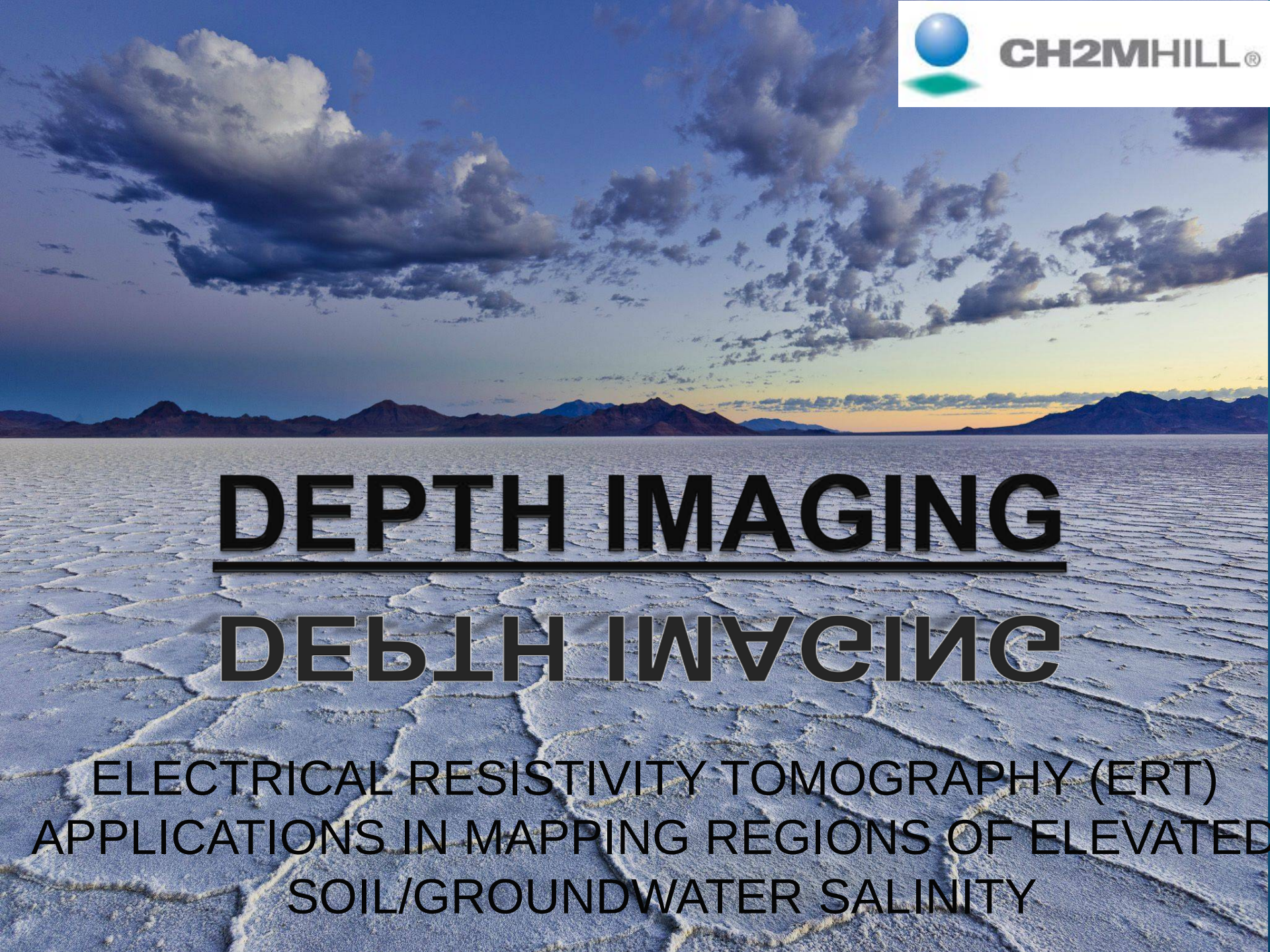
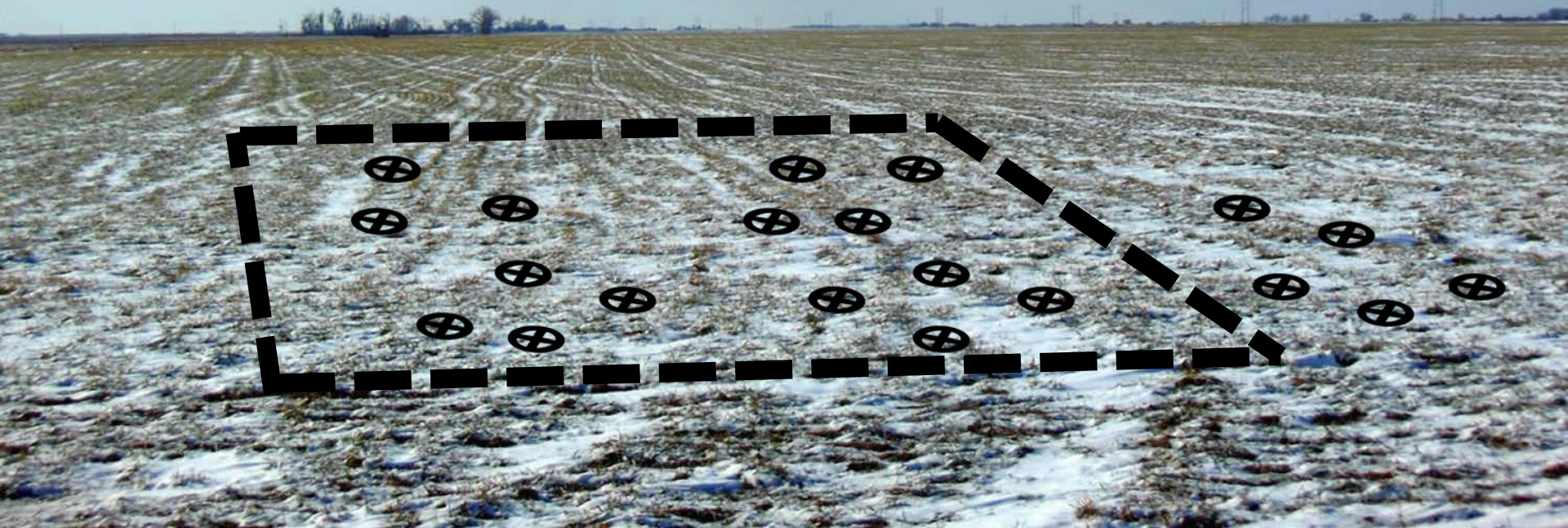


DEPTH IMAGING

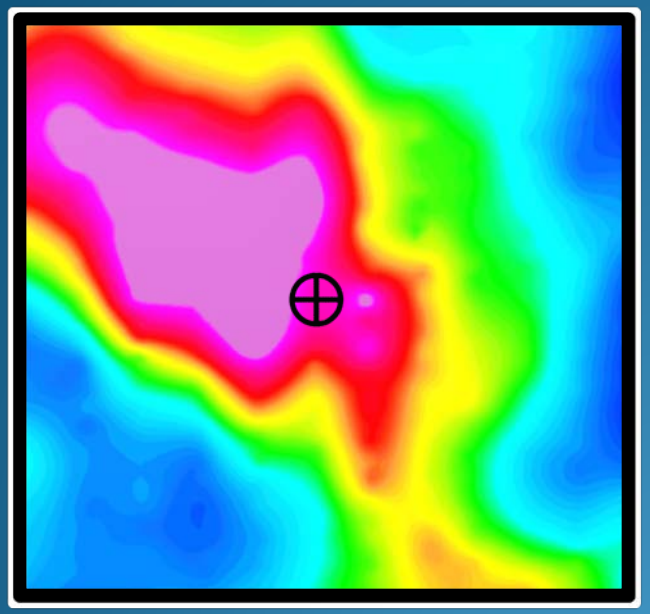
ELECTRICAL RESISTIVITY TOMOGRAPHY (ERT) APPLICATIONS IN MAPPING REGIONS OF ELEVATED SOIL/GROUNDWATER SALINITY

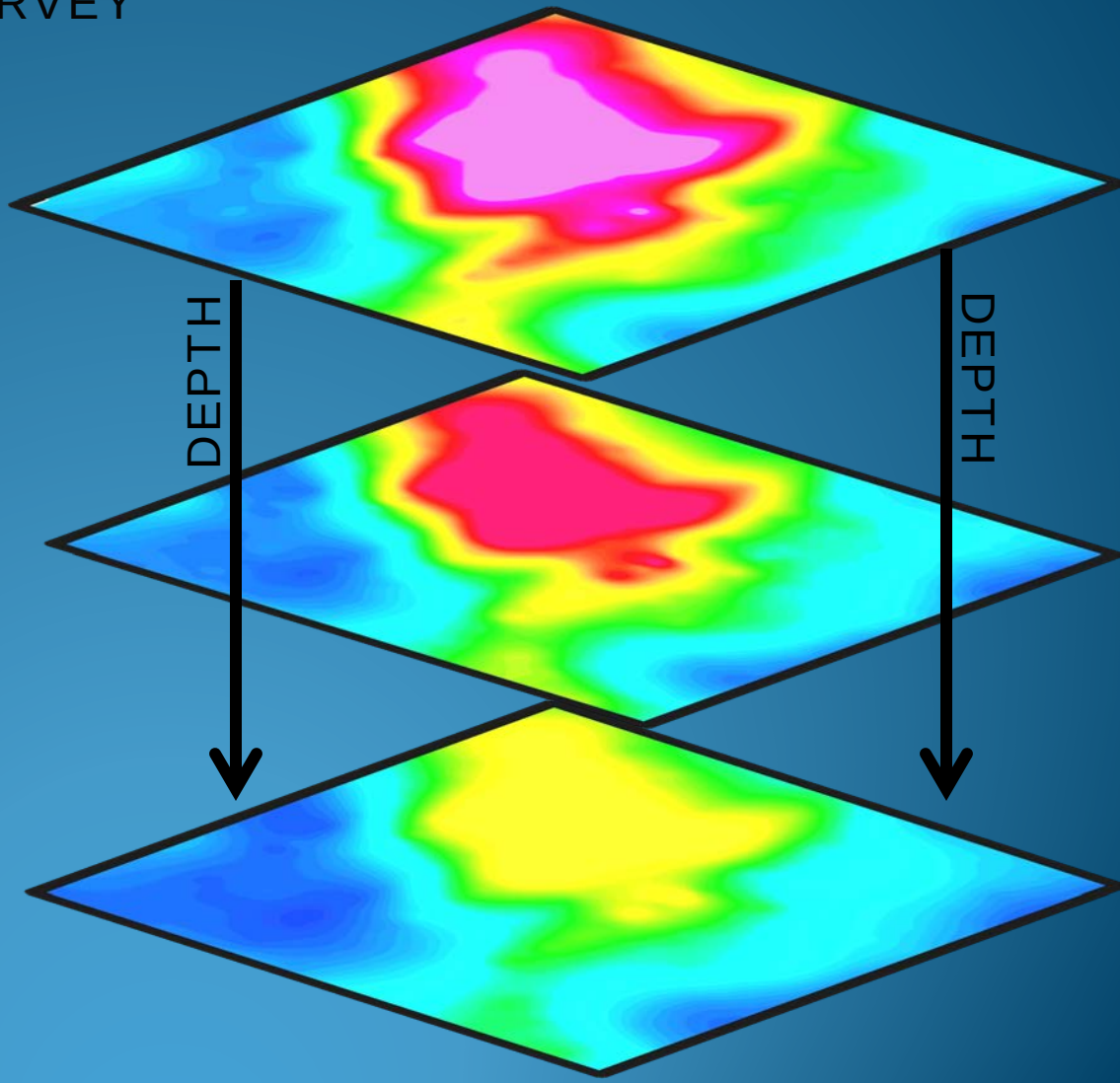
WHY GEOPHYSICS...

- HISTORICAL WELLFILE RECORDS
- DRILLING INFORMATION (D50)
- AIRPHOTOS
- OPERATOR/LANDOWNER INTERVIEWS
- ONLINE AND OTHER DATABASE SEARCHES



ELECTROMAGNETIC (EM) SURVEY





EM (ELECTROMAGNETIC) METHODOLOGY LATERAL DELINEATION

SINGLE FREQUENCY = AVERAGE 'BULK' APPARENT CONDUCTIVITY MEASUREMENT

MULTIPLE FREQUENCIES = SEVERAL MULTI LAYER 'INTERPRETED' DEPTHS

DEPTH INTERPRETATION CONSTRAINTS USING MULTIPLE FREQUENCIES

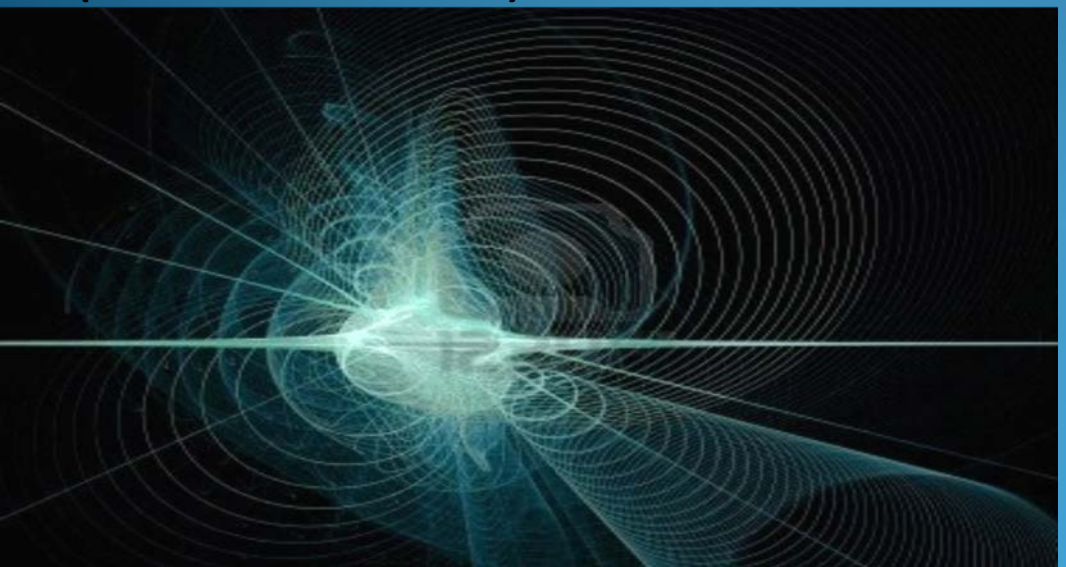
- SKIN DEPTH IS THE ATTENUATION (LOSS IN INTENSITY) DEPTH OF THE EM SOURCE
- SKIN DEPTH APPROXIMATION:

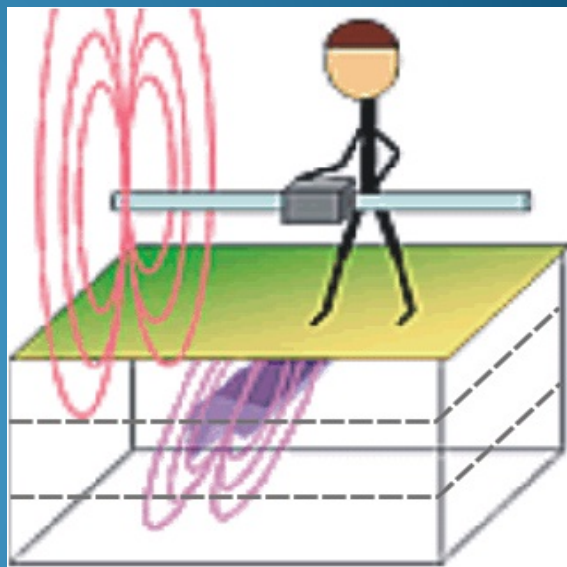
$$\delta = \frac{500}{\sqrt{f\sigma}}$$

σ is the half-space conductivity

f = frequency

- MANY DIFFERENT LAYERS CAN GIVE THE SAME MEASURED RESPONSE WITH FREQUENCY
- BECOMES EXTREMELY DIFFICULT TO DISTINGUISH WHICH LAYER (OR ASSUMED DEPTH) IS THE CORRECT FREQUENCY RESPONSE





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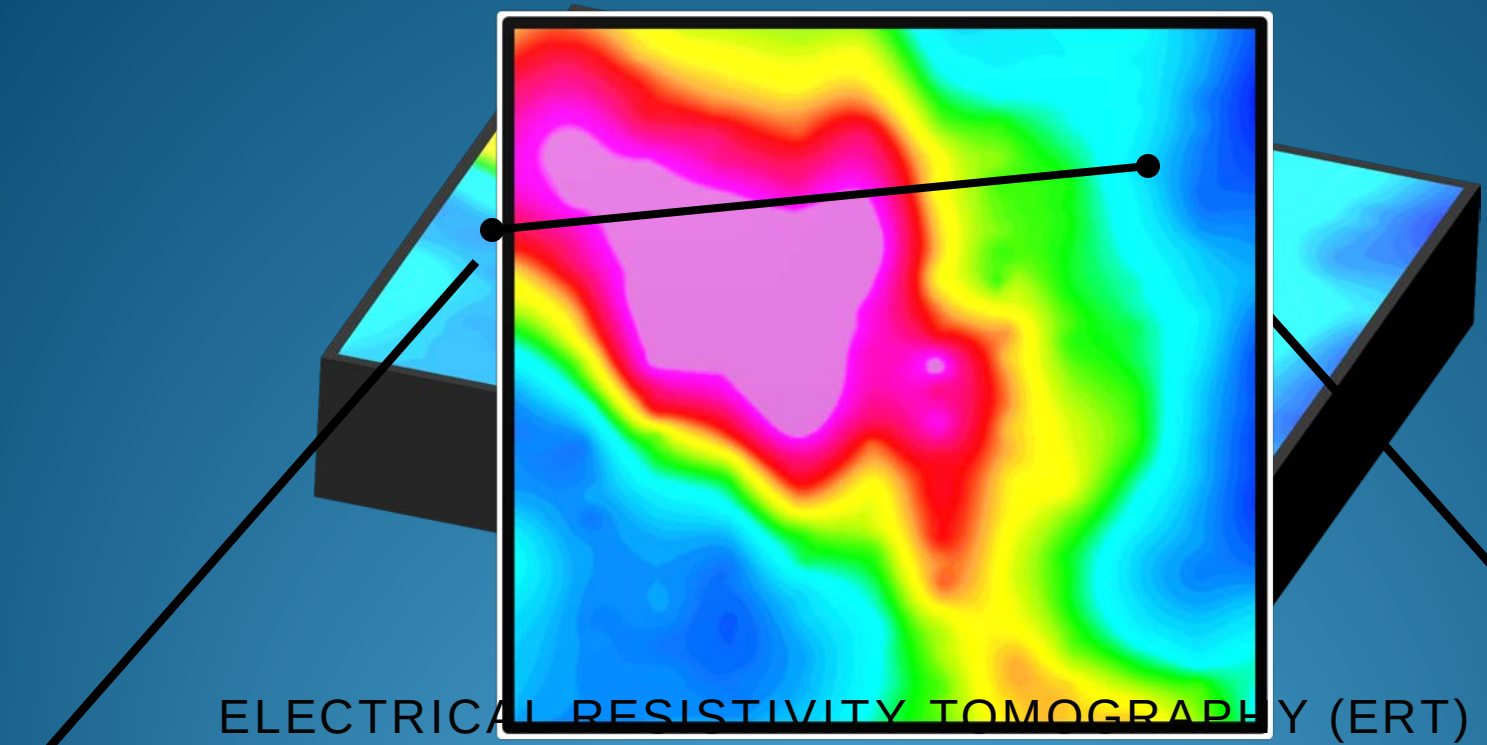
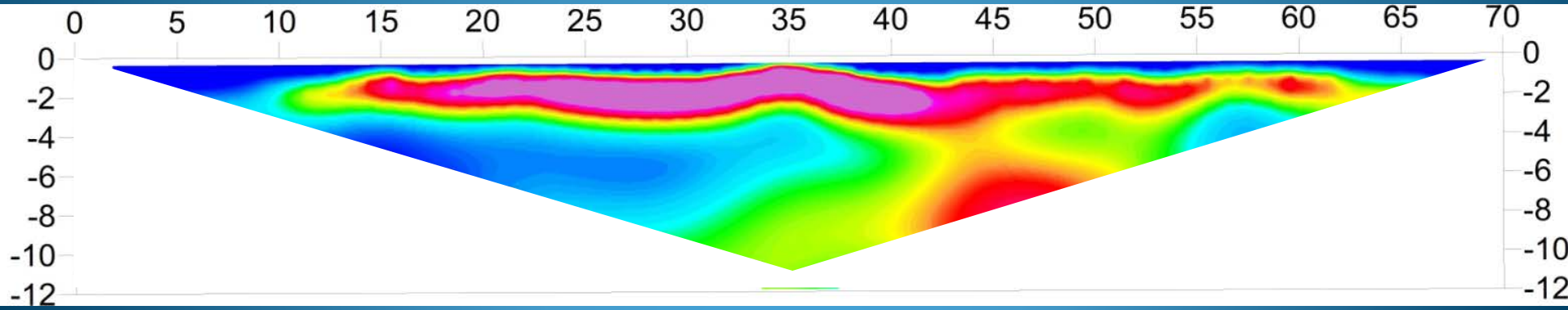
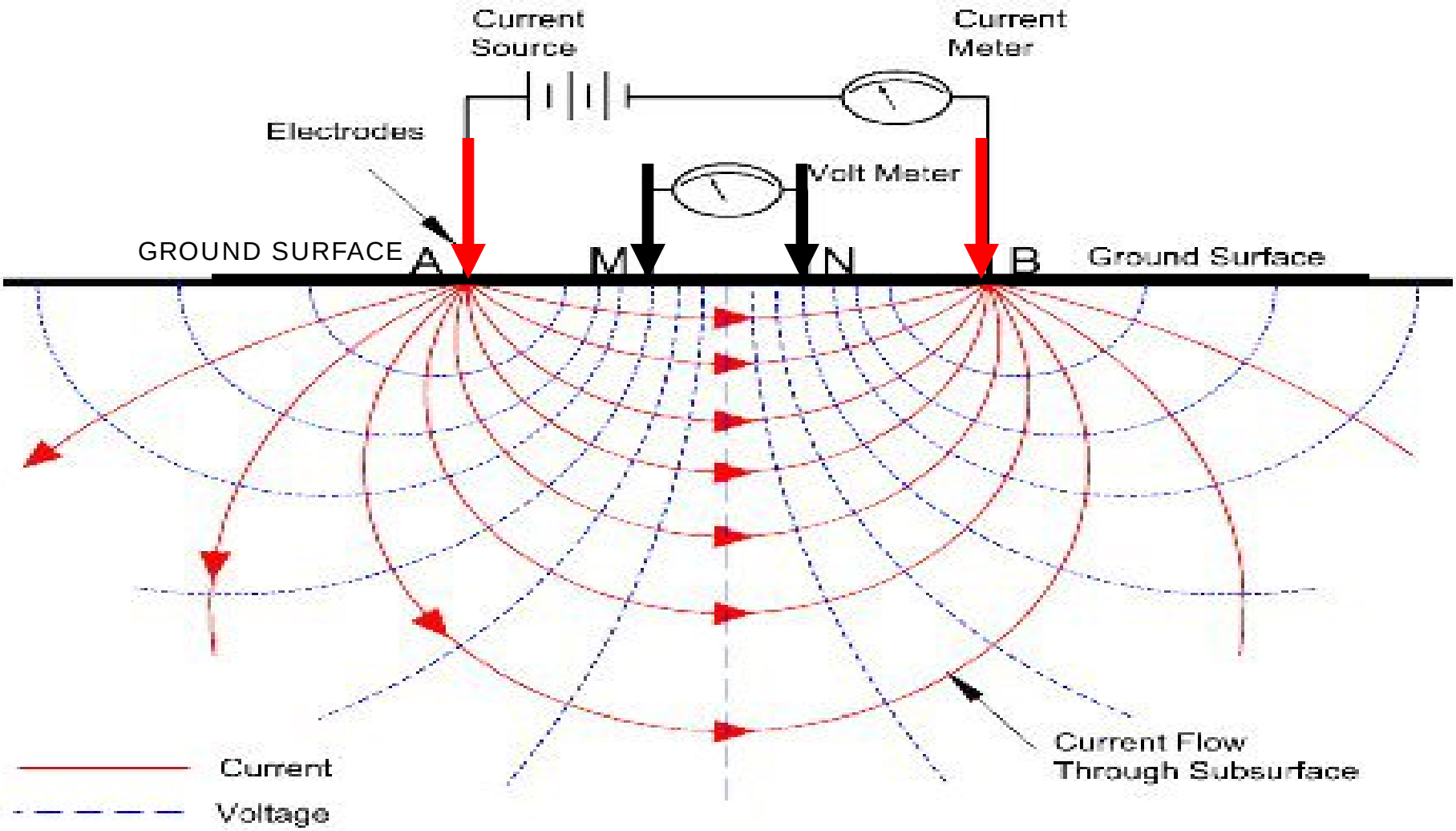
EM SURVEYS - LATERAL DELINEATION



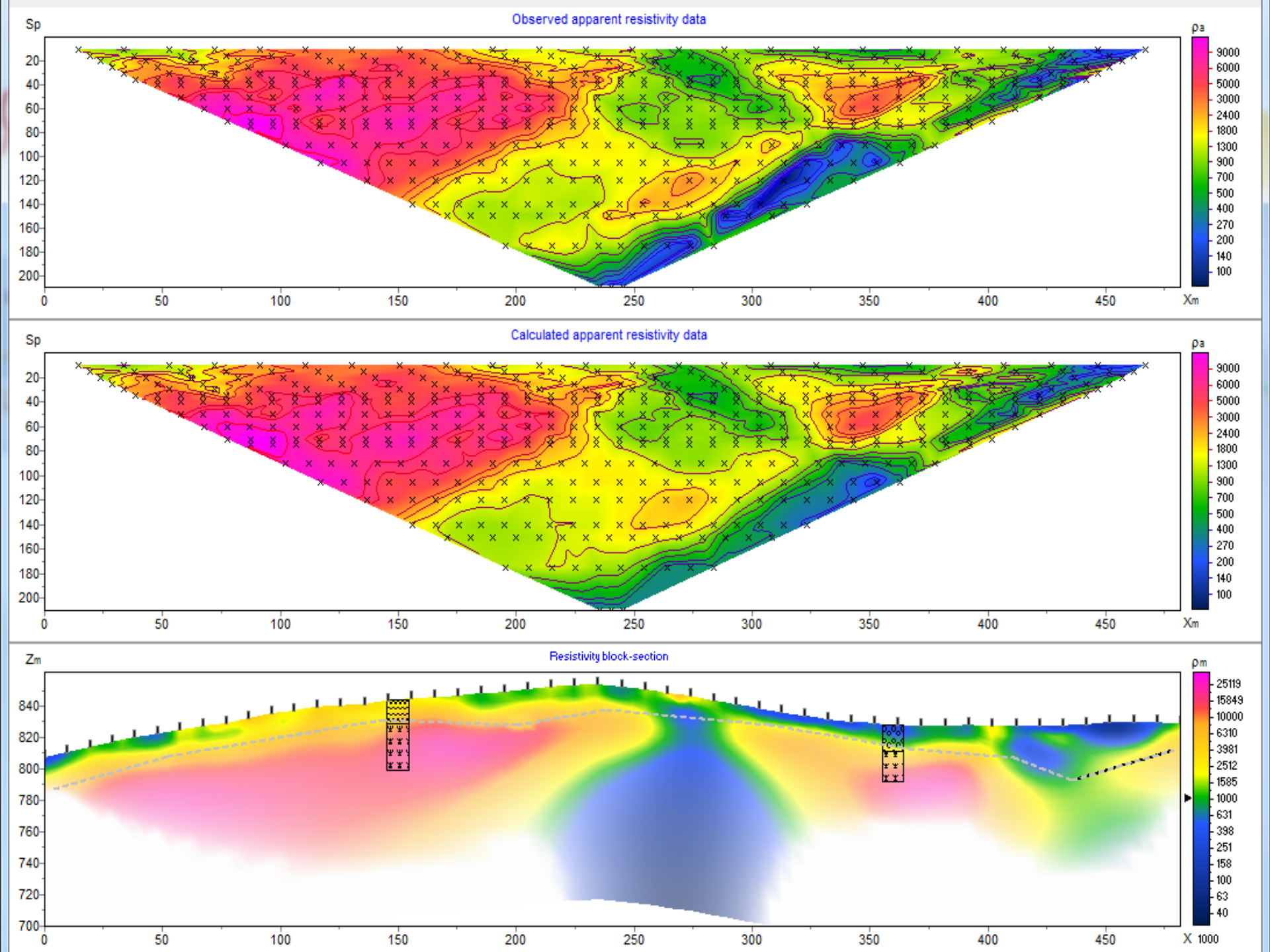
ELECTRICAL RESISTIVITY TOMOGRAPHY (ERT)
VERTICAL DELINEATION

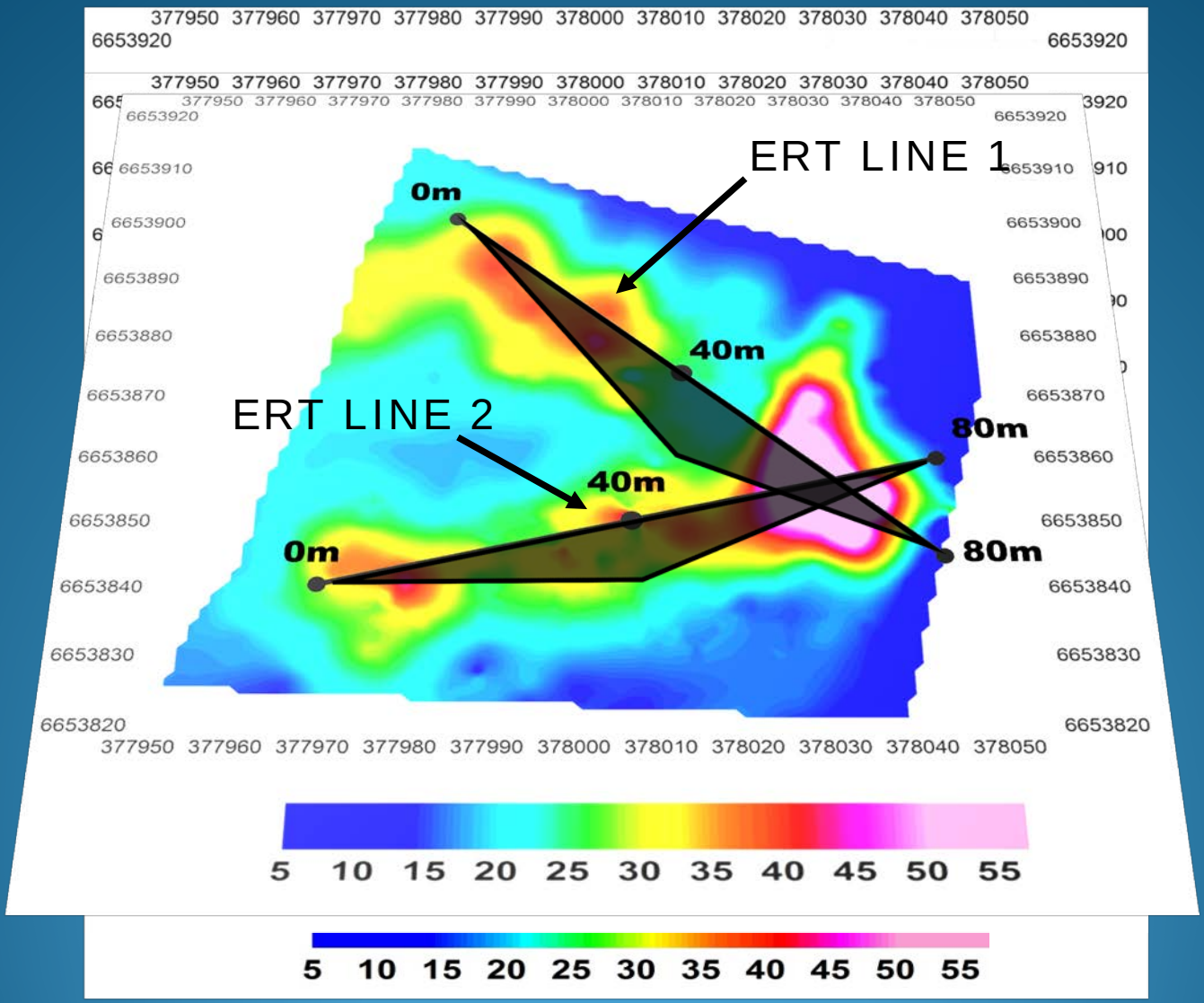


ELECTRICAL RESISTIVITY TOMOGRAPHY (ERT)

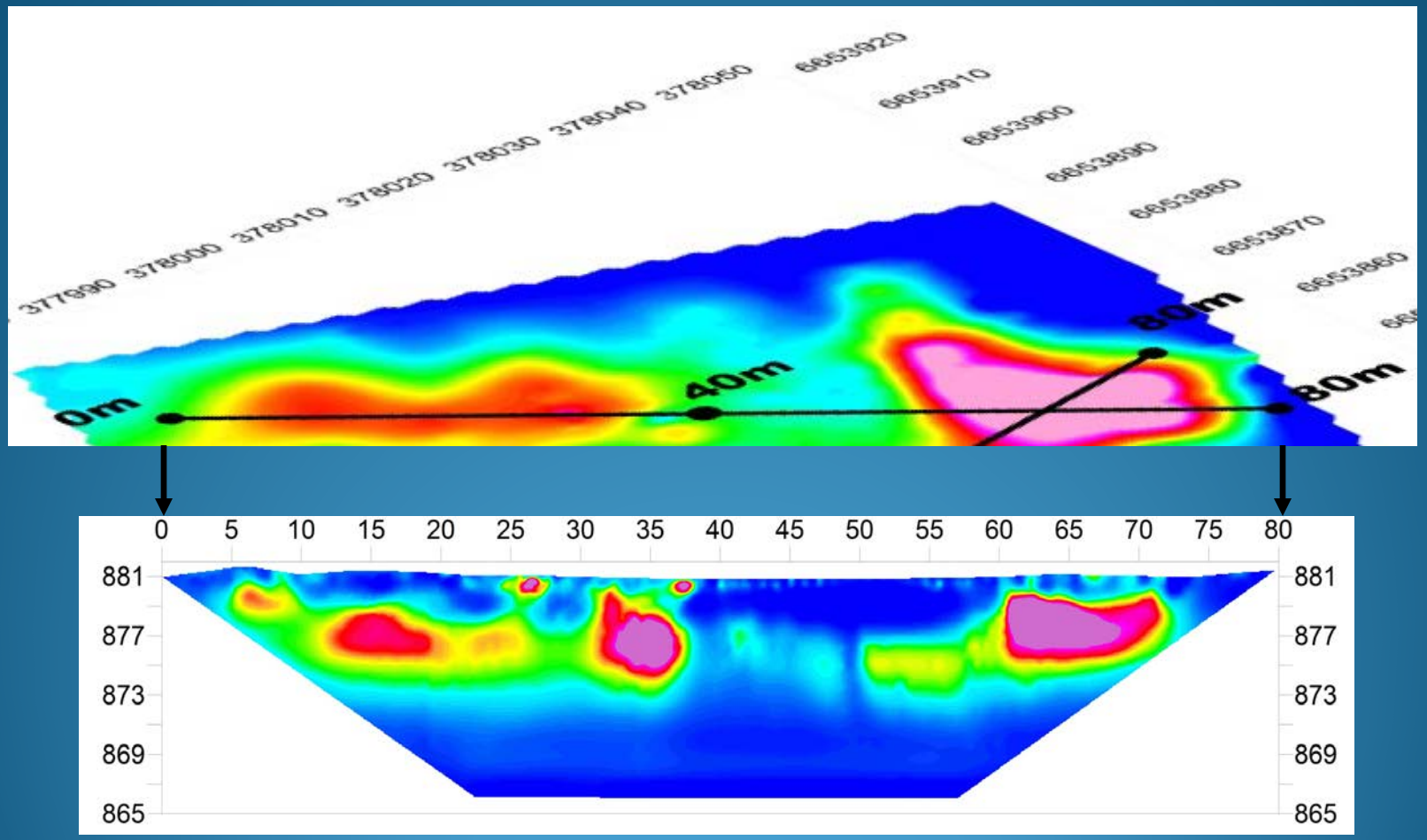


DEPTH RANGE = 5 mbgs to >100 mbgs

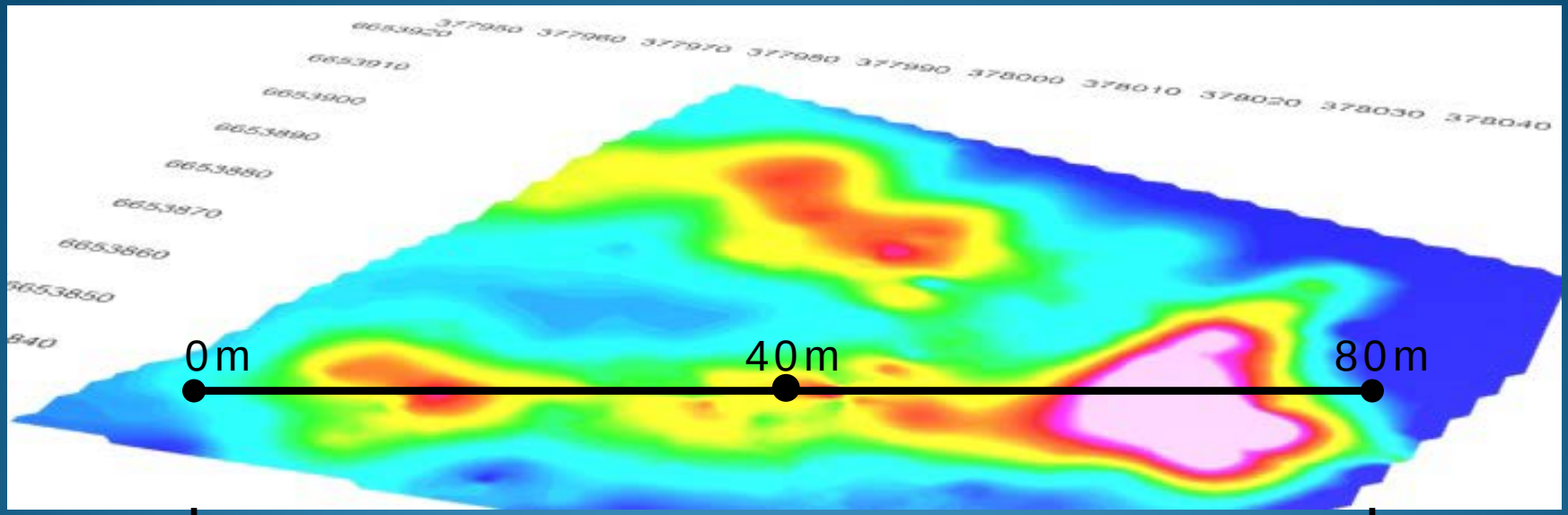

Observed apparent resistivity data
Sp
ρa
9000
6000
5000
3000
2400
1800
1300
900
700
500
400
270
200
140
100
20
40
60
80
100
120
140
160
180
200
0
50
100
150
200
250
300
350
400
450
Xm
Calculated apparent resistivity data
Sp
ρa
9000
6000
5000
3000
2400
1800
1300
900
700
500
400
270
200
140
100
20
40
60
80
100
120
140
160
180
200
0
50
100
150
200
250
300
350
400
450
Xm
Resistivity block-section
Zm
ρm
25119
15849
10000
6310
3981
2512
1585
1000
631
398
251
158
100
63
40
840
820
800
780
760
740
720
700
0
50
100
150
200
250
300
350
400
450
X 1000

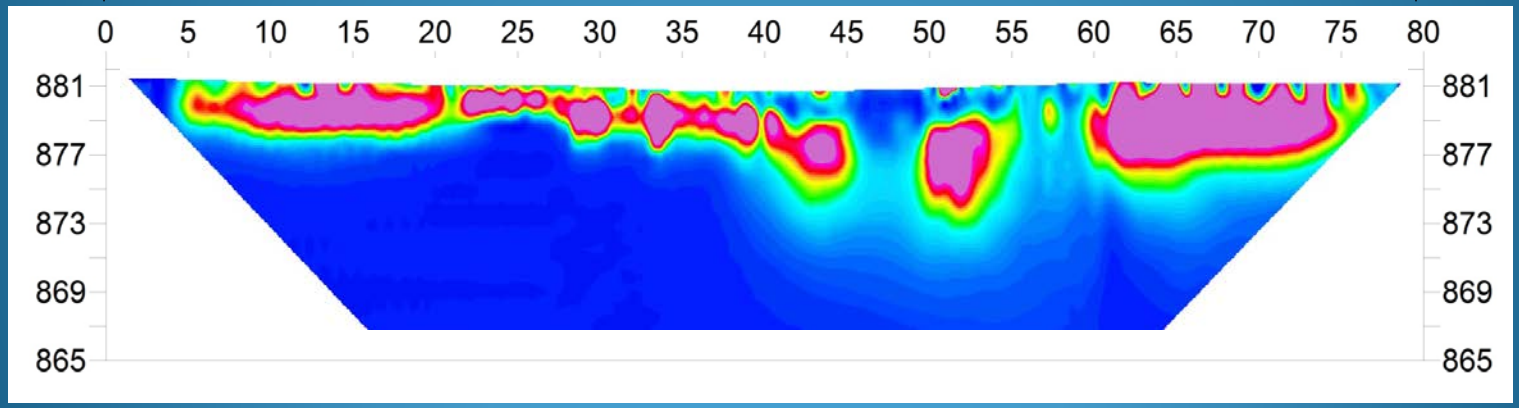

377950 377960 377970 377980 377990 378000 378010 378020 378030 378040 378050
6653920
6653910
6653900
6653890
6653880
6653870
6653860
6653850
6653840
6653830
6653820
ERT LINE 1
0m
40m
80m
ERT LINE 2
0m
40m
80m
5 10 15 20 25 30 35 40 45 50 55

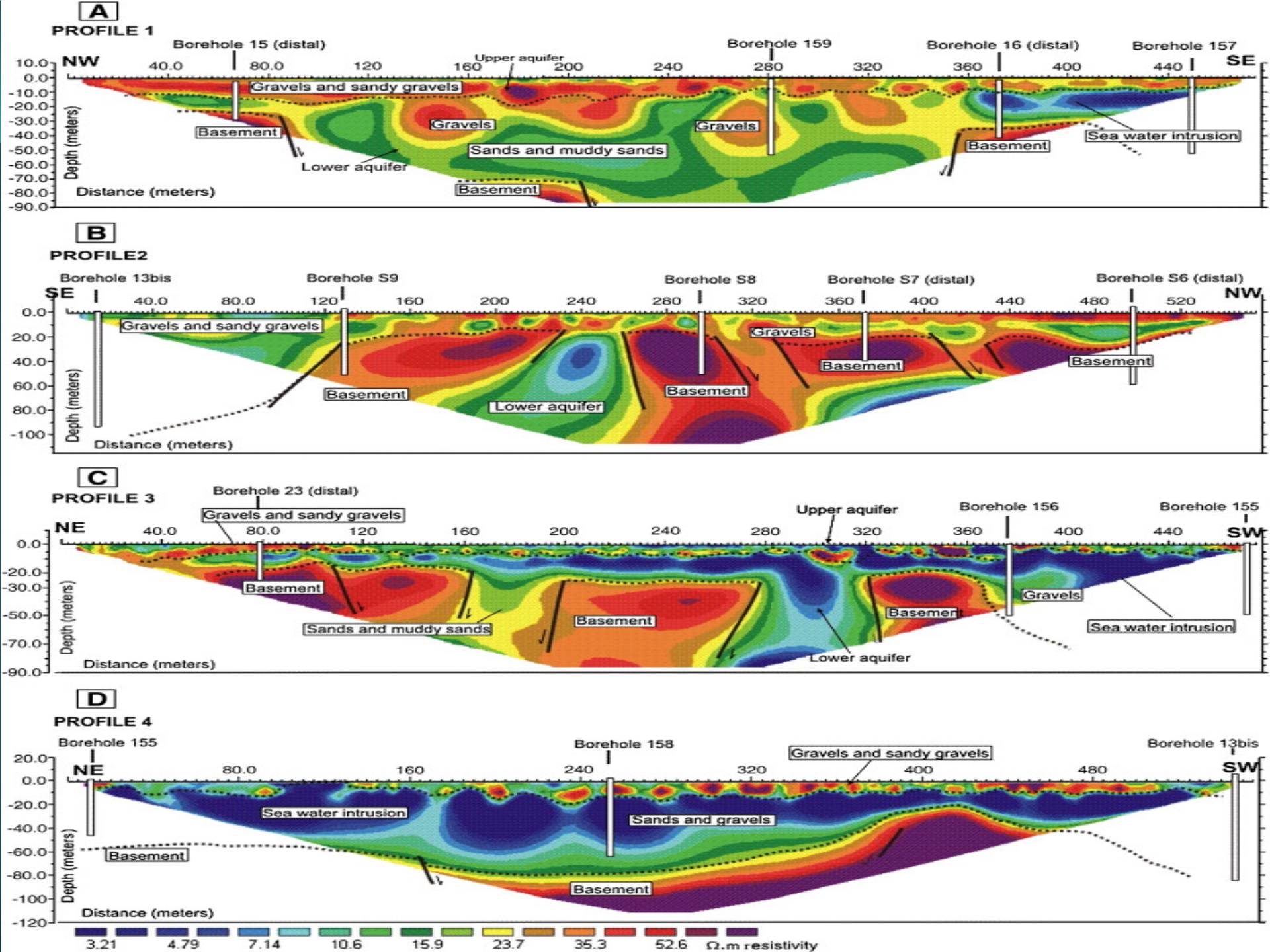
ERT LINE 1

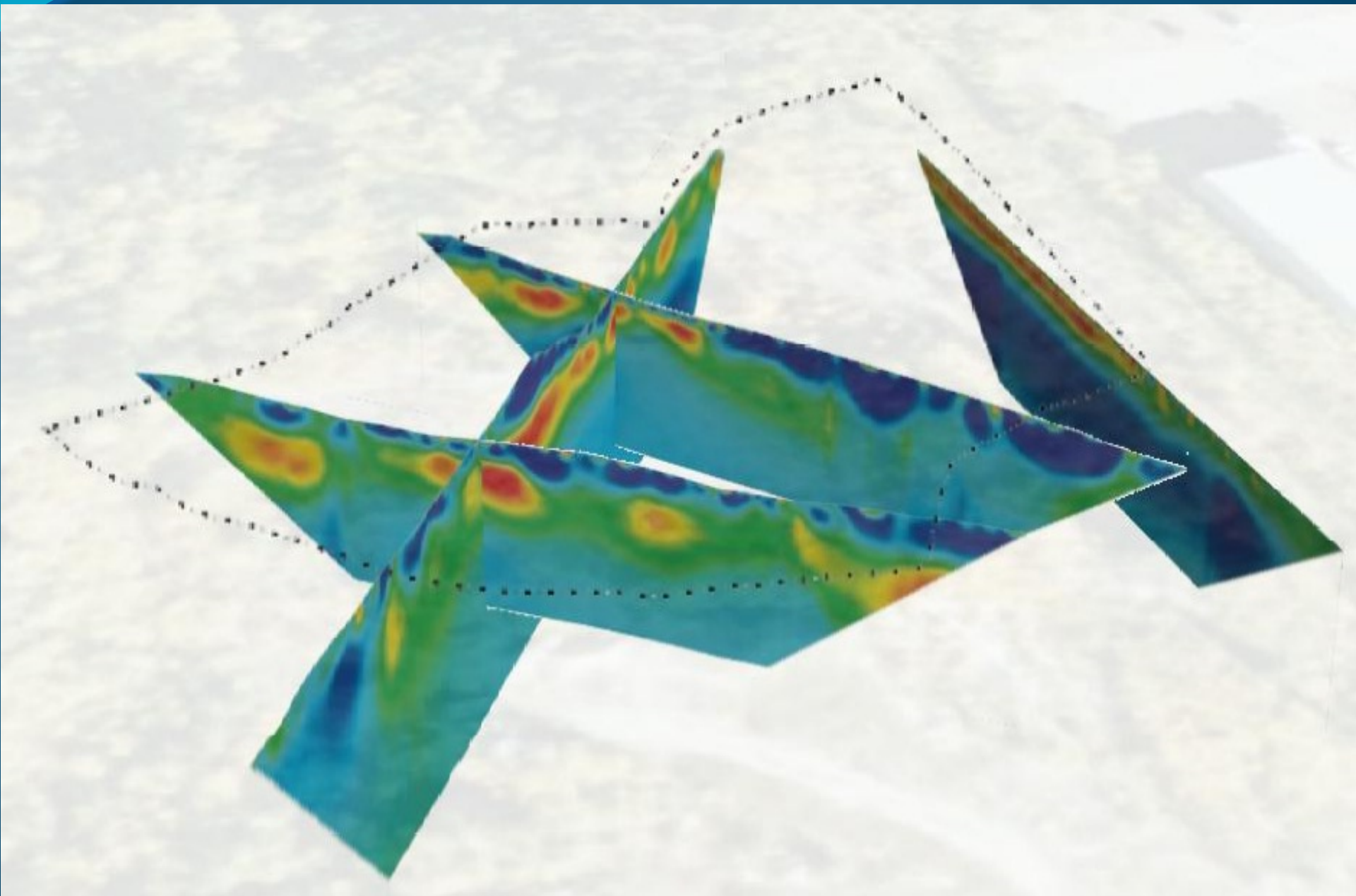

377990 378000 378010 378020 378030 378040 378050
6653920
6653910
6653900
6653890
6653880
6653870
6653860
0m
40m
80m
80m
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80
881
877
873
869
865

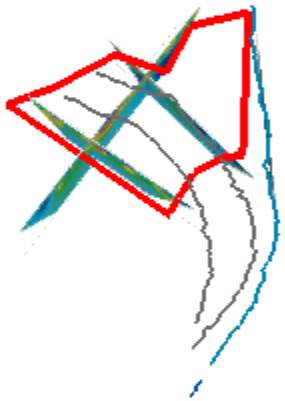
ERT LINE 2


0m
40m
80m


0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80
881
877
873
869
865


A
PROFILE 1
Borehole 15 (distal)
Upper aquifer
Borehole 159
Borehole 16 (distal)
Borehole 157
NW
SE
Gravels and sandy gravels
Basement
Gravels
Gravels
Sands and muddy sands
Lower aquifer
Basement
Basement
Sea water intrusion
Depth (meters)
Distance (meters)
B
PROFILE2
Borehole 13bis
Borehole S9
Borehole S8
Borehole S7 (distal)
Borehole S6 (distal)
SE
NW
Gravels and sandy gravels
Basement
Lower aquifer
Basement
Gravels
Basement
Basement
Depth (meters)
Distance (meters)
C
PROFILE 3
Borehole 23 (distal)
Gravels and sandy gravels
Upper aquifer
Borehole 156
Borehole 155
NE
SW
Basement
Sands and muddy sands
Basement
Lower aquifer
Gravels
Sea water intrusion
Depth (meters)
Distance (meters)
D
PROFILE 4
Borehole 155
Borehole 158
Gravels and sandy gravels
Borehole 13bis
NE
SW
Sea water intrusion
Sands and gravels
Basement
Basement
Depth (meters)
Distance (meters)
3.21
4.79
7.14
10.6
15.9
23.7
35.3
52.6
Ω.m resistivity

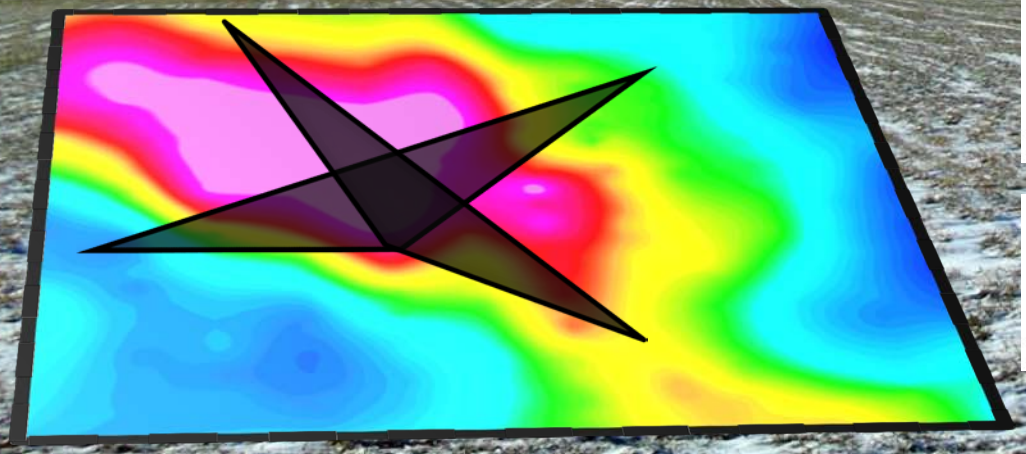


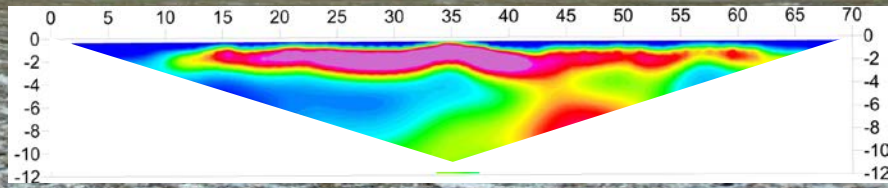


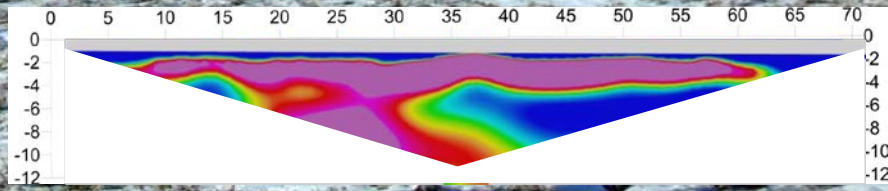
COST BENEFITS

PHASE II ESA
DRILLING PROGRAM
12 BOREHOLES
DELINEATION?....
~$30K

GEOPHYSICS PROGRAM
~$8-10K
PHASE II ESA TARGETED
DRILLING PROGRAM
~$10-12K
SAVINGS ~35-40%







QUESTIONS