




**High Resolution Site Characterization at an
Industrial Site in Paraná, Brazil**

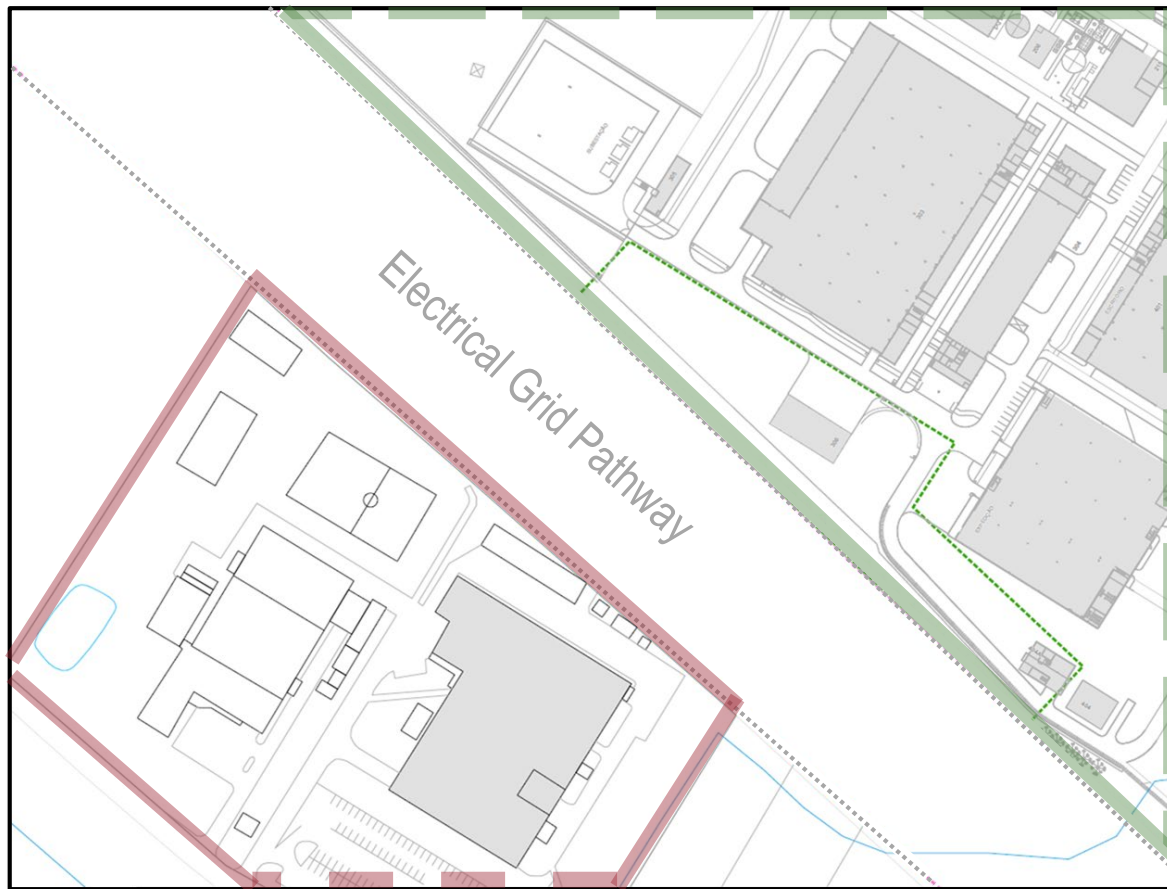
GEOKLOCK

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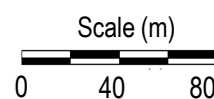
PURPOSE

A combination of HRSC Tools and standard methods of investigation were used to determine the source of a VOC plume.

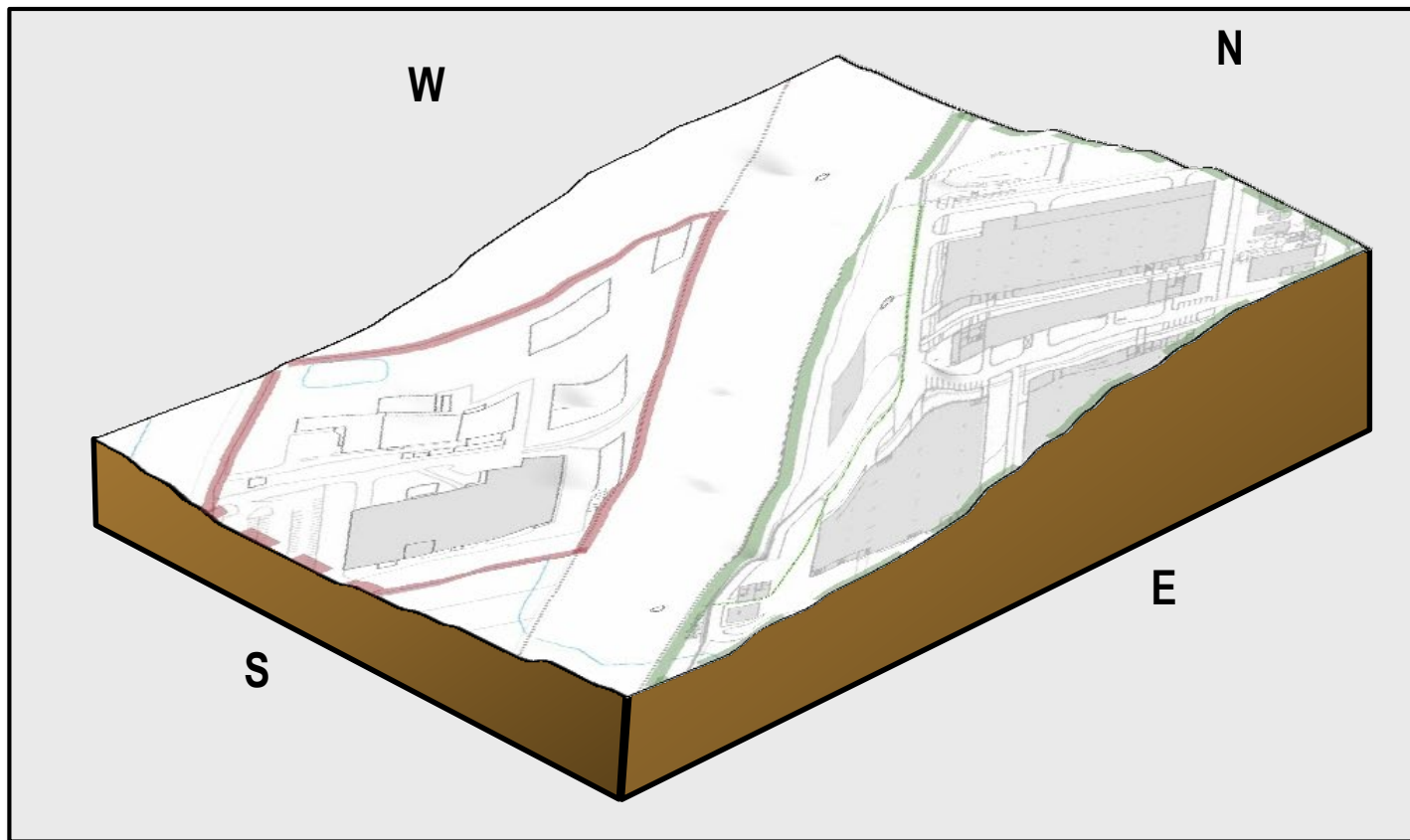
SITE'S PLAN



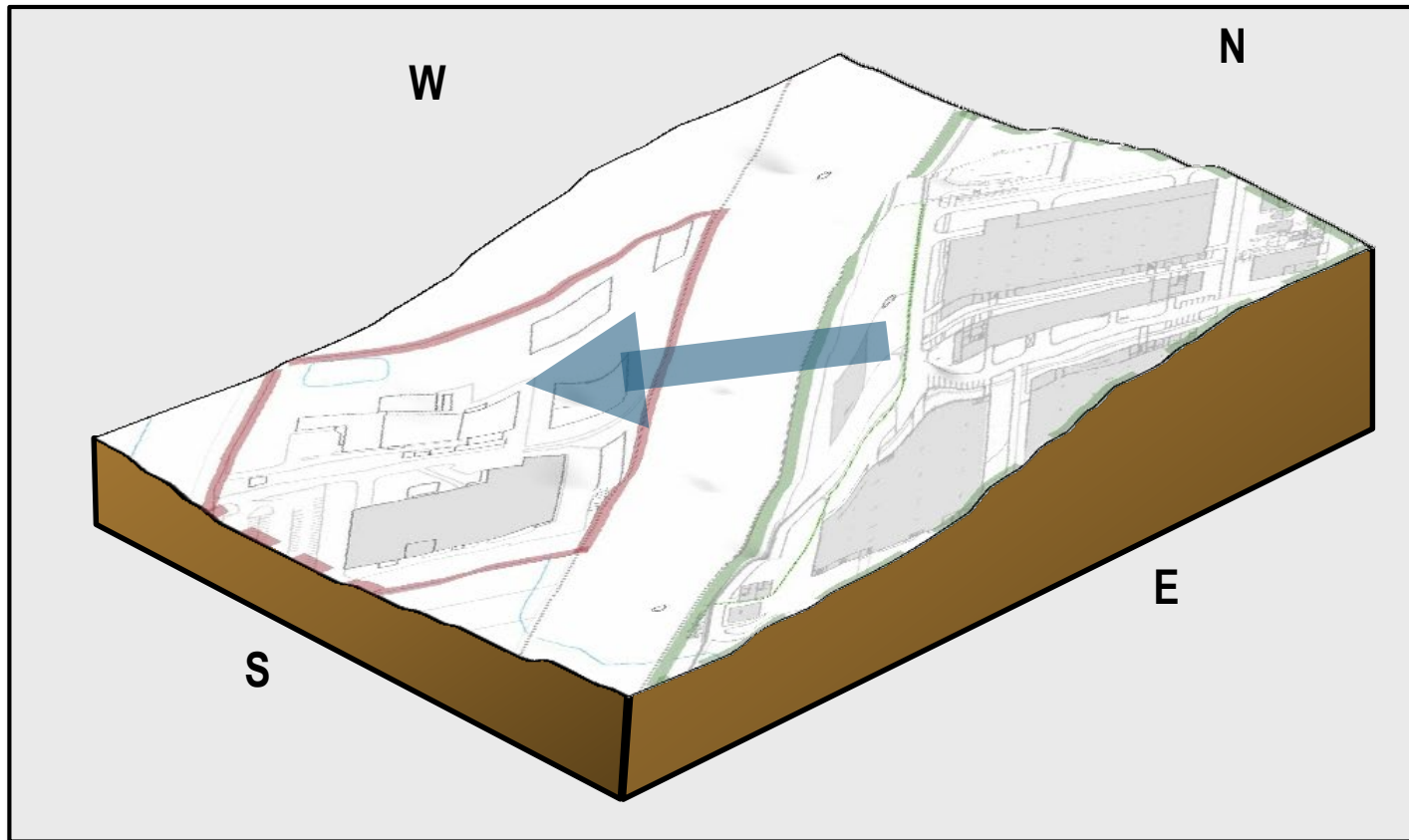
- Site 1
- Site 2
- Productive Buildings



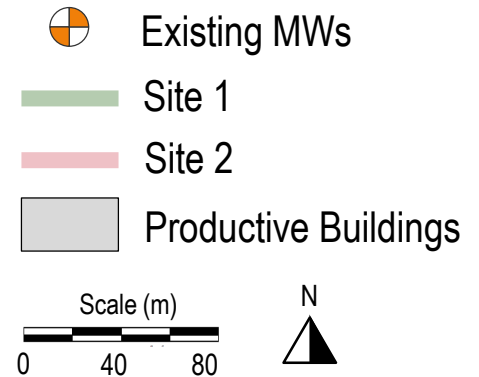
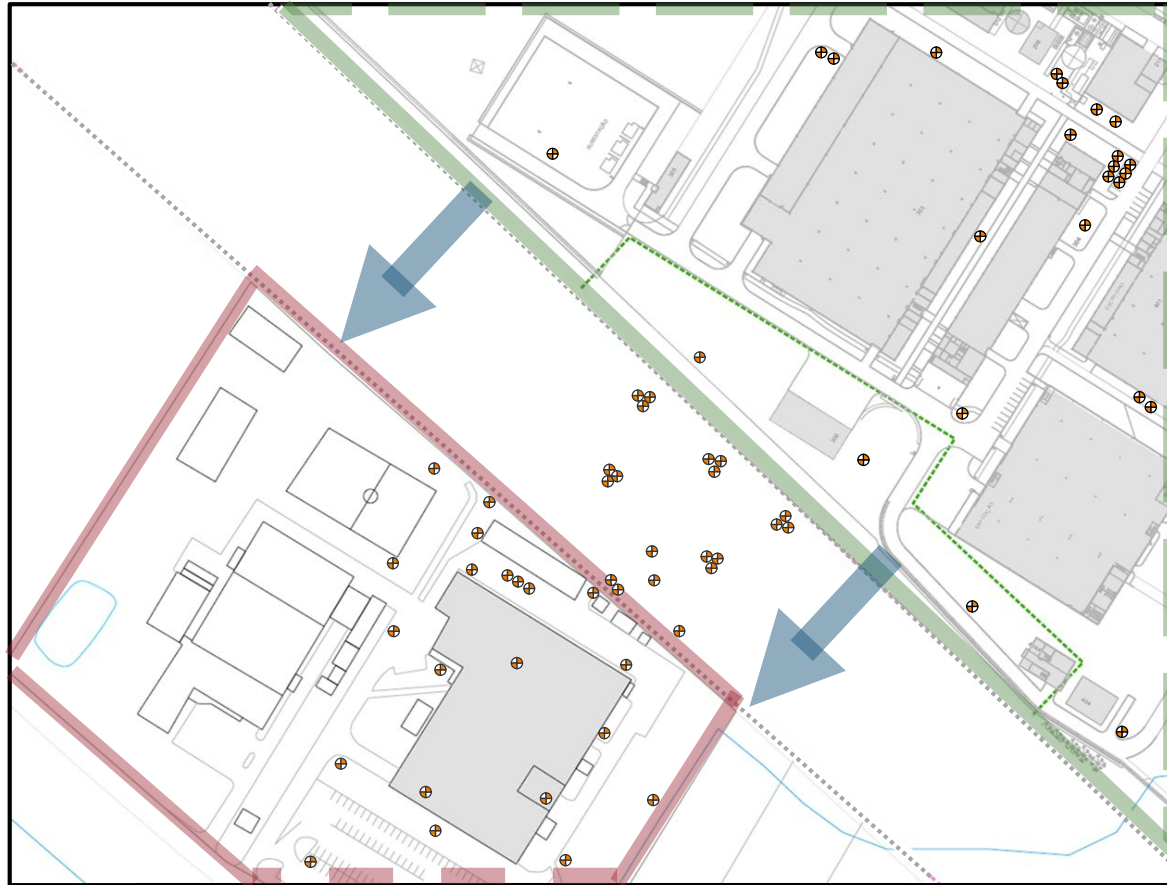
TOPOGRAPHY



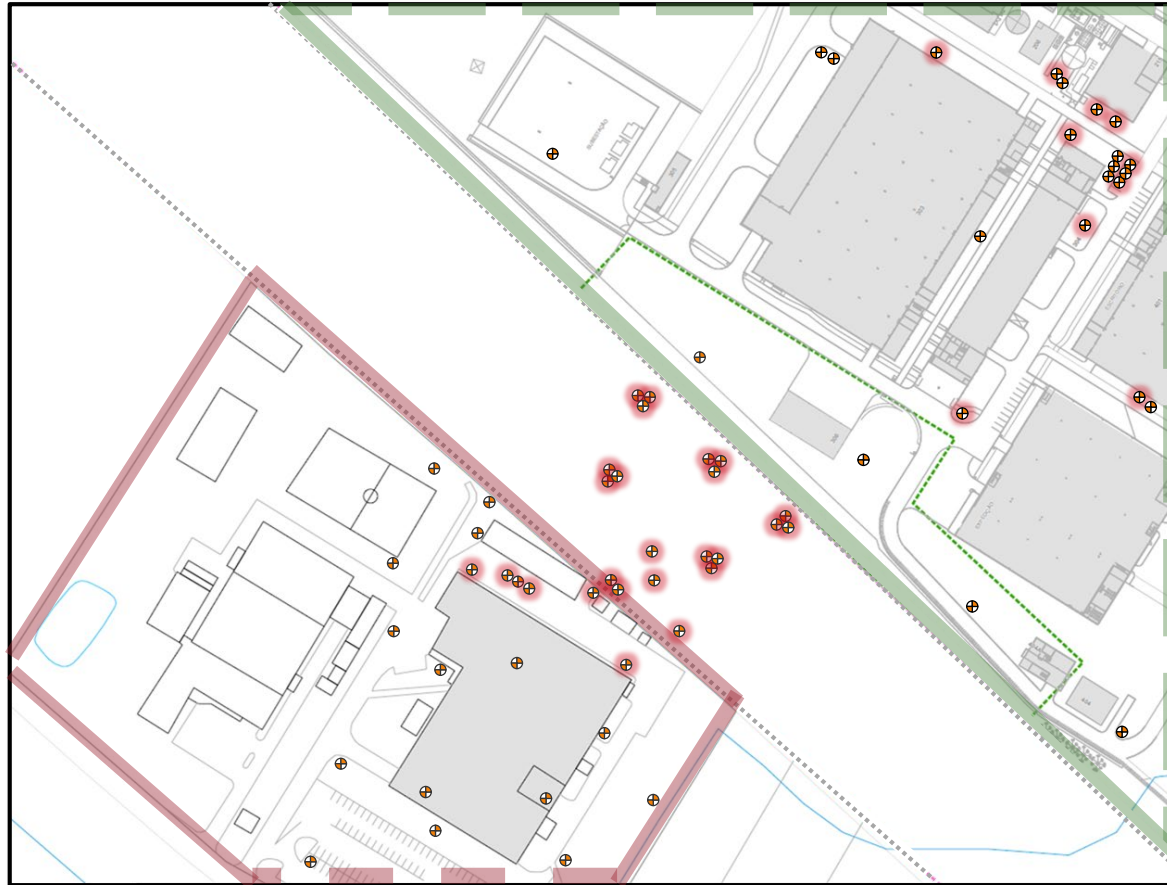
GROUNDWATER FLOW







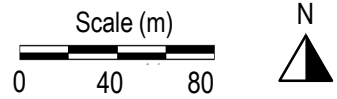
PREVIOUSLY INSTALLED MWs



PREVIOUSLY INSTALLED MWs








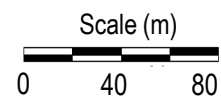
-  Existing MWs
-  Site 1
-  Site 2
-  Productive Buildings



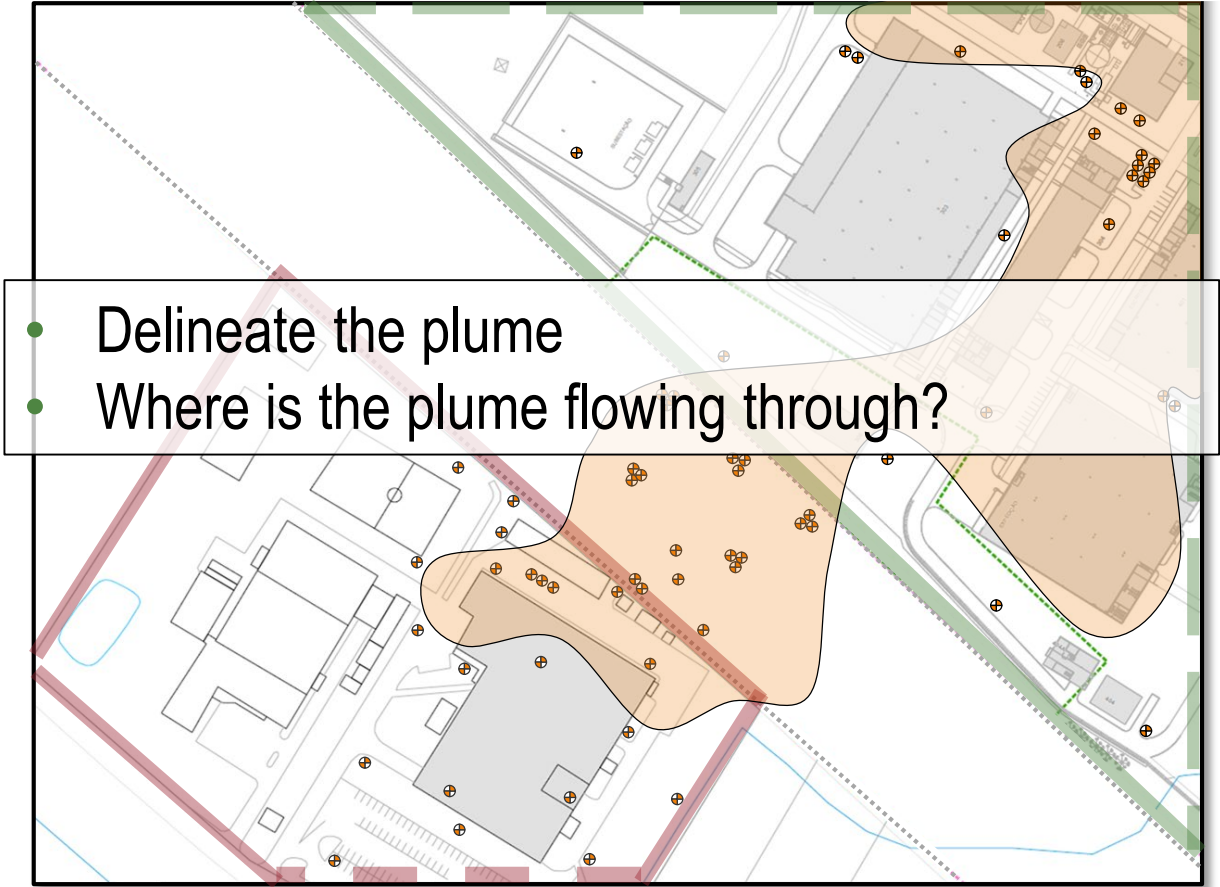
PREVIOUS PCE PLUME



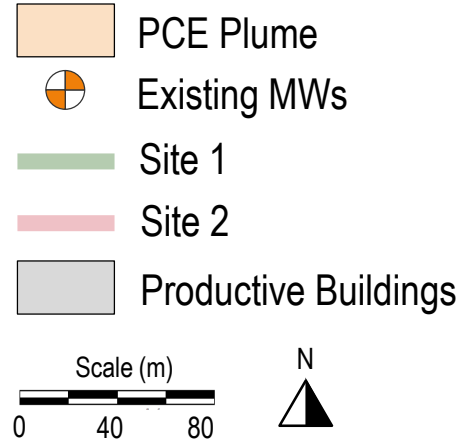
-  PCE Plume
-  Existing MWs
-  Site 1
-  Site 2
-  Productive Buildings



PREVIOUS PCE PLUME



- Delineate the plume
- Where is the plume flowing through?



SCOPE-OF-WORK

High Resolution:

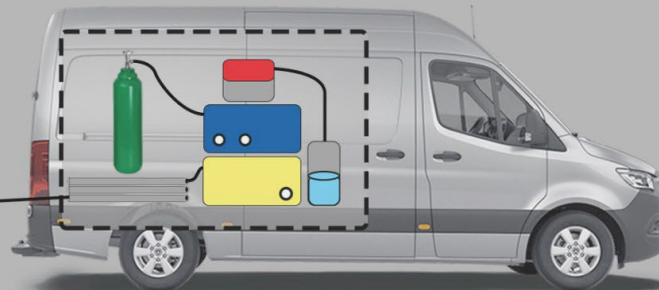
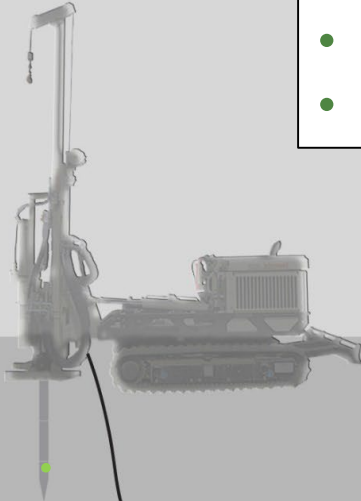
- 39 MiHPT borings
- 09 Low Level-MiHPT borings
- 01 HPT-GWS boring and 02 samples

Investigation:

- 20 groups of multilevel monitoring wells instalation
- 66 water samples

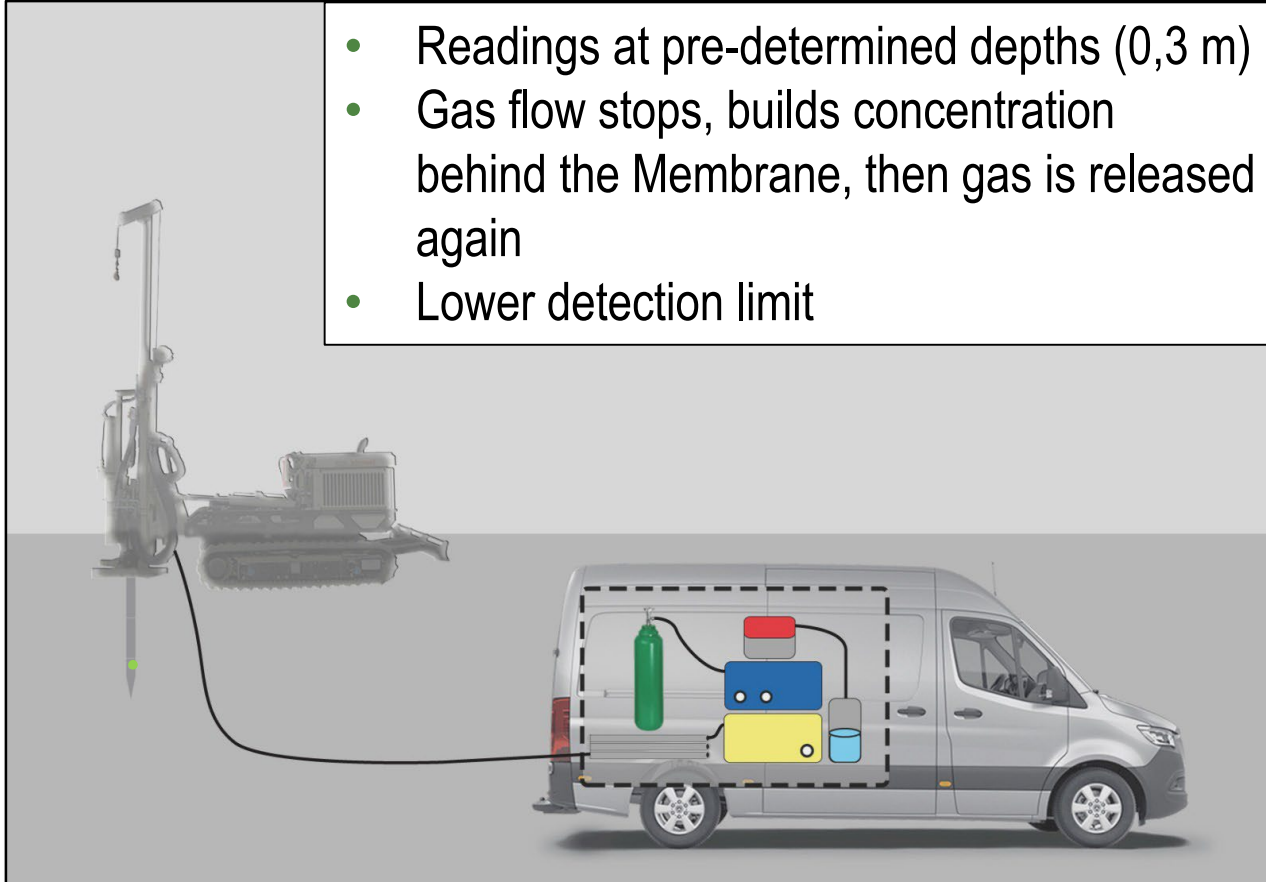
MIHPT

- Vertical Screening High Resolution Tool;
- Readings every 1,5 cm
- Contamination (PID, FID, XSD)
- Permeability (HPT)
- Electrical Conductivity



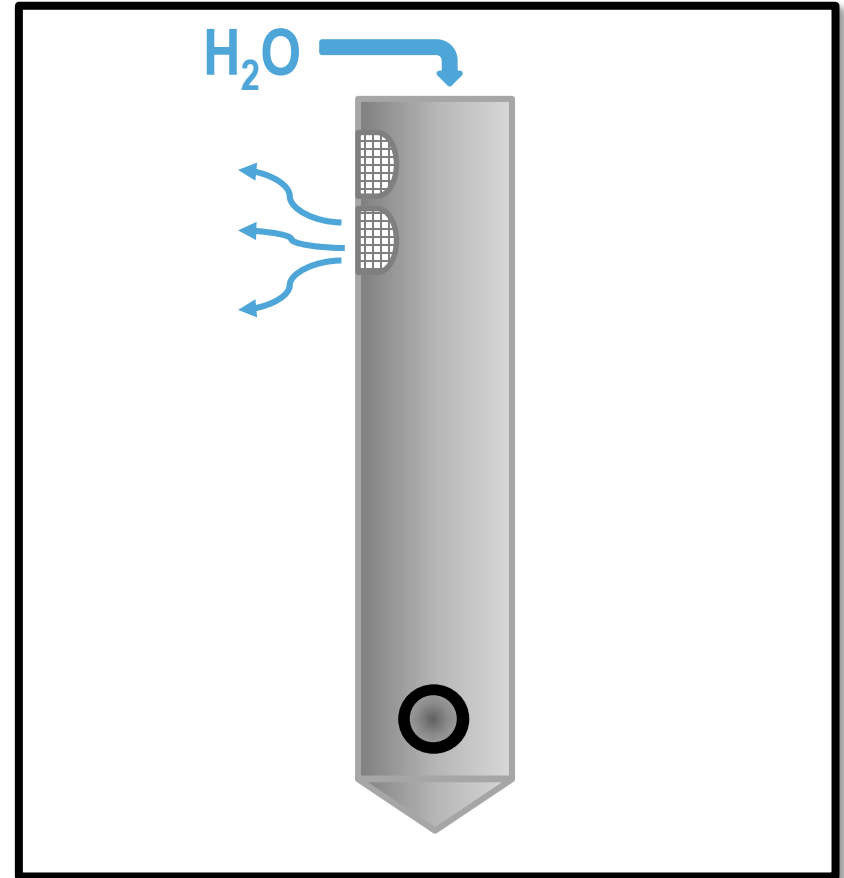
LOW LEVEL MIHPT

- Readings at pre-determined depths (0,3 m)
- Gas flow stops, builds concentration behind the Membrane, then gas is released again
- Lower detection limit



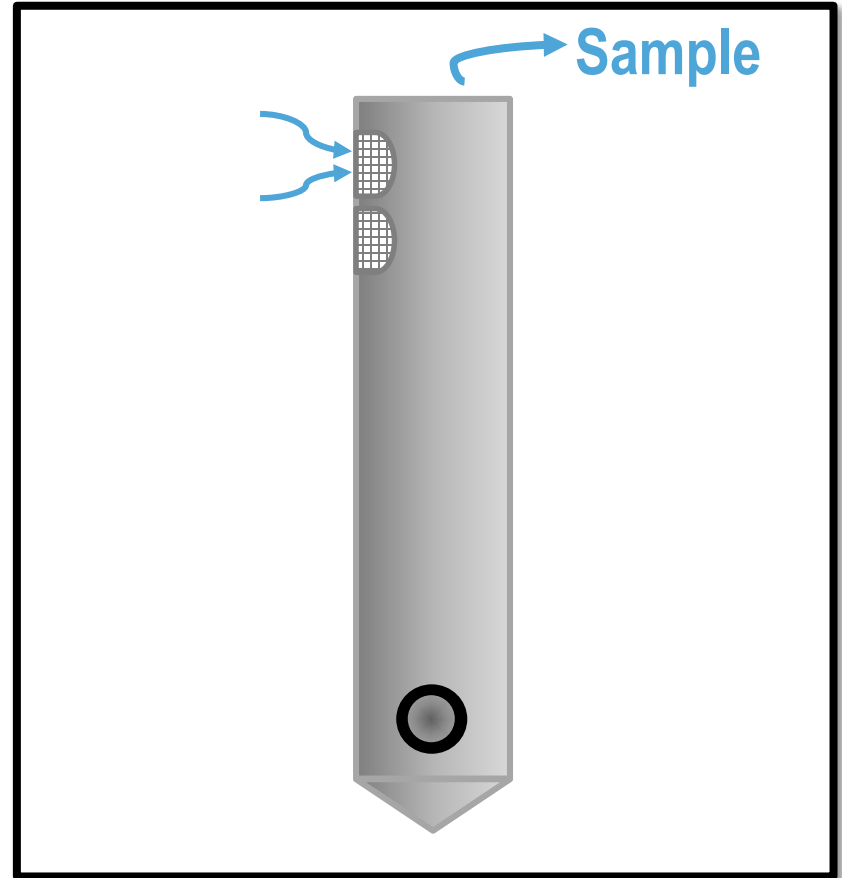
HPT- GWS

- Readings every 1,5 cm
- Permeability (HPT)
- Electrical Conductivity
- Groundwater Sampler



HPT- GWS

- Readings every 1,5 cm
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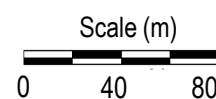
HIGH RESOLUTION BORINGS

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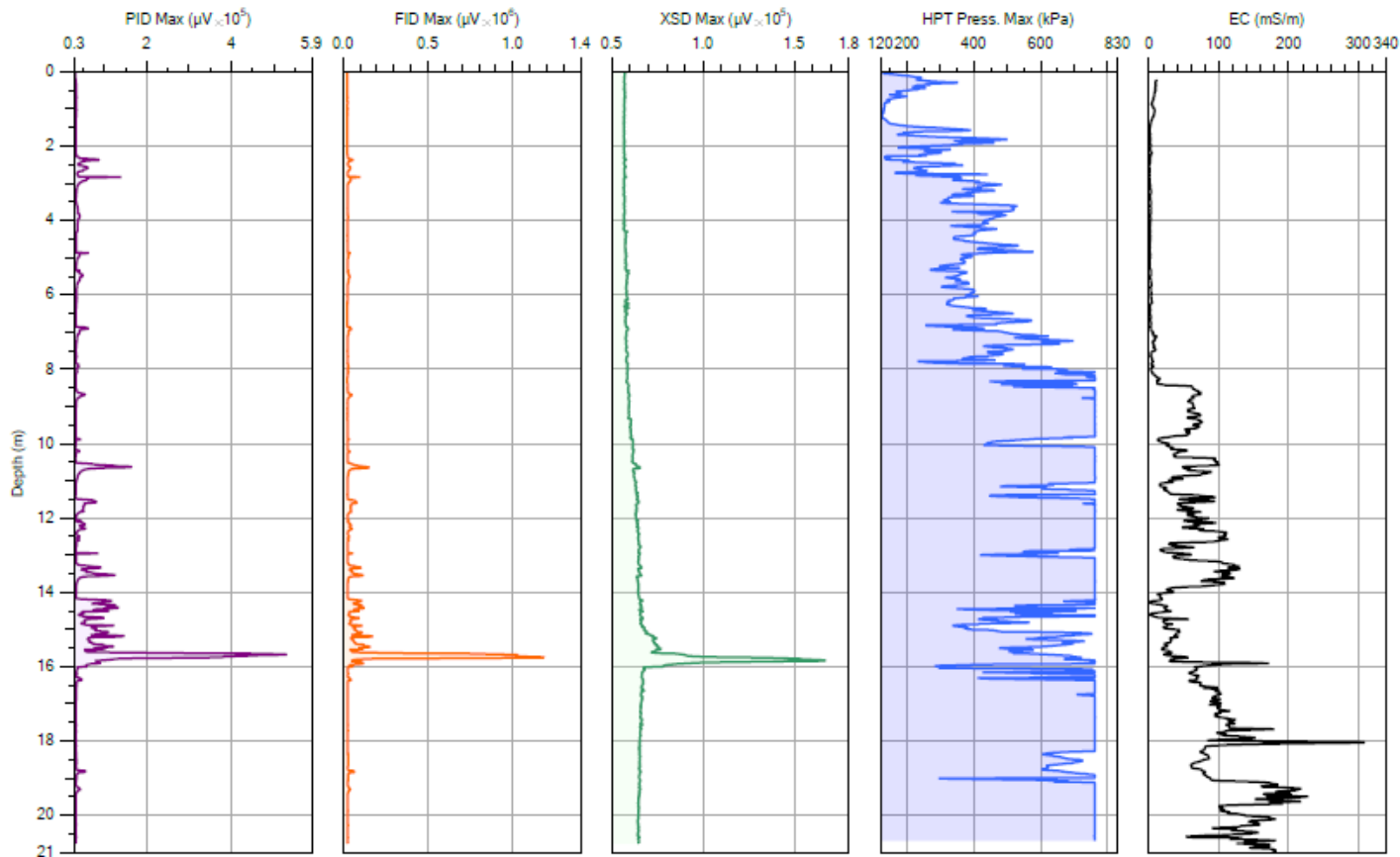
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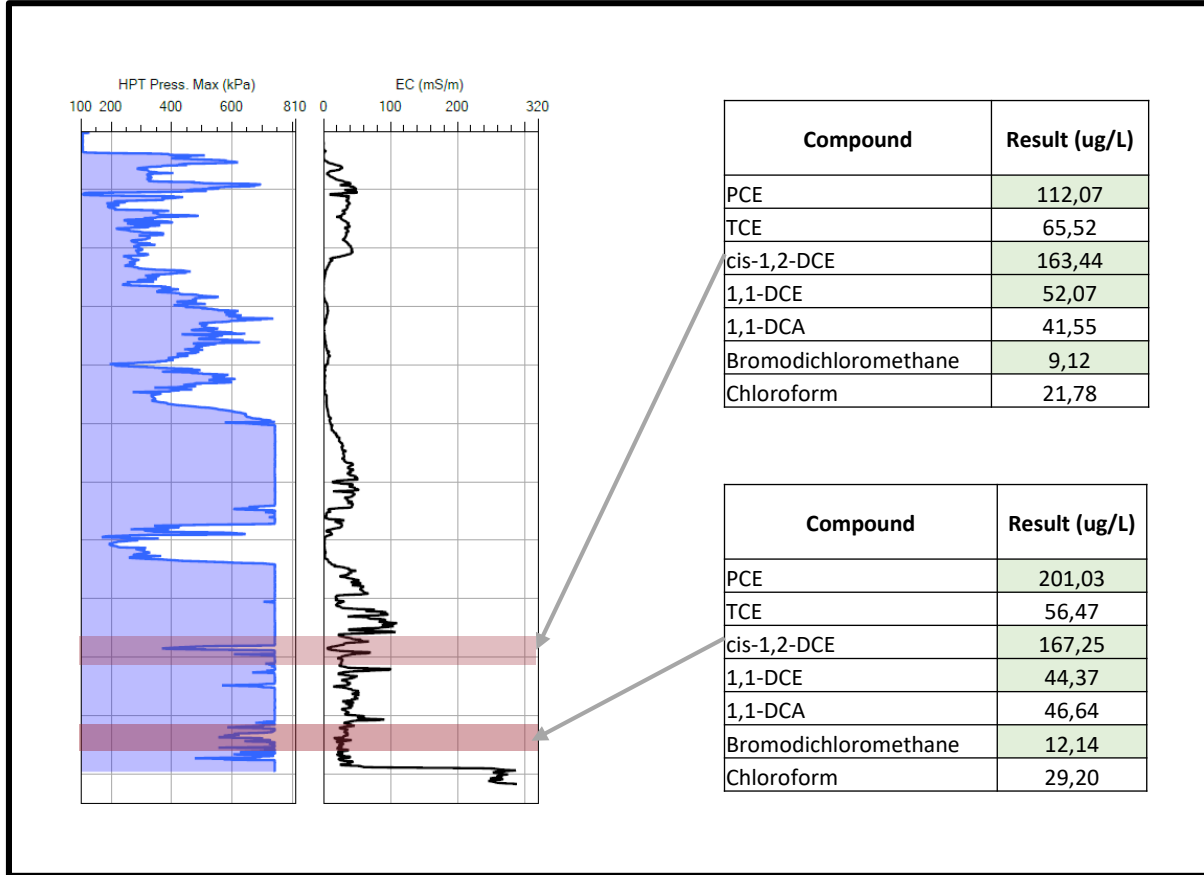
-  MiHPT Borings
-  LL MiHPT Borings
-  HPT GWS Boring and Sample
-  Site 1
-  Site 2
-  Productive Buildings



MIHPT LOG



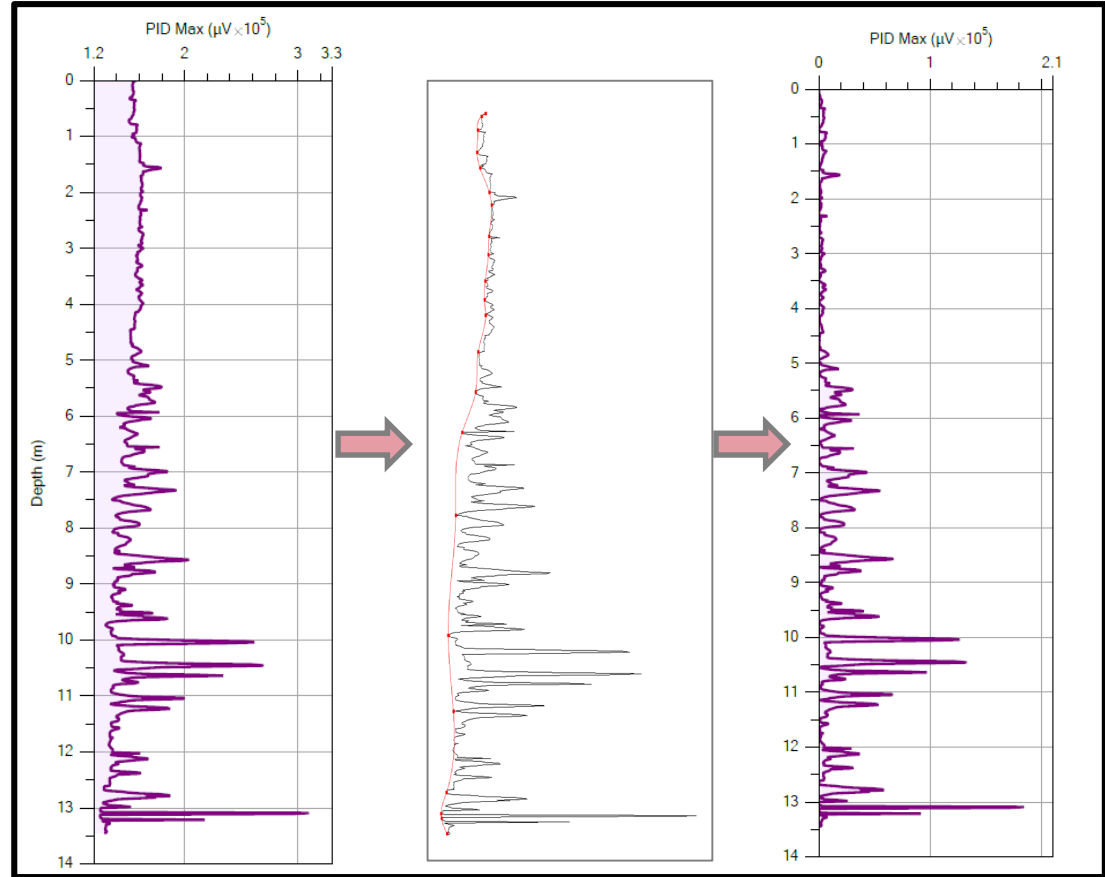
GWS SAMPLE RESULTS



Sample horizon
 [] above standards

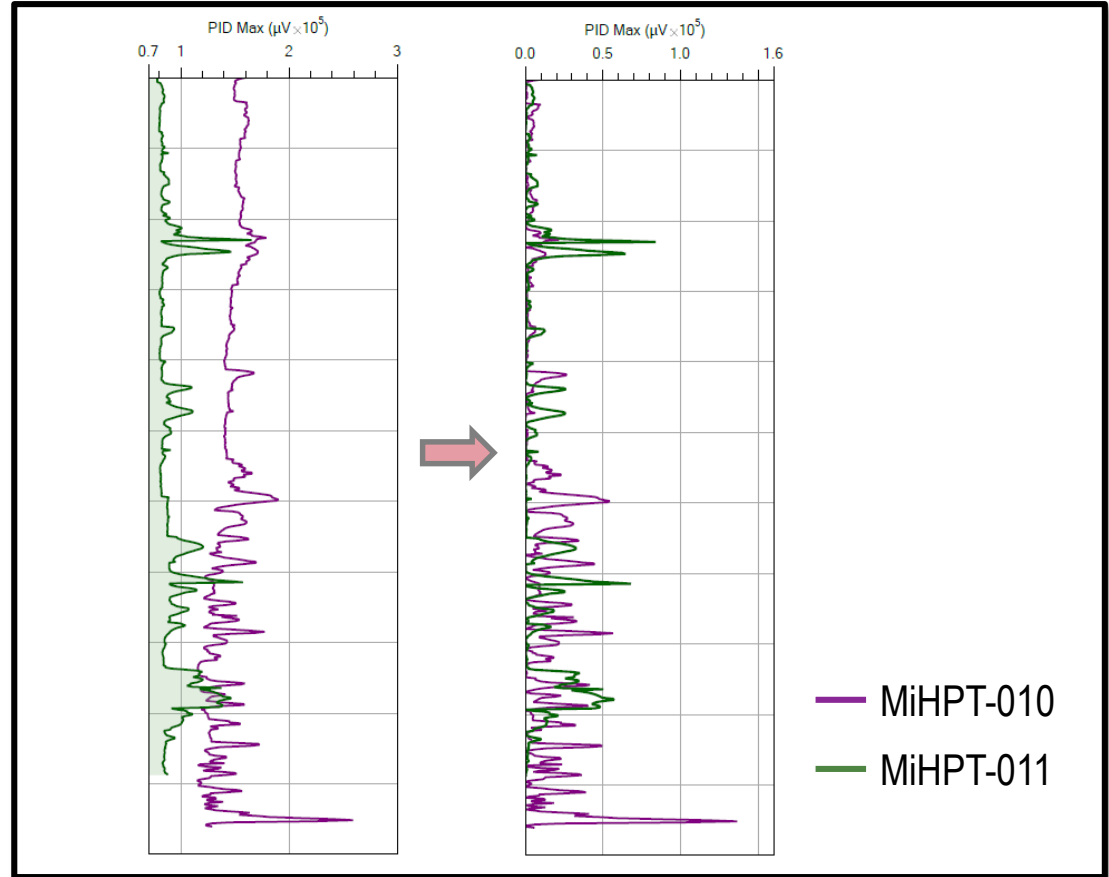
DATA PROCESSING

- Baseline drift correction

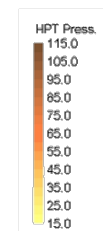
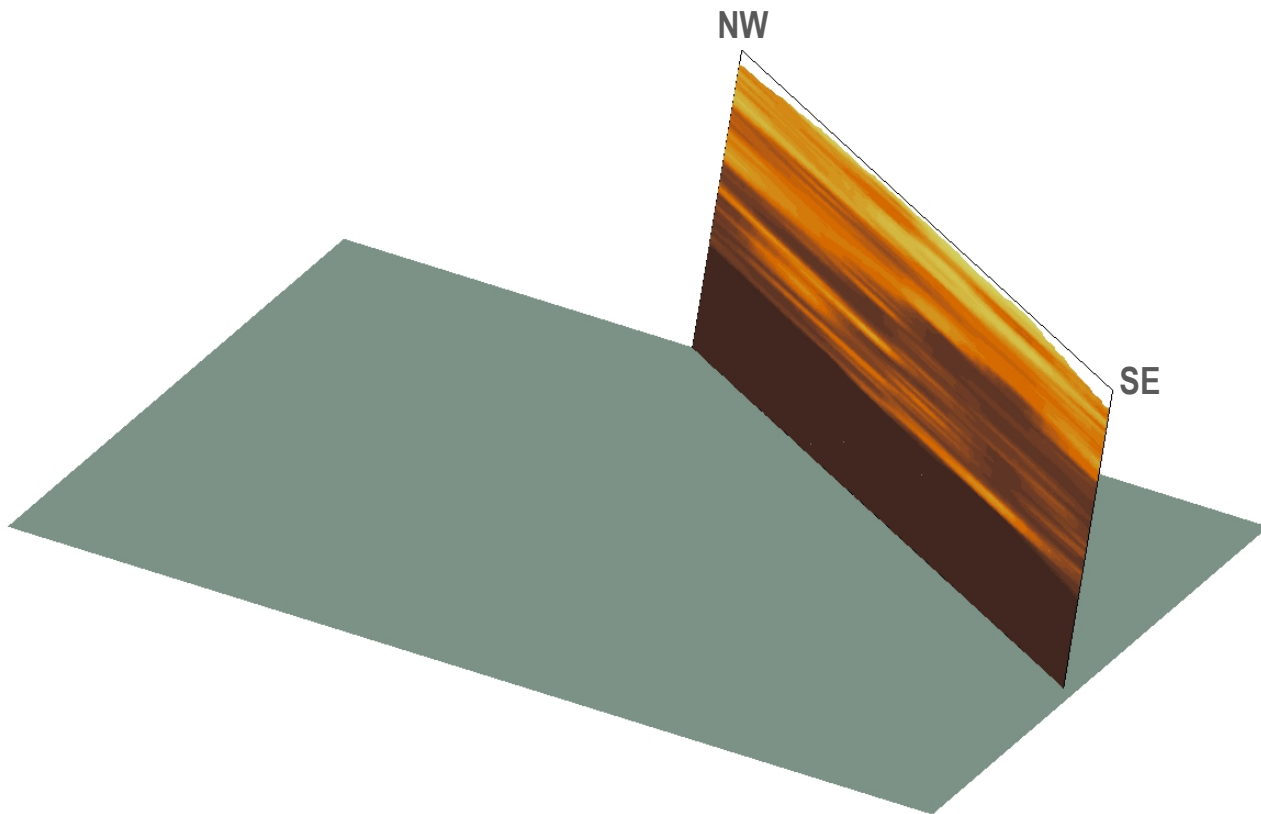


DATA PROCESSING

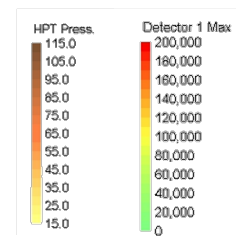
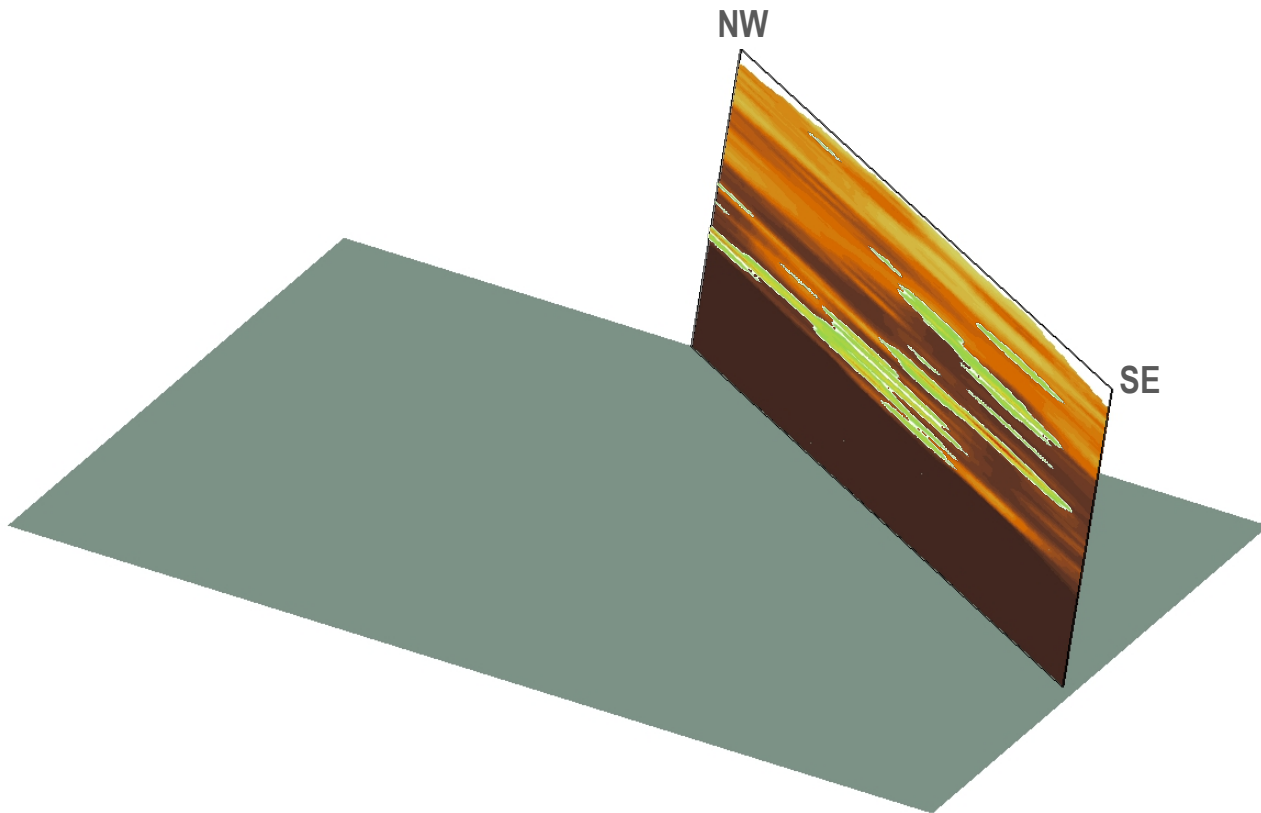
- Baseline level correction



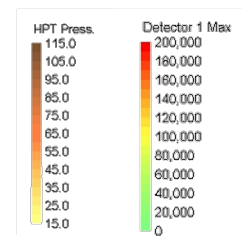
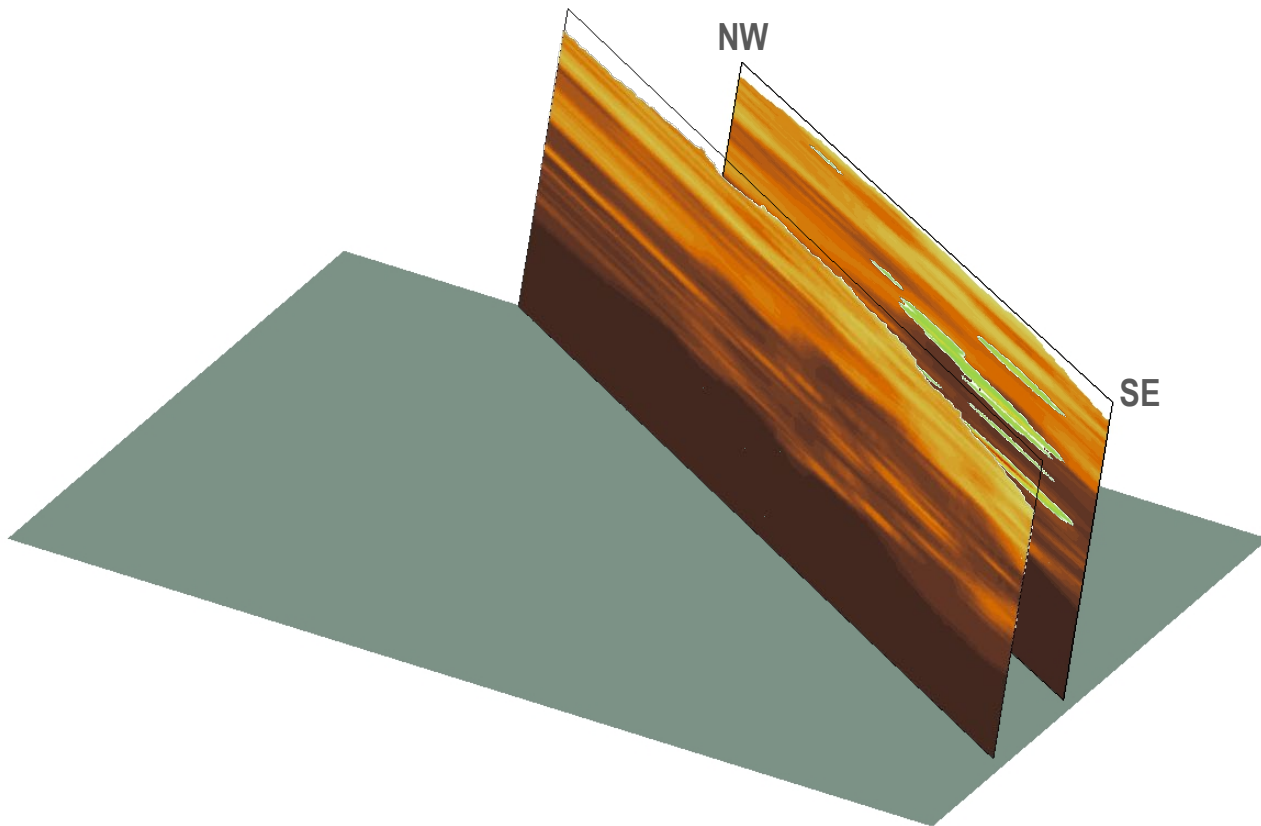
HIGH RESOLUTION SECTIONS



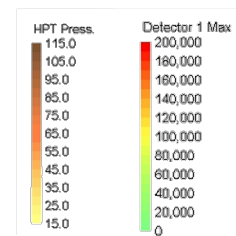
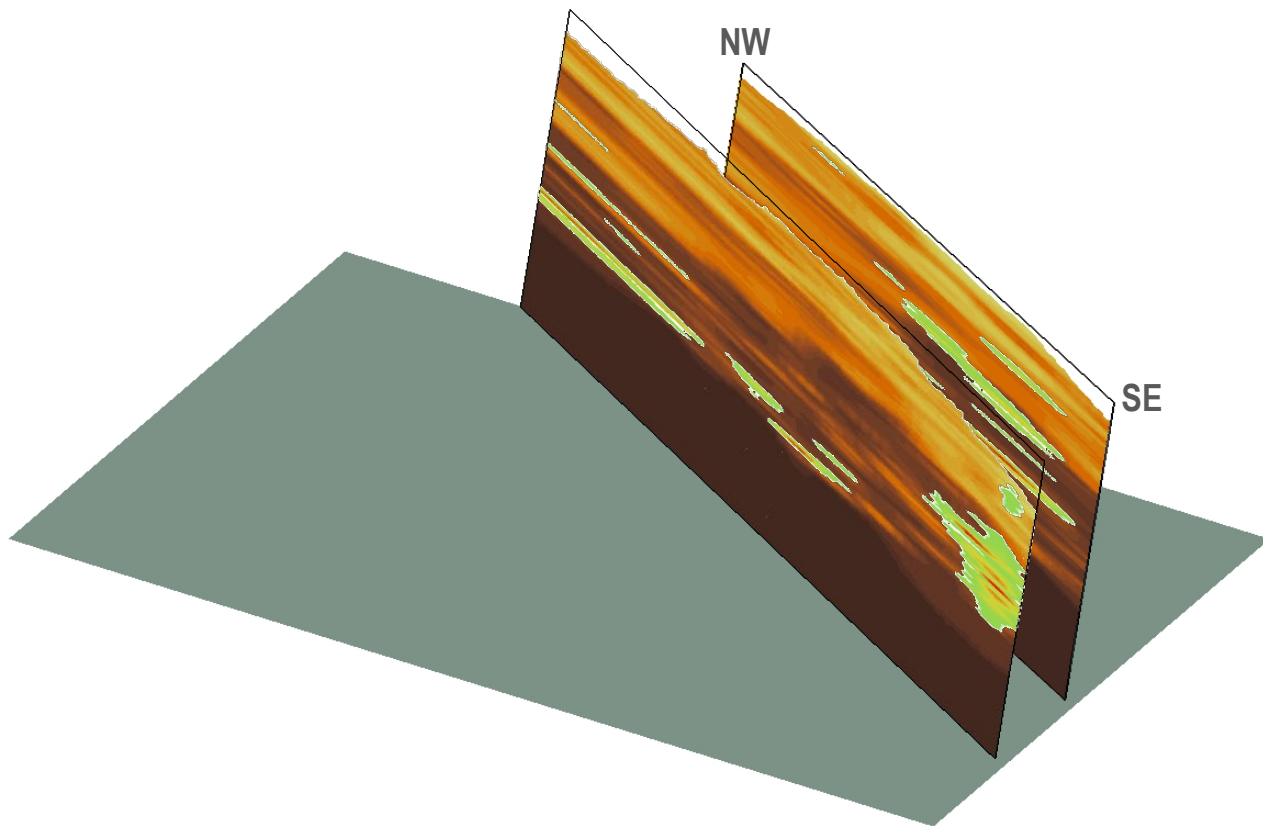
HIGH RESOLUTION SECTIONS



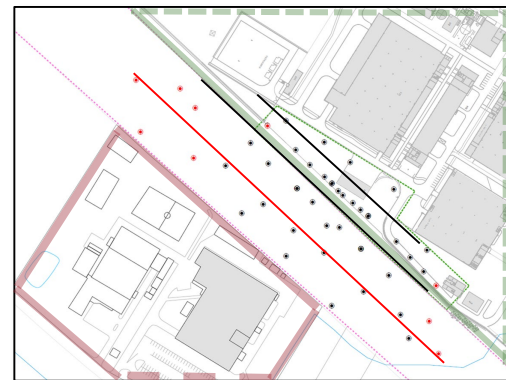
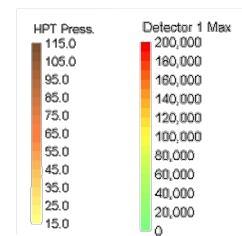
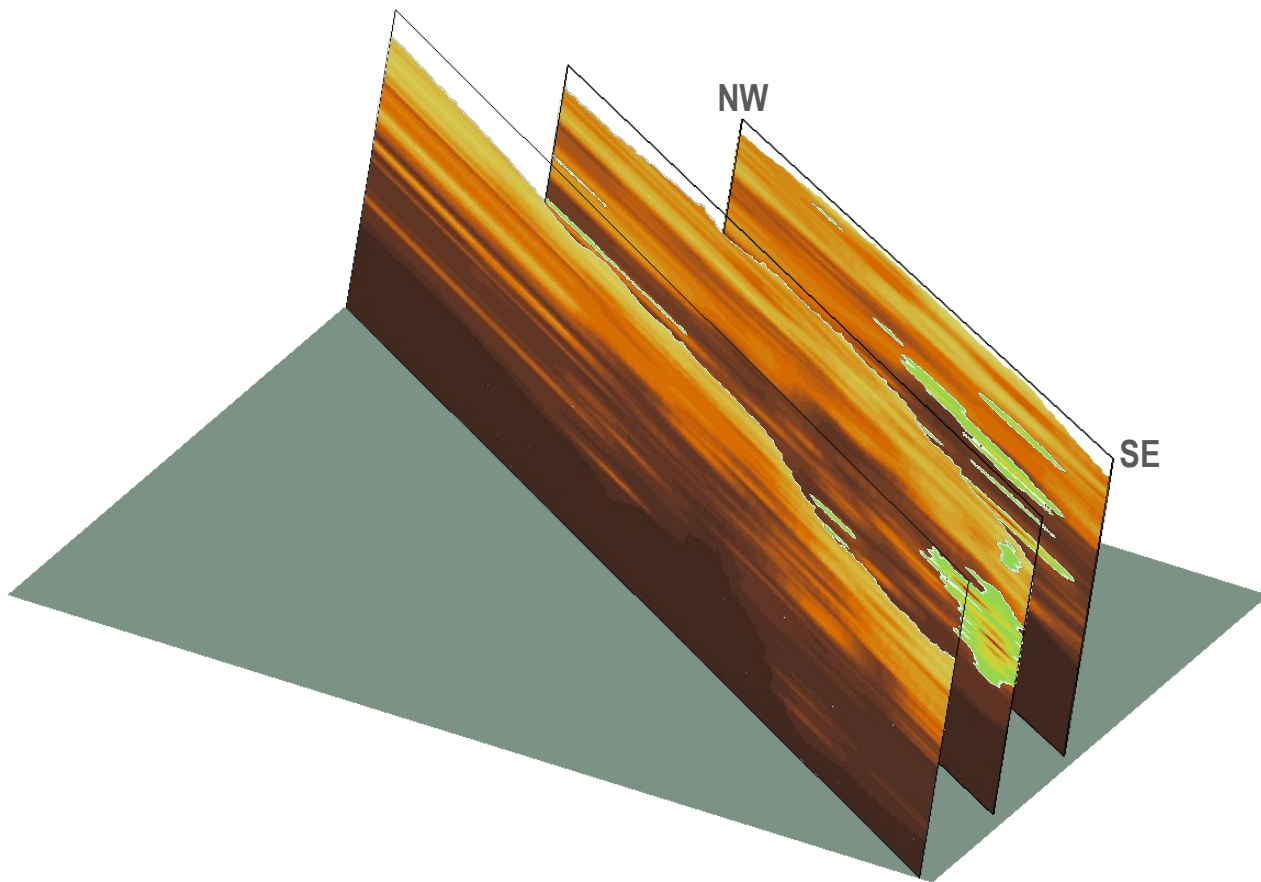
HIGH RESOLUTION SECTIONS



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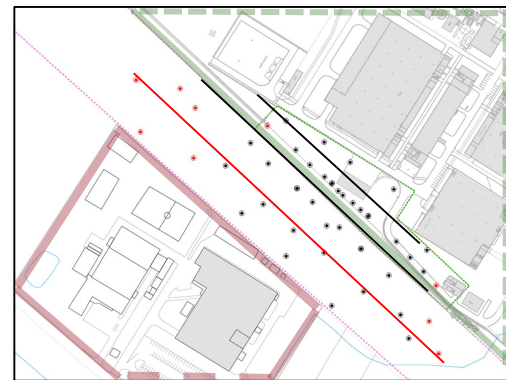
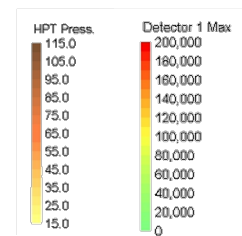
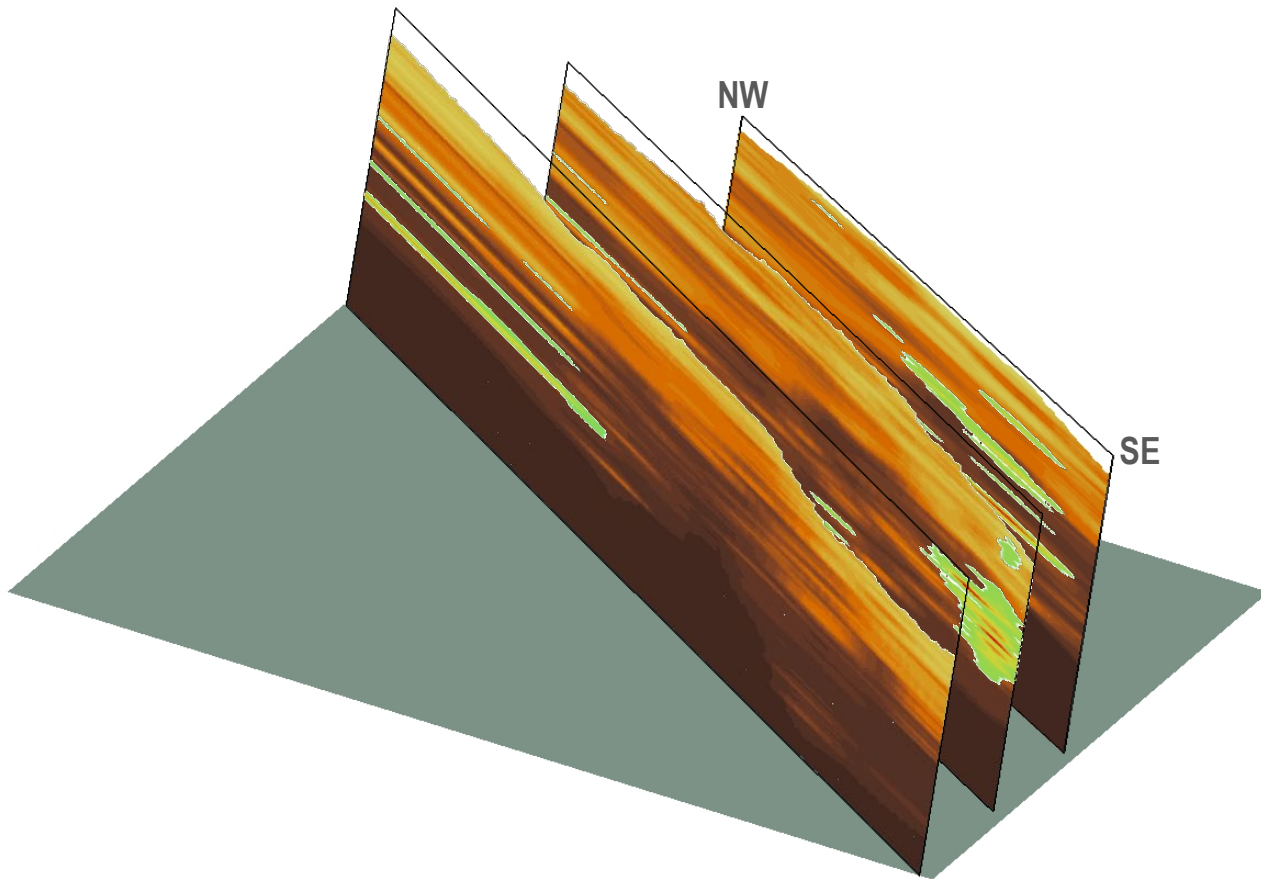
HIGH RESOLUTION SECTIONS



HIGH RESOLUTION SECTIONS

GEOKLOCK

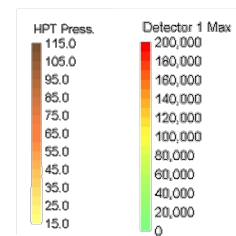
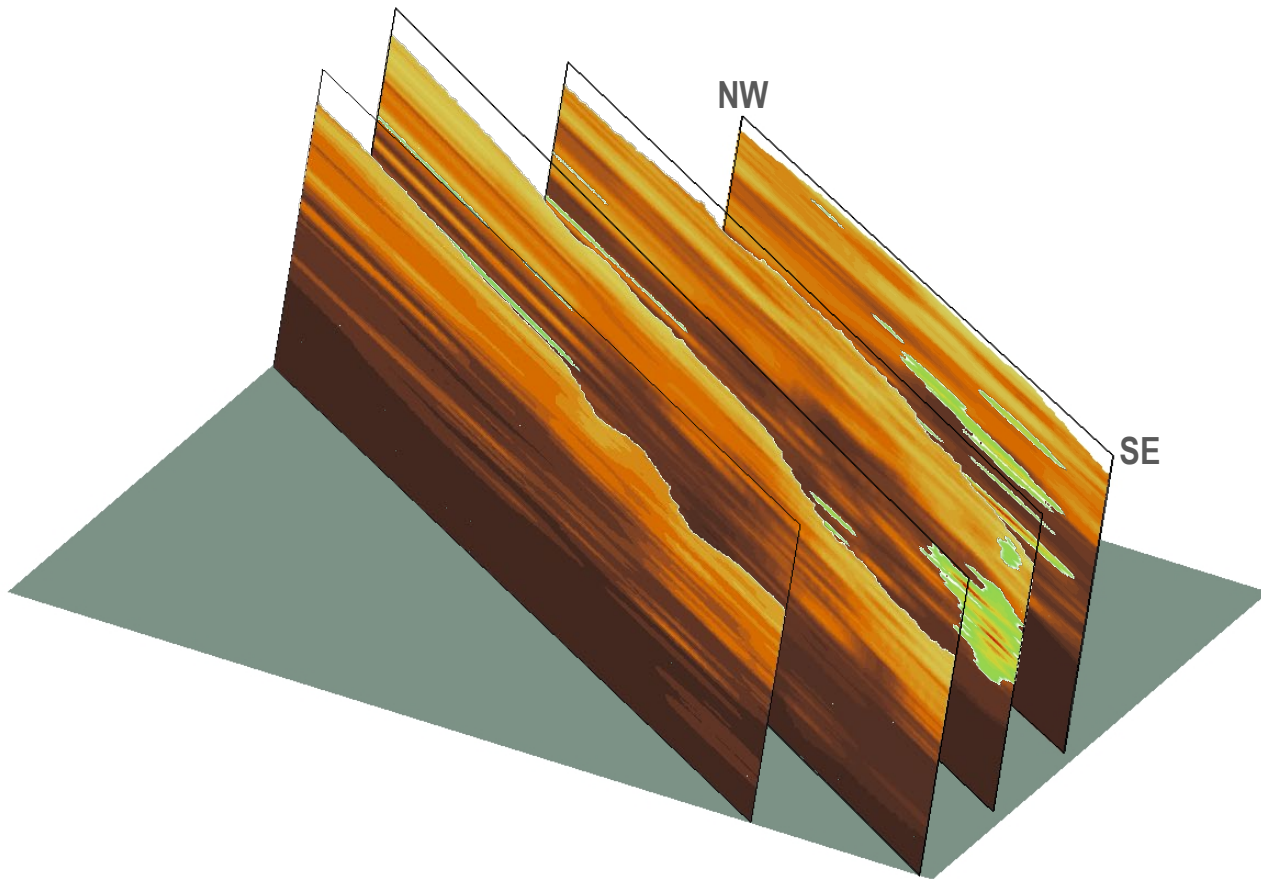
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HIGH RESOLUTION SECTIONS

GEOKLOCK

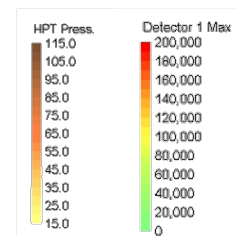
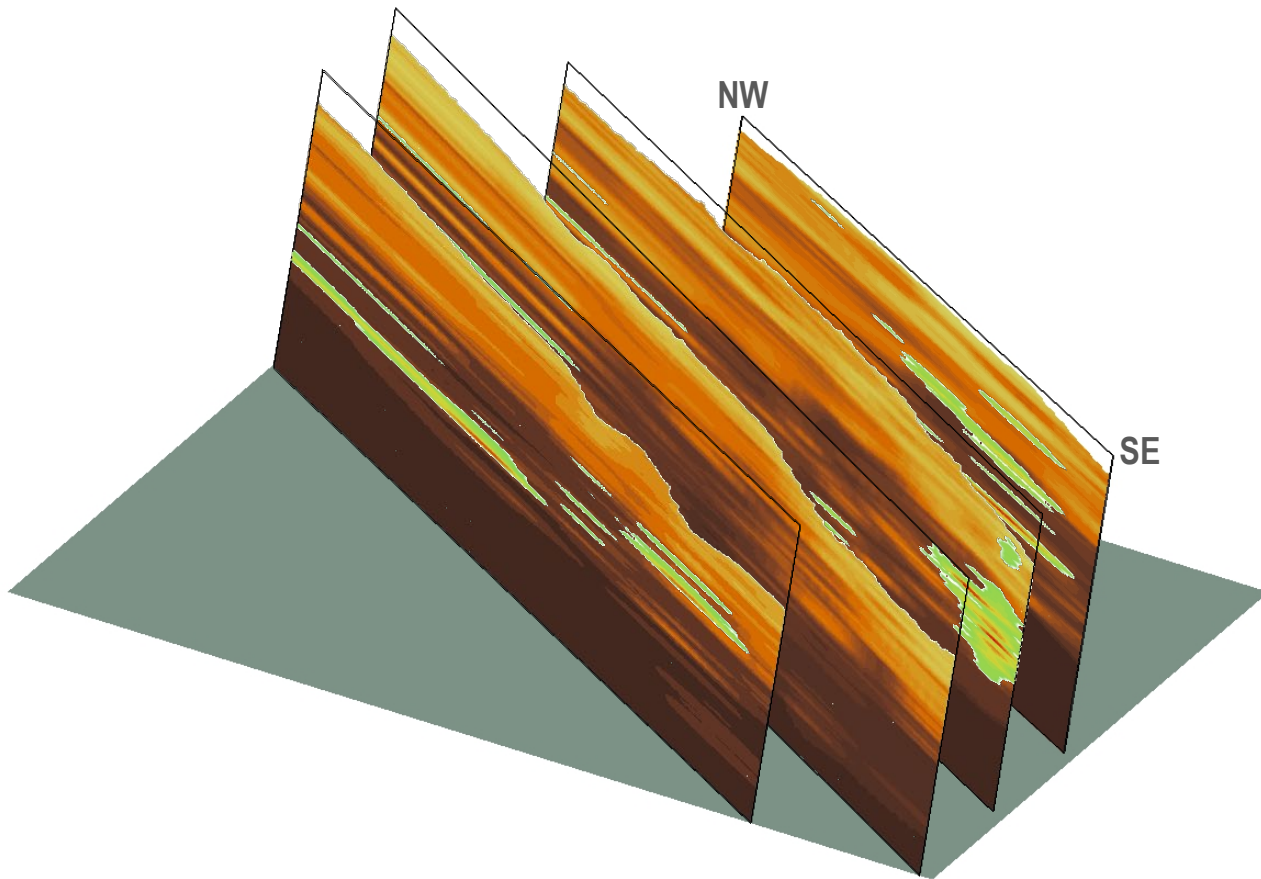
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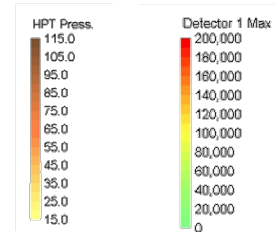
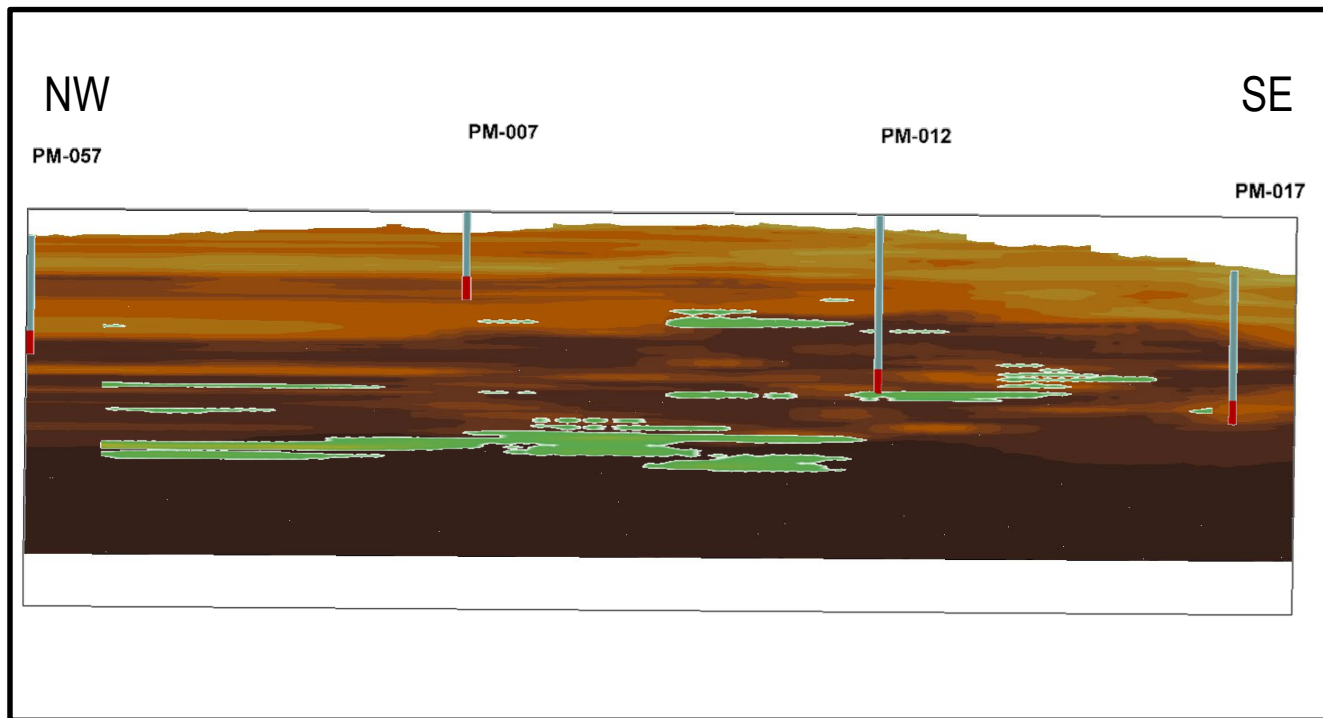
HIGH RESOLUTION SECTIONS

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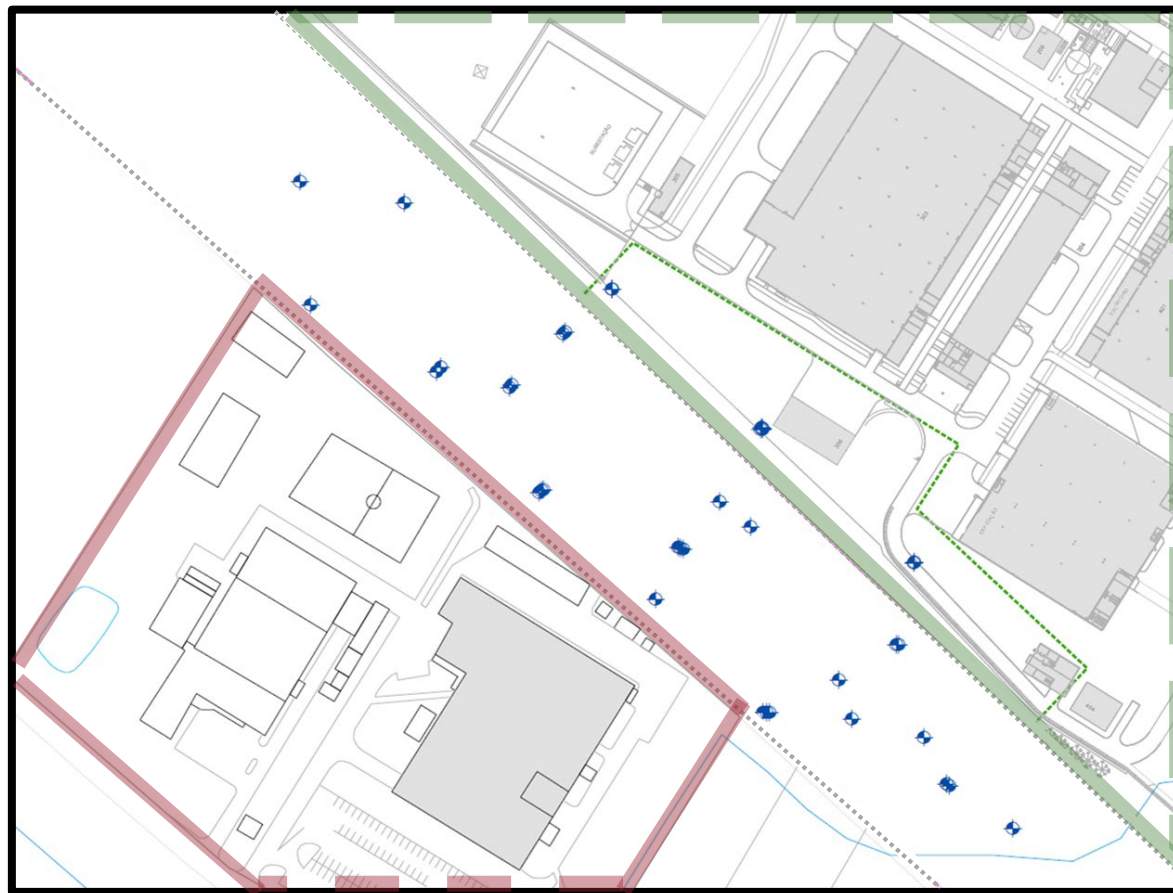
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VOC PLUME AND PREVIOUS MW



NEW MONITORING WELLS



New MWs



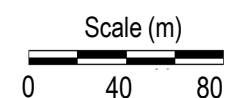
Site 1



Site 2



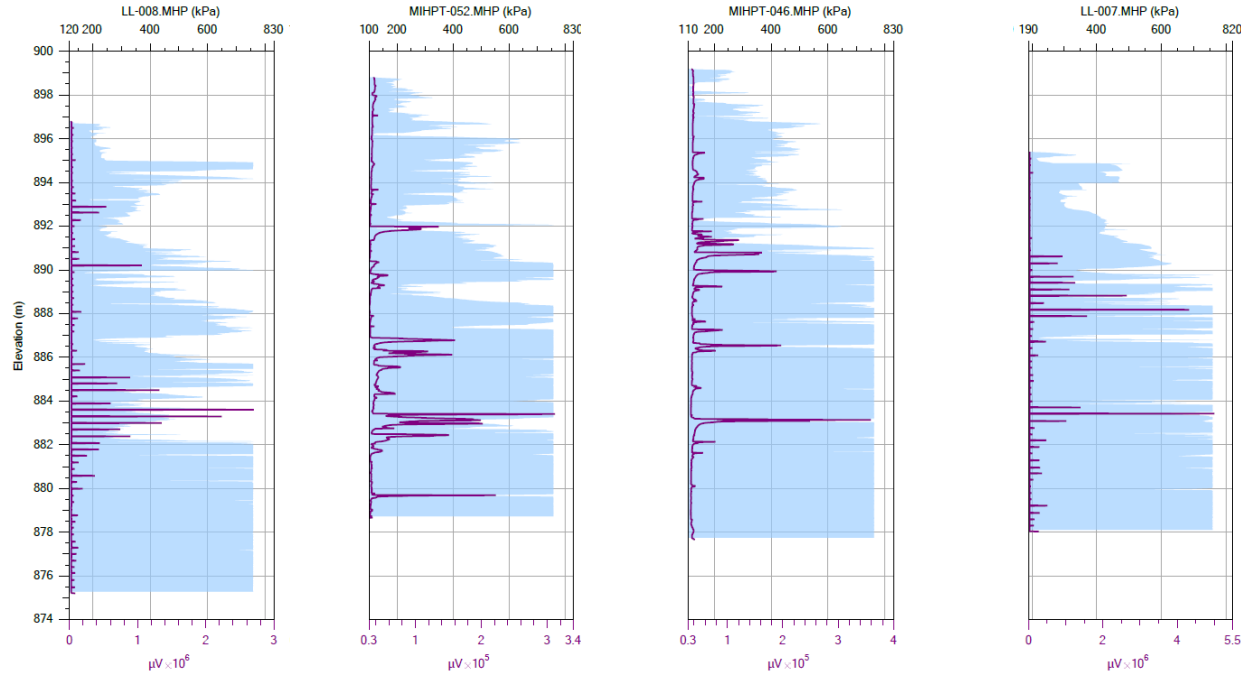
Productive Buildings



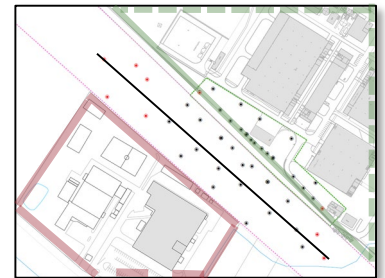
LOGS CROSS SECTION - LLMIP

NW

SE



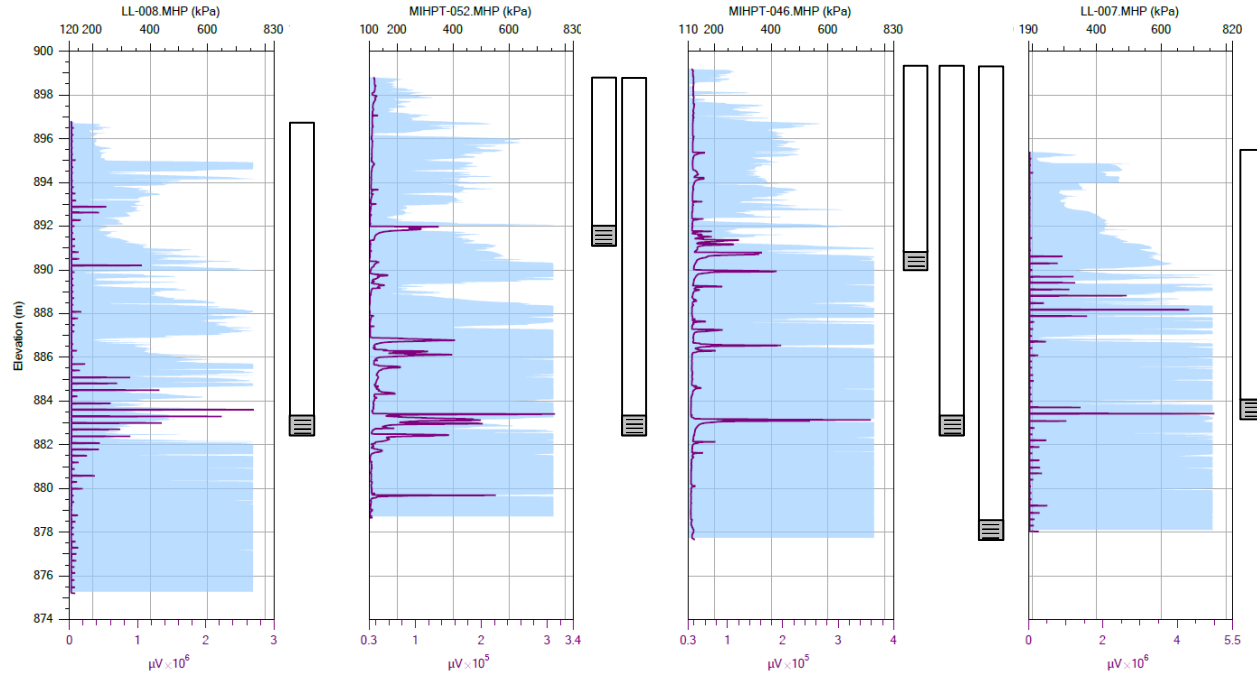
■ HPT PRESS.
— PID



LOGS CROSS SECTION - LLMIP

NW

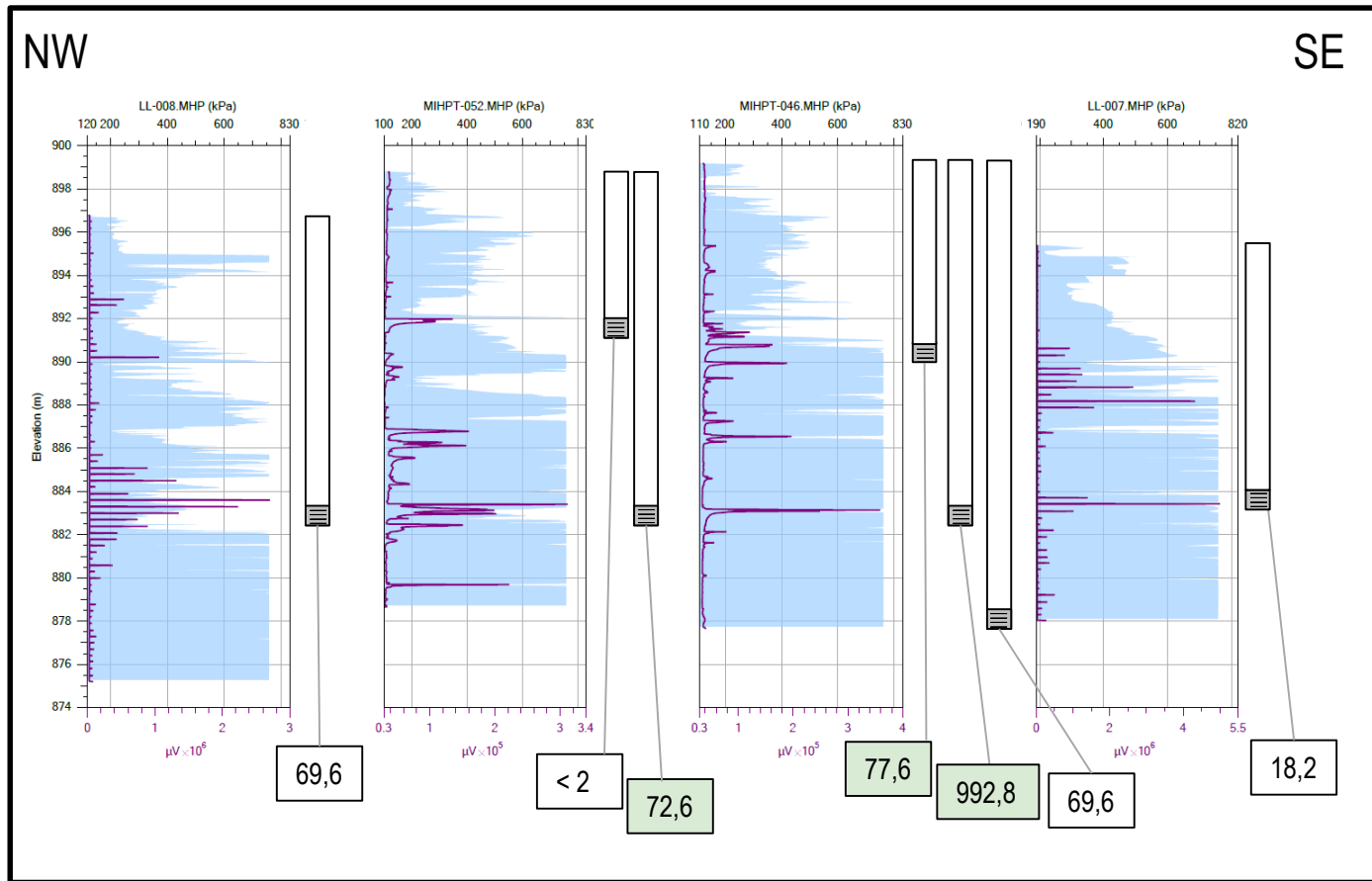
SE



■ HPT PRESS.
— PID



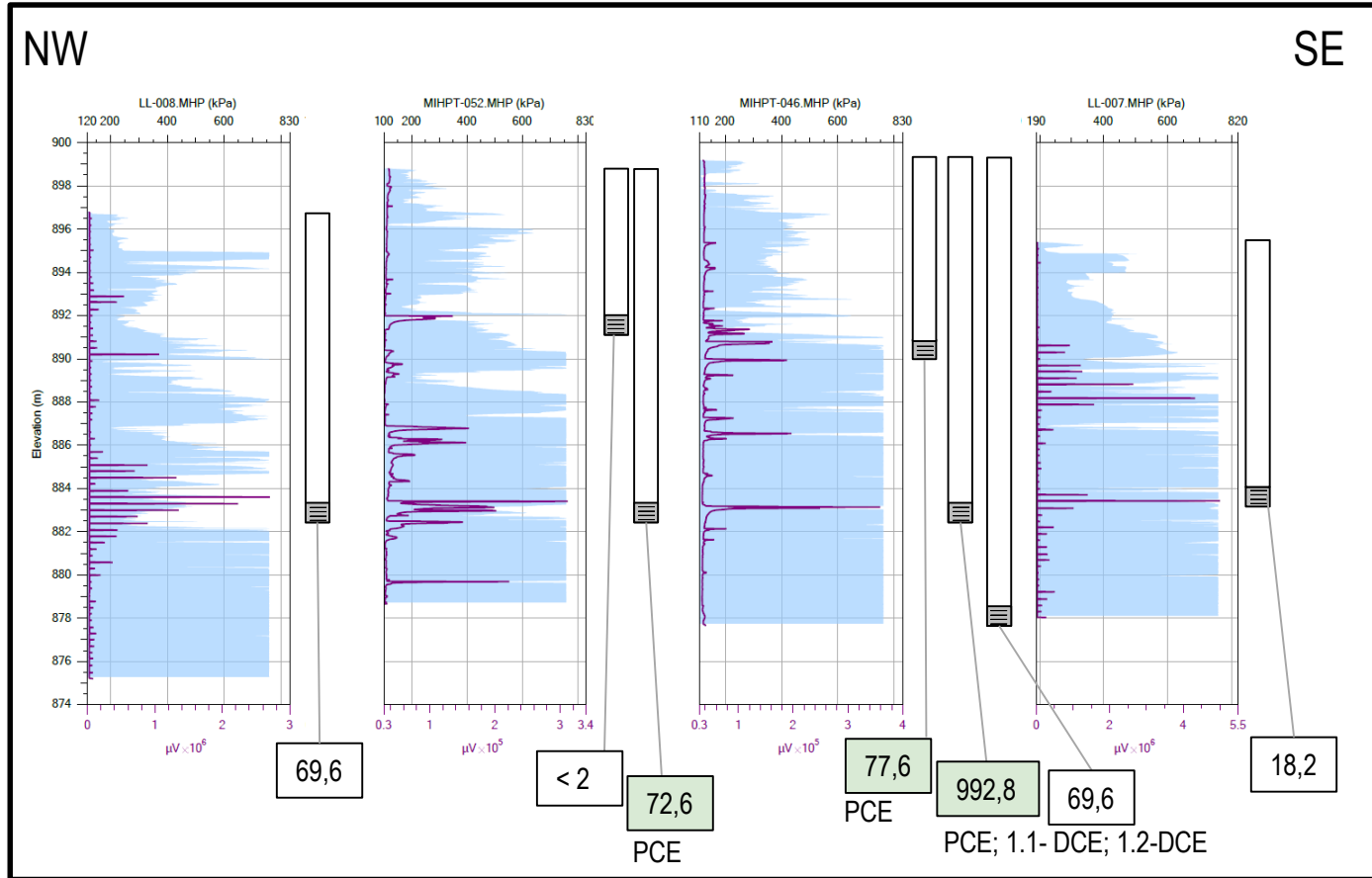
LOGS CROSS SECTION - LLMIP



- Σ Cl Ethenes (ppb)
- [] above standards
- HPT PRESS.
- PID



LOGS CROSS SECTION - LLMIP









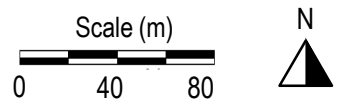
NEW PCE PLUME

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-  PCE (ppb) 40 -100
-  PCE (ppb) >100
-  New MWs
-  Site 1
-  Site 2
-  Productive Buildings



CONCLUSIONS

- Site 1 was responsible for the chlorinated solvents plume;
- Most of mass flow occurs in a small area: contamination pathways are the sandy layers and lenses trapped in a low permeable clay;

CONCLUSIONS

- Low Risk:
 - industrial area
 - low concentrations
 - low permeability
 - deep occurrence;
- No emergencial actions needed.

LESSONS LEARNED

- High density of vertical data made possible to understand the relationship between lithology and contaminant flow;
- The combination of methods made possible to target the screening sections at the contaminated lenses and layers, even at the border of the plume;
- The combination of methods allowed the delineation of the plume in vertical and horizontal directions;

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