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Hedwige- Prosperpolder ERT-metingen

Griet De Backer



Grondonderzoek Hedwige- Prosperpolder

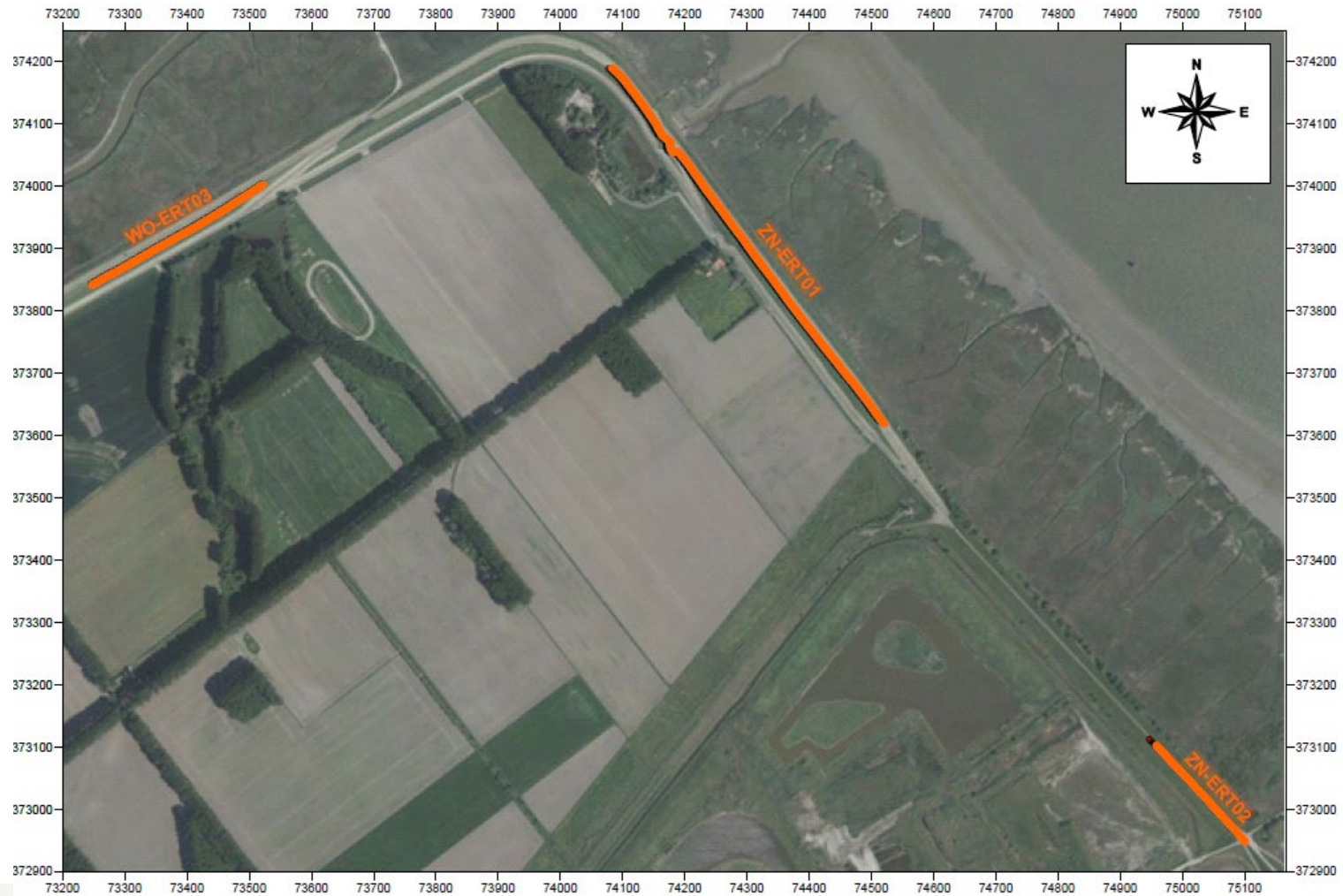
Geplande proeven Hedwige-Prosperpolder: bresproeven, overloopproeven, pipingproeven, ...

Doel grondonderzoek: opbouw dijk in kaart brengen



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ERT-metingen (Elektrische resistiviteitstomografie) - Fugro

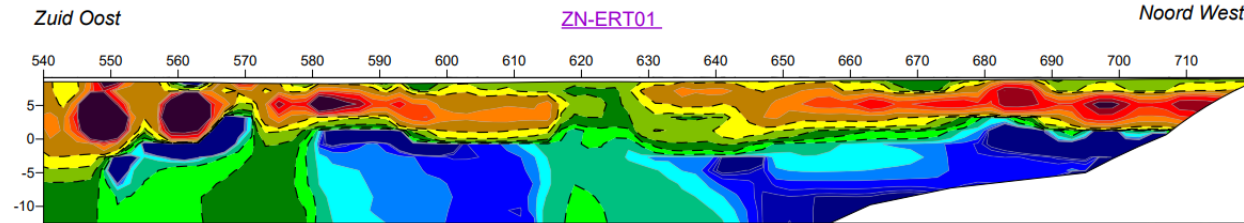


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Waarom geofysische onderzoek?

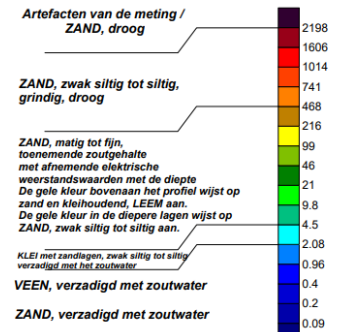
Pluspunten:

- Continu beeld
- Snelle methode
- Niet-destructief
- Opsporen van lokale anomalieën
- Aanvulling op geotechnisch onderzoek (op betrouwbare wijze interpoleren tussen 2 sondeerpunten)
- Gericht aansturen van geotechnisch onderzoek (anomalie)



LEGENDA:

Elektrische-weerstand waarden [Ohm.m]
met lithologische classificatie van de ondergrond

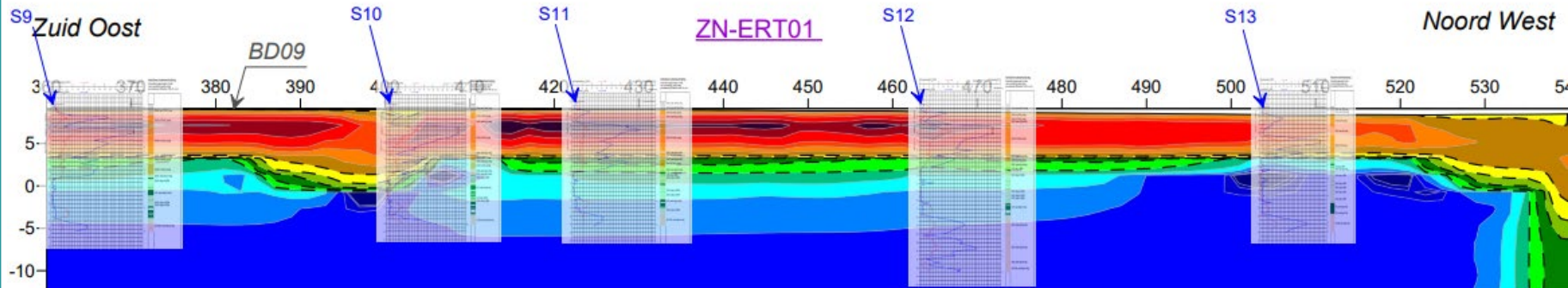


— — — Globale laaggrenzen
S2 Geotechnische sonderingen april 2019
BD10 Boringen uitgevoerd in 2015

Waarom geofysische onderzoek?

Minpunten / moeilijkheden:

- Resultaten vaak moeilijk interpreteerbaar
- Oorzaak van een anomalie?
- Link naar geotechnische karakteristieken (bresgevoeligheid) via geotechnische proeven.
- Metingen op grotere diepte → invloed op nauwkeurigheid
- Tijdstip van opmeten is zeer belangrijk bij bepaalde technieken.



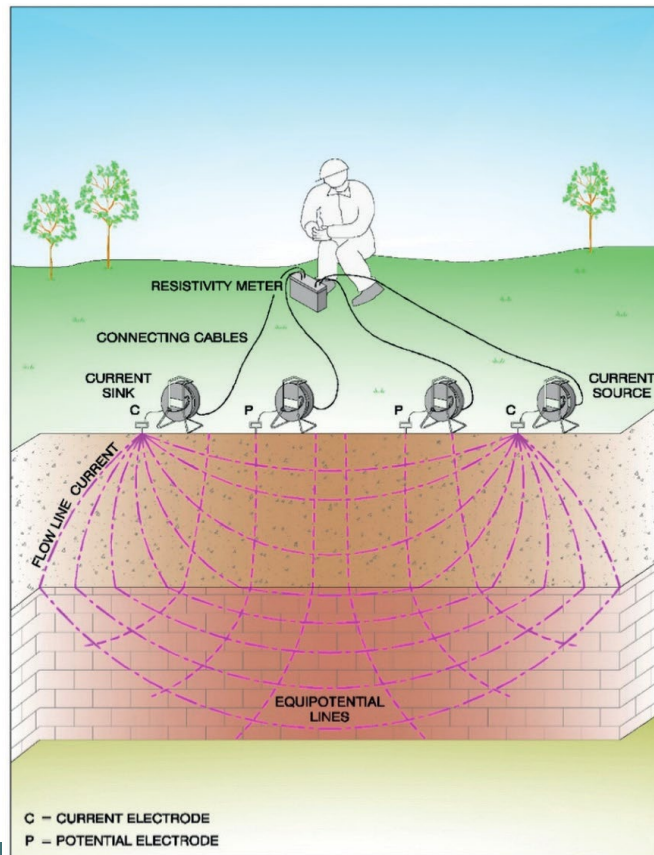
Grondonderzoek

Invasief onderzoek	Niet-invasief onderzoek	
Sonderingen	Elektrische methodes	- Resistiviteitstomografie (ERT) - Spontane polarisatie
Boringen	Elektro-magnetisch	- Grondradar (GPR) - Elektromagnetisme: frequentiedomein FDEM / tijdsdomein (metaaldetectie)
Peilbuizen	Magnetische methodes	- Magnetische gradiometrie (metaaldetectie)
	Seismische methodes	- P-golven refractie - S-golven refractie
	Akoestische methodes	- Side scan sonar - Sector scanner



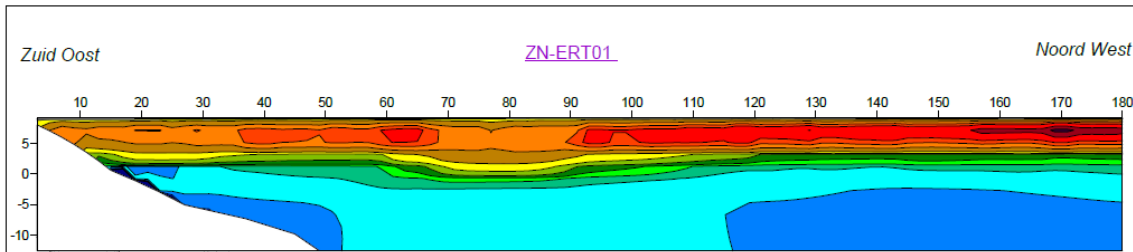
Geofysische metingen: ERT

ERT = elektrische resistiviteitsmetingen



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ERT-metingen: zone ERT 1



LEGENDA:

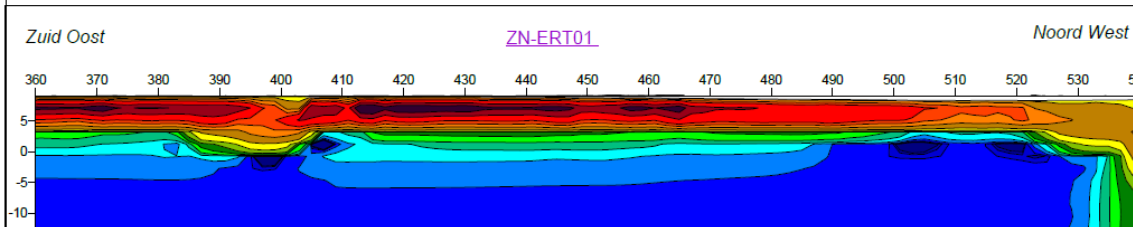
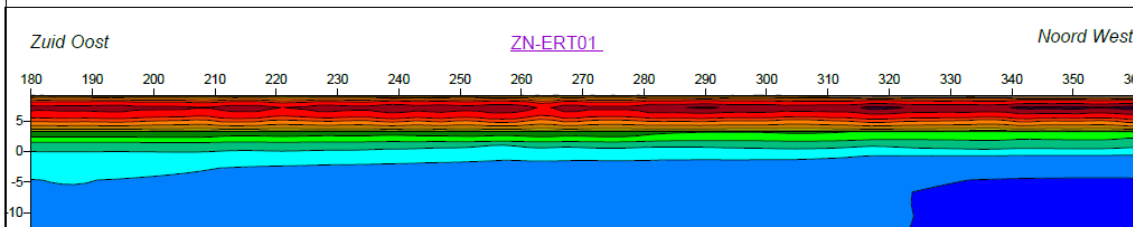
Elektrische-weerstand waarden [Ohm.m]



OPMERKINGEN:

Resultaten van ERT-metingen

Double protocol (Dipole-Dipole en Wenner-Schlumberger)



Resultaten van ZN-ERT01
PROGRAMMA VAN EISEN
ERT METINGEN LLHPP

GEODETISCH & PROJECTIE PARAMETERS

Coordinate system: RijksDriehoek 2008

Horizontal scale = 1:600 (Scale at A3 size)

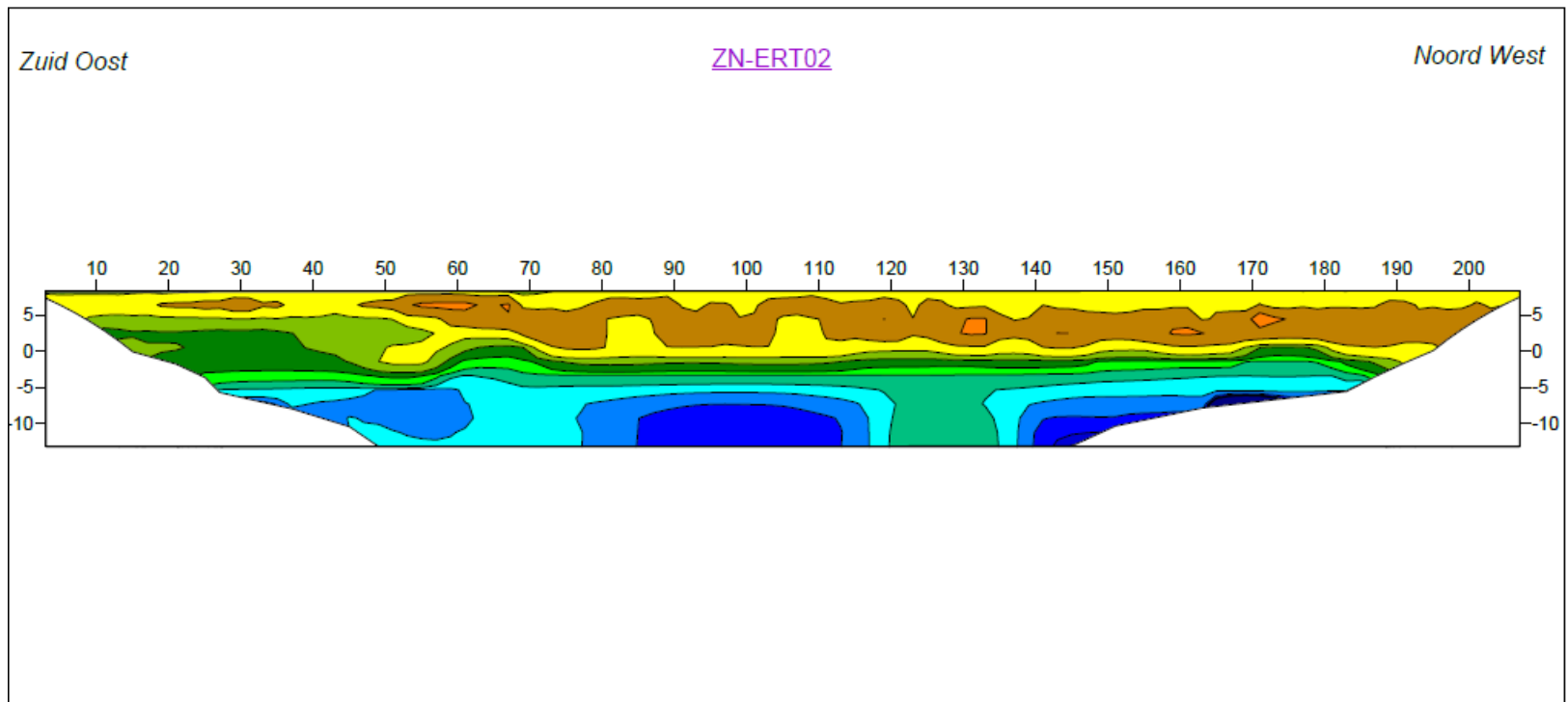
Verticale scale = 1:600 (Scale at A3 size)

Onderzoekdatum: 22/01/19 - 24/01/19				Proj. Ref: 1518-0058-000			
Versie	Datum	Omschrijving	Interpr	Tekenaar	Gecontroleerd	Goedgekeurd	
01	01/02/19	CONCEPT	ALF	ALF	SNE	SNE	
Klant Ref:				Bijlage: 02			

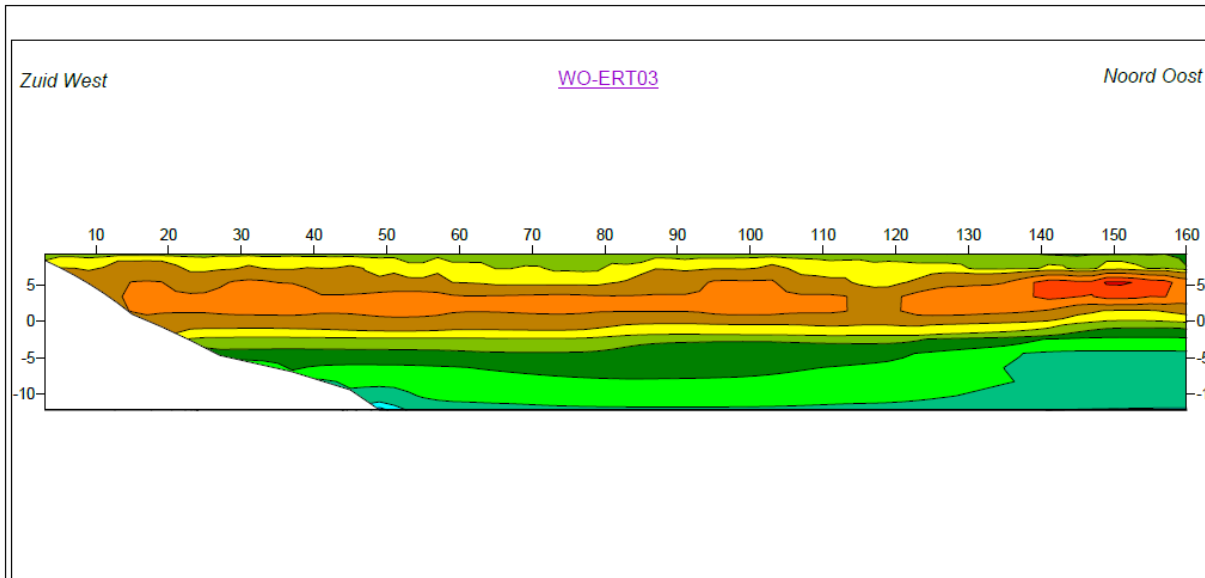


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ERT-metingen: zone ERT2



ERT-metingen: zone ERT 3



LEGENDA:

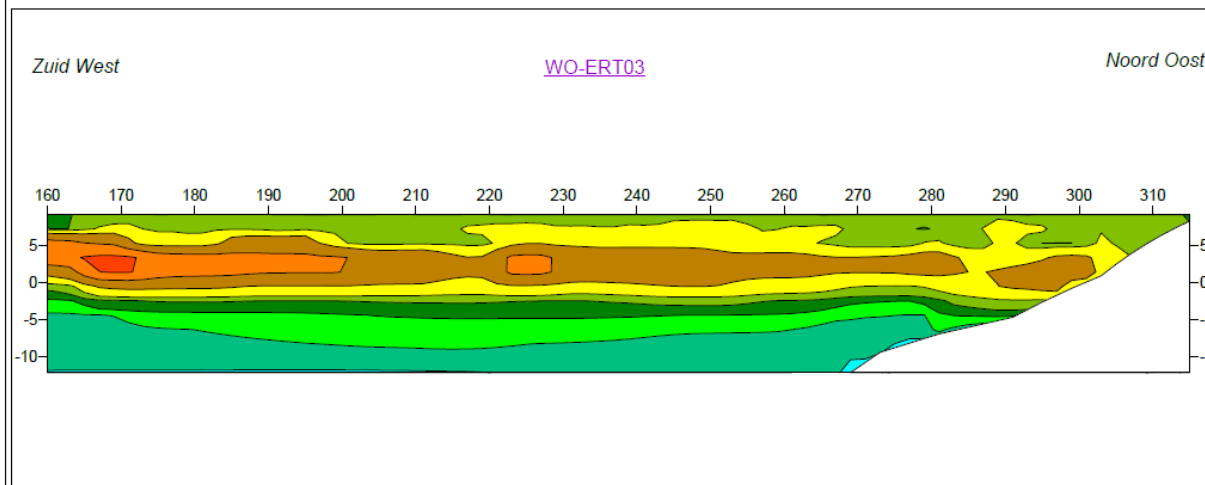
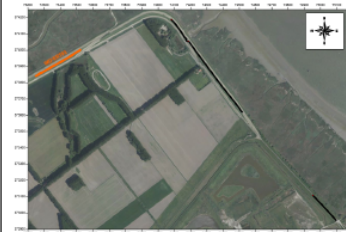
Elektrische weerstand waarden [Ohm.m]



OPMERKINGEN:

Resultaten van ERT-metingen

Double protocol (Dipole-Dipole en Wenner-Schlumberger)



Xperta
Expertise in beweging

Vlaanderen
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stowa

fugro

Resultaten van WO-ERT03
PROGRAMMA VAN EISEN
ERT METINGEN LLHPP

GEODETISCH & PROJECTIE PARAMETERS

Coordinate system: RijksDriehoek 2008

Horizontal scale = 1:600 (Scale at A3 size)

Verticale scale = 1:600 (Scale at A3 size)

Onderzoekdatum: 22/01/19 - 24/01/19 Proj. Ref: 1518-0058-000

Versie	Datum	Omschrijving	Interpr	Drawing	Geometrie	Goedgekeurd
01	01/02/19	CONCEPT	ALF	ALF	SNE	SNE

Klant Ref:

Bijlage: 04

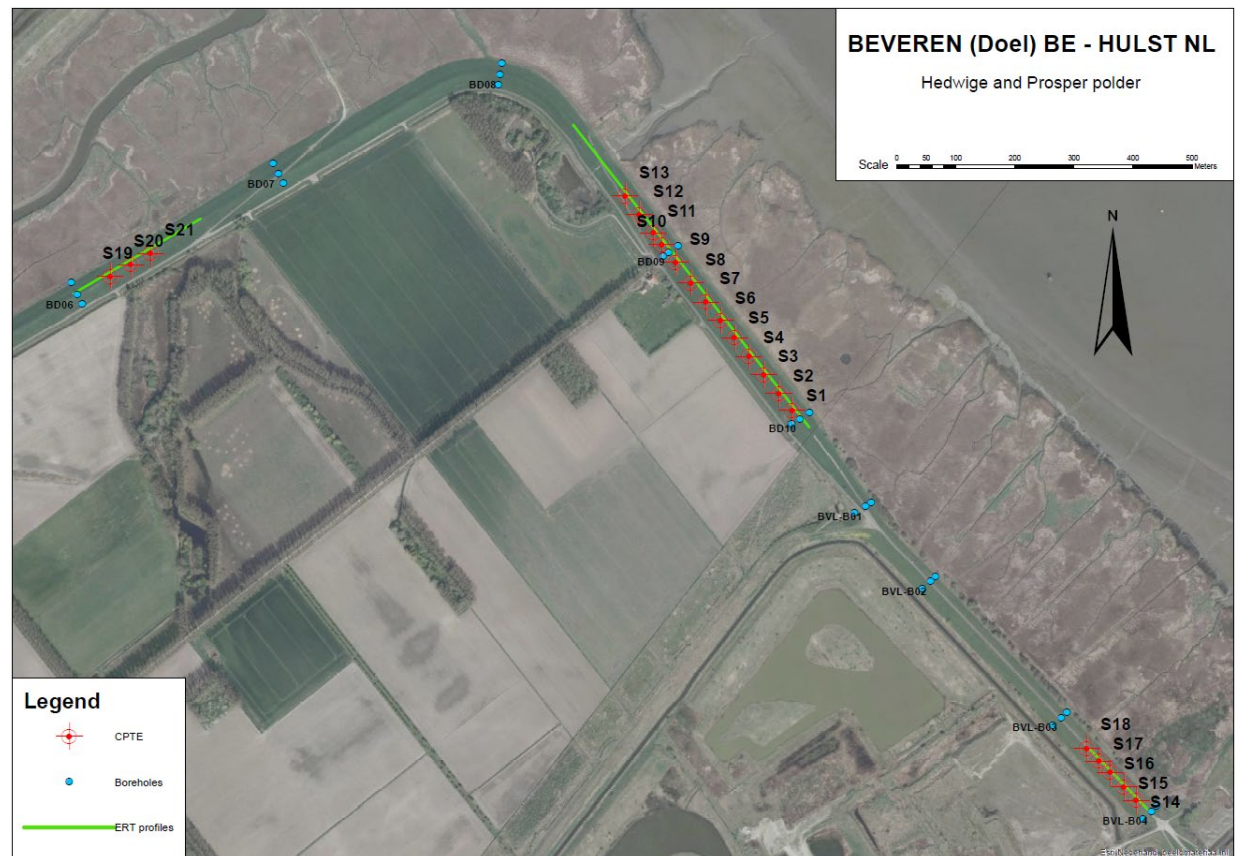


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Sonderingen

21 sonderingen doorheen dijkkruin in 3 zones:

- 2 zones op Nederlandse dijk en
- 1 zone op Belgische dijk.



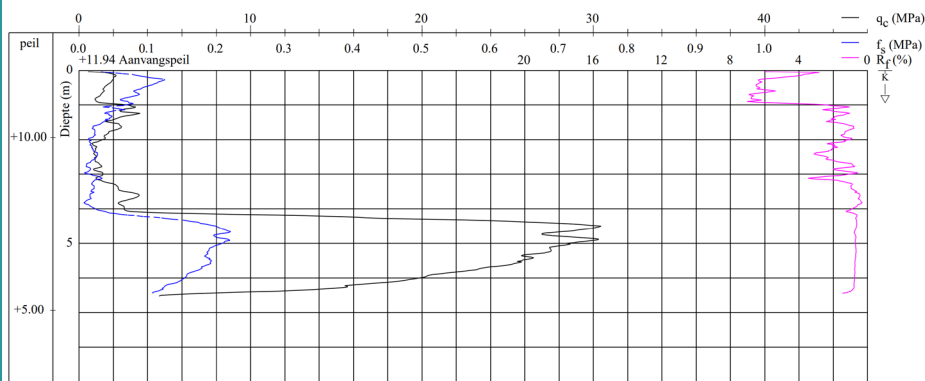
Sonderingen

Voorbeeld: S9 t.h.v. zone ERT1 en S20 t.h.v. zone ERT3.

Sonderingen in zone ERT3 ondiep (ca. 6m), wegens aan de rand van een risicogebied voor ontploffingstuigen uit WOII.

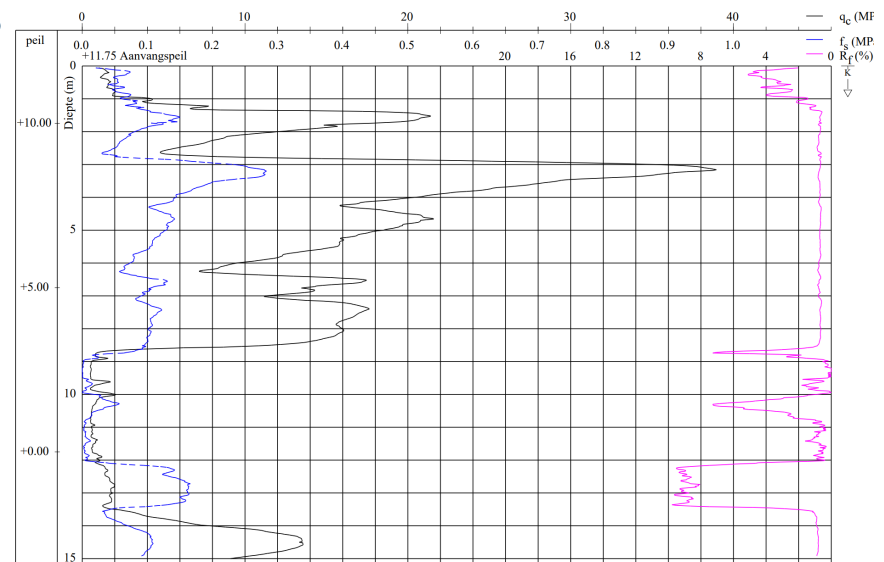
SONDERING (CPT-E)

Dossier	Datum		Proef
GEO-18/110	02/04/2019	x=139326.85 y=226541.73 z=+11.94	S20
Apparaat : 200kN - TRACK-TRUCK Conus : E Uitgevoerd door: VO - Afdeling Geotechniek			
Sondeergat dicht op : 0.20 m(peil +11.74) opgemeten op 02/04/2019 09:35			
Opmerkingen: Gemeentenaam = Hulst in Nederland.			



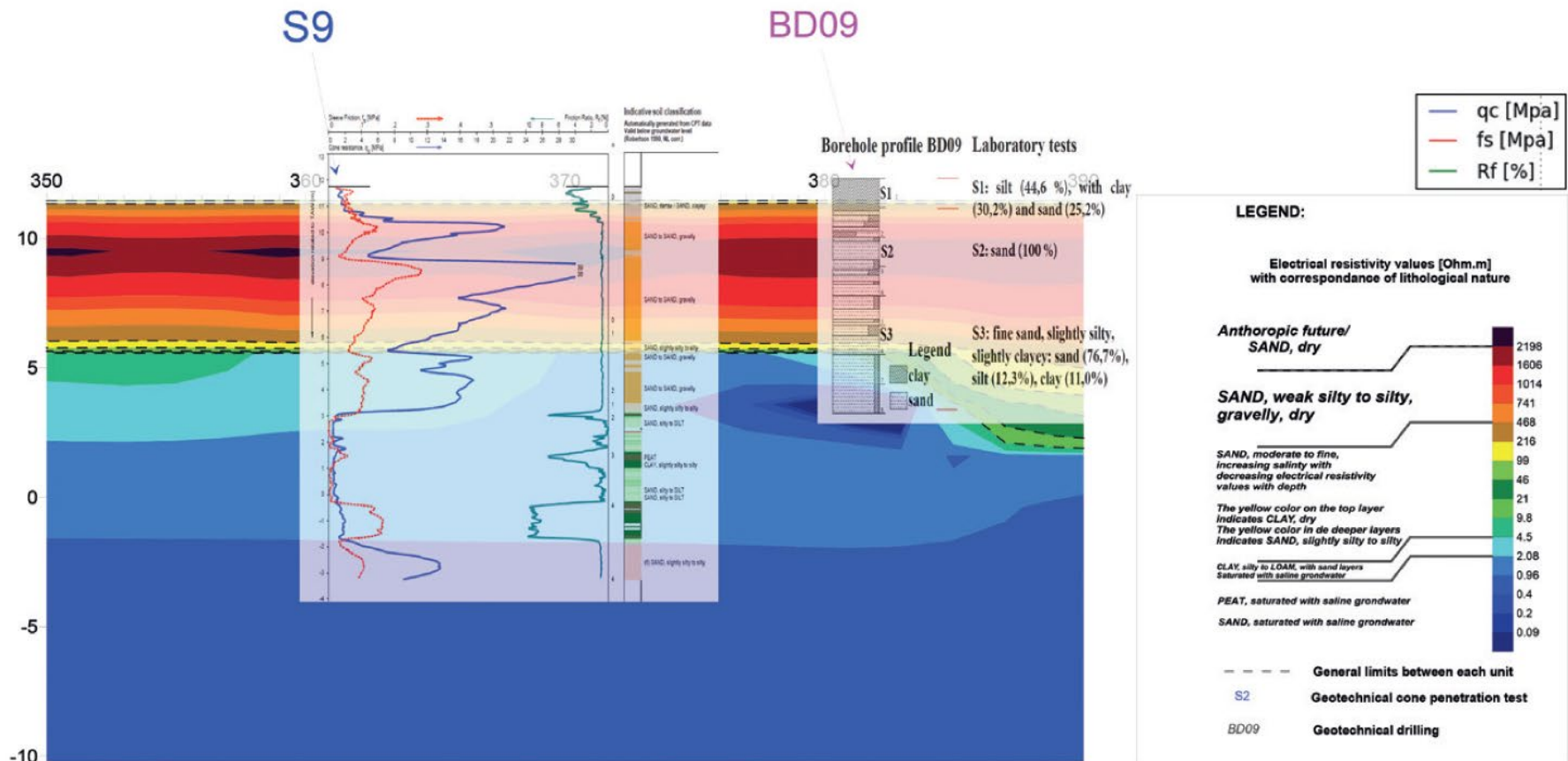
SONDERING (CPT-E)

Dossier	Datum		Proef
GEO-18/110	29/03/2019	x=140249.48 y=226545.01 z=+11.75	S9
Apparaat : 200kN - TRACK-TRUCK Conus : E Uitgevoerd door: VO - Afdeling Geotechniek			
Sondeergat dicht op : 5.85 m(peil +5.90) opgemeten op 29/03/2019 11:50			
Opmerkingen: Gemeentenaam = Hulst in Nederland.			



Vergelijking Sonderingen – ERT-metingen

ERT01



ERT-metingen + gepland onderzoek

Uitgevoerde ERT-data: zal beschikbaar zijn in de dijkenverkenner (BE) en Dijk Data Service Centrum (DDSC) Nederland.

Paper met Fugro:

First results of geophysical and geotechnical investigations along the Hedwige- and Prosperpolder dykes

Serkan Nuri Elgün¹*, Griet De Backer², Jasper Bink³, Wouter Zomer³ and Patrik Peeters⁴ present the results of electrical resistivity tomography (ERT) measurements conducted along the dykes of the Hedwige- and Prosperpolder in order to obtain continuous profiles of the dyke composition.

First results of geophysical and geotechnical investigations along the Hedwige- and Prosperpolder dykes

Serkan Nuri Elçin¹*, Grief De Backer², Jasper Bink³, Wouter Zomer³ and Patrik Peeters⁴ present the results of electrical resistivity tomography (ERT) measurements conducted along the dykes of the Hedwig- and Prosperpolder in order to obtain continuous profiles of the dyke composition.

Introduction

The Havel and Prosopky rivers are situated on the border of Belgium and the Netherlands near Antwerp, as presented in Figure 1. A poller is a low-lying tract of land that forms an artificial hydrological entity, enclosed by embankments known as dykes. It is decided whether two pollers will be turned into one (artificial nature) or whether the pollers will remain separate with the 'Downed Land of sunlight' they will be part of the largest artificial nature area in Western Europe. The reconstruction means that the current dyke along the river Scheldt will become obsolete and partially removed. This presents a unique opportunity to perform full-scale tests on this dyke, which has been in service for several decades. RZ Engineers & Managers commissioned by The Dutch Foundation for Applied Water Research (STOWA) and the Rijkswaterstaat (RWS) (the Dutch National Agency of Mobility and Public Works) have joined forces to organize these experiments. Together with several other partners, including knowledge institutes, universities and flood managers, the tests and experiments will improve understanding of the impact of

pride will also be an impetus to use area covering measurement techniques on a wider scale on dykes fatally protecting the hinterland from flooding. The application of such measurement techniques is now limited, but it is expected that these techniques will be used more extensively in the future. The use of the dyke and its adjacent SLEs as failure mechanisms can occur on a volume or area scale, the translation from point measurements to volume increases our understanding of failure mechanisms related to dyke strength.

It is important to establish that dyke composition is dimensionally homogeneous along the section under investigation if meaningful comparisons can be made. The present study has shown that for the three-dimensional composition of the dyke body needs to be determined. Geotechnical measurements based on point sampling techniques including CPTs (Lunne and Robertson, 1997; Robertson, 1998) provide precise, localized information but leave much of the ground unexplored. This reduces the reliability of the data and the ability to make meaningful comparisons. CPT provides a means to populate a more reliable ground model with continuous or quasi-continuous information.

Choosing the technique

A number of geophysical methods were deemed potentially suitable for the purpose of this research (Radhakrishnan, 2009). Three geophysical measurement techniques were initially considered: Electrical Resistivity Tomography (ERT), Frequency Domain Electro-Magnetic profiling (FDEM) and Ground Penetrating Radar (GPR). Since the target dyke has a height of around 7 metres, the chosen technique should be able to investigate at least 10 metres into the ground. Therefore, given the likely material composition of the dyke, GPR (Morey, 1996) was excluded, since the desired depth of measurements could not be reached. ERT was chosen as the preferred technique, since the accuracy and the resolution of this technique were expected to be better than can be achieved with an FDEM measurement (Pellerin, 2002; Morey, 1996).

The ERT measurements were planned in two-phases, comprising measurements along (phase 1) and across the dyke (phase 2). The ERT measurements pertaining to the phase 1 have been executed by Fugro in spring of 2016. This article is based on the

Figure 1 Location of the Hedys and Prosperpolder (source: Google Maps)

¹Fugro NL Land | ²Geotechnics Division | ³SZ Engineers & Managers (SOM) on behalf of STOWA
⁴Randers Hydraulics Research
⁵Corresponding author, E-mail: s.aljunied@fugro.com

FIRST ISSUE | VOLUME 37 | AUGUST 2019 63

Gepland onderzoek in de toekomst:

- Dwarse ERT-metingen t.h.v.:
 - locatie ERT-1 (locatie bresproeven)
 - locatie ERT-3 (locatie pipingproeven)
- Dwarse geleidbaarheidssonderingen op dezelfde locaties.
- Boringen met monsternamen + labo-onderzoek

Einde

