Geophysical Investigation Using Multi-Electrode Resistivity Implant Technique (MERIT)

Geophysical Investigation Using Multi-Electrode Resistivity Implant Technique (MERIT) CR46A – Section 5, Site B
Contract No. C-9570
FPN: 238275-8-32-01
T.W.O. No. 10.04

Prepared For:

Zachary A. Sullivan, P.E.
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D-5 Geotechnical Department
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G3 Group Project # 15-103G3
January 12, 2016

Photograph 1 View of Geophysical Measurements Primary MERIT Line View Looking North

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December 3, 2015

Mr. Zachary A. Sullivan, P.E.
District Geotechnical Design Engineer
D-5 Geotechnical Department
Florida Department of Transportation

Re: Results MERIT Geophysical Survey CR46A Site B (MERIT) on CR46A –Section 5
Contract No. C-9570
FPN: 238275-8-32-01
T.W.O. No. 10.04

Dear Mr. Sullivan,

The G3 Group is completed the geophysical investigation of the CR46A-Section 5 Site B in Lake County using Multi-Electrode Resistivity Implant Technique (MERIT) to evaluate the deep surface geologic conditions and to better define possible relic karst/sinkhole features.

This report represents our procedures, exhibits and data obtained and presents our conclusions and recommendations.

The G3 Group appreciates the opportunity to provide you with the requested geophysical services. If you have any questions or comments, please feel free to contact us.

G3 Group

David Harro

David Harro PG
Professional Geologist

PROFESSIONAL CERTIFICATION

I am a professional licensed Engineer with the State of Florida and, I or others, under my direct supervision, have prepared the engineering evaluations, findings, opinions, calculations or technical advice.

Don R. Stites P.E. No. 42290
Principal Engineer

I am a professional geologist licensed in the state of Florida and I or others, under my direct supervision, have prepared the geologic evaluations, findings, opinions, calculations or technical advice.

David Harro P.G. No 2593
Senior Forensic Geologist

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1.0 PROJECT DESCRIPTION

The MERIT geophysical survey is located within an area identified as a relic sinkhole called site B of Section 5 of the Wekiva Parkway CR46A **[Figure1].** A preliminary geotechnical investigation was conducted by others at Site B which included the drilling of Standard Penetration Borings (SPT) and a series of Cone Penetrometer Tests (CPT's) between Stations 412+97 to 418+37 to better define the depth and extent of the relic sinkhole **[Figure 2]**.

Based on the geotechnical investigation performed by GEC and the FDOT, the limestone formation was encountered at depths between 60 and 150 feet below land surface (bls). The high degree of variability of the limestone formation encountered in the geotechnical investigation identified the potential for karst or sinkhole conditions which are considered to be a concern for this project. The application of the MERIT system abilities to provide deep geophysical images was deemed beneficial to the project.

2.0 SCOPE AND PURPOSE OF SERVICES

The objective of the MERIT survey was to document any deep geophysical anomalies associated with the possible karst features using G3's patent-pending geophysical Multi-Electrode Resistivity Implant Technique (MERIT).

The Scope of MERIT Geophysical Survey

- Installation of one geophysical MERIT survey line and two offset MERIT survey lines along the alignment
- Implants installed using direct-push technology to a pre-determined depth or refusal based on geologic conditions and the intended geophysical target
- MERIT geophysical survey data collection
- Inversion of the geophysical data
- Report of findings

3.0 REVIEW OF PUBLISHED DOCUMENTS

A review of relevant literature was performed. This included NRCS publications of soil maps surrounding the survey area for engineering properties and properties of the soils. USGS publications of geologic map(s) of the county were reviewed **[Attachment E – Geologic Data].**

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NRCS Publications

According to the United States Department of Agriculture's Natural Resource Conservation Service (NRCS) publication for Lake County, Florida, the site soils are classified in the area of the geophysical survey as being Placid sand, The Placid series consists of very deep, very poorly drained, rapidly permeable soils on low flats, depressions, poorly defined drainage ways on uplands, and flood plains on the Lower Coastal Plain. The Placid series formed in sandy marine sediments. AASHTO Group Classification for the surface is A-2-4.

Florida Geological Survey Publications

A review of the Florida Geological Survey Open File Map Series, "Geologic Map of Lake County and Open File Report 80 Text to Accompany the Geologic Map of Florida" includes:

Undifferentiated Sediments (Pleistocene/Holocene)

Undifferentiated Quaternary Sediments - Much of Florida's surface is covered by a varying thickness of undifferentiated sediments consisting of siliciclastics, organics and freshwater carbonates. Where these sediments exceed 20 feet (6.1 meters) thick, they were mapped as discrete units. In an effort to subdivide the undifferentiated sediments, those sediments occurring in flood plains were mapped as alluvial and flood plain deposits The subdivisions of the Undifferentiated Quaternary Sediments (Qu) are not lithostratigraphic units but are utilized in order to facilitate a better understanding of the State's geology. The siliciclastics are light gray, tan, brown to black, unconsolidated to poorly consolidated, clean to clayey, silty, unfossiliferous, variably organic-bearing sands to blue green to olive green, poorly to moderately consolidated, sandy, silty clays. The lithology: is comprised of clay or mud; beach sand; silt; gravel; peat; sand.

Reworked Cypresshead sediments (Pliocene/Pleistocene)

This unit is the result of post depositional reworking of the Cypresshead siliciclastics. The sediments are fine to coarse quartz sands with scattered quartz gravel and varying percentages of clay matrix. The lithology consist of; sand, gravel, clay or mud.

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Cypresshead Formation (Pliocene)

Cypresshead Formation - The Cypresshead Formation named is composed of siliciclastics and occurs only in the peninsula and eastern Georgia. The Cypresshead Formation is a shallow marine, near shore deposit equivalent to the Citronelle Formation deltaic sediments and the Miccosukee Formation prodeltaic sediments. The Cypresshead Formation consists of reddish brown to reddish orange, unconsolidated to poorly consolidated, fine to very coarse grained, clean to clayey sands. Cross bedded sands are common within the formation. Discoid quartzite pebbles and mica are often present. Clay beds are scattered and not a really extensive. In general, the Cypresshead Formation in exposure occurs above 100 feet (30 meters) above mean sea level (msl). Cypresshead Formation forms part of the surficial aquifer system. The lithology consists of sand; clay or mud.

Hawthorn Group, Coosawhatchie Formation (Miocene)

Coosawhatchie Formation - The Coosawhatchie Formation is exposed or lies beneath a thin overburden on the eastern flank of the Ocala Platform from southern Columbia County to southern Marion County. Within the outcrop region, the Coosawhatchie Formation varies from a light gray to olive gray, poorly consolidated, variably clayey and phosphatic sand with few fossils, to an olive gray, poorly to moderately consolidated, slightly sandy, silty clay with few to no fossils. Occasionally the sands will contain a dolomitic component and, rarely, the dominant lithology will be dolostone or limestone. Silicified nodules are often present in the Coosawhatchie Formation sediments in the outcrop region. The sediment may contain 20 percent or more phosphate. Permeability of the Coosawhatchie sediments is generally low, forming part of the intermediate confining unit/aquifer system. The lithology of the Hawthorn Group typically consists of: sand; clay or mud; silt; dolostone (dolomite); limestone.

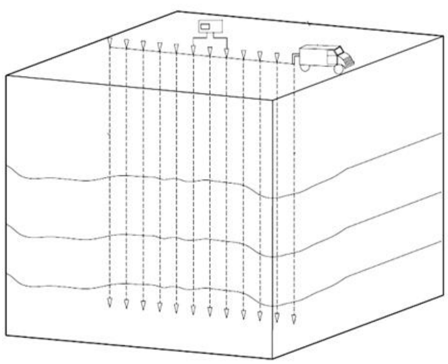
Ocala Limestone (Eocene)

Ocala Limestone - The Ocala Limestone consists of nearly pure limestones and occasional dolostones. It can be subdivided into lower and upper facies on the basis of lithology. The lower member is composed of a white to cream-colored, fine to medium grained, poorly to moderately indurated, very fossiliferous limestone (grainstone and packstone). The lower facies may not be present throughout the areal extent of the Ocala Limestone and may be partially to completely dolomitized in some regions. The upper facies is a white, poorly to well indurated, poorly sorted, very fossiliferous limestone (grainstone, packstone and wackestone). Silicified limestone (chert) is common in the upper facies. The Ocala Limestone is at or near the surface within the Ocala Karst District in the westcentral to northwestern peninsula and within the Dougherty Plain District in the north-central panhandle. In these areas, the Ocala Limestone exhibits extensive karstification. These karst features often have tens of feet (meters) of relief, dramatically influencing the topography of the Ocala Karst District and the Dougherty Plain District. Numerous disappearing streams and springs occur within these areas. The permeable, highly transmissive carbonates of the Ocala Limestone form an important part of the Florida Aquifer System (FAS). It is one of the most permeable rock units in the FAS The lithology consist of: limestone; dolostone (dolomite).

Regional Geomorphology

The study area is within the Wekiva Plain the Wekiva Plain is bounded to the west by the Mount Dora Ridge and to the north by the Marion Upland and the east by the Osceola Plain, and the south by the Orlando Ridge and the Osceola Plain. Elevations within the Wekiva Plain range from less than 15 feet msl to more than 50 feet msl. Elevations in the uplands often exceed 100 feet msl. The transition from the Wekiva Plain to the surrounding uplands takes place over relatively short distances along the western, southern and eastern boundaries of the plain. The transition is more subdued to the north. Karst features are abundant in the uplands surrounding the Wekiva Plain. However, within the lowlands, few karst features other than the springs are evident. As elevations in the plain increase, more karst features can be recognized. Karst processes appear to have been responsible for the formation of the Wekiva Plain (Southeastern Geologic Society Guide Book No.49)

4.0 The MERIT System



MERIT is a unique technology that increases the depth of penetration of resistivity surveys to approximately twice the depth as surface geophysical application. MERIT system also has higher resolution than surface methods due to its tomographic arrangements of surface and buried electrodes (Plate 1) and its propriety mathematically optimized data collection process. Electrodes are placed at the surface and at depth with direct push technology effectively increasing the depth of electrical resistivity.

Plate 1: MERIT Implants Installed by Direct Push and Surface Electrode Locations

5.0 Data Collection

Data Collection Procedures (Standard Electrical Resistivity)

Metal probes (electrodes) are inserted into the ground to obtain a reading of the local electrical resistance. A variety of probe configurations are used, most having four probes. In these systems, two of the probes, called current probes, are used to introduce a current (either direct or low-frequency alternating current) into the earth. The other two probes, called voltage or potential probes are used to measure the voltage, which indicates the local resistivity. In general, greater probe spacing yields greater depth of investigation, but at the cost of sensitivity and spatial resolution. The MERIT system greatly improves the sensitivity and spatial resolution by having tomographic arrangement of two arrays one surface array and a buried array.

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Data Collection (MERIT)

Geophysical investigation using MERIT involved the direct-push drilling installation of 28 implants at 20 foot spacing to approximate depths of 48 feet (below land surface) bls. A total of 1344 linear feet of drilling was accomplished in three (3) days to produce the geophysical array spanning 540 feet between stations 412+97 to 418+37. Over 2000 feet of electrical wire at 28 locations was used to provide the connection of the MERIT subsurface implants to surface data collection. The installation of the MERIT implants was overseen by a G3 Group geologist. An additional 1400 linear feet of wire was used for the offset connections.

Geophysical measurements were taken of the primary line along the center line between stations 412+97 to 418+37 and offset locations at +40 and -40 feet from the center line. The geophysical measurements were taken from 28 surface electrodes and 28 implants for total of 56 electrodes. The G3 Group utilized a propriety optimization code to perform the data collection.

The electrodes were connected to AGI Super Sting 8 channel electrical resistivity instrument. Data collection required several hours for the primary line and the offsets each. Redundant measurements of the primary line and the offset lines were taken to insure the collection of viable data.

Data reduction and inversion was completed back at the G3 office location. Because the MERIT imaging technology is unique by its utilization of two geophysical arrays a full day of effort was performed for the data reduction, quality assurance and inversion process to produce the deep subsurface imaging.

The offset method is unique to MERIT geophysical survey; however care must be taken since the offset profiles are produced at angles. Distortion and relative location of the planes must be taken into consideration when analyzing the offset images. Based on the surface distance the offset is from the primary line. The lower parts of the offset may extend to some distance opposite the primary line. The angle of the MERIT offset can be determined by Tan^{-1} d'/d, where d is the distance from the primary line; in this case 40 feet, and d' is the distance to the implants from the surface, in this case 48 feet.

Thus the angle (a) =Tan^{-1} 48/40 is 50 degrees. The configuration of the offset and angles can be seen in the figure below.

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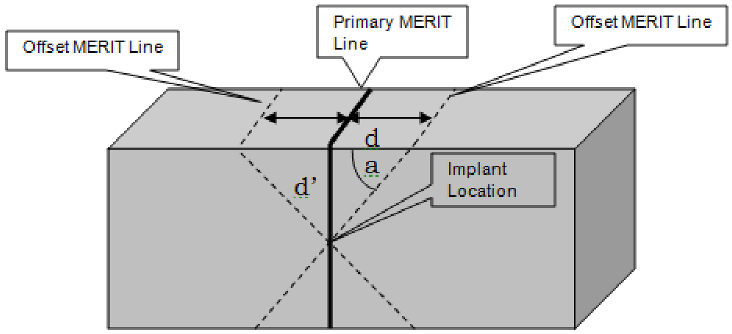

Plate 2: Configuration of the MERIT Offset Locations

MERIT Correlation with Geotechnical Data

One MERIT geophysical surveys and two (2) offset-MERIT surveys were performed to address the relic sinkhole. The MERIT survey lines were designed to provide a subsurface profile that would intersect the previous 26 geotechnical standard penetration test borings and cone penetrometer test performed over the area of investigation. Table 1 shows the boring locations relative to the MERIT geophysical survey(s).

Table 1: MERIT Survey Correlation with Previous Geotechnical Investigation

Location	GPS Location MERIT Start	GPS Location MERIT End	Station No (Start End)	SPT/CPT Borings No.
MERIT Primary Line 1 C/L	28.82449526 81.52165611	28.82589997 81.52144442	418+37 to 412+97	RS25,RS22,RS10,RS16,RS13,RS10,RS8
East Offset MERIT Line	28.82448943 81.52168229	28.826000038 81.52134827	418+37 to 412+97, 40 Feet East	RS24,RS21,RS18,RS15,RS12,RS7
West Offset MERIT Line	28.8244971 81.52168679	28.82599291 81.521578	418+37 to 412+97, 40 Feet West	RS26,RS23,ES20,RS17,RS14,RS11,RS9

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6.0 ANALYSIS OF GEOPHYSICAL DATA COLLECTED BY MERIT

Overview of Results Primary MERIT Line

The primary MERIT line profiles A-A' (stations 418+37 - 412+97) spanned 540 feet along the center line of the alignment and extended over the area of the geotechnical investigation of the relic sinkhole. The MERIT geophysical technique penetrated to approximately 170 feet (below land surface) bls, and identified four distinct Stratums. Based on comparisons of the MERIT survey to the results geotechnical testing the following analysis is given **[See Figure 3A]**.

Stratum 1 (Surficial Sands)

Analysis of the MERIT survey indicates the upper stratum (Red) consisted of a highly resistive unit comprised of sand. Based on the geologic map of Lake County the Stratum 1 sediments are considered to be associated with Cypresshead Formation or the Reworked Cypresshead sediments. Over the MERIT profile length the sand unit varied in thickness from approximately 25 feet bls to over 75 feet bls.

A distinct thickening of Stratum 1 to depths of 75 feet bls can be observed along the profile at approximate stations 417+77 to 415+77. This thickening of the Stratum 1 represents a 320 foot long depression feature that has been filled in by the surficial deposits of sands and silty sands. In contrast, Stratum 1 north of this feature thins to only 25 feet from stations 415+77 to 413+77.

Stratum 2 (Intermediate Varying Deposits)

Stratum 2 is a conductive unit (Blue). From geotechnical investigation Stratum 2 is comprised of various percents of sand/clay/silt and organics and may represent reworked Cypresshead sediments and/or reworked Hawthorn Group, Coosawhatchie Formation.

Stratum 2 unit varied in depth from 25 feet bls to the termination of the MERIT survey at 170 feet bls. Stratum 2 follows a downward slope of underlying Stratum 3 & 4 limestone surfaces at depths from 100 feet bls to 175 feet bls at approximate stations 418+37 at 417+17. Between approximate stations locations at 417+17 and 415+57 Stratum 2 remains consistent at the maximum penetration of the MERIT survey of 175 feet bls.

Stratum 2 sharply rises in elevation to approximate 80 feet bls along the edge of Stratum 3 at approximate station 415+57, after which Stratum 2 is bounded between the Stratum 1 at approximately 25 feet bls and highly variable Stratum 3 between approximate stations locations at 415+57, and 412+97.

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Stratum 3 (Limestone – Weathered Section)

Stratum 3 is identified as a highly variable section of limestone (weathered) potentially associated with Ocala Limestone. Stratum 3 is divided along the MERIT profile as a thin section along the south of the profile, to the section where it is absent in the middle of the profile to a very pronounced highly variable thick section along the north of the profile. From approximate stations 418+37 to 417+17, Stratum 3 is a thin veneer covering the limestone of Stratum 4 at depth ranging from 100 feet bls to 175 feet bls. Between approximate stations locations at 417+17 and 415+57 Stratum 3 is absent. Stratum 3 sharply rises in elevation to approximate 80 feet bls at approximate station 415+57. Stratum 3 is highly variable between approximate stations locations at 415+57, and 412+97 ranging from 60 feet bls to 100 feet bls.

Stratum 4 (Limestone – Competent Section)

Stratum 4 is identified as competent limestone potentially associated with Ocala Limestone. Stratum 4 is also divided along the MERIT profile as a section along the south of the profile to a section where it is absent in the middle of the profile to a corresponding section along the north of the profile.

From approximate stations 418+37 to 417+17, Stratum 4 limestone has a pronounced dipping with depth ranging from 110 feet bls to 175 feet bls. Between approximate stations locations at 417+17 and 415+57 Stratum 4 is absent in the MERIT profile. Stratum 4 is relatively consistent at approximate stations locations from 415+57 to 413+37. The surface Stratum 4 at these locations averages in depth 150 feet bls and extends to 170 feet bls. A review of SPT RS-1 and RS-18, deep SPT borings indicated similar depths of Stratum 3 and Stratum 4.

Summary of Geotechnical Evaluation Compared Primary MERIT Line Results [Figure 3B]

In the geotechnical report produced by GEC (No. 3407G) the Ground Penetrating Radar (GPR) line scan C-C' indicated a geophysical anomaly that was located depths of 25 feet bls. The corresponding geotechnical test RS-25, RS-2, RS-19 and RS-16 were performed in part of the thickened Stratum 1 unit and within the relic sinkhole geometry defined by MERIT survey. RS-13, RS-10 and RS-8 were conducted outside the relic sinkhole geometry defined by MERIT.

The CPT results taken along the center line were compared with the results of a MERIT along the primary line. There is a good correlation between the MERIT Stratum boundaries and the results of the CPT's soil behavior type and noticeable changes in tip resistance. The results of MERIT/CPT comparison can be seen in **Figures 6 through 9**. Of note is the MERIT results are within the accepted electrical resistivity resolution of ½ the electrode spacing to the CPT results.

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The CPT boring RS-8 was performed to a total depth of -92 NAV088 (148 feet bls). The CPT recorded declining tip resistance from +50 NAV088 (8 feet bls) to +36 NAV088 (22 feet bls), where a noticeable spike occurred. Tip values continued to steadily decline to -52 NAV088 (110 feet bls), after which tip values increased to the termination of the boring at 148 feet. The MERIT image at the boring location indicated that Stratum 1 extended to a depth of approximately 20 feet bls, after which Stratum 2 is imaged to approximately 110 feet bls, where Stratum 3 was extended to approximately 140 feet bls where Stratum 4 is shown**[See Figure 6].**

RS-10 a SPT boring encountered loose silty fine sands (SP-SM) through the majority of the boring to 60 and 65 feet bls where 50 N values were obtained. RS-10 was terminated at 65 feet bls. The corresponding MERIT image at this location identified Stratum 1 to approximately 20 feet bls, after which Stratum 2 continued to the intersection of Stratum 3 at approximately 60-65 feet bls.

The CPT boring RS-13 was performed to a depth of +5 feet NAV088 (58 feet bls). CPT tip resistance shows a sharp decline at +34 NAV088 (28 feet bls) continuing to the termination of the boring. The corresponding MERIT image at this location identified Stratum 1 to approximately 25 feet bls after which Stratum 2 was identified **[See Figure 7].**

The SPT boring RS-16 encountered loose fine sands (SP) to 12 feet bls grading to silty fine sands (SM), Clays (CL) and another unit of silty fine sands (SM). The corresponding MERIT image at this location identified Stratum 1 to approximately 18 feet bls after which Stratum 2 was identified.

The CPT boring RS-19 indicated a decline in tip resistance from +20 feet NAV088 to the termination of the boring at -45 feet NAV088. The tip resistance reaches a consistent value below 20 tons/ft2 at approximately +8 feet NAV088 (73 feet bls) and continues to the termination of the boring at -45 feet NAV088 (106 feet bls). The consistent low tip resistance readings at 73 feet bls corresponds to the base Stratum 1 and the intersection of Stratum 2 **[See Figure 8].**

The boring RS-22 consisted of medium dense to dense Sand (SP) and Silty Sand (SP-SM) to total boring depth of 55 feet terminating in the thickened section of the MERIT profile.

The CPT boring RS-25 shows notable decrease in tip pressure at approximate -20 feet NAV088 or approximately 80 feet bls which continued to the termination of the boring at approximately -74 feet (134 feet bls). The location of Stratum 1-2 boundary corresponds to decrease in tip pressures **[See Figure 9]**.

MERIT Offset Results

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Two offset MERIT profiles were performed at -40 left and +40 right of center line station 418+37 to 412+97. The offsets were comprised of 28 surface electrodes that interacted with the 28 implants along the center line between the stations listed. The offset method provides an angled profile to help verify the potential geometry of large subsurface features. Since the offset method is angled it may not to correspond well with vertical geotechnical test locations taken at its maximum extent.

East (-40 Left) MERIT Offset

This MERIT offset profile **[Figure 4]** was closest to the existing pond/karst feature and indicated that the extent of the relic sinkhole feature is blended with a relative variability of materials.. Additionally, the configuration of Stratum 1 can be seen to have consistent depressional in-fill at area in the south of the image with thinning of the Stratum towards the north. Due to angle of the offset the thicken Stratum 1 image may be enlarged. Stratum 2 has also a similar configuration to the primary line. Stratum 3 is not mappable in this offset position. However, Stratum 4 has similar configuration as the primary line.

West (+40 Right) MERIT Offset

This MERIT offset profile **[Figure 5]** indicated that the extent of the relic sinkhole feature is continuous What can be deciphered is consistent depressional in- fill in an area the south of the image, however the Stratum 1 image may be enlarged do to the angled confirmation. Stratum 2 has somewhat of a similar configuration to the primary line. Stratum 3 and 4 are not entirely mappable in this offset position.

7.0 CONCLUSIONS

The MERIT geophysical survey achieved several objectives.

- A complete profile of across the relic sinkhole where a geotechnical investigation was performed to 170 feet bls using a 540 foot long array instead of the required 850-1000 foot surface electrical resistivity to reach similar depths
- The MERIT profile achieved significantly higher resolution at depth than what can be achieved with surface electrical resistivity
- The MERIT profile depth extended to and beyond the depths of the geotechnical investigation or the capacity for typical surface geophysical methods
- The results of the primary MERIT profile indicated a very good correlation with SPT and CPT data obtained during the Geotechnical investigation. A comparison of SPT RS-1 and RS-18, deep SPT borings indicated similar depths of all stratums as the MERIT profile
- MERIT geophysical survey shows a very good potential to correlate CPT data (See comparison in Section 6 of this report)

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- MERIT survey provided geometry of the Stratum 1 layer, in particular an infilled depression area related to the relic sinkhole; an understanding of distribution of Stratum 2 soils deposited that filled in the relic sinkhole, geometry and distribution of the Stratum 3 weathered or karst limestone, and configuration of Stratum 3 competent limestone
- The two offset methods while aiding the understanding of the 3D aspects of the relic sinkhole, did not correlate well with geotechnical testing performed at the extent of the offset, future possibilities for the offset methods would be the 3D integration of multiple offsets within a defined boundary

7.0 LIMITATIONS

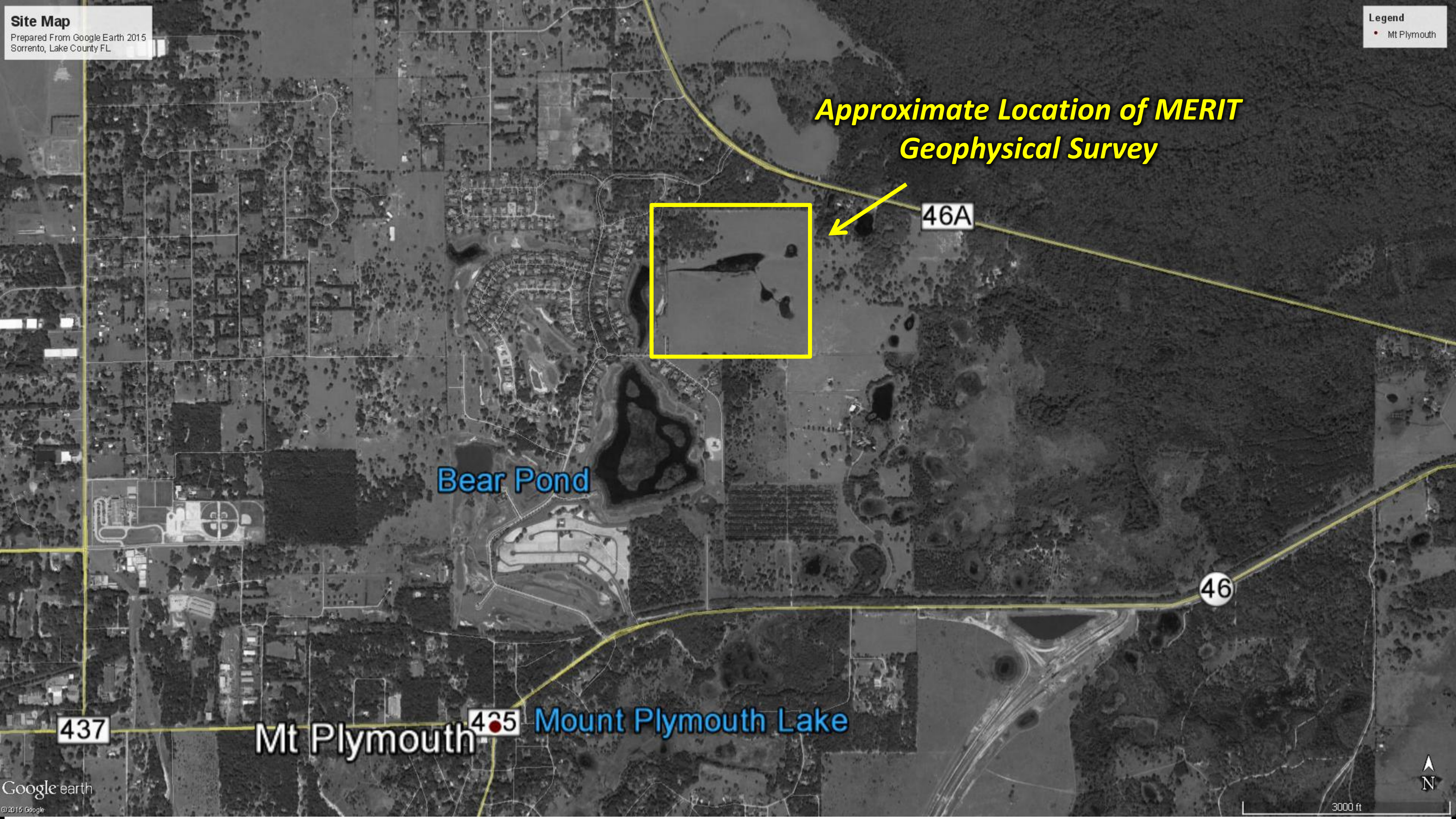
This report is subject to the following limitations. While due care has been exercised in the performance of the measurements and the interpretations described herein; we can make no representations, warranties, or guarantees with respect to latent or concealed conditions, which may exist and that may be beyond the limits of detection with the methods used. No liability can be accepted by us, nor do we accept, in any way, responsibility for defects of any kind arising from a cause that is beyond our immediate control or knowledge, or for any fault in the junction of our work with subsequent work carried out by others.

After tests are performed, conditions may change as a result of subsurface karst erosion, weathering, and/or absorption or loss of moisture. Field measurements are positioned by field methods that are generally accepted in geologic practices and should not be considered to be accurate to that of land surveyor.

8.0 CLOSURE

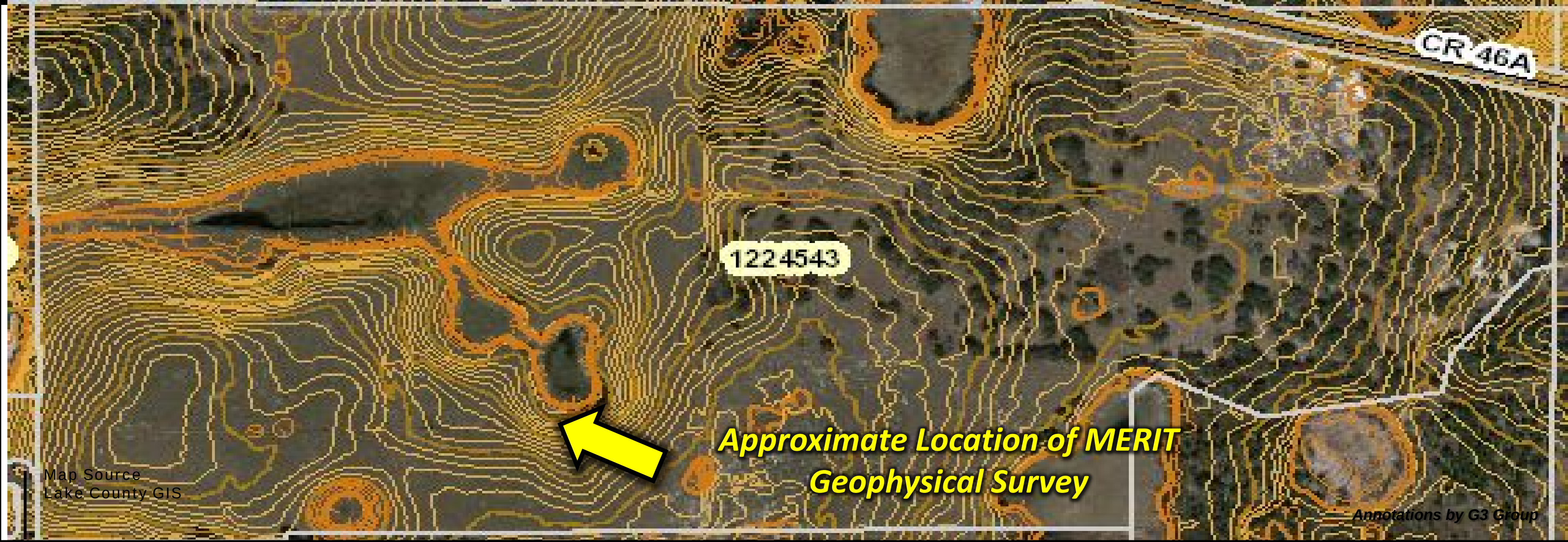
This report is for the exclusive use of our client and is not intended for any other purpose. Our report is based on information made available to us at this time. Should additional information become available, we reserve the right to determine the impact, if any, of the new information on our opinions and conclusions and to revise our opinions and conclusions if necessary and warranted by the discovery of additional information.

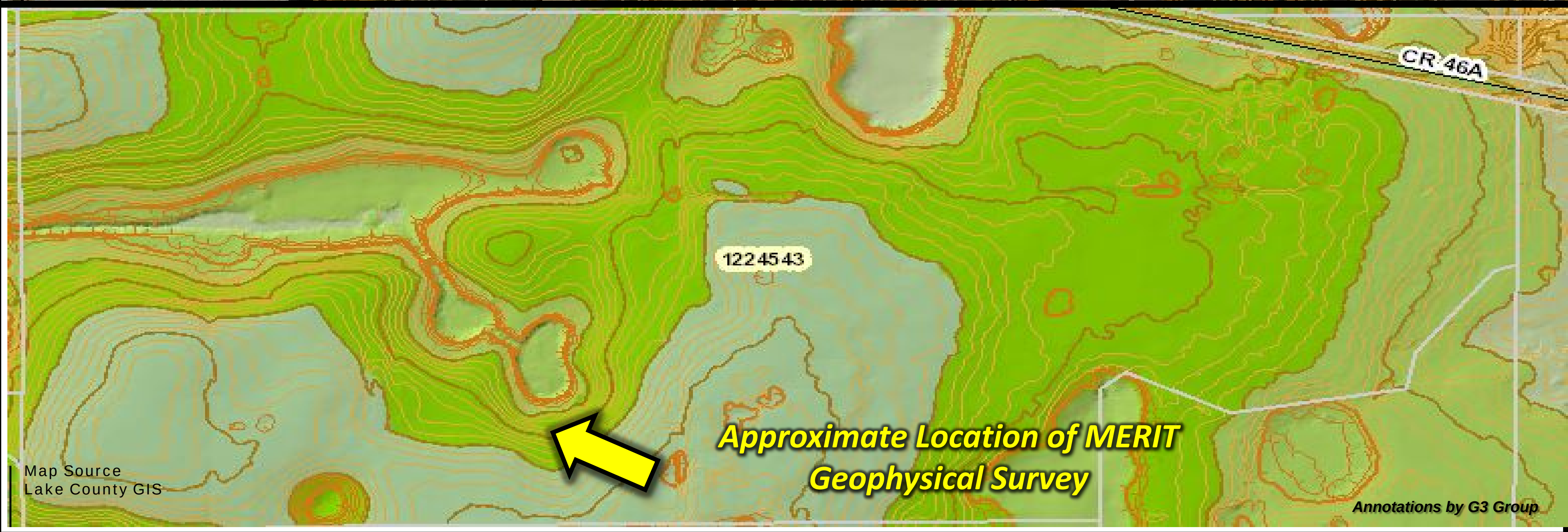
Appendix



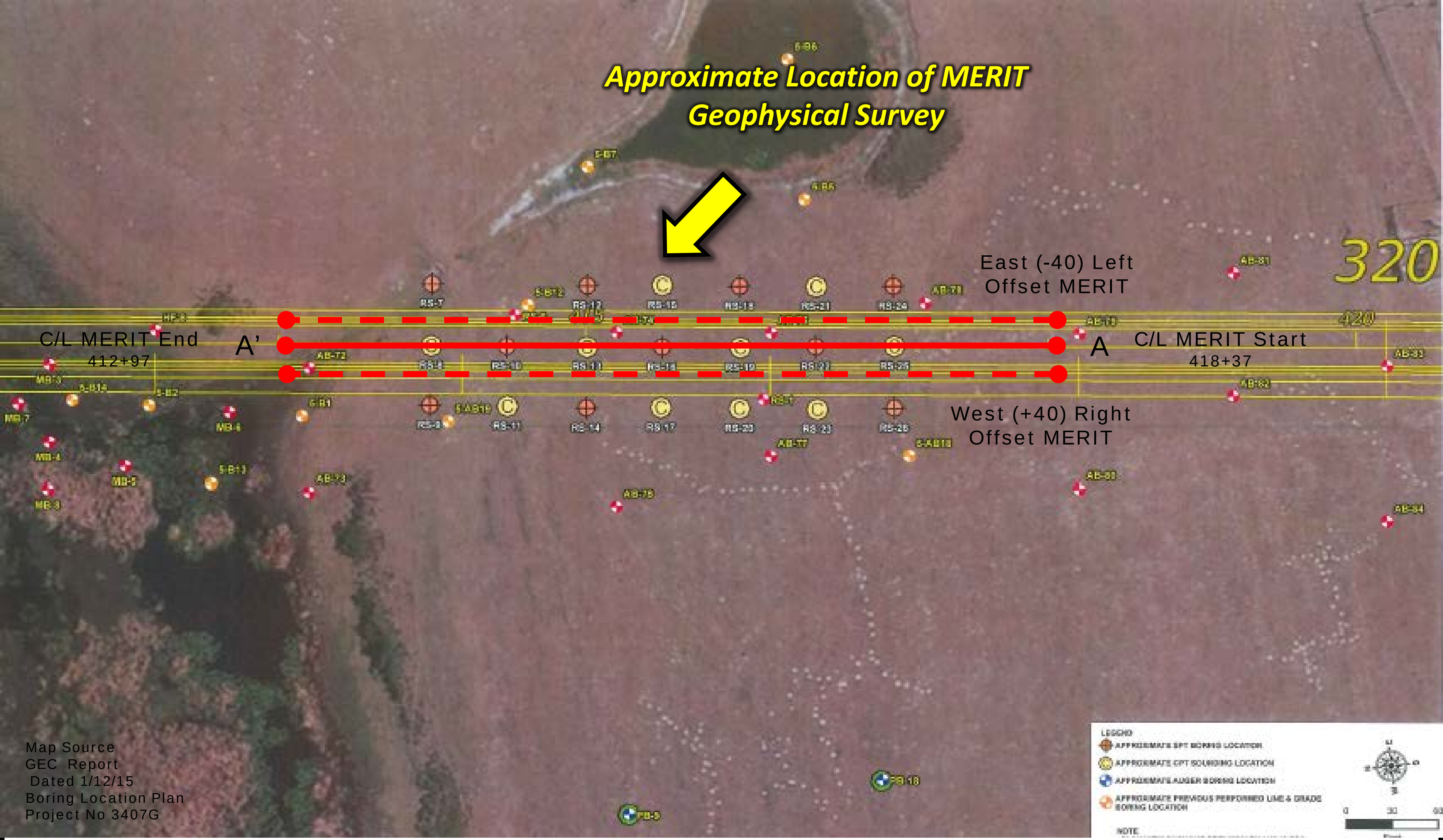
Annotations by G3 Group

G3 GROUP	2509 Success Drive Suite 101 Odessa, FL	**Figure 1 Location Map Showing Location Geophysical Investigation Using Multi-Electrode Resistivity Implant Technique (MERIT) CR46A –Section 5, Site B** **Contract No. C-9570 FPN: 238275-8-32-01** **T.W.O. No. 10.04**	Date:12//03/2015 Project No.15-103G3



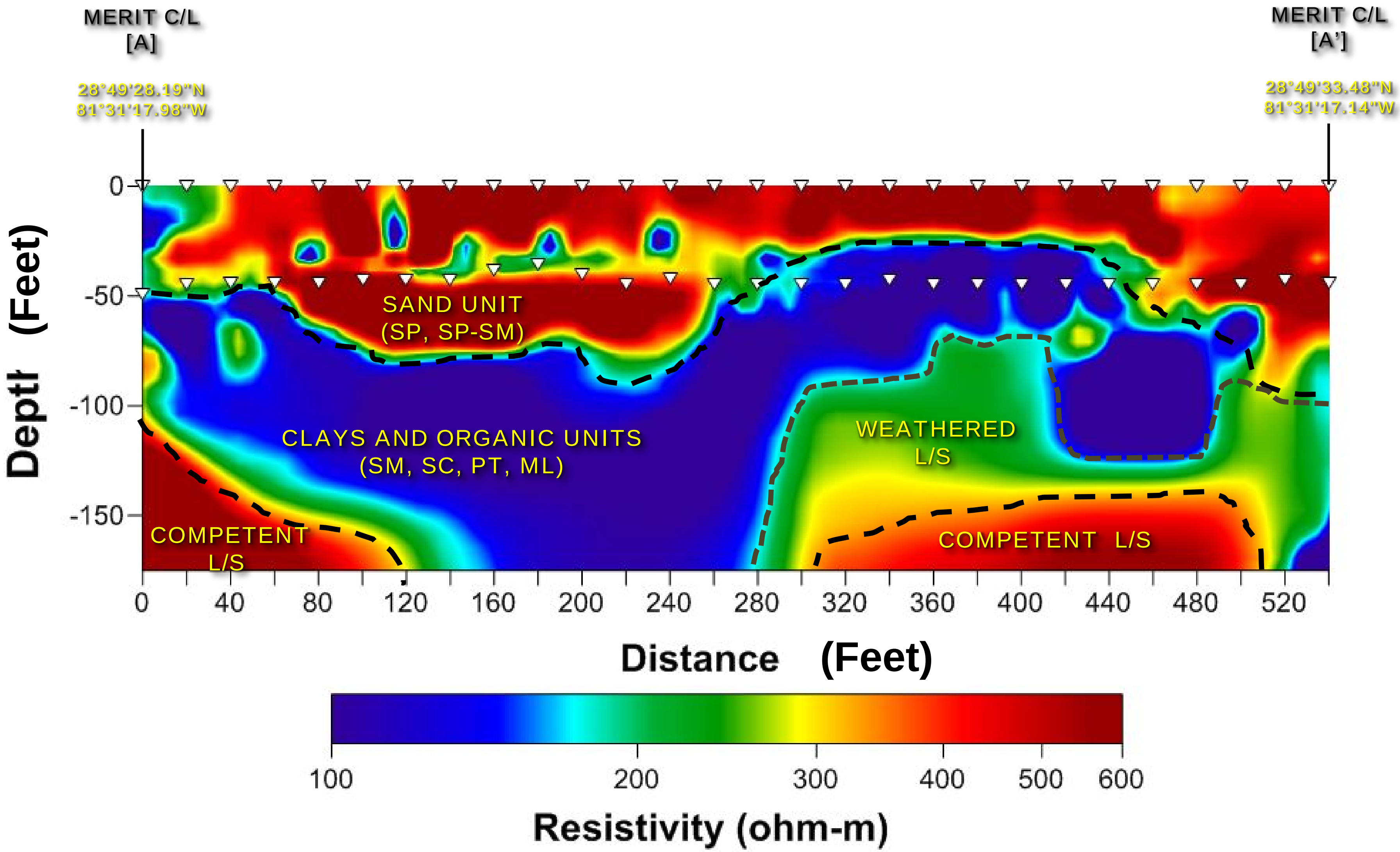


G3 GROUP	2509 Success Drive Suite 101 Odessa, FL	**Figure 2A Approximate Location of Geophysical Survey Site B (MERIT)** **CR46A –Section 5,** **Contract No. C-9570 FPN: 238275-8-32-01** **T.W.O. No. 10.04**	Date:12//03/2015 Project No.15-103G3



Annotations by G3 Group

G3 GROUP	2509 Success Drive Suite 101 Odessa, FL	**Figure 2B Approximate Location of Geophysical Survey Site B (MERIT)** **CR46A –Section 5,** **Contract No. C-9570 FPN: 238275-8-32-01** **T.W.O. No. 10.04**	Date:12//03/2015 Project No.15-103G3

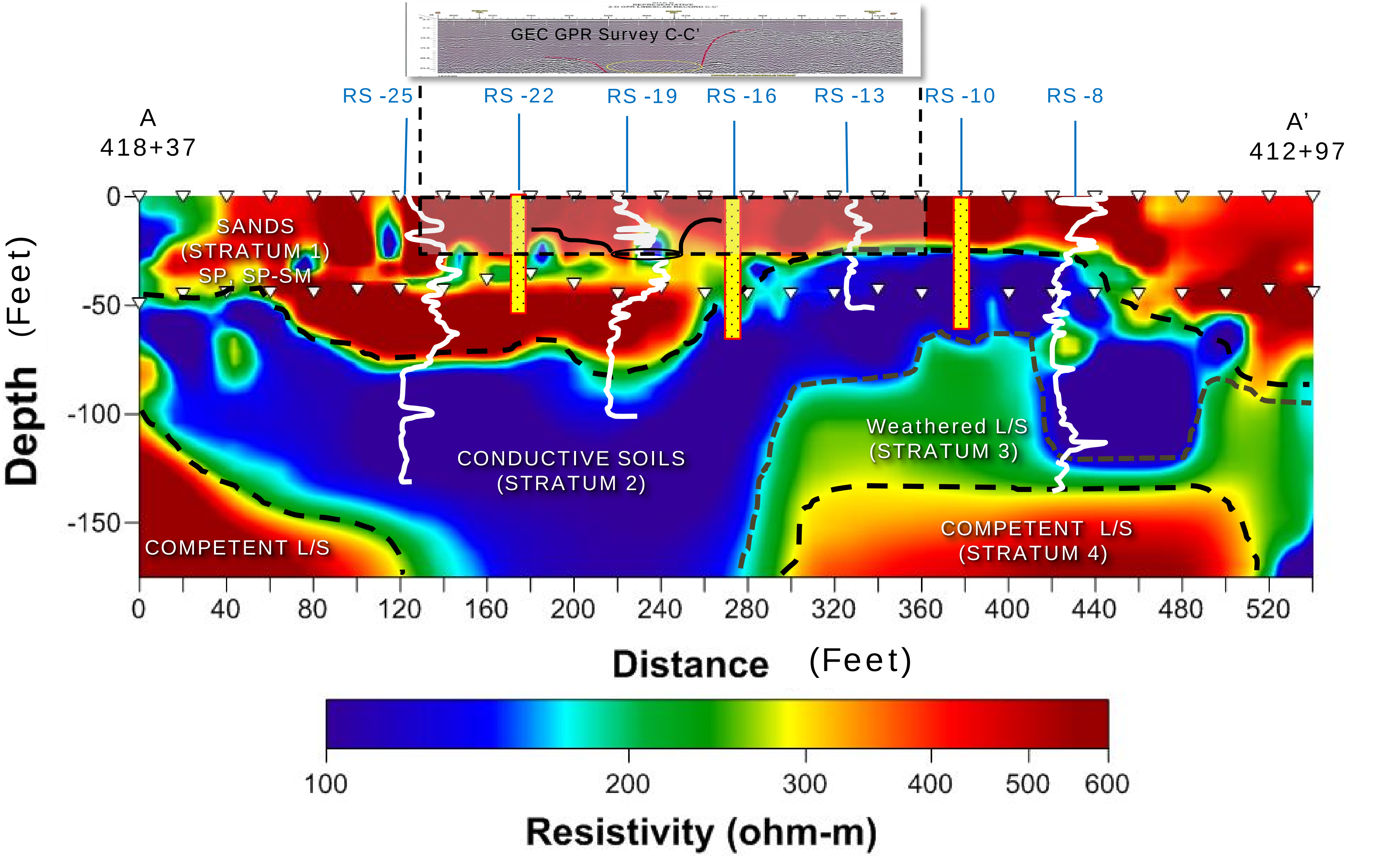


Annotations by G3 Group

G3 GROUP
2509 Success Drive
Suite 101
Odessa, FL

Figure 3A Multi-Electrode Resistivity Implant Technique (MERIT) Primary Line Results
CR46A –Section 5, Site B
Contract No. C-9570 FPN: 238275-8-32-01
T.W.O. No. 10.04

Date:10/29/2015
Project No.15-103G3
N



Annotations by G3 Group

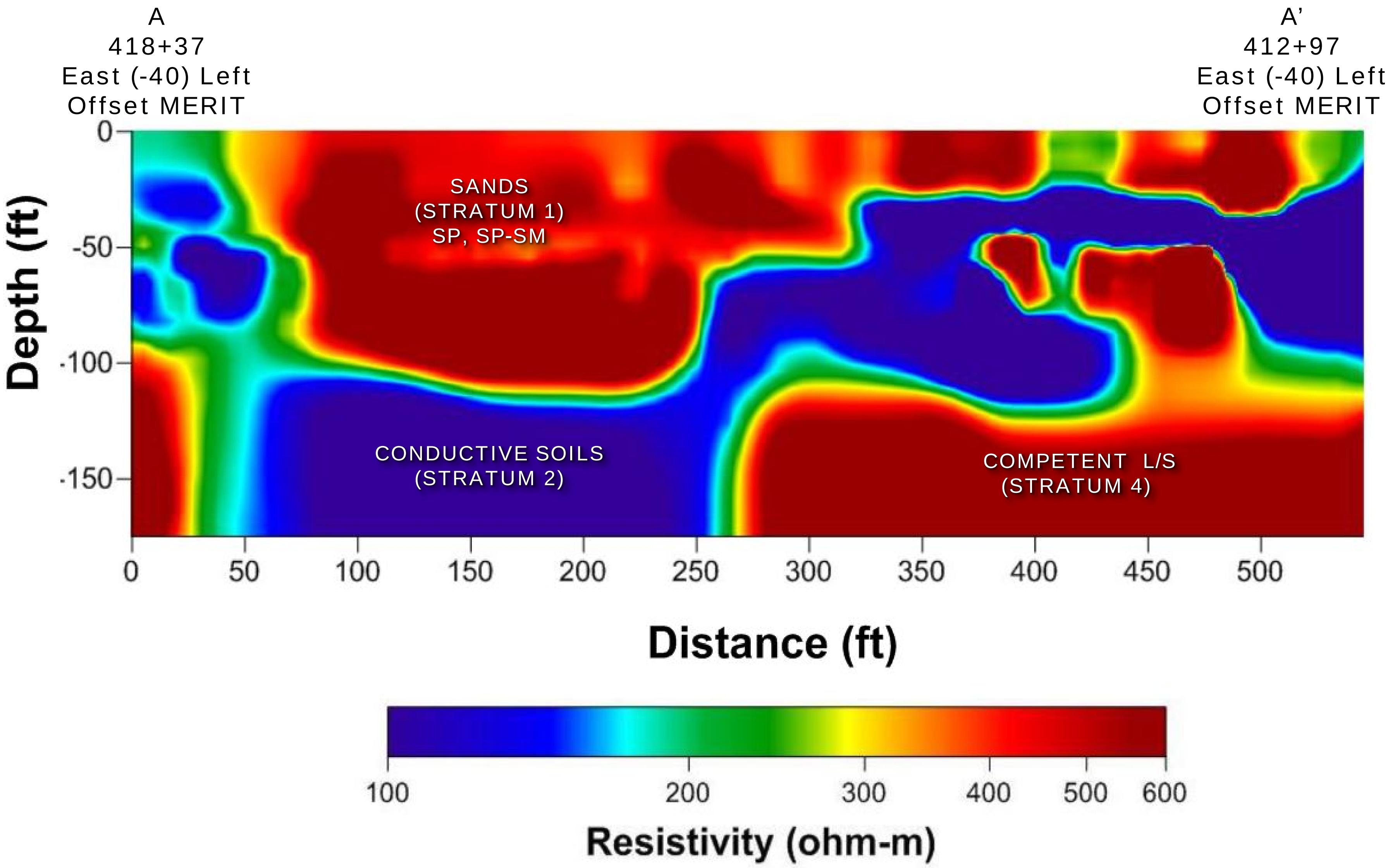
G3 GROUP

2509 Success Drive
Suite 101
Odessa, FL

Figure 3B Comparison of GPR, SPT and CPT to MERIT Primary Line A-A'
CR46A –Section 5, Site B
Contract No. C-9570 FPN: 238275-8-32-01
T.W.O. No. 10.04

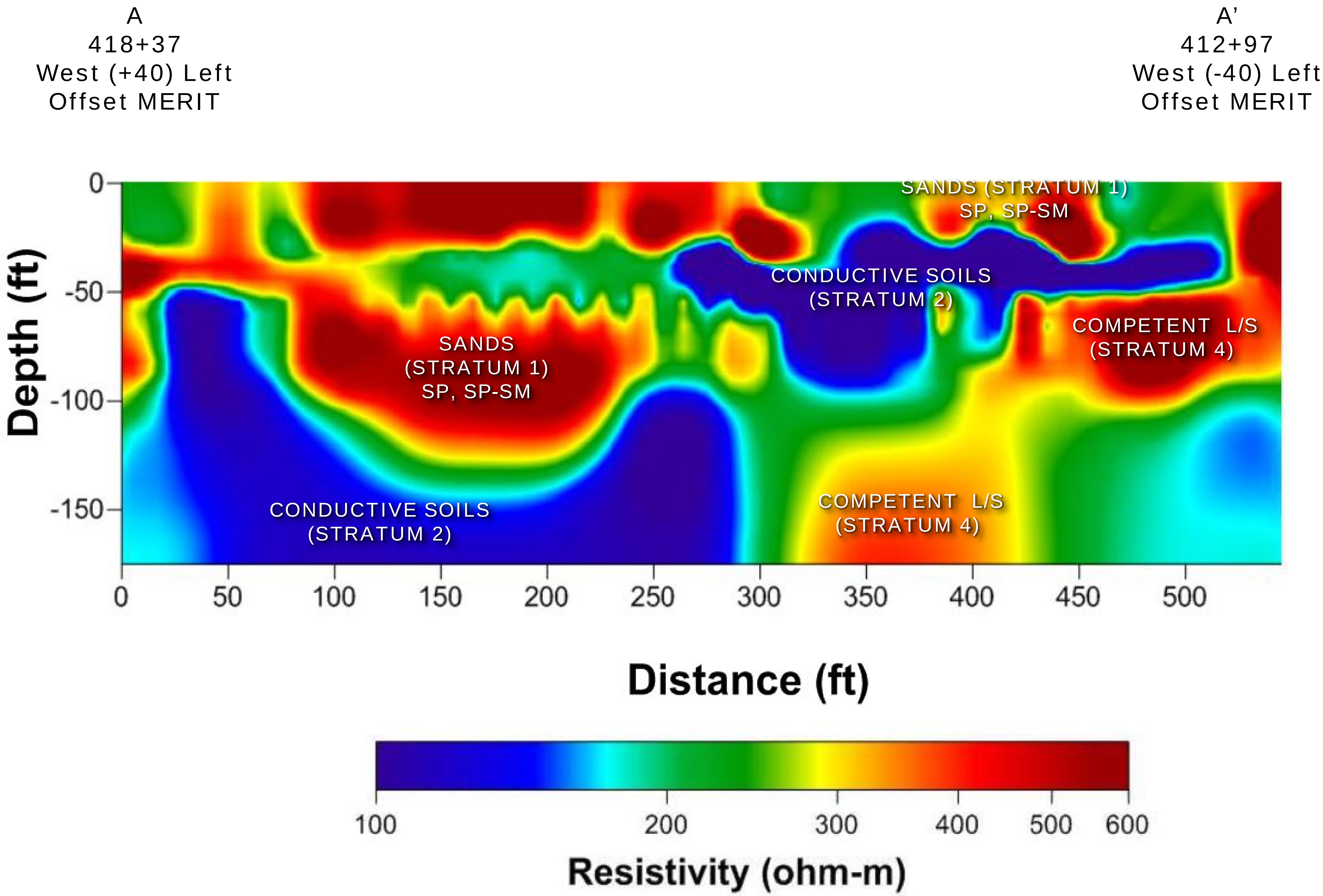
Date:10/2015
Project No.15-103G3

N



Annotations by G3 Group

G3 GROUP	2509 Success Drive Suite 101 Odessa, FL	**Figure 4 MERIT East Offset (-40) Left** **CR46A –Section 5, Site B** **Contract No. C-9570 FPN: 238275-8-32-01** **T.W.O. No. 10.04**	Date:10/29/2015 Project No.15-103G3



Annotations by G3 Group

GROUP

2509 Success Drive
Suite 101
Odessa, FL

Figure 5 MERIT West Offset (+40) Right
CR46A –Section 5, Site B
Contract No. C-9570 FPN: 238275-8-32-01
T.W.O. No. 10.04

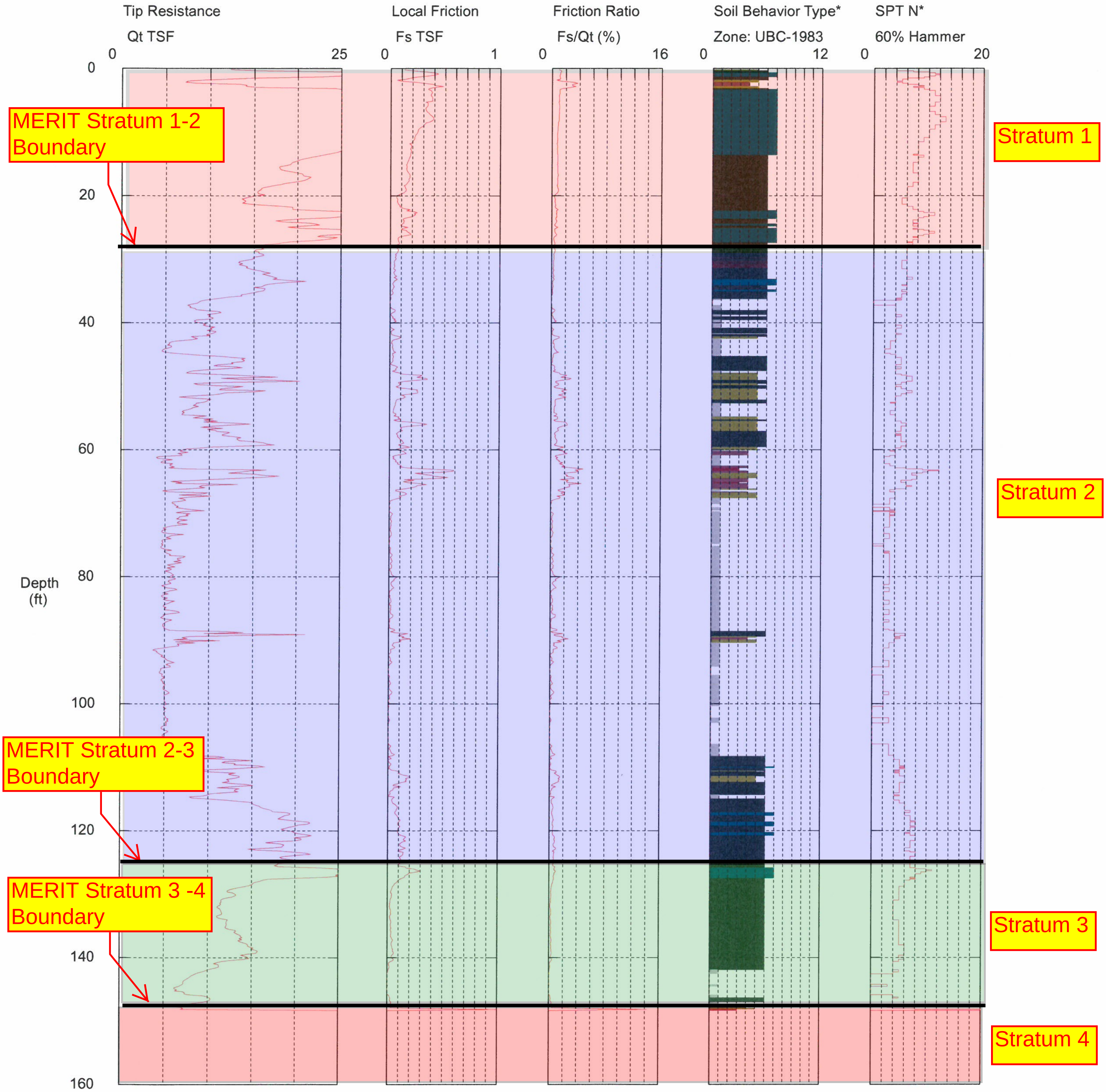
Date:10/29/2015
Project No.15-103G3

Figure 6
Geophysical Survey CR46A
Site B (MERIT)
G3 Project 15-103G3

FLDOT

Operator: JT/MM/JA
Sounding: 8
Cone Used: DSA1007

CPT Date/Time: 2/10/2015 10:55:23 AM
Location: Wekiva Pkwy
Job Number: Wekiva Pkwy



Maximum Depth = 148.29 feet
Depth Increment = 0.164 feet

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

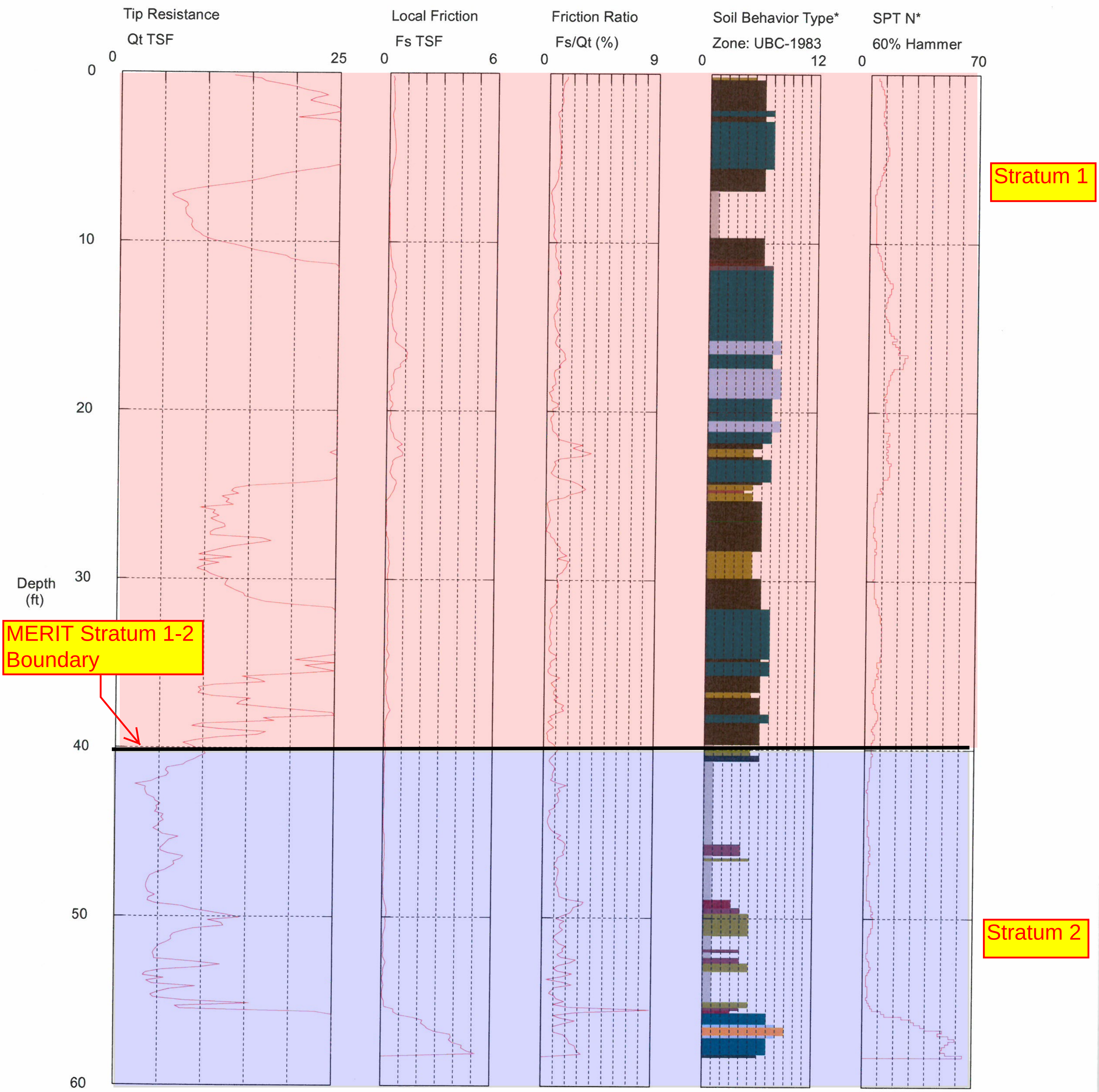
*Soil behavior type and SPT based on data from UBC-1983

Figure 7
Geophysical Survey CR46A
Site B (MERIT)
G3 Project 15-103G3

FLDOT

Operator: JT/MM/JA
Sounding: 13
Cone Used: DSA1007

CPT Date/Time: 2/10/2015 10:15:46 AM
Location: Wekiva Pkwy
Job Number: Wekiva Pkwy



Maximum Depth = 58.23 feet

Depth Increment = 0.164 feet

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

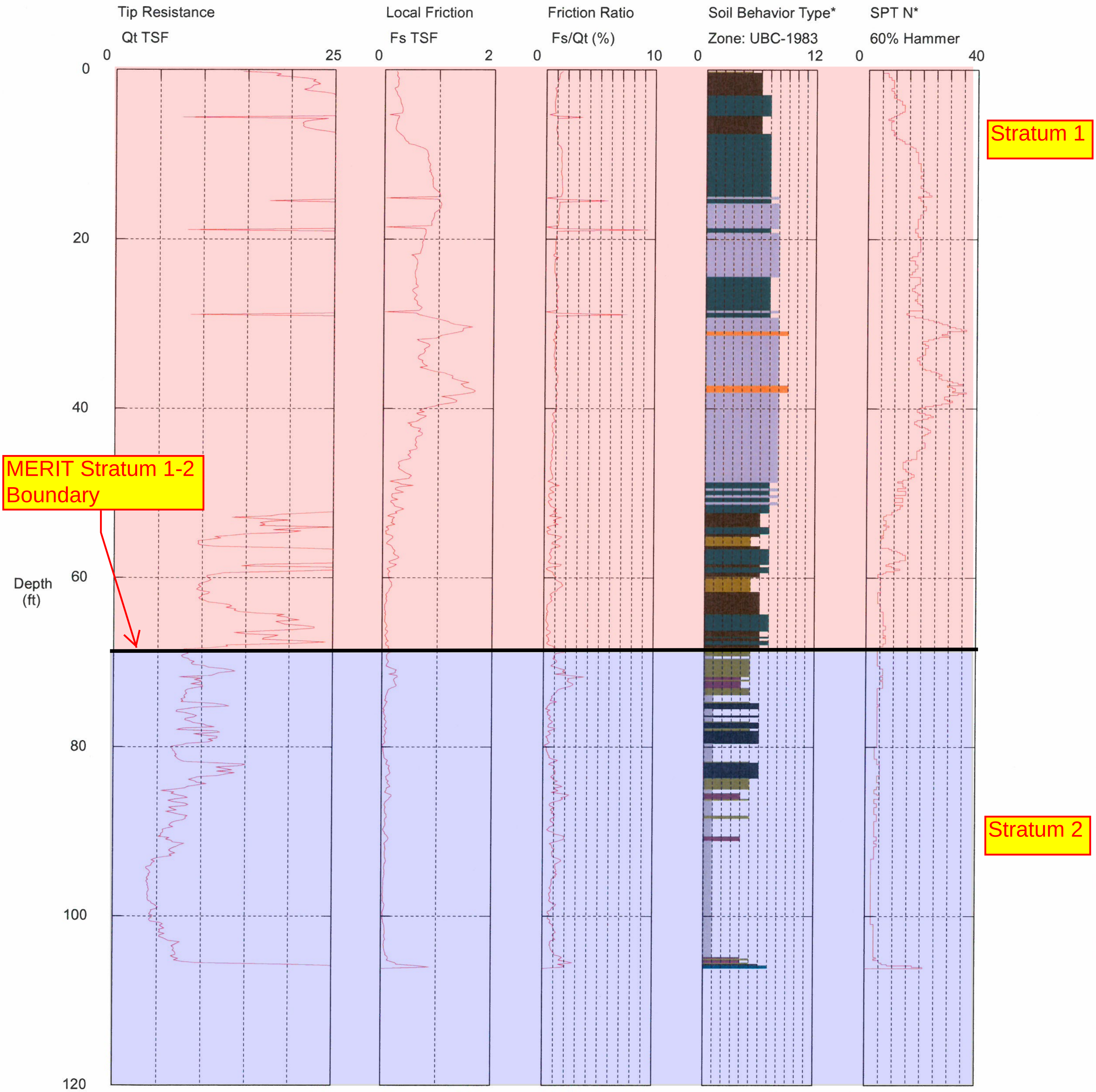
*Soil behavior type and SPT based on data from UBC-1983

Figure 8
Geophysical Survey CR46A
Site B (MERIT)
G3 Project 15-103G3

FLDOT

Operator: JT/MM/JA
Sounding: 19
Cone Used: DSA1007

CPT Date/Time: 2/10/2015 9:13:44 AM
Location: Wekiva Pkwy
Job Number: Wekiva Pkwy



Maximum Depth = 106.14 feet
Depth Increment = 0.164 feet

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

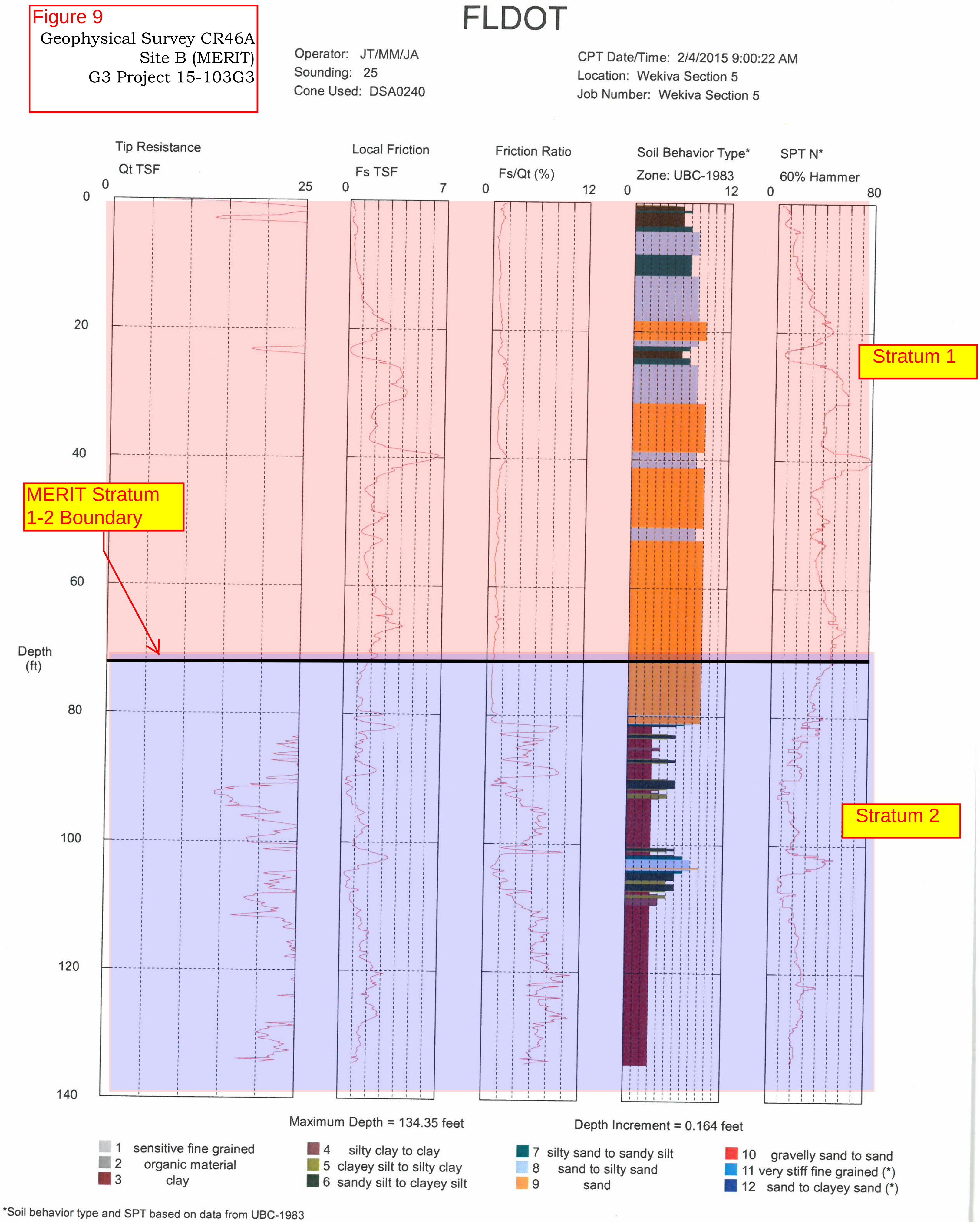


Figure 9
Geophysical Survey CR46A
Site B (MERIT)
G3 Project 15-103G3
FLDOT
Operator: JT/MM/JA
Sounding: 25
Cone Used: DSA0240
CPT Date/Time: 2/4/2015 9:00:22 AM
Location: Wekiva Section 5
Job Number: Wekiva Section 5
Tip Resistance
Qt TSF
0
25
Local Friction
Fs TSF
0
7
Friction Ratio
Fs/Qt (%)
0
12
Soil Behavior Type*
Zone: UBC-1983
0
12
SPT N*
60% Hammer
0
80
0
20
40
60
Depth
(ft)
80
100
120
140
Stratum 1
MERIT Stratum
1-2 Boundary
Stratum 2
Maximum Depth = 134.35 feet
Depth Increment = 0.164 feet
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)
*Soil behavior type and SPT based on data from UBC-1983

Table A: Implant/Electrodes Locations and Depths

Implant Location	Electrode Location	MERIT Primary Line Station Location on C/L	Implant Depth (Feet) Below Land Surface	East Off-Set MERIT Line Station Location	West Off-Set MERIT Line Station Location
1	2	418+37	48	418+37 E40’	418+37 W40’
3	4	418+17	48	418+17 E40’	418+17 W40’
5	6	417+97	48	417+97 E40’	417+97 W40’
7	8	417+77	48	417+77 E40’	417+77 W40’
9	10	417+57	48	417+57 E40’	417+57 W40’
11	12	417+37	48	417+37 E40’	417+37 W40’
13	14	417+17	48	417+17 E40’	417+17 W40’
15	16	416+97	48	416+97 E40’	416+97 W40’
17	18	416+77	48	416+77 E40’	416+77 W40’
19	20	416+57	48	416+57 E40’	416+57 W40’
21	22	416+37	48	416+37 E40’	416+37 W40’
23	24	416+17	48	416+17 E40’	416+17 W40’
25	26	415+97	48	415+97 E40’	415+97 W40’
27	28	415+77	48	415+77 E40’	415+77 W40’
29	30	415+57	48	415+57 E40’	415+57 W40’
31	32	415+37	48	415+37 E40’	415+37 W40’
33	34	415+17	48	415+17 E40’	415+17 W40’
35	36	414+97	48	414+97 E40’	414+97 W40’
37	38	414+77	48	414+77 E40’	414+77 W40’
39	40	414+57	48	414+57 E40’	414+57 W40’
41	42	414+37	48	414+37 E40’	414+37 W40’
43	44	414+17	48	414+17 E40’	414+17 W40’
45	46	413+97	48	413+97 E40’	413+97 W40’
47	48	413+77	48	413+77 E40’	413+77 W40’
49	50	413+57	48	413+57 E40’	413+57 W40’
51	52	413+37	48	413+37 E40’	413+37 W40’
53	54	413+17	48	413+17 E40’	413+17 W40’
55	56	412+97	48	412+97 E40’	412+97 W40’