



## Evaluation of a Rapid Airborne Method for Locating Legacy Wells in Pennsylvania

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U.S. DEPARTMENT OF  
**ENERGY**

National Energy  
Technology Laboratory

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# Locating Wells in Wyoming Oilfield

## Approach

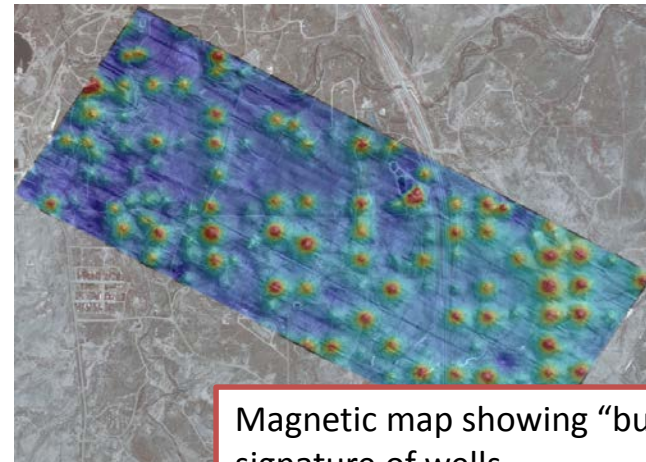
- Helicopter survey using two boom-mounted magnetometers
- Detects the unmistakable “bull's-eye” magnetic signature of vertical steel well casing

## Results from Test Area

- Method located 100% of wells drilled for primary production (1912-1926)
- Method located 82% of wells drilled for secondary recovery (water flood, 1965-1990)
- Based on success locating old wells at test area, operator used helicopter method to survey entire oilfield

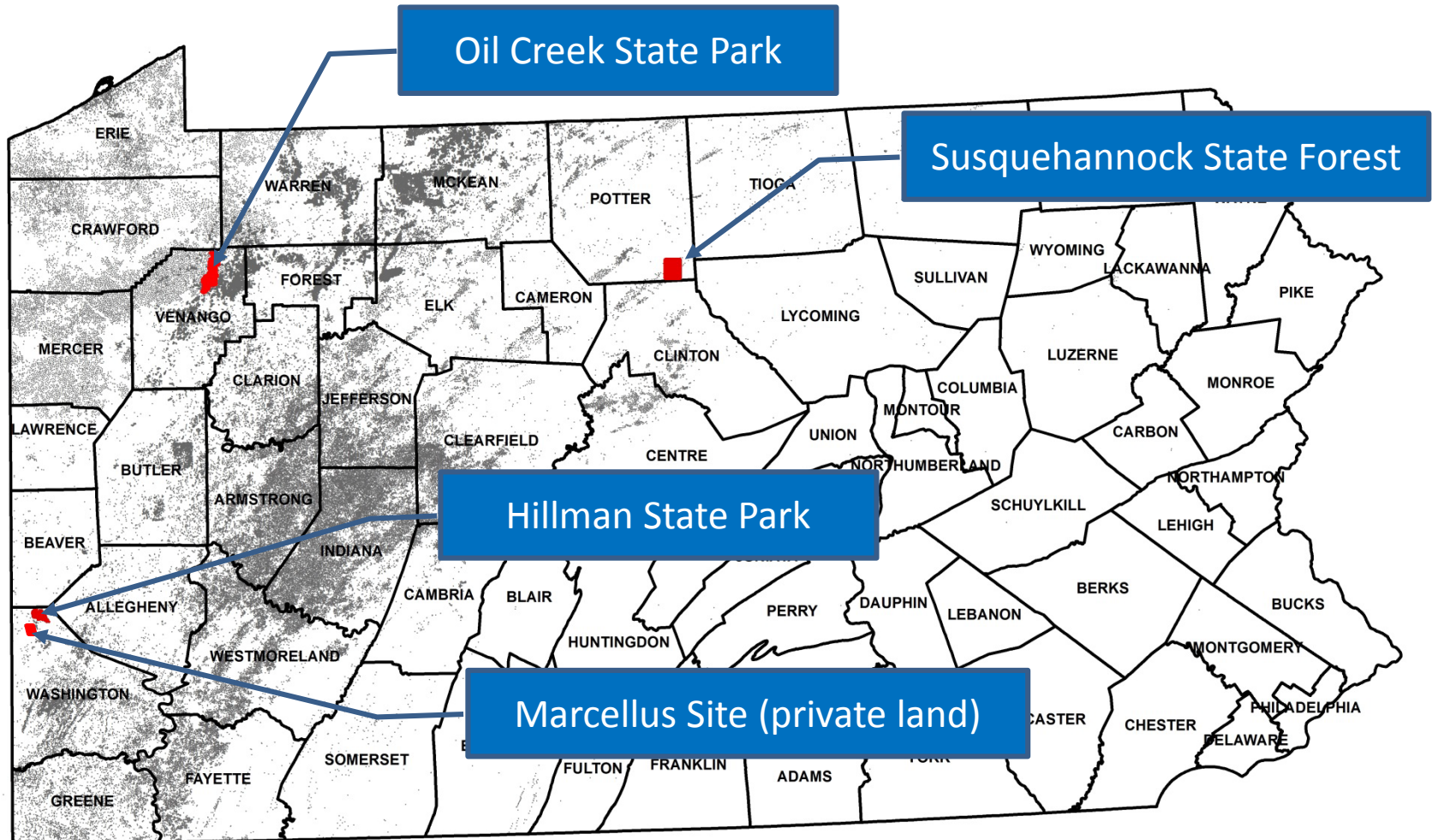


Helicopter with two boom-mounted magnetometers



Magnetic map showing “bull’s eye” signature of wells

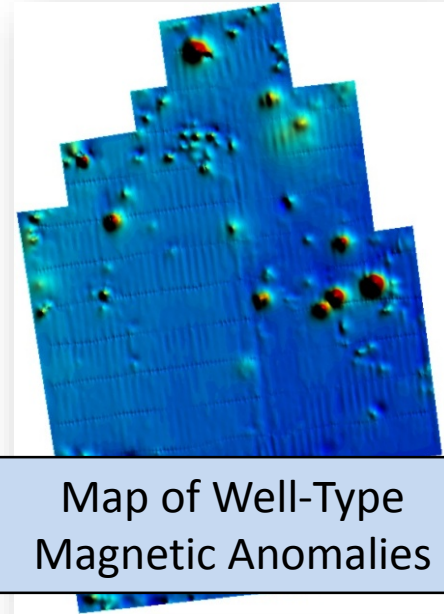
# Helicopter Magnetic and Methane Surveys of PA State Lands with Legacy Oil and Gas Wells



Gray shading denotes legacy well density

# Locating Wells in Pennsylvania

Airborne Magnetic Survey



Map of Well-Type  
Magnetic Anomalies

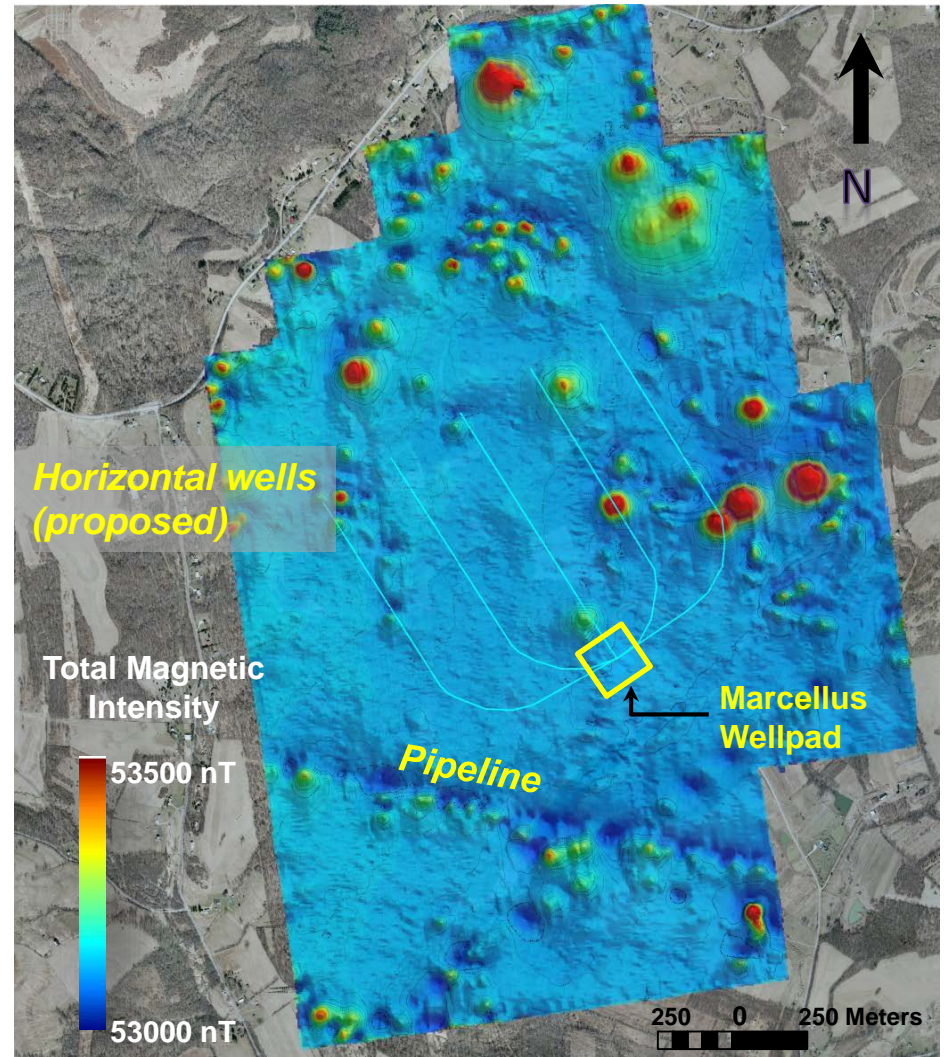


Navigating to Magnetic  
Anomaly Location

Locating Magnetic  
Anomaly on the Ground

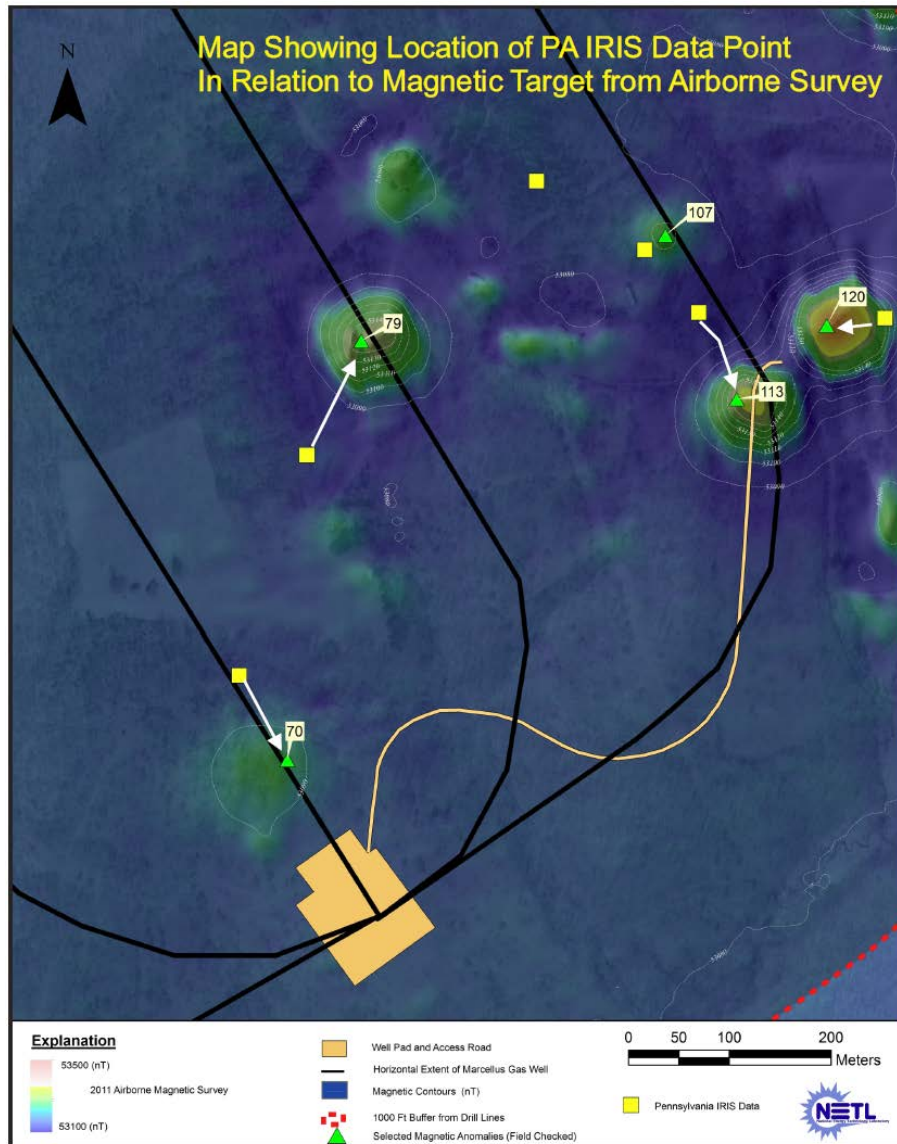
Excavation to Confirm  
Well Location

# Locating Wells in Pennsylvania



Helicopter Magnetic Map of Proposed Marcellus Well Pad Location

# Locating Wells in Pennsylvania

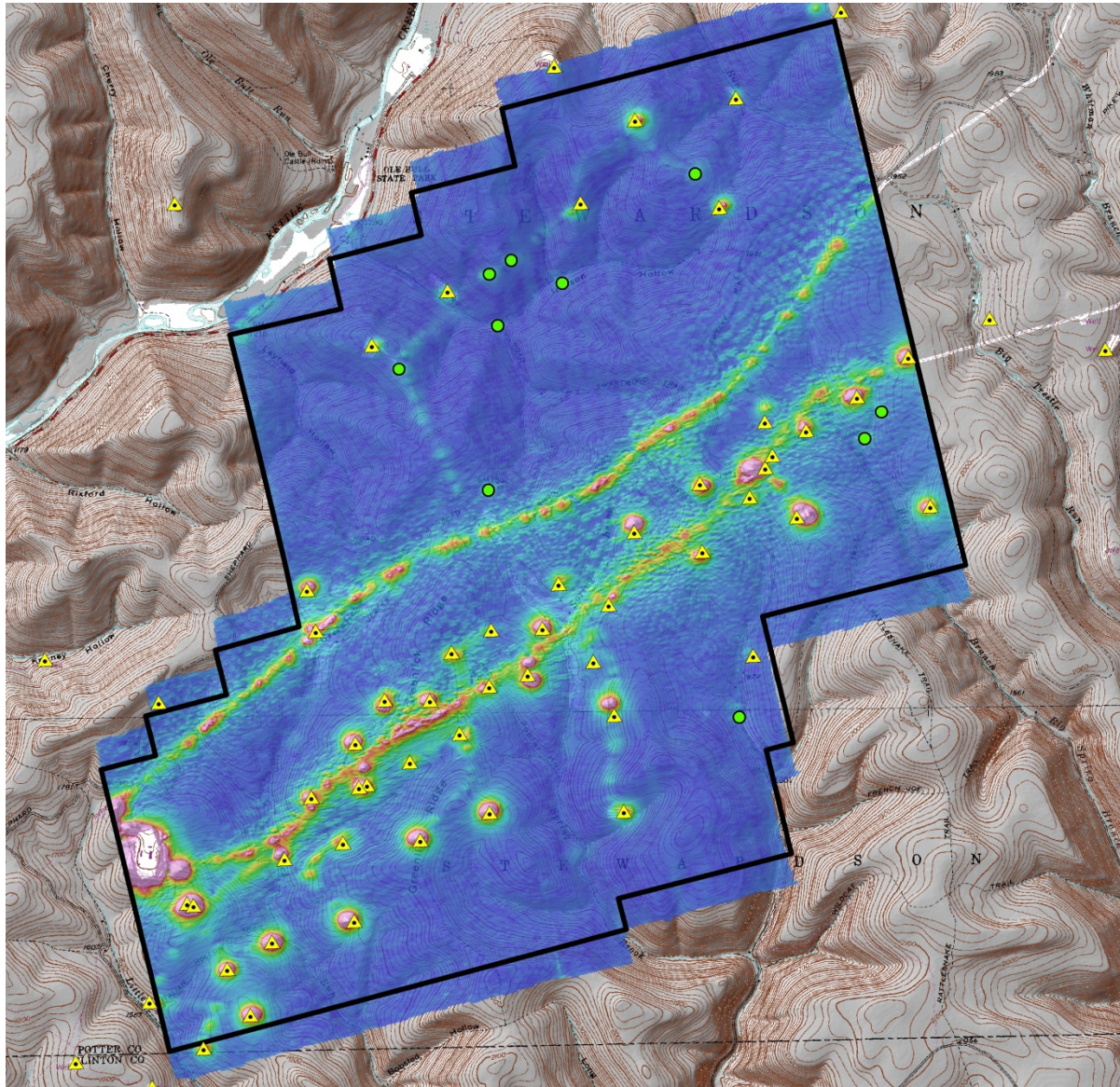


## How Accurate are Well Databases?

- PA IRIS database well positions often > 100 m from actual well locations
- 17 wells located in study area; six were in PA IRIS well database
- Some locations in PA IRIS well database were not close to any confirmed well

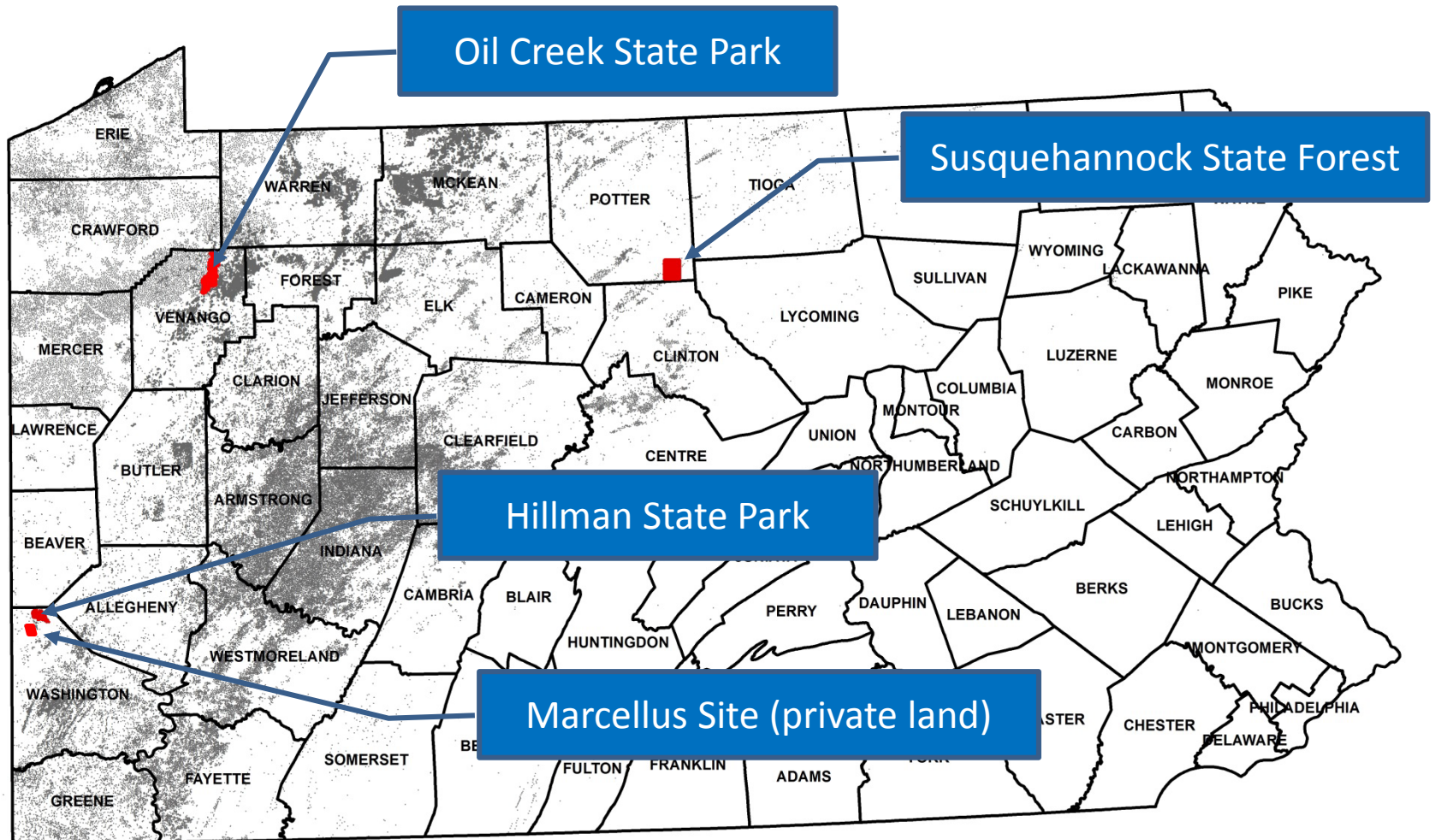


# Susquehannock SF



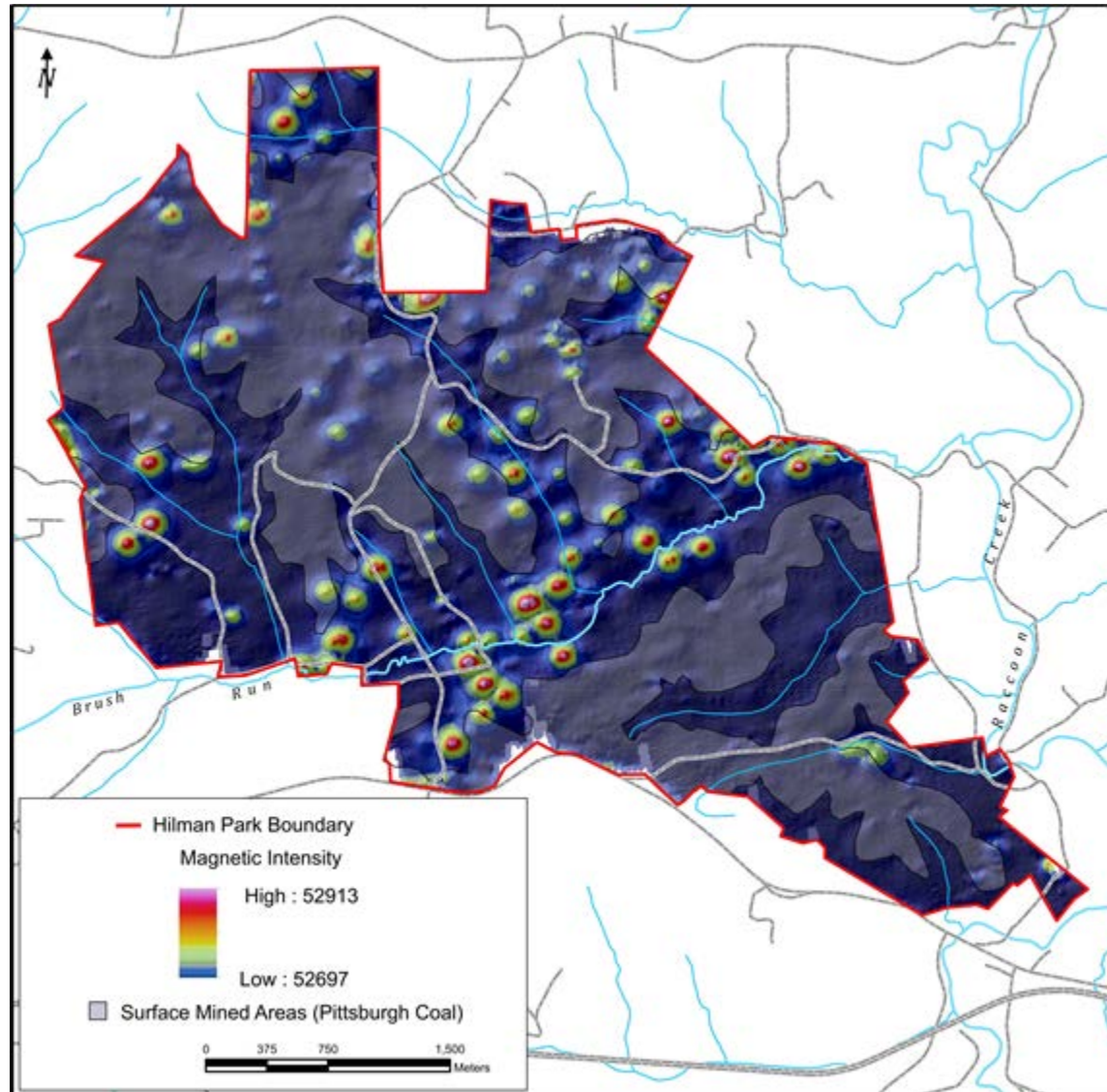


# Helicopter Magnetic and Methane Surveys of PA State Lands with Legacy Oil and Gas Wells



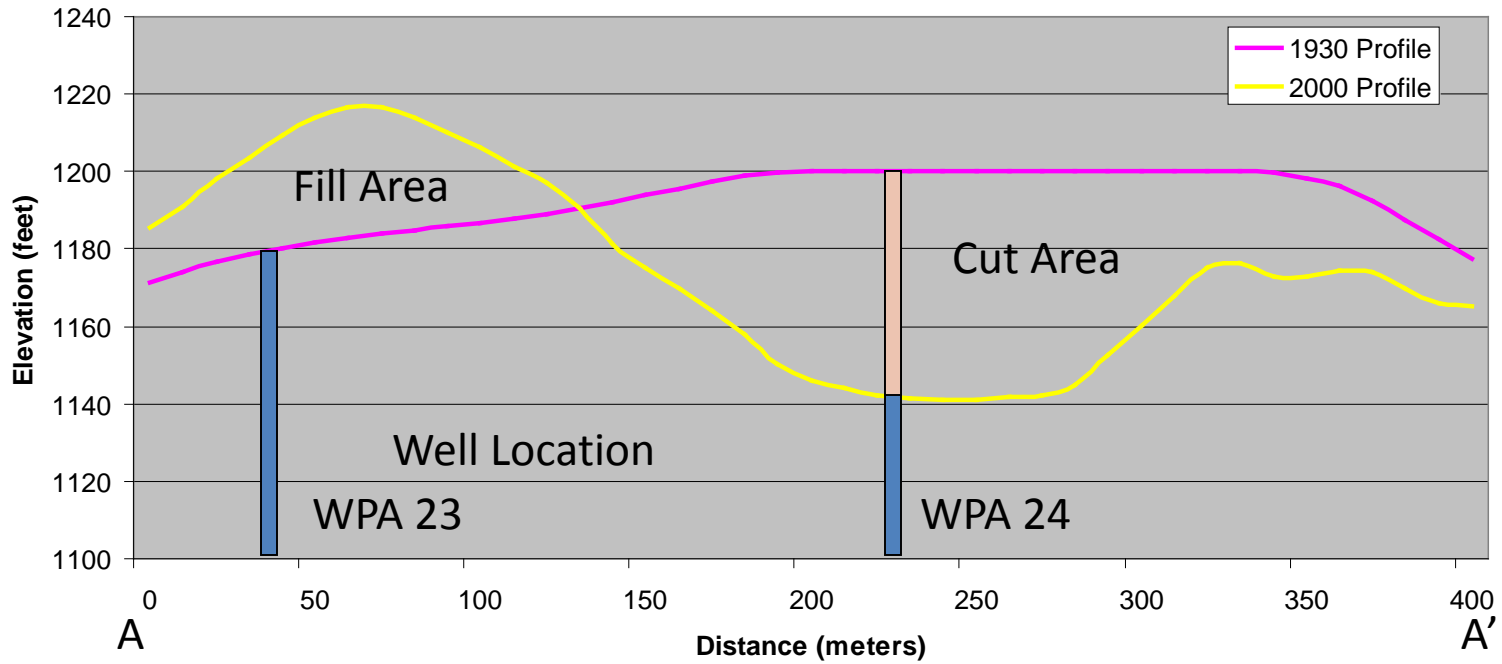
Gray shading denotes legacy well density

# Hillman State Park

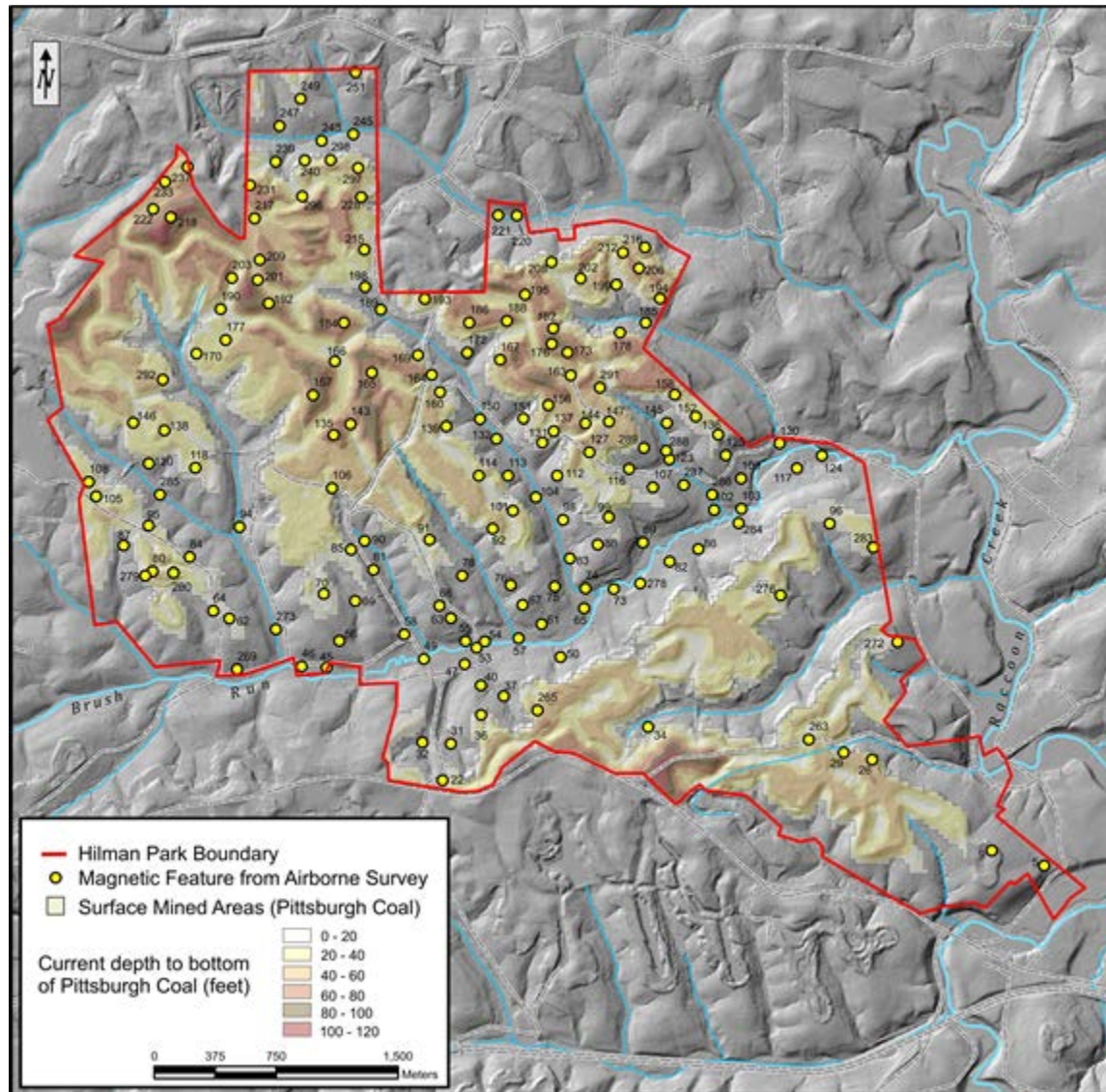




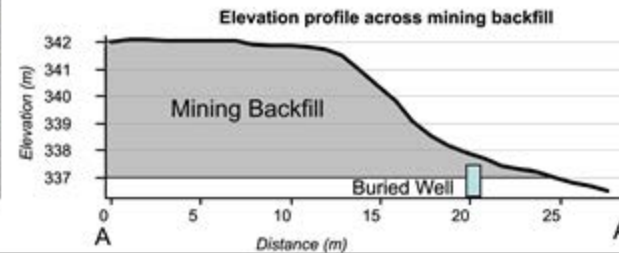
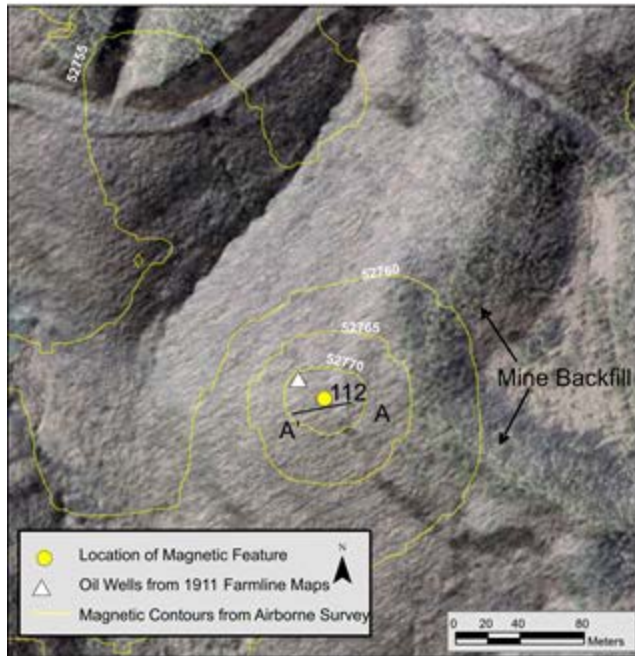
### Hilman State Park Well Profile A -- A'



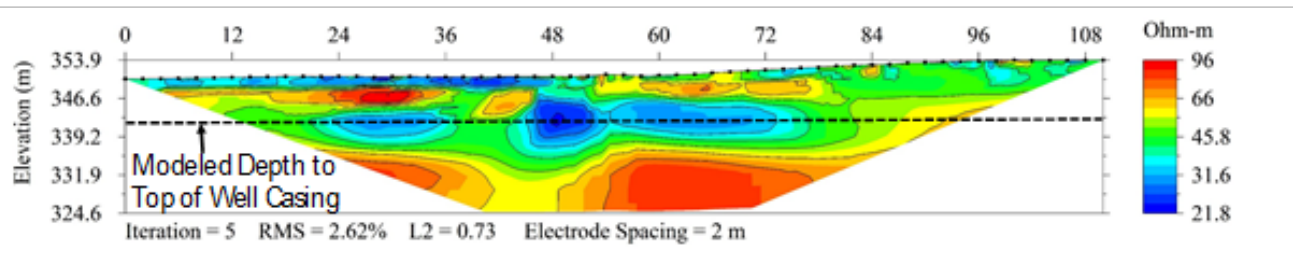
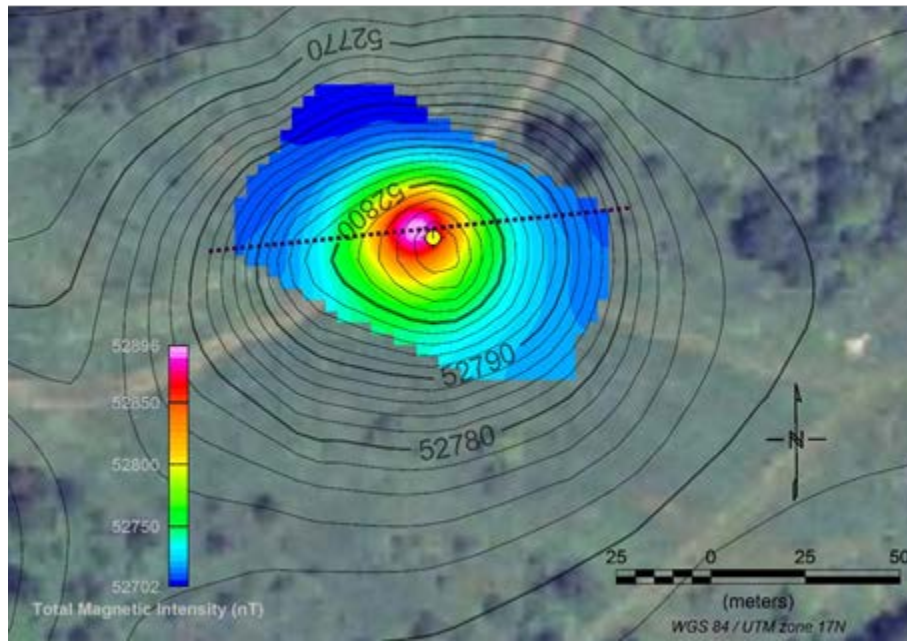
# Hillman State Park



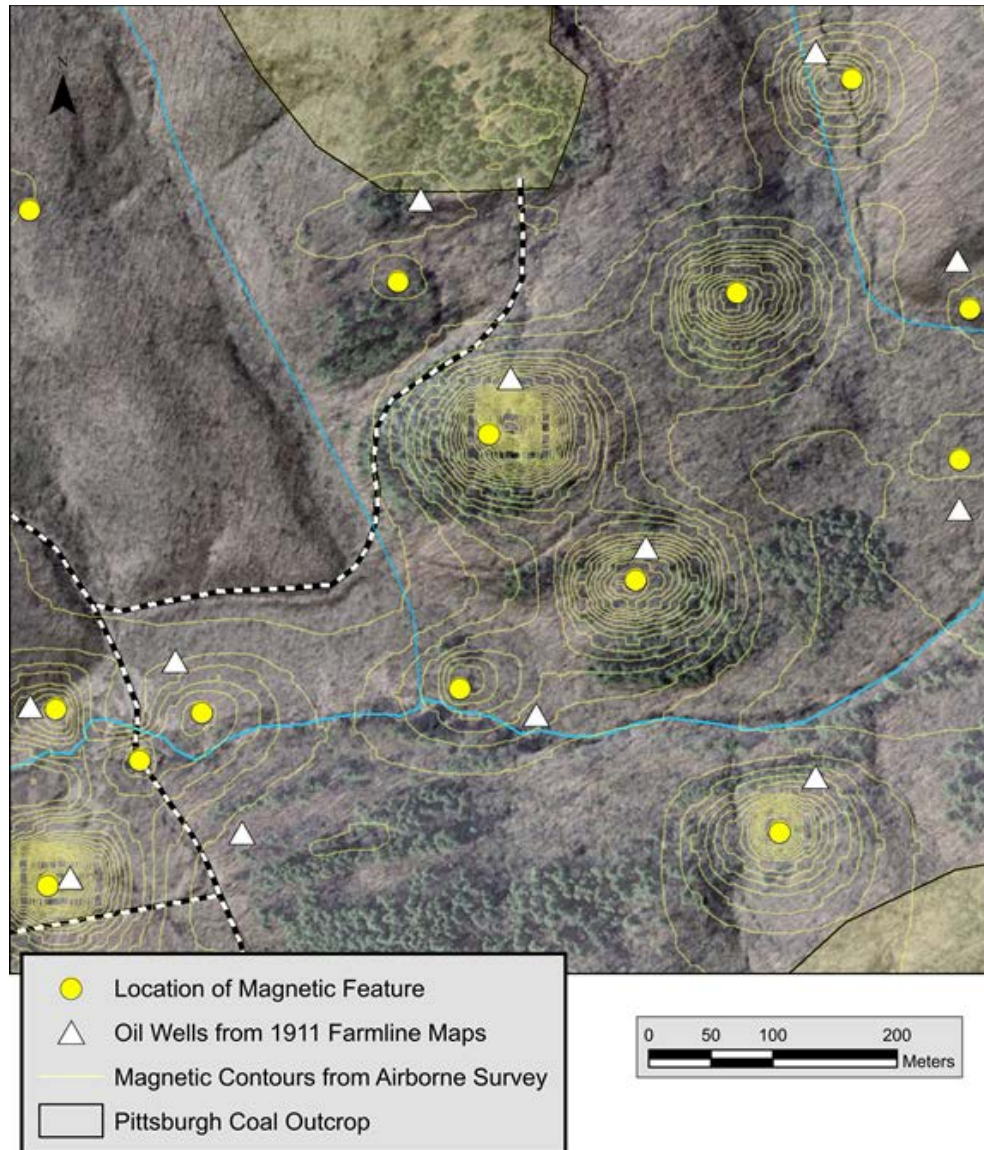
# Hillman State Park



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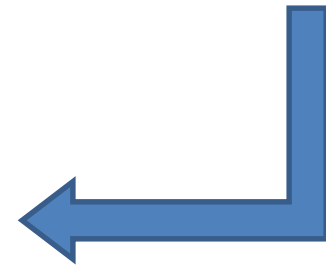
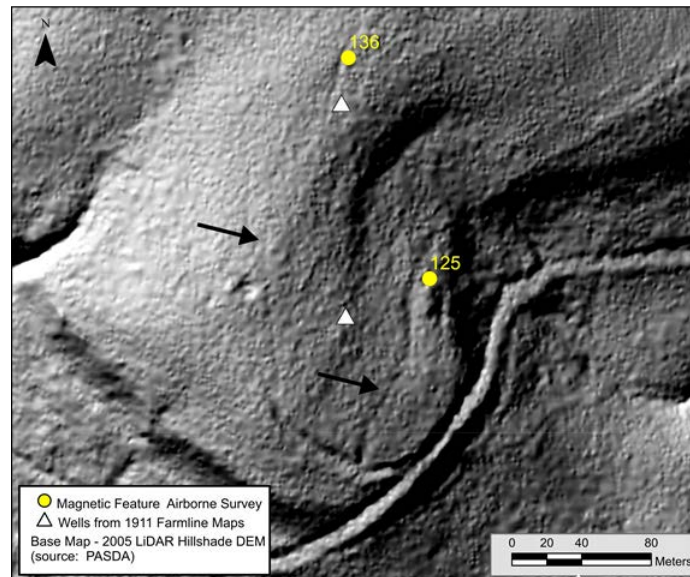
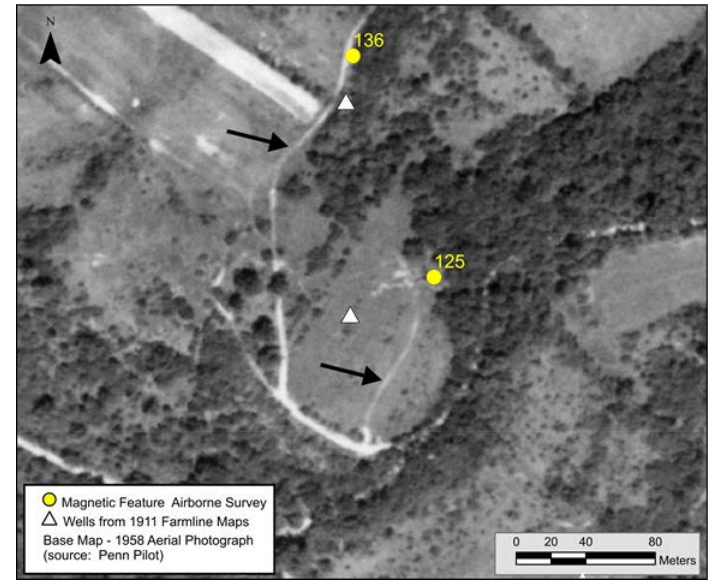
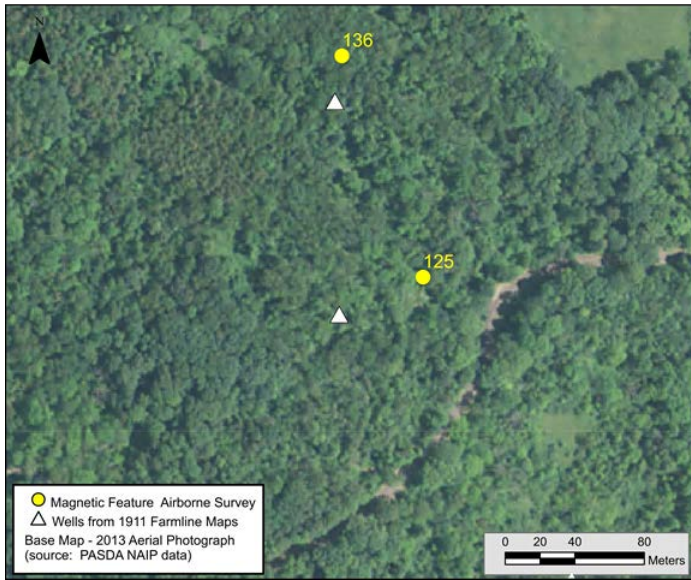


# Hillman State Park

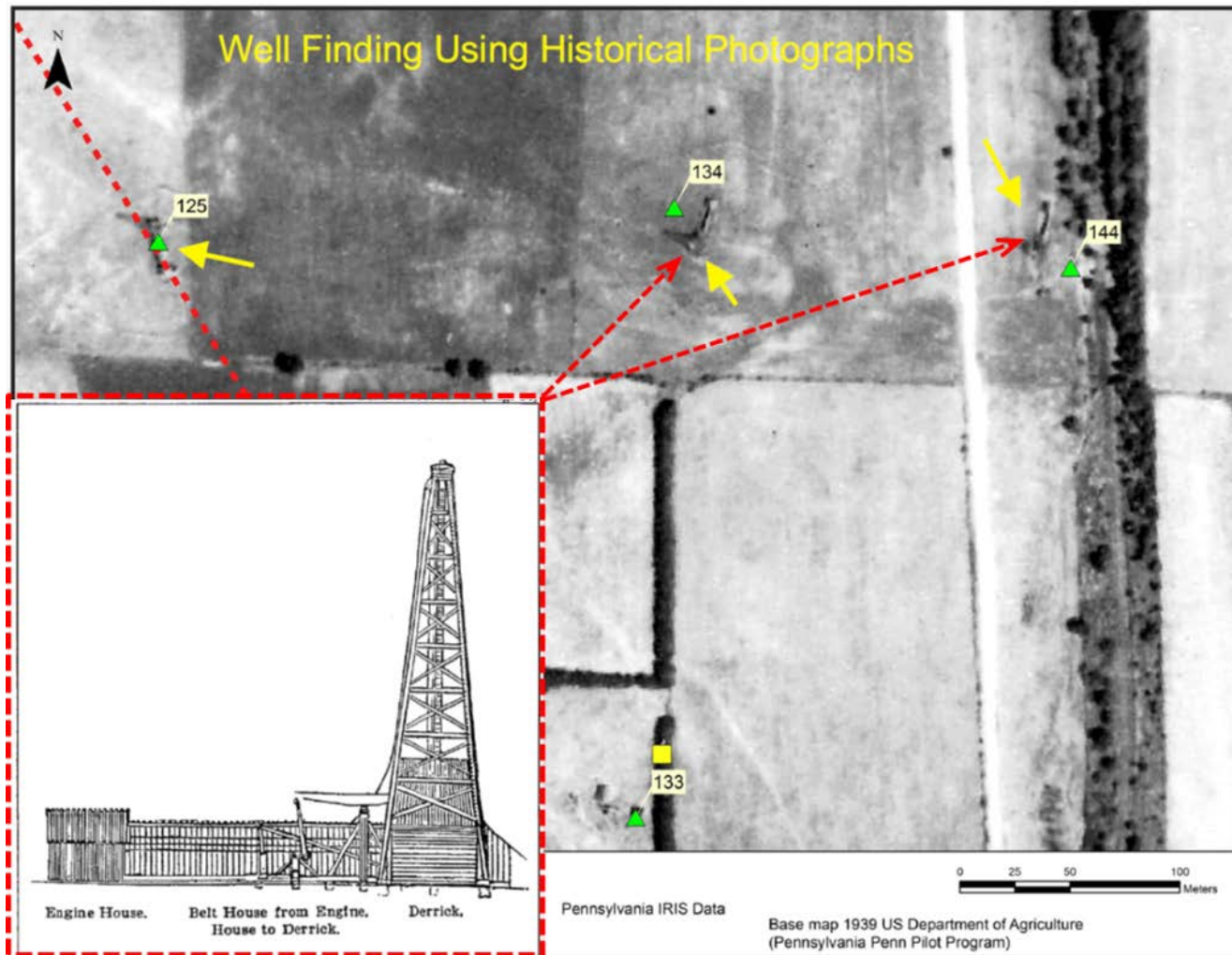




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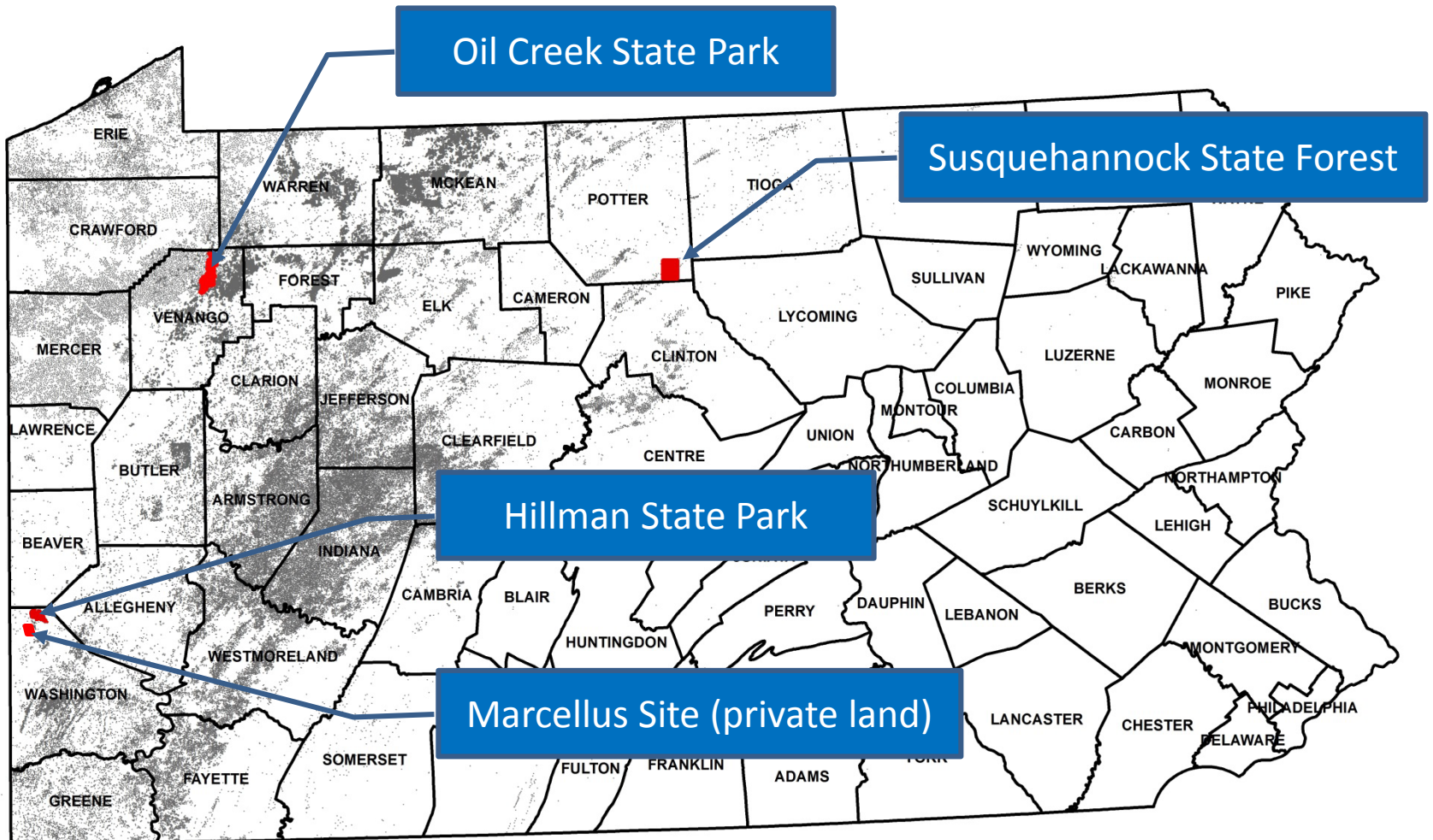


# Locating Wells in Pennsylvania



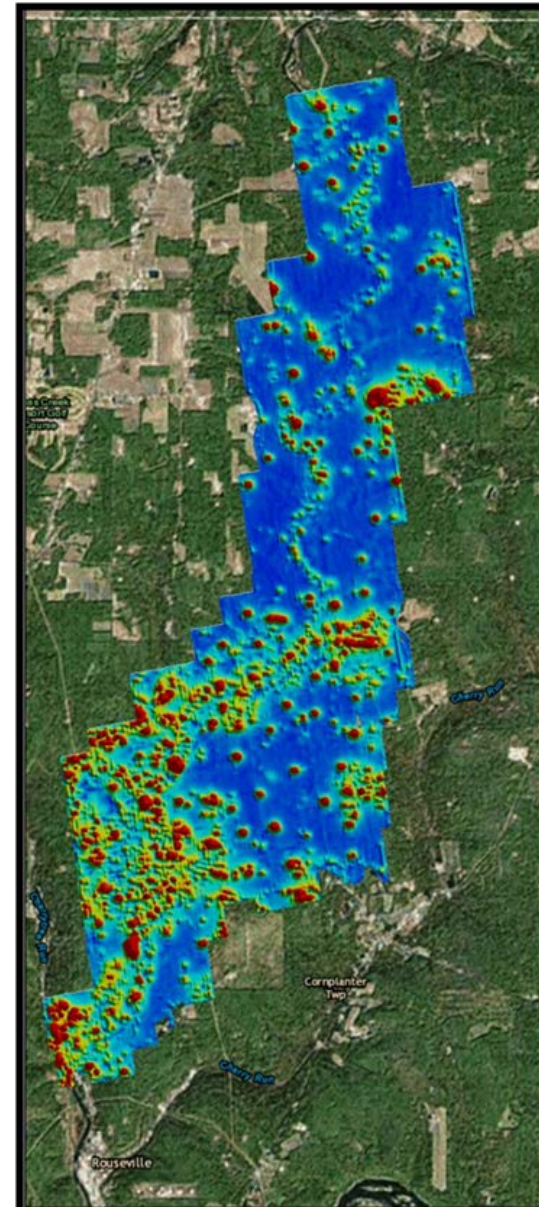
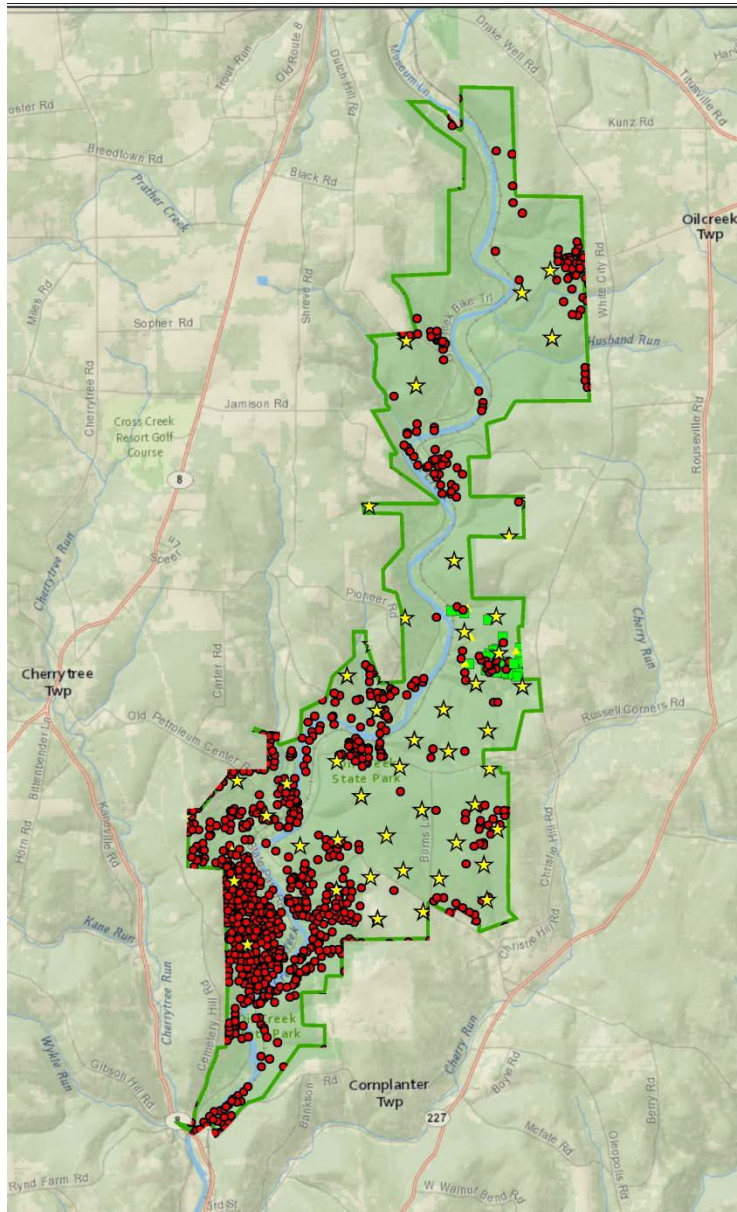
Historical air photos can be used to locate old wells in some areas

# Helicopter Magnetic and Methane Surveys of PA State Lands with Legacy Oil and Gas Wells

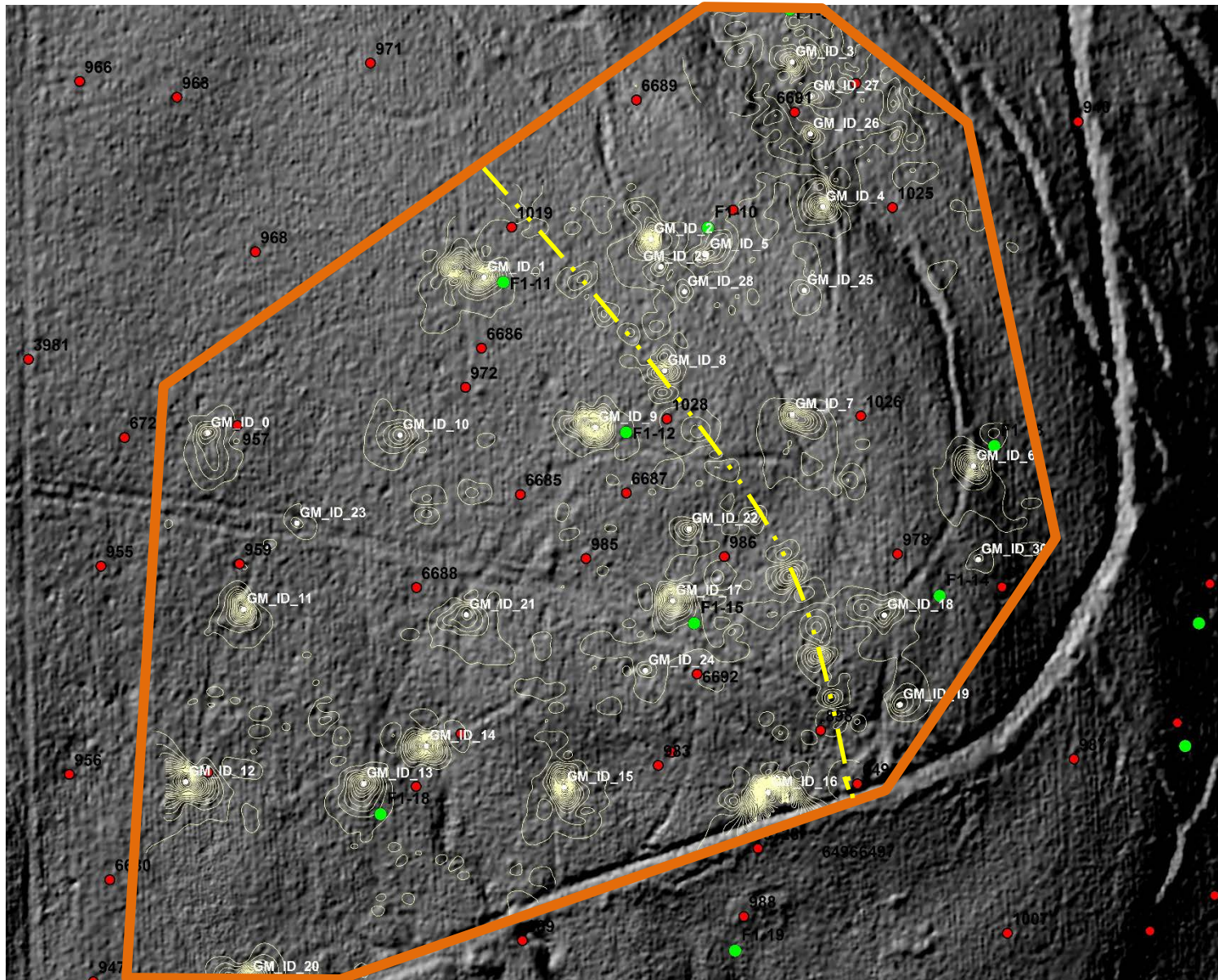


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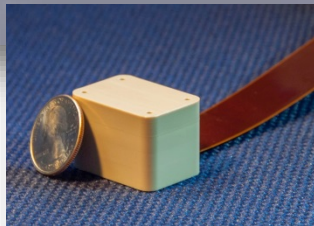
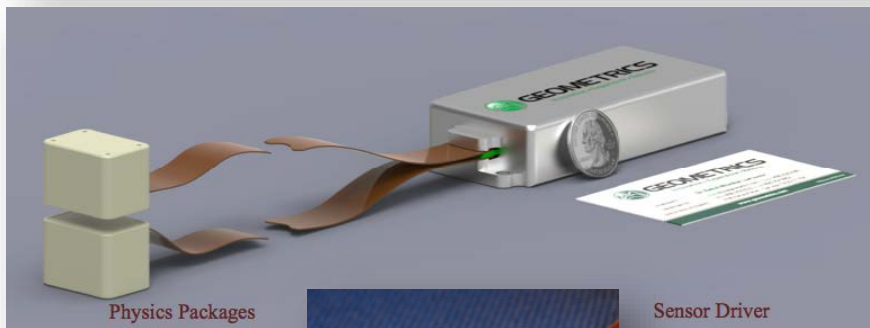
# Oil Creek State Park



# Oil Creek State Park



# Future



# Contact Information

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# Locating Wells in Pennsylvania



*Vertical steel well casing perturbs the earth's magnetic field and causes the distinctive "bull's eye" magnetic anomaly.*

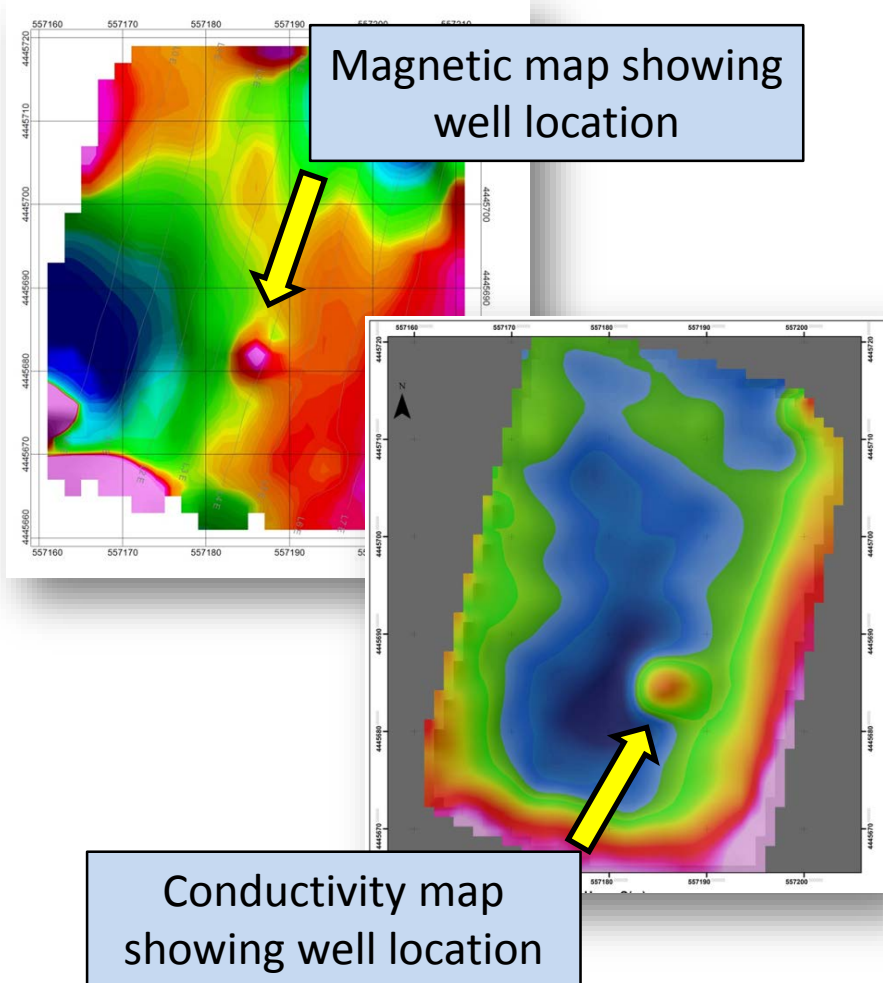
## **What if casing is missing because:**

- Casing was pulled from sub-economic well to be reused in another well
- Metal drives during World War II recovered well casing where possible to aid war effort.

Excavation of well where steel casing had been pulled; only the wooden surface conductor remained



# Locating Wells in Pennsylvania



## What if Casing is Missing?

- This well with no casing still exhibits magnetic and conductive signatures at ground level.

