




Application of HPT/EC Tools for Drawdown
Study in an Excavation Target Area

GE●KLOCK

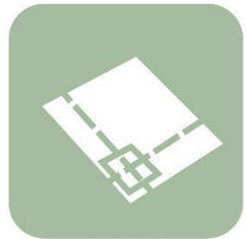
A company of **EBP** 

Main Topics

- Context
- Target Area Assessment
- Drawdown Study
- Final Result - Excavation Concept
- Lessons Learned

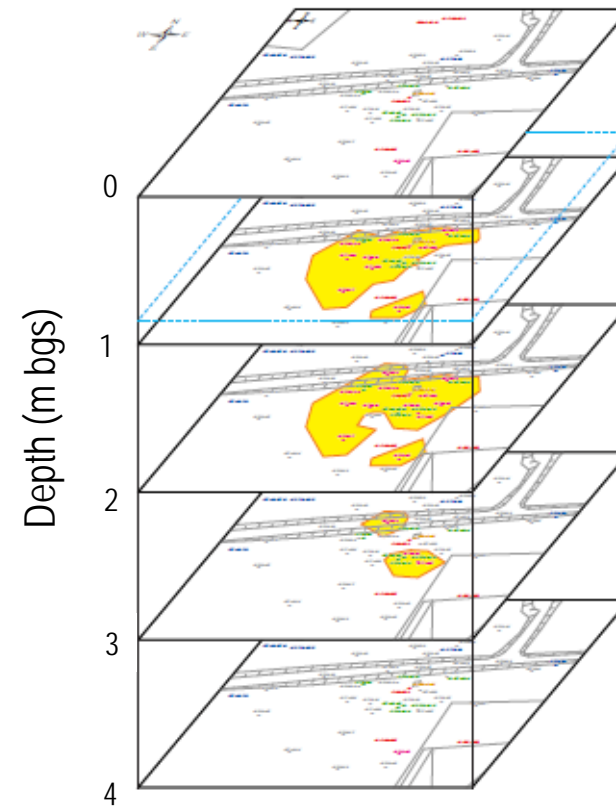
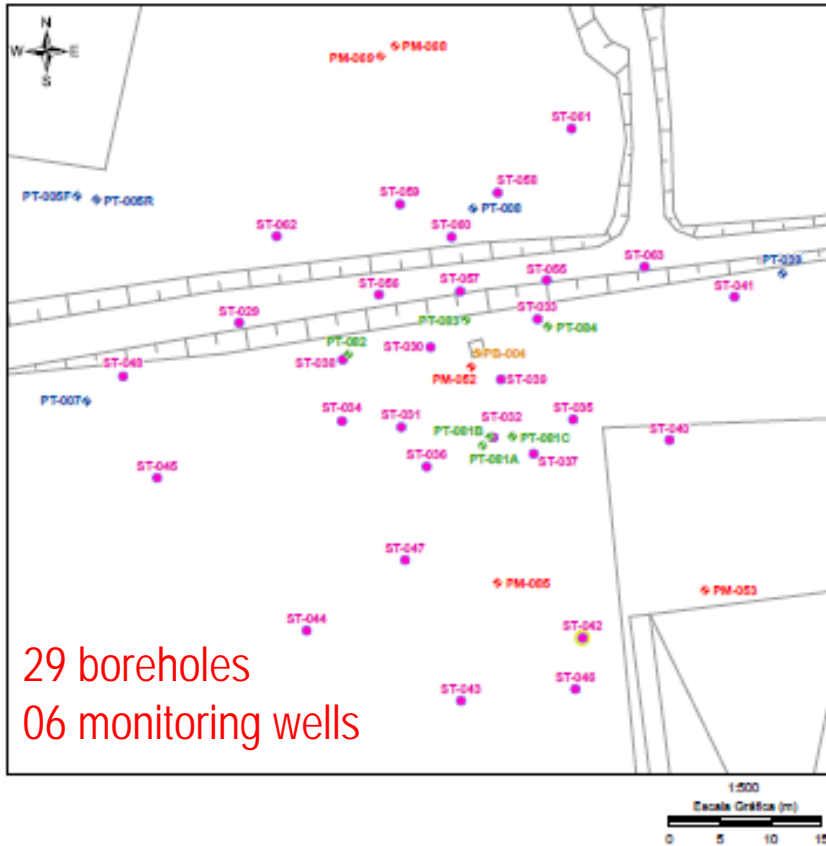
Context

- Chemical facility
 - Operating since the late 1950's
 - Site total area ~850,000 m²
 - Several sources of contamination
- **Target area:** a landfill nearby a river
 - **Authorities' demand:** the landfill full excavation
 - **Critical aspect:** most of the wastes are currently below the water table
 - **Challenge:** quickly provide a proper estimation of the required flow rate for the needed drawdown
 - **Expected result:** assure an excavation concept that suits the authorities' and client's needs

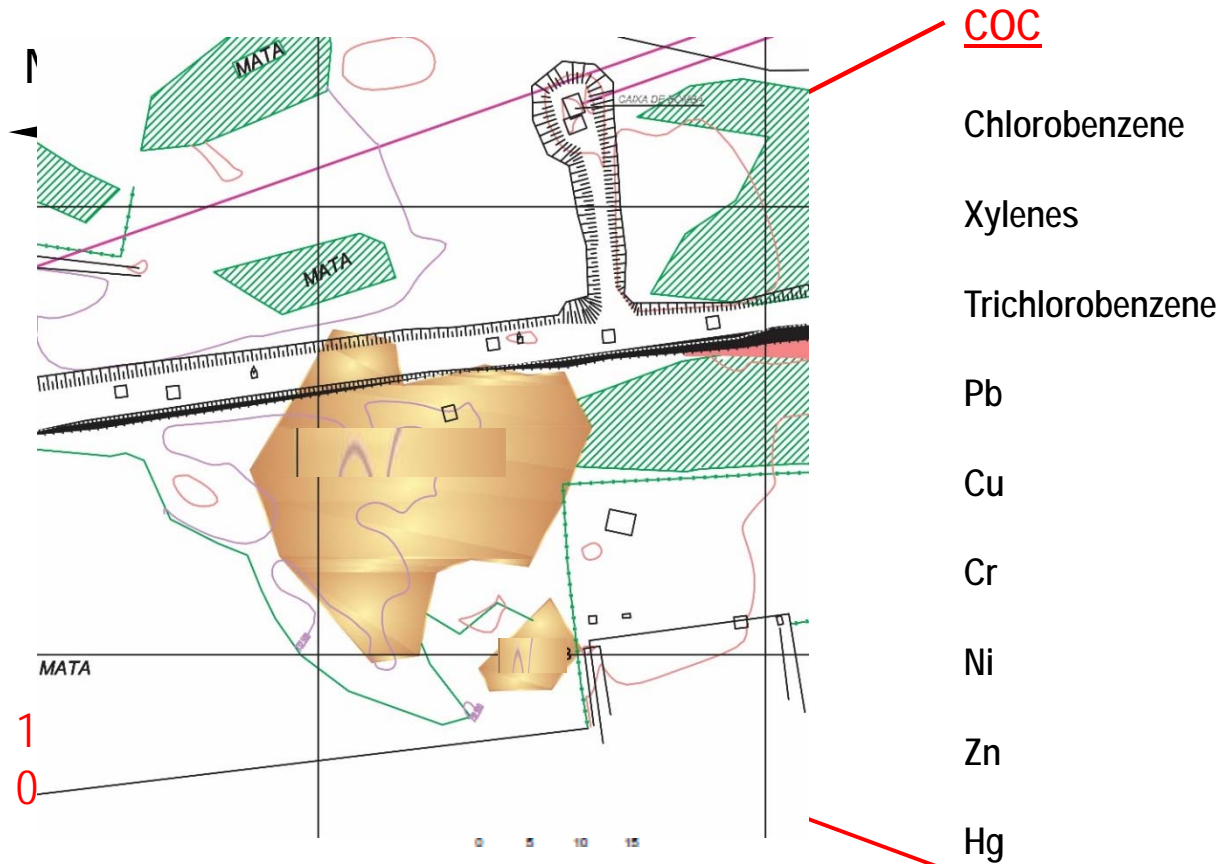


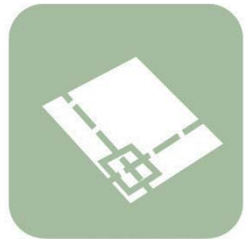
Target Zone Investigation

Target Zone Delineation



Target Zone Chemical Characterization

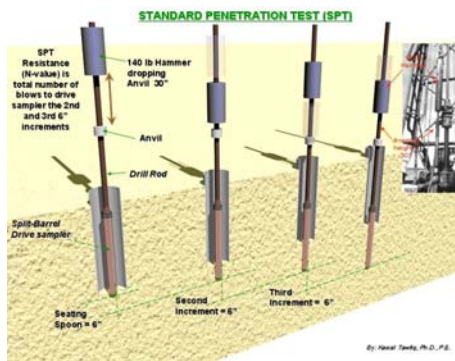




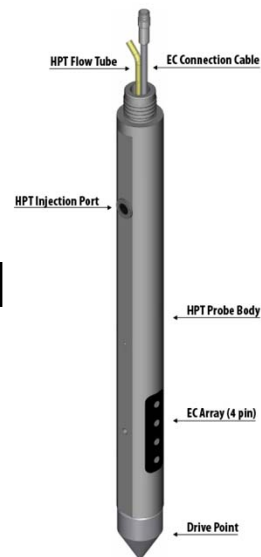
Drawdown Study

Data Acquisition Approach

SPT



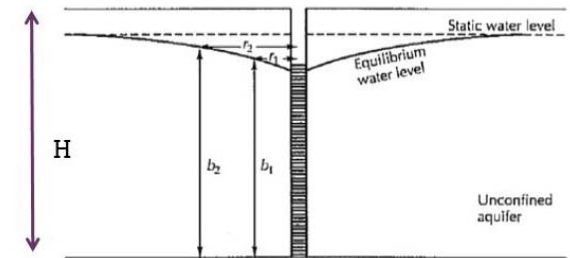
HPT/EC



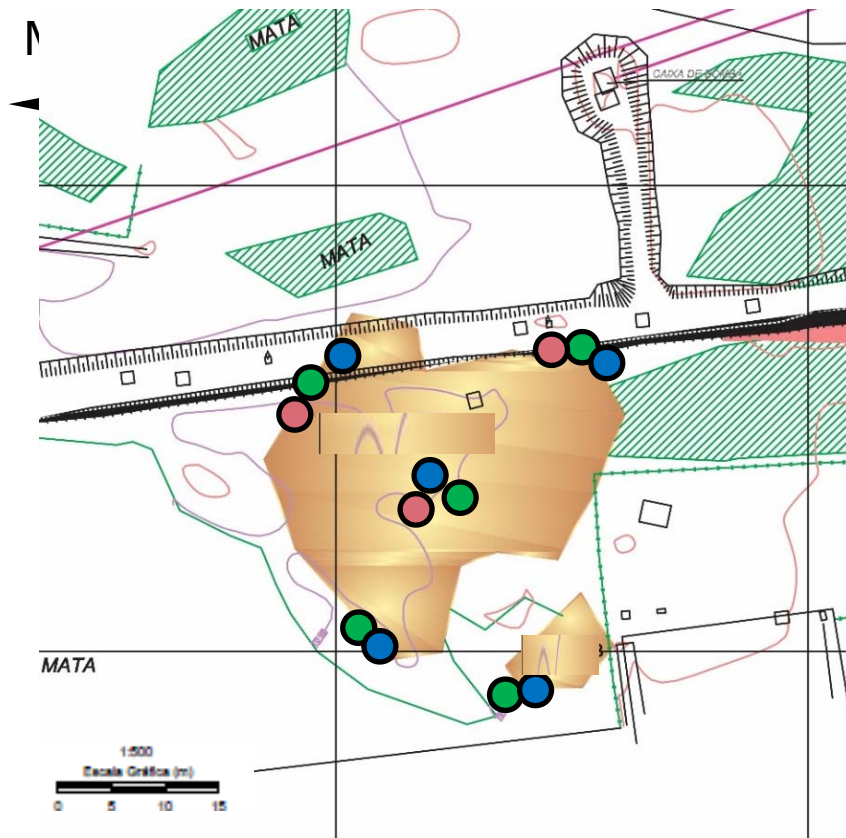
Boring
Logs



Bail
Down

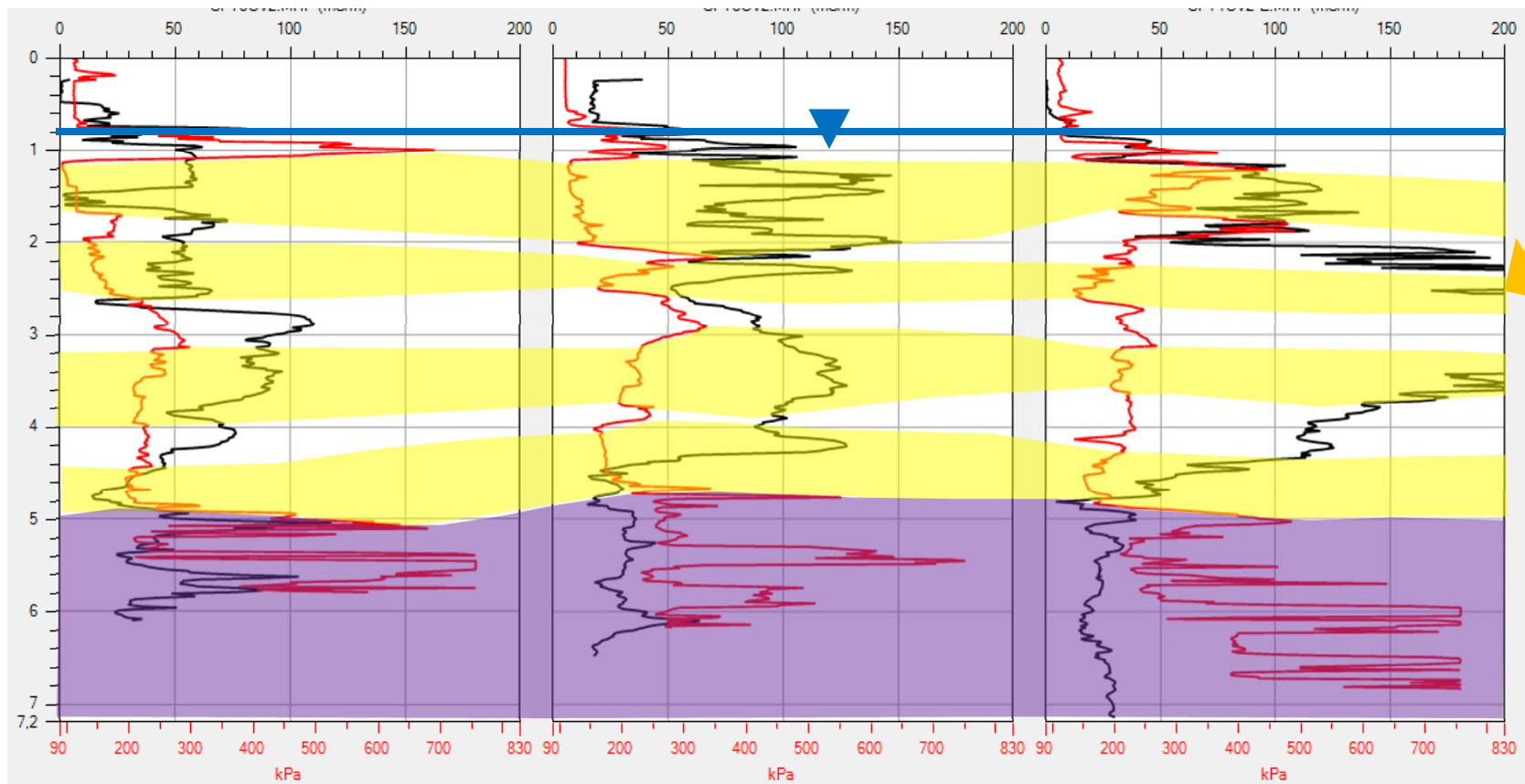


Data Acquisition – Field Work

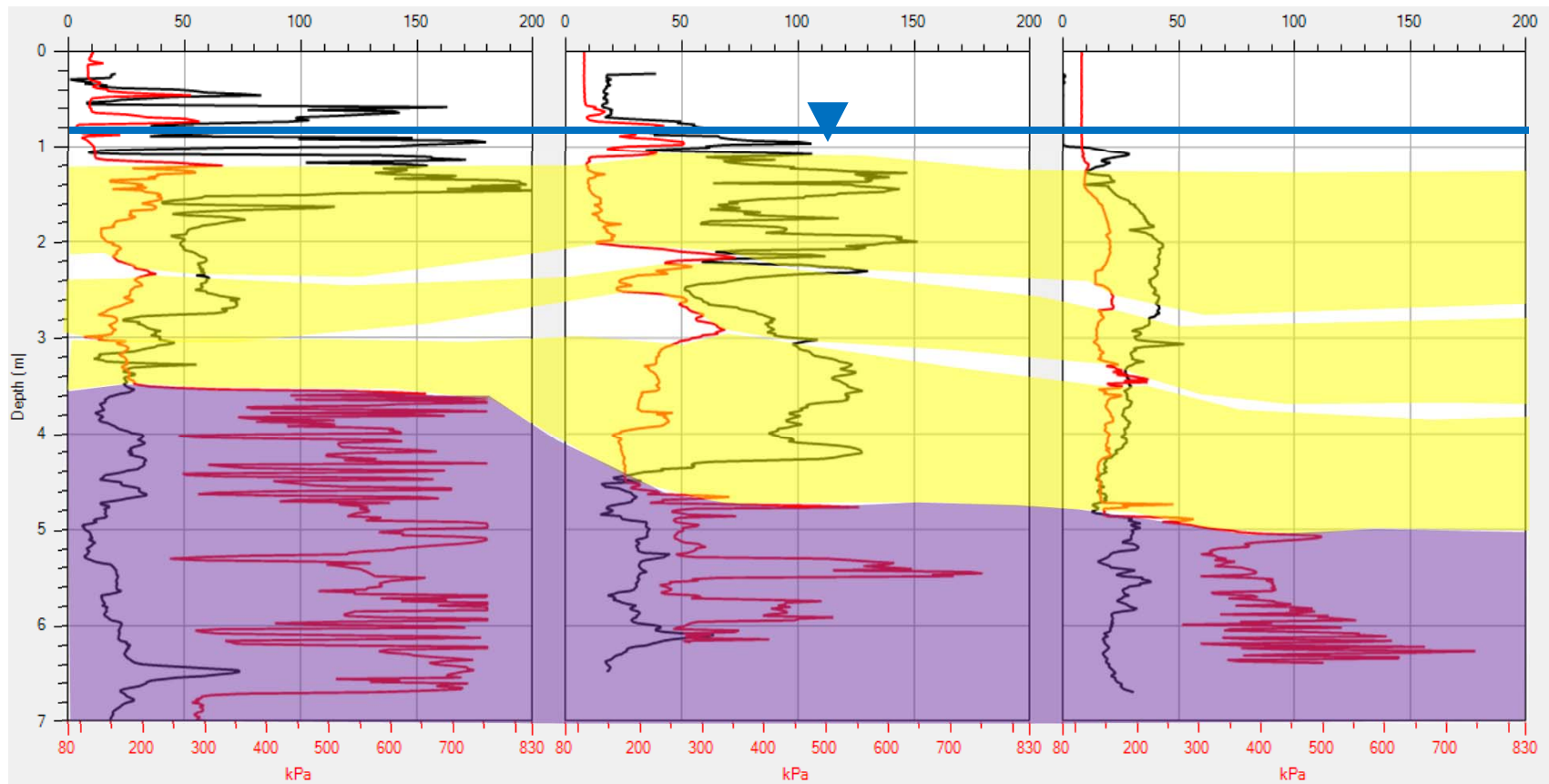


- SPT
- HPT/EC
- Bail Down Tests

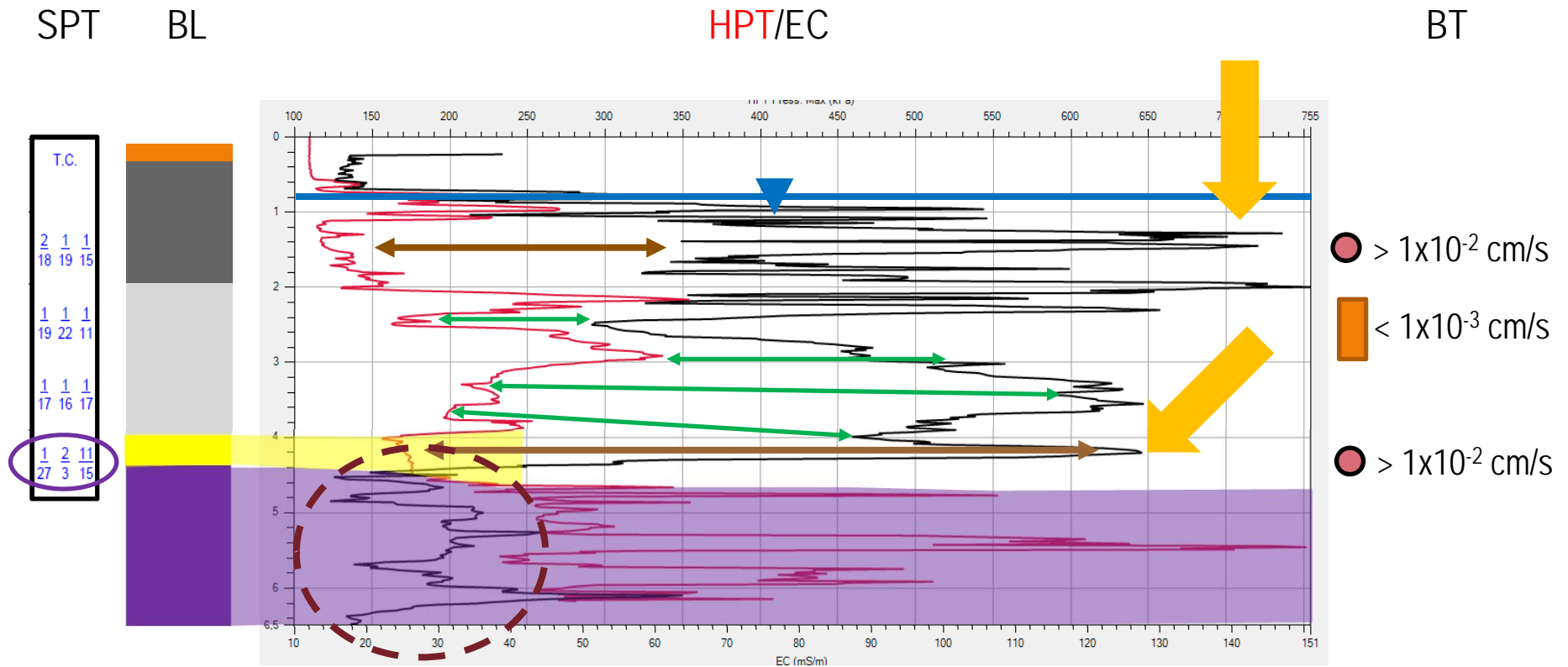
HPT/EC Results (Cross Section SE -NW)



HPT/EC Results (Cross Section SW – NE)



SPT/BL/HPT/EC/BAIL DOWN Results



Q Estimation

DRENAGEM DE ESCAVAÇÕES, ESPAÇOS SUBTERRÂNEOS, MINAS ETC.

adaptado de: Priz, H. (1991). Abriß der Ingenieurgeologie. Ferdinand Enke Verlag, Stuttgart

PREMISSAS

para aquífero não confinado
procura-se rebaixamento do lençol freático até 1 m por baixo da escavação
considera poços a 2 m distancia da escavação (ao redor)
considera poços de 1 " diametro
considera poços de 6 m de profundidade
considera que cada poço bombea com uma vazão de 0,25 m3/h
considera que o poço vai até uma camada não-permeável ("fully-penetrating well")

vazão total:

$$Q = \frac{\pi k (H^2 - h^2)}{\ln(R) - \ln(A)}$$

$$A = \sqrt{\frac{a \times b}{\pi}}$$

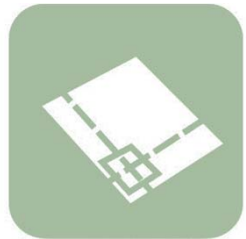
$$R = 3000 \times s' \times \sqrt{k}$$

vazão por poço:

$$q = 2 \pi r h' \frac{\sqrt{k}}{15}$$

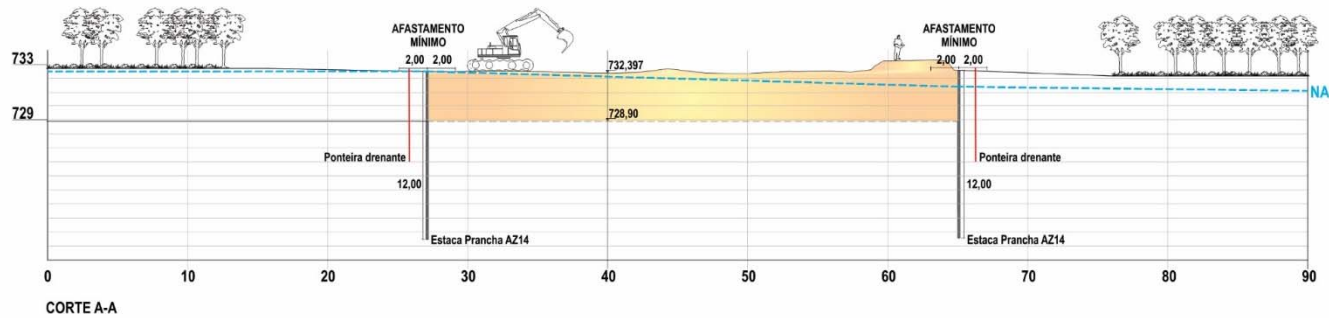
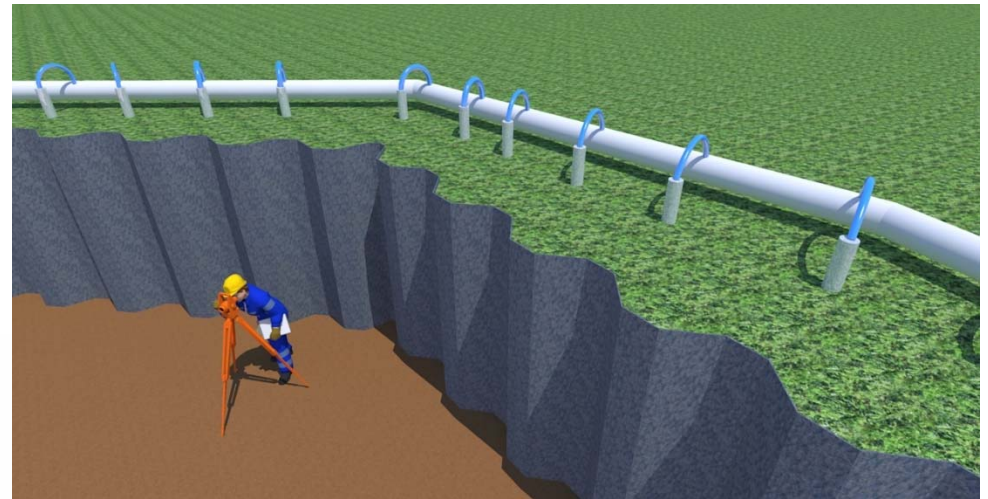
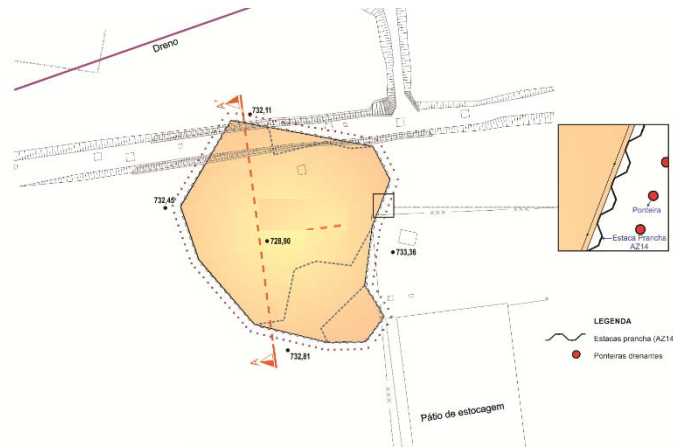
Q = 30 m³/h

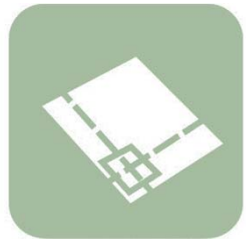
	1040	m ²	área da escavação
	3	m	profundidade da escavação
	0,5	m	Nível d'Água natural
k	2,00E-02	cm/s	condutividade hidráulica
k	2,00E-04	m/s	condutividade hidráulica
r	0,0127	m	radius do poço
a	36,24903	m	comprimento da escavação, mais a distancia dos poços
b	36,24903	m	largura da escavação, mais a distancia dos poços
A	20,5	m	radius efetivo da área para drenar
q	0,000069	m ³ /s	vazão por poço
H	5,5	m	coluna d'água no poço quando bomba está desligada
h	2	m	coluna d'água embaixo da escavação, quando bomba está ligada
h'	0,92	m	coluna d'água no poço quando bomba está ligada
s'	4,58	m	rebaixamento dentro do poço
R	194,2	m	radius de influência do poço
Q	0,008427	m ³ /s	vazão total
Q	30,33762	m ³ /h	vazão total
n	121,0585		número de poços



Final Result - Excavation Concept

Excavation Concept





Lessons Learned

Lessons Learned

- The HPT tool was very effective in providing high resolution/real time data for the drawdown/flow rate estimation
 - High lateral recharge through the made ground/landfill (connected voids, heterogeneity)
 - Low bottom recharge through the weathered rock
- By doing that it reduced the need for bail down/pumping tests, therefore reducing the project timeframe and costs
- The EC tool pointed out that there might be dissolved plumes migrating through the most permeable channels



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Thank you!

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