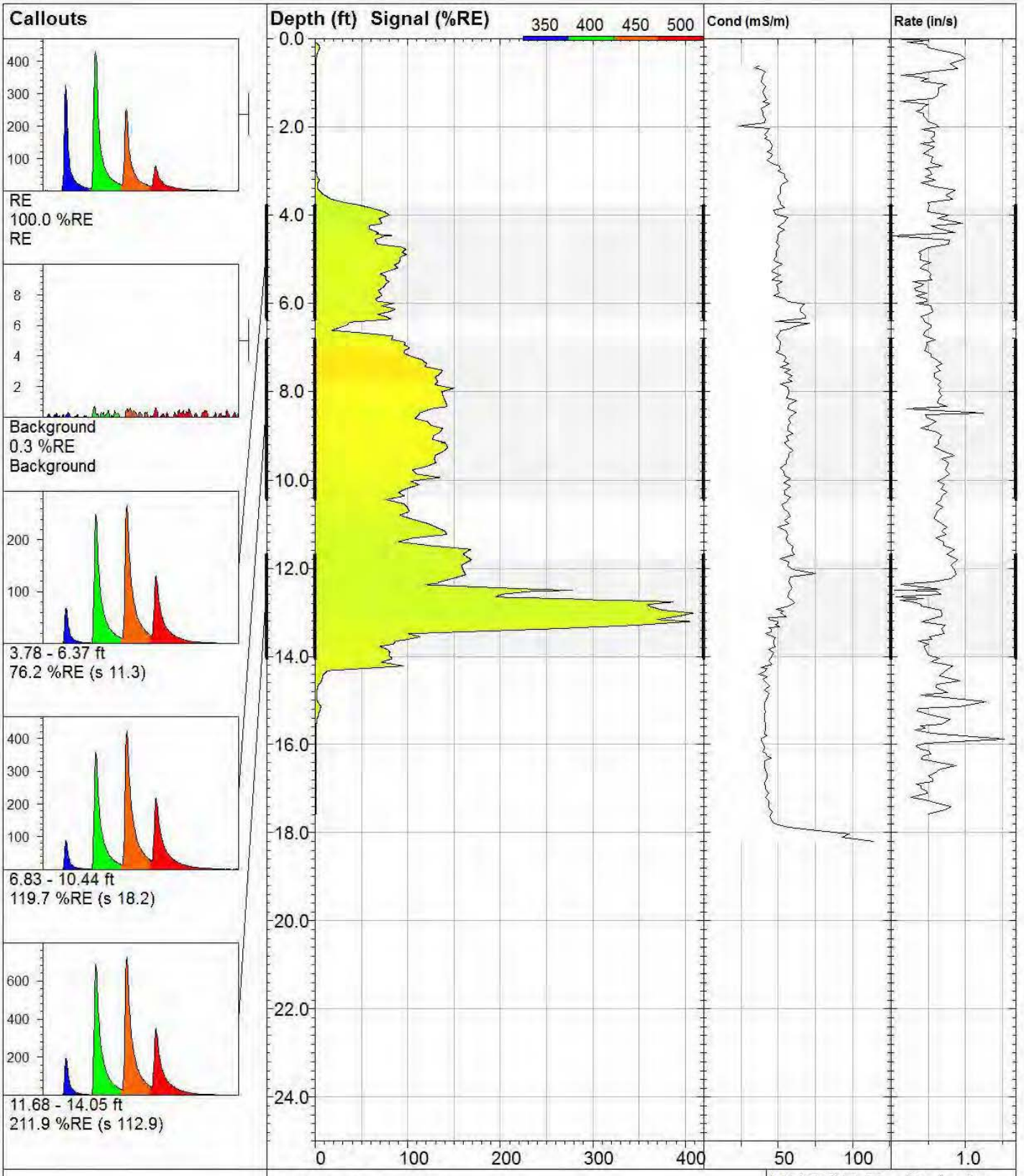
VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **19.75 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.3 %RE @ 0.08 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 14:22 MDT**



MW34R-L30

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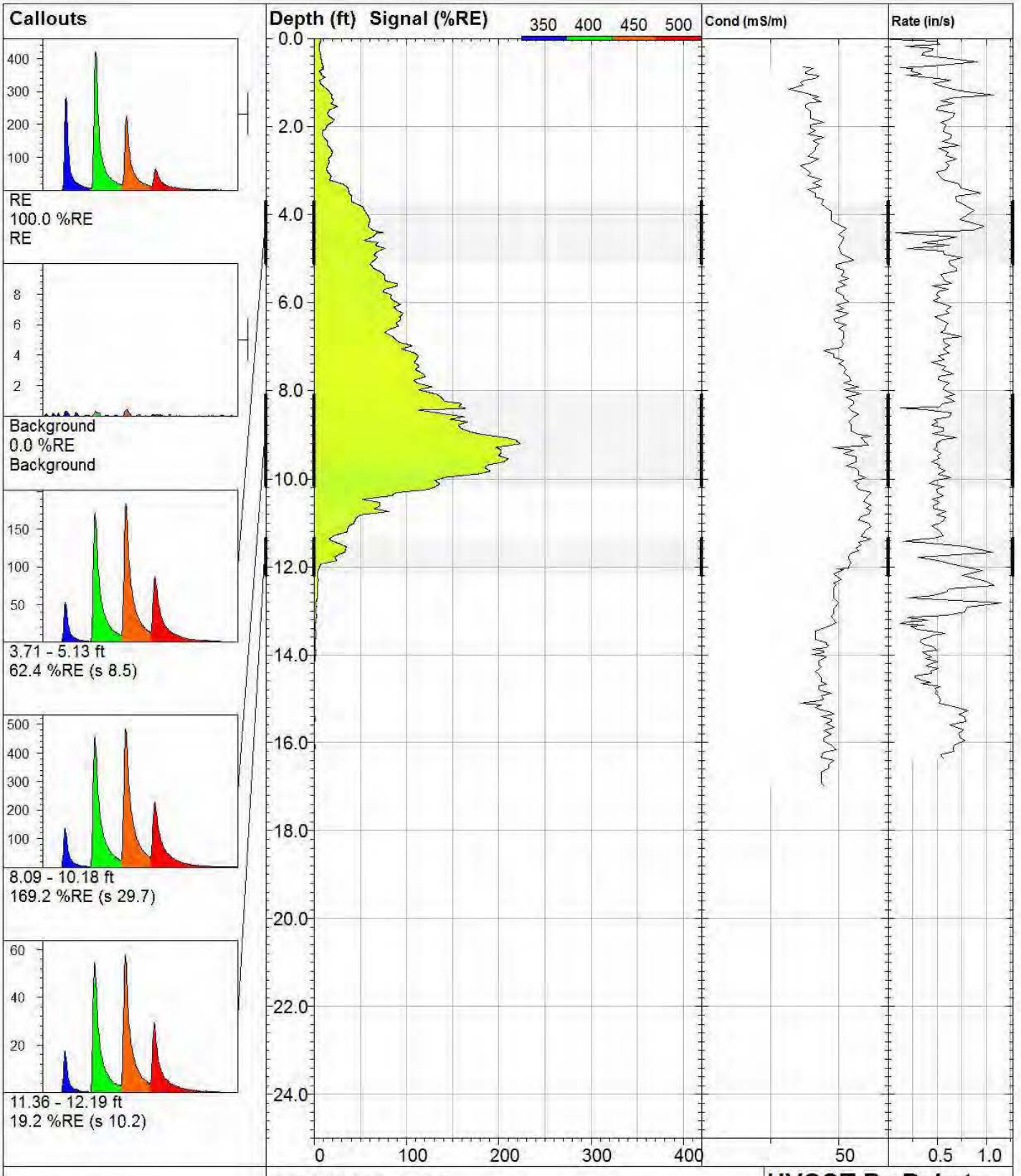
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **17.59 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **408.7 %RE @ 13.02 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-23 14:55 MDT**



MW34R-L31

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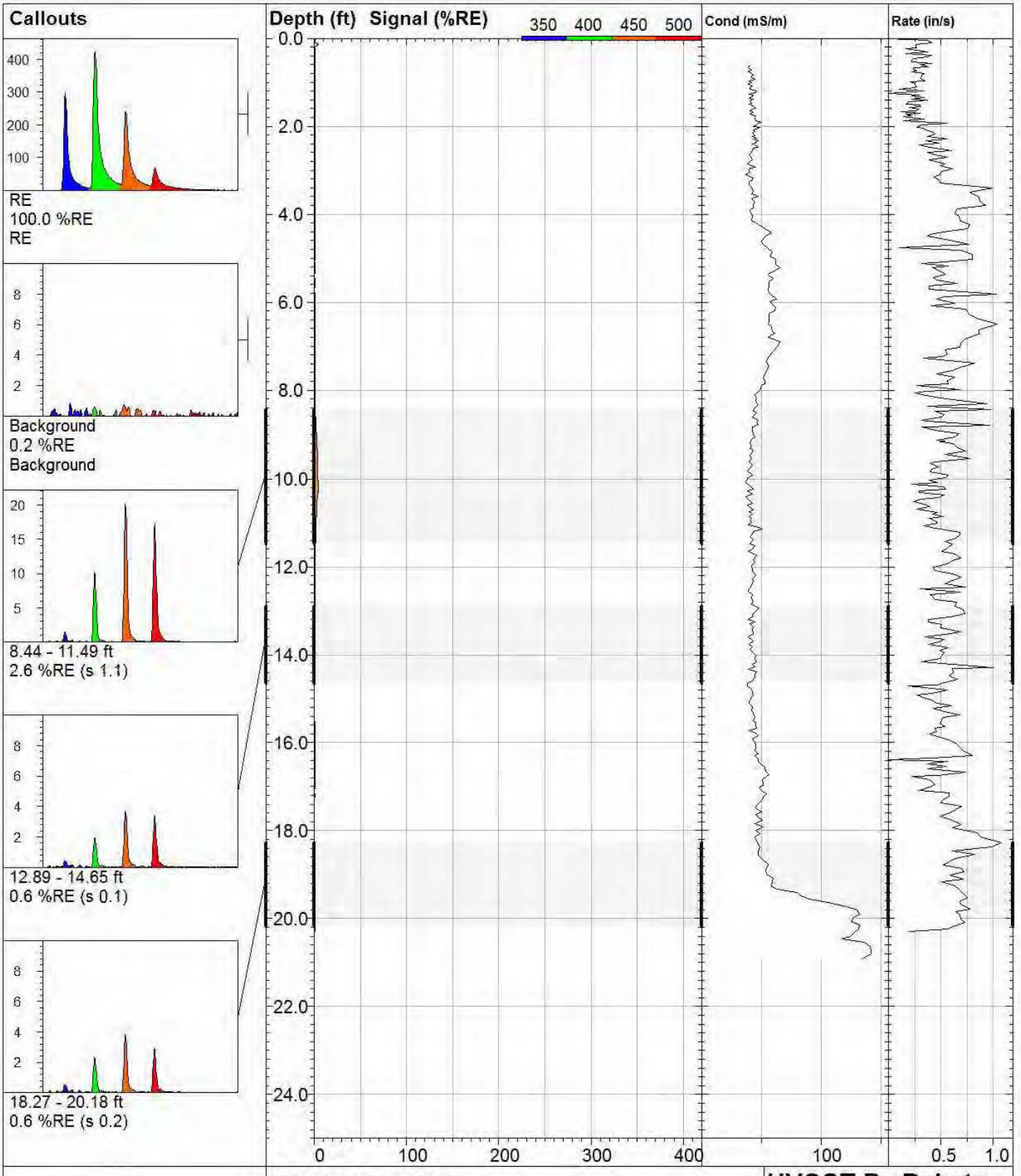
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.36 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **223.3 %RE @ 9.20 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 06:54 MDT**



MW34R-L32

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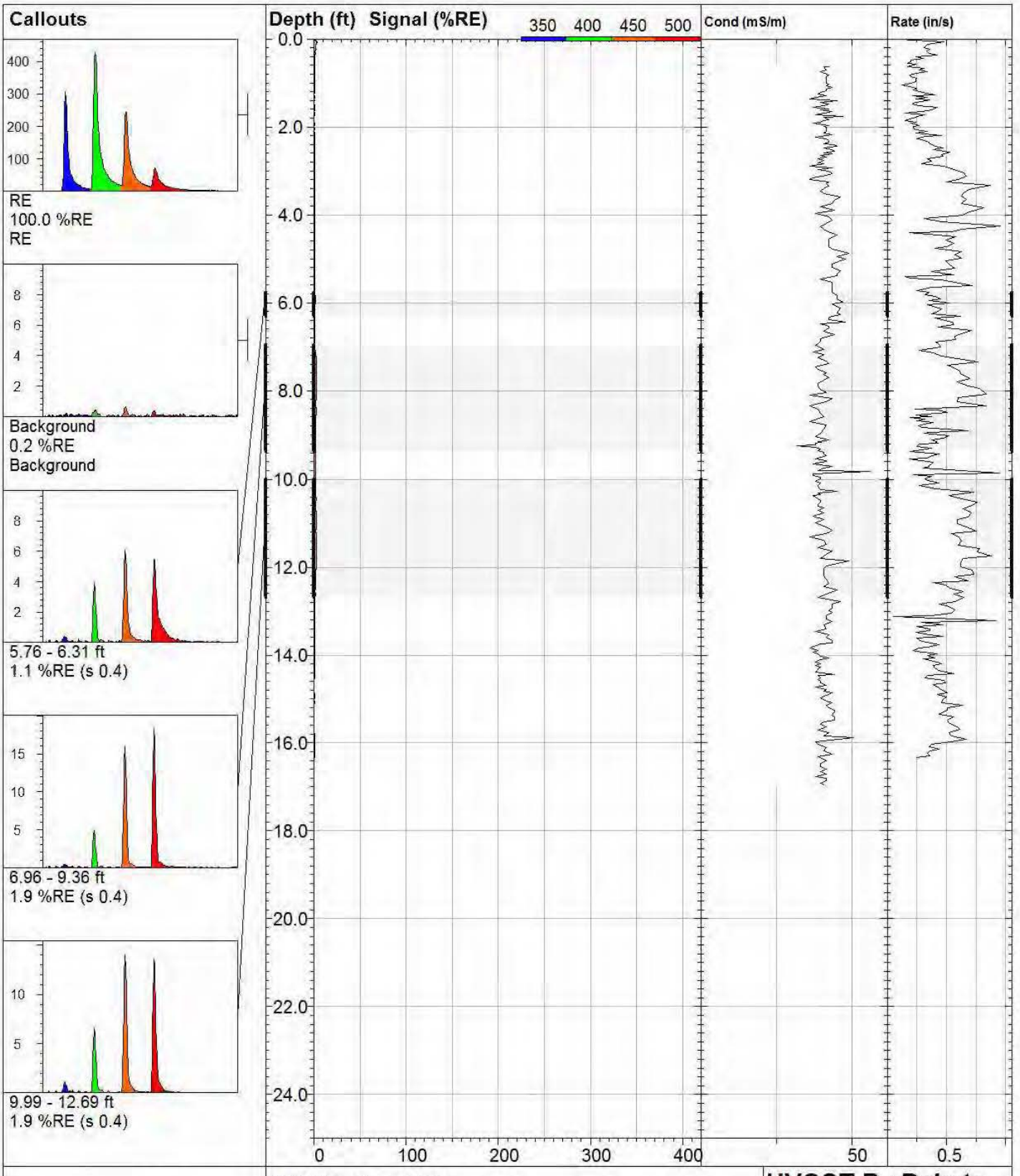
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **20.30 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.8 %RE @ 10.08 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 07:27 MDT**



MW34R-L33

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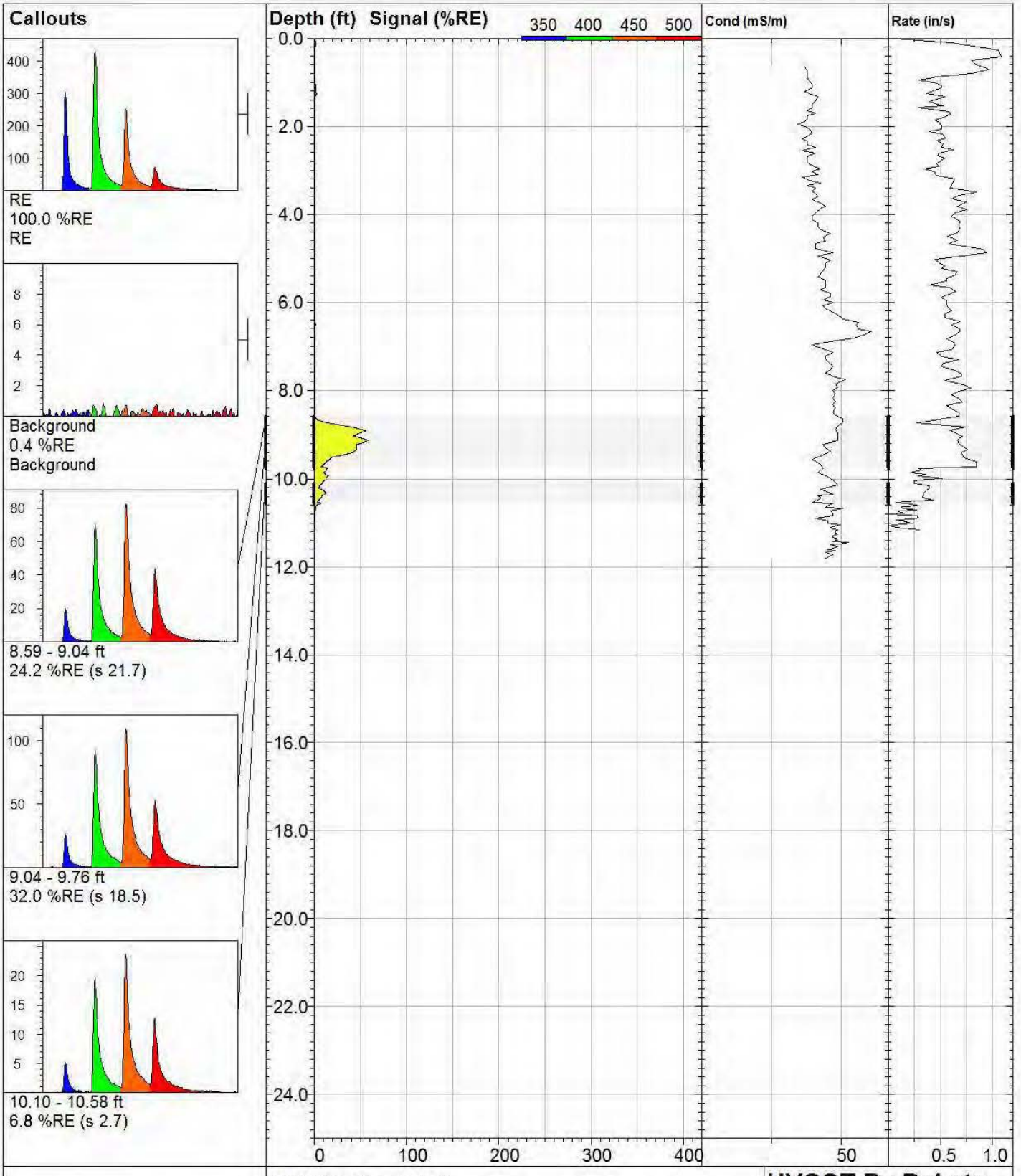
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.34 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.6 %RE @ 0.07 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 07:56 MDT**



VIRONEX

MW34R-L34

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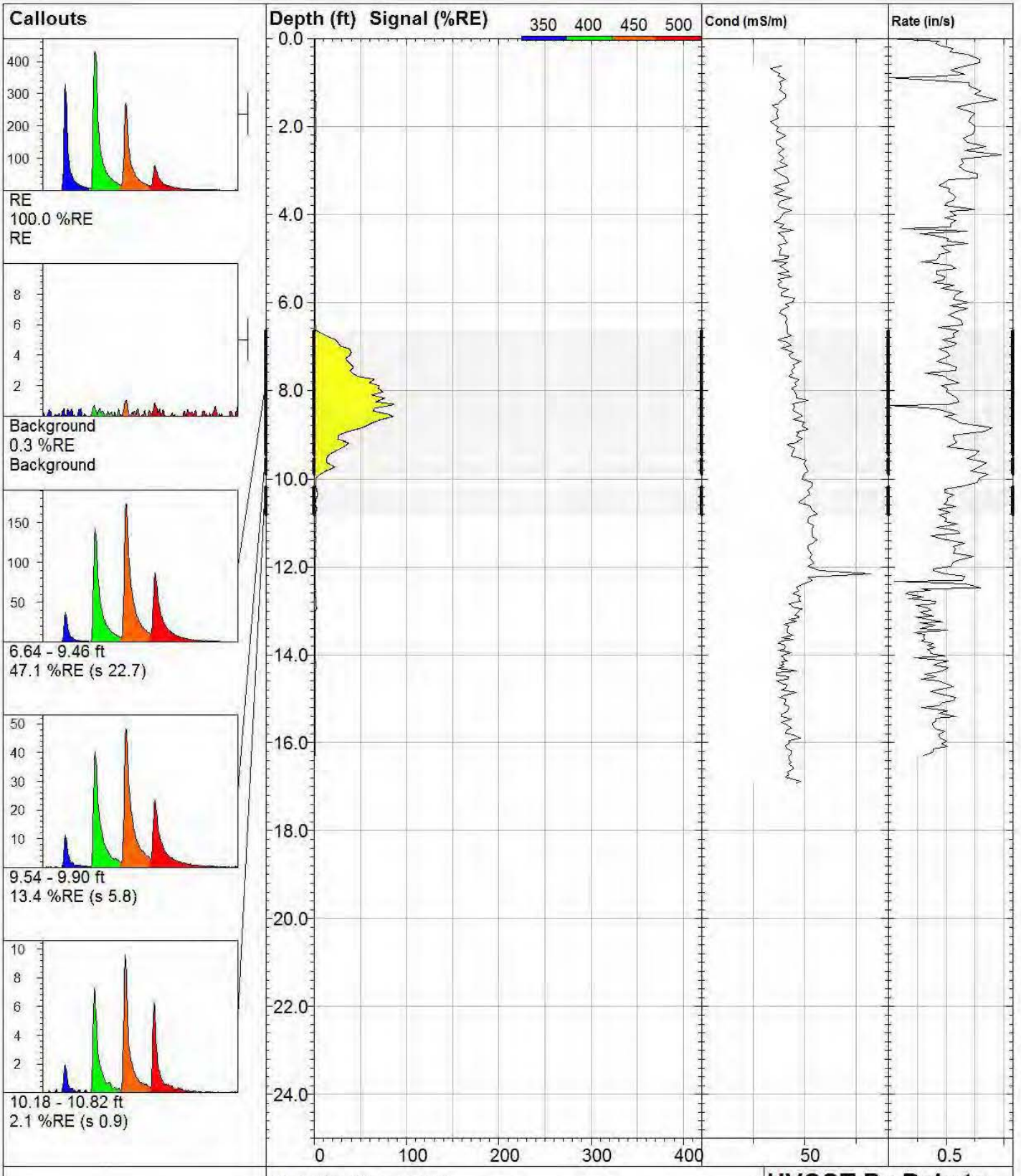
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **11.17 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **58.6 %RE @ 9.14 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 08:21 MDT**



MW34R-L35

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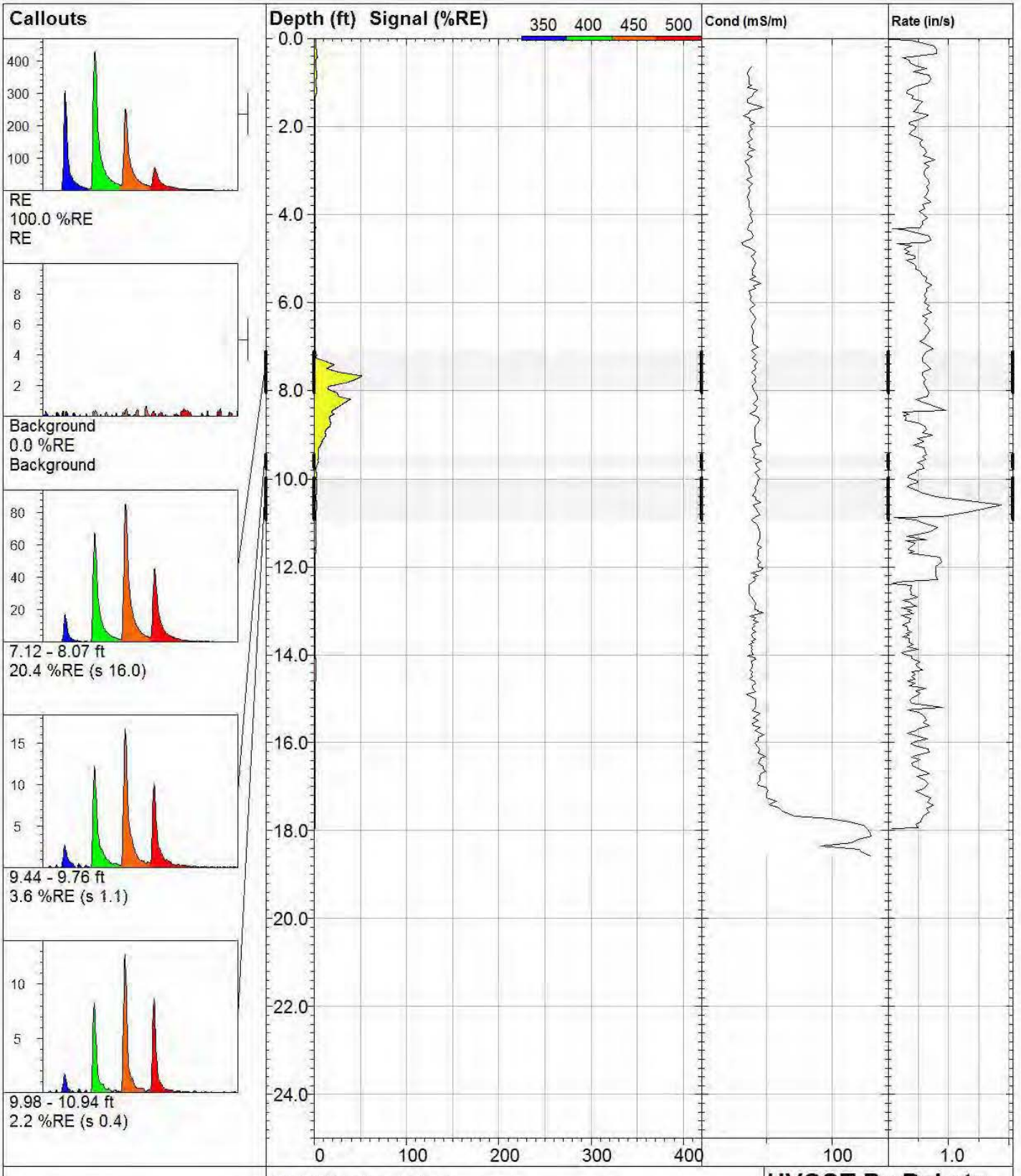
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.30 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **86.9 %RE @ 8.32 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 08:43 MDT**



MW34R-L36

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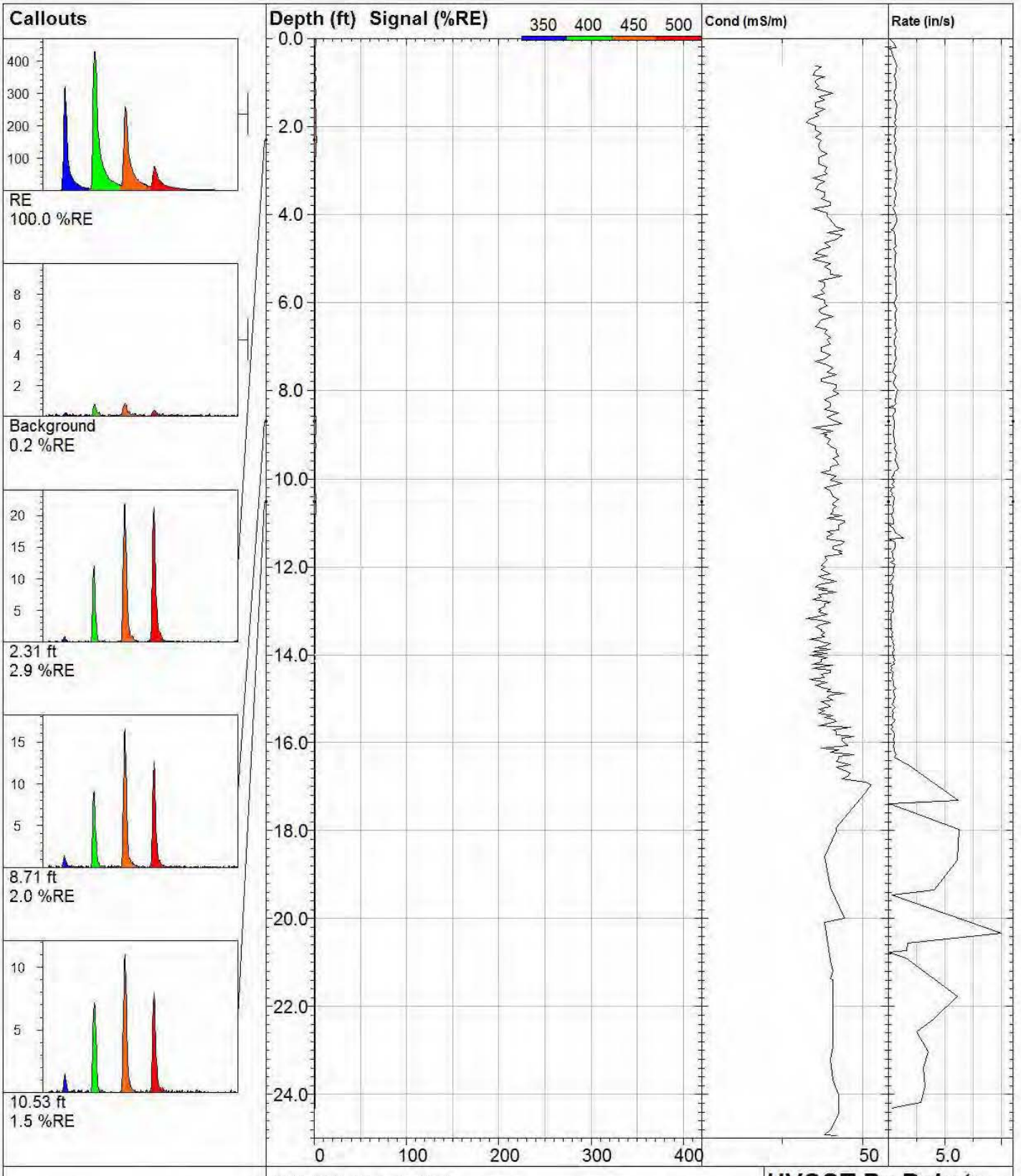
VIRONEX

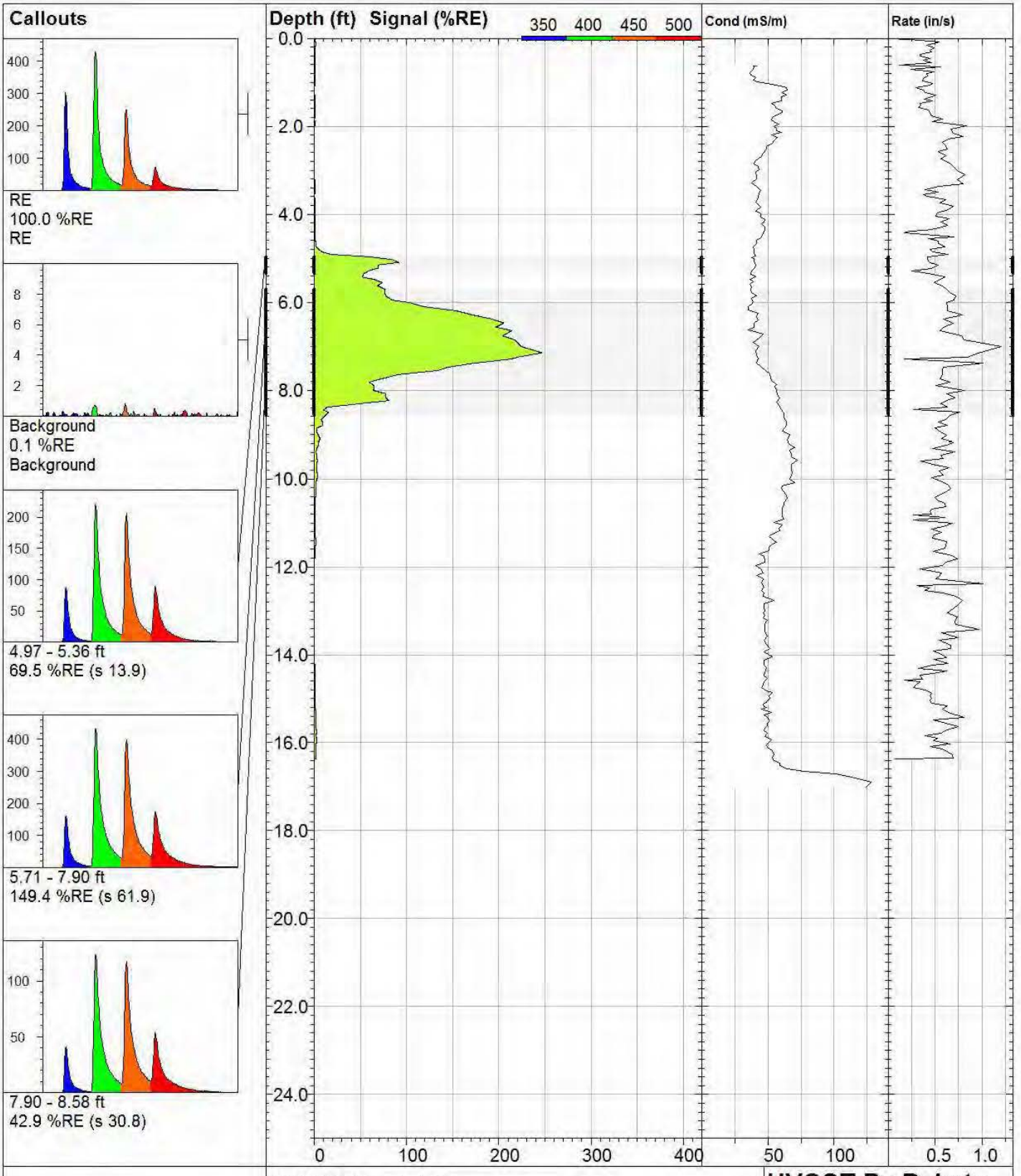
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **17.96 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **51.7 %RE @ 7.68 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 09:03 MDT**



MW34R-L37

UVOST By Dakota
www.DakotaTechnologies.com

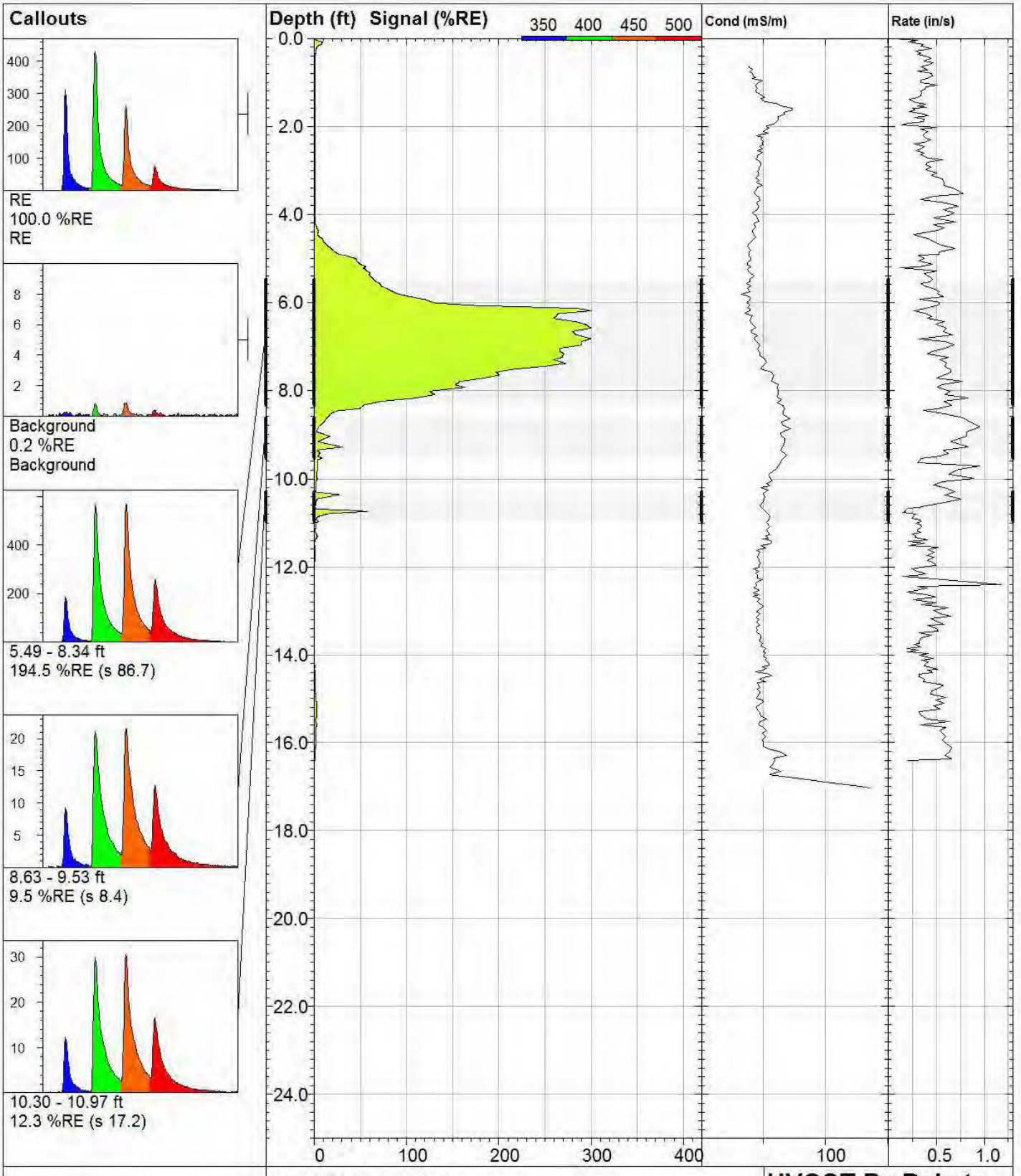
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **24.31 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.9 %RE @ 2.31 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 09:47 MDT**



MW34R-L38

UVOST By Dakota
www.DakotaTechnologies.com

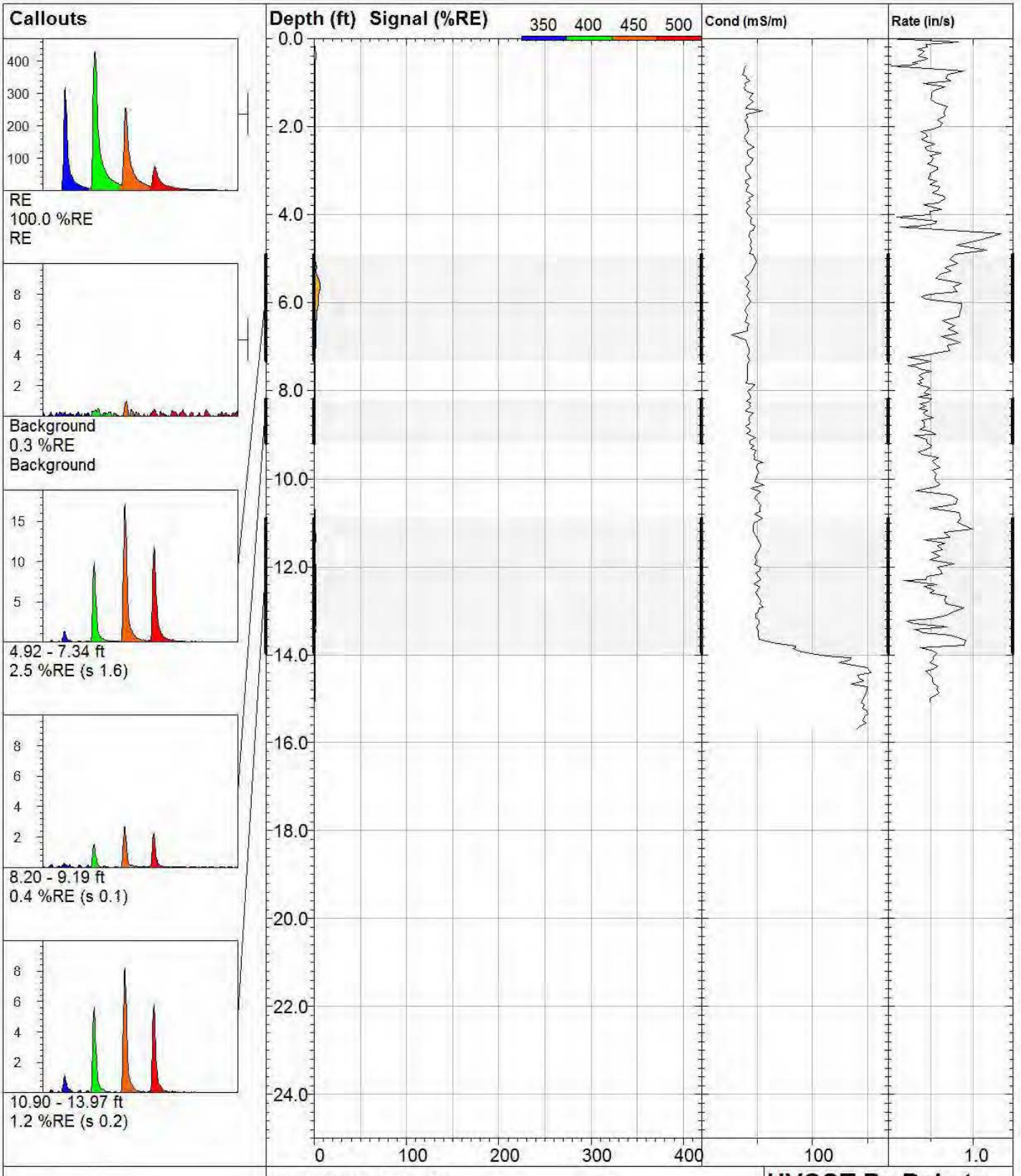
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.38 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **247.1 %RE @ 7.15 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 11:02 MDT**



MW34R-L39

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.41 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **301.1 %RE @ 6.20 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 11:24 MDT**

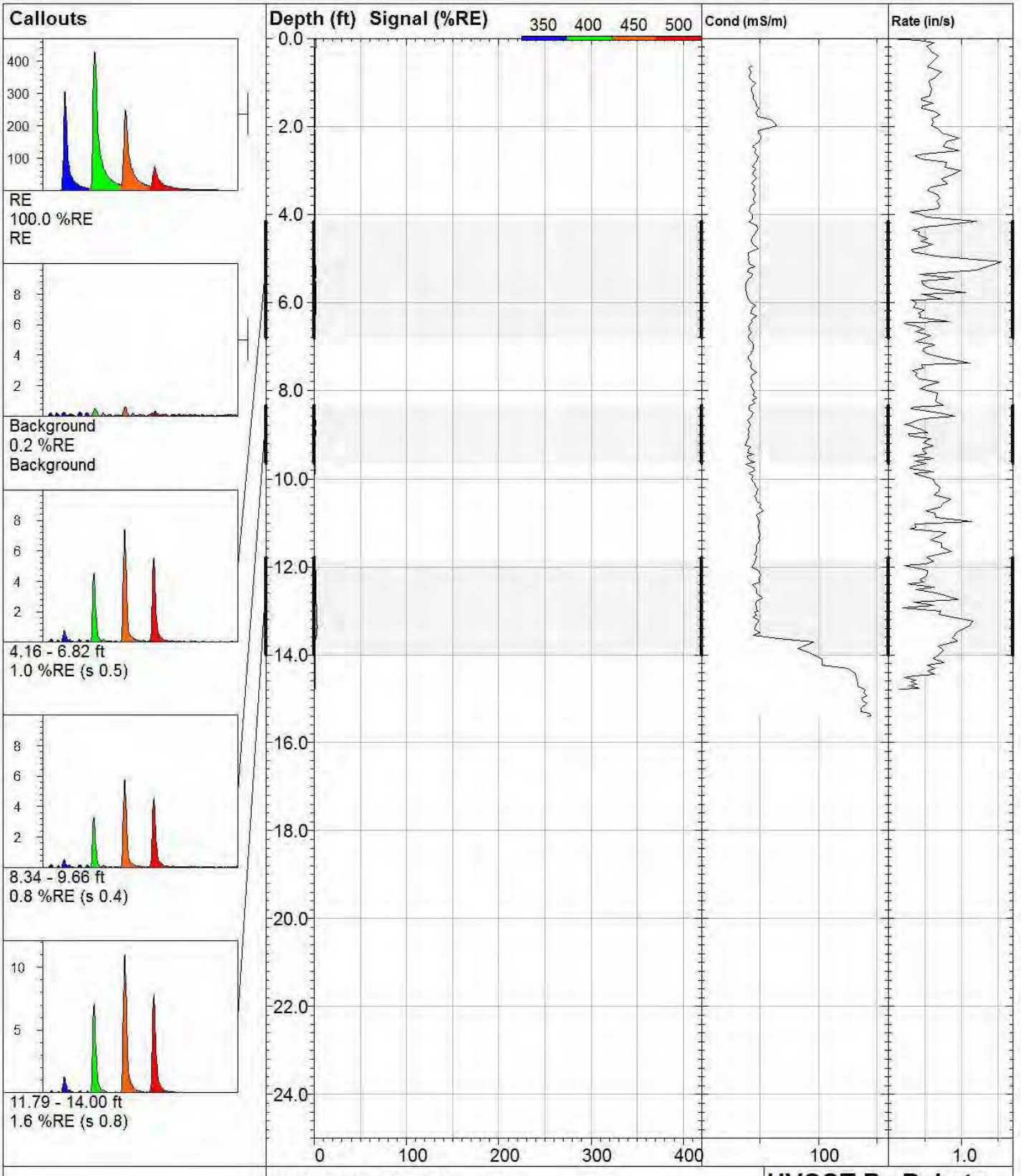


MW34R-L40

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **15.08 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **6.1 %RE @ 5.65 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 12:00 MDT**

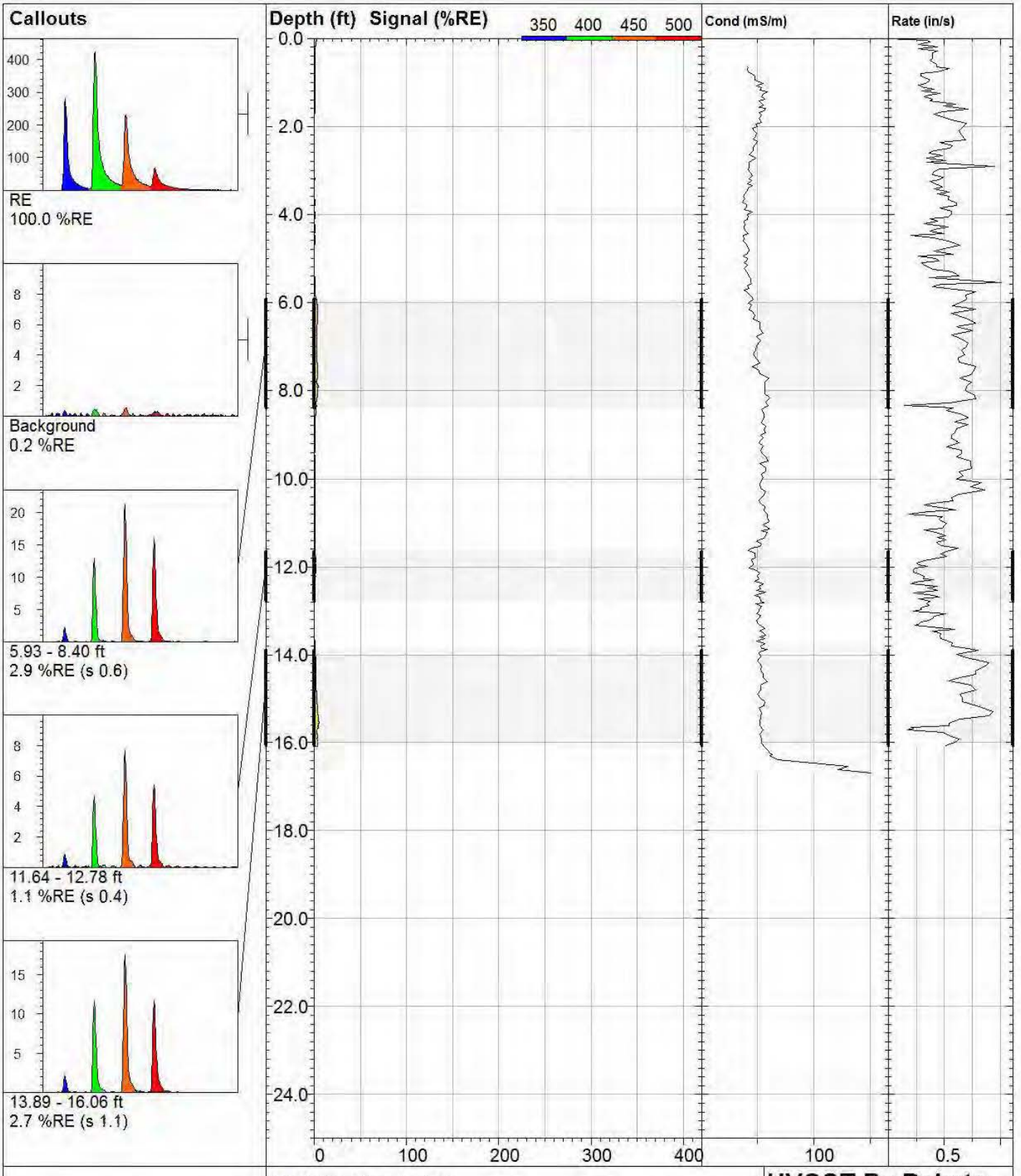


MW34R-L41

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **14.79 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.1 %RE @ 13.35 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 12:23 MDT**

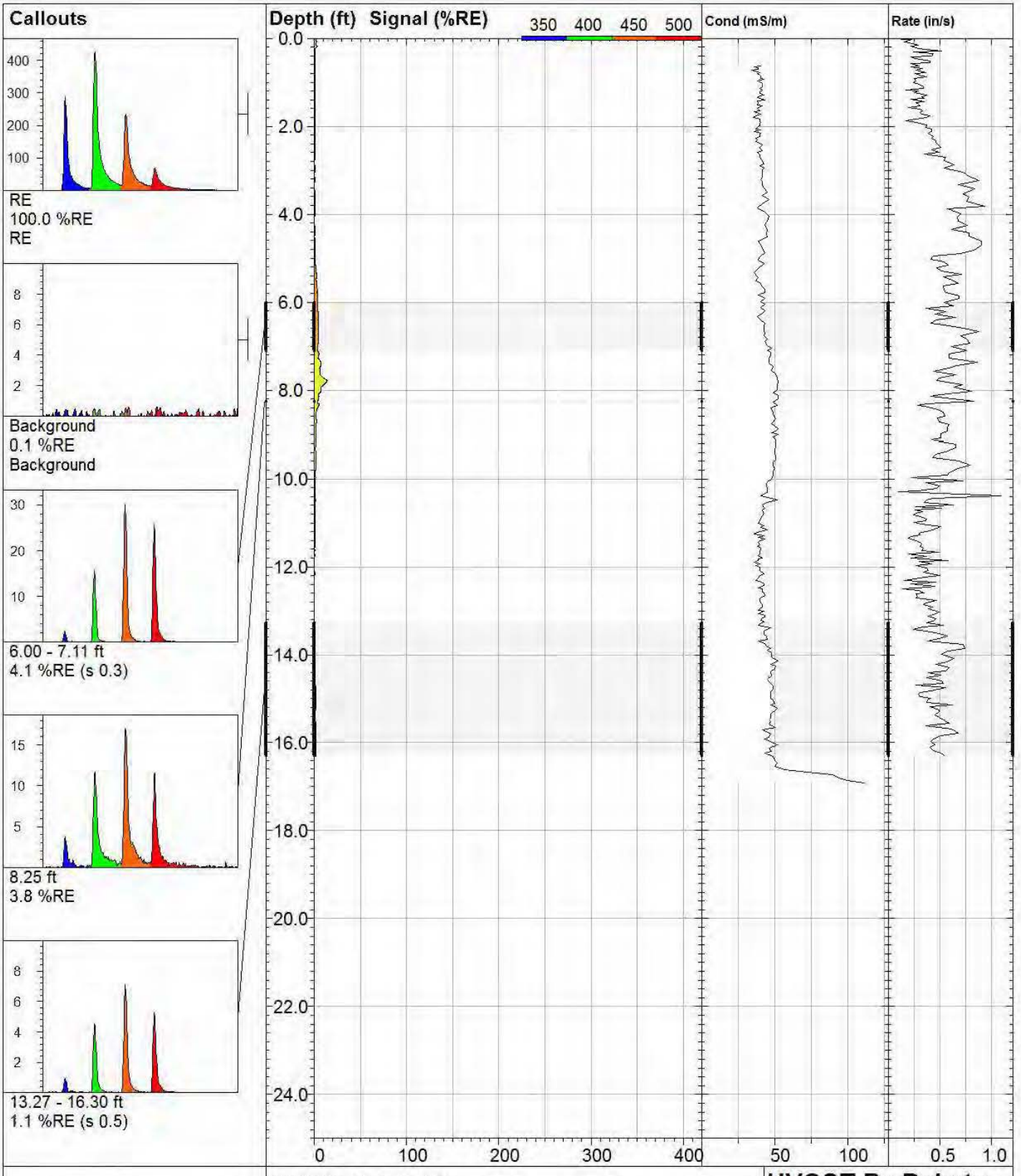


MW34R-L42

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.08 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **5.0 %RE @ 15.55 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 12:51 MDT**

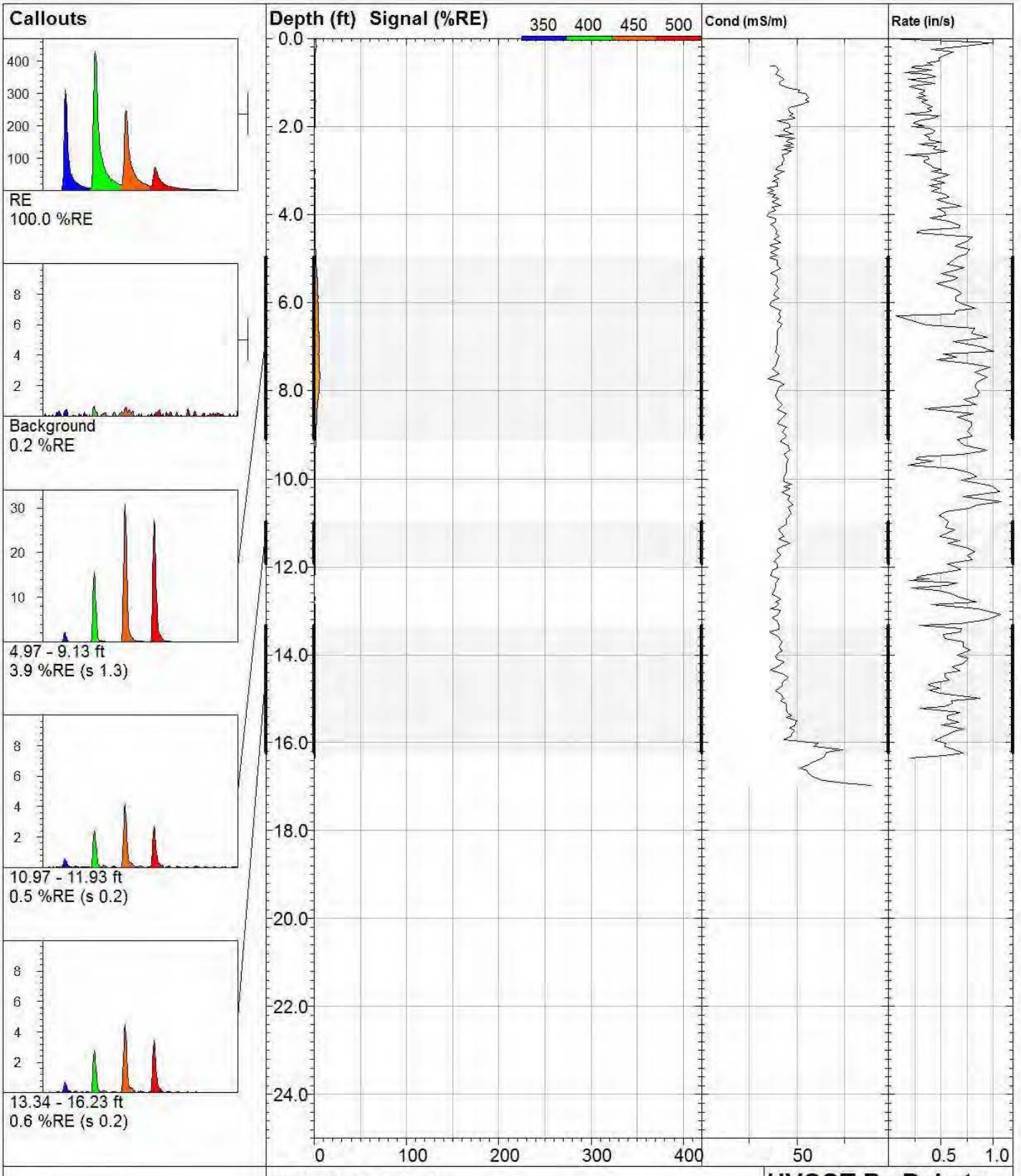


MW34R-L43

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.32 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **14.2 %RE @ 7.78 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 13:18 MDT**

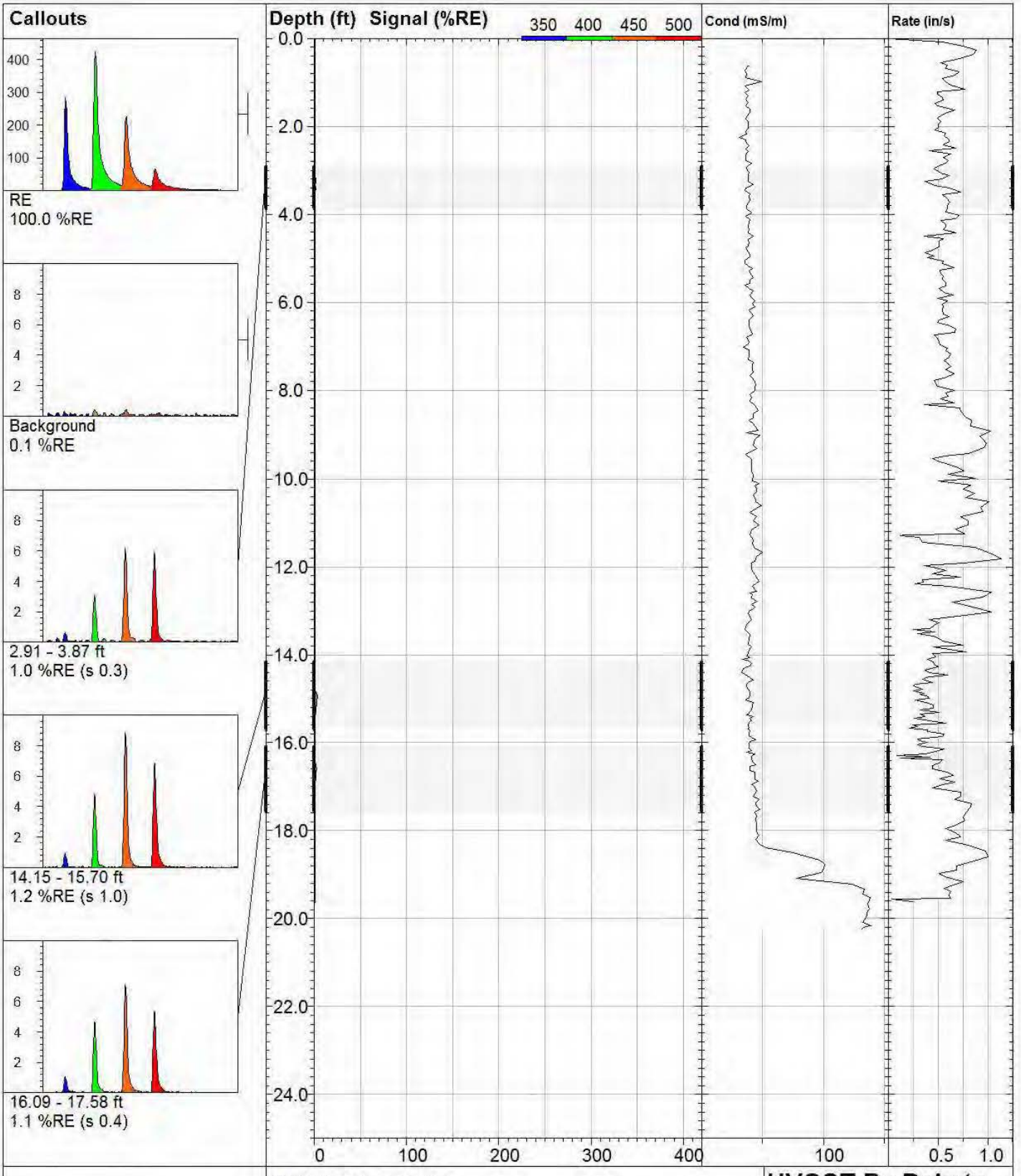


VIRONEX

MW34R-L44

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.35 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **5.8 %RE @ 7.71 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 13:45 MDT**

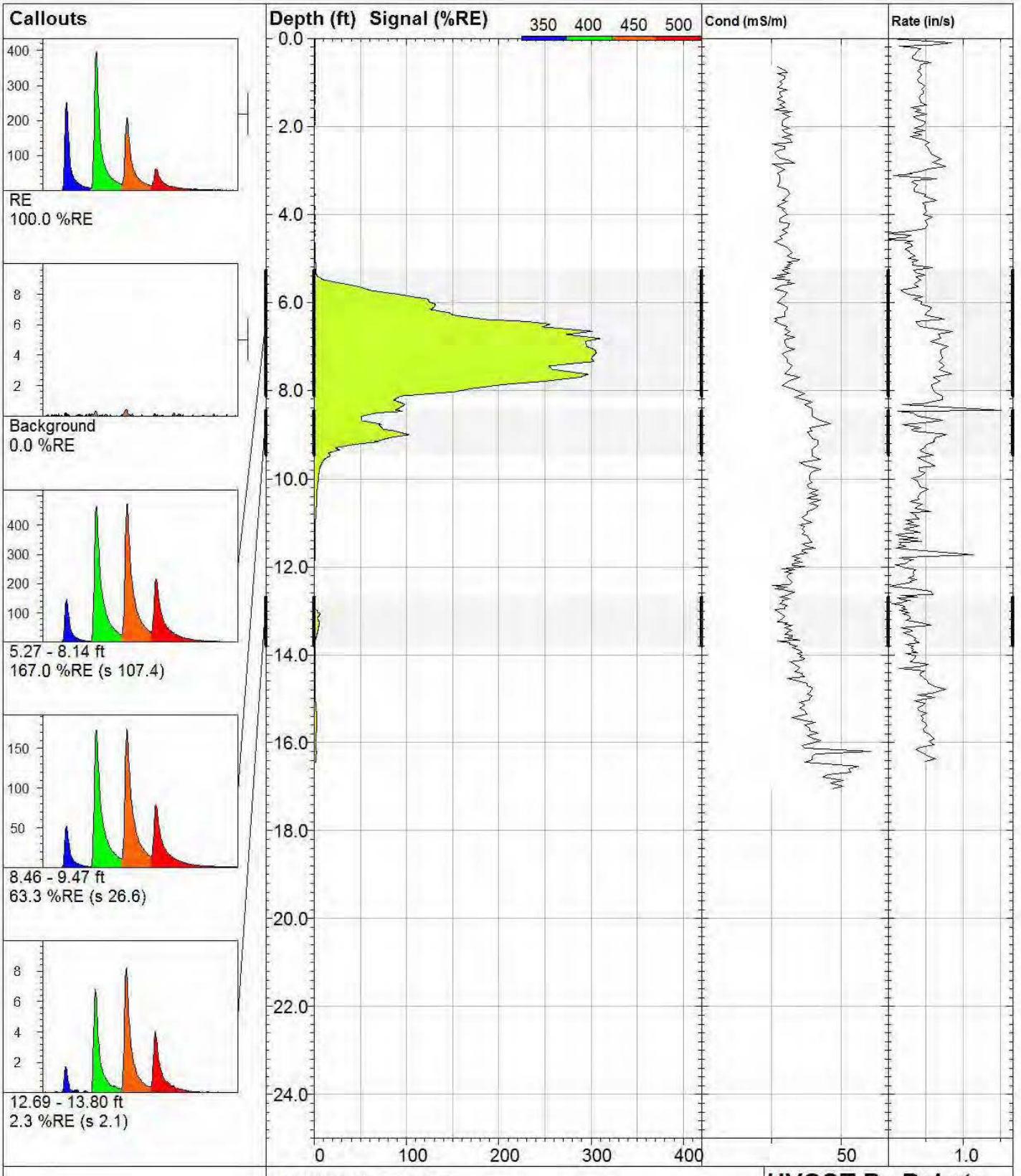


MW34R-L45

UVOST By Dakota
www.DakotaTechnologies.com

VIRONEX

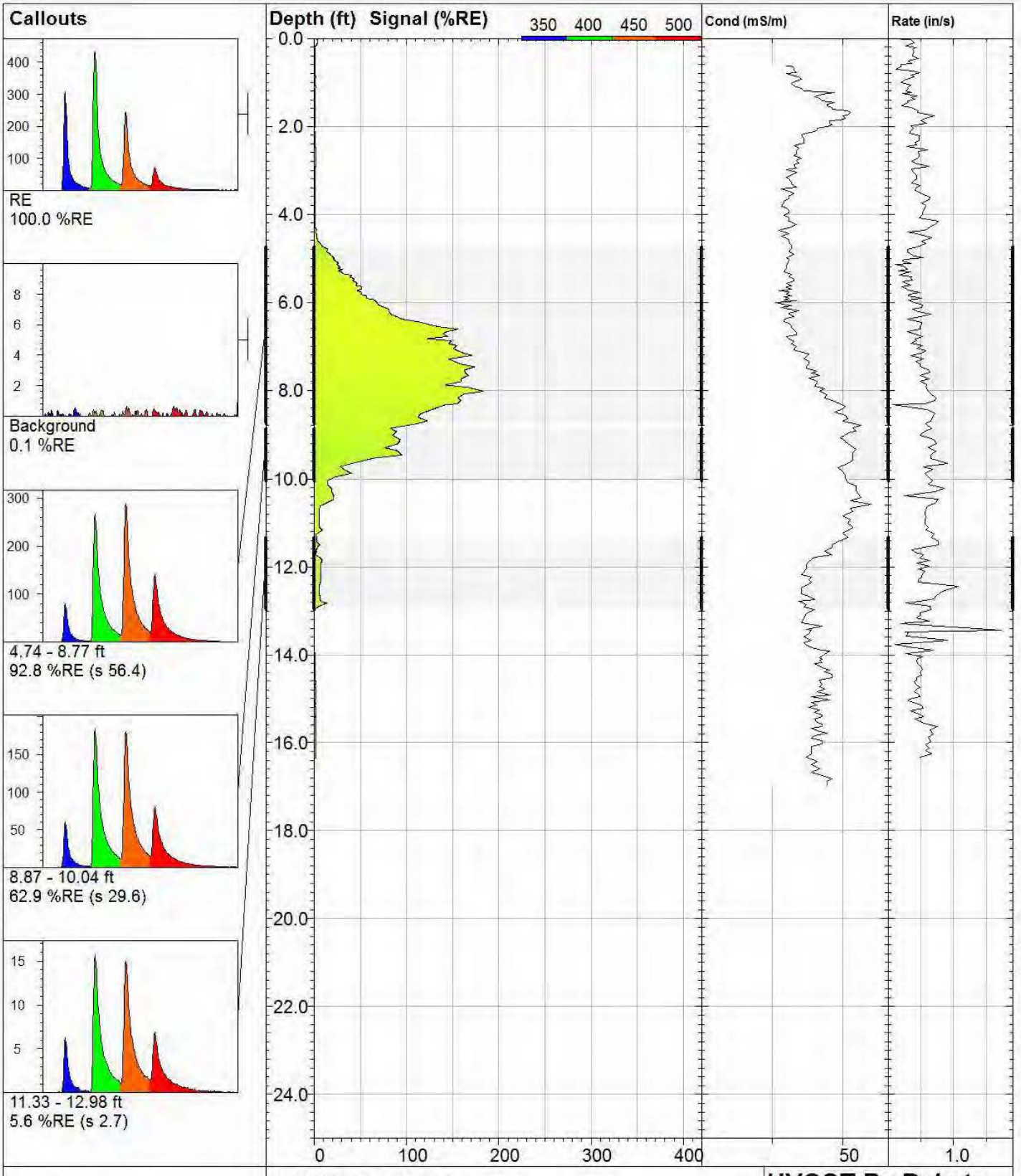
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **19.63 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.5 %RE @ 14.96 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-24 14:11 MDT**



MW34R-L46

UVOST By Dakota
www.DakotaTechnologies.com

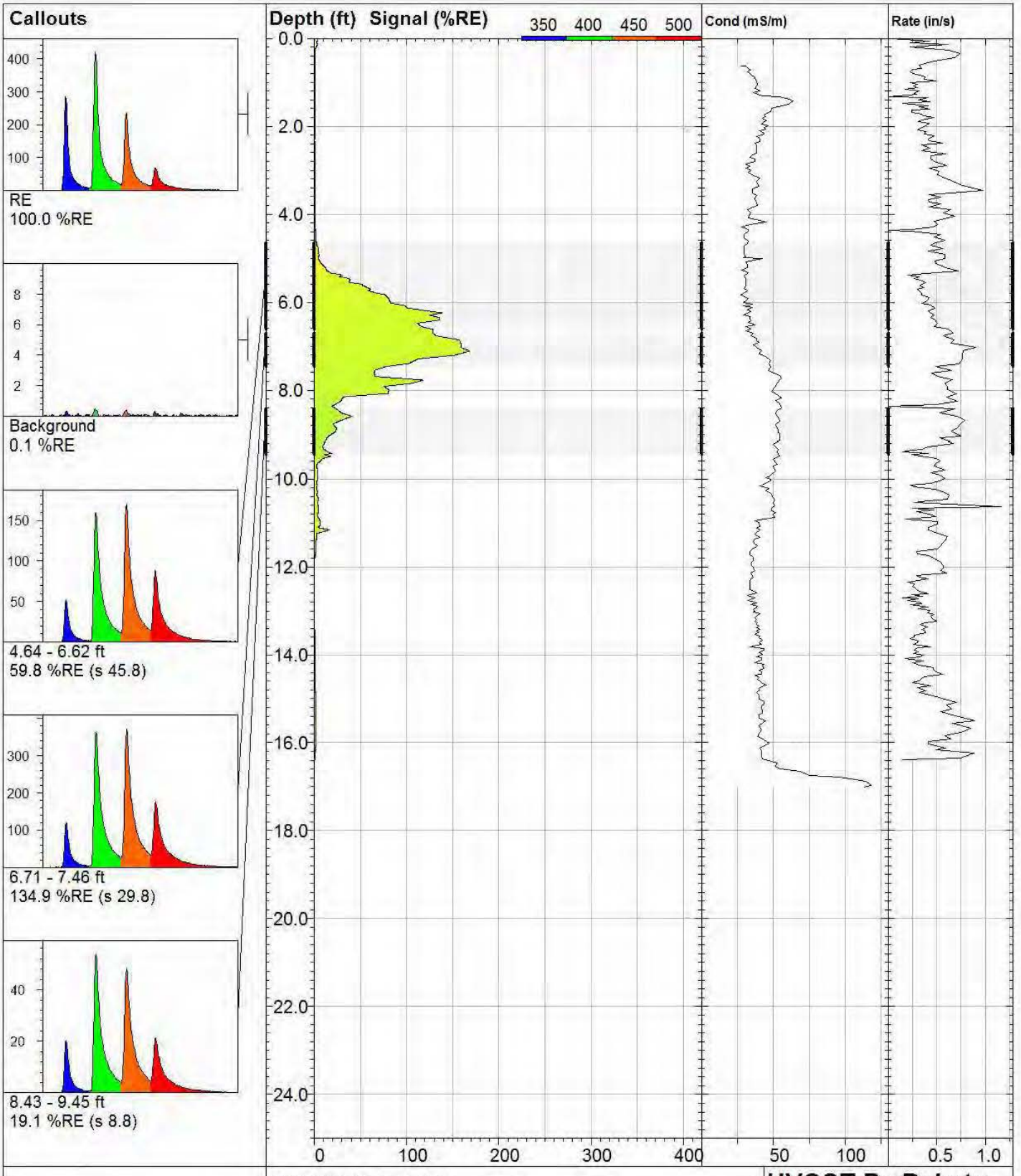
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.44 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **310.0 %RE @ 6.83 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 06:48 MDT**



MW34R-L47

UVOST By Dakota
www.DakotaTechnologies.com

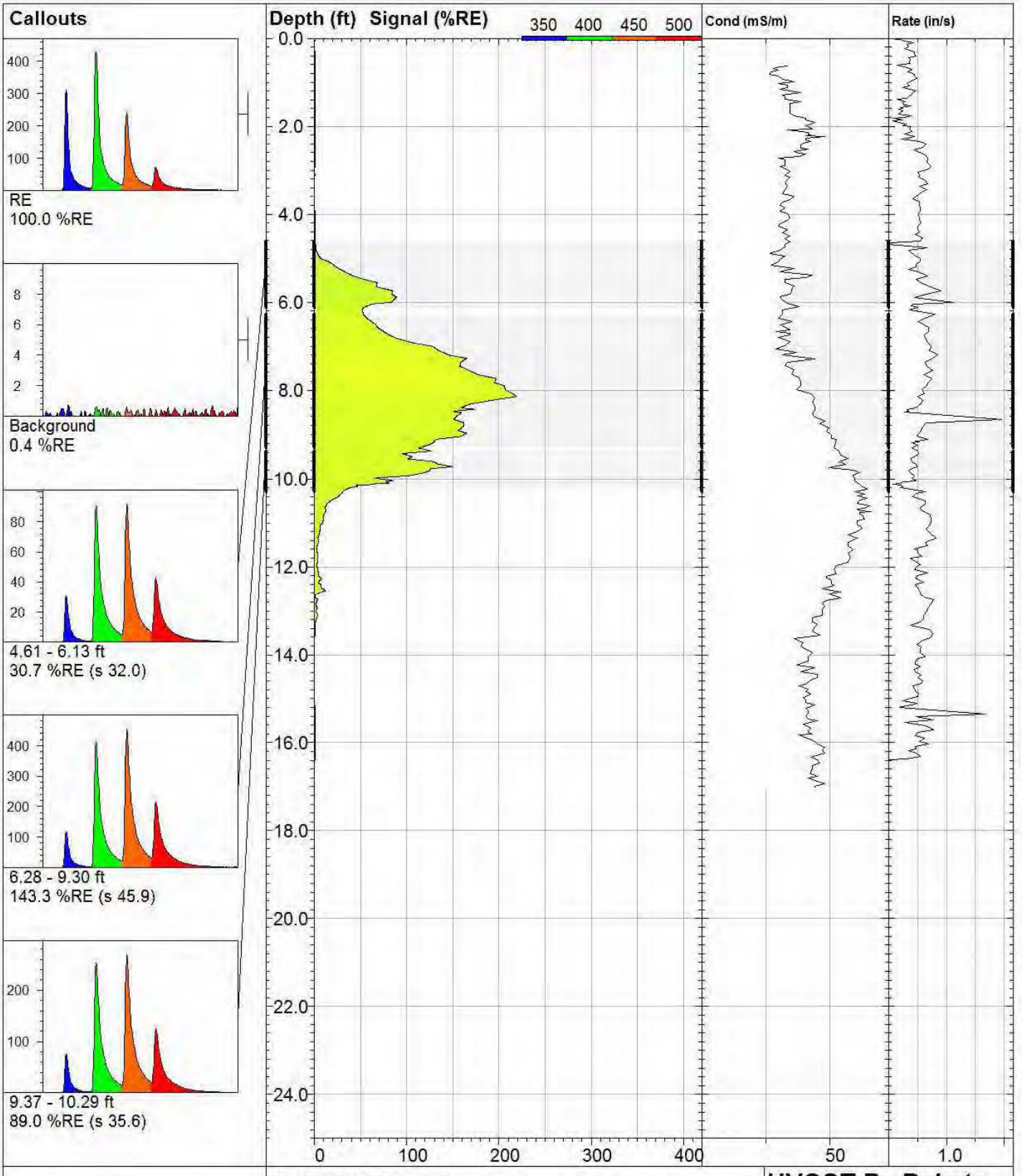
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.35 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **183.7 %RE @ 8.03 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 07:19 MDT**



MW34R-L48

UVOST By Dakota
www.DakotaTechnologies.com

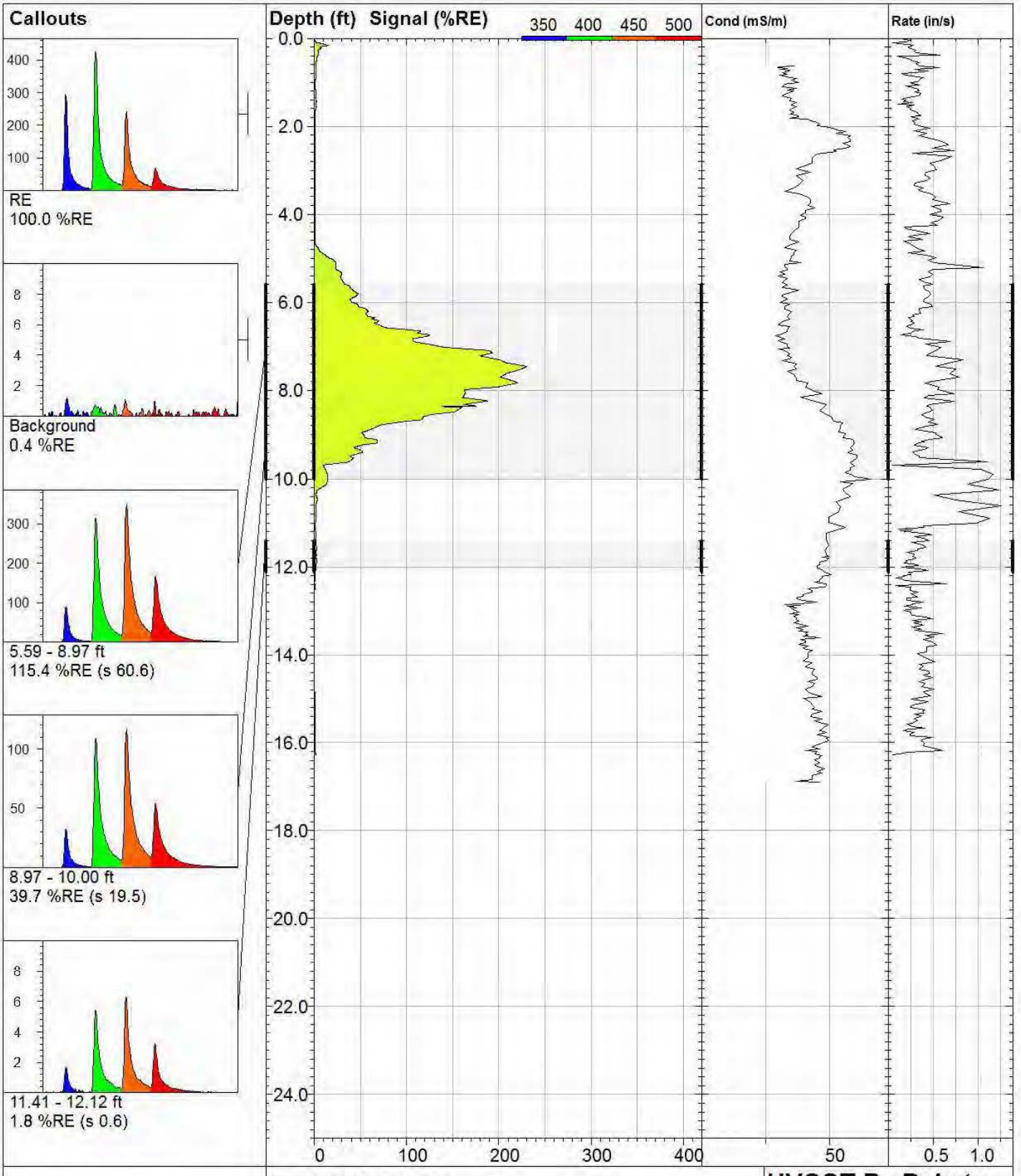
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.40 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **168.7 %RE @ 7.11 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 07:38 MDT**



MW34R-L49

UVOST By Dakota
www.DakotaTechnologies.com

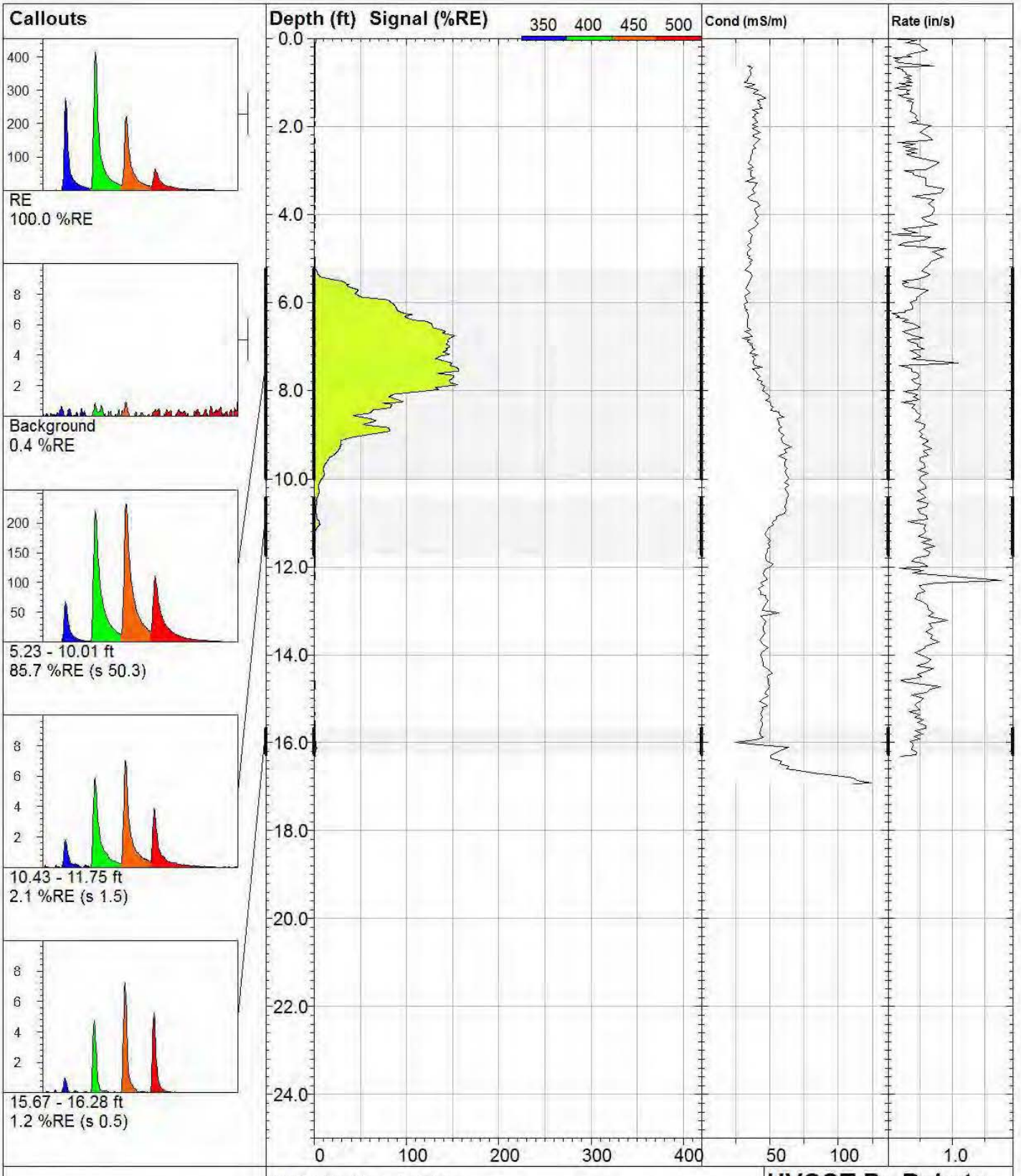
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.39 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **219.1 %RE @ 8.15 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 08:02 MDT**



MW34R-L50

UVOST By Dakota
www.DakotaTechnologies.com

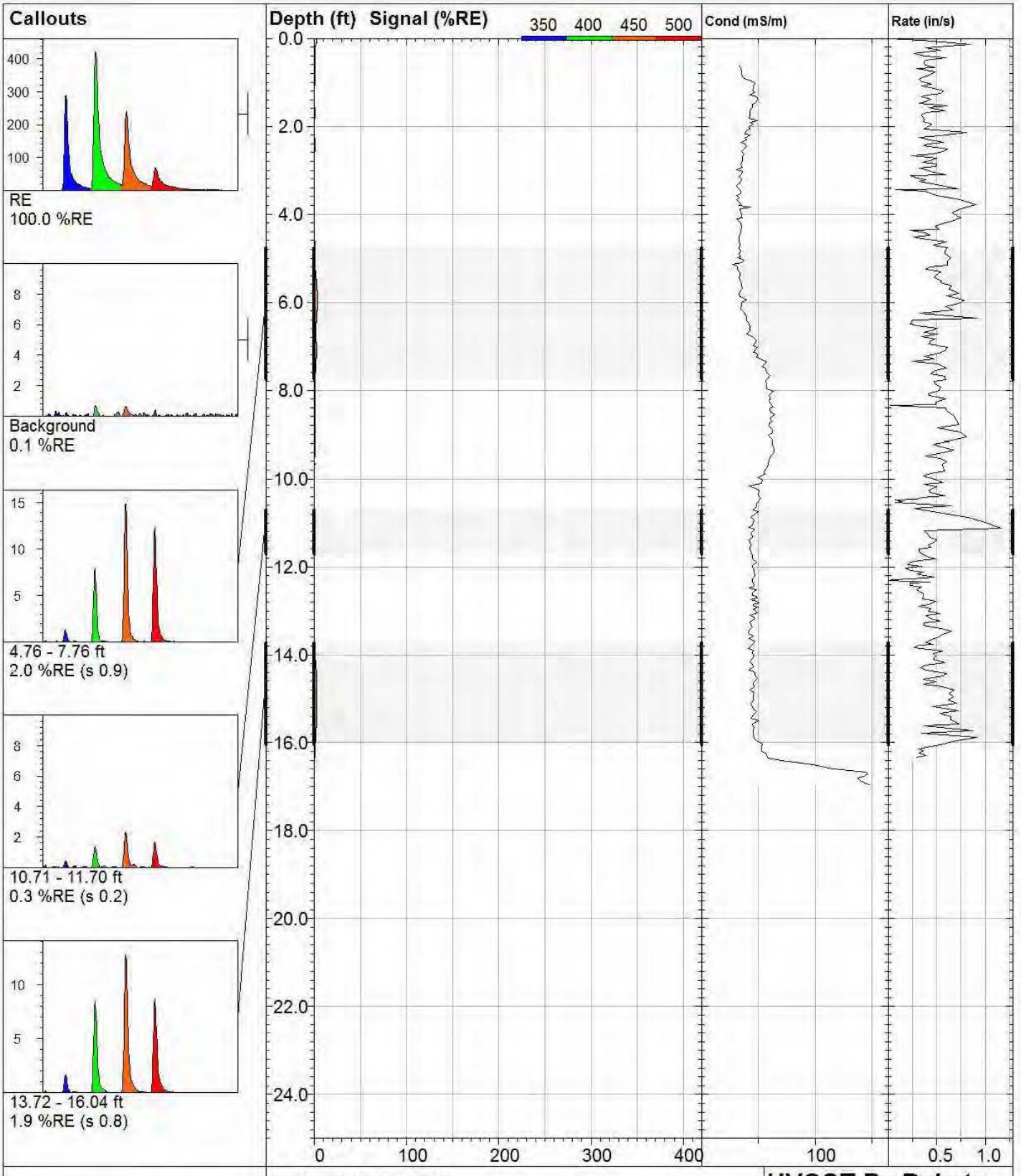
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.27 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **230.4 %RE @ 7.46 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 08:28 MDT**



MW34R-L51

UVOST By Dakota
www.DakotaTechnologies.com

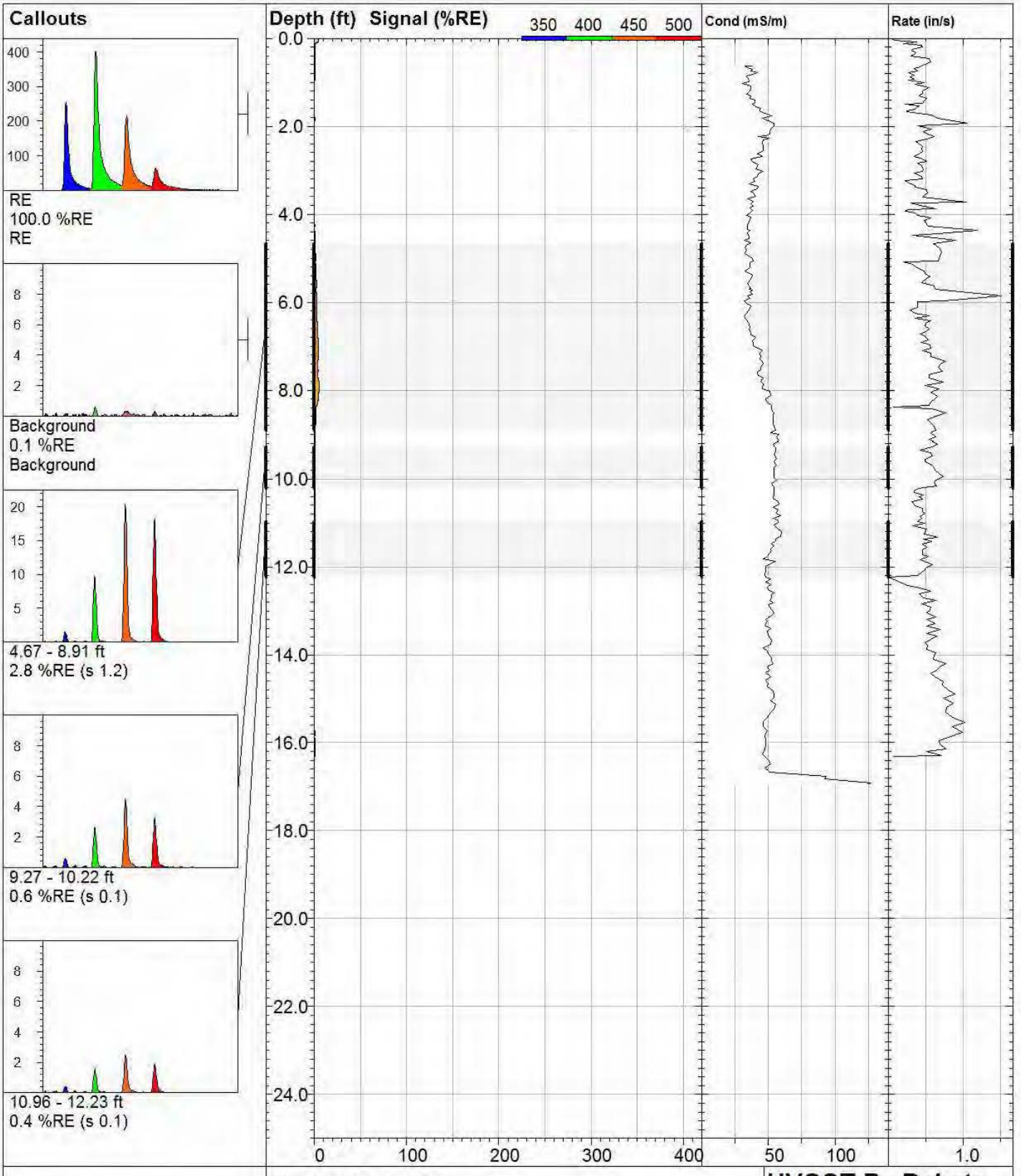
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.32 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **156.6 %RE @ 7.57 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 08:55 MDT**



MW34R-L52

UVOST By Dakota
www.DakotaTechnologies.com

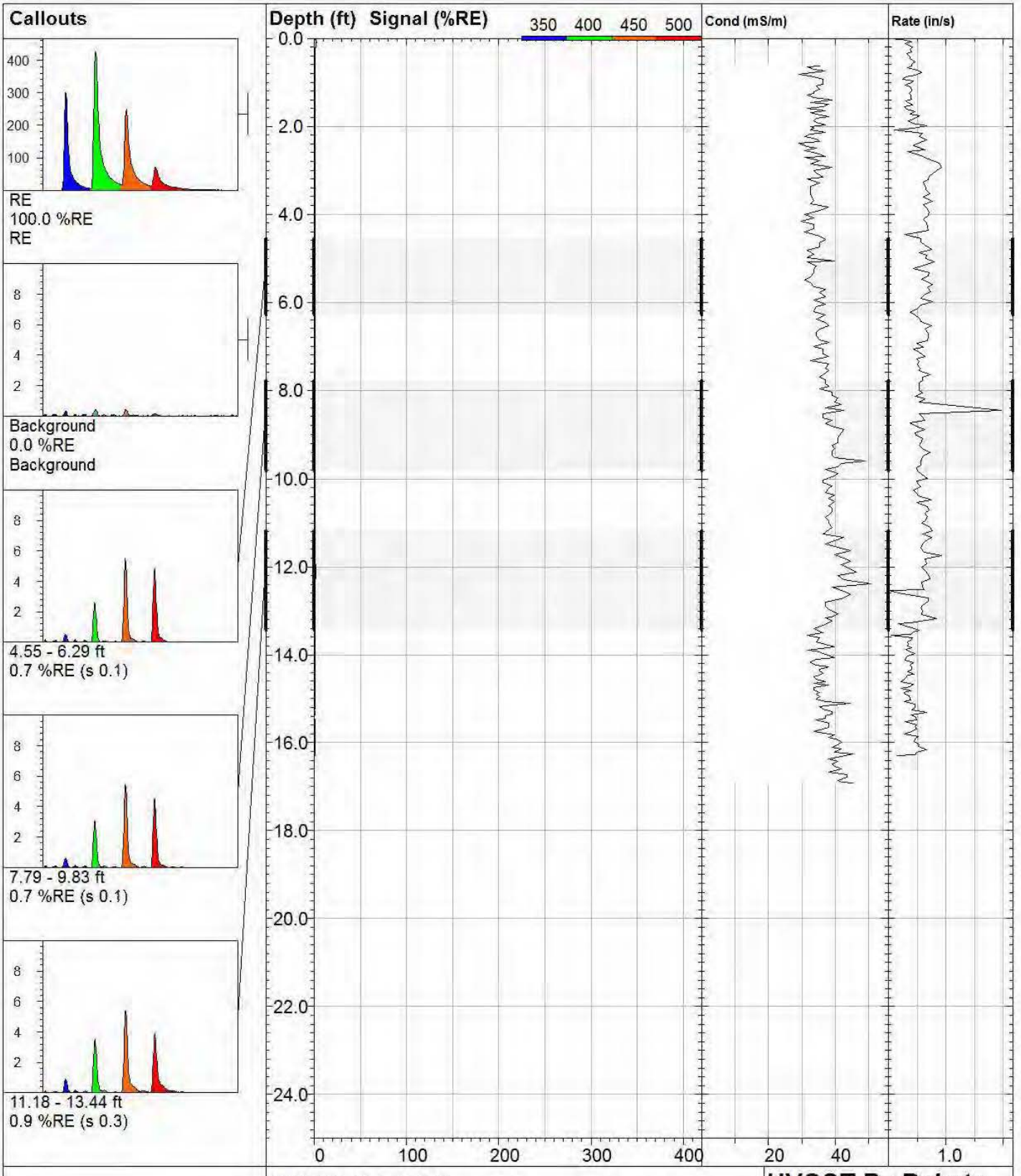
Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.33 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.6 %RE @ 5.79 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 09:28 MDT**



MW34R-L53

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.32 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **5.1 %RE @ 7.97 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 09:47 MDT**



MW34R-L54

UVOST By Dakota
www.DakotaTechnologies.com

Site: **Chicora Tank Farm**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **16.30 ft**
Client / Job: **Ensafe /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.4 %RE @ 0.09 ft**
Operator / Unit: **CST / UVOST1314**	*Elevation:* **Unavailable**	*Date & Time:* **2013-10-25 10:12 MDT**

Appendix C – UVOST System Overview

The Ultra-Violet Optical Screening Tool (UVOST) is a direct push system that produces semi-quantitative vertical profiles of fuel-related non-aqueous phase liquids (NAPL) in the subsurface. Multiple vertical profiles, or borings, may be advanced to develop more complex visual representations of NAPL distribution, such as transects, three dimensional models, and interactive maps. This system provides real-time information which allows users to make timely decisions during the mobilization of equipment.

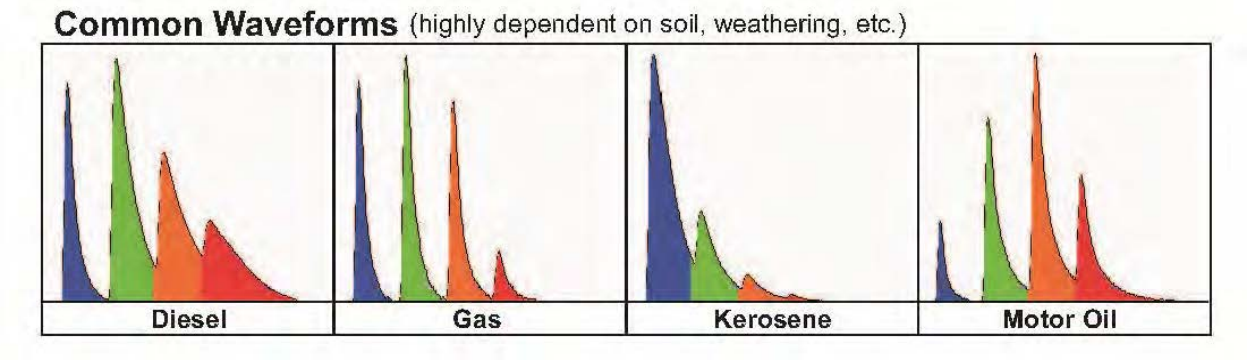
The UVOST system utilizes an Eximer laser to generate ultra-violet (UV) light. The UV light is transmitted down a fiber optic cable and reflected into the subsurface through a sapphire window located on the lowermost portion of a direct push rod string. Petroleum hydrocarbons contain significant amounts of naturally fluorescent poly-cyclic aromatics (PAHs). If PAHs are encountered in sufficient quantities, those similar to that found in NAPL, the resulting fluorescence is transmitted to an oscilloscope via a second fiber optic cable. The fluoresced light is processed through four wavelength-based channels. Move volatile PAHs with show response on the shorter wavelength channels. Larger and less volatile PAHs will produce response on the longer wavelength channels. The intensity and resonance time, across each channel, and in relation to one another, will provide indication of quantity and type of NAPL that is being detected. Each data depth has a specific waveform which may be called out and reviewed. The vertical UVOST log is composed of the data from the four channels at each data depth. The color of the vertical UVOST log provides an indication of the waveform shape.

Before each boring the UVOST system is calibrated against a reference emitter (RE). The RE is a blend of fuels developed by the manufacturer for standardizing the tool. Because the tool is standardized against the RE before each boring, responses from different borings can be compared with confidence. All UVOST response is displayed in %RE, where the original RE calibration is always 100%. It is common to have a background soil fluorescence between 0.1 and 5%RE. It is also possible to have positive NAPL responses higher than 100%RE.

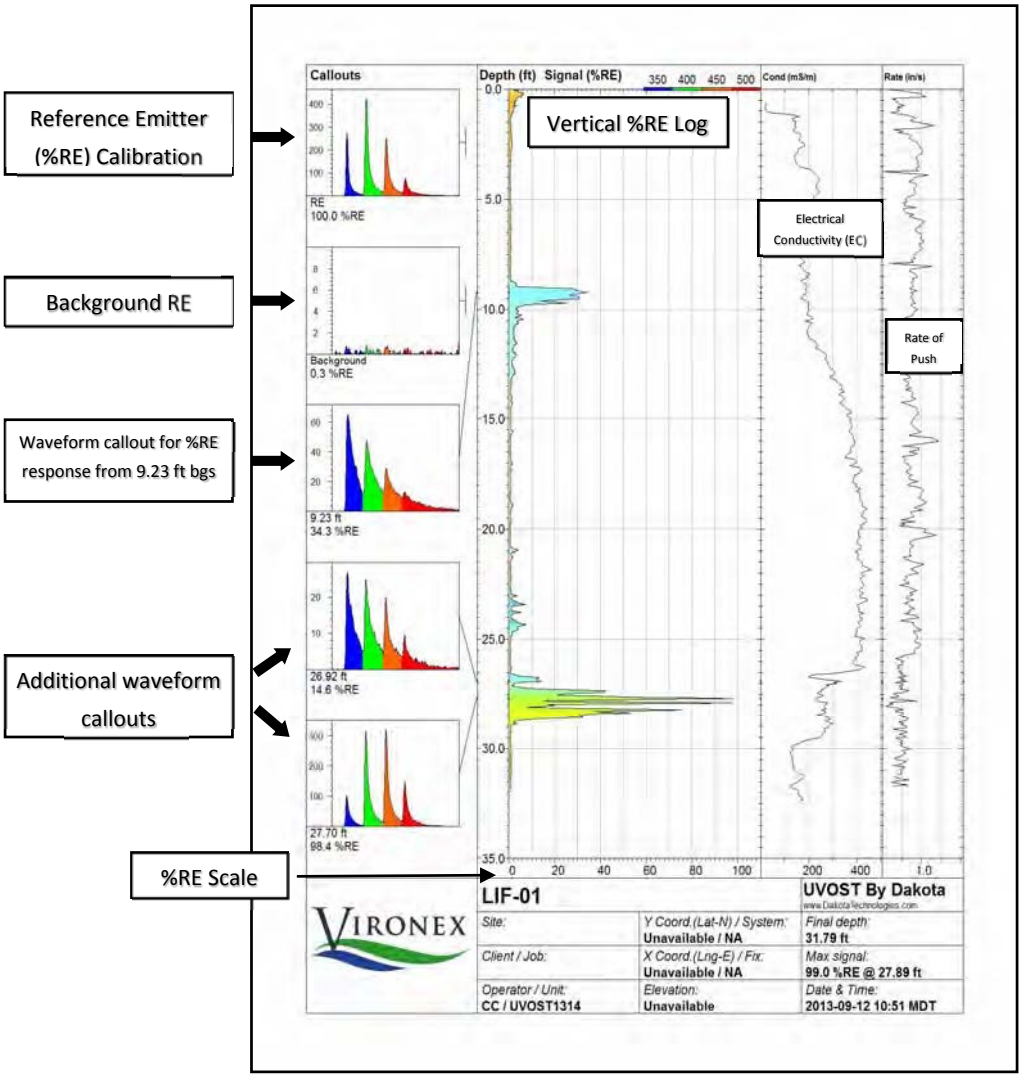
Additionally, a background %RE is always collected prior to the advancement of each boring. The background %RE is collected with the clean sapphire window exposed to ambient conditions. The background %RE defines background noise from the system and notifies the operator is there is any problems with the system.

Appendix D – UVOST Reference Guide

Provided here are some common waveforms of fuels based on research done by the manufacturer.



Below is an example of a common UVOST log.



Attachment B

SCDHEC Temporary Well Approval

D H E C
PROMOTE PROTECT PROSPER
Catherine B. Templeton, Director
Promoting and protecting the health of the public and the environment

September 6, 2013

David Criswell, P.E.
BRAC PMO SE
4130 Faber Place Drive
Suite 202
N. Charleston, SC 29405

RE: Approval of *Permit Request for Soil Borings and Temporary Monitoring Wells Supplemental Investigation at Chicora Tank Farm*
Charleston Naval Complex (CNC)
SC0 170 022 560

Dear Mr. Criswell:

The Department of Defense Corrective Action Section of the South Carolina Department of Health and Environmental Control (Department) received the above referenced document on August 30, 2013. The Department reviewed the request and subsequently approves it. Attached is the Temporary Monitoring Well Approval.

If you have any questions regarding this issue, please contact me at (803) 898-0368.
Sincerely,

Meredith Amick, P.E., Environmental Engineer
Corrective Action Engineering Section
Division of Waste Management
Bureau of Land and Waste Management

cc: Annie Gerry, Hydrogeology
Christine Sanford-Coker, EQC Region 7, Charleston
Gary Foster, CH2MHill
Lawson Anderson, Tetra Tech

D H E C

PROMOTE PROTECT PROSPER

Catherine B. Templeton, Director

Promoting and protecting the health of the public and the environment

MEMORANDUM

TO: Meredith Amick, P.E.
Departmentof Defense Corrective Action Section
Division of Waste Management
Bureau of Land and Waste Management

FROM: Annie M. Gerry, Hydrogeologist
Department of Defense Corrective Action Section
Division of Waste Management
Bureau of Land and Waste Management

DATE: September 4, 2013

RE: Charleston Naval Complex
SC0 170 022 560

Review of **Permit Request for Soil Borings and Temporary Monitoring Wells Supplemental Investigation –Chicora Tank Farm-** Charleston Naval Complex (CNC) North Charleston, South Carolina, dated August 2013

The above referenced document has been reviewed with respect to R.61-79 of the South Carolina Hazardous Waste Management Regulations and conditions of Hazardous Waste Permit SC0 170 022 560. A letter was received on 8/2/13 (Warren to Gerry), requesting to install 16 temporary monitoring wells in an effort evaluate the extent of light non-aqueous phase liquid (LNAPL) and naphthalene exceedences currently impacting the Chicora Tank Farm. Up to 10 monitoring wells are planned for the LNAPL investigation and up to 6 monitoring wells are planned for the naphthalene investigation. The Navy is also requesting a variance to allow the temporary monitoring wells to stay in place for a period of 10 days, instead of 5, to allow additional time for equilibrium prior to performing well gauging and bail down tests.

Based on review of the permit request, the temporary wells and variance are approved. Attached please find a temporary monitoring well approval form with additional conditions for installation.

Should you have any questions regarding this memo, please contact me via email at GerryAM@dhec.sc.gov or by phone at (803) 898-0359.

File # 50484

Temporary Monitoring Well Approval

Date of Issuance: 4 September 2013

Approval is hereby granted to: Mr. David Criswell
Facility: Charleston Naval Complex
SC0 170 022 560
Charleston County

This approval is for the installation of 16 temporary groundwater monitoring wells. The temporary monitoring wells are to be installed in the locations as illustrated on Figure 2, the approved *Tier II Sampling and Analysis Plan, Supplemental Investigation, Chicora Tank Farm, Charleston Naval Complex, Revision 1, dated 11 July 2013* and per the proposed construction details provided in the Warren to Gerry 2013 correspondence. The proposed drilling date is 10/21/2013. The monitoring wells are to be installed on 10/21/2013 following all of the applicable requirements of R.61-71.

R.61-71 requires the following:

1. All wells shall be drilled, constructed, and abandoned by a South Carolina certified well driller per R.61-71.D.1.

2. A Water Well Record Form or other form provided or approved by the Department shall be completed and submitted within 30 days after well completion or abandonment unless another schedule has been approved by the Department. The form should contain the "as-built" construction details and all other information required by R.61-71.H.1.f

3. All analytical data and water levels obtained from each monitoring well shall be submitted to the Department within 30 days of receipt of laboratory results unless another schedule has been approved by the Department as required by R.61-71.H.1.d.

4. All temporary monitoring wells shall be abandoned within 10 days of borehole completion using appropriate methods as required by R.61-71.H.4.c.

5. If any of the information provided to the Department changes, including the proposed drilling date, Annie Gerry (803-896-4018) shall be notified at least twenty-four (24) hours prior to well construction as required by R.61-71.H.1.a.

This approval is pursuant to the provisions of Section 44-55-40 of the 1976 South Carolina Code of Laws and R.61-71 of the South Carolina Well Standards, dated April 26, 2002.

Annie M. Gerry, Hydrogeologist
Department of Defense Corrective Action Section
Division of Waste Management
Bureau of Waste Management

Attachment C

Temporary Monitoring Well Construction Logs

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Temporary Monitoring Well TW01

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston S.C.

Project:	0888812637	Completion Date:	11/11/13	Northing:	371667.7939
Location:	CNC Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317405.043
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	LNAPL Evaluation	Logged By:	Steven Hodskins	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	Lithologic Description Visual-Manual Description (ASTM D 2488-06)	Soil Boring Construction
5				
0		Topsoil	grass, brown topsoil	2" Schedule 40 PVC casing
		Clay	clay, fill	Bentonite Seal
		SM	Light brown, fine silty sand, dry	
-5		SM	becoming gray, moist	30/40 Silica Sand Pack
				0.010" Slotted PVC Screen, 10ft
-10		SC	Red, fine clayey sand, wet	
-15				

NOTES:

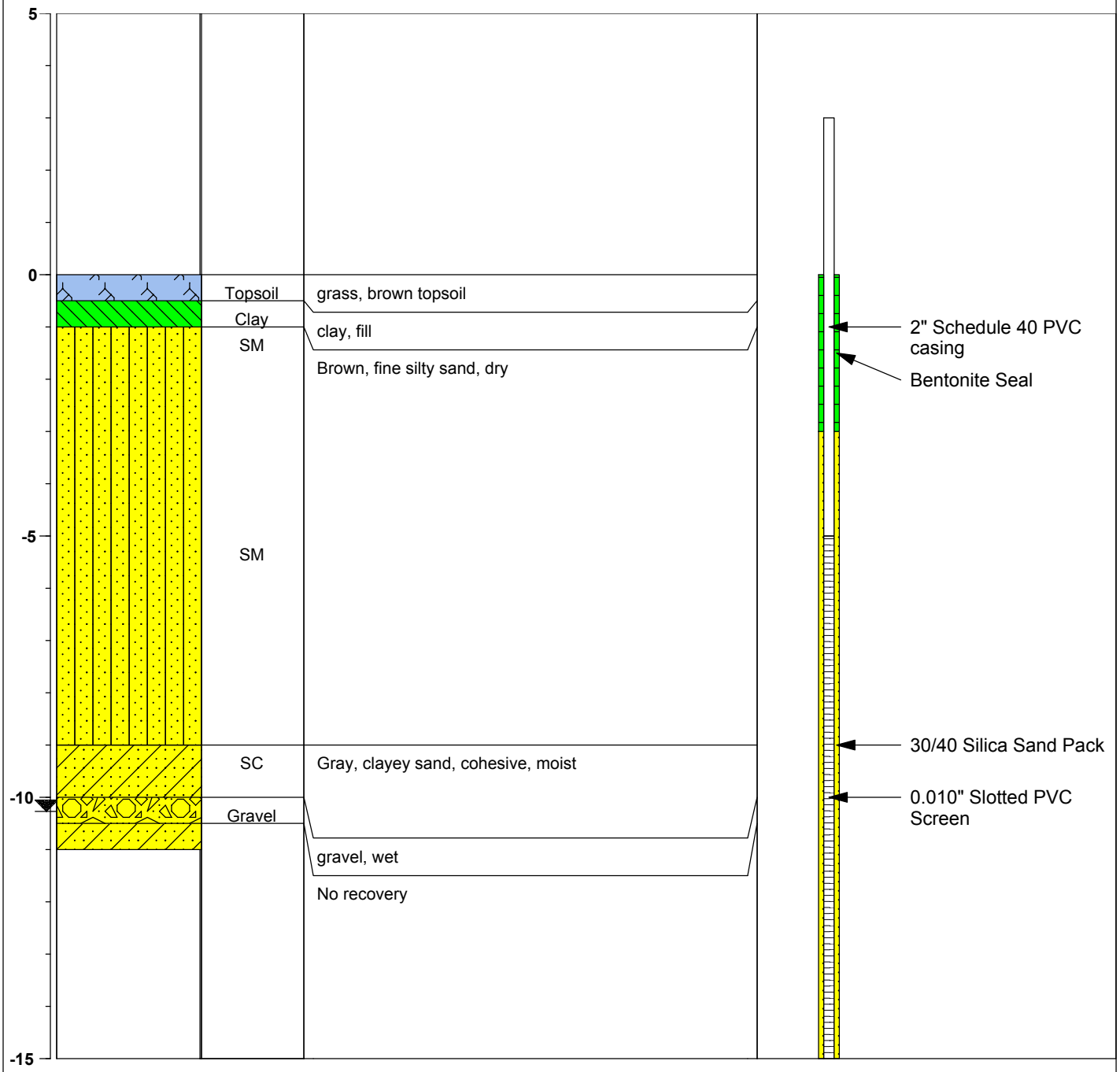
RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Temporary Monitoring Well TW02

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston S.C.

Project:	0888812637	Completion Date:	11/11/13	Northing:	371602.9239
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317391.96374
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	LNAPL Evaluation	Logged By:	Frank Burwell	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	Lithologic Description Visual-Manual Description (ASTM D 2488-06)	Soil Boring Construction



NOTES:

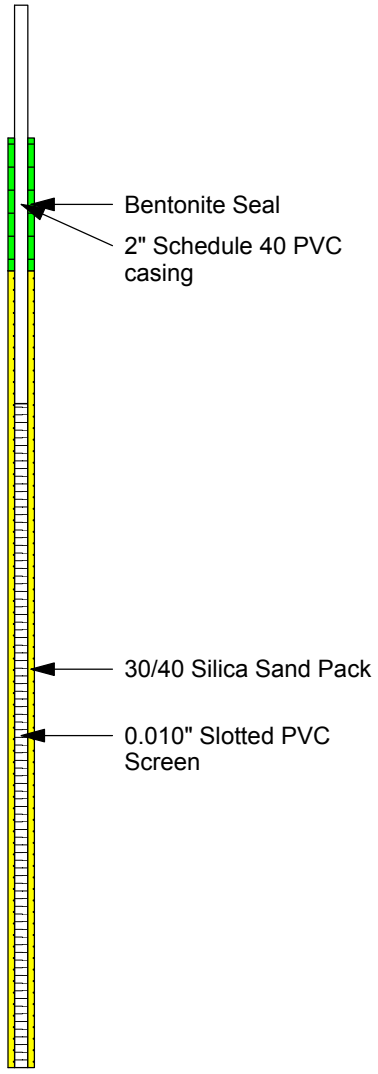
RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Temporary Monitoring Well TW03

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston S.C.

Project:	0888812637	Completion Date:	11/11/13	Northing:	371578.679
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317454.839
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	LNAPL Evaluation	Logged By:	Steven Hodskins	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	Lithologic Description Visual-Manual Description (ASTM D 2488-06)	Soil Boring Construction
5				
0		Topsoil	grass, brown topsoil	
		Clay	clay, fill	Bentonite Seal
		SM	Light brown, fine silty sand, dry	2" Schedule 40 PVC casing
-5		SM	red interbedded	
		SM	becomes grey, wet	30/40 Silica Sand Pack 0.010" Slotted PVC Screen
-10				
-15				



NOTES:

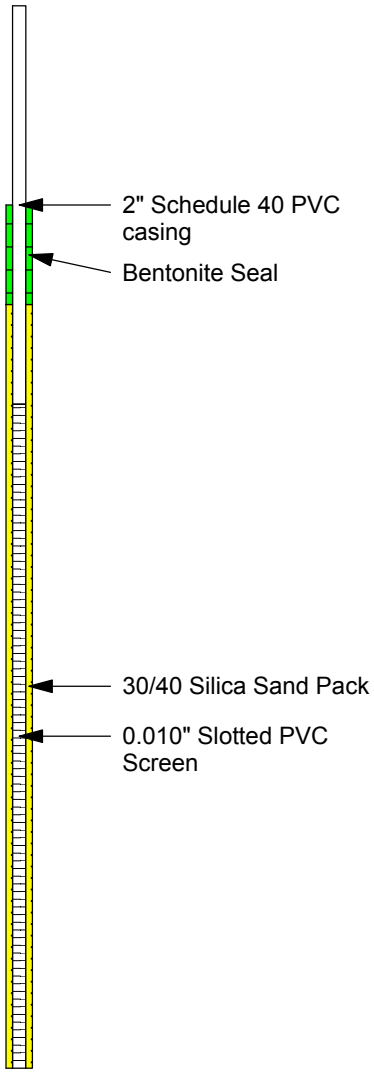
RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Temporary Monitoring Well TW04

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston S.C.

Project:	0888812637	Completion Date:	11/11/13	Northing:	371612.5532
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317478.168
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	LNAPL Evaluation	Logged By:	Frank Burwell	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	Lithologic Description Visual-Manual Description (ASTM D 2488-06)	Soil Boring Construction
5				
			grassy ditch	
0		SM	Brown, fine silty sand, dry	2" Schedule 40 PVC casing Bentonite Seal
-5		SM	Light brown, silty sand, dry, some shell fragments, wet	30/40 Silica Sand Pack 0.010" Slotted PVC Screen
-10		SM		
		SM	becomes gray, wet	
-15				



NOTES:

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

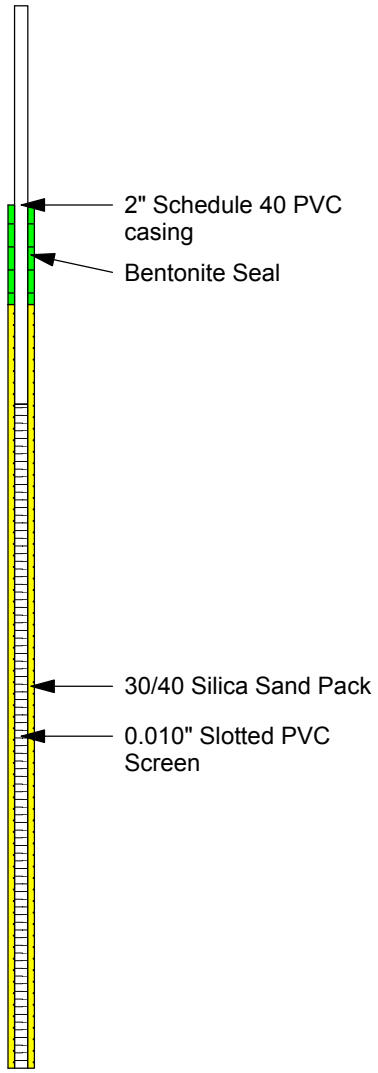
Temporary Monitoring Well TW05

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston S.C.

Project:	0888812637	Completion Date:	11/11/13	Northing:	371638.3853
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317464.399
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	LNAPL Evaluation	Logged By:	Steven Hodskins	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	Lithologic Description Visual-Manual Description (ASTM D 2488-06)
5			
			grassy ditch
0		SM	Light brown, fine silty sand, dry
-5		SM	becomes wet
		SM	becomes white and red interbedded, medium grain, wet
-10		SM	
		SP	becomes gray, some shell fragments, wet
-15			

Soil Boring Construction



NOTES:

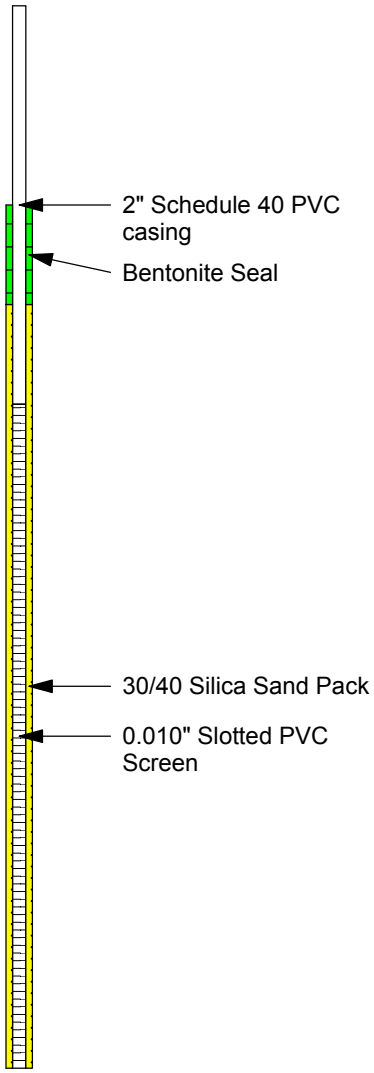
RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Temporary Monitoring Well TW06

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston S.C.

Project:	0888812637	Completion Date:	11/12/13	Northing:	371666.8702
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317450.64
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	LNAPL Evaluation	Logged By:	Frank Burwell	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	Lithologic Description Visual-Manual Description (ASTM D 2488-06)	Soil Boring Construction
5				
			grass	
0		SM	Brown, fine silty sand, dry	2" Schedule 40 PVC casing Bentonite Seal
		SM		
-5		SM	becomes gray, wet	
		SM		30/40 Silica Sand Pack 0.010" Slotted PVC Screen
-10		SM		
-15		SW	Gray, sand with shell fragments	



NOTES:

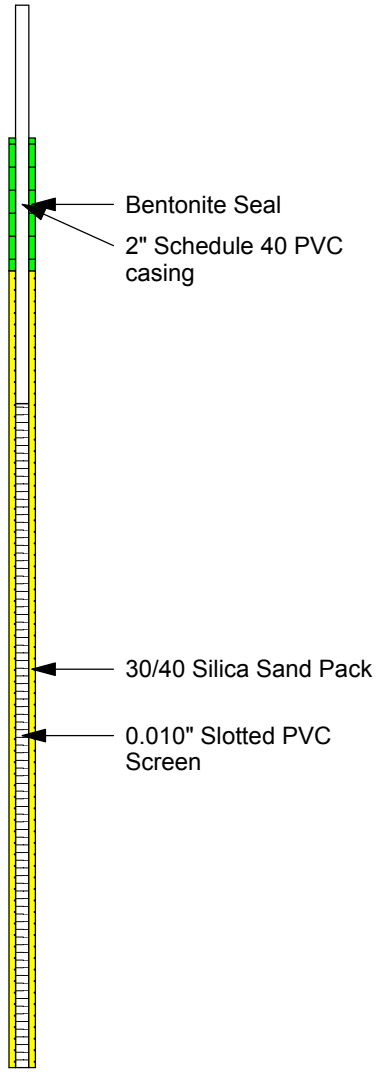
RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Temporary Monitoring Well TW07

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston S.C.

Project:	0888812637	Completion Date:	11/12/13	Northing:	371630.9867
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317426.059
CTO:	JM 29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	LNAPL Evaluation	Logged By:	Steven Hodskins	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	Lithologic Description Visual-Manual Description (ASTM D 2488-06)	Soil Boring Construction
5				
0		Topsoil	grass, brown topsoil	
		Clay	clay, fill	
		SM	Light brown, fine silty sand, dry	
-5		SM	becomes gray, strong petroleum odor	
		CH	Brown clay, firm	
-10		SM	Brown, fine silty sand, wet, odor	
		SW	Gray, medium sand, wet	
-15				



NOTES:

Attachment D
Well Development Logs

RESOLUTION CONSULTANTS

Attachment 1
Well Development Record

Well/Piezometer Development Record

Well ID: TW02

Client: CNL CTF

Project No: _____ Date: 11/13/13 Developer: SH + FB

Site Location: N. Charleston SC

Well/Piezometer Data

Well ☑ Piezometer ☐ Diameter 2" Material PVC

Measuring Point Description: ground surface

Depth to Top of Screen (ft.): 4

Depth to Bottom of Screen (ft.): 14

Total Well Depth (ft.): 14

Depth to Static Water Level (ft.): 7.52

Geology at Screen Interval (if known): Sand

Time of Water Level Measurement: 1303

Calculate Purge Volume (gal.): 3.65

Disposal Method: drum

Headspace: _____

Original Well Development ☑ Redevelopment ☐ Date of Original Development 11/13/13

DEVELOPMENT METHOD Waterra pump

~~PURGE METHOD~~ NO LNAPL Present

Time	Total Volume Purged (gal.)	Flow Rate (gpm)	Turbidity (NTU)	Color	pH	Temp	Other
1314	0.25		over range				
1316	2.25		over				
1318	4.25		over				
1320	6.25		over				
1330	7.25		over				

Final depth to water 8.08' bgs purged 10 gallons

ACCEPTANCE CRITERIA (from workplan)

Minimum Purge Volume Required 3.6 gallons

Maximum Turbidity Allowed 10 NTUs

Stabilization of parameters ____%

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☒	☐
Has parameters stabilized	☐	☐	☒

If no or N/A explain below:

Signature [signature] Date: 11/13/13

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RESOLUTION CONSULTANTS

Attachment 1
Well Development Record

Well/Piezometer Development Record

Well ID: TW02

Client: CNL CTF

Project No: _____ Date: 11/13/13 Developer: SH + FB

Site Location: N. Charleston SC

Well/Piezometer Data

Well ☑ Piezometer ☐ Diameter 2" Material PVC

Measuring Point Description: ground surface

Geology at Screen Interval (if known): Sand

Depth to Top of Screen (ft.): 5

Depth to Bottom of Screen (ft.): 15

Time of Water Level Measurement: 1350

Total Well Depth (ft.): 15

Calculate Purge Volume (gal.): 2.3

Depth to Static Water Level (ft.): 10.31

Disposal Method: Drum

Headspace: _____

Original Well Development ☒ Redevelopment ☐ Date of Original Development 11/13/13

DEVELOPMENT METHOD Whale Pump

~~PURGE METHOD~~ NO LNAPL ~~[illegible]~~ * Sheen present in purge water

Time	Total Volume Purged (gal.)	Flow Rate (gpm)	Turbidity (NTU)	Color	pH	Temp	Other
1356	1.75		over range				
1400	3.50		32.2				
1403	5.00		11.1				
1406	6.50		6.01				

Final DTW = 10.17 6.5 gal purged

ACCEPTANCE CRITERIA (from workplan)

Minimum Purge Volume Required 4.9 gallons

Maximum Turbidity Allowed 10 NTUs

Stabilization of parameters ____ %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☒	☐	☐
Has parameters stabilized	☐	☐	☒

If no or N/A explain below:

Signature [signature] Date: 11/13/13

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RESOLUTION CONSULTANTS

Attachment 1
Well Development Record

Well/Piezometer Development Record

Well ID: TW03

Client: NAVFAC

Project No: 12637 Date: 11/13/13 Developer: FB + SH

Site Location: CTF, North Charleston

Well/Piezometer Data

Well ☑ Piezometer ☐ Diameter 2" Material PVC

Measuring Point Description ground surface

Depth to Top of Screen (ft.) 4'

Depth to Bottom of Screen (ft.) 14'

Total Well Depth (ft.) 14'

Depth to Static Water Level (ft.) 7.51

Geology at Screen Interval (if known) SAND

Time of Water Level Measurement 1416

Calculate Purge Volume (gal.) 3.2 gallons

Disposal Method drum

Headspace

Original Well Development ☒ Redevelopment ☐ Date of Original Development

DEVELOPMENT METHOD Whale Pump, No LNAPL Present

PURGE METHOD

Time	Total Volume Purged (gal.)	Flow Rate (gpm)	Turbidity (NTU)	Color	pH	Temp	Other
1453	7		over				
1501	9		over				
1503	9.5		over				
1506	10.5		over				
1508	~~3~~ 12.5		36.4				
1510	13		34.3				

ACCEPTANCE CRITERIA (from workplan)

Minimum Purge Volume Required 3.2 gallons

Maximum Turbidity Allowed 10 NTUs

Stabilization of parameters ____%

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☒	☐
Has parameters stabilized	☒	☐	☒

If no or N/A explain below:

Signature [signature] Date: 11/13/13

DTW 11.2 ft

total purged 13 gallons

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RESOLUTION CONSULTANTS

Attachment 1
Well Development Record

Well/Piezometer Development Record

Well ID: TW04

Client: NAVFAC SE

Project No: 12637 Date: 11/13/13 Developer: FB + SH

Site Location: CTF, North Charleston SC

Well/Piezometer Data

Well ☒ Piezometer ☐ Diameter 2" Material PVC

Measuring Point Description Ground Surface Geology at Screen Interval (if known) SAND

Depth to Top of Screen (ft.) 3'

Depth to Bottom of Screen (ft.) 13 Time of Water Level Measurement 1323

Total Well Depth (ft.) 13 Calculate Purge Volume (gal.) 5.02

Depth to Static Water Level (ft.) 3.77' Disposal Method drum

Headspace

Original Well Development ☒ Redevelopment ☐ Date of Original Development

DEVELOPMENT METHOD Whale Pump, No LNAPL

PURGE METHOD

Time	Total Volume Purged (gal.)	Flow Rate (gpm)	Turbidity (NTU)	Color	pH	Temp	Other
1533	3.5		over range				
1537	5.5		over				
1540	7.5		over				
1548	13		over				
1551	14.5		over				
			Final DTW 3.79				

ACCEPTANCE CRITERIA (from workplan)

Minimum Purge Volume Required 1.8 gallons
Maximum Turbidity Allowed 10 NTUs
Stabilization of parameters ____ %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☒	☐
Has parameters stabilized	☐	☐	☒

If no or N/A explain below:

Signature [signature] Date: 11/13/13

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RESOLUTION CONSULTANTS

Attachment 1
Well Development Record

Well/Piezometer Development Record

Well ID: TW05

Client: CNC CTF

Project No: _____ Date: 11/13/13 Developer: SH + FB

Site Location: N. Charleston SC

Well/Piezometer Data

Well ☒ Piezometer ☐ Diameter 2" Material PVC

Measuring Point Description: ground surface

Geology at Screen Interval (if known): Sand

Depth to Top of Screen (ft.): 3

Depth to Bottom of Screen (ft.): 13

Time of Water Level Measurement: 1521

Total Well Depth (ft.): 13

Calculate Purge Volume (gal.): 4.23

Depth to Static Water Level (ft.): 4.35

Disposal Method: Drum

Headspace: _____

Original Well Development ☒ Redevelopment ☐ Date of Original Development 11/13/13

DEVELOPMENT METHOD Peristaltic

~~PURGE METHOD~~ No LNAPL Present

Time	Total Volume Purged (gal.)	Flow Rate (gpm)	Turbidity (NTU)	Color	pH	Temp	Other
1540	3.5		over range				
1550	5.0		over				
1600	6.5		36.0				
1610	8.0		18.5				
1620	10.0		10.7				

Final DTW = 4.51 Gallons purged = 10.0

ACCEPTANCE CRITERIA (from workplan)

Minimum Purge Volume Required 2.1 gallons

Maximum Turbidity Allowed 10 NTUs

Stabilization of parameters ____%

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☒	☐	☐
Has parameters stabilized	☐	☐	☐

If no or N/A explain below:

Signature [signature] Date: 11/13/13

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RESOLUTION CONSULTANTS

Attachment 1
Well Development Record

Well/Piezometer Development Record

Well ID: TW06

Client: NAVFACSE

Project No: 12637 Date: 11/13 Developer: FBI SH

Site Location: CTF North Charleston

Well/Piezometer Data

Well ☒ Piezometer ☐ Diameter 2" Material PVC

Measuring Point Description Ground Surface Geology at Screen Interval (if known) SAND

Depth to Top of Screen (ft.) 3

Depth to Bottom of Screen (ft.) 13 Time of Water Level Measurement 1610

Total Well Depth (ft.) 13 Calculate Purge Volume (gal.) 4.5 gallons

Depth to Static Water Level (ft.) 3.74' Disposal Method drum

Headspace

Original Well Development ☒ Redevelopment ☐ Date of Original Development

DEVELOPMENT METHOD Whale Pump

PURGE METHOD

Time	Total Volume Purged (gal.)	Flow Rate (gpm)	Turbidity (NTU)	Color	pH	Temp	Other
1620	3		over range				
1635	11		over range				
1630	12		over range				

total purged 13 gallons

ACCEPTANCE CRITERIA (from workplan)

Minimum Purge Volume Required 1.8 gallons
Maximum Turbidity Allowed 10 NTUs
Stabilization of parameters ____%

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☒	☐
Has parameters stabilized	☐	☐	☒

If no or N/A explain below:

Signature [signature] Date: 11/13/13

DTW @ end 3.79'

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Attachment E
Soil Boring Logs

Environmental Soil Boring: SB01

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Project:	0888812637	Completion Date:	11/12/13	Northing:	371680.1785
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317387.781
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Frank Burwell	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0		topsoil		Brown and red topsoil
		clay		clay fill
-1		SM		Light brown, fine silty sand, dry
-2			PID - 0	
-3				
-4			PID - 0	
-5				
-6			PID - 0	boring terminated
-7				
-8				
-9				
-10				
-11				

NOTES: Sample taken at 2 ft bgs and 6 ft bgs

Environmental Soil Boring: SB02

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Project:	0888812637	Completion Date:	11/12/13	Northing:	371671.1519
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317391.835
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Steven Hodskins	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0	topsoil			Brown and red topsoil
	clay			clay fill, dry
-1		SM		Light brown, fine silty sand, dry
-2			PID - 0	
-3				
-4			PID - 0	
-5				
-6			PID - 0	
-7				
-8		SM		becomes gray, moist
-9				becomes wet
-10				boring terminated
-11				

NOTES: Sample taken at 4 ft bgs and 6 ft bgs

Environmental Soil Boring: SB03

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Project:	0888812637	Completion Date:	11/12/13	Northing:	371660.9117
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317397.921
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Frank Burwell	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0	topsoil			Brown and red topsoil
	clay			clay fill
-1		SM		Light brown, fine silty sand, dry
-2			PID - 0	
-3				
-4				
-5			PID - 0	
-6				
-7			PID - 0	
-8		SM		becomes gray, wet
-9				
-10				boring terminated
-11				

NOTES: Sample taken at 2 feet bgs and 6 feet bgs

Environmental Soil Boring: SB04

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Project:	0888812637	Completion Date:	11/12/13	Northing:	371648.8644
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317417.916
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Frank Burwell	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0	topsoil			Brown and red topsoil
	clay			clay fill
-1		SM		Light brown, fine silty sand, dry
-2			PID - 1.3	
-3				
-4			PID - 1.1	
-5				
-6			PID - 1.4	
-7				
-8		SM		becomes gray, wet
-9				
-10				boring terminated
-11				

NOTES: Sample taken at 2 feet bgs and 6 feet bgs

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Environmental Soil Boring: SB05

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

Project:	0888812637	Completion Date:	11/12/13	Northing:	371640.5902
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317421.341
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Frank Burwell	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0	topsoil			Brown and red topsoil
	clay			clay fill
-1		SM		Light brown, fine silty sand,dry
-2			PID - 2.9	
-3				
-4				
-5			PID - 2.5	
-6				
-7			PID - 231	
-8		SM		becomes gray, wet
-9				
-10				boring terminated
-11				

NOTES: Sample taken at 2 feet bgs and 7 feet bgs

Environmental Soil Boring: SB06

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Project:	0888812637	Completion Date:	11/12/13	Northing:	371625.4135
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317418.18
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Steven Hodskins	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0	topsoil			Brown and red topsoil
	clay			clay fill
-1		SM		Yellow, fine silty sand, dry, petroleum odor
-2			PID - 19	
-3				
-4		SM	PID - 276	becomes gray, petroleum odor
-5				
-6			PID - 373	
-7				
-8		SM	PID - 330	becomes moist
-9				Refusal
-10				

NOTES: Sample taken at 6 feet bgs and 8 feet bgs

Environmental Soil Boring: SB07

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Project:	0888812637	Completion Date:	11/12/13	Northing:	371633.658
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317426.371
CTO:	JM 29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Frank Burwell	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0	topsoil			Brown and red topsoil
	clay			clay fill
-1		SM		Brown, medium silty sand, dry
-2			PID - 3.3	
-3		SM		becomes gray with black lenses, oily sheen
-4			PID - 342	
-5		SM		becomes black
-6			PID - 349	
-7				
-8		SM	PID - 329	becomes gray, wet
-9				
-10				boring terminated
-11				

NOTES: Sample taken at 4 feet bgs and 6 feet bgs

Environmental Soil Boring: SB08

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Project:	0888812637	Completion Date:	11/12/13	Northing:	371636.6468
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317436.35
CTO:	JM 29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Steven Hodskins	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0		topsoil		Brown and red topsoil
		clay		clay fill
-1		SM		Light brown, fine silty sand, dry, petroluem odor
-2			PID - 31	
-3				
-4			PID - 263	
-5		SM		
-6			PID - 395	
-7				
-8		SM	PID - 362	become gray, moist
-9				wet
-10				boring terminated
-11				

NOTES: Samle taken at 6 feet bgs and 8 feet bgs

Environmental Soil Boring: SB09

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Project:	0888812637	Completion Date:	11/12/13	Northing:	371618.4424
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317420.596
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Frank Burwell	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0	topsoil			Brown and red topsoil
	clay			clay fill
-1		SM		Light brown, fine silty sand, dry
-2			PID - 57	
-3				
-4		SM	PID - 245	becomes gray, petroluem odor
-5				
-6			PID - 300	
-7				
-8			PID - 395	
-9				becomes wet
-10				boring terminated
-11				

NOTES: Sample taken at 6 feet bgs and 8 feet bgs

Environmental Soil Boring: SB10

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Project:	0888812637	Completion Date:	11/12/13	Northing:	371622.7362
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317431.389
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Frank Burwell	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0	topsoil			Brown and red topsoil
	clay			clay fill
-1		SM		Dark brown, fine silty sand,dry
-2			PID - 2.4	
-3				
-4			PID - 4.7	
-5				
-6			PID - 178	
-7		SM		becomes dark gray, moist
-8			PID - 335	
-9		SM		becomes wet
-10				boring terminated
-11				

NOTES: Sample taken at 6 feet bgs and 8 feet bgs

Environmental Soil Boring: SB11

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Project:	0888812637	Completion Date:	11/12/13	Northing:	371614.6456
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317435.474
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Frank Burwell	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0	topsoil			Brown and red topsoil
	clay			clay fill
-1		SM		Light brown, fine silty sand, dry
-2			PID - 36	
-3		SM		
-4			PID - 63	
-5		SM		
-6		SM	PID - 72	becomes dark grey
-7				
-8		SM	PID - 104	becomes moist
-9				wet
-10				boring terminated
-11				

NOTES: Sample taken at 6 feet bgs and 8 feet bgs

Environmental Soil Boring: SB12

Project: Supplemental Investigation, Chicora Tank Farm
Location: Former Charleston Naval Complex, North Charleston, S.C.

RESOLUTION CONSULTANTS
5724 Summer Trees Dr.
Memphis TN 38134

Project:	0888812637	Completion Date:	11/12/13	Northing:	371602.5093
Location:	Chicora Tank Farm	Drilling Method:	DPT	Easting:	2317441.593
CTO:	JM29	Drilling Contractor:	SAEDACCO	TOC Elevation:	NA
Purpose:	Soil/Groundwater Evaluation	Logged By:	Steven Hodskins	Surface Elevation:	NA

DEPTH BGS	SYMBOLS	USCS	PID (PPM)	Lithologic Description Visual-Manual Description (ASTM D 2488)
1				grass
0	topsoil			Brown and red topsoil
	clay			clay fill
-1		SM		Light brown, fine silty sand, dry
-2			PID - 3	
-3				
-4		SM	PID - 45	petroluem odor
-5		SM		
-6			PID - 14	
-7				
-8		SM	PID - 61	becomes gray, petroleum odor, moist
-9				wet
-10				boring terminated
-11				

NOTES: Sample taken at 4 feet bgs and 8 feet bgs

Attachment F
Groundwater Sampling Logs

WELL DEVELOPMENT & GROUNDWATER SAMPLING FORM

Comprehensive Long-Term Environmental Action Navy

DATE: 11/14/13	JOB NUMBER: 0888812637	EQUIPMENT (Make/Model #/Serial #):
PROJECT: JM 29 CNC Chicora Tank Farm	EVENT: 2013 SI	See cal sheets (1) /
WELL ID: TW01	LOCATION: North Charleston, SC	/ /
WEATHER CONDITIONS: Sunny	AMBIENT TEMP: 50s	/ /
REVIEWED BY: CT	PERSONNEL: SH + FB	/ /

WELL DIA: 2"	**WELL DEVELOPMENT**	
SCREENLENGTH (ft) 10	START: NA	FINISH: NA
TOTAL DEPTH from TOC (ft.): 14	VOLUME PURGED (gal): NA	
DEPTH TO WATER from TOC (ft.): 7.61	**GROUNDWATER SAMPLING**	
LENGTH OF WATER COL. (ft.):	START: 1100	FINISH: 1130
1 VOLUME OF WATER (gal):	VOLUME PURGED (gal): 1.1	
3 VOLUMES OF WATER (gal):	ANALYSIS: Naphthalene	

WELL DEVELOPMENT PARAMETERS		GW SAMPLING PARAMETERS	
Temperature:	± 1.0° C	Temperature:	± 0.2° C
pH:	± 0.5 standard units	pH:	± 0.2 standard units
Specific Conductance:	± 10% of the past measurement	Specific Conductance:	± 5% of the past measurement
Turbidity:	relatively stable	DO:	≤ 20% saturation
		ORP:	± 10 millivolts
		Turbidity:	≤ 10 NTU

IN-SITU TESTING

Circle one: DEVELOPMENT SAMPLING ☐ Bailer X Pump Description: Peristaltic Pump

Time (hh:mm):	1108	1113	1118	1123								
pH (units):	6.15	6.15	6.07	6.02								
Conductivity (mS/cm):	0.079	0.073	0.070	0.070								
Turbidity (NTU):	over	over	27.0	21.3								
DO (mg/L): YSI 556	0.95	0.63	0.60	0.65								
DO (mg/L): YSI 550	—	—	—	—								
Temperature (C°):	22.31	22.26	22.36	22.35								
ORP (mV):	42.0	38.3	46.6	48.1								
Volume Purged (gal):	0.5	0.7	0.9	1.1								
Depth to Water (ft):	8.77	7.75	7.77	7.65								
								Well Goes Dry While Purging ☐				

SAMPLE DATA

☐ Bailer X Pump Description: Peristaltic Pump

Sample ID	Date (m/d/y)	Time (hh:mm)	Bottles (total to lab)	Filtered (0.45 µm)	Remarks
CTFTW01-WG-111413	11/14/13	1125	3	N	[redacted]
CTFTW01-WG-111413-D	11/14/13	1127	3	N	Field Dup.
CTFTW01-WG-111413-MS	11/14/13	1125	3	N	MS

Purging/Sampling Device Decon Process: Liquinox/distilled water and disposable supplies

COMMENTS: * CTFTW01-WG-111413-MSD | 11/14/13 | 1125 | 3 | N | MSD

Purge water placed in drum# 1

WELL DEVELOPMENT & GROUNDWATER SAMPLING FORM

Comprehensive Long-Term Environmental Action Navy

DATE: 11/14/13	JOB NUMBER: 0888812637	EQUIPMENT (Make/Model #/Serial #):
PROJECT: JM 29 CNC Chicora Tank Farm	EVENT: 2013 SI	' (1) '
WELL ID: TWØ 2	LOCATION: North Charleston, SC	' See '
WEATHER CONDITIONS: Clear 50's	AMBIENT TEMP: 50's	' Calibration
REVIEWED BY: CT	PERSONNEL: FB + SH	' sheet

WELL DIA: 2"		WELL DEVELOPMENT	
SCREENLENGTH (ft) 10'		START: —	FINISH: —
TOTAL DEPTH from TOC (ft.): 15'		VOLUME PURGED (gal): —	
DEPTH TO WATER from TOC (ft.): 10.24		GROUNDWATER SAMPLING	
LENGTH OF WATER COL. (ft.): 5.24		START: 1143	FINISH: 1212
1 VOLUME OF WATER (gal):		VOLUME PURGED (gal): 0.7	
3 VOLUMES OF WATER (gal):		ANALYSIS: VOCs - Naphthalene	

WELL DEVELOPMENT PARAMETERS		GW SAMPLING PARAMETERS	
Temperature:	± 1.0° C	Temperature:	± 0.2° C
pH:	± 0.5 standard units	pH:	± 0.2 standard units
Specific Conductance:	± 10% of the past measurement	Specific Conductance:	± 5% of the past measurement
Turbidity:	relatively stable	DO:	≤ 20% saturation
		ORP:	± 10 millivolts
		Turbidity:	≤ 10 NTU

IN-SITU TESTING

Circle one: DEVELOPMENT SAMPLING ☐ Bailer X Pump Description: Peristaltic Pump

Time (hh:mm):	1152	1157	1202	1207	1212							
pH (units):	6.53	6.60	6.62	6.61	6.60							
Conductivity (mS/cm):	0.226	0.224	0.226	0.221	0.216							
Turbidity (NTU):	over 6	31.2	19.6	7.86	4.34							
DO (mg/L): YSI 556	0.75	0.57	0.56	0.48	0.43							
DO (mg/L): YSI 550	—											
Temperature (C°):	21.46	21.31	20.67	21.23	21.49							
ORP (mV):	-33.8	-57.3	-64.4	-51.5	-51.5							
Volume Purged (gal):	0.3	0.4	0.5	0.6	0.7							
Depth to Water (ft):	10.12	10.12	10.12	10.15	10.15							

Well Goes Dry While Purging ☐

SAMPLE DATA

☐ Bailer X Pump Description: Peristaltic Pump

Sample ID	Date (m/d/y)	Time (hh:mm)	Bottles (total to lab)	Filtered (0.45 µm)	Remarks
CTF-TWØ2-WG-111413	11/14/13	1215	3	0	VOCs

Purging/Sampling Device Decon Process: Liquinox/distilled water and disposable supplies

COMMENTS:

Purge water placed in drum# 1

WELL DEVELOPMENT & GROUNDWATER SAMPLING FORM

Comprehensive Long-Term Environmental Action Navy

DATE: 11/14/13	JOB NUMBER: 0888812637	EQUIPMENT (Make/Model #/Serial #):
PROJECT: JM 29 CNC Chicora Tank Farm	EVENT: 2013 SI	/ (1) /
WELL ID: TW03	LOCATION: North Charleston, SC	/ /
WEATHER CONDITIONS: Sunny	AMBIENT TEMP: 50s	/ /
REVIEWED BY: CT	PERSONNEL: SH + FD	/ /

WELL DIA: 2"	WELL DEVELOPMENT		
SCREENLENGTH (ft) 10	START: NA	FINISH: NA	
TOTAL DEPTH from TOC (ft.): 14	VOLUME PURGED (gal): NA		
DEPTH TO WATER from TOC (ft.): 7.50	GROUNDWATER SAMPLING		
LENGTH OF WATER COL. (ft.):	START: 1252	FINISH: 1335	
1 VOLUME OF WATER (gal):	VOLUME PURGED (gal): 1.3		
3 VOLUMES OF WATER (gal):	ANALYSIS: VOCs – Naphthalene		

WELL DEVELOPMENT PARAMETERS		GW SAMPLING PARAMETERS	
Temperature:	± 1.0° C	Temperature:	± 0.2° C
pH:	± 0.5 standard units	pH:	± 0.2 standard units
Specific Conductance:	± 10% of the past measurement	Specific Conductance:	± 5% of the past measurement
Turbidity:	relatively stable	DO:	≤ 20% saturation
		ORP:	± 10 millivolts
		Turbidity:	≤ 10 NTU

IN-SITU TESTING

Circle one: DEVELOPMENT SAMPLING ☐ Bailer X Pump Description: Peristaltic Pump

Time (hh:mm):	1307	1312	1317	1322	1327							
pH (units):	6.83	6.86	6.84	6.85	6.83							
Conductivity (mS/cm):	0.784	0.787	0.786	0.789	0.790							
Turbidity (NTU):	27.4	20.7	16.1	15.1	15.8							
DO (mg/L): YSI 556	0.92	0.54	0.41	0.33	0.32							
DO (mg/L): YSI 550	—	—	—	—	—							
Temperature (C°):	22.55	22.20	22.33	22.18	22.47							
ORP (mV):	-75.6	-76.9	-77.2	-78.7	-77.6							
Volume Purged (gal):	0.5	0.7	0.9	1.1	1.3							
Depth to Water (ft):	7.67	7.69	7.69	7.69	7.69							

Well Goes Dry While Purging ☐

SAMPLE DATA

☐ Bailer X Pump Description: Peristaltic Pump

Sample ID	Date (m/d/y)	Time (hh:mm)	Bottles (total to lab)	Filtered (0.45 µm)	Remarks
CTFTW03-WG-111413	11/14/13	1328	3	N	

Purging/Sampling Device Decon Process: Liquinox/distilled water and disposable supplies

COMMENTS:

Purge water placed in drum# 1

WELL DEVELOPMENT & GROUNDWATER SAMPLING FORM

Comprehensive Long-Term Environmental Action Navy

DATE: 11/14/13	JOB NUMBER: 0888812637	EQUIPMENT (Make/Model #/Serial #):
PROJECT: JM 29 CNC Chicora Tank Farm	EVENT: 2013 SI	/ /
WELL ID: TWØ 5	LOCATION: North Charleston, SC	See 'Calibration'
WEATHER CONDITIONS: Sunny 60's	AMBIENT TEMP: 60's	/ Sheet
REVIEWED BY: CT	PERSONNEL: SH + FB	/ /

WELL DIA: 2"	WELL DEVELOPMENT	
SCREENLENGTH (ft) 10'	START: —	FINISH: —
TOTAL DEPTH from TOC (ft.): 13'	VOLUME PURGED (gal): —	
DEPTH TO WATER from TOC (ft.): 4.38	GROUNDWATER SAMPLING	
LENGTH OF WATER COL. (ft.):	START: 1338	FINISH: 1413
1 VOLUME OF WATER (gal):	VOLUME PURGED (gal): 0.9	
3 VOLUMES OF WATER (gal):	ANALYSIS: VOCs	

WELL DEVELOPMENT PARAMETERS		GW SAMPLING PARAMETERS	
Temperature:	± 1.0° C	Temperature:	± 0.2° C
pH:	± 0.5 standard units	pH:	± 0.2 standard units
Specific Conductance:	± 10% of the past measurement	Specific Conductance:	± 5% of the past measurement
Turbidity:	relatively stable	DO:	≤ 20% saturation
		ORP:	± 10 millivolts
		Turbidity:	≤ 10 NTU

IN-SITU TESTING

Circle one: DEVELOPMENT SAMPLING ☐ Bailer X Pump Description: Peristaltic Pump

Time (hh:mm):	~~1345~~	1348	1353	1358	1403	1408	1413					
pH (units):		7.29	7.23	7.16	7.12	7.05	6.97					
Conductivity (mS/cm):		0.301	0.294	0.288	0.288	0.279	0.275					
Turbidity (NTU):		over	over	31.5	37.2	20.0	15.6					
DO (mg/L): YSI 556		0.73	0.52	0.46	0.41	0.39	0.37					
DO (mg/L): YSI 550												
Temperature (C°):		20.92	21.04	21.13	20.82	20.81	20.73					
ORP (mV):		-27.4	-30.5	-28.4	-27.7	-22	-12.4					
Volume Purged (gal):		0.4	0.5	.6	.7	.8	.9					
Depth to Water (ft):		4.4	4.4	4.38	4.4	4.4	4.4					
								Well Goes Dry While Purging ☐				

SAMPLE DATA

☐ Bailer X Pump Description: Peristaltic Pump

Sample ID	Date (m/d/y)	Time (hh:mm)	Bottles (total to lab)	Filtered (0.45 µm)	Remarks
CTFTWØ5-WG-111413	11/14/13	1415	3	O	VOCs

Purging/Sampling Device Decon Process: Liquinox/distilled water and disposable supplies

COMMENTS:

Purge water placed in drum# 1

WELL DEVELOPMENT & GROUNDWATER SAMPLING FORM

Comprehensive Long-Term Environmental Action Navy

DATE: 11/14/13	JOB NUMBER: 0888812637	EQUIPMENT (Make/Model #/Serial #):
PROJECT: JM 29 CNC Chicora Tank Farm	EVENT: 2013 SI	see 'Calibration
WELL ID: TW07	LOCATION: North Charleston, SC	sheet'
WEATHER CONDITIONS: Sunny 50's	AMBIENT TEMP: 50s	
REVIEWED BY: CT	PERSONNEL: FB + SH	

WELL DIA: 2"	WELL DEVELOPMENT	
SCREENLENGTH (ft) 10'	START: —	FINISH: —
TOTAL DEPTH from TOC (ft.):	VOLUME PURGED (gal): —	
DEPTH TO WATER from TOC (ft.): 8.09	GROUNDWATER SAMPLING	
LENGTH OF WATER COL. (ft.):	START: 1433	FINISH: 1506
1 VOLUME OF WATER (gal):	VOLUME PURGED (gal): 0.6	
3 VOLUMES OF WATER (gal):	ANALYSIS: naphthalene	

WELL DEVELOPMENT PARAMETERS		GW SAMPLING PARAMETERS	
Temperature:	± 1.0° C	Temperature:	± 0.2° C
pH:	± 0.5 standard units	pH:	± 0.2 standard units
Specific Conductance:	± 10% of the past measurement	Specific Conductance:	± 5% of the past measurement
Turbidity:	relatively stable	DO:	≤ 20% saturation
		ORP:	± 10 millivolts
		Turbidity:	≤ 10 NTU

IN-SITU TESTING

Circle one: DEVELOPMENT SAMPLING ☐ Bailer X Pump Description: Peristaltic Pump

Time (hh:mm):	1447	1452	1457	1502								
pH (units):	6.43	6.44	6.45	6.48								
Conductivity (mS/cm):	0.429	0.432	0.428	0.424								
Turbidity (NTU):	36.4	39.1	over	over								
DO (mg/L): YSI 556	0.91	0.62	0.46	0.41								
DO (mg/L): YSI 550	—											
Temperature (C°):	21.25	21.30	21.24	21.15								
ORP (mV):	-33	-35.7	-39.5	-44.2								
Volume Purged (gal):	0.2	[illegible]	0.5	0.6								
Depth to Water (ft):	8.91	8.91	8.92	9								
		>0.4										
								Well Goes Dry While Purging ☐				

SAMPLE DATA

☐ Bailer X Pump Description: Peristaltic Pump

Sample ID	Date (m/d/y)	Time (hh:mm)	Bottles (total to lab)	Filtered (0.45 µm)	Remarks
CTFTW07-WG-111413	11/14/13	1508	3	0	

Purging/Sampling Device Decon Process: Liquinox/distilled water and disposable supplies

COMMENTS:

Purge WATER HAS mild odor
small # of product globules in VOA bottles + purge H_2O

Purge water placed in drum# 1

WELL DEVELOPMENT & GROUNDWATER SAMPLING FORM

DATE: 11-12-13	JOB NUMBER: 883812637	EQUIPMENT (Make/Model #/Serial #):
PROJECT: JM26 CNC CTF	EVENT: 2013 S2	'see cal sheets'
WELL ID: SB09	LOCATION: N. Chs SC	/ /
WEATHER CONDITIONS: sunny	AMBIENT TEMP: 60's	/ /
REVIEWED BY: CT	PERSONNEL: FB + SH	/ /

WELL DIA: 1.5" DPT Point	WELL DEVELOPMENT		
TOTAL DEPTH from TOC (ft.): 10' bgs	START: —	FINISH: —	
DEPTH TO WATER from TOC (ft.): 9' bgs	VOLUME PURGED (gal): —		
LENGTH OF WATER COL. (ft.):	GROUNDWATER SAMPLING		
1 VOLUME OF WATER (gal):	START: 1320	FINISH: 1325	
3 VOLUMES OF WATER (gal):	VOLUME PURGED (gal): none		
	ANALYSIS: naphthalene		

WELL DEVELOPMENT PARAMETERS		GW SAMPLING PARAMETERS	
Temperature:	± 1.0° C	Temperature:	± 0.2° C
pH:	± 0.5 standard units	pH:	± 0.2 standard units
Specific Conductance:	± 10% of the past measurement	Specific Conductance:	± 5% of the past measurement
Turbidity:	relatively stable	DO:	≤ 20% saturation
		ORP:	± 10 millivolts
		Turbidity:	≤ 10 NTU

IN-SITU TESTING

Circle one: DEVELOPMENT SAMPLING ☐ Bailer ☒ Pump Description: Peristaltic

Time (hh:mm):												
pH (units):												
Conductivity (mS/cm):												
Turbidity (NTU):												
DO (mg/L): YSI 556												
DO (mg/L): YSI 650												
Temperature (C°):												
ORP (mV):												
Volume Purged (gal):												
Depth to Water (ft):												
								Well Goes Dry While Purging ☐				

SAMPLE DATA

☐ Bailer ☒ Pump Description: Peristaltic

Sample ID	Date (m/d/y)	Time (hh:mm)	Bottles (total to lab)	Filtered (0.45 um)	Remarks
CTFSB09-WG-111213	11-12-13	1320	3	0	

Purging/Sampling Device Decon Process:

COMMENTS: grab sample, no purging
Water has petroleum odor

Purge water placed in drum# 1

Appendix G
Laboratory Reports
(GCAL Report 213111534)

(Submitted Under Separate Cover)

Attachment H
Data Validation Report

VALIDATION SUMMARY

This report summarizes data review findings for samples collected at the former Chicora Tank Farm (CTF) associated with Charleston Naval Complex in North Charleston, South Carolina, in accordance with the following Sampling and Analysis Plan:

- *Sampling and Analysis Plan, Supplemental Investigation, Chicora Tank Farm, Charleston Naval Complex, Charleston, South Carolina, July 2013.*

Data were evaluated independently from the laboratory to assess data quality. Samples discussed in this report were collected on 12 November and 14 November 2013, and were submitted to Gulf Coast Analytical Laboratories in Baton Rouge, Louisiana. Dana Miller, a staff chemist from Resolution Consultants, reviewed the data packages reported for these samples. The quality assurance criteria used to assess all data were established by the analytical methods and were consistent with the measurement performance criteria provided in the project's Sampling and Analysis Plan and relevant standards in the following guidance documents:

- *Department of Defense Quality Systems Manual for Environmental Laboratories*, Version 4.2. (October 2010)

- *U.S. Environmental Protection Agency, Contract Laboratory Program, National Functional Guidelines for Organic Data Review*. (October 1999)

Validation was performed on the water samples from sample delivery group 213111534, summarized in Attachment A, Table A-1. Samples discussed in this report were analyzed and reported as definitive data and a full deliverable data package, including quality control summaries and raw data, was submitted for data review. When the quality control parameters did not fall within the specific method or data review guidelines, the data evaluator annotated or "flagged" the corresponding compounds. The flags used during data review are as follows: All samples were received intact by the laboratory and with the proper documentation. The data review consisted of reviewing the following parameters:

* Data completeness
* Sample receipt and preservation
* Holding times
* Instrument tuning
* Initial calibration
* Continuing calibration verification
* Laboratory blanks
* Trip blanks (volatile organic compounds only)
* Surrogate recoveries
* Matrix spike/matrix spike duplicates
* Laboratory control samples
* Field duplicate precision

An asterisk (*) above indicates that all criteria were met. Data, which were acceptable, as indicated with an asterisk (*) above, will not be discussed further in the following sections. A minimum of 10% of all laboratory transcriptions and calculations have been verified as part of this validation and raw data reviewed were found to be acceptable. Samples CTFSB01-SO02-111213, CTFSB03-SO02-111213, and CTFTW01-WG-111413 were used as the matrix spike/matrix spike duplicates and all precision and accuracy criteria were met. Samples CTFSB03-SO02-111213 and CTFTW01-WG-111413 were duplicated in the field and all precision criteria were met.

Overall Assessment

The data from sample delivery group 213111534 were reviewed independently from the laboratory to assess data quality. No results were qualified during data review and all results are acceptable for their intended purpose, according to U.S. Environmental Protection Agency guidelines. Table 2 shows final data review qualifiers used to describe results and how they should be interpreted by the end data user. Attachment B provides final results after data review.

Table 2
Result Flagging Codes

Data Qualifier	Qualifier Definition	Interpret Result As a Detection?	Result Usable?	Potential Result Bias
no qualifier	Acceptable	Yes	Yes	None expected
U	Undetected	No	Yes	None expected

Attachment A
Sample and Analysis Summary

Table A-1
Sample and Analysis Summary
Chicora Tank Farm
November 2013

Sample Delivery Group	Field Sample ID	Lab ID	Sample Type	Sample Date	Naphthalene (8260B)
213111534	CTFSB01-SO02-111213	21311153401	Soil	11/12/2013	X
213111534	CTFSB01-SO02-111213-D	21311153405	Duplicate of CTFSB01-SO02-111213	11/12/2013	X
213111534	CTFSB01-SO06-111213	21311153404	Soil	11/12/2013	X
213111534	CTFSB02-SO04-111213	21311153406	Soil	11/12/2013	X
213111534	CTFSB02-SO06-111213	21311153407	Soil	11/12/2013	X
213111534	CTFSB03-SO02-111213	21311153408	Soil	11/12/2013	X
213111534	CTFSB03-SO02-111213-D	21311153411	Duplicate of CTFSB03-SO02-111213	11/12/2013	X
213111534	CTFSB03-SO06-111213	21311153412	Soil	11/12/2013	X
213111534	CTFSB04-SO02-111213	21311153413	Soil	11/12/2013	X
213111534	CTFSB04-SO06-111213	21311153414	Soil	11/12/2013	X
213111534	CTFSB05-SO02-111213	21311153415	Soil	11/12/2013	X
213111534	CTFSB05-SO07-111213	21311153416	Soil	11/12/2013	X
213111534	CTFSB06-SO06-111213	21311153417	Soil	11/12/2013	X
213111534	CTFSB06-SO08-111213	21311153418	Soil	11/12/2013	X
213111534	CTFSB07-SO04-111213	21311153419	Soil	11/12/2013	X
213111534	CTFSB07-SO06-111213	21311153420	Soil	11/12/2013	X
213111534	CTFSB08-SO06-111213	21311153421	Soil	11/12/2013	X
213111534	CTFSB08-SO08-111213	21311153422	Soil	11/12/2013	X
213111534	CTFSB09-SO06-111213	21311153423	Soil	11/12/2013	X
213111534	CTFSB09-SO08-111213	21311153424	Soil	11/12/2013	X
213111534	CTFSB10-SO06-111213	21311153425	Soil	11/12/2013	X
213111534	CTFSB10-SO08-111213	21311153426	Soil	11/12/2013	X
213111534	CTFSB11-SO06-111213	21311153427	Soil	11/12/2013	X
213111534	CTFSB11-SO08-111213	21311153428	Soil	11/12/2013	X
213111534	CTFSB12-SO04-111213	21311153429	Soil	11/12/2013	X

Table A-1
Sample and Analysis Summary
Chicora Tank Farm
November 2013

Sample Delivery Group	Field Sample ID	Lab ID	Sample Type	Sample Date	Naphthalene (8260B)
213111534	CTFSB12-SO08-111213	21311153430	Soil	11/12/2013	X
213111534	TB111213	21311153435	Trip Blank	11/12/2013	X
213111534	CTFTW01-WG-111413	21311153436	Groundwater	11/14/2013	X
213111534	CTFTW01-WG-111413-D	21311153437	Duplicate of CTFTW01-WG-111413	11/14/2013	X
213111534	CTFTW02-WG-111413	21311153440	Groundwater	11/14/2013	X
213111534	CTFTW03-WG-111413	21311153441	Groundwater	11/14/2013	X
213111534	CTFTW05-WG-111413	21311153442	Groundwater	11/14/2013	X
213111534	CTFTW07-WG-111413	21311153446	Groundwater	11/14/2013	X
213111534	CTFSB09-WG-111213	21311153431	Groundwater	11/14/2013	X
213111534	TB111413	21311153444	Trip Blank	11/14/2013	X

Notes:
X = Sample was analyzed for the method indicated in the column header
CTF = Chicora Tank Farm

Attachment B
Final Results after Data Review
Sample Delivery Group 213111534

Table A-2
Validated Sample Results
Sample Delivery Group 213111534

						Analyte CAS No Method	NAPHTHALENE 91-20-3 8260B	
Sample Delivery Group	**Location**	**Sample ID**	**Lab ID**	**Sample Date**	**Sample Type**	**Units**	**Result**	**Qualifier**
213111534	CTFSB01	CTFSB01-SO02-111213	21311153401	11/12/2013	Soil	µg/kg	0.512	U
213111534	CTFSB01	CTFSB01-SO02-111213-D	21311153405	11/12/2013	Soil	µg/kg	0.482	U
213111534	CTFSB01	CTFSB01-SO06-111213	21311153404	11/12/2013	Soil	µg/kg	0.452	U
213111534	CTFSB02	CTFSB02-SO04-111213	21311153406	11/12/2013	Soil	µg/kg	0.439	U
213111534	CTFSB02	CTFSB02-SO06-111213	21311153407	11/12/2013	Soil	µg/kg	0.403	U
213111534	CTFSB03	CTFSB03-SO02-111213	21311153408	11/12/2013	Soil	µg/kg	0.545	U
213111534	CTFSB03	CTFSB03-SO02-111213-D	21311153411	11/12/2013	Duplicate	µg/kg	0.556	U
213111534	CTFSB03	CTFSB03-SO06-111213	21311153412	11/12/2013	Soil	µg/kg	0.459	U
213111534	CTFSB04	CTFSB04-SO02-111213	21311153413	11/12/2013	Soil	µg/kg	0.486	U
213111534	CTFSB04	CTFSB04-SO06-111213	21311153414	11/12/2013	Soil	µg/kg	0.45	U
213111534	CTFSB05	CTFSB05-SO02-111213	21311153415	11/12/2013	Soil	µg/kg	0.484	U
213111534	CTFSB05	CTFSB05-SO07-111213	21311153416	11/12/2013	Soil	µg/kg	4610	
213111534	CTFSB06	CTFSB06-SO06-111213	21311153417	11/12/2013	Soil	µg/kg	20400	
213111534	CTFSB06	CTFSB06-SO08-111213	21311153418	11/12/2013	Soil	µg/kg	6870	
213111534	CTFSB07	CTFSB07-SO04-111213	21311153419	11/12/2013	Soil	µg/kg	13300	
213111534	CTFSB07	CTFSB07-SO06-111213	21311153420	11/12/2013	Soil	µg/kg	18700	
213111534	CTFSB08	CTFSB08-SO06-111213	21311153421	11/12/2013	Soil	µg/kg	2850	
213111534	CTFSB08	CTFSB08-SO08-111213	21311153422	11/12/2013	Soil	µg/kg	17300	
213111534	CTFSB09	CTFSB09-SO06-111213	21311153423	11/12/2013	Soil	µg/kg	8230	
213111534	CTFSB09	CTFSB09-SO08-111213	21311153424	11/12/2013	Soil	µg/kg	4730	
213111534	CTFSB10	CTFSB10-SO06-111213	21311153425	11/12/2013	Soil	µg/kg	3320	
213111534	CTFSB10	CTFSB10-SO08-111213	21311153426	11/12/2013	Soil	µg/kg	15300	
213111534	CTFSB11	CTFSB11-SO06-111213	21311153427	11/12/2013	Soil	µg/kg	295	
213111534	CTFSB11	CTFSB11-SO08-111213	21311153428	11/12/2013	Soil	µg/kg	1430	
213111534	CTFSB12	CTFSB12-SO04-111213	21311153429	11/12/2013	Soil	µg/kg	147	

Table A-2
Validated Sample Results
Sample Delivery Group 213111534

						Analyte CAS No Method	NAPHTHALENE 91-20-3 8260B	
Sample Delivery Group	**Location**	**Sample ID**	**Lab ID**	**Sample Date**	**Sample Type**	**Units**	**Result**	**Qualifier**
213111534	CTFSB12	CTFSB12-SO08-111213	21311153430	11/12/2013	Soil	µg/kg	130	
213111534	CTFSB09	CTFSB09-WG-111213	21311153431	11/12/2013	Groundwater	µg/L	437	
213111534	CTFTW01	CTFTW01-WG-111413	21311153436	11/14/2013	Groundwater	µg/L	0.2	U
213111534	CTFTW01	CTFTW01-WG-111413-D	21311153437	11/14/2013	Duplicate	µg/L	0.2	U
213111534	CTFTW02	CTFTW02-WG-111413	21311153440	11/14/2013	Groundwater	µg/L	0.2	U
213111534	CTFTW03	CTFTW03-WG-111413	21311153441	11/14/2013	Groundwater	µg/L	0.2	U
213111534	CTFTW05	CTFTW05-WG-111413	21311153442	11/14/2013	Groundwater	µg/L	0.2	U
213111534	CTFTW07	CTFTW07-WG-111413	21311153446	11/14/2013	Groundwater	µg/L	202	

Notes:

µg/kg = Micrograms per kilogram
µg/L = Micrograms per liter
U = Undetected
CTF = Chicora Tank Farm

Attachment I
IDW Disposal Manifests

Please print or type
(Form designed for use on elite (12-pitch) typewriter.)

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number
2. Page 1 of 1
3. Emergency Response Phone: 803-957-9175
4. Waste Tracking Number: 84158

5. Generator's Name and Mailing Address: Former Naval Complex Charleston, Navy BRAC office, 203 S. Davis Drive, Bld 247, Joint Base Charleston, SC

Generator's Site Address (if different than mailing address): Chicora Tank Farm, 2905 Carner Avenue, N. Charleston SC

Generator's Phone: David Criswell, Navy, 843-963-4974

6. Transporter 1 Company Name: ~~A&D Environmental Services (SC) LLC~~ — U.S. EPA ID Number: ~~SCD987593324~~

7. Transporter 2 Company Name — U.S. EPA ID Number:

8. Designated Facility Name and Site Address: A&D Environmental Services, Inc, 2718 Uhwarrie Road, Archdale, NC 27263 — U.S. EPA ID Number: NCD986232221

Facility's Phone: ~~336-434-7750~~

9. Waste Shipping Name and Description	10. Containers No.	Type	11. Total Quantity	12. Unit Wt./Vol.
1. NON-HAZARDOUS NON-REGULATED MATERIAL Purge Water	2	DM	110	G
2. NON-HAZARDOUS NON-REGULATED MATERIAL Soil	2	DM	650	P
3. Non-DOT / Non-RCRA Regulated Purge Water	2	DF	110	G
4.				

13. Special Handling Instructions and Additional Information

In Case of Emergency Call: 800-255-3924 A&D (SC) Job # 13880 Work Order PO # 15352

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: CHAD TRIPP, RESOLUTION CONSULTANTS (AS AGENT FOR NAVY) — Signature: Ch Tripp — Month 2 Day 25 Year 14

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name — Signature — Month Day Year
Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy
17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
17b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:
17c. Signature of Alternate Facility (or Generator) — Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a
Printed/Typed Name: Eric D McMahon — Signature: E. D. McMahon — Month 3 Day 27 Year 14