Johnson, Sabrina O

From:	Newsome, Kaitlyn
Sent:	Monday, January 6, 2020 11:06 PM
To:	SWD_Waste
Subject:	Fw: SCLF - December 2019 Subsurface Conductivity Memorandum
Attachments:	M20200106 SCLF December 2019 GeoView Memorandum.pdf

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From: Spradlin, Kollan <KSpradlin@scsengineers.com>
Sent: Monday, January 6, 2020 7:08:00 PM
To: Madden, Melissa <Melissa.Madden@FloridaDEP.gov>; Morgan, Steve <Steve.Morgan@FloridaDEP.gov>; Dilmore, Cory <Cory.Dilmore@FloridaDEP.gov>; Chamberlain, Justin <Justin.Chamberlain@FloridaDEP.gov>; Ciaravella, Philip <Philip.Ciaravella@FloridaDEP.gov>; Newsome, Kaitlyn <Kaitlyn.Newsome@FloridaDEP.gov>
Cc: RuizLE@hillsboroughcounty.org <RuizLE@hillsboroughcounty.org>; O'Neill, Joseph(Hillsborough County <oneillj@HCFLGov.net>; Michael Townsel <TownselM@hillsboroughcounty.org>; Devitt, Caroline <CDevitt@scsengineers.com>; Curtis, Bob <BCurtis@scsengineers.com>; Patel, Yashvi <YPatel@scsengineers.com>; Arney, Trent <TArney@scsengineers.com>
Subject: SCLF - December 2019 Subsurface Conductivity Memorandum

All,

Please see the attached memorandum summarizing the findings of the December 2019 Geoview subsurface conductivity survey of the area adjacent to Phase II at the Southeast County Landfill. The December 2019 subsurface conductivity map is included as Figure 6.

Please feel free to contact us at 813-804-676 should you have any questions.

Thank you,

Kollan

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January 6, 2020
File No. 09215600.09

MEMORANDUM

TO: Mr. Joe O'Neill, P.E. and Mr. Larry Ruiz, S.C.
FROM: Ms. Yashvi Patel and Mr. Kollan Spradlin, P.E.
SUBJECT: December 2019 Subsurface Geophysics Survey, Southeast County Landfill

Executive Summary

SCS Engineers (SCS) contracted Geoview, Inc. (Geoview) in 2016, 2017, 2018, May 2019, and October 2019 to perform subsurface conductivity surveys adjacent to the southeast corner of Phase II of the Southeast County Landfill (SCLF). In order to evaluate the change in conductivity over time, SCS contracted Geoview again in December 2019 to perform an additional subsurface conductivity survey of the subject area. SCS found that a comparison of the 2016, 2017, 2018, and 2019 subsurface conductivity shows a discernable and steady decline in bulk subsurface conductivity. Additionally, local groundwater quality continues to improve and monitored parameters meet primary drinking water standards. The corrective actions implemented by the Hillsborough County, Solid Waste Management Division (SWMD) have isolated and abated the source of previous groundwater impacts observed during quarterly monitoring events.

Introduction

As requested by the SWMD, SCS has prepared this memorandum to present the findings of the December 2019 geophysical survey conducted between the southeastern edge of Phase II and the perimeter road at the SCLF.

Background

Previously, subsurface geophysical surveys were performed by Geoview in November 2016, October 2017, November 2018, May 2019, and October 2019 near the southeast perimeter of Phase II. Each of the previous reports presented the bulk conductivity measurements near the edge of the Phase II perimeter berm to a depth of approximately 16 feet below ground surface.

The surveys conducted from November 2016 through October 2019 identified an area of elevated subsurface conductivity that was mapped and defined within the Geoview reports. Each of the 2016 through October 2019 reports delineated an area of elevated conductivity near the Phase II landfill limit.

In order to continue to assess conductivity trends over time, SCS again contracted Geoview to survey the local subsurface conductivity in December 2019. The geophysical survey was performed on December 9, 2019 which coincided with the groundwater monitoring event. SCS recommends conducting future subsurface conductivity surveys in coordination with quarterly groundwater sampling events to generate analytical data for comparison. The December 2019 report is included as **Attachment 1**.

Field Investigation

Geoview personnel performed the December 2019 field measurements of bulk subsurface conductivity using a Geonics EM-31-MK2 ground conductivity meter in vertical dipole orientation. An SCS representative was on site to observe and document field activities. Conductivity measurements were collected by Geoview at one-foot intervals along transects spaced approximately 15 feet apart, parallel to the SCLF landfill limits. Previous surveys performed by Geoview in 2016 through October 2019 used the same type of equipment with the same orientation and settings.

The limits of survey areas deviated slightly for each investigation. The survey limits of the November 2016, October 2017, and each of the 2019 surveys extended further into the landfill than the December 2019 survey limits, resulting in the observation of high conductivity areas within the landfill. These high conductivity areas are to be expected under normal operating conditions and are likely caused by leachate within the landfill limits and the presence of conductive material within the waste mass. The purpose of this geophysical investigation was to identify potential high conductivity areas outside the landfill limits.

Findings

Each of the 2016, 2017, 2018, and 2019 Geoview report figures show an area of elevated soil conductivity response near the toe of the containment berm in the southeast corner of Phase II. The figures produced by Geoview depicting terrain conductivity are included as **Figure 1** (2016), **Figure 2** (2017), **Figure 3** (2018), **Figure 4** (May 2019), **Figure 5** (October 2019), and **Figure 6** (December 2019).

SCS compared the results of the December 2019 geophysical investigation to the November 2016 geophysical investigation. The figures indicate a discernable and steady decrease in the bulk subsurface conductivity within the area of elevated conductivity response, outside of the landfill limits.

From November 2016 to December 2019, conductivity values between TH-67 and TH-83 decreased approximately 55 milli-Seimens/meter (mS/m). Additionally, the subsurface conductivity of the area immediately south of TH-79 has decreased approximately 35 mS/m. Conversely, conductivity values near the perimeter road have changed little (less than 10 mS/m) from 2016 to December 2019, which supports that conductivity changes within areas of similar soil morphology are a result of changes in groundwater conductivity.

The Geoview reports state that changes in local conductivity measurements can be caused by either metallic interference (metal monitoring well housings and pumps), changes in geologic conditions, or changes in groundwater chemistry. For the purposes of the December 2019 report, Geoview concluded that the changes in conductivity are a result of changes in the conductance of shallow groundwater with exception of areas affected by data interference.

As shown in Figure 4, metallic objects that caused data interference and data gaps were identified and notated (vehicles, heavy machinery, surface metal, well casings, bollards, open excavations, equipment, etc.). The presences of vehicles and equipment were prevalent during the May 2019 geophysical survey as a result of cut-off trench extension construction and equipment staging; however, it is our opinion that the subsurface conductivity surveys of the area east of Phase II collectively demonstrate a downward trend in bulk subsurface conductivity. Below, Table 1 summarizes peak subsurface conductivity survey results within a radius of approximately 50 feet around TH-67, TH-79, and TH-83 for each of the included conductivity surveys.

Table 1. Summary of Subsurface Conductivity Near Monitoring Wells

Monitoring Well	Subsurface Conductivity (Milli-Seimens/Meter)					
	Nov. 2016	Nov. 2017	Nov. 2018	May 2019	Oct. 2019	Dec. 2019
TH-67	80	75	65	65	65	65
TH-79	100	75	65	65	70	65
TH-83	120	90	85	80	75	70

Conclusion

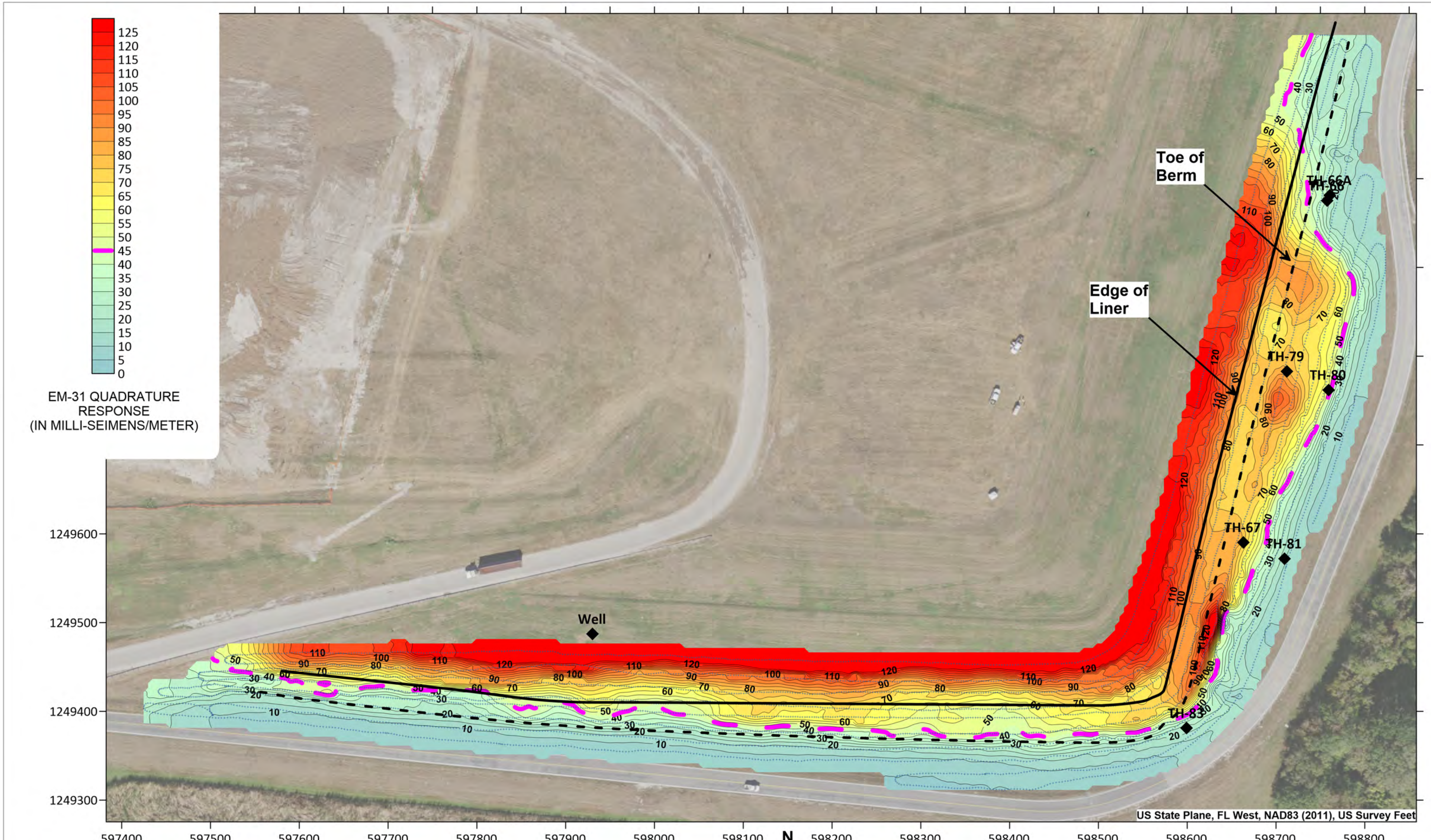
Overall, groundwater quality continues to improve as shown in the most recent groundwater monitoring well sampling events in which the monitored groundwater parameters meet primary drinking water standards. The subsurface conductivity surveys performed by Geoview support these findings by documenting areas that have reduced in bulk conductivity over time; however, as stated in Geoview's report, conductivity results are not entirely attributable to groundwater changes in the presence of varying soil morphology and geology. For example, the presence of clay will usually result in bulk subsurface conductivity readings greater than that of clean sand.

Together, groundwater sampling and subsurface conductivity survey results indicate that the corrective actions implemented by SWMD have isolated and abated the source of previous groundwater impacts observed during quarterly monitoring events.

Attachments

Figure 1

November 2016 Geoview Subsurface Conductivity Figure



EXPLANATION

CONTOUR OF EM31 TERRAIN CONDUCTIVITY RESPONSE (IN MILLI-SEIMENS PER METER)

++++ EM DATA STATIONS

LOCATION OF MONITORING WELL (WITH DESIGNATION)

APPROXIMATE EDGE OF AREA OF ELEVATED CONDUCTIVITY RESPONSE

GeoView A geophysical services company

FIGURE 1

COLOR CONTOUR MAP OF EM-31 TERRAIN CONDUCTIVITY RESPONSE

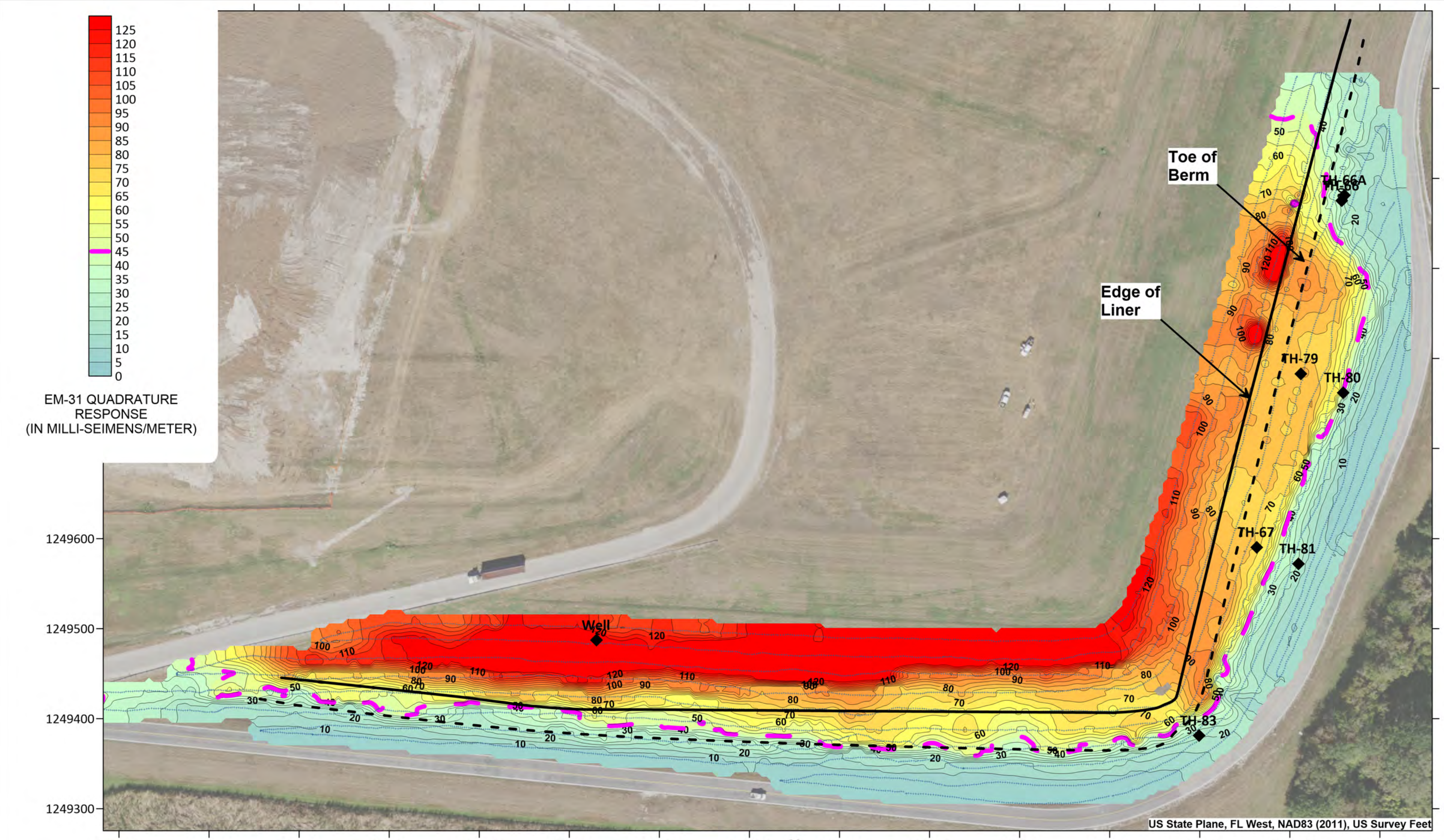
SOUTHEAST COUNTY LANDFILL
DATA COLLECTED NOVEMBER 10, 2016
LITHIA, FLORIDA

SCS ENGINEERS
TAMPA, FLORIDA

PROJECT: 24527.0
DATE: 07/02/19

Figure 2

November 2017 Geoview Subsurface Conductivity Figure



EXPLANATION

CONTOUR OF EM31 TERRAIN CONDUCTIVITY RESPONSE (IN MILLI-SEIMENS PER METER)

++++ EM DATA STATIONS

LOCATION OF MONITORING WELL (WITH DESIGNATION)

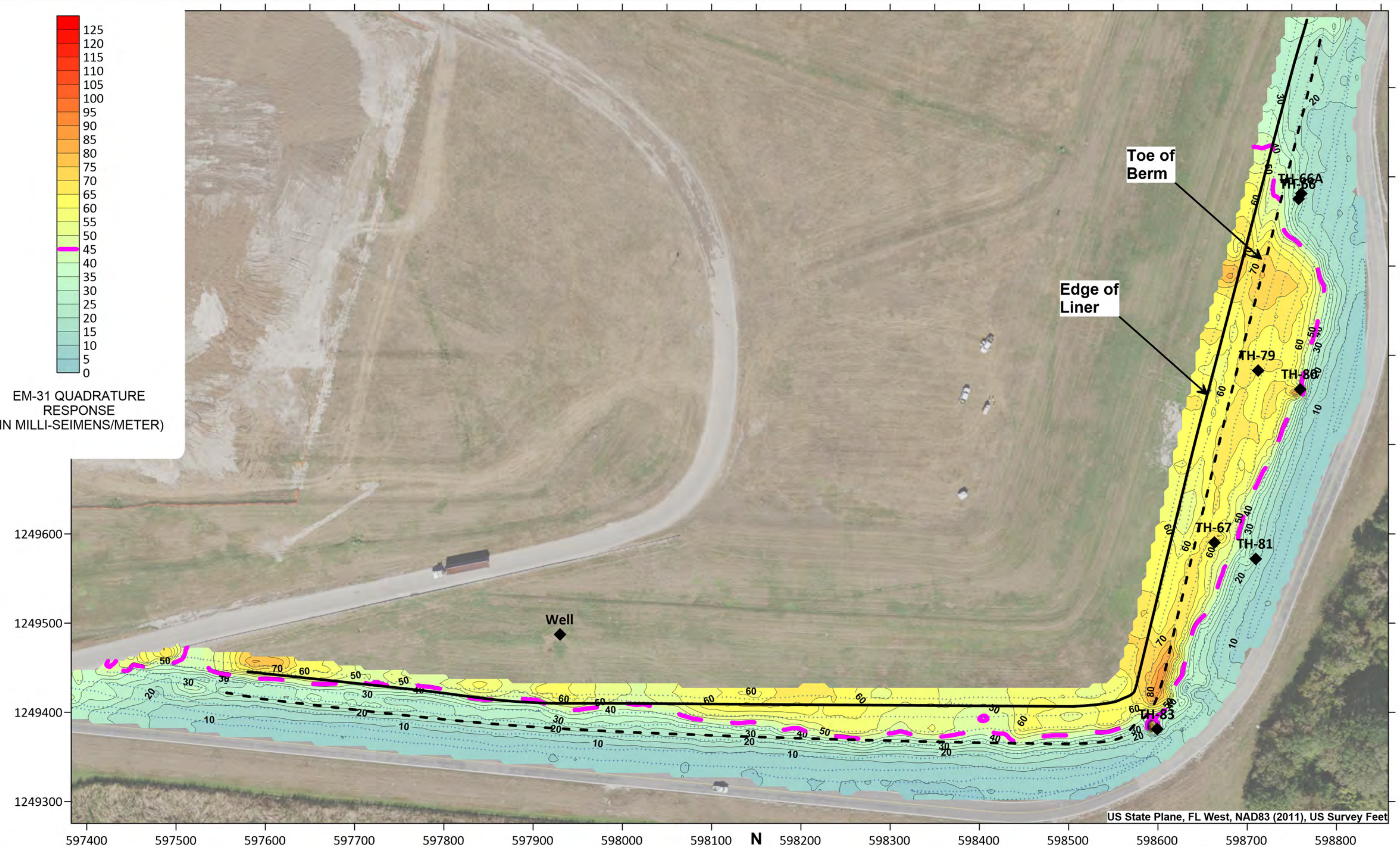
APPROXIMATE EDGE OF AREA OF ELEVATED CONDUCTIVITY RESPONSE

GeoView A geophysical services company

FIGURE 1	SOUTHEAST COUNTY LANDFILL DATA COLLECTED OCTOBER 11, 2017 LITHIA, FLORIDA	
COLOR CONTOUR MAP OF EM-31 TERRAIN CONDUCTIVITY RESPONSE	SCS ENGINEERS TAMPA, FLORIDA	PROJECT: 24527.1 DATE: 07/02/19

Figure 3

November 2018 Geoview Subsurface Conductivity Figure



N

0 50 100

EXPLANATION

CONTOUR OF EM31 TERRAIN CONDUCTIVITY RESPONSE (IN MILLI-SEIMENS PER METER)

++++ EM DATA STATIONS

LOCATION OF MONITORING WELL (WITH DESIGNATION)

APPROXIMATE EDGE OF AREA OF ELEVATED CONDUCTIVITY RESPONSE

GeoView A geophysical services company

FIGURE 1

COLOR CONTOUR MAP OF EM-31 TERRAIN CONDUCTIVITY RESPONSE

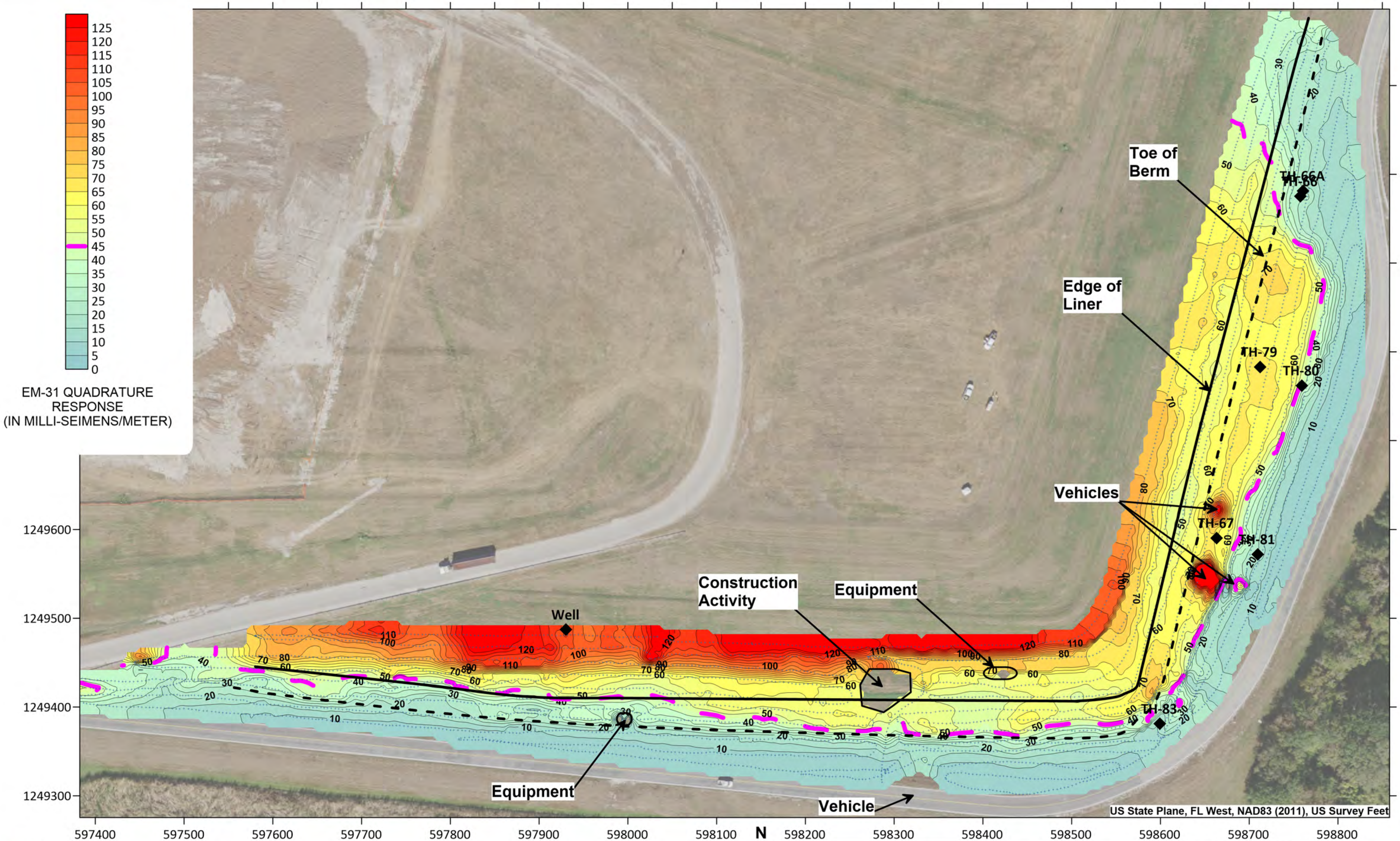
SOUTHEAST COUNTY LANDFILL
DATA COLLECTED NOVEMBER 2, 2018
LITHIA, FLORIDA

SCS ENGINEERS
TAMPA, FLORIDA

PROJECT: 24527.2
DATE: 07/02/19

Figure 4

May 2019 Geoview Subsurface Conductivity Figure



EXPLANATION

CONTOUR OF EM31 TERRAIN CONDUCTIVITY RESPONSE (IN MILLI-SEIMENS PER METER)

++++ EM DATA STATIONS

LOCATION OF MONITORING WELL (WITH DESIGNATION)

APPROXIMATE EDGE OF AREA OF ELEVATED CONDUCTIVITY RESPONSE

N

0 50 100

GeoView A geophysical services company

FIGURE 1

COLOR CONTOUR MAP OF EM-31 TERRAIN CONDUCTIVITY RESPONSE

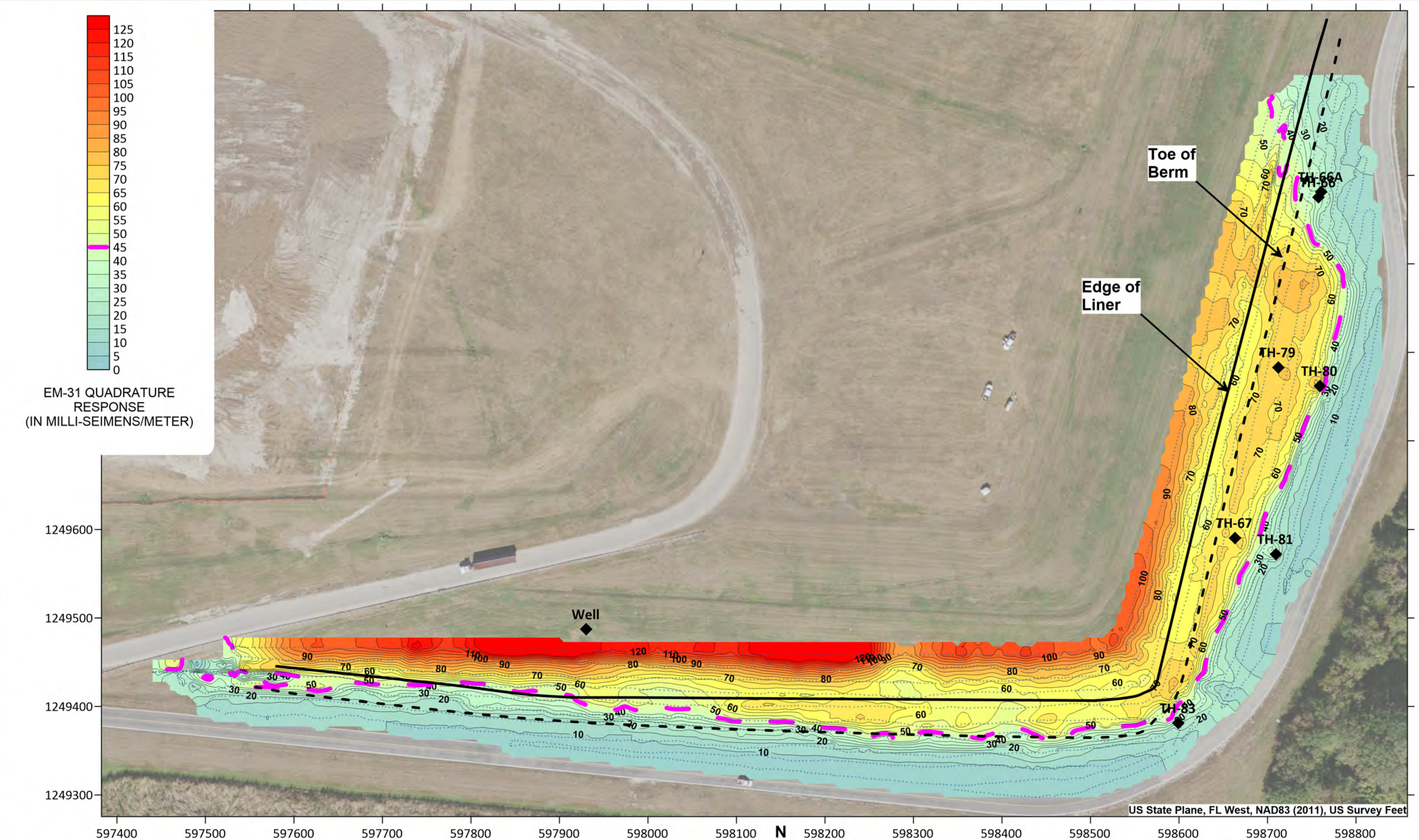
SOUTHEAST COUNTY LANDFILL
DATA COLLECTED MAY 8, 2019
LITHIA, FLORIDA

SCS ENGINEERS
TAMPA, FLORIDA

PROJECT: 24527.3
DATE: 07/02/19

Figure 5

October 2019 Geoview Subsurface Conductivity Figure



EXPLANATION

CONTOUR OF EM31 TERRAIN CONDUCTIVITY RESPONSE (IN MILLI-SEIMENS PER METER)

++++ EM DATA STATIONS

LOCATION OF MONITORING WELL (WITH DESIGNATION)

APPROXIMATE EDGE OF AREA OF ELEVATED CONDUCTIVITY RESPONSE

N

0 50 100

GeoView A geophysical services company

FIGURE 1

COLOR CONTOUR MAP OF EM-31 TERRAIN CONDUCTIVITY RESPONSE

SOUTHEAST COUNTY LANDFILL
DATA COLLECTED OCTOBER 8, 2019
LITHIA, FLORIDA

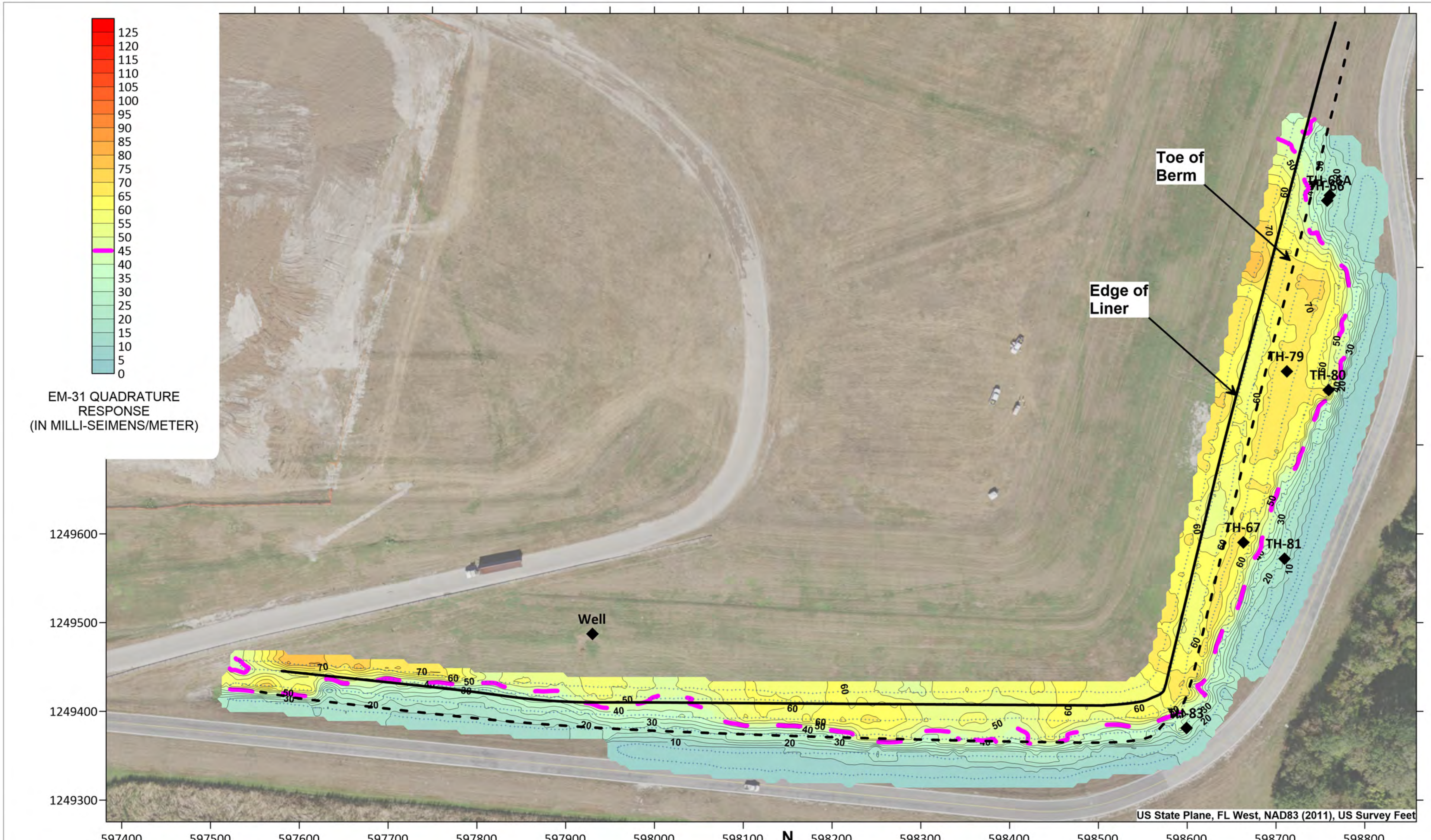
SCS ENGINEERS
TAMPA, FLORIDA

PROJECT: 24527.5
DATE: 10/14/19

Figure 6

December 2019 Geoview Subsurface Conductivity

Figure



EXPLANATION

CONTOUR OF EM31 TERRAIN CONDUCTIVITY RESPONSE (IN MILLI-SEIMENS PER METER)

++++ EM DATA STATIONS

LOCATION OF MONITORING WELL (WITH DESIGNATION)

APPROXIMATE EDGE OF AREA OF ELEVATED CONDUCTIVITY RESPONSE

GeoView
A geophysical services company

FIGURE 1	SOUTHEAST COUNTY LANDFILL DATA COLLECTED DECEMBER 11, 2019 LITHIA, FLORIDA		
COLOR CONTOUR MAP OF EM-31 TERRAIN CONDUCTIVITY RESPONSE	SCS ENGINEERS TAMPA, FLORIDA	PROJECT: 24527.7 DATE: 12/11/19	

Attachment 1

December 2019 Geoview Geophysical Investigation Report

FINAL REPORT
GEOPHYSICAL INVESTIGATION
SOUTHEAST COUNTY LANDFILL - PHASE 9
LITHIA, FLORIDA

Prepared for SCS Engineers
Tampa, FL

Prepared by GeoView, Inc.
St. Petersburg, FL

December 11, 2019

Kollan Spradlin, PE, CHMM
Hillsborough County
3922 Coconut Palm Drive, Suite 102
Tampa, FL 33619

Subject: **Transmittal of Final Report for Geophysical Investigation**
Southeast County Landfill - Phase 9 – Lithia, Florida
GeoView Project Number 24527.9

GeoView, Inc. (GeoView) is pleased to submit the final report that summarizes and presents the results of the geophysical investigation performed at the above referenced site. Electromagnetics were used to help determine the source of elevated shallow groundwater conductivity values observed in one of the on-site monitoring wells. GeoView appreciates the opportunity to have assisted you on this project. If you have any questions or comments about the report, please contact us.

Sincerely,
GEOVIEW, INC.

Michael J. Wightman, P.G.
President
Florida Professional Geologist
Number 1423

Chris Taylor, P.G.
Vice President
Florida Professional Geologist
Number 2256

4610 Central Avenue
St. Petersburg, FL 33711
Tel.: (727) 209-2334
Fax: (727) 328-2477

1.0 Introduction

A geophysical investigation was conducted on December 11, 2019 at the Southeast County Landfill in Lithia, Florida. The geophysical investigation was performed near the southeastern corner of the landfill as specified by Hillsborough County personnel. The geophysical investigation was centered about monitoring well TH-67 where elevated conductivity levels have previously been detected in the shallow groundwater. The purpose of this investigation was to help identify the source of the elevated groundwater conductivity. The geophysical investigation was conducted using frequency domain electromagnetics (EM).

The majority of the study area was previously surveyed using EM in 2016, 2017, 2018 and 2019. Results from the prior investigations were provided in GeoView Project Numbers 24527.0 through 24527.6

2.0 Site Description

The geophysical investigation was performed near the southeast corner of the landfill. The survey area extended from 10 feet inside the edge of the liner of the landfill towards the access road to the south and east of the landfill. The survey area encompassed monitoring wells TH-66, TH-67, TH-79, TH-81 and TH83 as shown on Figure 1.

3.0 Description of Geophysical Investigation

3.1 Instrumentation and Field Procedures

The EM survey was conducted using a Geonics EM31-MK2 (EM-31) ground conductivity meter. The EM-31 survey was conducted using a vertical dipole orientation which provided bulk conductivity readings for the earth materials to an approximate depth of 16 to 18 ft below land surface (bls). Terrain conductivity and inphase data was collected at intervals of every 1 ft along transects spaced approximately 10 to 20 ft apart. The transects were oriented parallel to the edge of the landfill. The positions of the geophysical transect lines were recorded using a Trimble Geo7x. The data then contoured using Surfer^{tm} contouring software.

3.2 Causes for Observed Changes in Terrain Conductivity

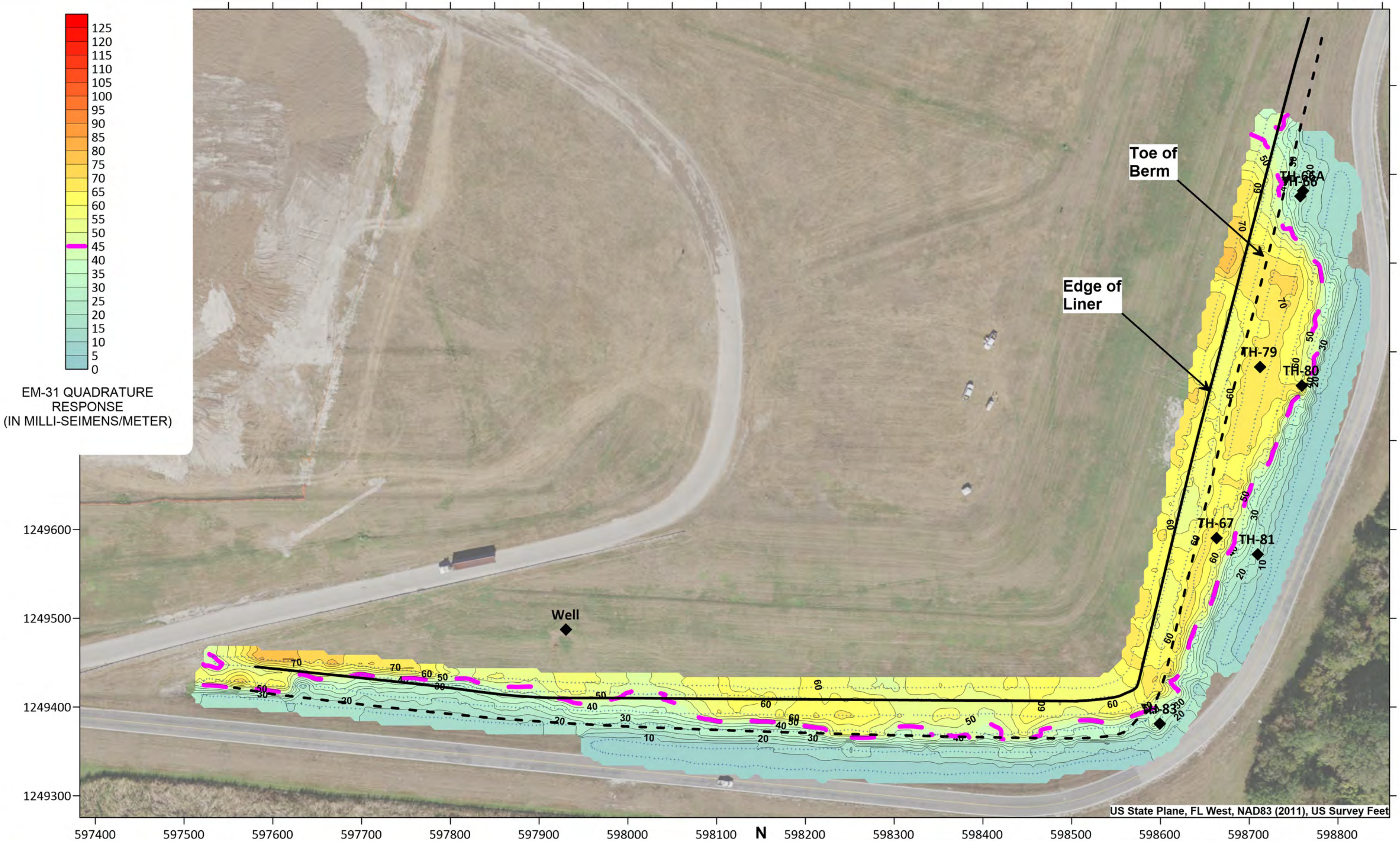
Changes in terrain conductivity, that are not associated with interference effects, can be caused by either changes in geological conditions or changes in the groundwater chemistry. Typical changes that cause increases in terrain conductivity related to geological factors are increases in the clay, silt or organic content of the soils that are within the effective depth of exploration for the EM equipment. Typical changes in the groundwater chemistry that cause increases in terrain conductivity are increases in the concentration of dissolved ions. Increases in either salt or metallic ion concentrations typically have the greatest effect upon increasing the terrain conductivity response.

It is not possible to distinguish the cause of a change in terrain conductivity from variations in geological or groundwater conditions. In order to make such a distinction, it is necessary to collect and analyze soil and groundwater samples in suspect and background areas. For the purposes of this study, it is assumed that any increases in terrain conductivity are associated with increases in conductance of the shallow groundwater.

4.0 Survey Results

The EM-31 terrain conductivity results are presented in Figure 1. The terrain conductivity response measures the bulk conductivity of soil and groundwater and is expressed in milli-siemens per meter (mS/m). Terrain conductivity values considered to represent background conditions ranged up to 50 mS/m. These areas are shown in light blue to light yellow on Figure 1. One broad anomaly area consisting of an elevated conductivity response was identified east and south of the toe of the landfill berm. The area is identified by conductivity values in excess of 45 to 55 mS/m (yellow to red contours on Figure 1). This anomaly area may represent an area of elevated shallow groundwater conductivity. The area extended up to 80 ft east of the toe of the berm. The boundary of this anomaly area is indicated with a magenta dashed line at the 45 mS/m contour level on Figure 1. The boundary of this anomaly has remained relatively unchanged since the previous survey in October 2019 survey (GeoView Project No. 24527.6). Monitoring TH-67 (where elevated groundwater conductivities are present) was located within this area. Monitoring well TH-66 (where elevated groundwater conductivities are not present) is outside of this area.

APPENDIX 1
FIGURE



EXPLANATION

CONTOUR OF EM31 TERRAIN CONDUCTIVITY RESPONSE (IN MILLI-SEIMENS PER METER)

++++ EM DATA STATIONS

LOCATION OF MONITORING WELL (WITH DESIGNATION)

APPROXIMATE EDGE OF AREA OF ELEVATED CONDUCTIVITY RESPONSE

N

0 50 100

GeoView A geophysical services company

FIGURE 1	SOUTHEAST COUNTY LANDFILL DATA COLLECTED DECEMBER 11, 2019 LITHIA, FLORIDA	
COLOR CONTOUR MAP OF EM-31 TERRAIN CONDUCTIVITY RESPONSE	SCS ENGINEERS TAMPA, FLORIDA	PROJECT: 24527.7 DATE: 12/11/19

APPENDIX 2
DESCRIPTION OF GEOPHYSICAL METHODS, SURVEY METHODOLOGIES AND LIMITATIONS

A2.1 On Site Measurements

The measurements that were collected and used to identify the location of the EM-31 data points were made using a Trimble Geo7x GPS. The degree of accuracy of such an approach is typically less than one foot.

A2.2 Electromagnetics

The EM method is a non-destructive geophysical technique that measures the electrical conductivity of subsurface materials. The conductivity is determined by inducing (from a transmitter) a time-varying magnetic field and measuring (with a receiver) the amplitude and phase shift of an induced secondary magnetic field. The EM survey was conducted using a Geonics EM31-MK2 (EM-31). For soil conditions typical to Florida, the EM-31 unit provides a measurement of ground conductivity to a depth of 16 to 18 ft bls.

Variations in subsurface conductivity may be caused by the presence of buried metallic objects or by geological changes such as changes in soil type (clay vs. sand) or variations in pore fluid conductivity. Typical applications for the EM method include:

- Location of buried metallic objects
- Mapping conductive contaminant groundwater plumes (chlorides)
- Mapping of non-conductive (hydrocarbon) contaminant groundwater plumes
- Delineating abandoned trenches or lagoons with fill material different from native soils
- Determining relative concentrations of near-surface conductive soils (clays)
- Delineating bedrock fracture zones
- Identifying large voids or cavities

There are two components of the induced magnetic field measured by the EM-31 equipment. The first is the quadrature-phase (out-of-phase) component that measures the bulk conductivity of soil and groundwater. This is referred to as the terrain conductivity response with units that are expressed in milli-Siemens per meter (mS/m). The second component is the in-phase response that is relatively more sensitive to large metallic objects such as pipes, drums, large items of buried metallic debris and underground storage tanks. This portion of the instrument response is expressed in parts per thousand (ppt). In areas where no metals are present the in-phase response is zero. By using the in-phase and quadrature-phase components, it is possible to determine whether a change in bulk conductivity is due to the presence of buried metallic objects or due to changes in either subsurface soil conditions or pore fluid conductivity.

The EM-31 survey is performed by walking the instrumentation across the project site along a system of parallel transect lines. The separation distance between transect sites is dictated by the survey requirements. For surveys designed to identify relatively large areas of buried debris (e.g., landfills), a transect spacing of 50 to 100 feet is typical. For surveys designed to identify discrete areas of buried debris, a transect spacing of 10 to 20 feet is used. The EM-31 data is electronically recorded and then downloaded to a computer for processing. EM data is usually presented as either profiles (for an individual transect) or as contour maps. Contour maps are developed using Surfer^tm^, a computer contouring program.

The estimated maximum depths of investigation are for homogenous (similar) soil materials that are relatively resistive. Depending upon site conditions, the actual depth of investigation could be 10 to 30 percent less. Also, the measured conductivity value for a particular coil orientation and spacing is representative (in a complex relationship) of all the soil materials between the ground surface and the maximum depth of investigation. In other words, the conductivity measurement is not representative of the actual conductance of the earth materials that occur at the maximum depth of investigation.

GeoView can make no warranties or representations of the conditions that may be present beyond the depth of investigation or resolving capability of the EM method or in areas that were either not accessible to the geophysical investigation or where areas of cultural interference were present.