



Ohio Department of Natural Resources
Division of Oil and Gas Resources Management
Orphan Well Program Survey Section

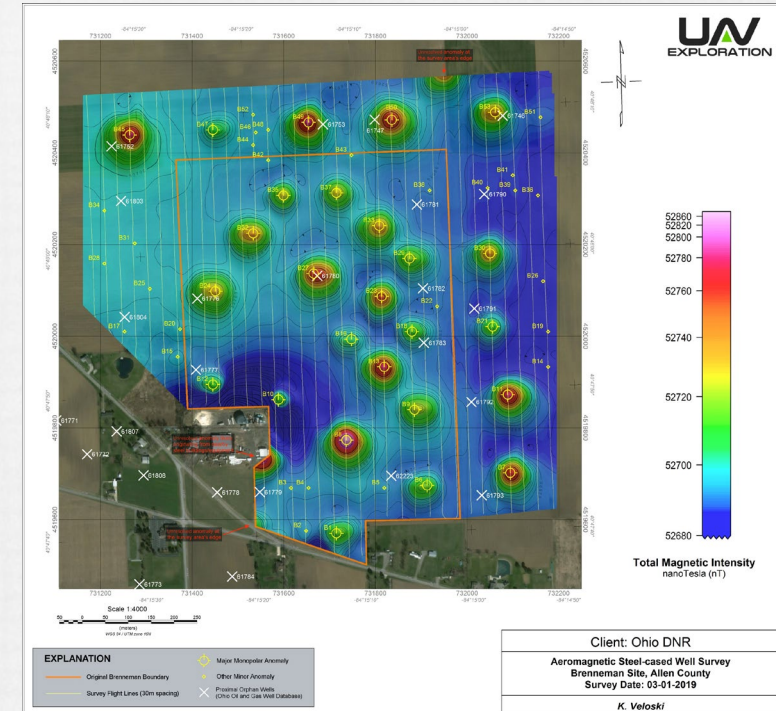


OHIO'S APPROACH TO ORPHAN WELL LOCATION AND SITE SURVEY

GEOMETRICS

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NATURAL RESOURCES



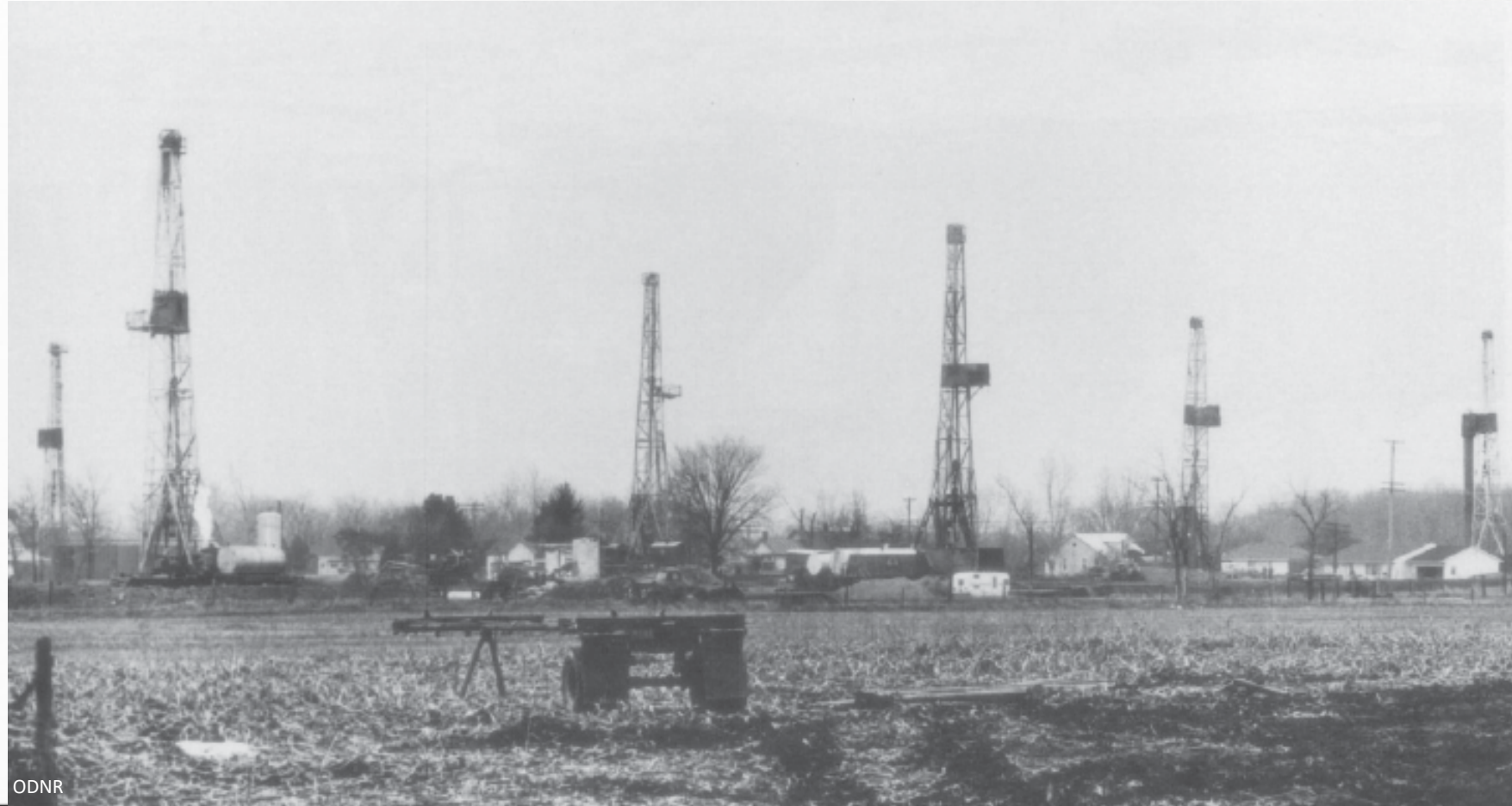
Welcome & Overview

- Airborne magnetometer use in finding orphan wells.
- 3DEP, investing in Ohio's 3D elevation model.
- 3D laser scanning to improve design efficiency.

Ohio's Oil and Gas History

- The Division of Oil and Gas Resources Management was created in 1965 by House Bill 234.
- Creation of oil and gas regulation in Ohio for well spacing.

Unregulated “town lot” drilling in Morrow County, February 1964



Ohio's Oil and Gas History

- The Orphan Well Program was established in 1977.
- Over 250,000 oil and natural gas wells have been drilled in Ohio.

Estimates of potentially
19,000 orphan wells in
Division database.

Unregulated
plugging and
abandonment
practices,
including
plugging with
cannonballs,
trees, and used
tools; pulled
casing, etc.

Time Period	Oil Field	Location	Estimated Number of Wells
1880 - 1930	Trenton-Limestone	Northwest Ohio	70,000
1880 – 1910	Ohio Shale	Northeast Ohio	5,000
1880 – 1910	Shallow Sandstone	Southeast Ohio	3,000
1860 – 1910	Mecca Field	Trumbull County	2,500
1900 – present	Clinton Sandstone	Statewide	85,000
1800's; 1950's – present	Berea Sandstone	Statewide	13,000
1960's – present	Trempealeau	Morrow County	5,000
1980's – 1990's	Knox Group	NE to Central Ohio	2,500

Division Created

OWP Created

What is the Orphan Well Program?

- The Orphan Well Program was established in 1977.
- A portion of Ohio's oil and natural gas severance tax is set aside to plug improperly abandoned oil and gas wells.
- OAC 1501:9.01 (CC): “‘Idle and orphaned well’ means a well for which a bond has been forfeited or an abandoned well for which no money is available to plug the well in accordance with this chapter and rules adopted under it.”
- ORC 1507.071 provides for the Orphan Well Program and charges the Chief with plugging idle and orphan wells, land surfaces, and correcting conditions that cause imminent health or safety risks at idle and orphan wells.



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Where are Orphan Wells?

- Orphan wells have been found and plugged in a school gymnasium, in building basements, amongst homes, in farm fields, in waterways and wetlands, along shorelines, and within forests.
- Construction access can be challenging and may require permits or approvals from federal, state, and/or local authorities.



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Division Survey Section established in 2016

- After the Admiral King incident, Chief Simmers created the Survey Technical Section within the Division of Oil and Gas Resources Management.
- Surveyors hold the necessary skills of map understanding, historical marker search, measurement and have experience in dealing with the public.



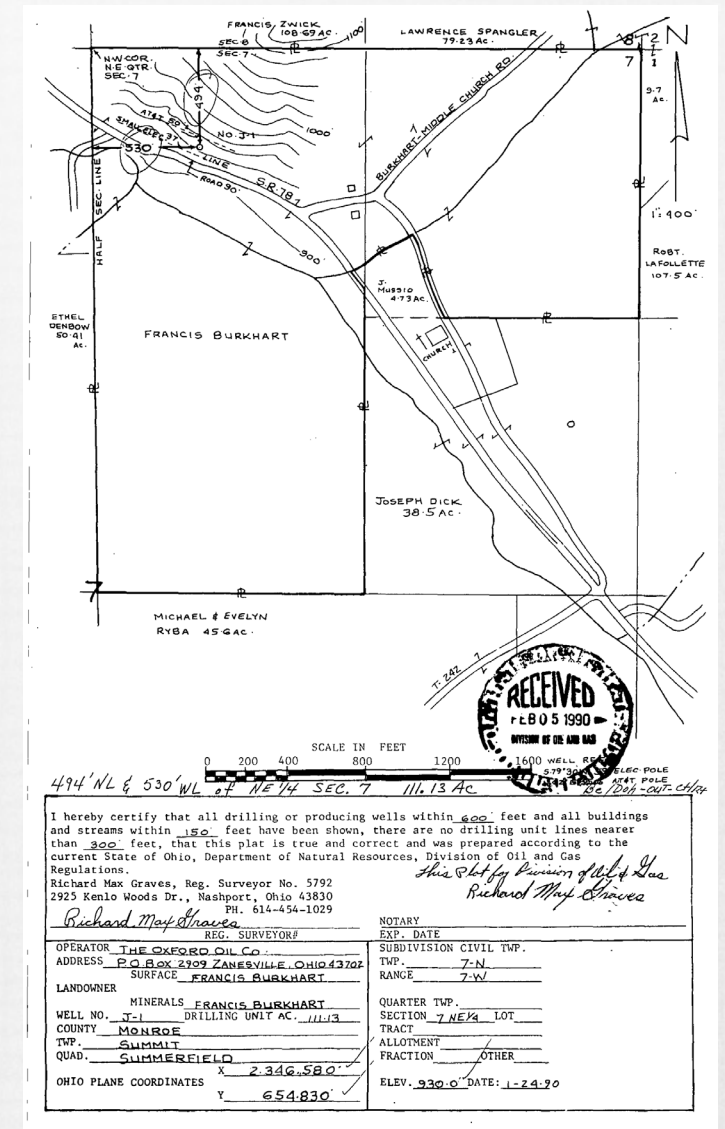
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Why Surveyors?

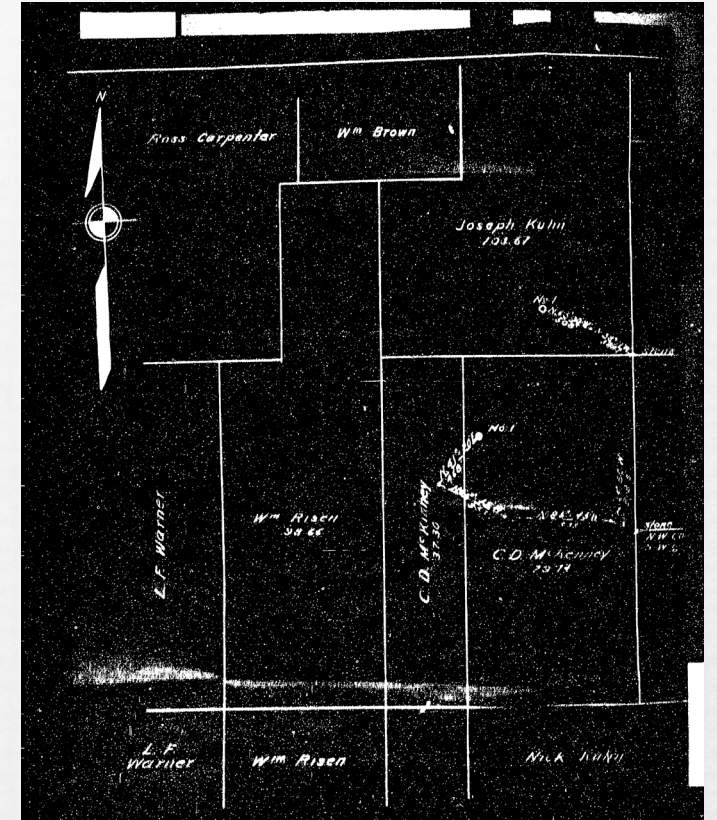
- Map makers.
- Professional measurement.
- Good well survey plats with lots of info (circa 1990).
- Measurements with EDM, newer with survey grade GPS.



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Why Surveyors?

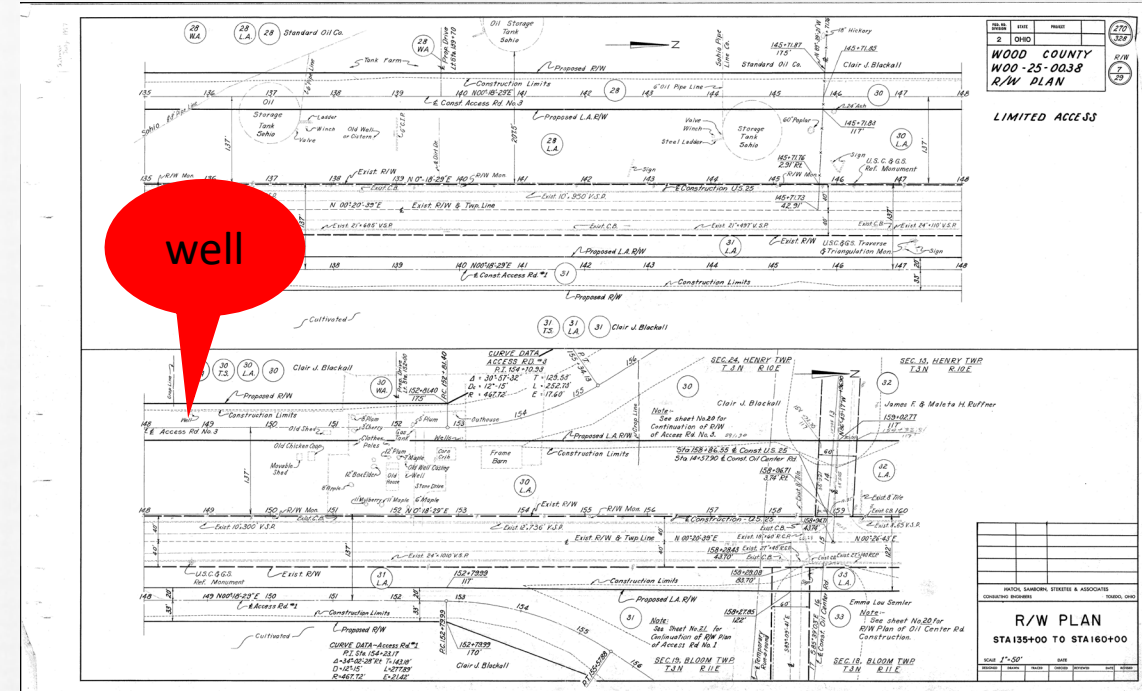
- Older survey plats (circa 1940's).
- Few details.
- Property owners names are not valid today.
- Measurements in bearing, distance.
- Measurements with a compass/steel tape/other.



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How we currently look for Orphaned wells

- Use all available information to establish a target position.
- Internal ODNR document (RBDMS inspection reports, old survey plat and township maps).
- External documents (Ohio Department of Transportation right of way maps, company provided documents, etc.).
- Stake position and look for signs of oil & gas activity, run a grid with a surveyors metal detector.



ODOT

Problems finding wells with no records?

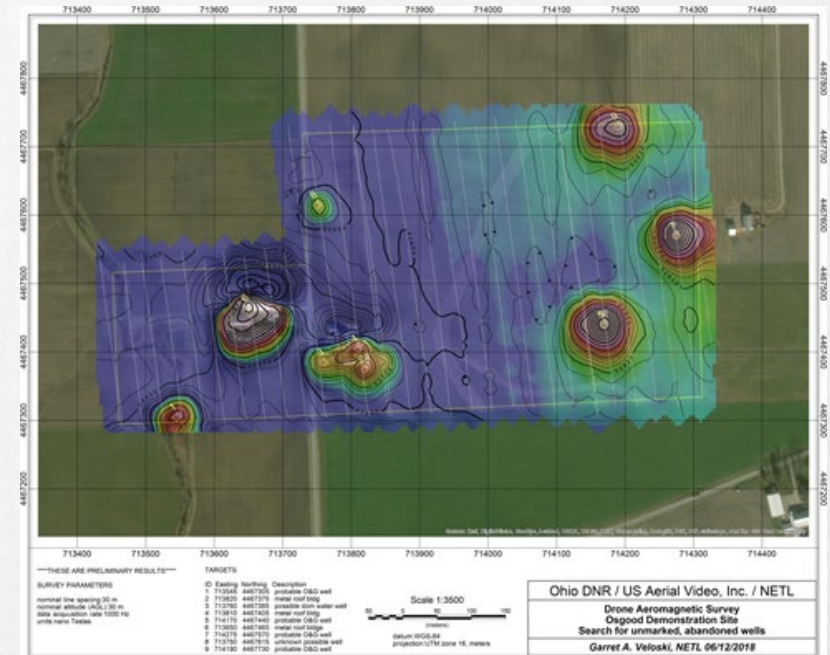
- What do we do when the well head has been removed many years ago and there is no visible oil & gas activity?



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The Magnetic Approach

- Wyoming, private oil and gas company – ODNR staff referral January 2018.
- United States Department of Energy, National Energy Technology Laboratory – Richard Hammack and Garret Veloski and others.
- Contractors we have contacted include UAV Exploration (PA, formerly US aerial video), Juniper Unmanned (CO).



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Finding a more productive tool for the toolbox

- Aeromagnetic surveying.
- Is used in the energy sector by geologist/geophysicist .
- Traditionally sensors where large and mounted on manned aircraft .
- Military uses this technology for finding Unexploded Ordinances (UXO).



USEPA

UAS based Aeromagnetic surveying

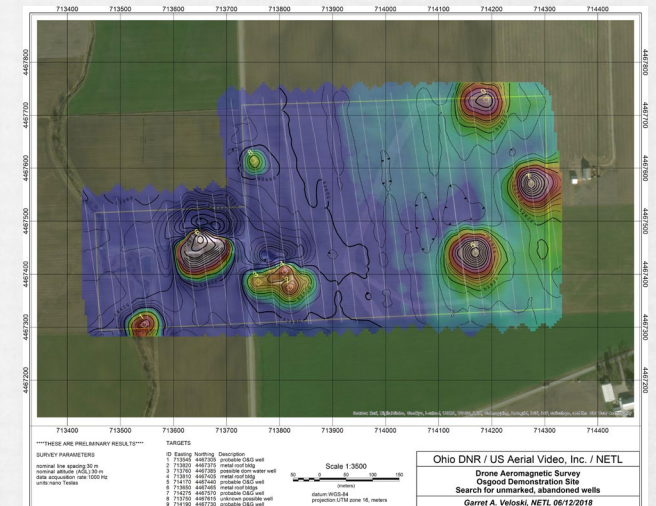
- Technological advancements have created “micro” sensors.
- Enabling the magnetometer to be carried safely under a medium sized drone.
- Controlled Test in Darke County.



GEOMETRICS



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Aeromagnetic Surveying Idle & Orphan Contract #1

- 4 Sites
 - Kelly – Wood County – 137 Acres
 - Brenneman – Allen County – 109 Acres
 - Thomas – Hancock County – 98 Acres
 - Wynn – Pike County – 1.86 Acres
- Flights occurred in March 2019.
- Site magnetometer work was contracted with UAV Exploration (PA).
- Juniper Unmanned (CO) expressed interest and demonstrated experience.



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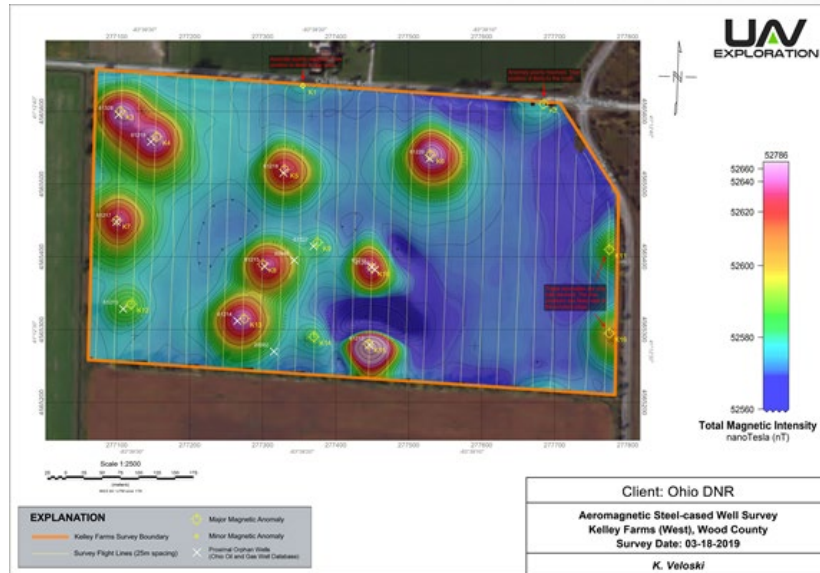
Idle & Orphan Contract #1 Site Expectation Overview

- 4 Sites
 - Kelly – Wood County – 137 Acres
 - 17 known wells – 17 known wells confirmed, 6 additional well casings confirmed, 3 additional targets to be explored
 - Brenneman – Allen County – 109 Acres
 - 6 known wells – 6 known wells confirmed, 9 additional targets to be explored
 - Thomas – Hancock County – 98 Acres
 - 1 known well – 1 known well confirmed, 3 additional well casings confirmed, 2 additional targets to be explored
 - Wynn – Pike County – 1.86 Acres
 - 1 potential well – survey confirmed there is no metal casing present

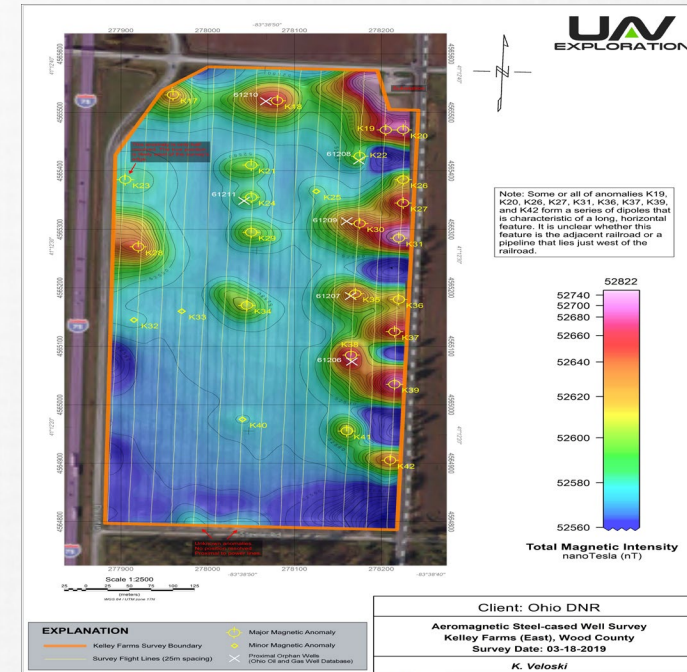
Kelly Aerial Overview



Results From Kelly Farm



UAV EXPLORATION



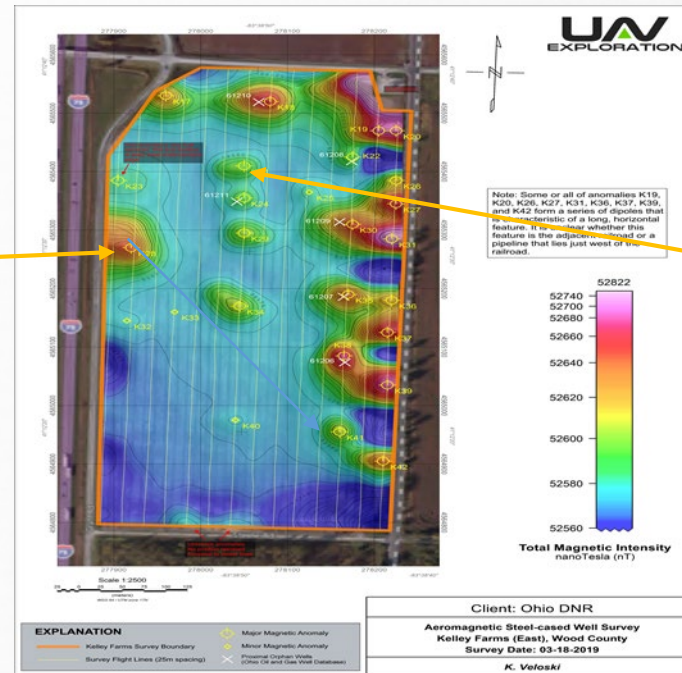
UAV EXPLORATION

- 17 known wells were confirmed, 5 unknown buried casings on the east side were exposed and confirmed, 1 buried casing on the west side was exposed and confirmed.
- East side targets investigated were confirmed as well casings.

Results From Kelly Farm East



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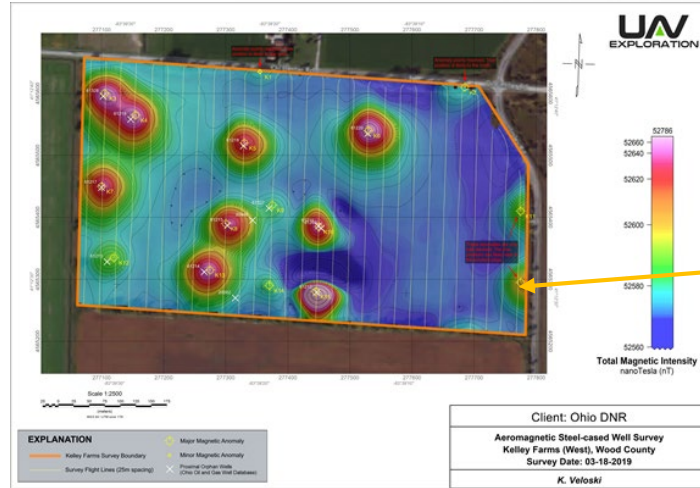
UAV EXPLORATION



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- The east side 5 targets were explored and 5 buried casings were found.
- We found three casings, that when probed produced gas and oil odors.
- One casing appeared to be bent over, potentially by the highway construction in the north west corner of the mapping.
- One casing appeared to have a mass of concrete or large rock over the casing.

Results From Kelly Farm West



UAV EXPLORATION



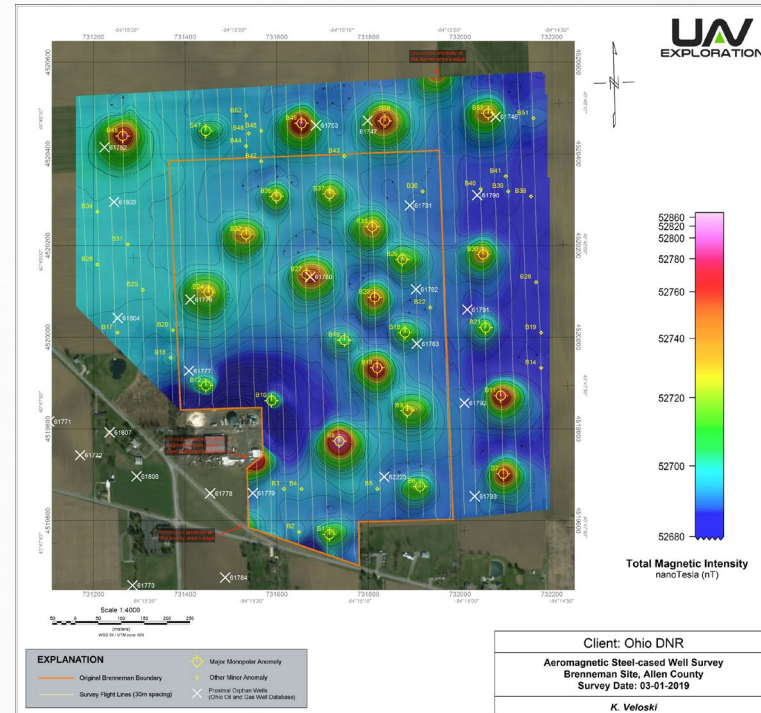
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- 11 known wells were confirmed, 1 well casing was found.
- The well casing was an open, and was found in the roadside ditch of the county right of way.
- It appears ground water has been entering the casing for an undetermined amount of time.
- The I&O Inspector was notified, and an investigation and potential remedial action is pending.

Results From Brenneman Farm

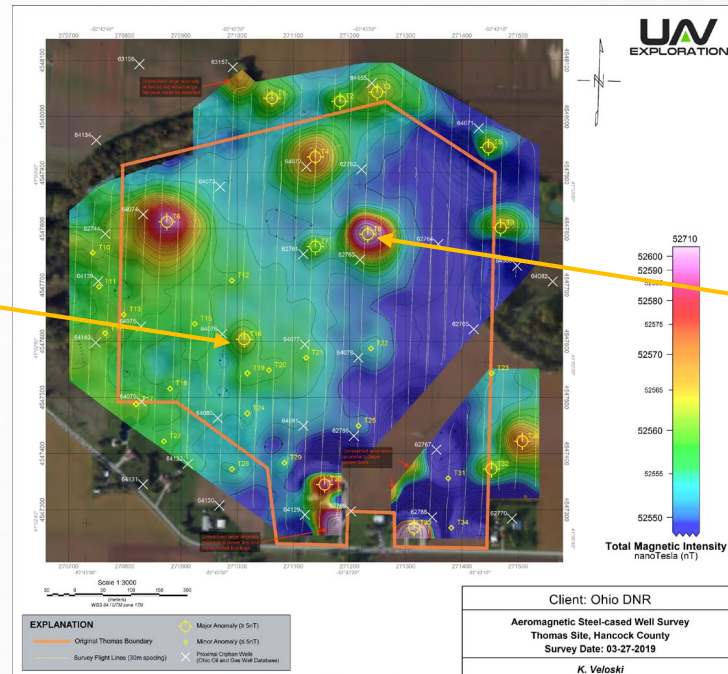


- The 6 known casings were confirmed, >8 targets to be explored at a later date.

Thomas Farm



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UAV EXPLORATION



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- 5 targets were explored and 3 buried casings were found.
- We found three casings, two were full of water (no oil show), one when uncovered produced gas and oil odors.
- The two missing casings, were proving difficult to locate and will be explored in more detail in the future.

Magnetic survey conclusion

- Questions?



3DEP and Ohio Investment in a Detailed Elevation Model

- Ohio is participating in the National 3D elevation program (3DEP) with the USGS to acquire 3d LiDAR data.
- Increased detail, Quality level 1 (~4" elevation resolution).
- Ohio's Current model is accurate to 2-4 foot elevation state wide.
- Many uses for the increased resolution include, project design, building/infrastructure assessment, environmental/hydrographic assessments.
- With the Increased level of resolution old oil and gas pad/roads will be come visible, aiding in locating the possible well locations.
- Possible to automate the process of locating potential well heads.

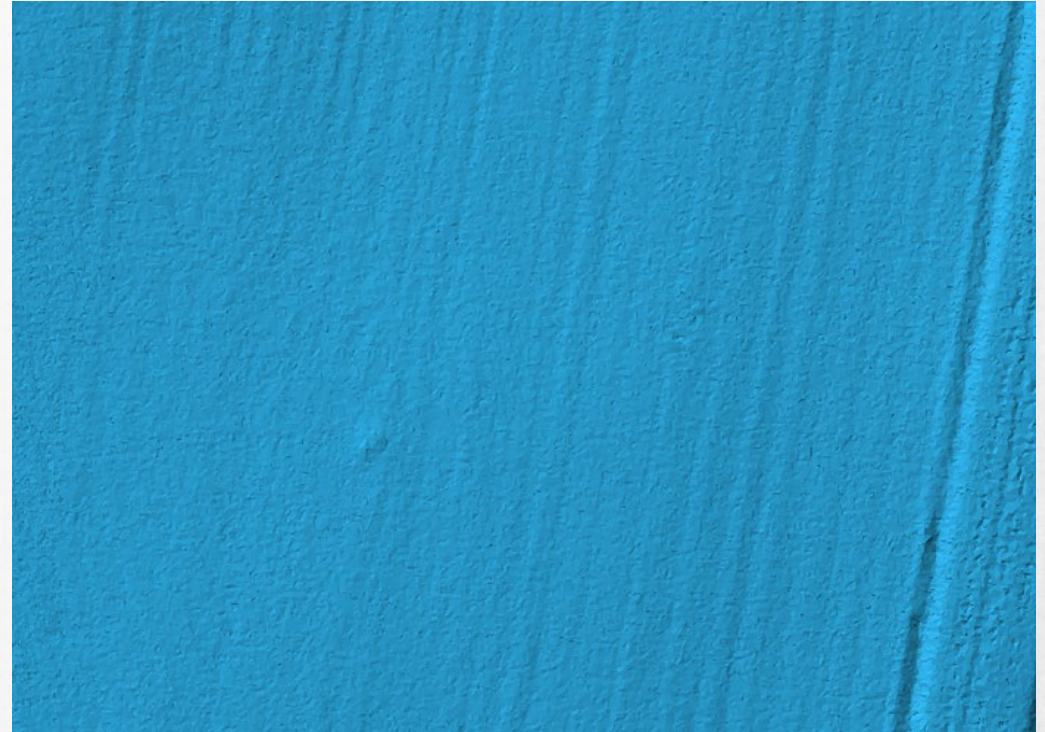


WOLPERT

3DEP and Ohio Investment in a Detailed Elevation Model



WOLPERT



WOLPERT

Idle & Orphan Site Topographic Surveys



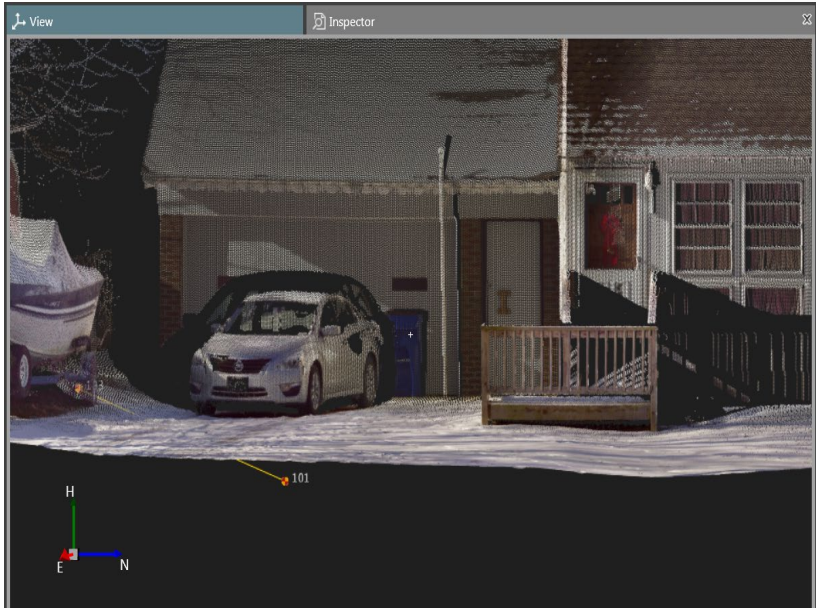
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- Providing data for design engineers to make the most informed decision on plugging plans.
- Site safety, environmental impact, efficiency, cost.

Site Documentation Tool - Laser Scanner



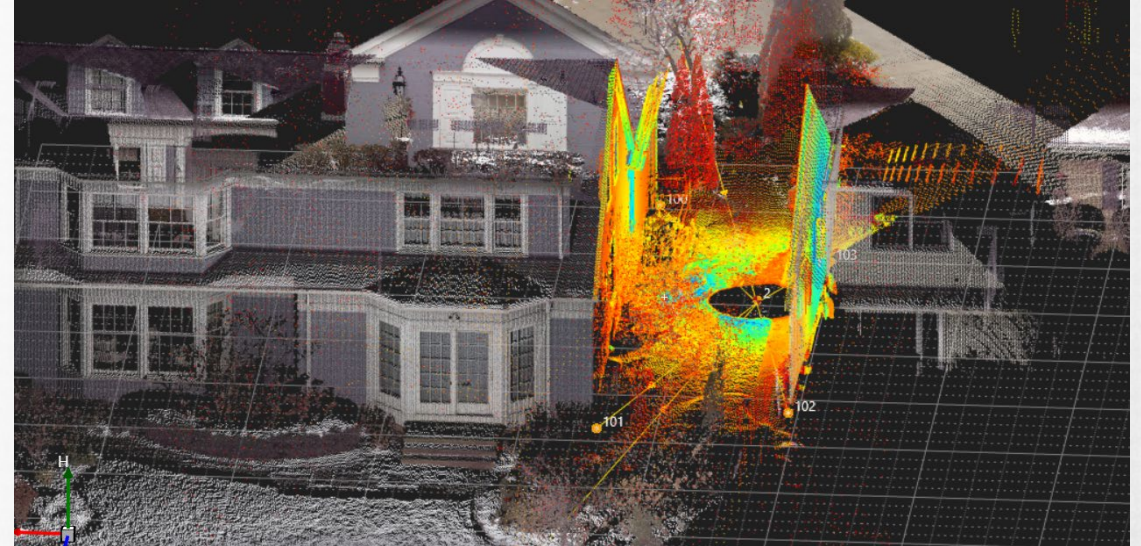
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- Need for better pre-construction site documentation.
- Imagery/point cloud you can measure from.
- Accuracy estimates and design grade information.

Idle & Orphan Site Topographic Surveys



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- <https://truview.leica-geosystems.com/welcome>



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