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A Review of Three Methods to Delineate Salt Impacts in Soil

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Presentation Agenda

- Site background
- Review of three methods for salinity delineation
- Comparison of data – what did the method tell us?
- Comparison of methods – strengths and weaknesses
- Questions?

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Site Background

- Drilled in 1977 to 900 m.
- Produced gas and water until 1987.
- Abandoned in 1993.
- No drilling waste information.
- Failed Compliance Option 2 for salinity.

*You should suspect that there might be a salt problem.

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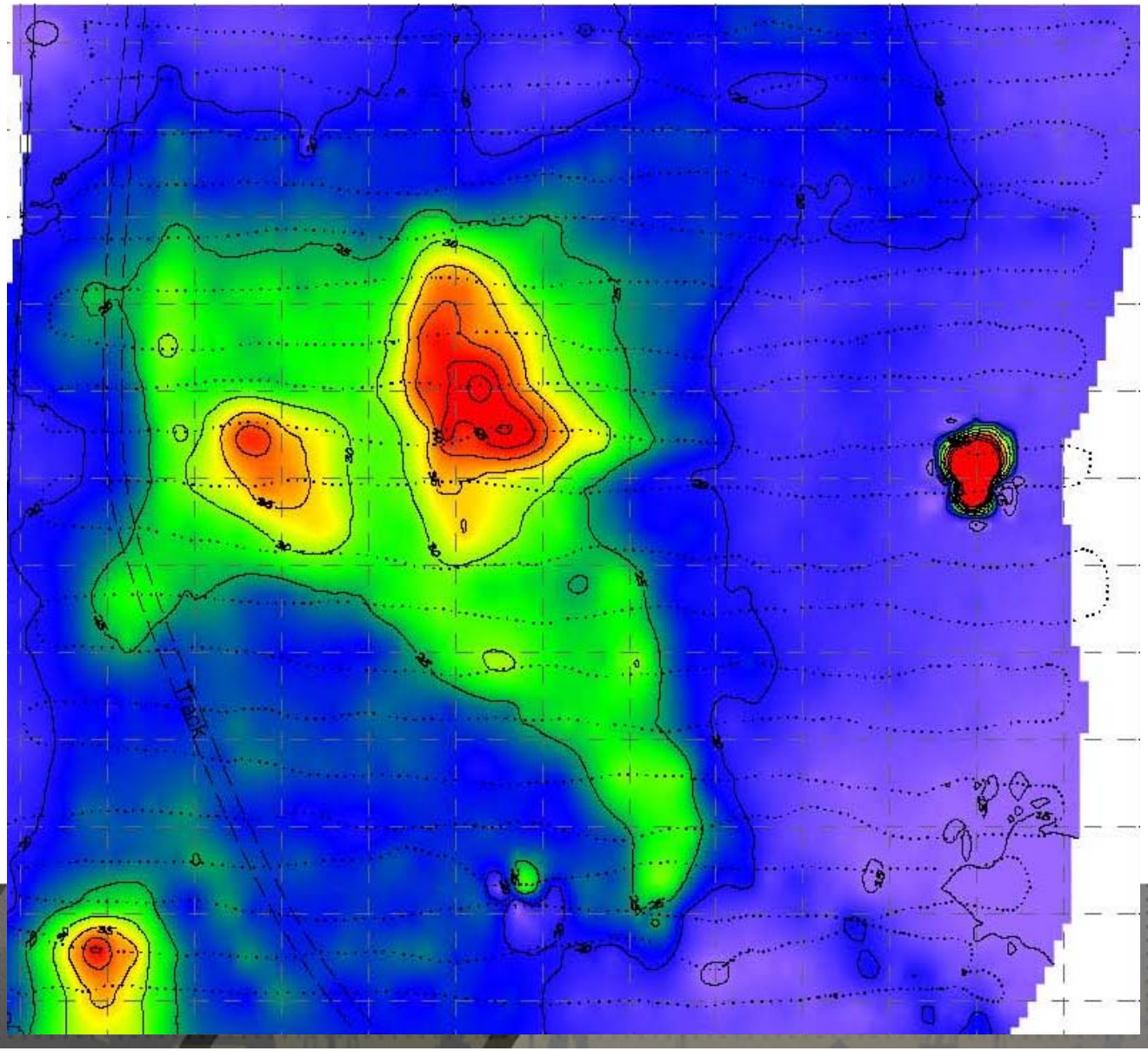
EM 38



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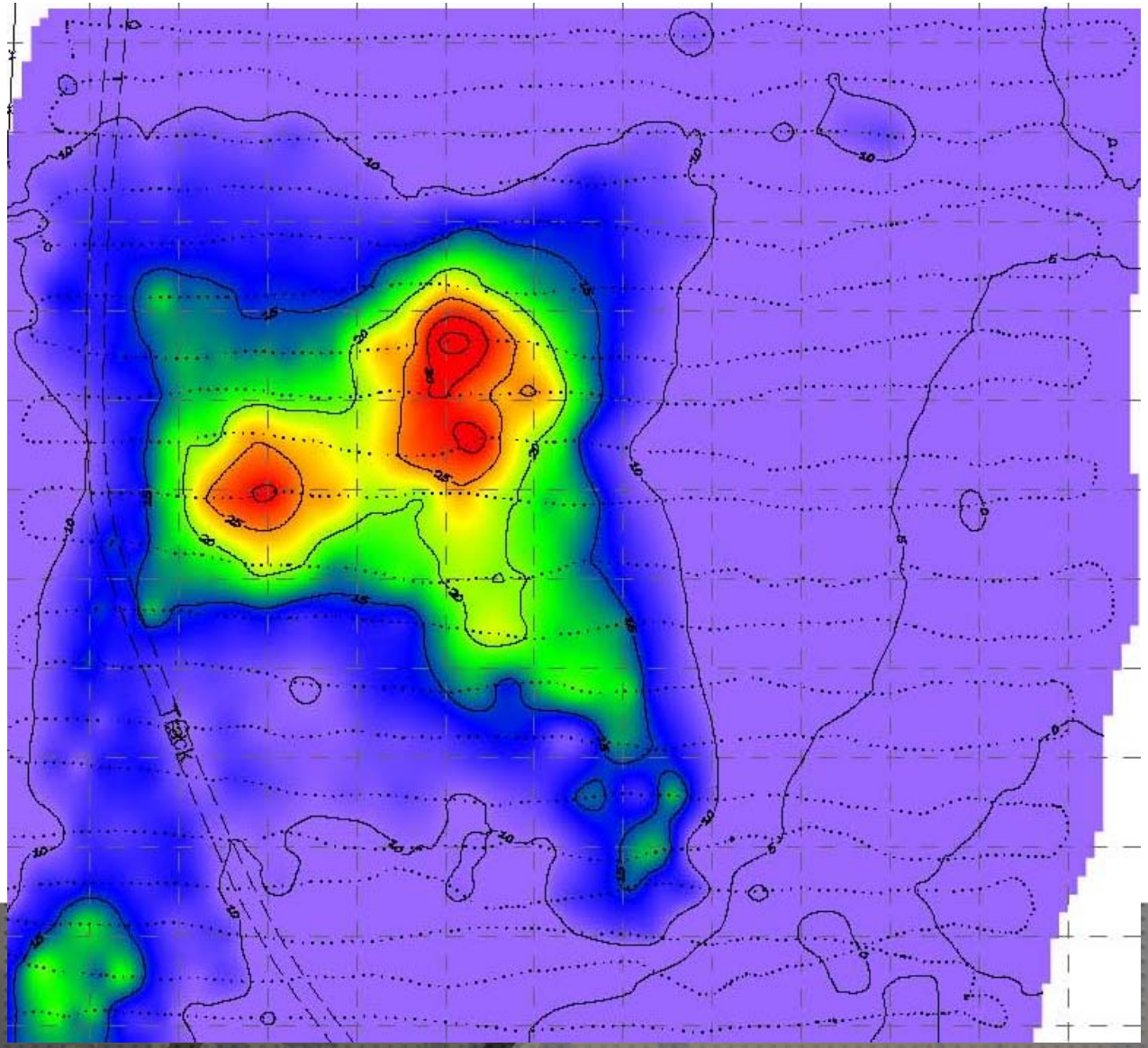
EM 31



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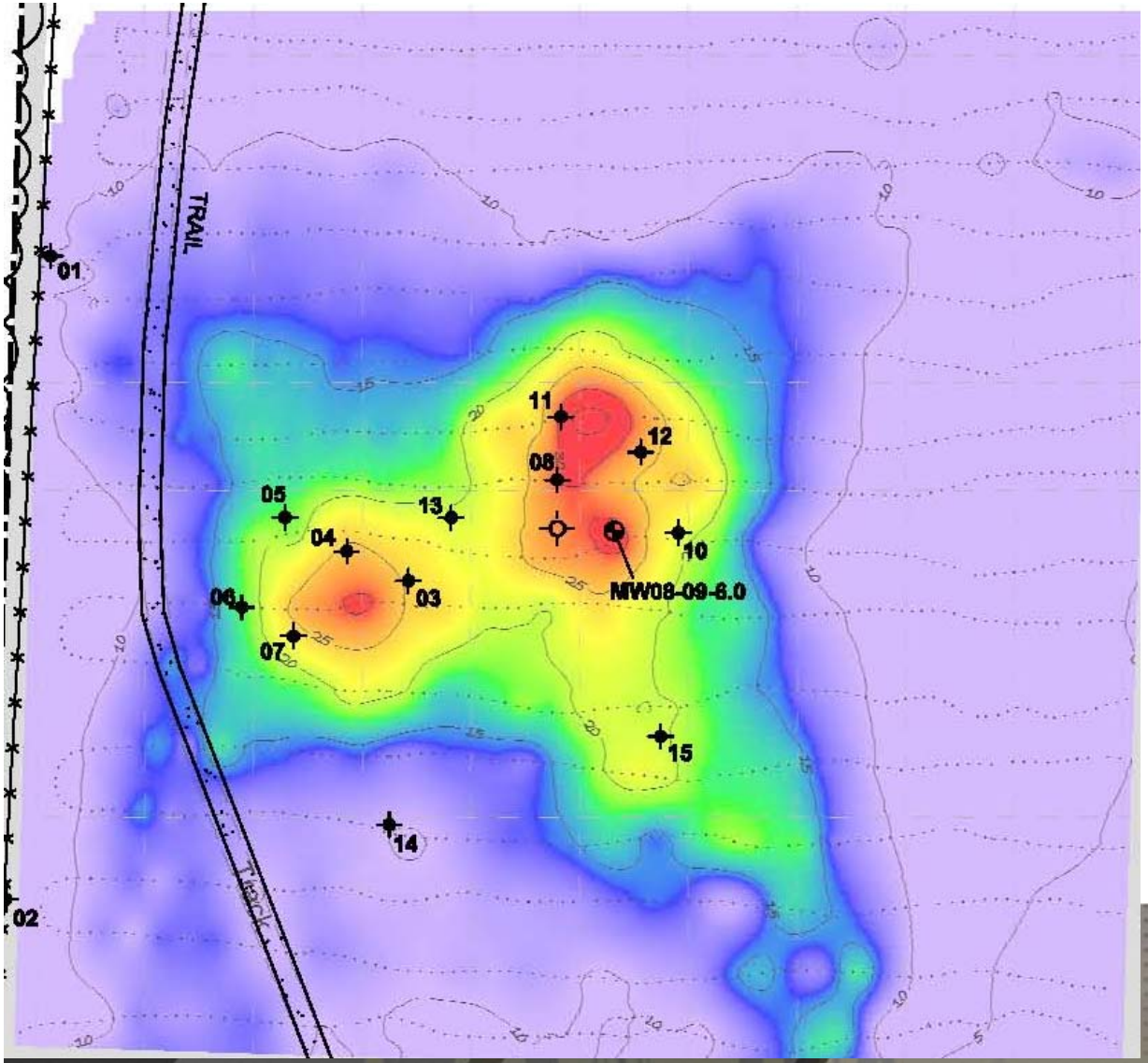
Phase II Assessment - 2008



- 15 BHs
- BH04 – chlorides increase with depth to 4000 ppm at 4.5 m (bottom)
- BH08 – chlorides increase with depth to 1200 ppm at 4.5 m (bottom)
- No vertical delineation

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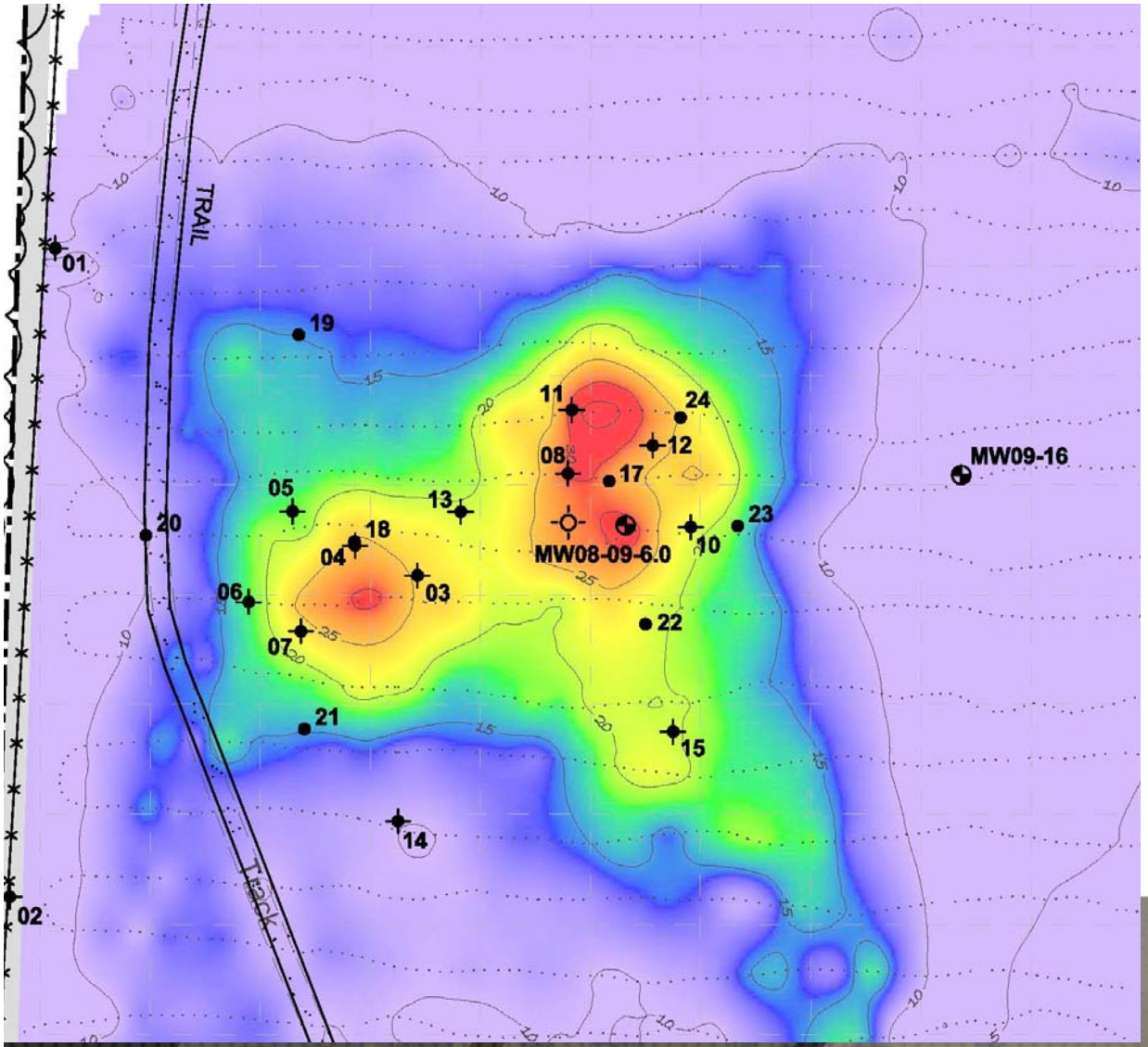
Phase II Assessment - 2009



- 9 more BHs
- BH17 – chloride concentration drops to below 100 ppm by 5 m.
- BH18 – chlorides increase with depth to 5300 ppm at 10 m (bottom)
- No vertical delineation for western plume.

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Issue

- Initial Phase II (and Phase I ESA) indicates a significant salinity problem.
- An assessment tool is required to determine depth of impact so that vertical delineation can be achieved.
- If we knew at EM stage what we know after two Phase II assessments, we'd only have to drill the site once.
- Tested 3 possible methods to achieve that…

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EM 34

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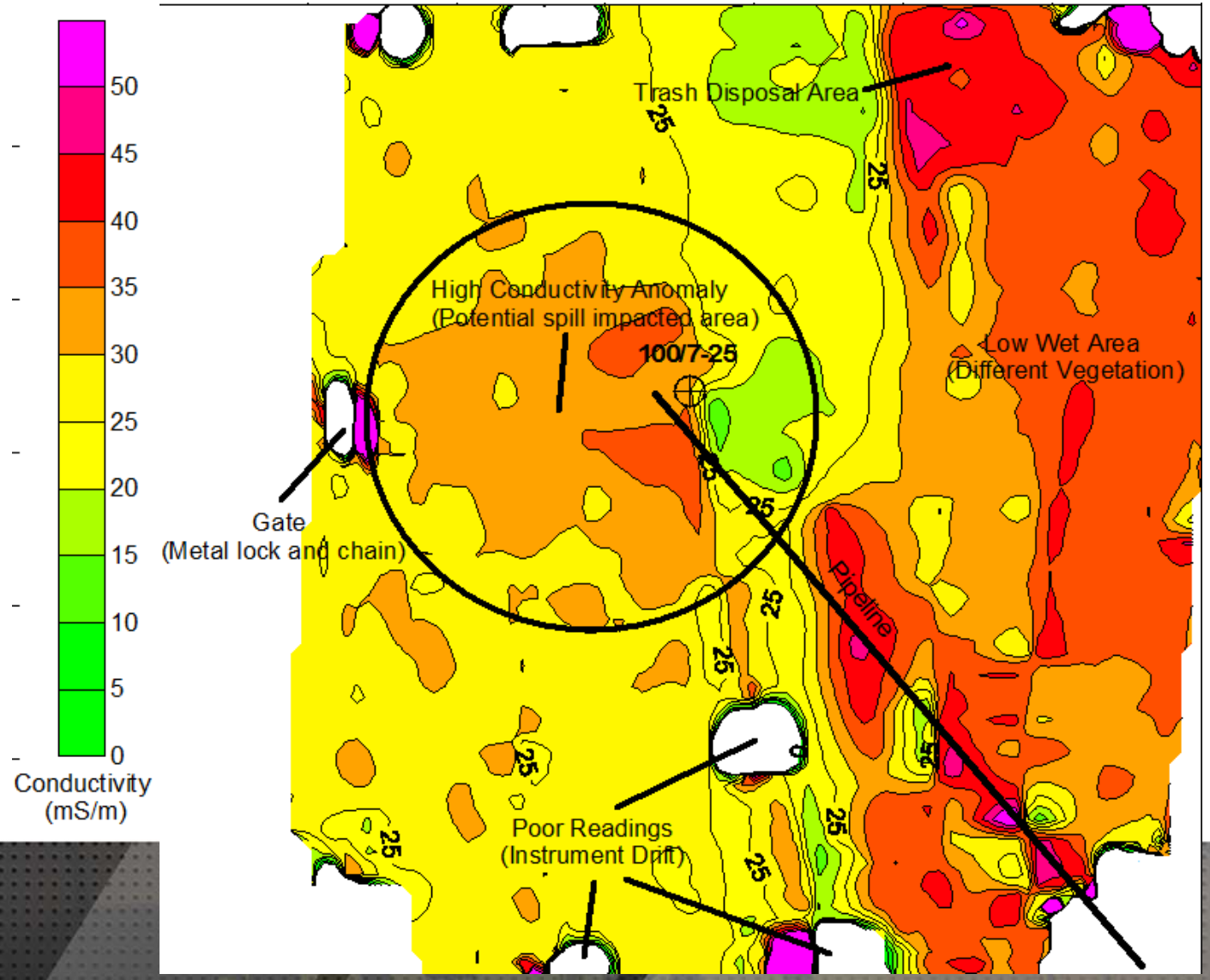
EM 34



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ERT

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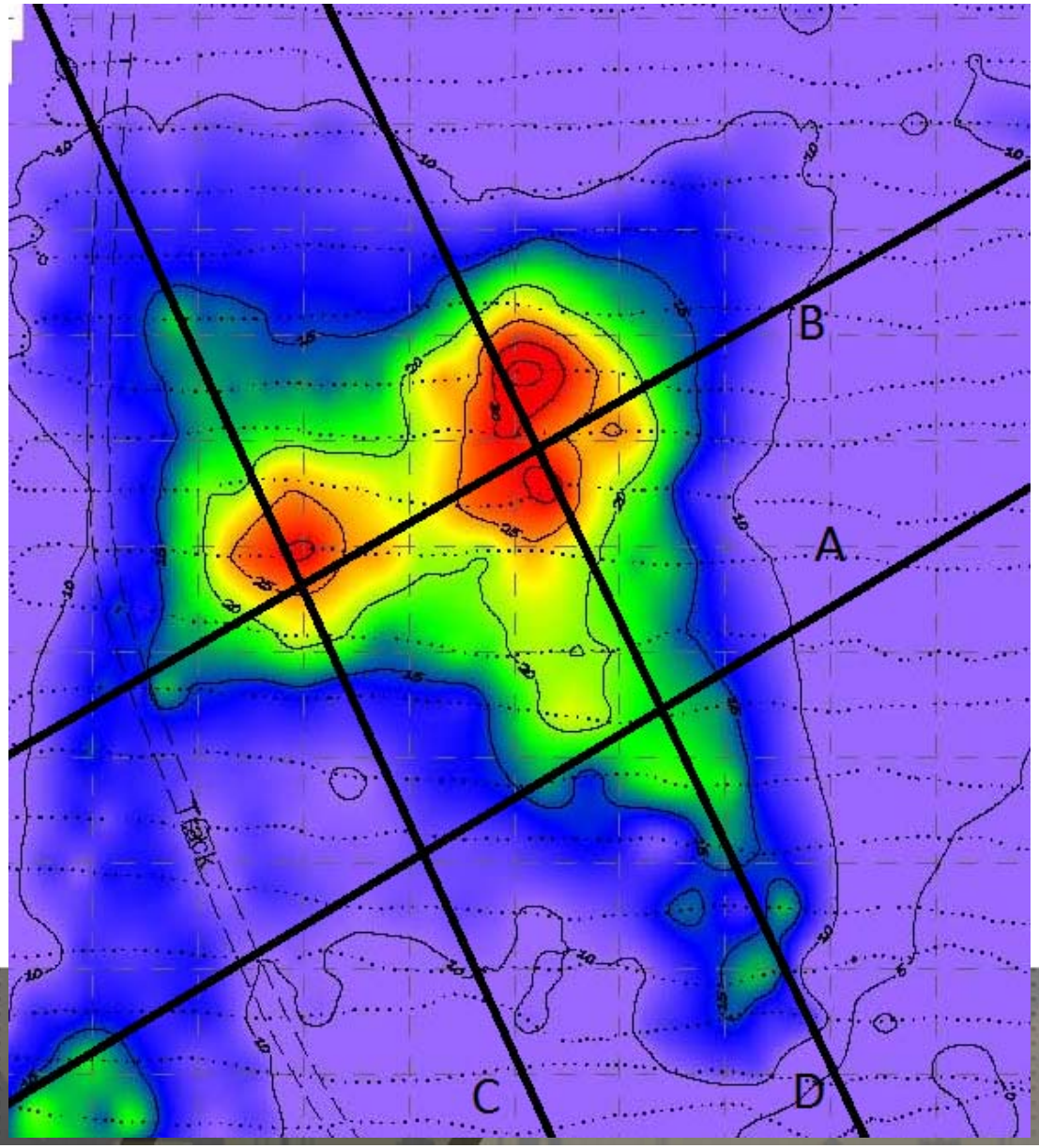
ERT



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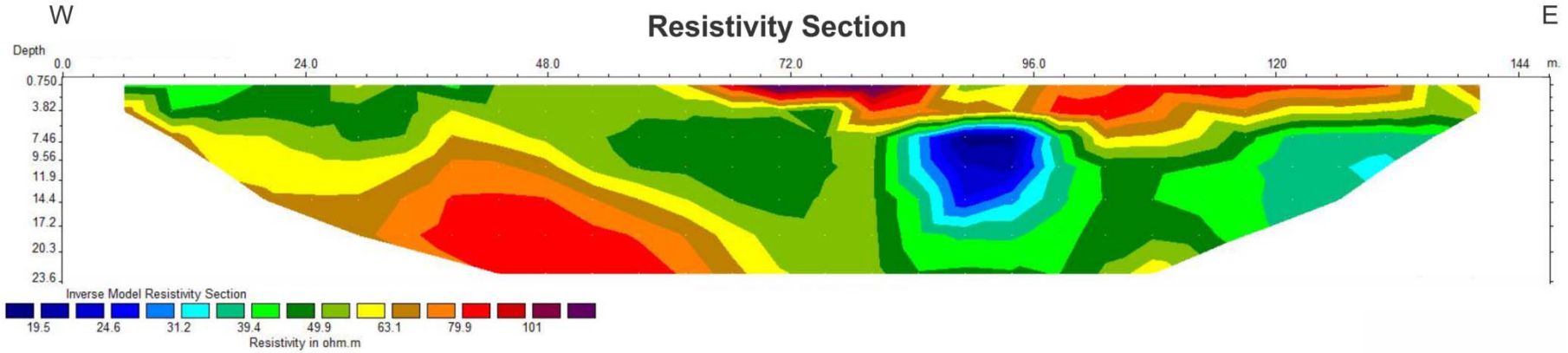

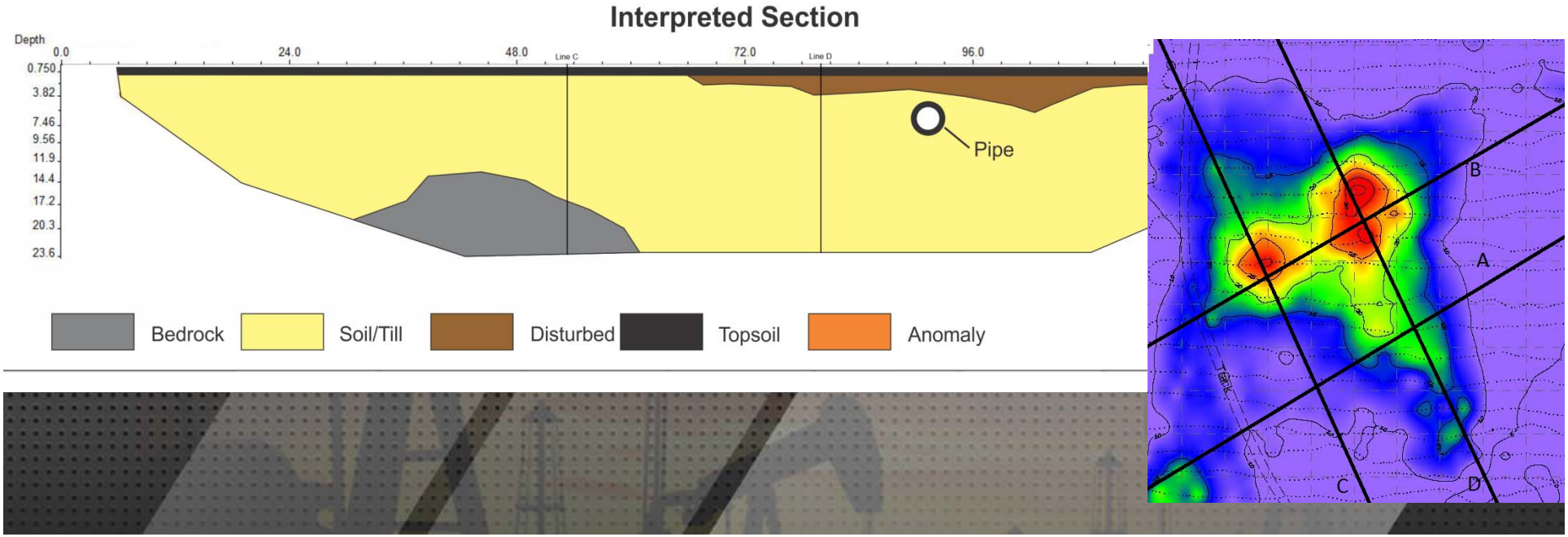

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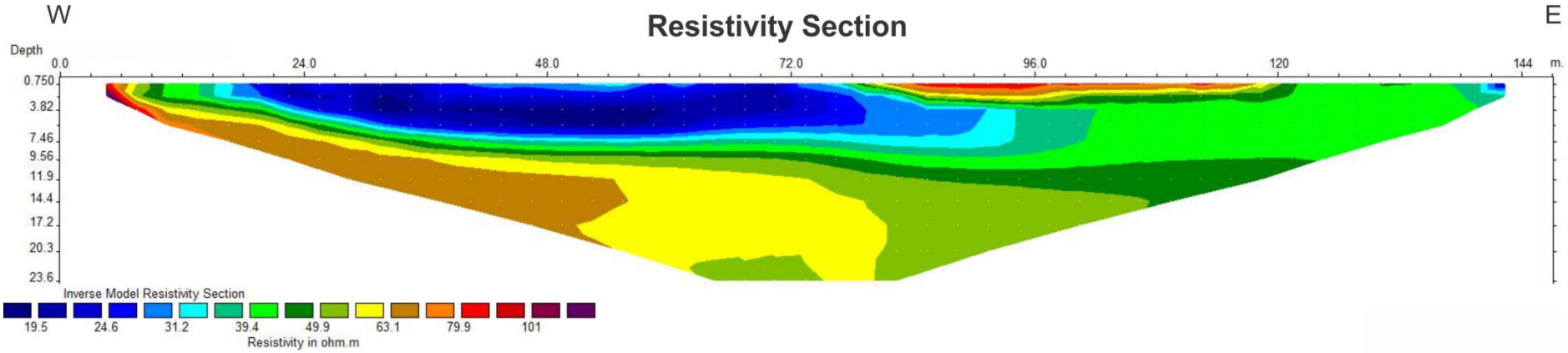

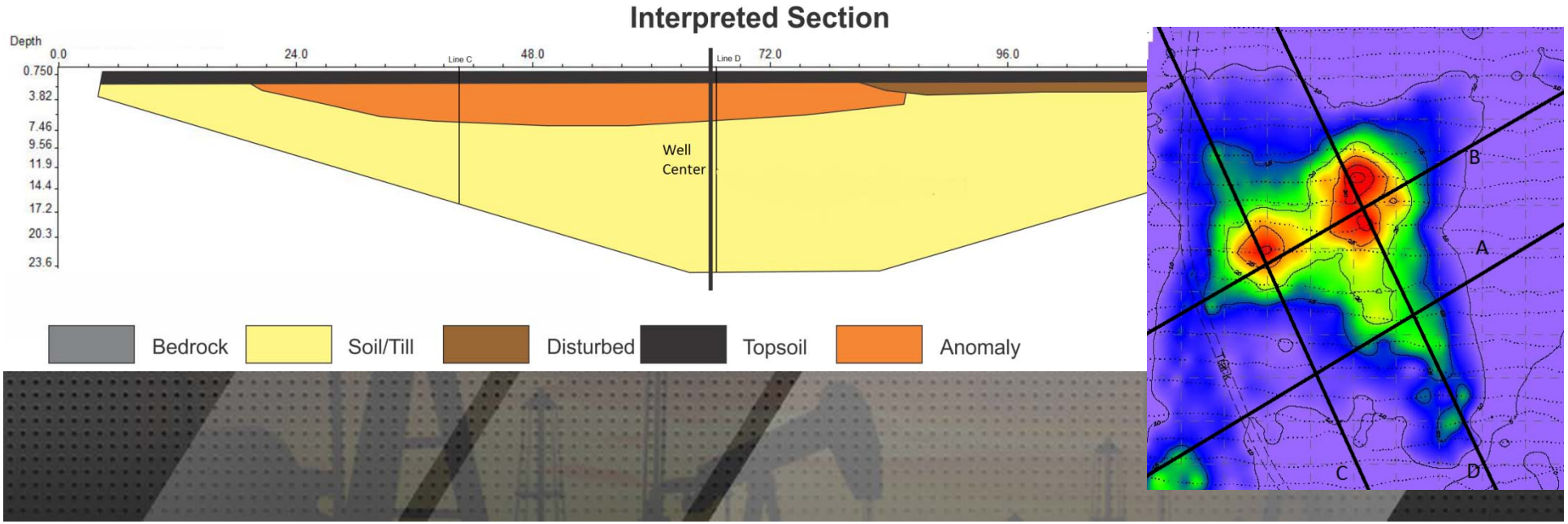

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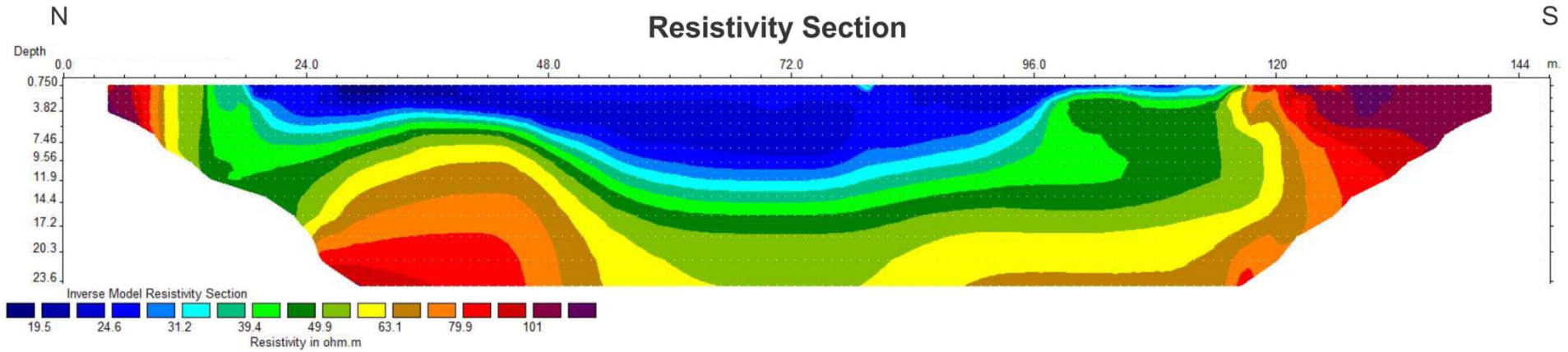
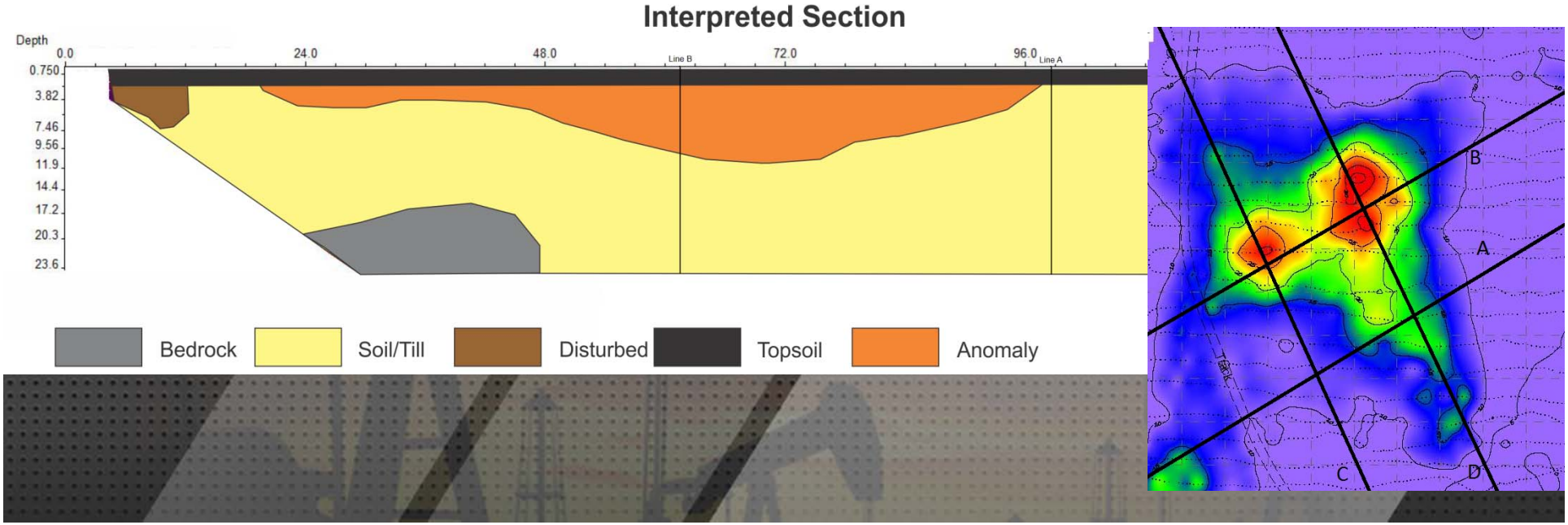
ERT – Line C





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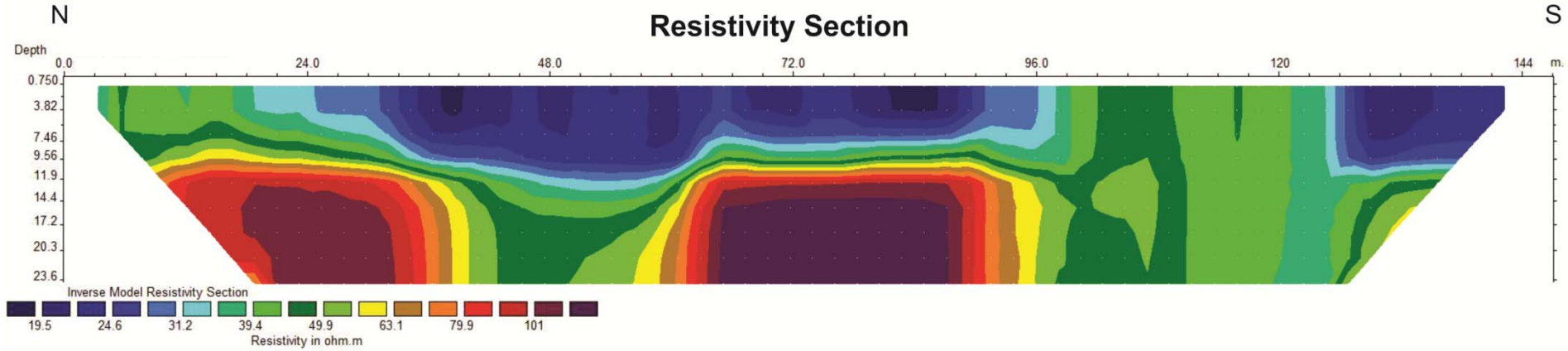

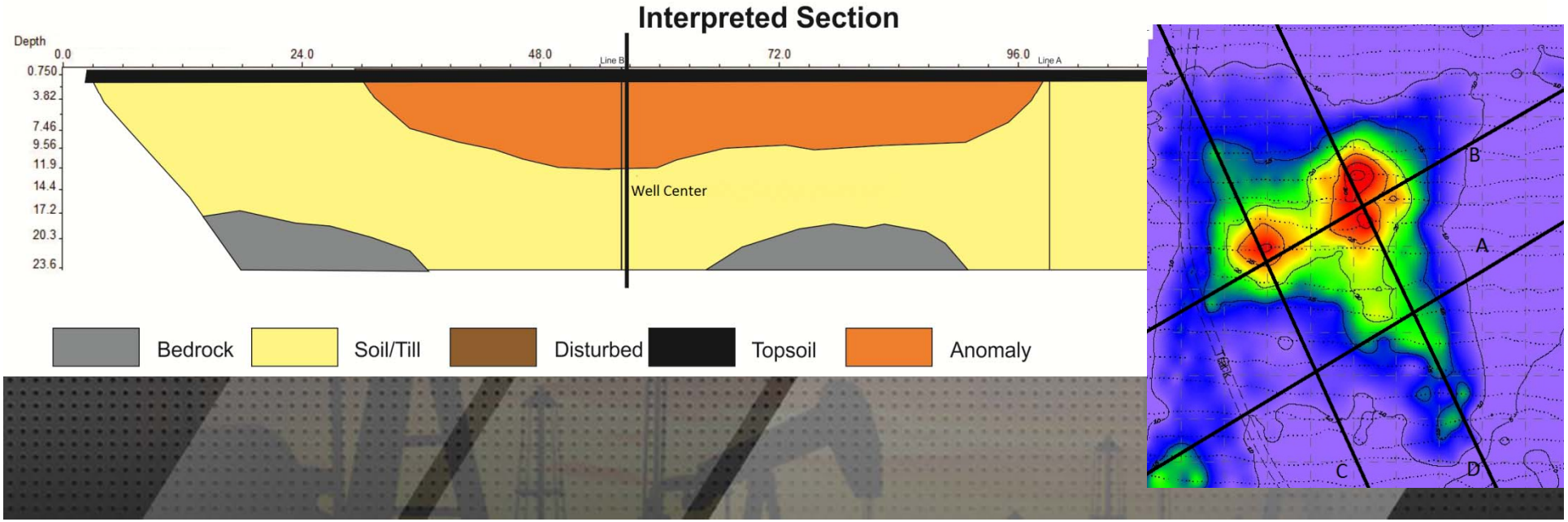

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Vertical Conductivity Profiling

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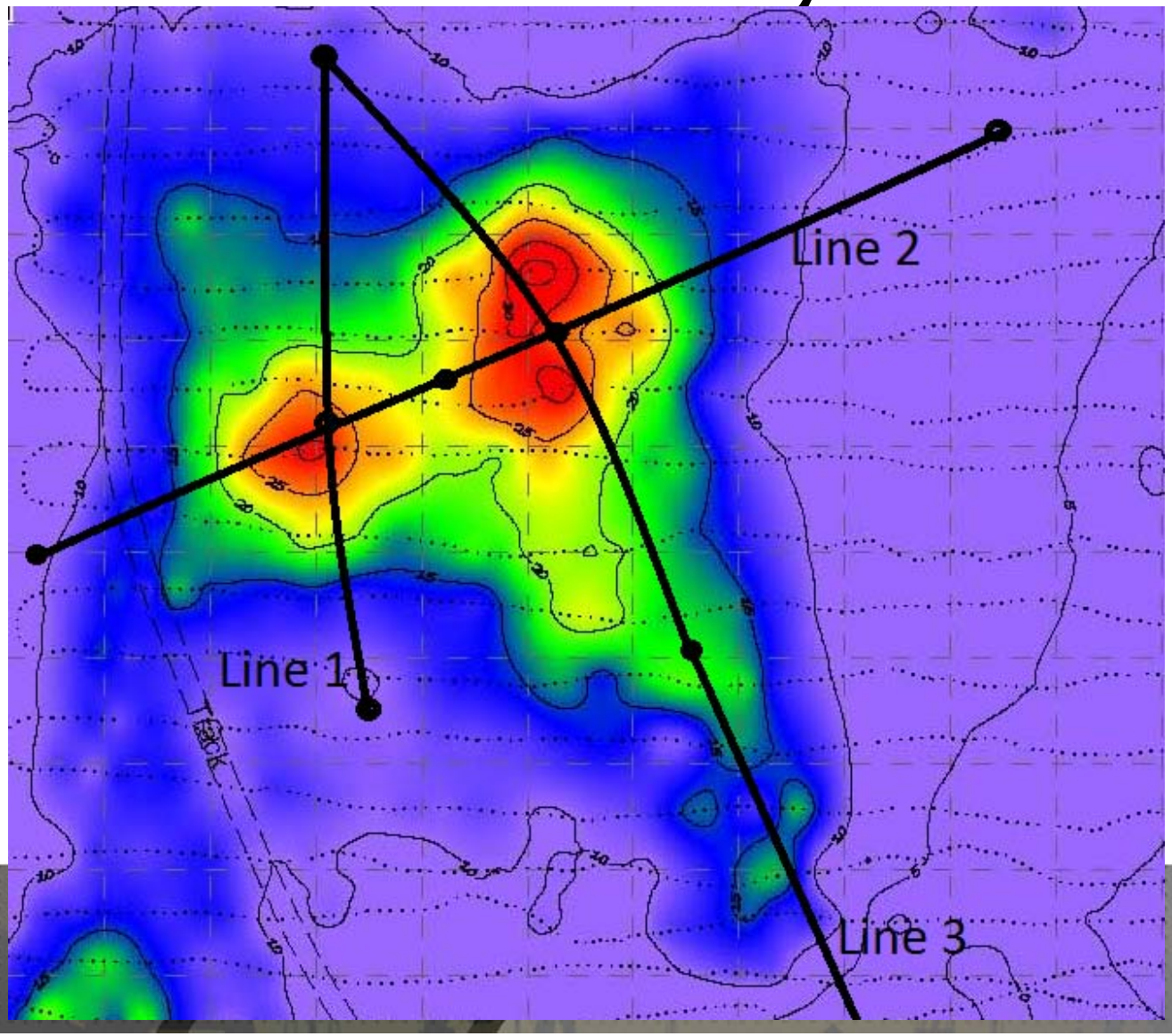
Vertical Conductivity Profiling



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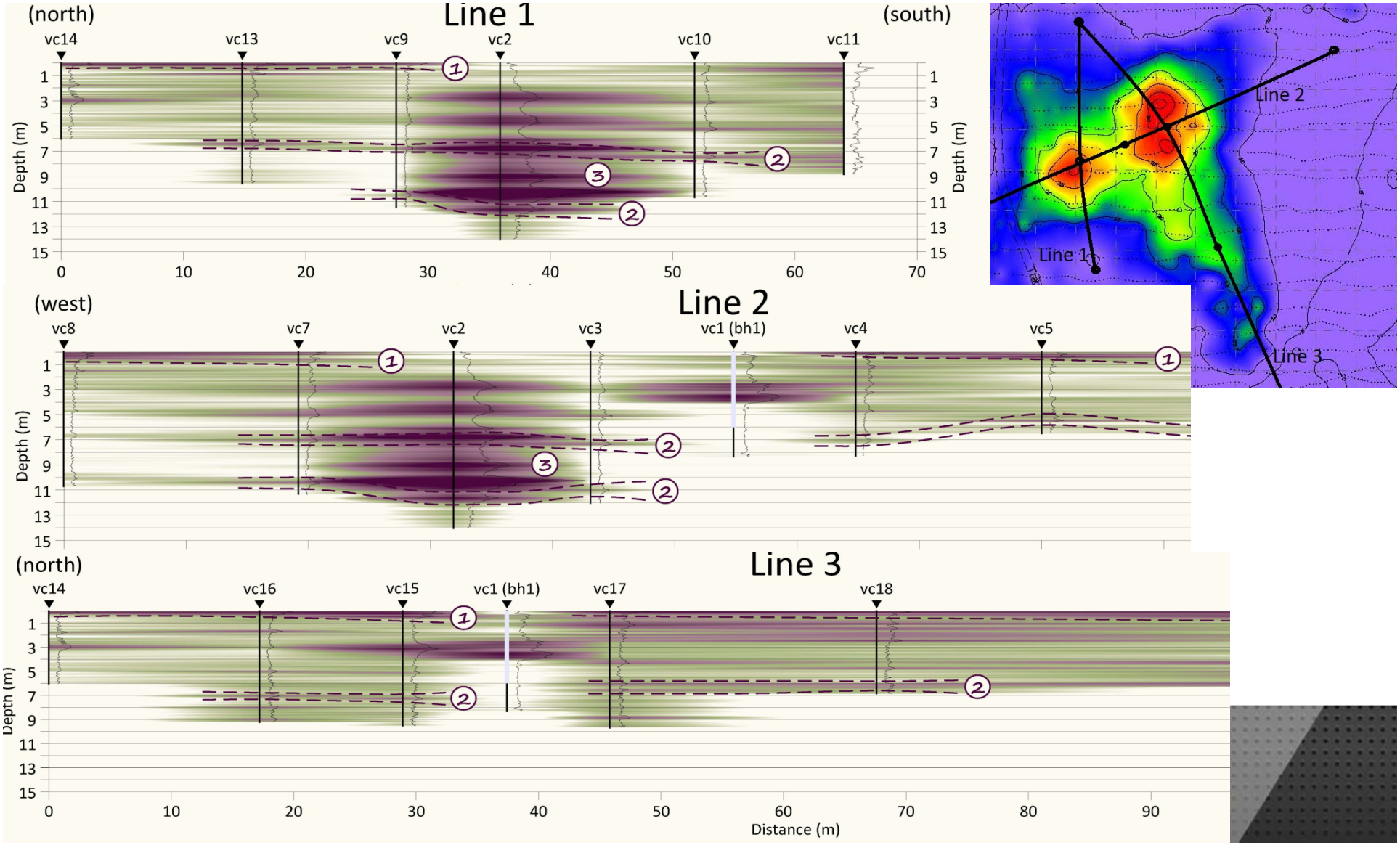
Vertical Conductivity Profiling



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Data Comparison

Method	Max Depth of Impact	Approximate Volume of Impact	Cost
EM34	~15 m	17,000 m^3	$5,000
ERT	14 m	28,500 m^3	$6,000
Vertical Conductivity	12 – 13 m	11,500 m^3	$7,000

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Method Comparison

	Accuracy	Cost	Safety	Mobility	Field Time Required	Carbon Footprint	Ground Disturbance	Ease of interpretation	Soil Samples?	Seasonal	TOTAL
ERT	**0**	**1**	**1**	**1**	**0**	1	1	0	0	0	5
VCP	**1**	**0**	**0**	**0**	**1**	0	0	1	1	1	5

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Thank you

Special thanks to Kathy Cox at

enerPLUS