Agricola Wind
Magnetic Well Survey
Final Report

Cayuga County, NY

Prepared by UAV Exploration Inc.

June 2024

CONTENTS

INTRODUCTION

This report describes a Magnetic Orphaned/ Plugged & Abandoned Well Survey carried out by UAV Exploration (UAVEX) in May 2024 as part of the Agricola Wind Project in Cayuga County, NY. The project goal was to identify and locate orphaned, plugged and abandoned (P&A) and potential unknown steel-cased Oil and Gas (O&G) wells within the project area.

PROJECT AREA

The project/ survey area of operations (AOI) consists of an approximately 2,629 acre network of proposed wind turbine locations and collection corridors near Venice Center, NY.

The project area can be described as moderate rolling terrain with elevation changes of approximately 100-115 meters across the AOI. The area has a mixture of light woods, agricultural farm fields, residential housing, farms, country and state roads, as well as power lines and sparce towers.

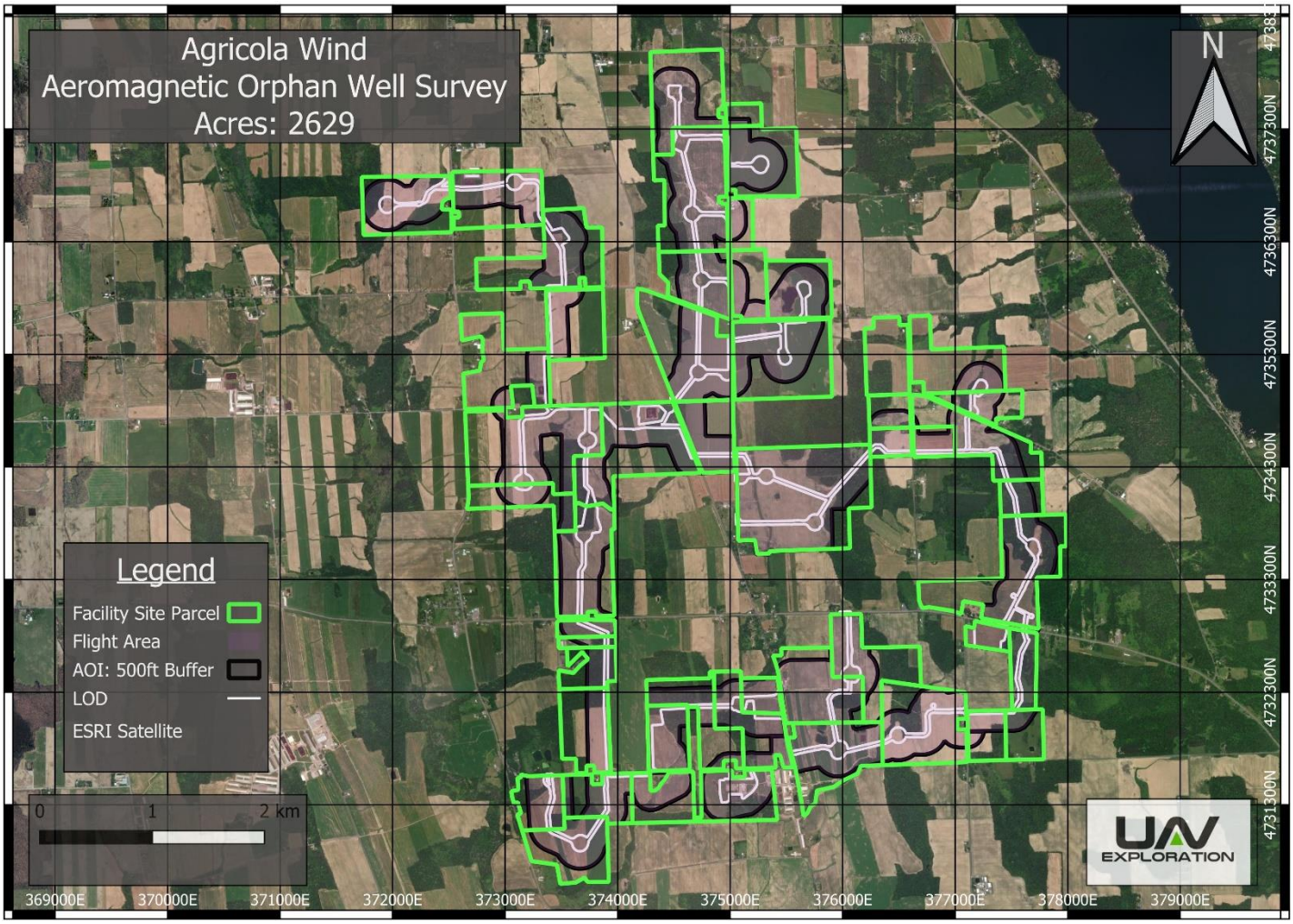

Figure 1: Project Area

GEOPHYSICAL SURVEY METHODOLOGY

The survey called for a multi-phase approach to collect, process, interpret, and confirm magnetic data to locate potential steel-cased wells in the project AOI. These primary phases were Flight Operations, Data Processing and Interpretation, and Ground Truthing.

The principal geophysical sensors used included an Ex-Mag atomic magnetometer system mounted on an Unmanned Aerial System (UAS) platform, a Gem Systems GSM-19 Overhauser Proton Procession magnetometer base station and Schondstedt handheld magnetic locators.

FLIGHT OPERATIONS

UAVEX flight crews go to great lengths to conduct aerial data with the utmost precision. Strict quality control of flight operations is paramount to locating subtle and weak anomalies, eliminating false positives, and producing the most accurate and aesthetically pleasing deliverables. Flight crews perform aerial data collection only when conditions are ideal; refraining from operations during periods of moderate to high winds and/or high thermal activity or during high solar activity, all of which can negatively impact data quality.

The survey AOI was established and divided into subsections consisting of areas of manageable size and shape to allow the UAS field crews to perform the aerial surveying efficiently while complying with line of sight (LOS) requirements and other safety related standard operating procedures. Each subsection's boundaries were defined according to best practices with the necessary overlaps between individual flight missions. All flights were planned and executed at the lowest, safest, nominal draped altitude above ground level (AGL) utilizing a 1-meter Digital Terrain Model (DTM) while considering on site conditions and maximum tree height within the AOI. The nominal altitude selected for this project was 38 Meters AGL (sensor height). Nominal line-spacing was 30 meters.

Each survey day began with a thorough pre-flight and safety briefing, including checking FAA notices to airmen, airspace restrictions, temporary flight restrictions, weather, obstacles, and monitoring space weather. UAS flights were operated within FAR Part 107 guidelines by an FAA certified pilot holding a valid commercial UAS pilot certificate and visual observer flight crew.

At the start of aerial survey operations, the GSM-19W Overhauser Base Station was set up and initiated at a magnetically quiet location with a logging rate of .33 Hz.

Takeoffs were performed manually by the pilot and the pre-programed survey lines were flown by autonomous lateral and vertical navigation. Landings were conducted manually by the UAS pilot and ground crew.

The position and altitude of the aircraft and magnetometer payload was achieved using a combination of Barometric Pressure Measurement, GPS, Compass, Inertial Measurement Unit (IMU) and RADAR altimeter. AGL altitude was maintained using a combination of RADAR altitude measurement and barometric pressure readings. Barometric pressure and altitude corrections were maintained during flight operations using a stationary barometric base station.

The magnetometer was suspended from the UAS in a fixed orientation by a proprietary vibration isolated mounting and stowing system at a sensor distance of approximately 1.3 meters to reduce UAV noise and magnetic interference. Nominal survey speed was maintained at 6-10 meters per second ground speed to achieve optimal and consistent pitch attitude.

Scan rates for data acquisition were 1000 Hertz (Hz) for the magnetometer and 5 Hz for GPS positioning which translates to an effective downline sampling of 6mm – 10mm.

Raw survey data was downloaded at the completion of each flight and quality checked before proceeding to the next survey area. The total combined survey distance for the project was approximately 432 line-kilometers.

UAS AIRCRAFT

The primary unmanned aircraft systems (UAS) used was a UAVEX Explorer-3 UAS Hexacopter, custom manufactured by UAV Exploration in the US. The platform has a maximum takeoff weight of 55lbs and contains various onboard systems specifically developed for use in geophysical surveys while providing the highest level of safety possible. Some of the aircraft's features are: Terrain following RADAR, Triple redundant IMUs, Barometers, and Compass Systems. Dual GPS system, dual battery systems and redundant power management systems. The aircraft has 6 propulsion motors which provide stable flight characteristics and can maintain flight in the event of a motor failure. The aircraft also has emergency features such as autonomous return to home, autoland, and battery and communications failsafes.

AIRBORNE MAGNETOMETER SYSTEM

The magnetometer system used was a custom ExMag Atomic Magnetometer System. The onboard sensor package is centered around a Geometrics Micro Fabricated Atomic Magnetometer (MFAM) system. It is a dual sensor, 1000 Hz logging rate device with onboard logging, GPS and telemetry capabilities. Specifications listed below.

Operating Principle: Laser pumped cesium vapor (Cs133 non-radioactive) dual-sensor, total field scalar magnetometer with onboard IMU.

Operating Range: 20,000 to 100,000 nT.

Gradient Tolerance: 10,000nT/m.

Noise/Sensitivity: 0.005nT/ Hzrms typical.

Sample Rate: 1000 Hz. synchronized to GPS 1PPS.

Bandwidth: 400Hz.

Heading Error: ± 5 nT over entire 360° equatorial and polar spins typical.

Telemetry Output: 900 MHz

GPS: Commercial grade with typical 1 m accuracy.

MAGNETIC BASE STATION

Recording of diurnal magnetic variation was performed using a Gem Systems GSM-19W Overhauser base station magnetometer. This system was set up each day prior to aeromagnetic surveying in the same location for the duration of the project. The sample rate was 0.33 Hz. This base station, as well as the drone-mounted magnetometer, are time synchronized to UTC+0 time using each systems' integrated GPS unit. This common time index was used to align the diurnal magnetic trends in time to the aeromagnetic data for removal/ correction.

DATA PROCESSING

For each mission dataset, raw data files were batch processed into a single comma-delimited file using custom software. The concatenated files from each mission were imported into Oasis Montaj for all remaining processing.

The major processing steps include:

- Instrument Lag
- Removal of magnetic heading error
- Removal of diurnal variation using base station data
- 1D filtering to remove 60 Hz AC power interference.
- Magnetic attitude correction of noise due to wind / motion
- 2D data gridding using the Minimum Curvature gridding algorithm.
- Leveling and combining sorties into one dataset
- Vertical derivative convolution 2D grid filter
- Analytic signal 2D grid filter
- Other 2D smoothing filters

TARGET SELECTION

At the completion of processing for each survey grid sub-section, data was analyzed and a comprehensive list of targets of interest (also known as anomalies of interest) was compiled for further field investigation along with their respective latitude and longitude positions.

A variety of methods are used to determine if a target has the possibility to be a sub-surface O&G well. The initial process begins with reconciling targets with georeferenced aerial imagery and video to eliminate visible anomalous signatures such as housing, commercial structures, steel infrastructure, agriculture, utilities and other discernable ferromagnetic features. Due to the varied magnetic response generated by wells, many initial targets are selected for investigation and reconciled one-by-one until only potential well-like anomalies remain. All un-reconciled targets were investigated during the ground truthing survey.

GROUND TRUTHING SURVEY

For the ground survey the field crew traversed on foot to each anomaly location individually for ground identification and magnetic verification. Sub-surface targets that presented as a potential well based on the aerial and ground-based magnetic response were ground surveyed by:

(1) The peak aerial detection location was first flagged using the GNSS system.

(2) Using the magnetic locator systems, a serpentine path was walked within an approximate 20-meter diameter radius, starting at the center.

(3) Once the potential target source was detected, a circular survey was conducted around the target to determine if the magnetic field is monopolar (well-like) or dipolar (not well-like).

(4) If determined to be monopolar, the exact position was located where the magnetic gradient was the highest and its respective location collected with the GNSS system.

(5) A wider 30+ meter circle was surveyed to rule out any additional weaker anomalous signatures in proximity to the target.

FINDINGS

Upon completion of ground truthing all anomalies of interest were confirmed as non-O&G well-like. These targets were classified as structures, vehicles, culverts, steel debris piles, as well as 2 likely subsurface water wells (WW). No oil and gas well evidence was observed in the survey area including leaking petroleum liquids, gas or other contaminants. No other hazards were noted.

Note: All project magnetic maps, anomaly points and electronic files associated with this project are delivered separately and are not included in this project narrative.

SUMMARY

UAVEX is pleased with the quality of data collected throughout this survey and the results of the ground truthing effort. Our flight and ground crews go to great lengths to ensure the highest quality of our surveys. This includes operating custom-tailored magnetic-survey UAV platforms, limiting data collection to periods of ideal environmental conditions and following strict flight operational procedures to ensure high target magnetic response.

UAVEX pioneered drone-based orphaned and abandoned well surveying. The techniques and methods utilized in this survey have resulted in having successfully located and mapped thousands of oil and gas wells across the US, serving industries such as utility-scale renewables, gas storage, environmental permitting, and commercial development projects.

END OF REPORT

Please contact us with questions:

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Renfrew, PA

724-432-2999

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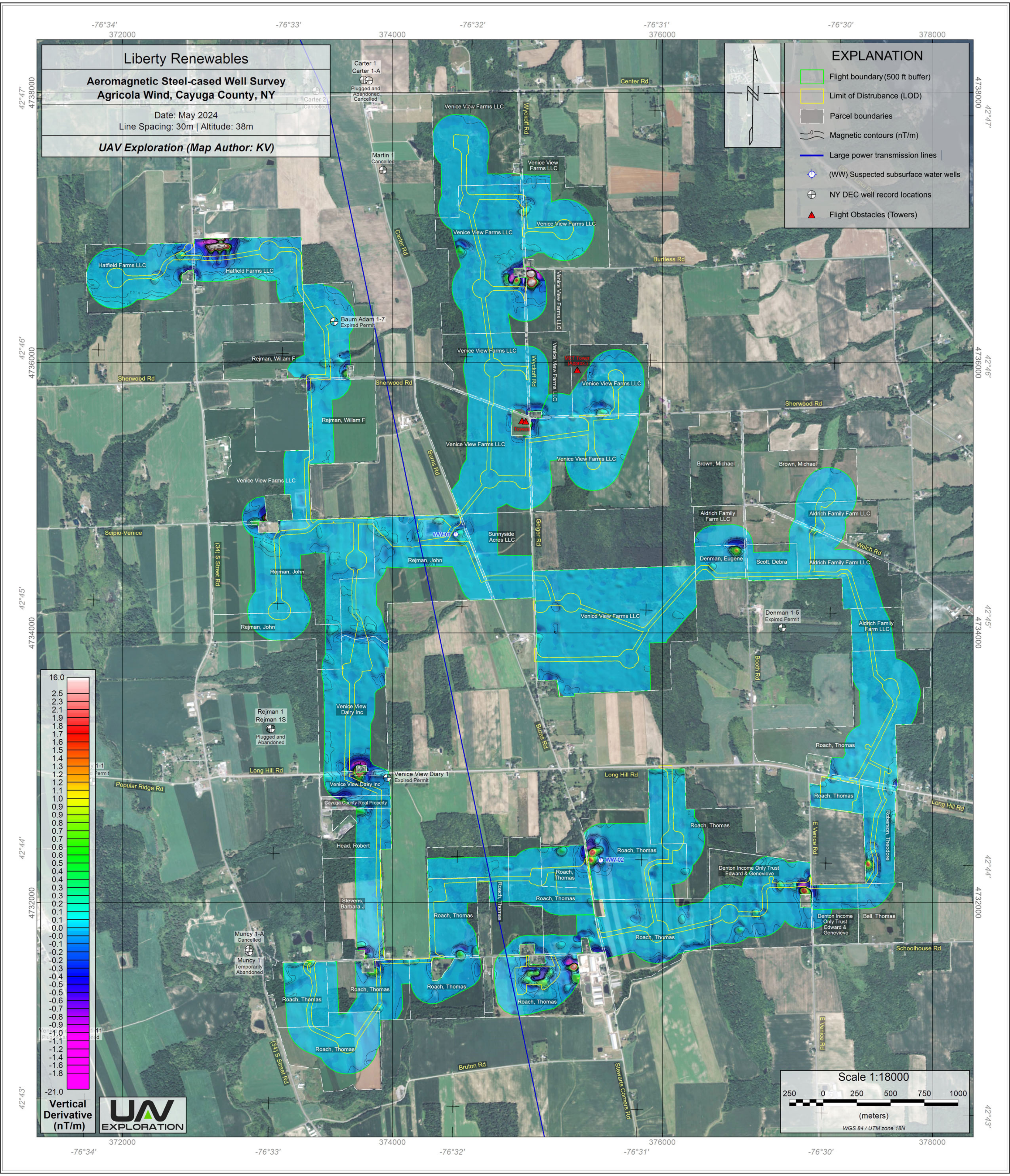
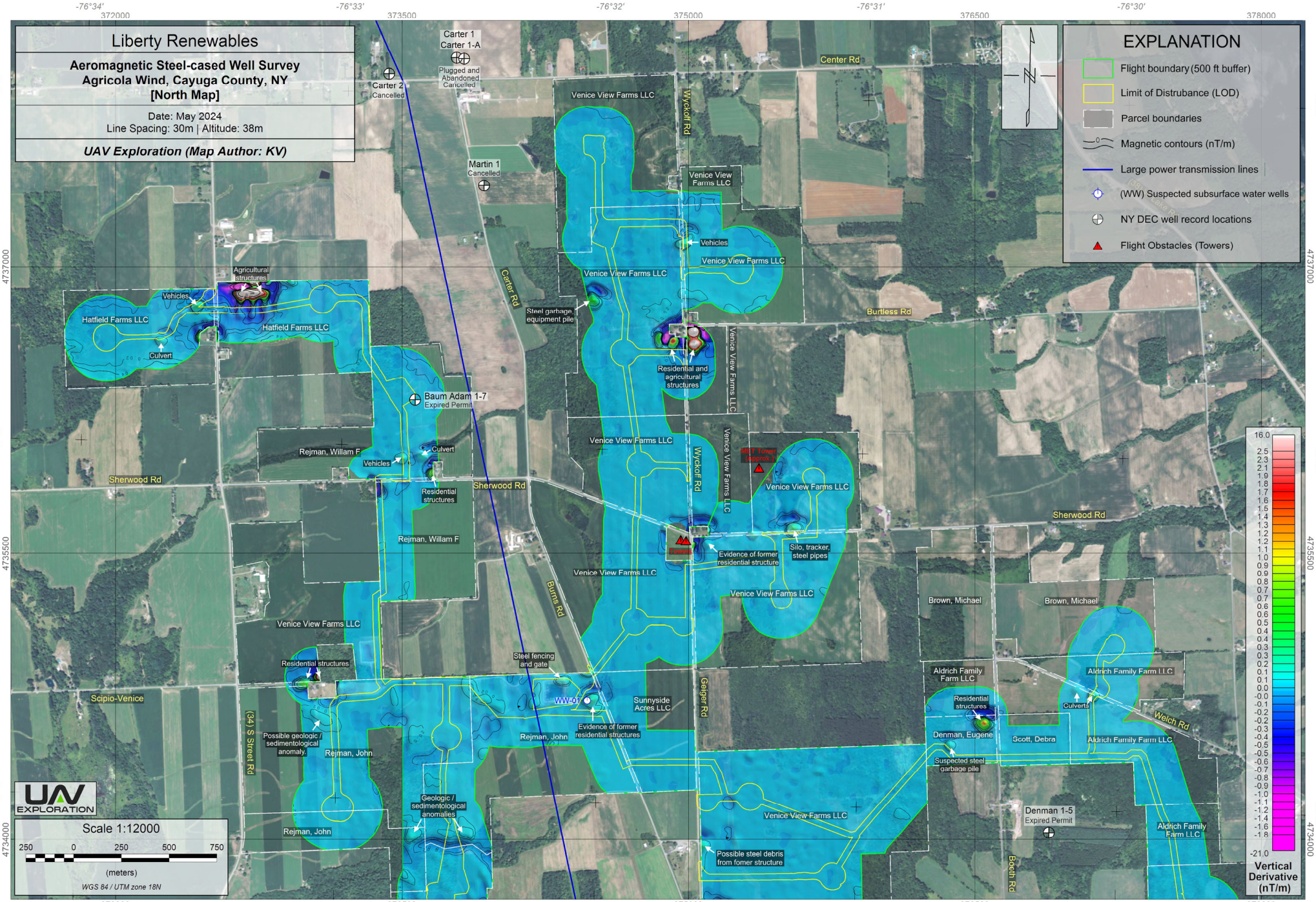
DISCLAIMER

UAV Exploration Inc., the geophysical survey provider, their client and/or their client's contractor collectively, are not liable for damages that occur from excavations, construction or other activities based on the results of this survey. Although sound technical procedures and prudent application of oversight are exercised by the geophysical service provider, to the extent possible, due caution should be observed when performing any subsurface excavation or construction activities based on results of this survey. The methods proposed in this document are proven effective in locating steel-cased Oil and Gas wells. In rare instances, targets of interest can be obscured or go undetected due to influences including, but not limited to: space weather, magnetic soils and sediments, magnetically weak or removed borehole/ well casings or targets obscured, omitted or undetected due to proximal magnetic infrastructure or debris. The users of this data agree to release liabilities, perceived or otherwise, toward UAV Exploration and their client, caused by the actions or recommendations or lack thereof related to the discovery or lack thereof of well bores, O&G infrastructure or hazardous objects within the surveyed area.


Liberty Renewables
Aeromagnetic Steel-cased Well Survey
Agricola Wind, Cayuga County, NY
Date: May 2024
Line Spacing: 30m | Altitude: 38m
UAV Exploration (Map Author: KV)
EXPLANATION
Flight boundary (500 ft buffer)
Limit of Distrubance (LOD)
Parcel boundaries
Magnetic contours (nT/m)
Large power transmission lines
(WW) Suspected subsurface water wells
NY DEC well record locations
Flight Obstacles (Towers)
Vertical Derivative (nT/m)
16.0
2.5
2.3
2.1
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.2
1.1
1.0
0.9
0.9
0.8
0.7
0.7
0.6
0.6
0.5
0.5
0.4
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
-0.0
-0.1
-0.1
-0.2
-0.2
-0.3
-0.3
-0.4
-0.5
-0.5
-0.6
-0.7
-0.8
-0.9
-1.0
-1.1
-1.2
-1.4
-1.6
-1.8
-21.0
UAV EXPLORATION
Scale 1:18000
250 0 250 500 750 1000
(meters)
WGS 84 / UTM zone 18N
-76°34'
-76°33'
-76°32'
-76°31'
-76°30'
372000
374000
376000
378000
42°47'
42°46'
42°45'
42°44'
42°43'
4738000
4736000
4734000
4732000
Carter 1
Carter 1-A
Plugged and Abandoned
Cancelled
Martin 1
Cancelled
Baum Adam 1-7
Expired Permit
Rejman 1
Rejman 1S
Plugged and Abandoned
Venice View Diary 1
Expired Permit
Denman 1-5
Expired Permit
Muncy 1-A
Cancelled
Muncy 1
Temporarily Abandoned
WW-01
WW-02
Center Rd
Burtless Rd
Sherwood Rd
Scipio-Venice
Welch Rd
Long Hill Rd
Popular Ridge Rd
Schoolhouse Rd
Bruton Rd
Carter Rd
Wyckoff Rd
Burns Rd
Geiger Rd
Booth Rd
E Venice Rd
(34) S Street Rd
Stewarts Corners Rd
Roberson, Theodore
Hatfield Farms LLC
Venice View Farms LLC
Rejman, Willam F
Rejman, John
Sunnyside Acres LLC
Aldrich Family Farm LLC
Denman, Eugene
Scott, Debra
Brown, Michael
Venice View Dairy Inc
Cayuga County Real Property
Head, Robert
Stevens, Barbara J
Roach, Thomas
Denton Income Only Trust Edward & Genevieve
Bell, Thomas


Liberty Renewables
Aeromagnetic Steel-cased Well Survey
Agricola Wind, Cayuga County, NY
[North Map]
Date: May 2024
Line Spacing: 30m | Altitude: 38m
UAV Exploration (Map Author: KV)
EXPLANATION
Flight boundary (500 ft buffer)
Limit of Distrubance (LOD)
Parcel boundaries
Magnetic contours (nT/m)
Large power transmission lines
(WW) Suspected subsurface water wells
NY DEC well record locations
Flight Obstacles (Towers)
Carter 1
Carter 1-A
Plugged and Abandoned Cancelled
Carter 2
Cancelled
Martin 1
Cancelled
Baum Adam 1-7
Expired Permit
Denman 1-5
Expired Permit
Center Rd
Burtless Rd
Sherwood Rd
Carter Rd
Wyckoff Rd
Burns Rd
Geiger Rd
Welch Rd
Booth Rd
(34) S Street Rd
Scipio-Venice
Venice View Farms LLC
Hatfield Farms LLC
Rejman, Willam F
Rejman, John
Brown, Michael
Aldrich Family Farm LLC
Sunnyside Acres LLC
Scott, Debra
Denman, Eugene
Agricultural structures
Vehicles
Culvert
Residential structures
Residential and agricultural structures
Steel garbage equipment pile
Steel fencing and gate
Evidence of former residential structure
Evidence of former residential structures
Silo, tracker, steel pipes
Possible geologic / sedimentological anomaly.
Geologic / sedimentological anomalies
Suspected steel garbage pile
Possible steel debris from fomer structure
MET Tower (approx.)
WW-01
UAV EXPLORATION
Scale 1:12000
250 0 250 500 750
(meters)
WGS 84 / UTM zone 18N
Vertical Derivative (nT/m)
16.0
-21.0
-76°34'
-76°33'
-76°32'
-76°31'
-76°30'
372000
373500
375000
376500
378000
42°47'
42°46'
42°45'
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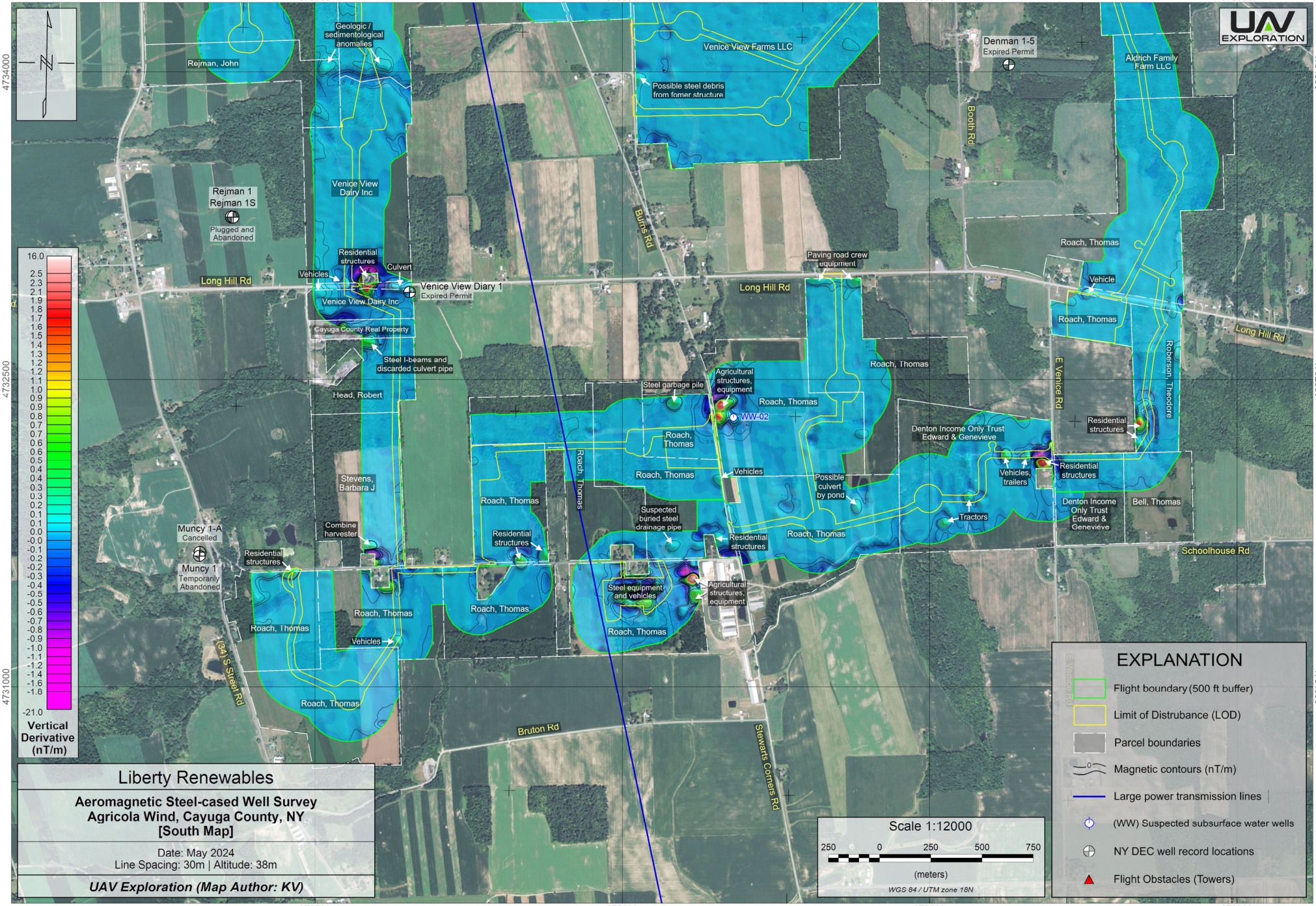
4735500
4734000


-76°33'
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-76°31'
-76°30'
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375000
376500
378000
42°45'
42°44'
42°43'
4734000
4732500
4731000
UAV EXPLORATION
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Booth Rd
Rejman 1
Rejman 1S
Plugged and Abandoned
Venice View Dairy Inc
Burns Rd
Residential structures
Culvert
Vehicles
Long Hill Rd
Venice View Diary 1
Expired Permit
Venice View Dairy Inc
Cayuga County Real Property
Steel I-beams and discarded culvert pipe
Head, Robert
Paving road crew equipment
Roach, Thomas
Vehicle
Roberson Theodore
E Venice Rd
Steel garbage pile
Agricultural structures, equipment
WW-02
Denton Income Only Trust Edward & Genevieve
Vehicles, trailers
Bell, Thomas
Stevens, Barbara J
Possible culvert by pond
Tractors
Suspected buried steel drainage pipe
Schoolhouse Rd
Muncy 1-A
Cancelled
Muncy 1
Temporarily Abandoned
Combine harvester
Steel equipment and vehicles
(34) S Street Rd
Bruton Rd
Stewarts Corners Rd
16.0
2.5
2.3
2.1
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.2
1.1
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0.0
-0.0
-0.1
-0.2
-0.2
-0.3
-0.4
-0.5
-0.5
-0.6
-0.7
-0.8
-0.9
-1.0
-1.1
-1.2
-1.4
-1.6
-1.8
-21.0
Vertical Derivative (nT/m)
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