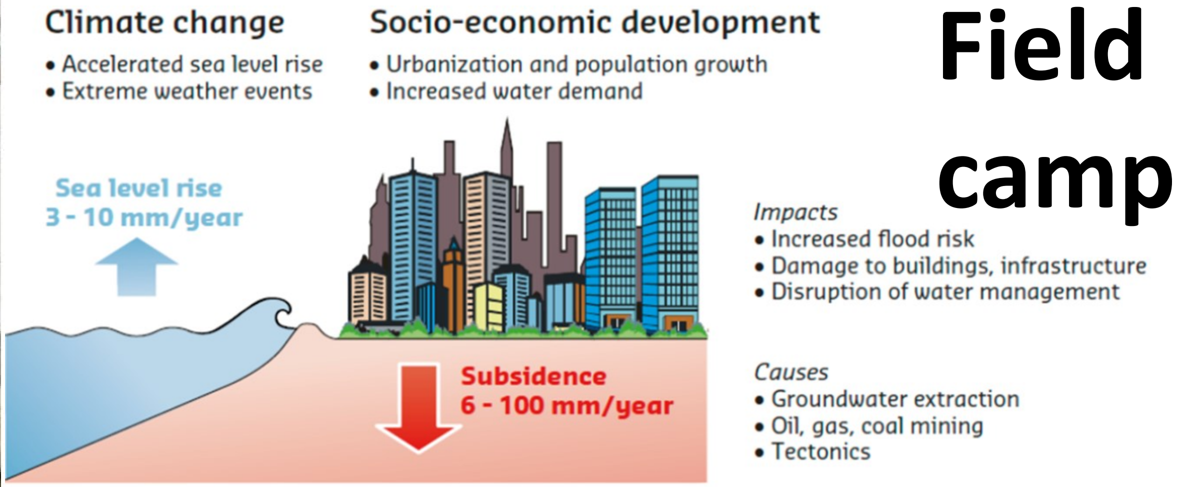
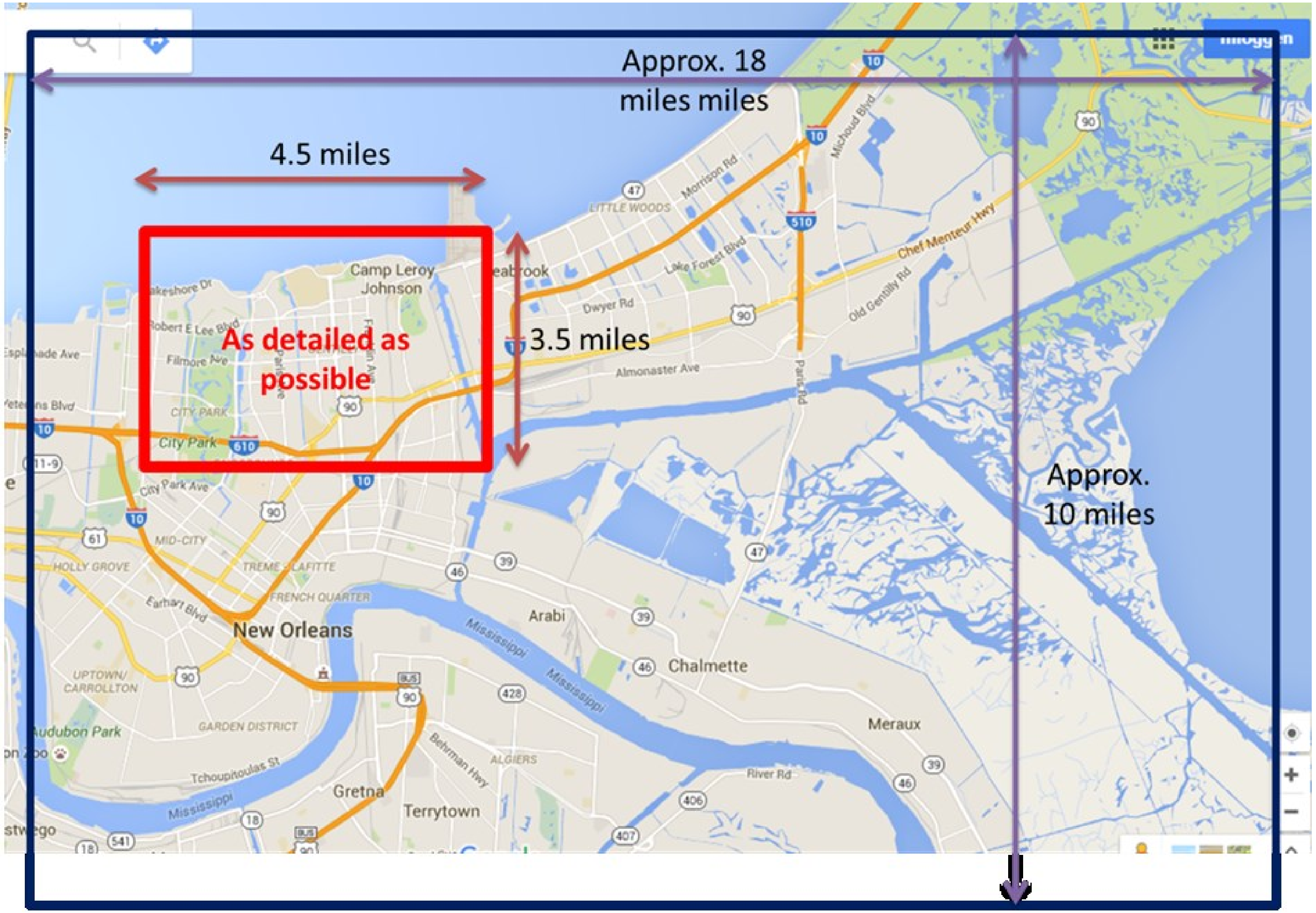
Towards resilient groundwater and surface water management in New Orleans

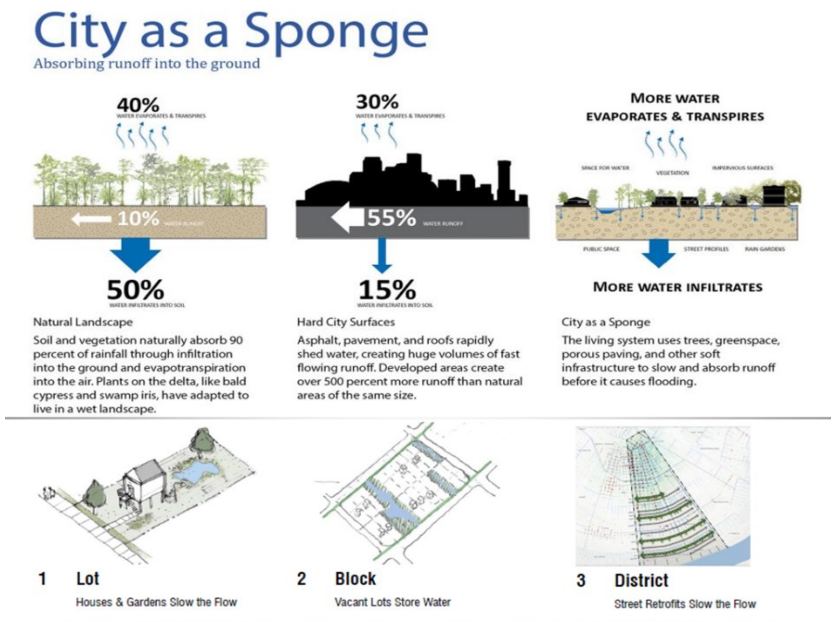
Roelof.stuurman@deltares.nl

November 2018, Field borehole campaign

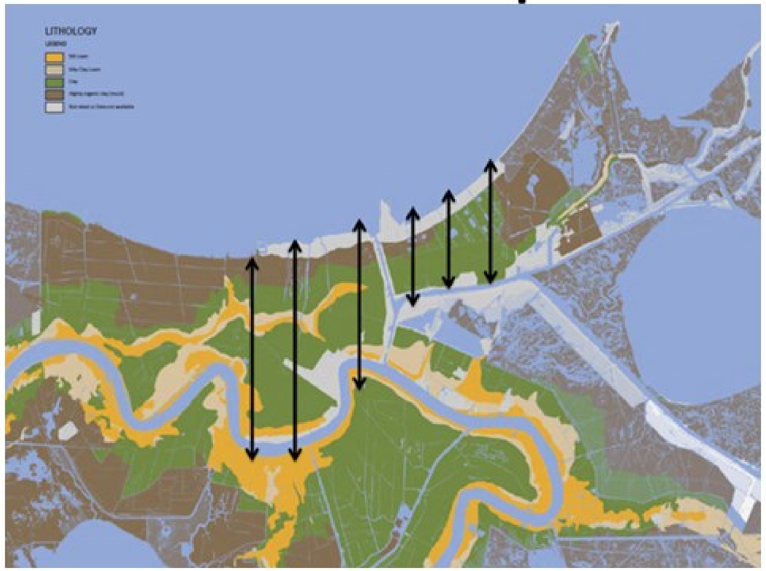


A 3 scales approach



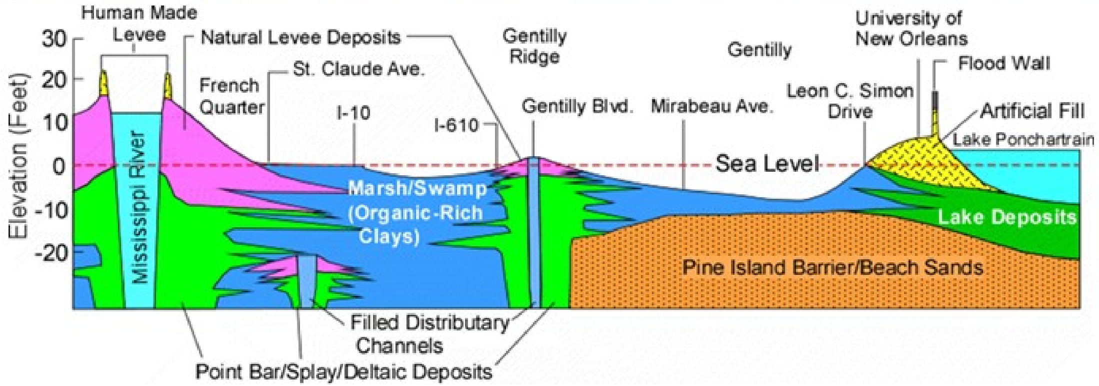


3. Prepare a subsidence vulnerability map of New Orleans



Deliverables mapping

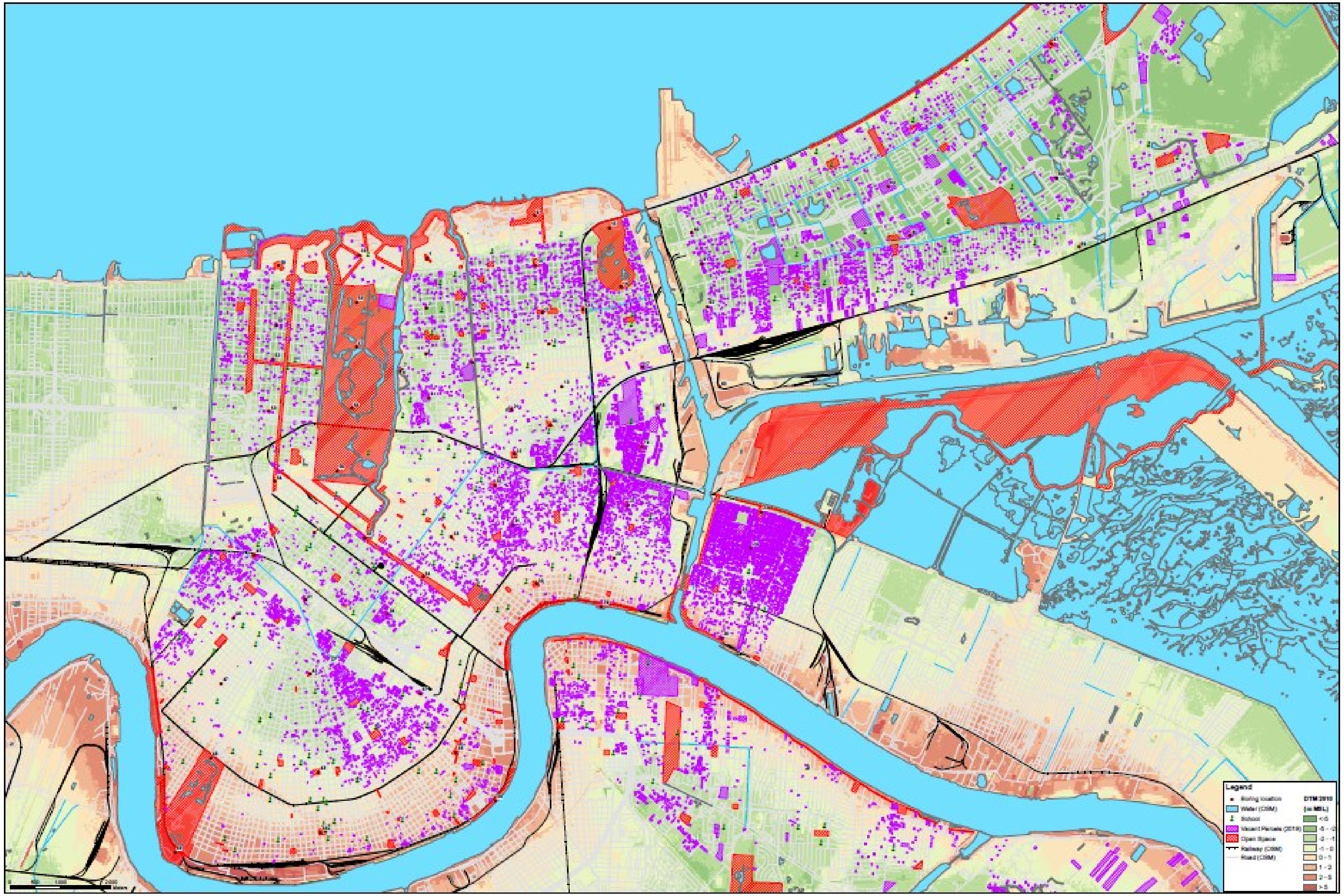
1. Dataset of borehole descriptions.
2. Freeboard map that shows the shallow drainage depth in New Orleans (in different depth classes), including explanatory text.
3. Organic matter content map of the shallow surface of New Orleans (different classes), including explanatory text.
4. Potential subsidence (vulnerability) as a result of oxidation of organic matter map of New Orleans under business as usual, including explanatory text. Subsequent maps may be produced based on different groundwater management scenarios (these maps will be mostly qualitative).
5. Stakeholder workshop in which maps are being explained and promoted.
6. Papers: at least one in popular scientific magazine/website.



Field campaign November 11th – 18th
In cooperation with Tulane University

Borehole locations

Deltares



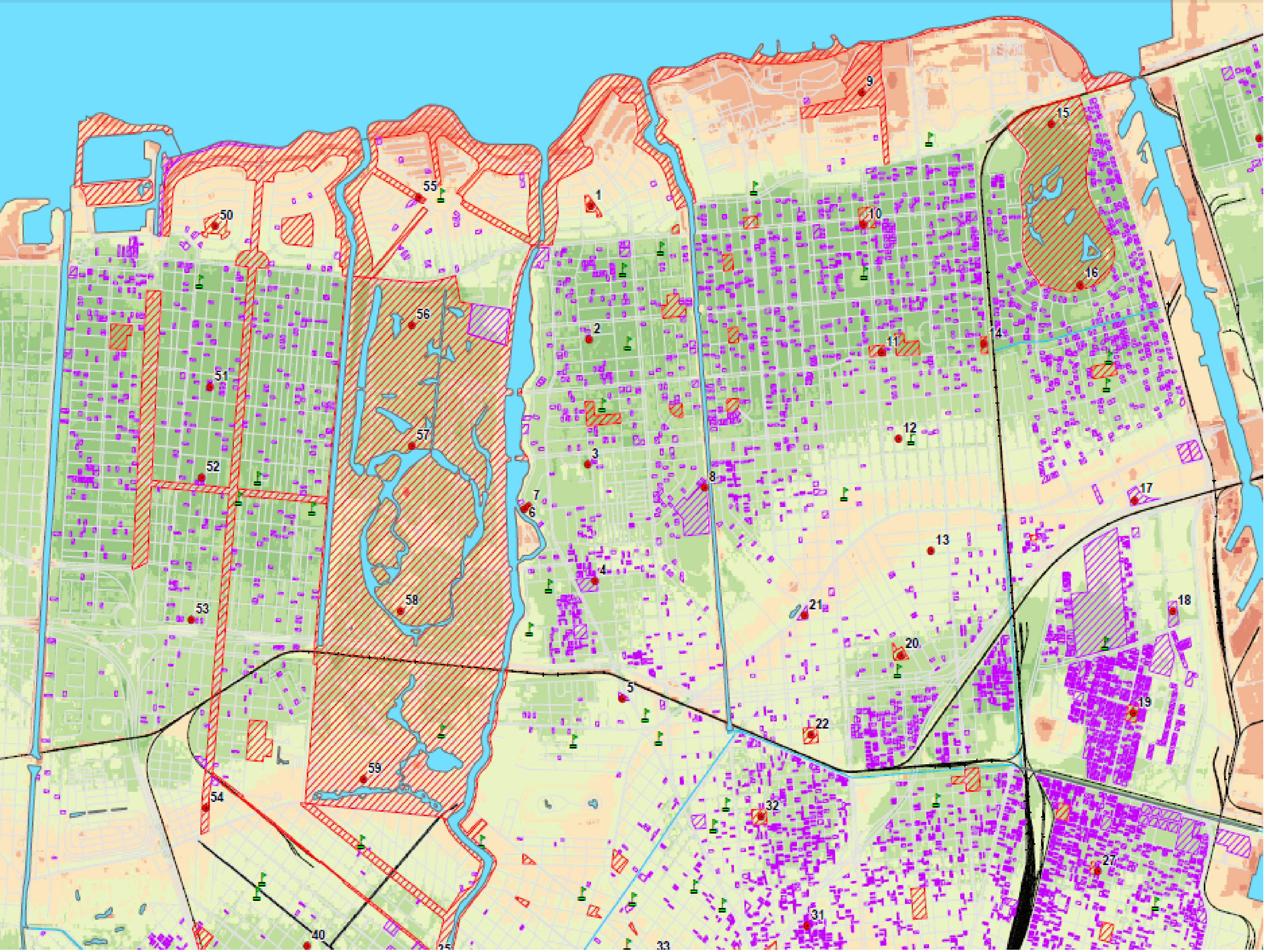
Contract : 63 boreholes
Our planning: 75 boreholes
Realization: 72 boreholes

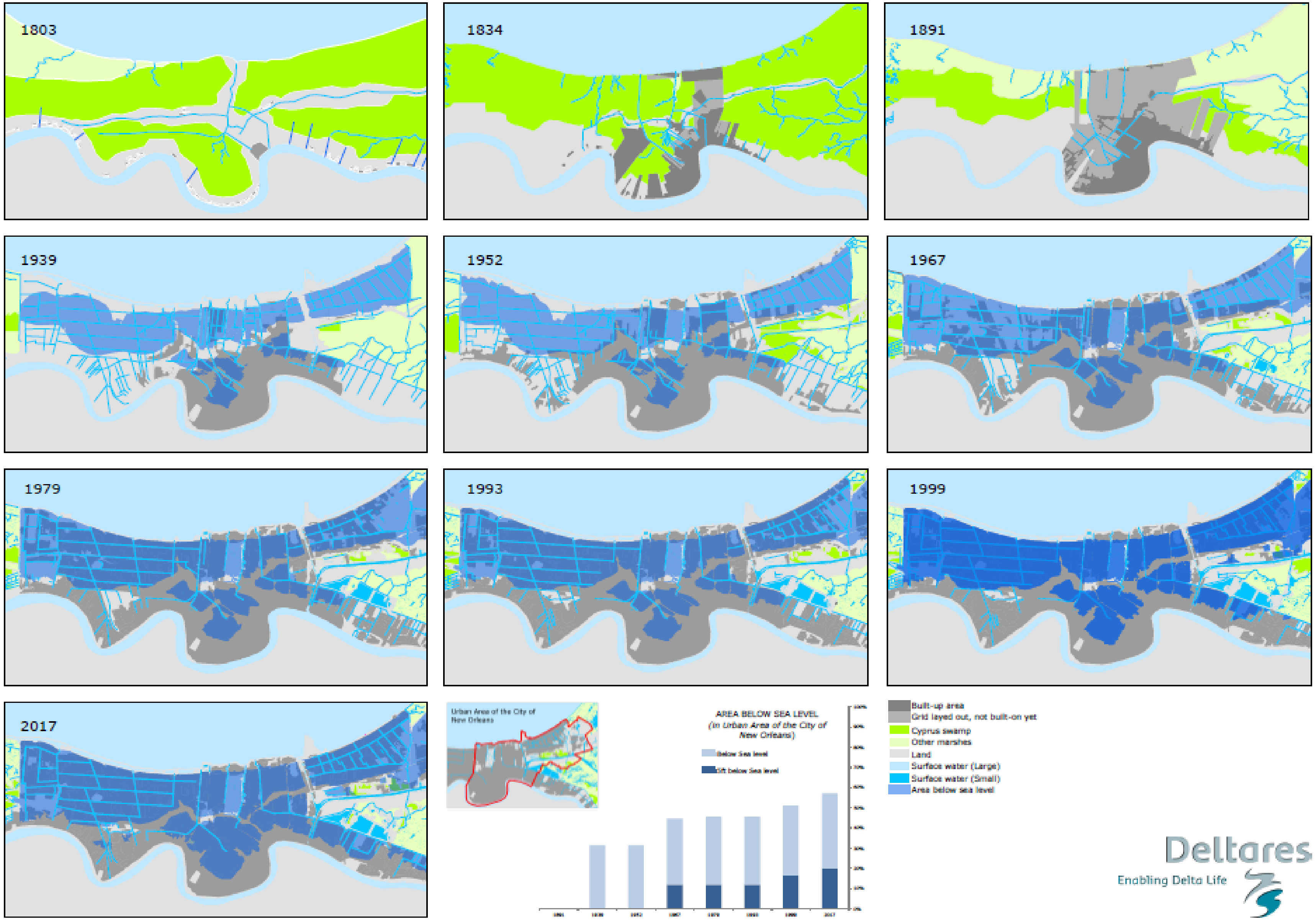
Preparation in Utrecht;

- ***Determination locations,***
- ***Ordering reserve augers etc.,***
- ***Buying sample equipment,***
- ***pH, EC meters***
- ***Organizing databasing,***
- ***Organizing borehole description (the Tulane way)***

More boreholes in Gentilly

Working with 3 drilling teams





PREPARATION:

Analyzing historical topographical maps

- Drainage system
- Change in elevation

Next step: distribution of levees in time

OUR TEAM

TULANE:
Ryan Clarke (LSU)
Molly Keogh (PhD-study)
Udita Mukherjee (PhD-study)
Tor Tornqvist (prof)
Alex Kolker (LUMCON)

DELTARES:
Sanneke van Asselen,
Gilles Erkens,
Peter Vos,
Marc Hijma,
Roelof Stuurman

BATTURE:
Chris Rutland

City of NEW ORLEANS
Tyler Antrup

Daily strategy 7:00 a.m. breakfast at Avenue Cafe,
Lunch around noon, returning at dark (5 p.m.), databasing

Sunday 10th , Preparation and fine-tuning !

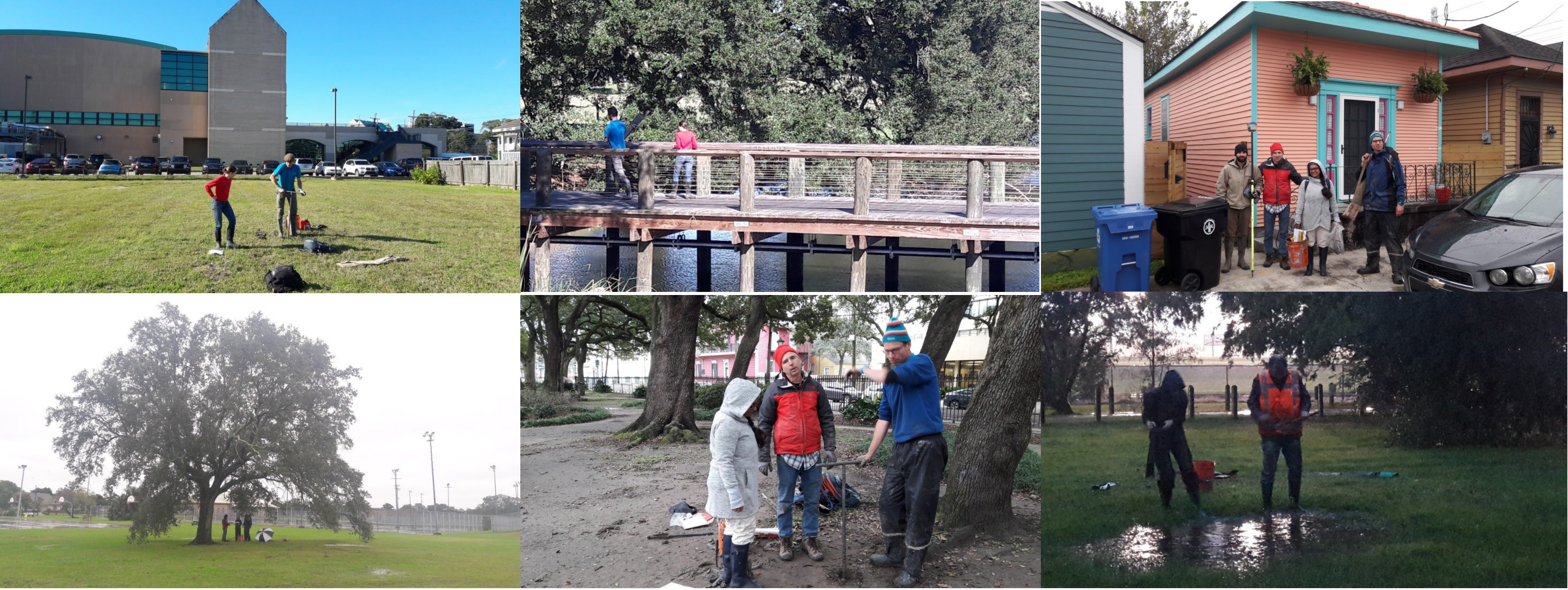
In the gardens of Tor Tornqvist and Julia Kumari Drapkin.

Bayou St. John.

Drilling in front and back garden

- **Understanding bank geology;**
- **Understanding groundwater level gradient**
- **Understanding Bayou groundwater recharge**

Start “drilling” week



November 11th – 17th

Monday, Tuesday cold and rain, Wednesday cold but dry, Thursday fresh and dry, Friday great!



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resilient groundwater & subsurface management

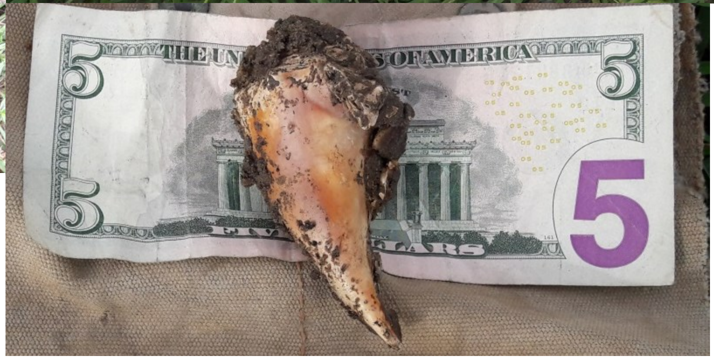
NOTE: Graphic Logo in Development

1. Drilling

2. Sediment analysis

resilient groundwater & subsurface management

NOTE: Graphic Logo in Development

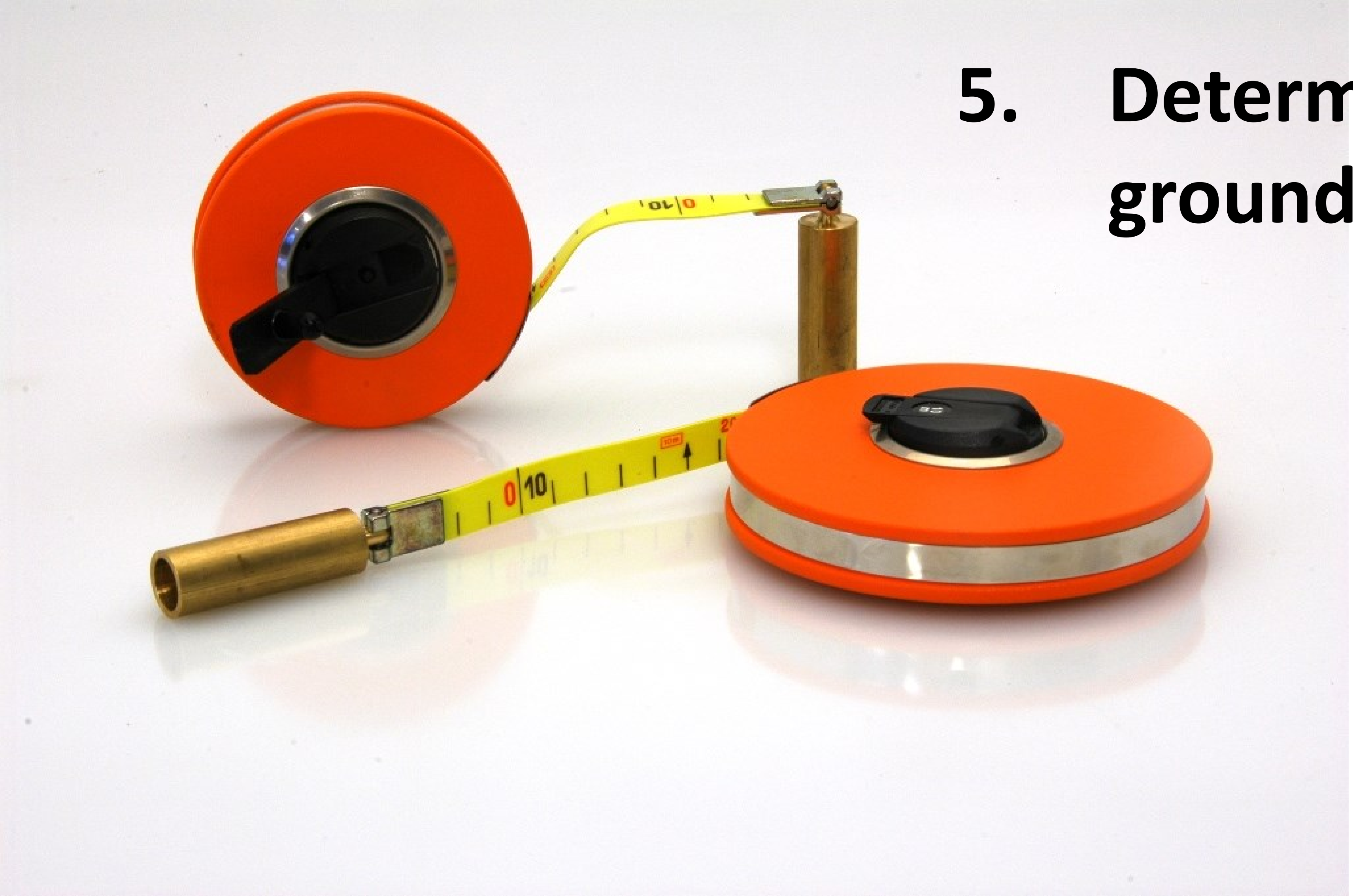


3. Sampling

- 100 samples
- Less than foreseen because of unforeseen lack of peat soils

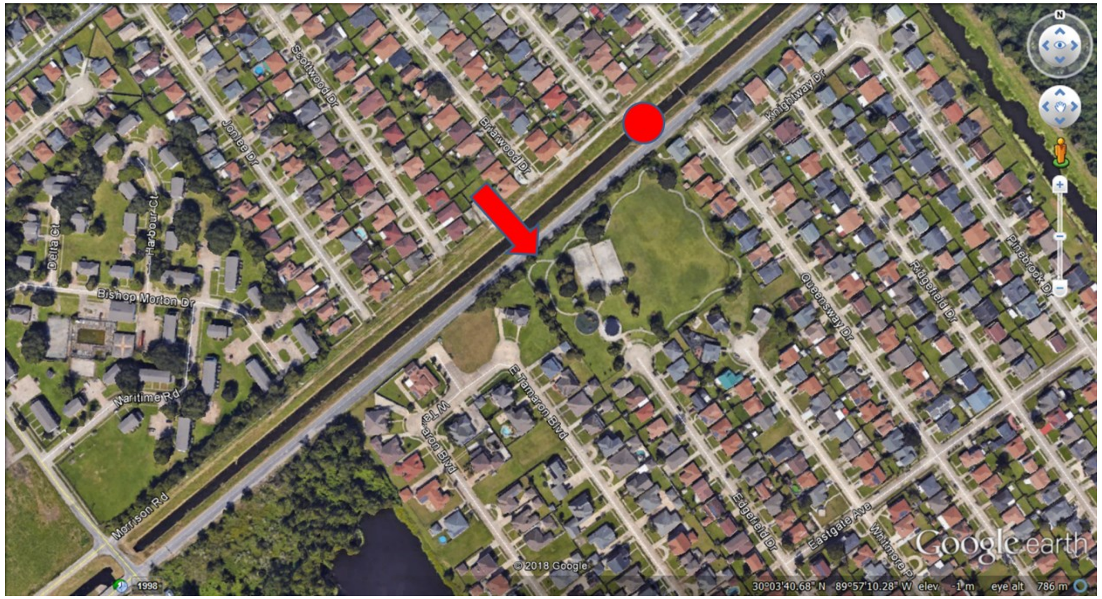
NOTE: Graphic Logo in Development

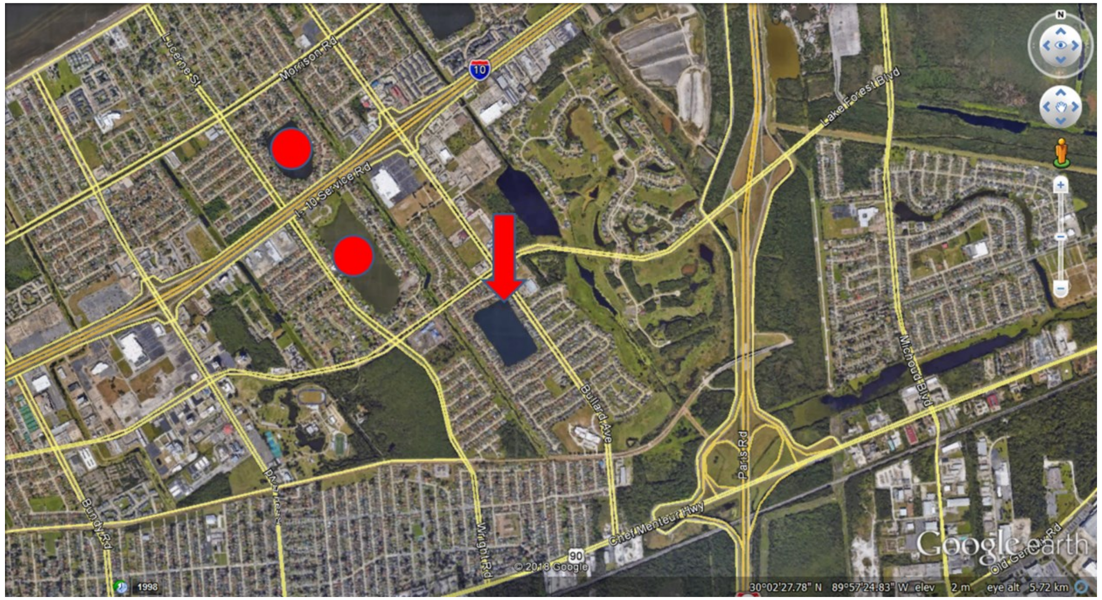
4. Determination lowest groundwater level



5. Determination actual groundwater level

6. Determination salinity and pH (groundwater)





7. Leveling

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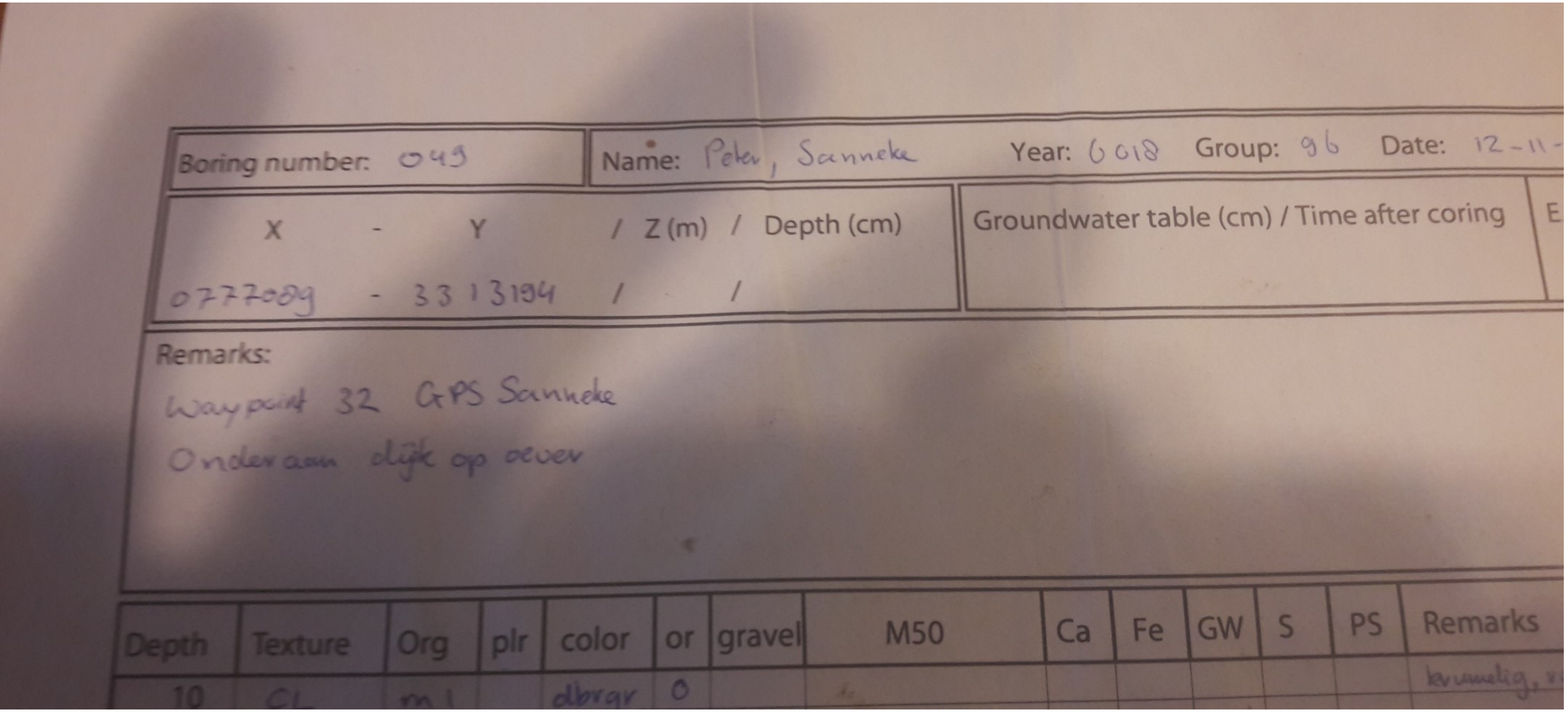
NOTE: Graphic Logo in Development

8. Databasing



Boring number: 049

Name: Peter, Sanneke Year: 2018 Group: 96 Date: 12-11-

X - Y / Z (m) / Depth (cm)	Groundwater table (cm) / Time after coring	E
0777089 - 3313194 / /		

Remarks:

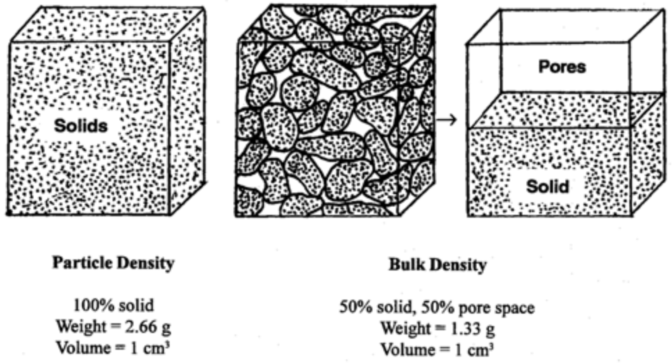
Waypoint 32 GPS Sanneke

Onderaan dijk op oever

Depth	Texture	Org	plr	color	or	gravel	M50	Ca	Fe	GW	S	PS	Remarks
10	CL	ml		dbrgr	0								kruimelig,

9. Laboratory analysis

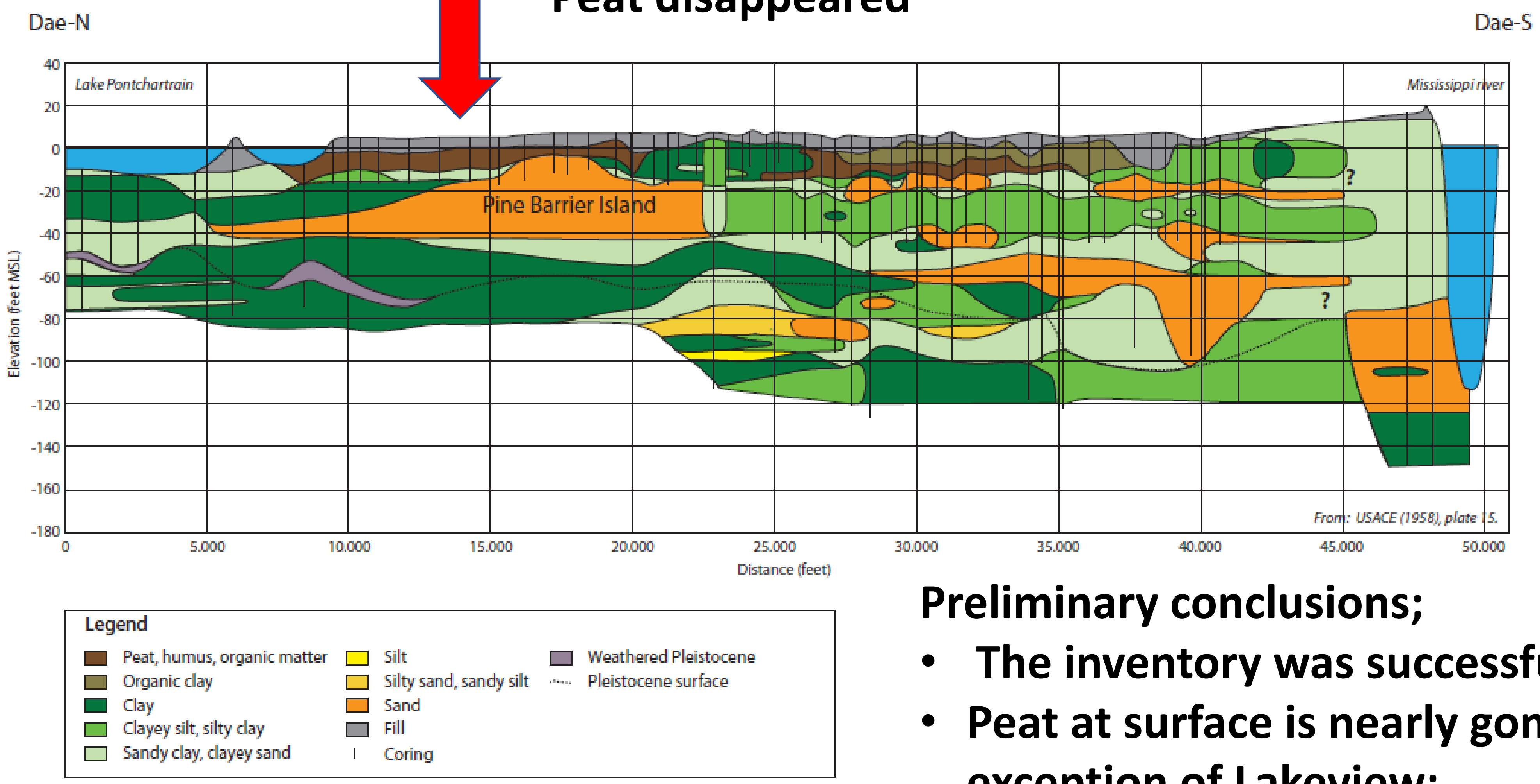
- Bulk density
- Organic content
  - Drying
  - Burning
  - weighting




Bradley
Deltares

Cross section D-D' (USACE 1958)

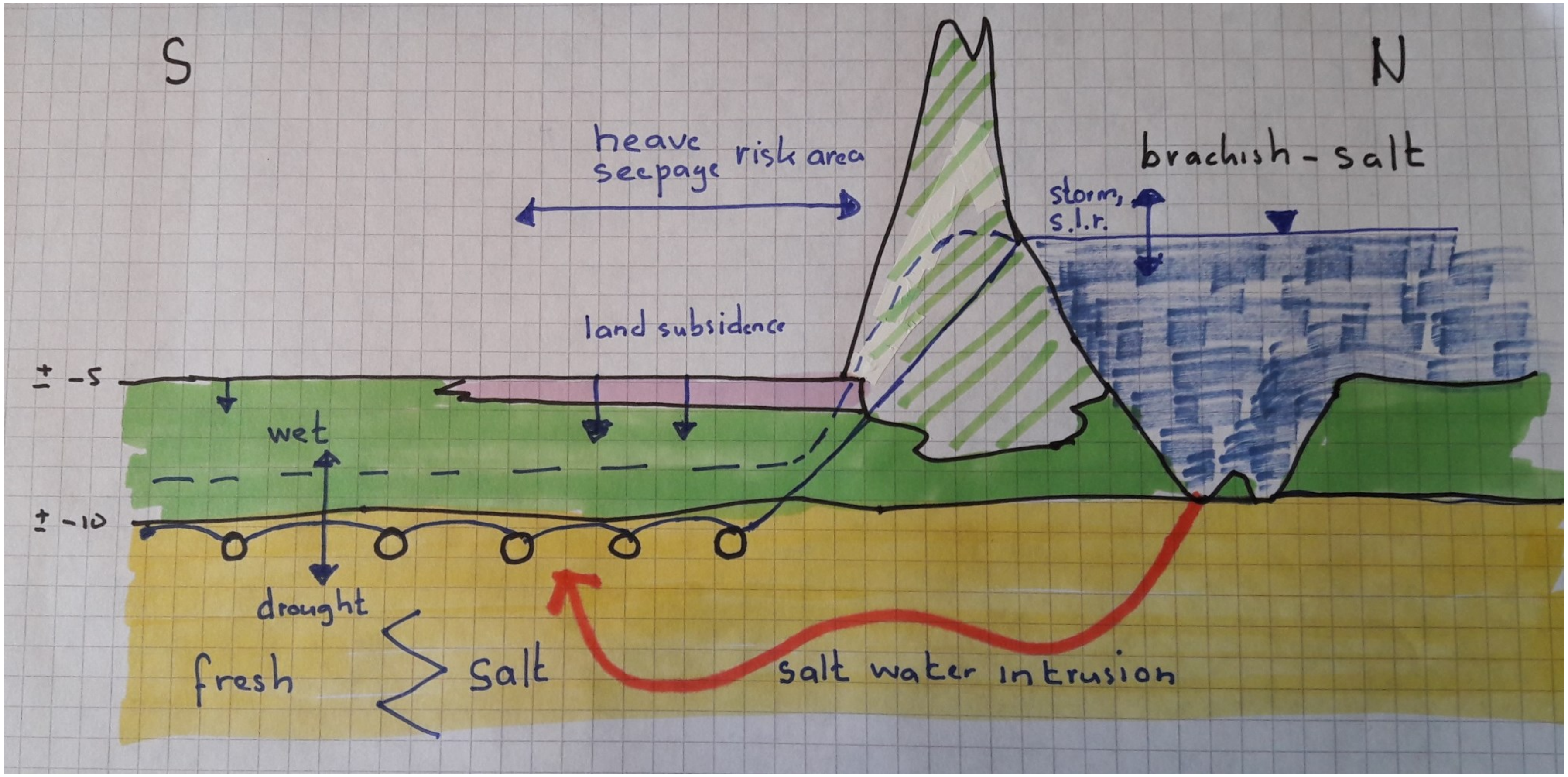
Peat disappeared



Preliminary conclusions;

- The inventory was successful;
- Peat at surface is nearly gone with the exception of Lakeview;
- Still peat levels below MLG
- Still a lot of soft (and organic) clays


Some additional observations

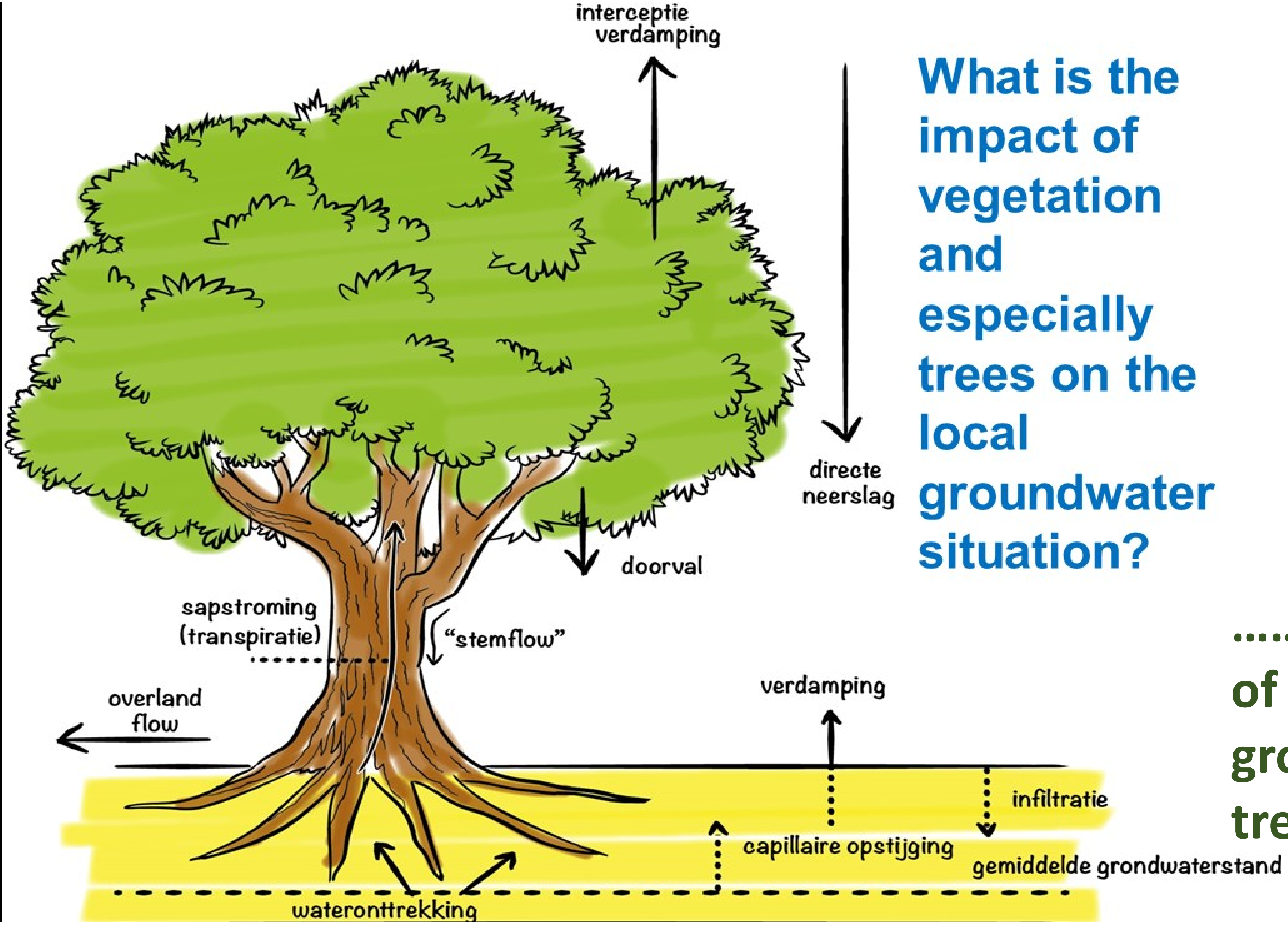


MODELING GROUNDWATER SALINIZATION

Salt seepage Press Drive Viaduct

EC puddles 1.3 mS/cm,
Borehole 1.5 mS/cm
Tipping point trees: 1.5 -2 mS/cm

Salinization is already a reality



What is the impact of vegetation and especially trees on the local groundwater situation?

......and what is the impact of salinization and rising groundwater levels on trees?


Lake Vista
EC 2.2 mS/cm
WATER


Lakeview
“peaty”


New Orleans NE
All kind of storm drainage pipe - canal relations

Dutch researchers dig into New Orleans to study subsidence

Updated Nov 15; Posted Nov 15

Gallery: Dutch soil borings on November 13, 2018

Scientists look to soil samples to predict future sinking, flooding in New Orleans

BY FAIMON A. ROBERTS III | FROBERTS@THEADVOCATE.COM NOV 12, 2018 - 7:15 PM

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John School Board sued over chemical plant

demands students near Denka be relocated

Absorbing solutions

Marc Hijma, second from right, inspects a soil sample Monday in the St. Anthony neighborhood of New Orleans. Scientists are using soil borings to study New Orleans' groundwater with an eye toward one day predicting future flooding events and identifying areas most vulnerable to subsidence.

ADVOCATE STAFF PHOTOS BY SOPHIA GERMER

Groundwater management could be key to limiting subsidence, flooding in New Orleans, scientists say

A scientist inspects the contents of soil as teams of geologists hope to shed light on poorly understood groundwater.

BY FAIMON A. ROBERTS III

Teams of geologists and other scientists spread out Monday to take soil samples across New Orleans, the first step in an ambitious project to study the city's groundwater with an eye toward one day predicting future flooding events and identifying areas most vulnerable to subsidence.

In New Orleans, surface water, in streets and sometimes buildings, gets the most attention after heavy rains. But groundwater could be a key part of helping to reduce the risk of flooding in many parts of the city. The problem is that the city's groundwater is poorly understood.

These scientists, working in partnership with the city and others, hope to change that by conducting an extensive study of New Orleans' groundwater.

The project is being led by Roelof Stuurman, a scientist with the Dutch company Deltares. The company is one of the world's leading experts in water management, and Stuurman said this project could help provide a three-dimensional picture of the city's underground soil and water.

That picture could be used to help reduce the impact of future flooding events and predict which areas could be most vulnerable to subsidence, the natural process by which land sinks.

See GROUNDWATER, page 2B

Orleans Parish superintendent to close four schools

OneApp enrollment opens next week

Time line: November 2018 –January 2019

- November and December analysis, mapping and reporting;
  - ❑ Design of a <u>mean lowest groundwater level map</u> (MLG) using soil characteristics and surface water levels;
  - ❑ Design of groundwater contour maps (NAVD 88)
  - ❑ Design of a “homogenous” geological areas (profile types) map by classifying our 72 boreholes and using the elevation map, soil map and other available geological information;
  - ❑ Design of (shallow) subsidence vulnerability map
- January concept report for evaluation;
- February definitive report and brochure;
- ……science article?