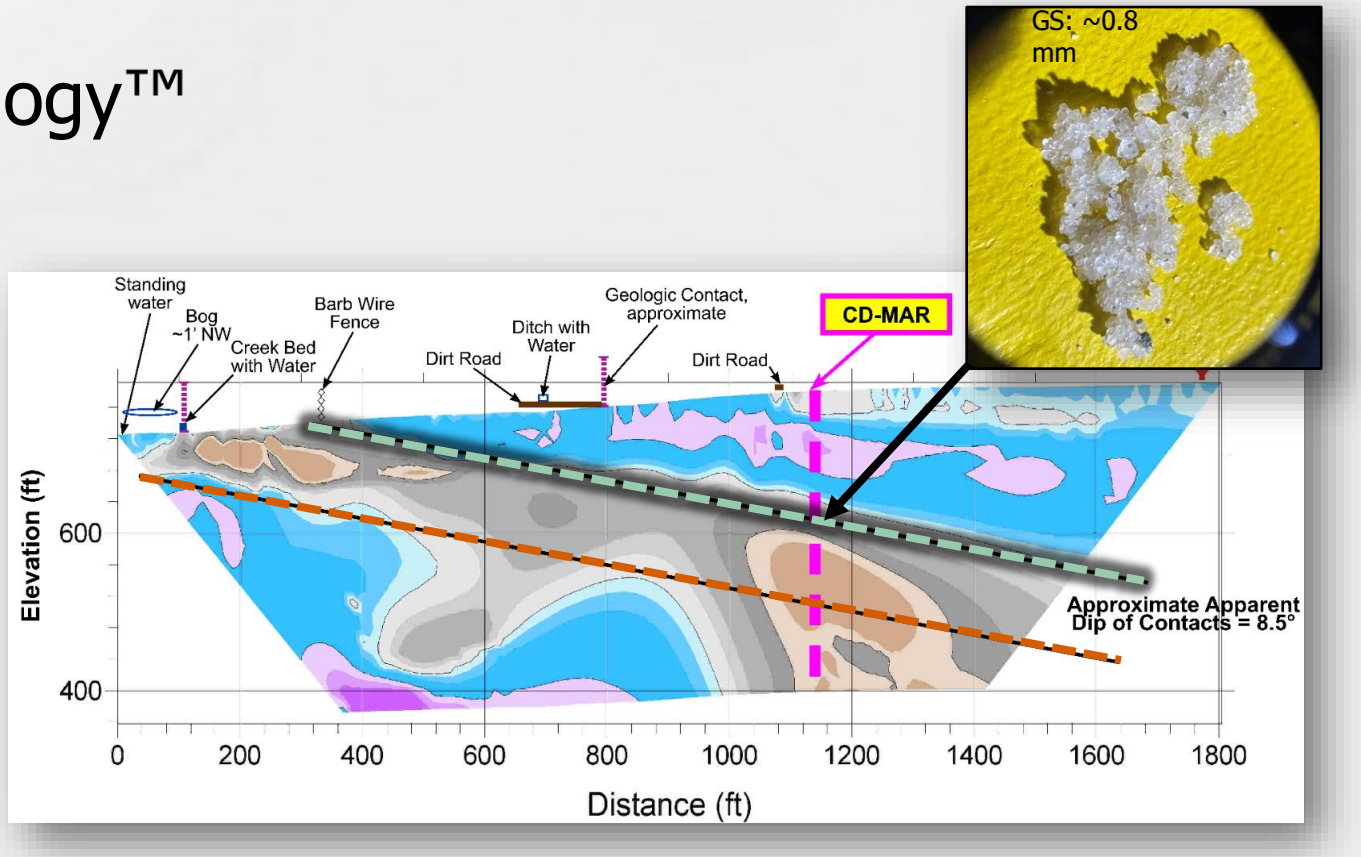
Beating the Odds: Efficiently Targeting Groundwater Wells

Madison Culver

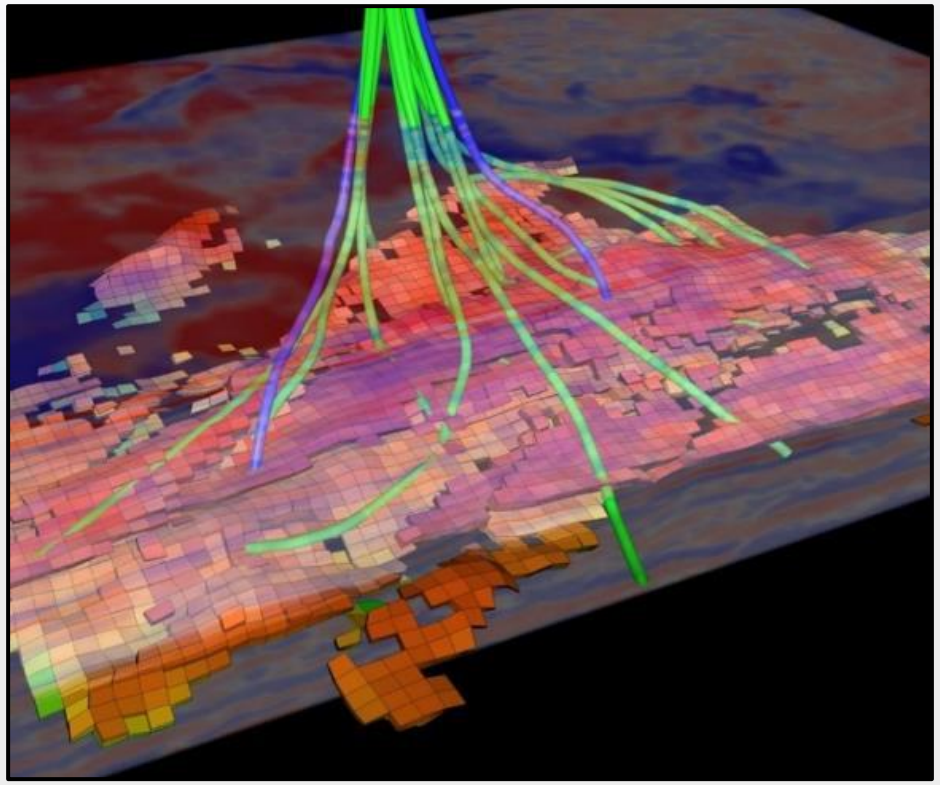
Staff Geologist / Technical Sales

Today's Topics

1. Why scan first?
2. What is Electrical Hydrogeology™
3. Case Studies
4. The GeoTrax Survey™ Difference
5. Best Practices for Groundwater Projects



Scan then Target Approach: "Water is the New Oil"



3-D Seismic North Sea

dgi.com

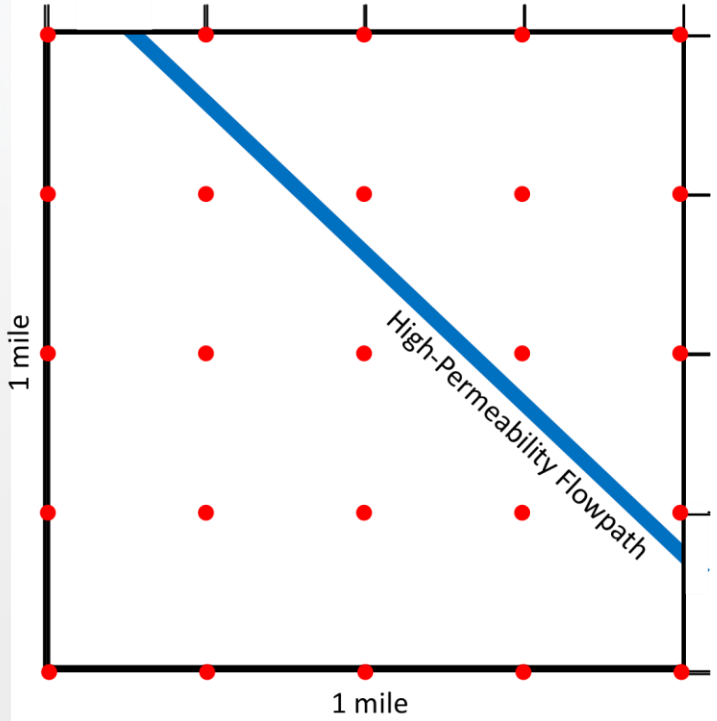


X-ray of Skull

nydailynews.com

Scanning is More Effective & Cost Efficient

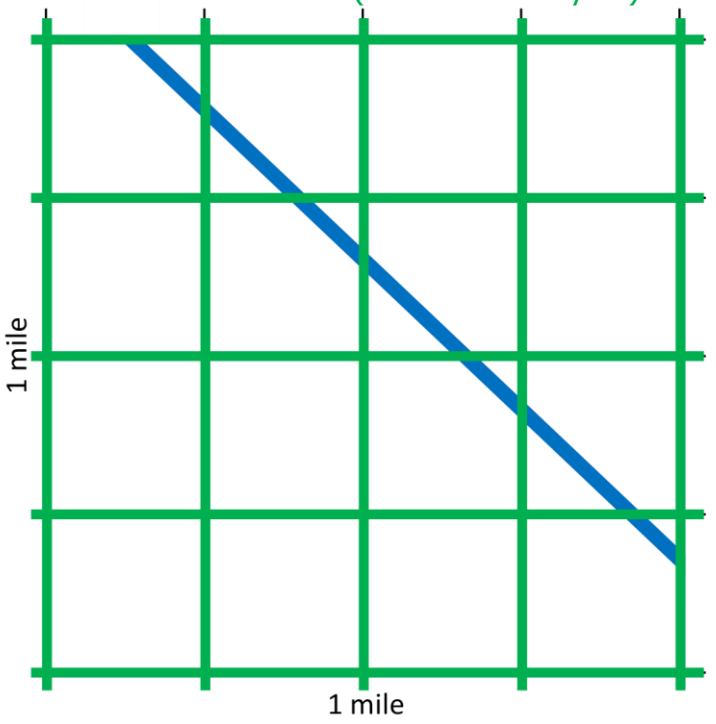
Grid of Test Wells



	Borings	Scans
Sampling Interval	1/4 mile	1/4 mile
Number of Test Wells/Surveys	25	10
Hydrogeologic Structures Delineated?	No	Yes
3D Modeling Included?	No	Yes
Odds of Targeting a 10-ft Wide Fracture	0.02%	80-100%
Approx. Cost	**$12,500,000**	**$200,000**

Sampling interval of ¼ mile for both wells & ERI Scans
Cost per test well from client up to 700 ft BGS = ~$500K ea.
Total scanning cost includes data acquisition & interpretation

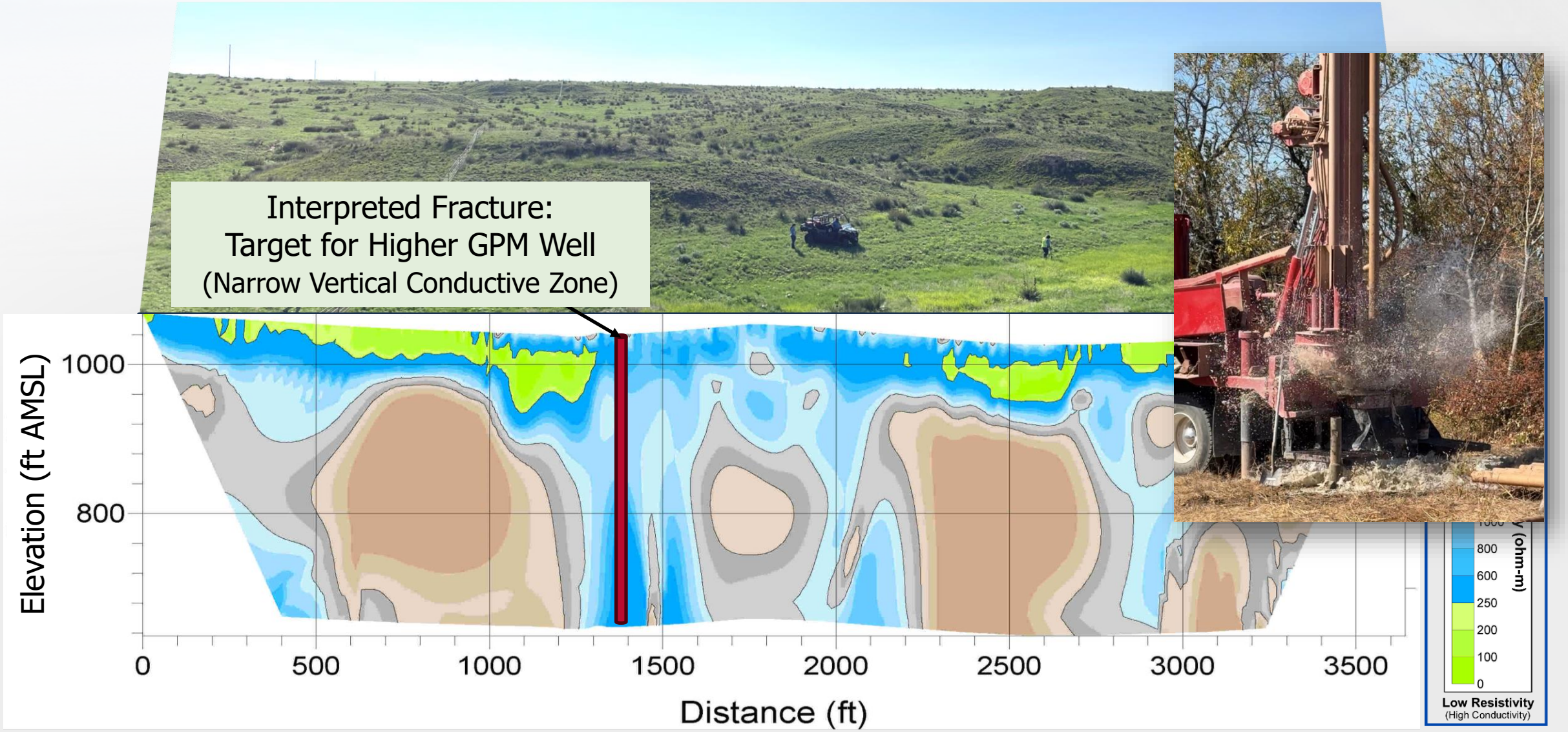
Grid of Scans (GeoTrax Surveys™)



If one test well costs $50K…eliminating 4 test wells pays for the entire scan.
If one test well costs $500K…eliminating 1 test well pays for the entire scan and saves $300K.

Aestus

Scan First. Drill with Confidence.



Electrical Hydrogeology™
Leveraging Integrated Data Sets

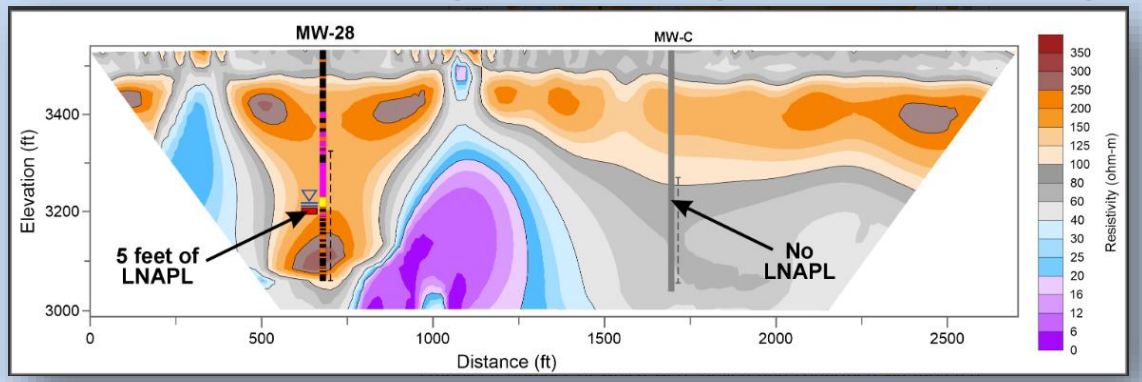
Electrical Hydrogeology =

Traditional Hydrogeology

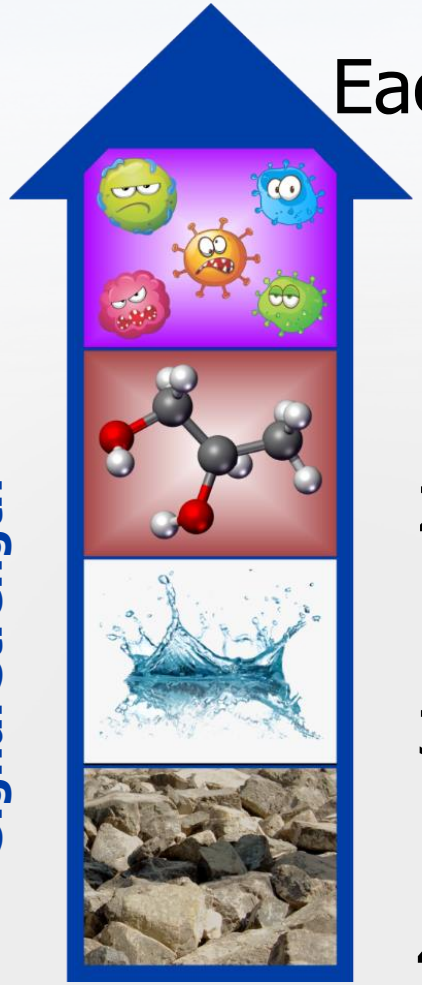
- Potentiometric surface maps
- Lithology logs
- Stiff Diagrams
- Pipe Diagrams
- GW Chemistry
- GW Flow Models
- Geology Maps
- Aquifer Maps
- HPT/MIP Results
- Etc.

+

Electrical Imagery/Targeted Drilling

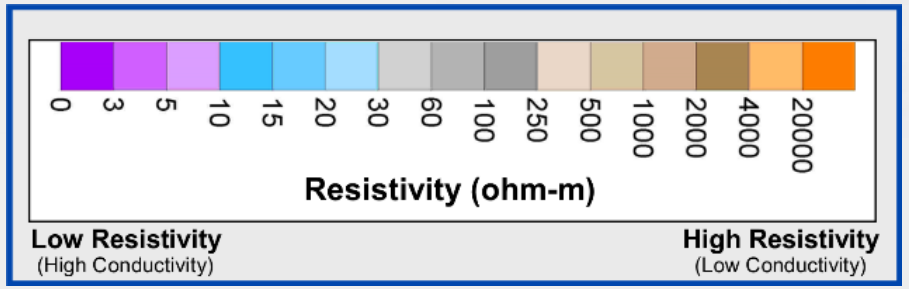


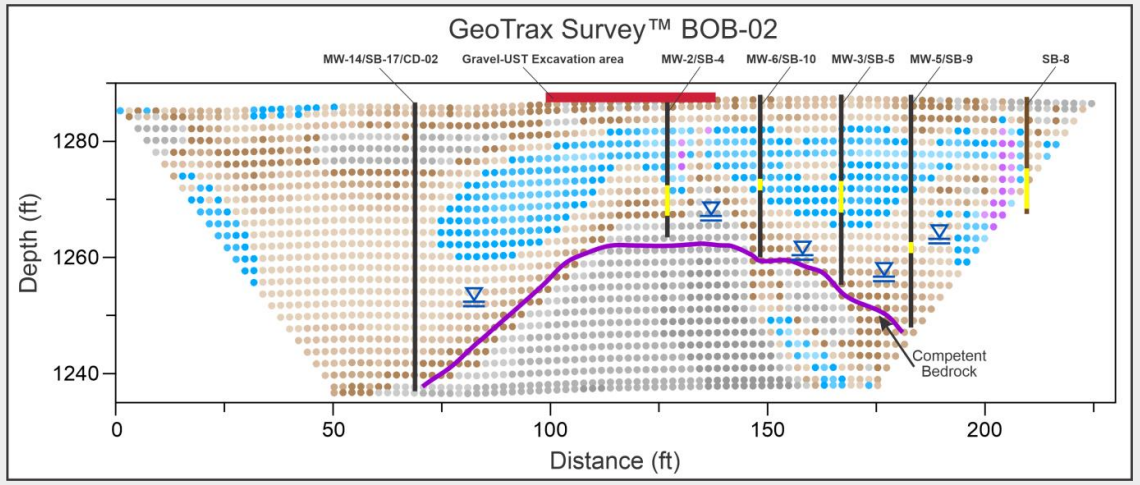
What Do Electrical Images See?



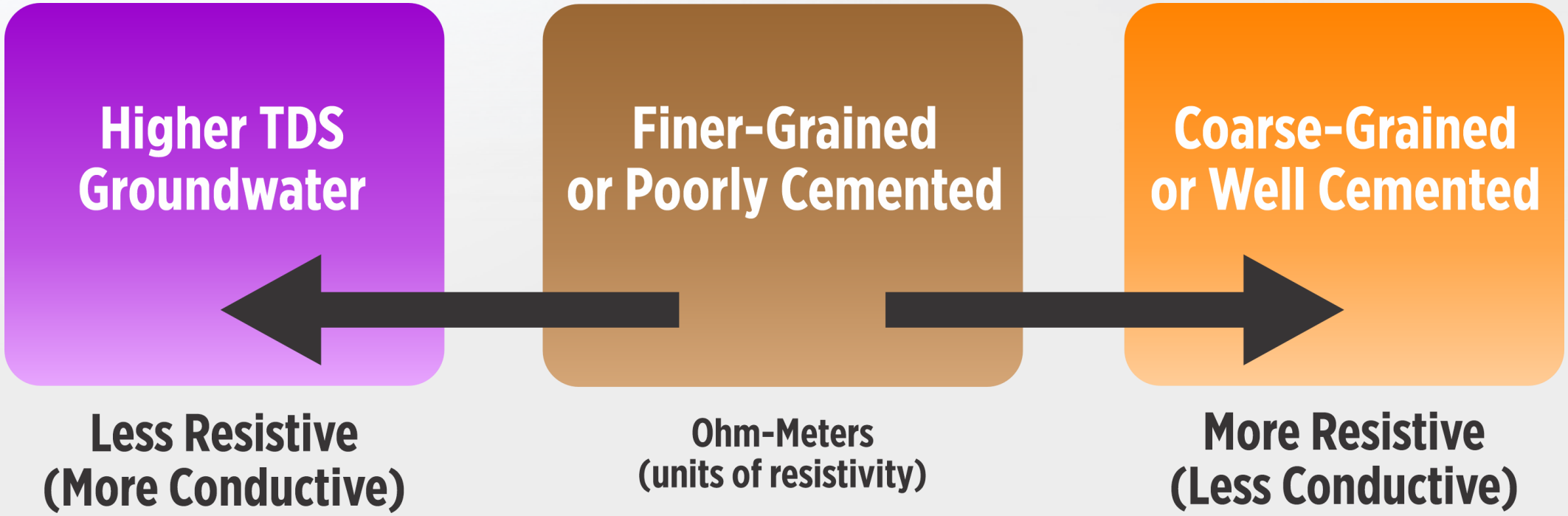
Each data point (pixel) equals the sum of:

1. Biological activity
2. Contamination/ Injectates/etc.
3. Groundwater/Fluids
4. Soil and rocks





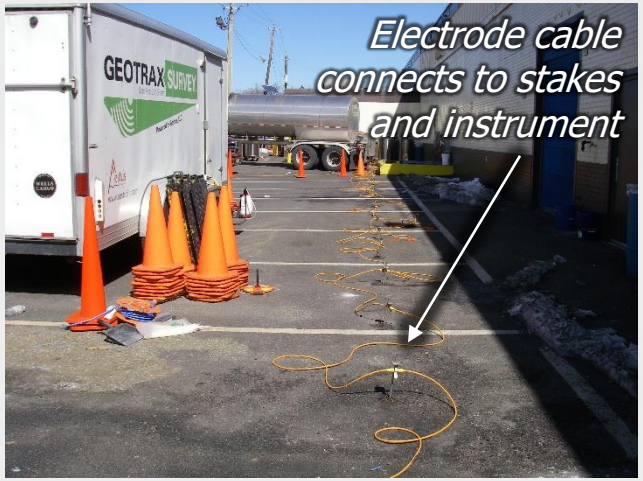
Typical Subsurface Electrical Properties
As Applied To Water Supply Projects



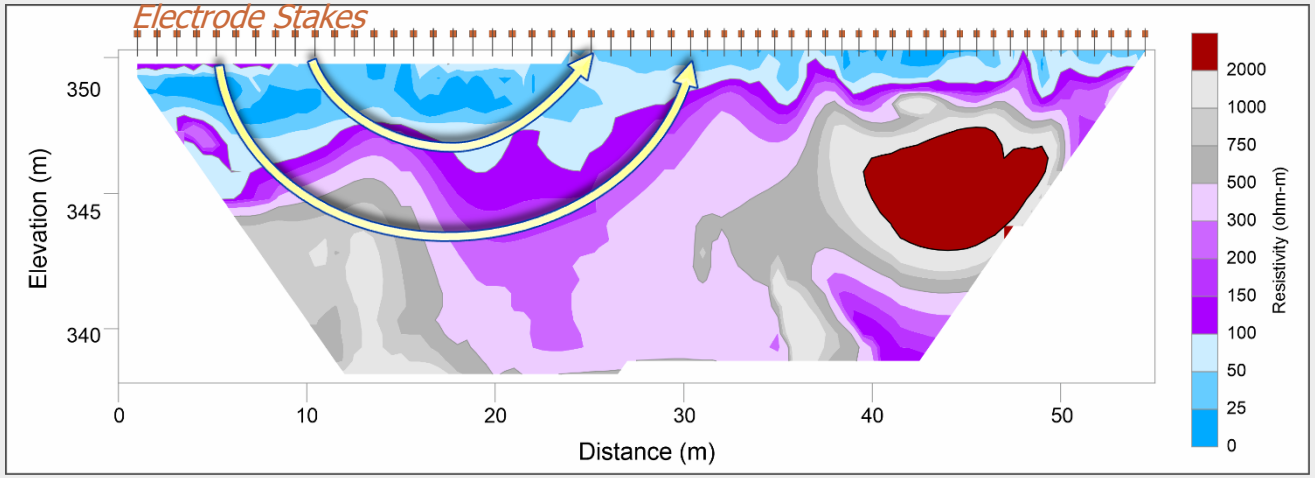
Field Deployment


Electrode stakes are 22 inches long

- Must be in a straight line
- Line length=5x imaging depth
- In place for ~3 to 5 hours




Stakes are advanced into the ground ~12-18 inches



Electrical current flows between electrode pairs
Results in a vertical 2D continuous electrical image of the subsurface

Case Studies

1. Single Water Well Siting in Karst (Tishomingo, OK)
2. Wellfield Development in Alluvial Sediments (Guymon, OK)
3. Water Supply Well Remediation in <2 Years (Ada, OK)



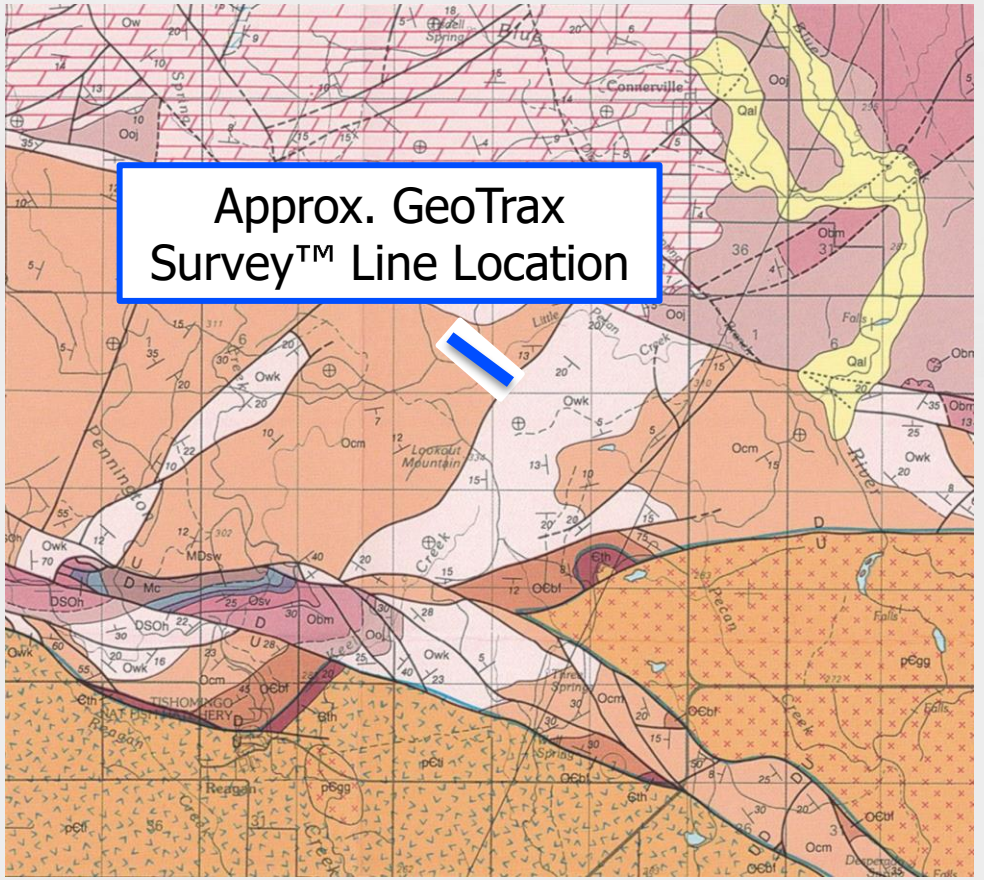




Aestus

Tishomingo, OK Water Supply Project
Project Background

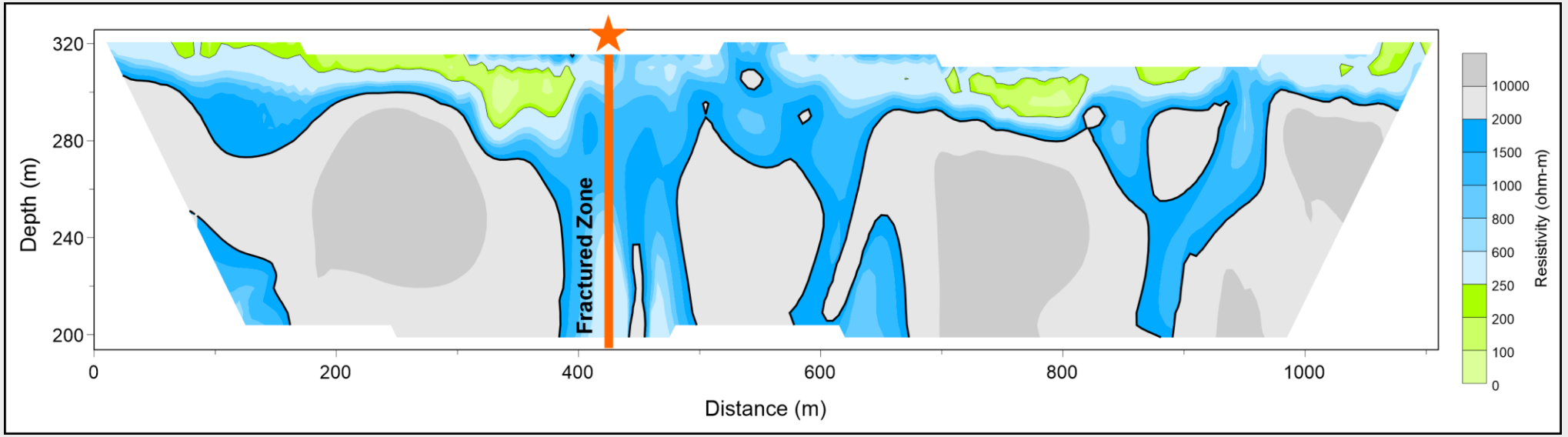
- Tishomingo needed an additional municipal water supply well
- Local geology is carbonate aquifer with poor yields **(~5-10 GPM)**
- USGS 3D Model cross sections show ~3,000 ft dolomite with no regional faults mapped (Faith, 2010)



Tishomingo, OK Water Supply Project
Targeted Drilling Produces Better Results

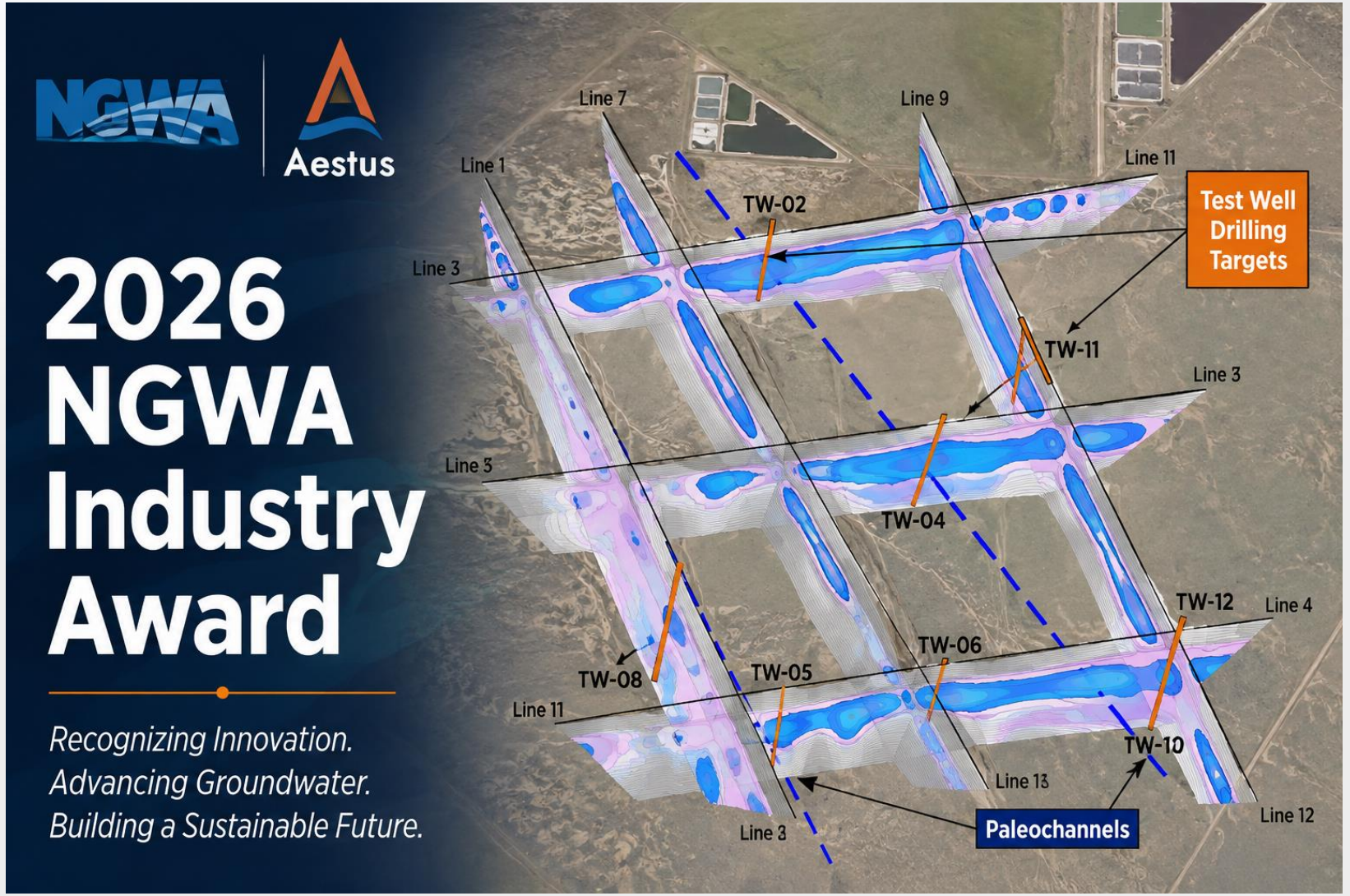
- Test well yield: ~450 GPM
- Production well yield: **700 GPM (70x expected yield)**
- Pipeline is currently being installed

50 m wide fracture zone out of 1,200 m…
~4% chance of drilling that zone blindly!



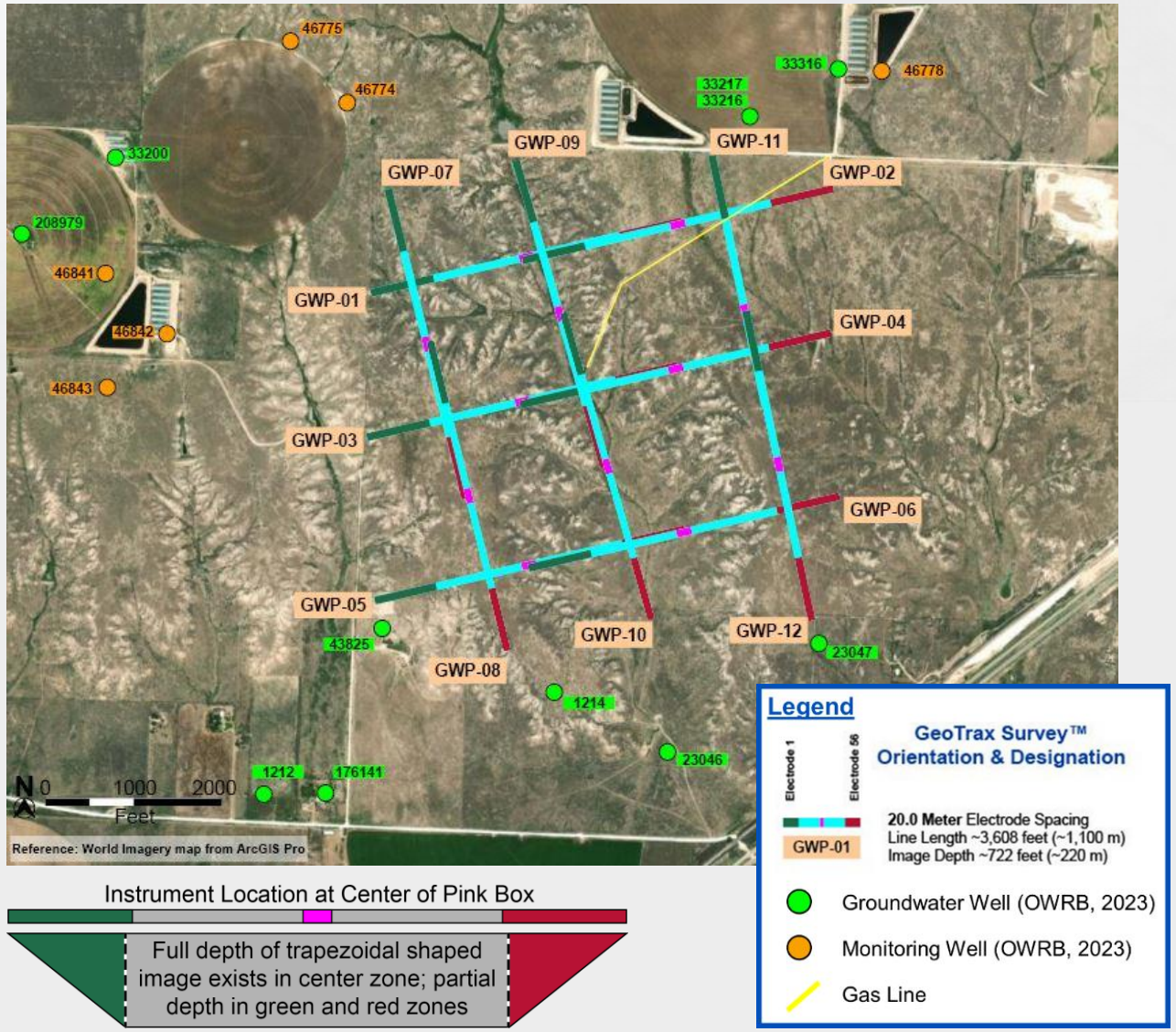
Guymon, OK Mesa Water Project

NGWA 2026 Outstanding Groundwater Project Award Winner

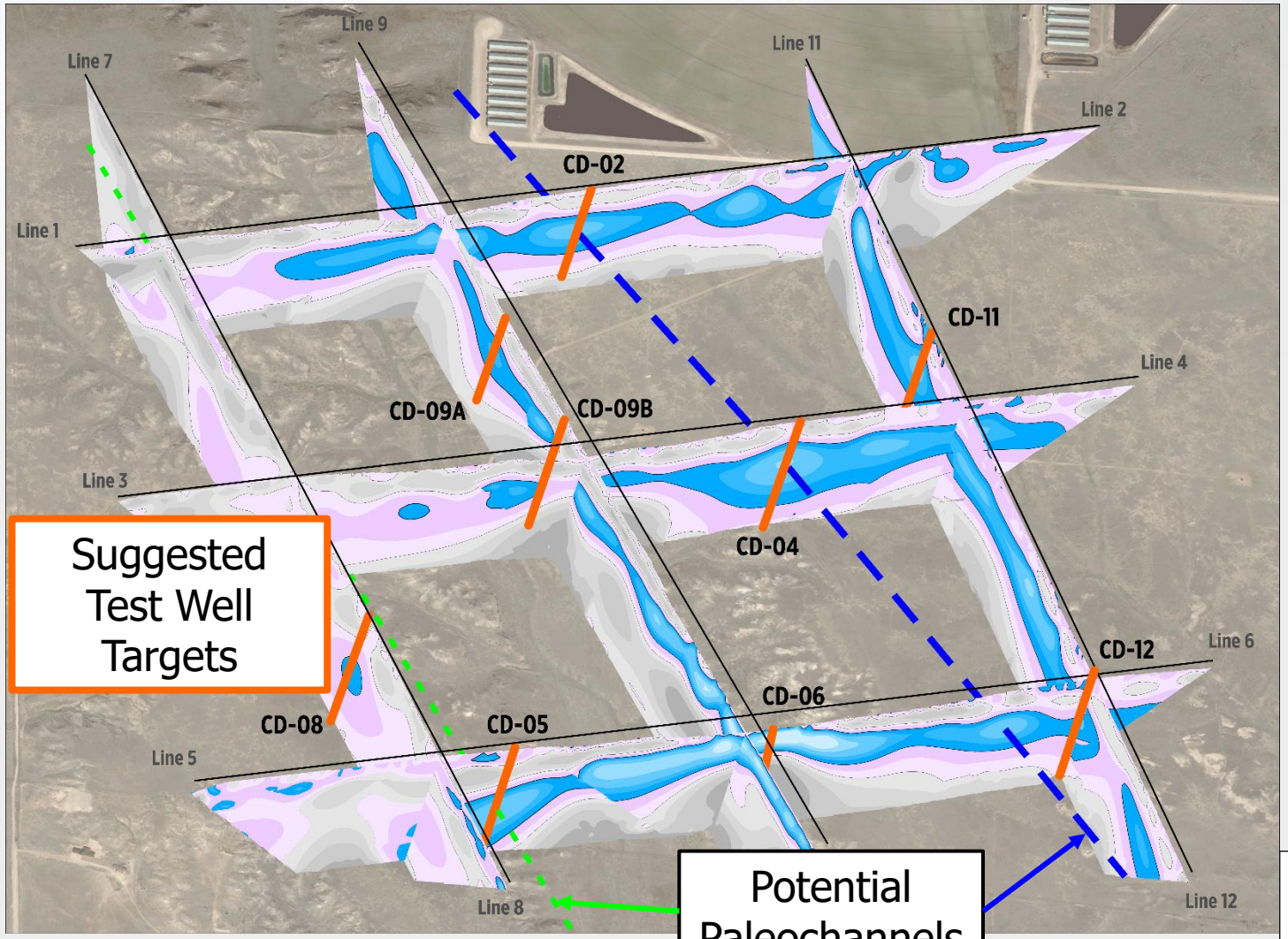


Guymon, OK Mesa Water Project
Objectives

1. Identify groundwater flowpaths/paleochannels in the investigation area
2. Map base of the Ogallala Formation
3. Optimize placement for municipal water supply wells

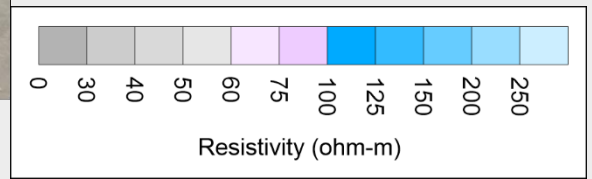


Guymon, OK Mesa Water Project
Electrical Imagery Reveals Test Well Targets



- Resistive targets in phreatic zone
- Indicative of coarse-grained media

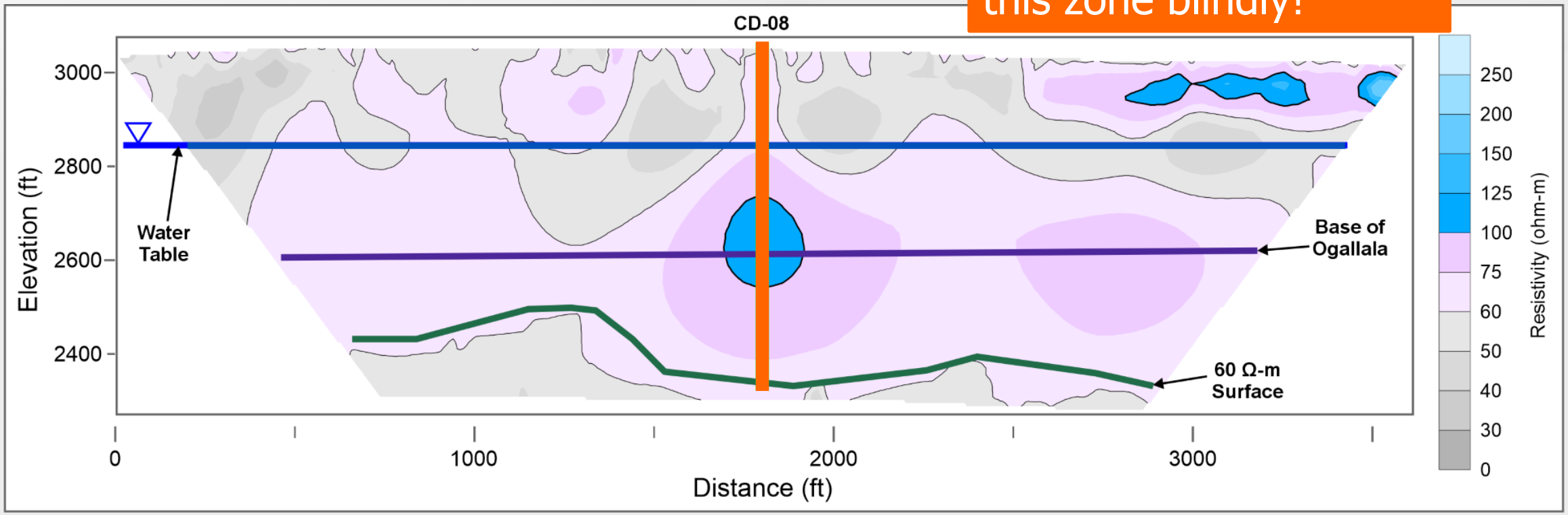
- Insight into well interactions
- Input for GW model
- Applicable to other sites



Mesa Water Project
Precision Targeting of Electrical Anomalies

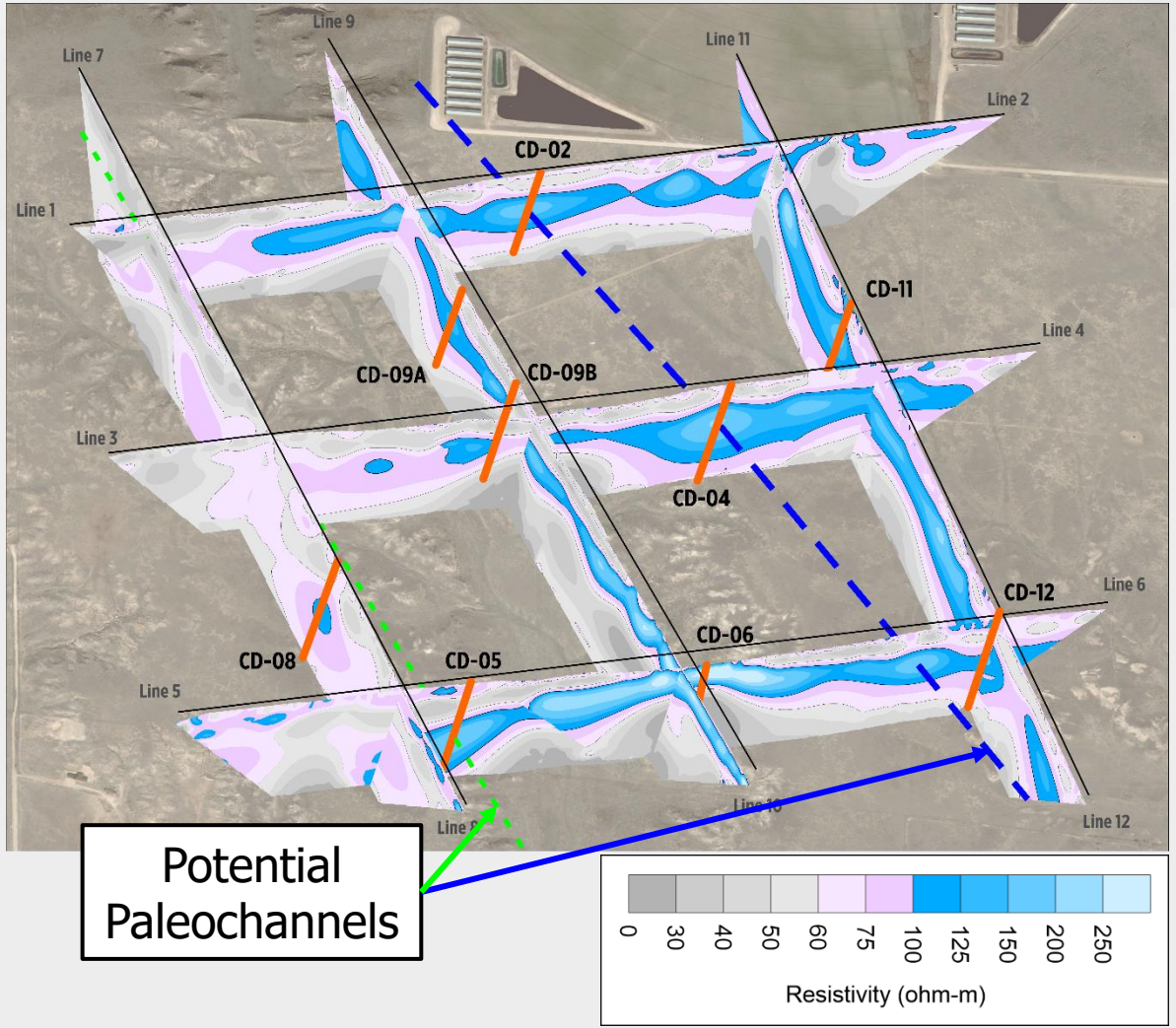
- ~300 ft wide high flux zone yielded ~1+ MGD (test well CD-08)
- Base of Ogallala thicker than expected

~8% chance of drilling this zone blindly!



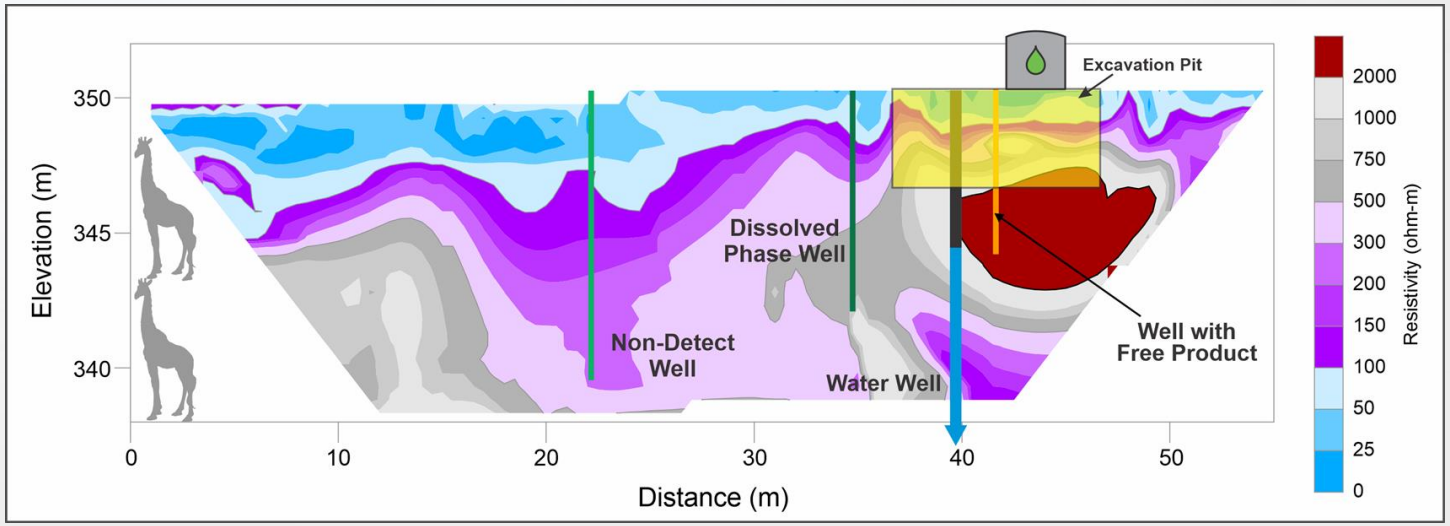
Mesa Water Project
Results Summary

- **100% success rate achieved!**
  - ✓ All 7 test wells **<u>~1 MGD or more</u>**
  - ✓ "Good" water quality at all 7 locations
  - ✓ If drilling blindly: expected ~28% success rate; would have needed ~25 test wells
  - ✓ **Estimated savings of $7.8 million**
- Base of Ogallala has significant topography in electrical data
- Interpreted geologic features:
  - 2 NW-SE trending channel features
  - W-E fracture feature (not shown)

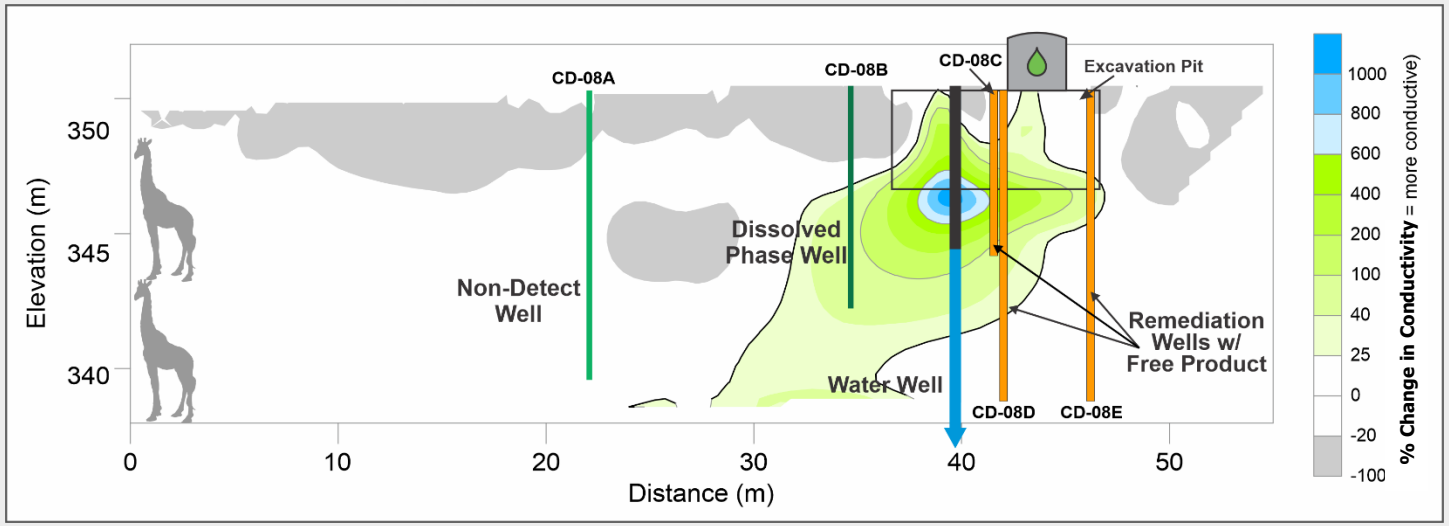


LNAPL in Karst (Ada, OK Water Supply Well)
Spill to Closure in < 2 years

GeoTrax Survey™ Static Image **(Res)**



GeoTrax Monitoring™ Temporal Image **(ΔRes)**



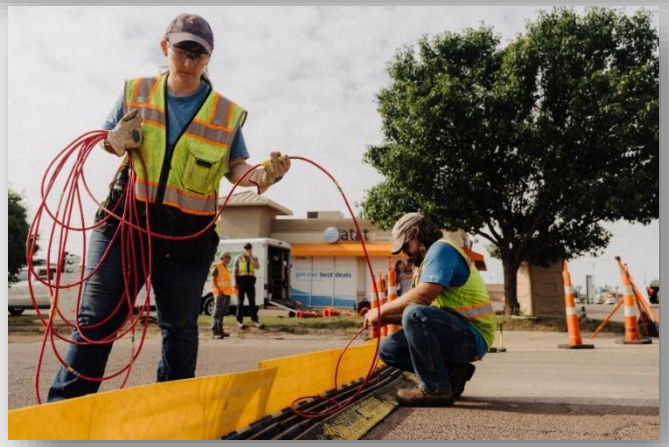
- 2,000 gallon diesel spill in karst
- Initial images guided remediation wells
- Additional imaging supported well data – site was clean and could be closed

The GeoTrax Survey™ Difference

1. **Better Data**: Sole proprietor of higher-sensitivity GeoTrax Survey™ electrical resistivity imaging technology
2. **Proven Process**: Defined process involving robust 3D data integration, analysis, and interpretation; developed over 25 years
3. **Specialized Team**: Field-tested experts bringing a unique mix of geophysics, hydrogeology, and environmental insight to every project

Experience: 1000's of images world-wide

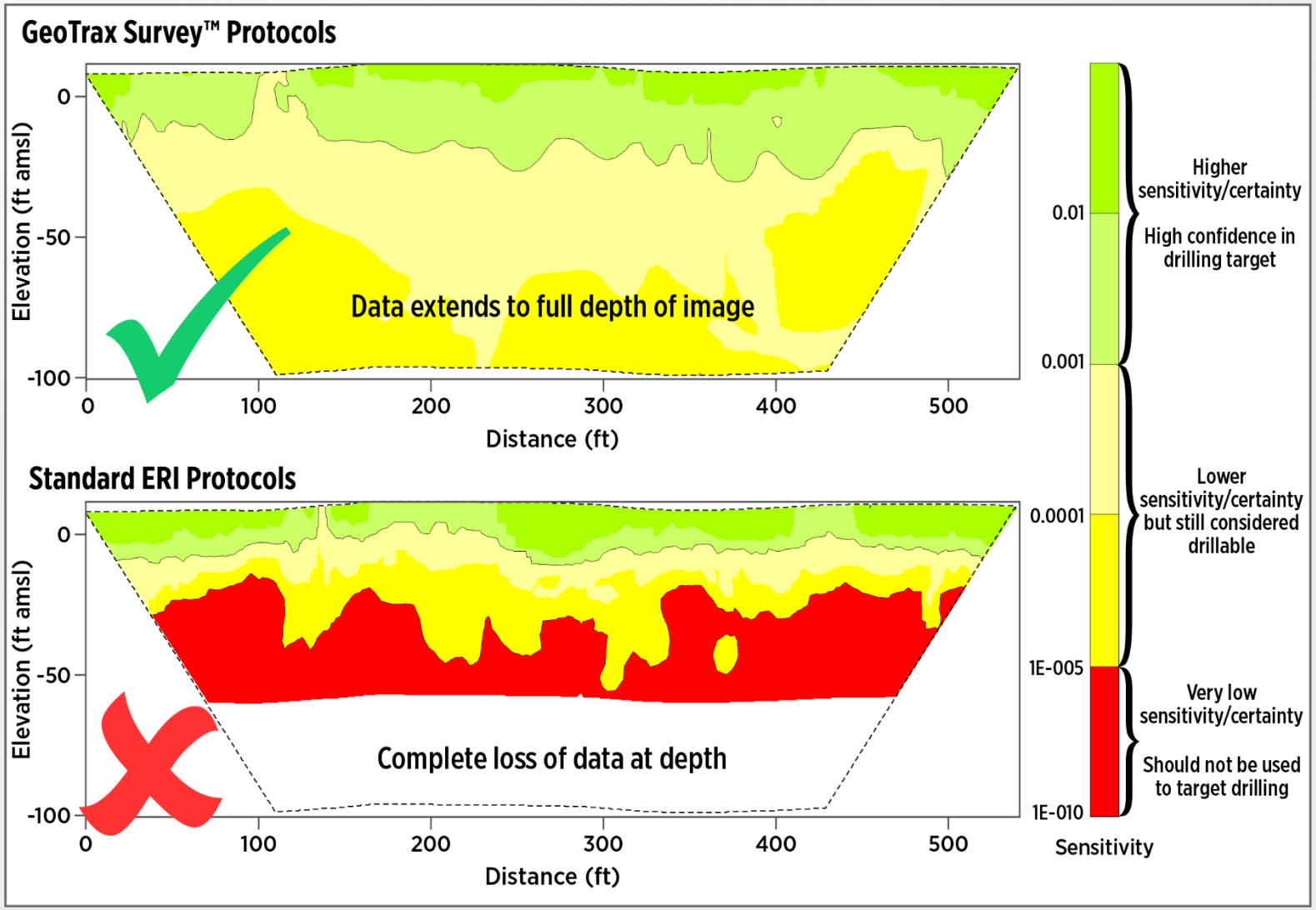




Guesswork is the enemy of smart drilling.

Our goal is to help our clients never have to drill blind again by changing the paradigm of subsurface characterization and CSM development to a scan-first, data driven approach.

Better Data
GeoTrax Survey™ vs Standard ERI

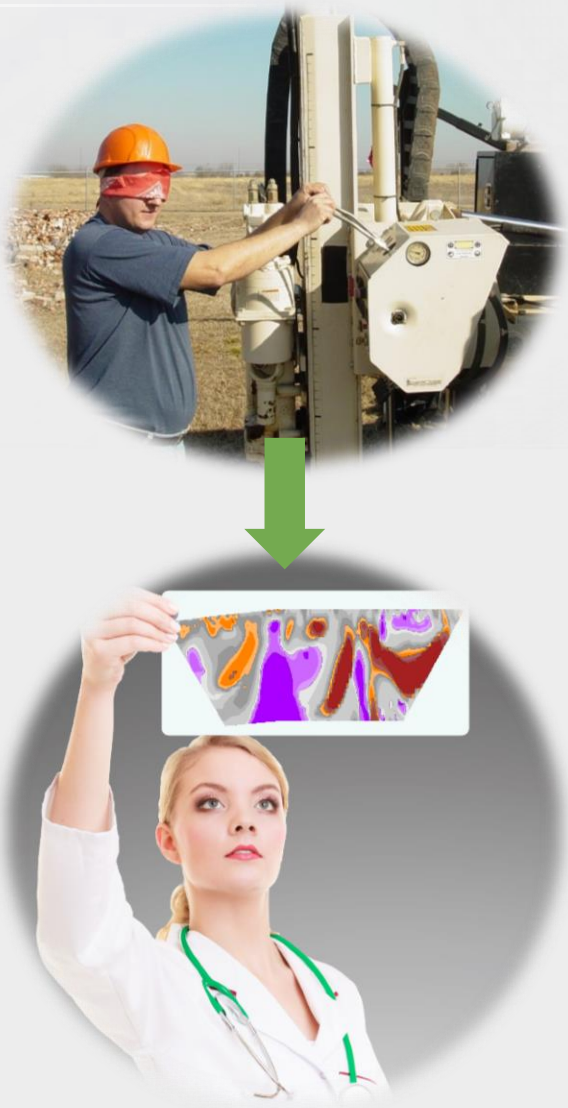


GeoTrax Survey™ is more sensitive to subsurface conditions than standard ERI = <u>complete and higher quality image</u>

For example: Contaminants with electrically resistive signals were accurately targeted in a brackish environment (where traditional methods often fail, as seen in the lower graphic)

Best Practices for Modern Groundwater Supply Projects

- Scanning first is accepted best-practice in other industries; GW Supply projects should adopt also
- Electrical Hydrogeology results in:
  - Targeted drilling locations that can beat the odds
  - Robust subsurface understanding
  - Time and cost savings
- Odds of drilling a successful well blindly: **30%**
- Odds of drilling a successful well w/ GeoTrax Survey™: **80-100%** (historically)



Better Data, Better Decisions



QUESTIONS?

Email **Sales-Team@aestusllc.com**
with questions or applicability to specific site

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