AE Order Number Banner

Report Description

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PPC OPERATING COMPANY LLC

3/11/2016

EARTH MEASUREMENT CORP.

Environmental & Engineering Geophysics

GEOPHYSICAL INVESTIGATION SURVEY
PPC OPERATING COMPANY, LLC
CAMBIO 31-1
SECTION 31, T15S, R35E
NEW MEXICO

PERFORMED BY:
THE EARTH MEASUREMENT CORP.
DECEMBER 2012

Professionally solving subsurface questions

EARTH MEASUREMENT CORP.
Environmental & Engineering Geophysics

January 2, 2014

Mr. Paul Muthig
Muthig Environmental, Inc.
100 East Springs Road
Columbia, SC 29223

TEL: 803.351.1048

RE: GEOPHYSICAL INVESTIGATION SURVEY - ELECTROMAGNETICS
PPC OPERATING COMPANY, LLC – CAMBIO 31-1
SECTION 31, T15S, R35E, NEW MEXICO

EMC Project # **ME121323**

Dear Mr. Muthig,

This report describes the results of a geophysical survey performed by the Earth Measurement Corp. (**EMC**) at the PPC Operating Company, LLC – Cambio 31-1 site located at Section 31, T15S, R35E in New Mexico.

SCOPE

The scope of this project was to delineate any areas of elevated conductivity as well as to attempt to locate any underground utilities, pipelines or unusual anomalies within the survey area.

ACQUISITION

EMC fielded a two-person crew for the acquisition phase of this project: Professional Geoscientist - Joe Austin and Operations Manager - Harold Fulton. **EMC** used Differentially Corrected Global Positioning System (DGPS) equipment to provide coordinate control for the geophysical data.

EQUIPMENT

The electromagnetic instrument used was the GEONICS ELECTROMAGNETIC METER, MODEL EM-31. The EM-31 provides a means of measuring the electrical conductivity of subsurface soil, rock and ground water. Electrical conductivity is a function of the soil and rock, its porosity, its permeability and the fluids which fill the pore spaces. The EM-31 has two modes of operation: In-phase and quadrature. Quadrature mode measures the general conductivity of the ground while the in-phase

mode detects the conductivity changes associated with buried objects in the subsurface to a depth of approximately eighteen (18') feet.

More information on the EM Instrument can be found in the Equipment Descriptions section of this report.

PROCESSING

After the data were acquired, geotechnical software was utilized to process the EM information for the Earth's normal field of adjustments, terrain corrections and filtering to discriminate against extraneous interference. The EM data were contoured using Golden Software's Surfer10 contouring and mapping program.

INTERPRETATION

A thorough review of the geophysical data indicates the following:

Please refer to the Interpretive Map for detailed information. The Interpretive Map displays all information graphically. All areas of elevated conductivity as well as any possible pipelines or other anomalous areas are indicated. Two versions of the Interpretive Map were created. Interpretive Map 1 shows the actual contours of the higher conductive areas encircled by the magenta contour. The Interpretive Map 2 shows only the magenta-hatched pattern of the elevated conductivity areas.

If there are any questions concerning the interpretation, **EMC** personnel are always available to answer any questions.

DELIVERABLES

Included with this report are two copies of the following items:

- Equipment Descriptions
- Site Maps
- Electromagnetic Maps:
  - EM-31 Quadrature
  - EM-31 Inphase
- Interpretive Maps

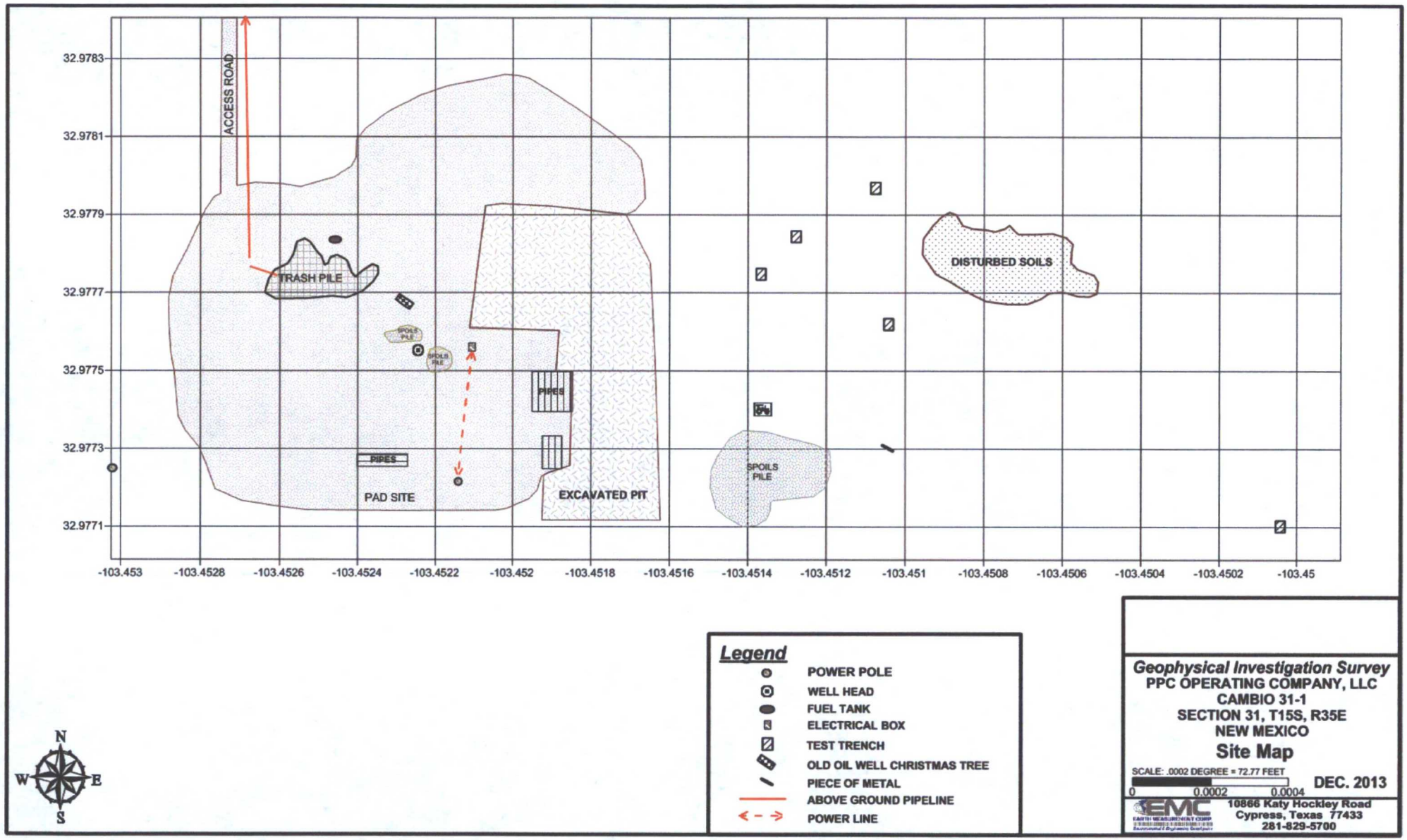
STATEMENT

Electromagnetic data are not definitive measures in obstructed environments and should not be the only methods used to define the boundaries of sub-surface anomalies. The interpretation of the processed data describes the anomalies as closely as possible. The survey results described in this report and illustrated on the Interpretive Maps represent theories supported by the evidence of the data collected. Based on experience and expertise in the field, **EMC** has every confidence in the results.

Please be advised that original project data will be held in **EMC**'s offices for a period of six months. After that time, the data will be destroyed. **EMC** personnel are always ready to answer any questions about this project. Please do not hesitate to call.

Thank you for this opportunity.

Joe M. Austin
Texas Professional Geoscientist
License # 5336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PAD SITE
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SPOILS PILE
DISTURBED SOILS
Legend
POWER POLE
WELL HEAD
FUEL TANK
ELECTRICAL BOX
TEST TRENCH
OLD OIL WELL CHRISTMAS TREE
PIECE OF METAL
ABOVE GROUND PIPELINE
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Geophysical Investigation Survey
PPC OPERATING COMPANY, LLC
CAMBIO 31-1
SECTION 31, T15S, R35E
NEW MEXICO
Site Map
SCALE: .0002 DEGREE = 72.77 FEET
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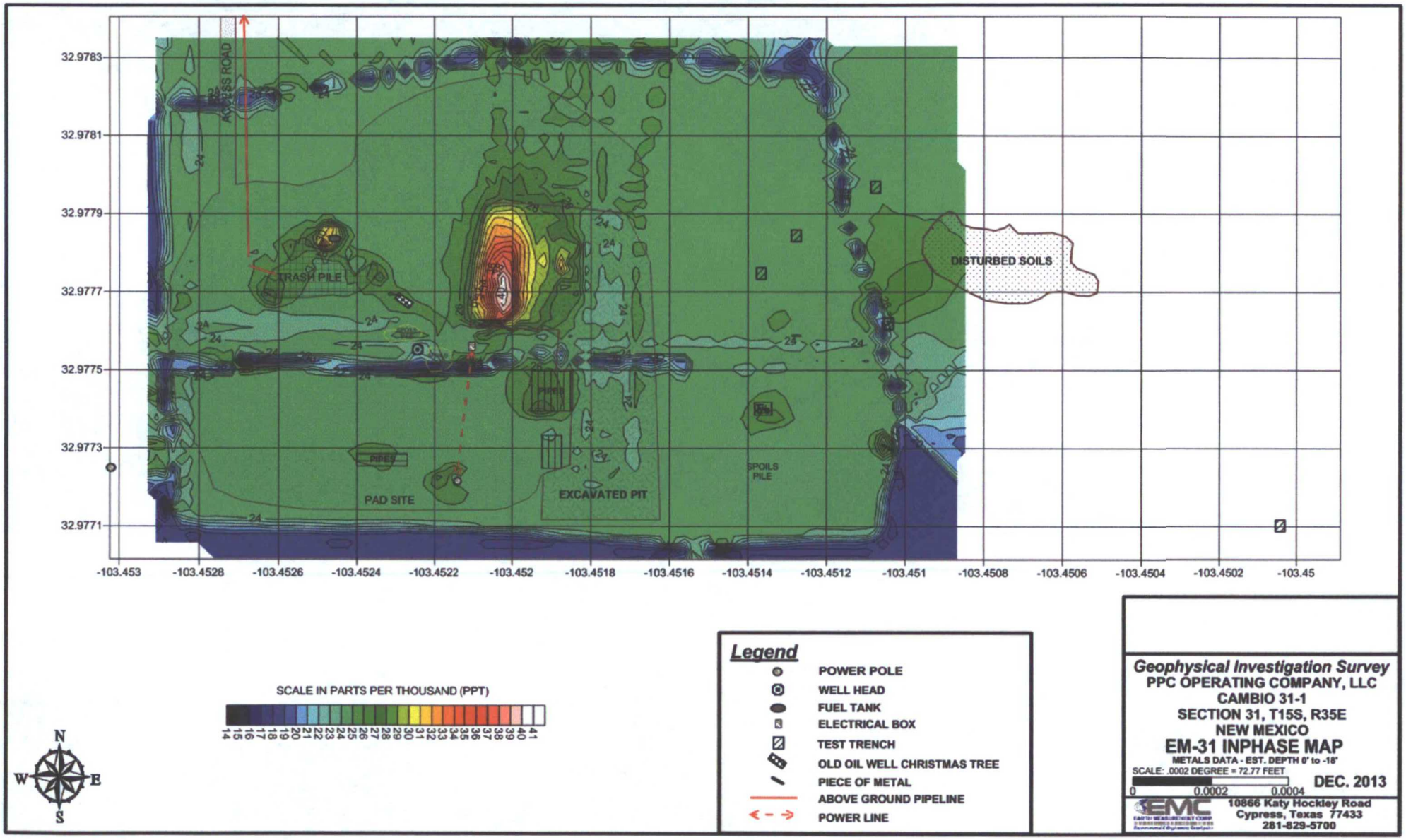
DEC. 2013
EMC
10866 Katy Hockley Road
Cypress, Texas 77433
281-829-5700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TRASH PILE
DISTURBED SOILS
PIPES
PAD SITE
EXCAVATED PIT
SPOILS PILE
SCALE IN PARTS PER THOUSAND (PPT)
14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41
N
W
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Legend
POWER POLE
WELL HEAD
FUEL TANK
ELECTRICAL BOX
TEST TRENCH
OLD OIL WELL CHRISTMAS TREE
PIECE OF METAL
ABOVE GROUND PIPELINE
POWER LINE
Geophysical Investigation Survey
PPC OPERATING COMPANY, LLC
CAMBIO 31-1
SECTION 31, T15S, R35E
NEW MEXICO
EM-31 INPHASE MAP
METALS DATA - EST. DEPTH 0' to -18'
SCALE: .0002 DEGREE = 72.77 FEET
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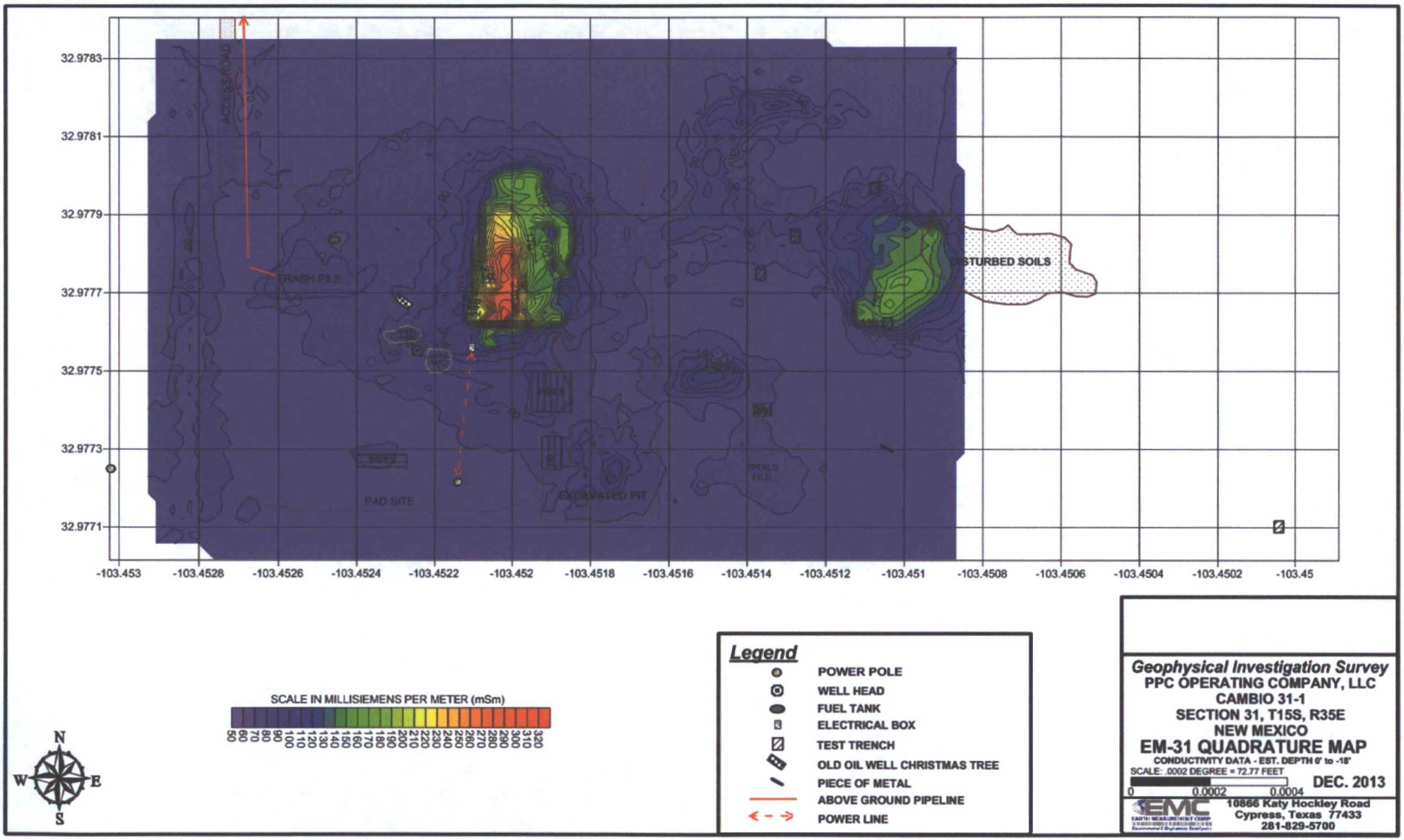
DEC. 2013
EMC
10866 Katy Hockley Road
Cypress, Texas 77433
281-829-5700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ACCESS ROAD
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DISTURBED SOILS
PAD SITE
EXCAVATED PIT
SPOILS PILE
SCALE IN MILLISIEMENS PER METER (mSm)
50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320
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Legend
POWER POLE
WELL HEAD
FUEL TANK
ELECTRICAL BOX
TEST TRENCH
OLD OIL WELL CHRISTMAS TREE
PIECE OF METAL
ABOVE GROUND PIPELINE
POWER LINE
Geophysical Investigation Survey
PPC OPERATING COMPANY, LLC
CAMBIO 31-1
SECTION 31, T15S, R35E
NEW MEXICO
EM-31 QUADRATURE MAP
CONDUCTIVITY DATA - EST. DEPTH 0' to -18'
SCALE: .0002 DEGREE = 72.77 FEET
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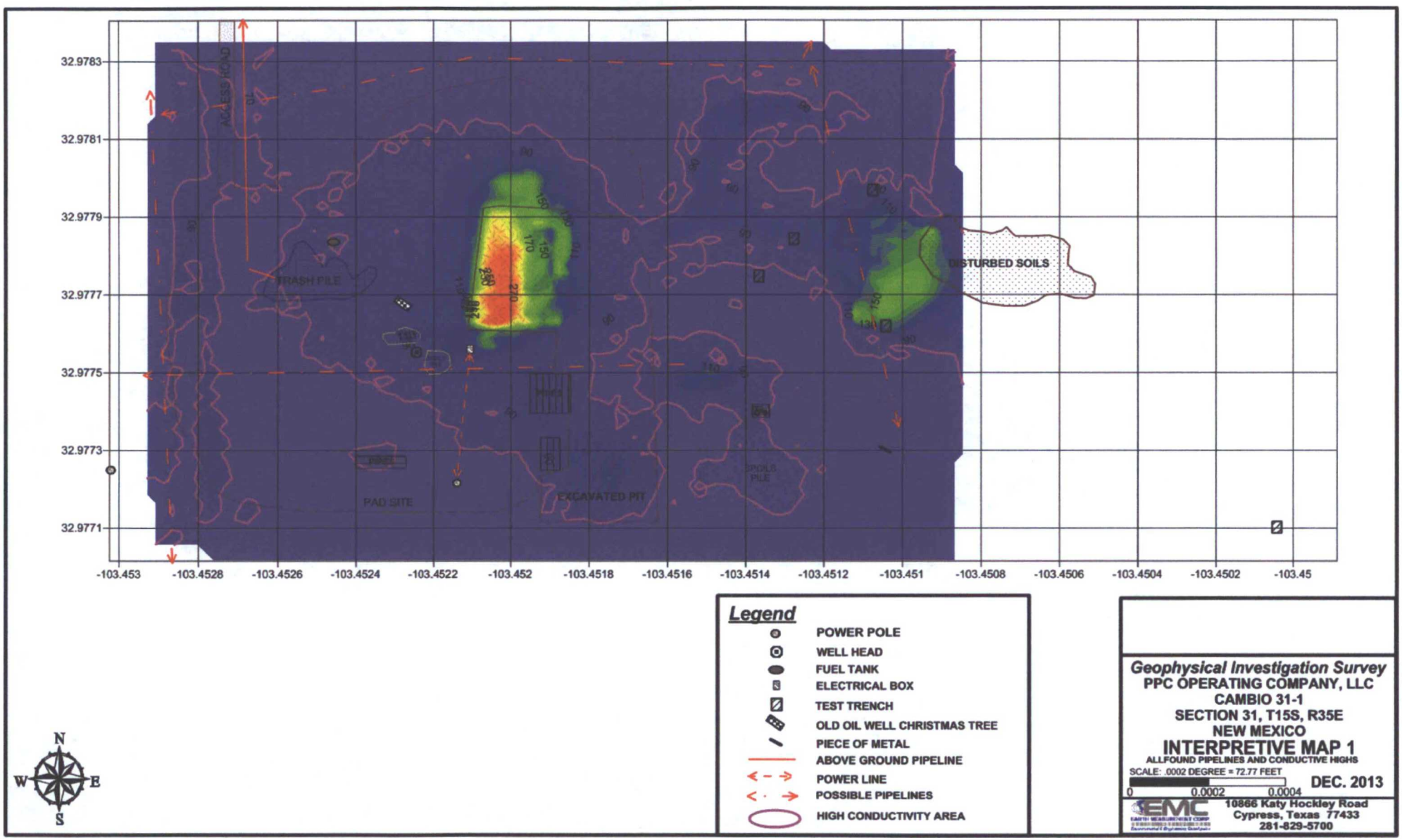
DEC. 2013
EMC
10866 Katy Hockley Road
Cypress, Texas 77433
281-829-5700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ACCESS ROAD
TRASH PILE
DISTURBED SOILS
PAD SITE
EXCAVATED PIT
POOLS PILE
Legend
POWER POLE
WELL HEAD
FUEL TANK
ELECTRICAL BOX
TEST TRENCH
OLD OIL WELL CHRISTMAS TREE
PIECE OF METAL
ABOVE GROUND PIPELINE
POWER LINE
POSSIBLE PIPELINES
HIGH CONDUCTIVITY AREA
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Geophysical Investigation Survey
PPC OPERATING COMPANY, LLC
CAMBIO 31-1
SECTION 31, T15S, R35E
NEW MEXICO
INTERPRETIVE MAP 1
ALLFOUND PIPELINES AND CONDUCTIVE HIGHS
SCALE: .0002 DEGREE = 72.77 FEET
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DEC. 2013
EMC
10866 Katy Hockley Road
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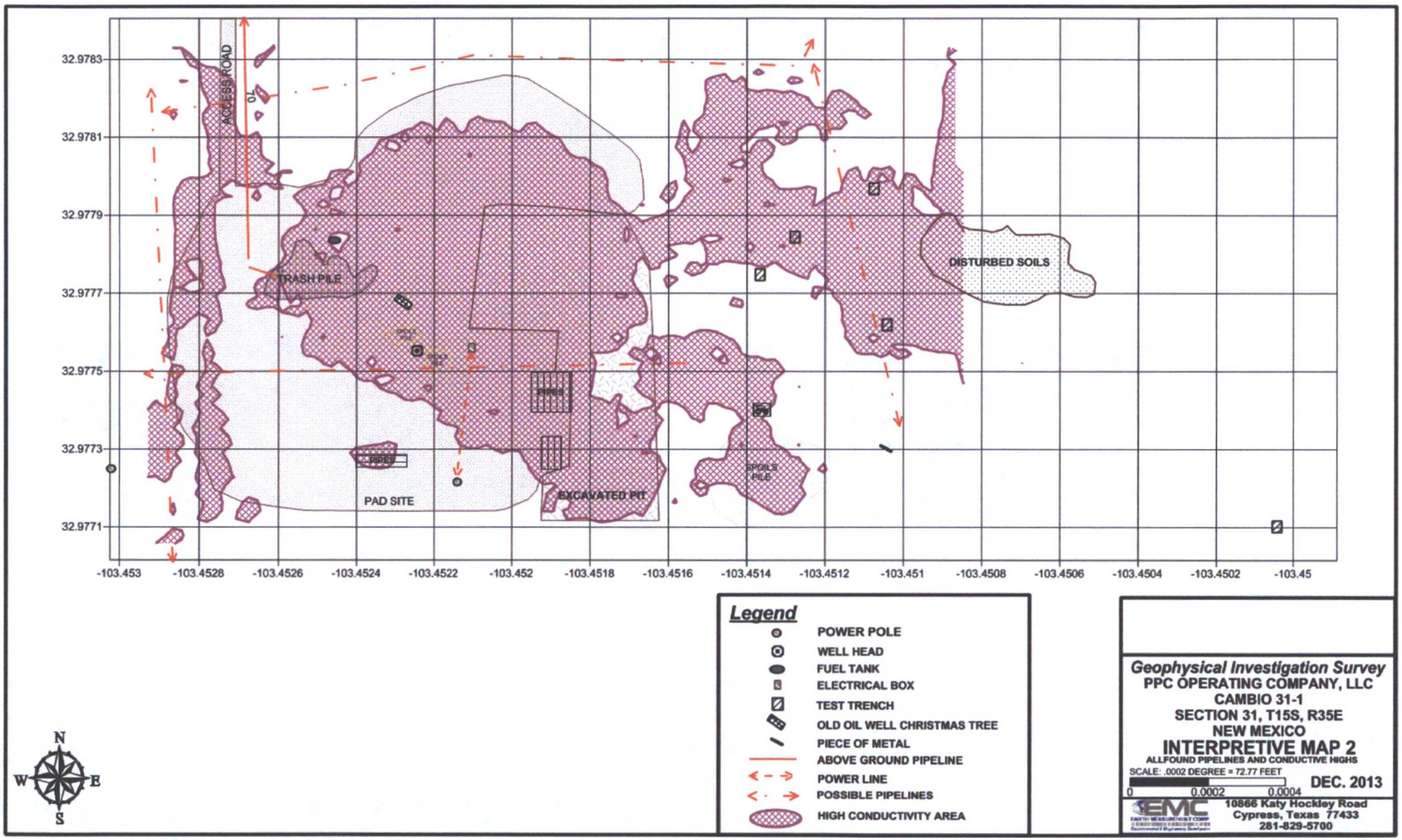

Geophysical Investigation Survey
PPC OPERATING COMPANY, LLC
CAMBIO 31-1
SECTION 31, T15S, R35E
NEW MEXICO

INTERPRETIVE MAP 2

ALLFOUND PIPELINES AND CONDUCTIVE HIGHS

SCALE: .0002 DEGREE = 72.77 FEET

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EARTH MEASUREMENT CORP.
Environmental & Engineering Geophysics

GEONICS EM-31
Electromagnetic Meter

The Geonics **EM-31** can be used to map geologic features or groundwater contaminant plumes by measuring terrain conductivity without electrodes or ground contact using a patented electromagnetic inductive technique. The instrument reads directly in millisiemens per meter. Using this inductive method, surveys are readily carried out in all regions including those with high surface resistivity such as sand, gravel and asphalt. The **EM-31** is one-person portable and has an effective depth-of-exploration of about six meters. It has been designed to cover the range-of-depths most useful to engineering geophysics. The **EM-31** is the ideal tool for site assessment surveys. Typical applications for the **EM-31** instrument are:

- Delineating regions of permafrost (frozen pore water)
- Locating suspected and delineating known gravel deposits
- Mapping saline intrusions and bedrock topography
- Detecting cavities in carbonate rocks
- Mapping pollution plumes in groundwater
- Mapping terrain conductivity for electrical grounding
- General geologic mapping of soil types, faults, and fracture zones
- Archaeological exploration
- Locating pipes and metallic conductors (tanks, drums and ferrous waste)

Advantages of this instrument over conventional resistivity methods are the speed with which surveys can be conducted, the precision with which small changes in conductivity can be measured and the capability of continuous readouts while traversing a survey area. The **EM-31** has the added ability of simultaneously mapping contaminant plumes and buried metals. These features make it ideal for most any type of geotechnical or groundwater contaminant survey.

EARTH MEASUREMENT CORP.
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Trimble Pro-XH GPS Receiver/Trimble Zephyr Dual Frequency Antenna

Fully integrated Bluetooth GPS receiver with H-Star technology for sub-foot accuracy

The GPS Pathfinder® ProXH™ receiver introduces a new era in GPS for GIS data collection. A GPS receiver, antenna, and all-day battery in one, the ProXH receiver delivers sub-foot (30 cm) accuracy with Trimble's revolutionary H-Star™ technology.

Bringing together advanced GPS receiver design and a powerful new post-processing engine, H-Star technology is in a class of its own. Working together with Trimble's TerraSync™ software, the Trimble® GPScorrect™ extension for ESRI ArcPad software, or an application built with the GPS Pathfinder Tools Software Development Kit (SDK), the ProXH receiver quickly and efficiently logs the data you need to achieve subfoot accuracy. Back in the office, the GPS Pathfinder Office software or the Trimble GPS Analyst™ extension for ESRI ArcGIS Desktop software guides you through the H-Star correction process and displays the accuracy you've achieved.

The all-in-one design of the ProXH receiver means it's simple to set up and easy to use. With a Bluetooth® wireless connection you're cable free between the ProXH receiver and a field computer.

Dual frequency GPS antenna for high-accuracy applications with the ProXH™ receiver

Trimble's Zephyr™ external L1/L2 GPS antenna contains advanced technology for extremely low multipath, outstanding low elevation satellite tracking, and sub-millimeter phase center accuracy. Use the Zephyr antenna together with a GeoXH handheld or GPS Pathfinder® ProXH receiver for high-accuracy mapping and GIS data collection.

Pro-XH Receiver

Zephyr Antenna