



iFLUX

Envision Groundwater in Motion  
Sensor solutions for Smart Groundwater Management



# China says more than half of its groundwater is polluted

Number of groundwater sites of poor or extremely poor quality increases to 59.6%, Chinese government says

# Our water system is under pressure

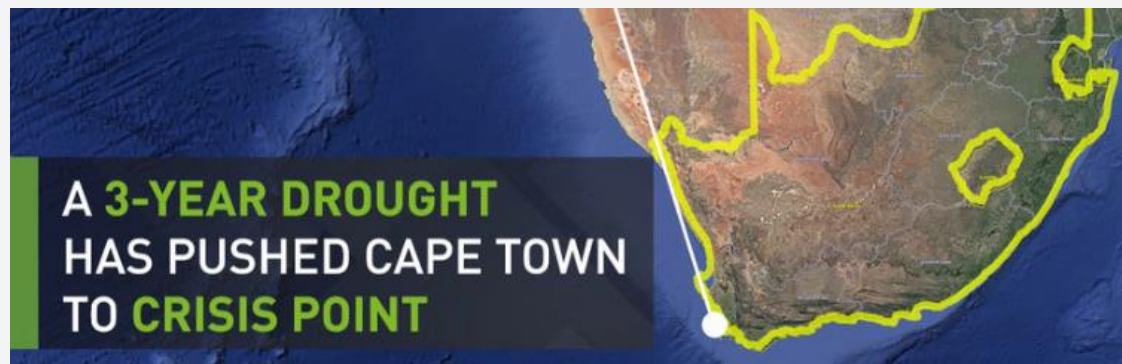
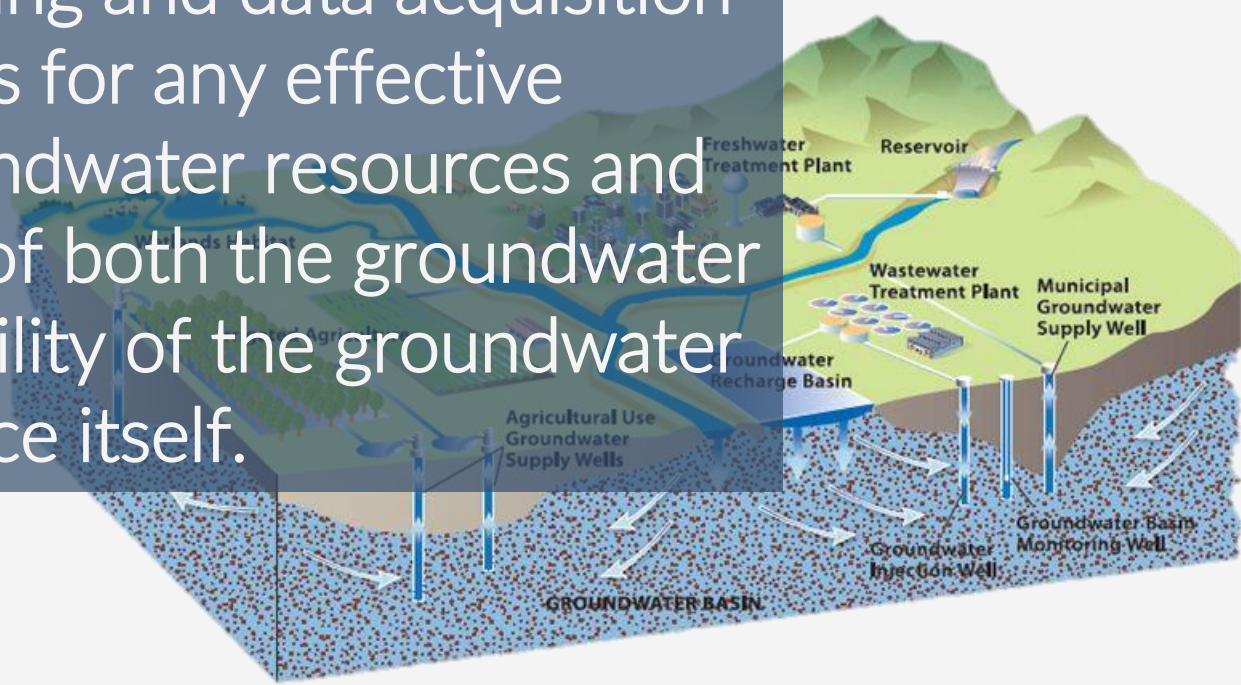
Chart: Globally, 70% of Freshwater is Used for Agriculture

Groundwater monitoring and data acquisition are pre-requisites for any effective management of groundwater resources and preservation, in terms of both the groundwater quality and the availability of the groundwater resource itself.

HYDROLOGY

## When wells run dry

A global analysis reveals growing concerns over the overuse of renewable freshwater resources that depletes groundwater reserves and undermines human resilience to water scarcity in a warming world.







# What if...

## We could look under the subsurface?



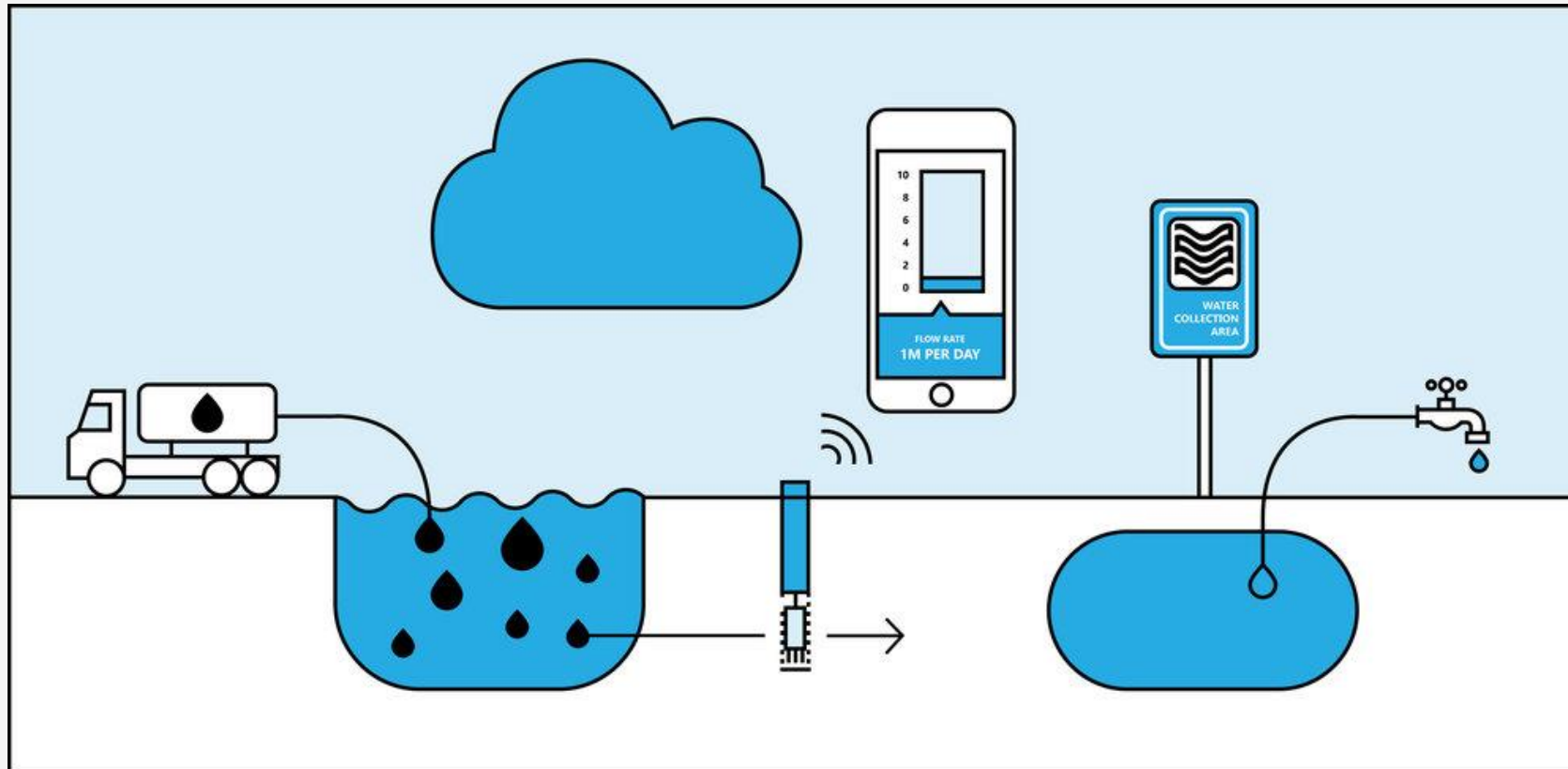
# What if...

## We could:

- Manage asset integrity of an industrial site
- Better forecast droughts episodes
- Monitor source-plume evolution before, during and after site clean-up process
- Develop insights in degradation behavior of emerging contaminants like nitrates, pesticides or PFAS

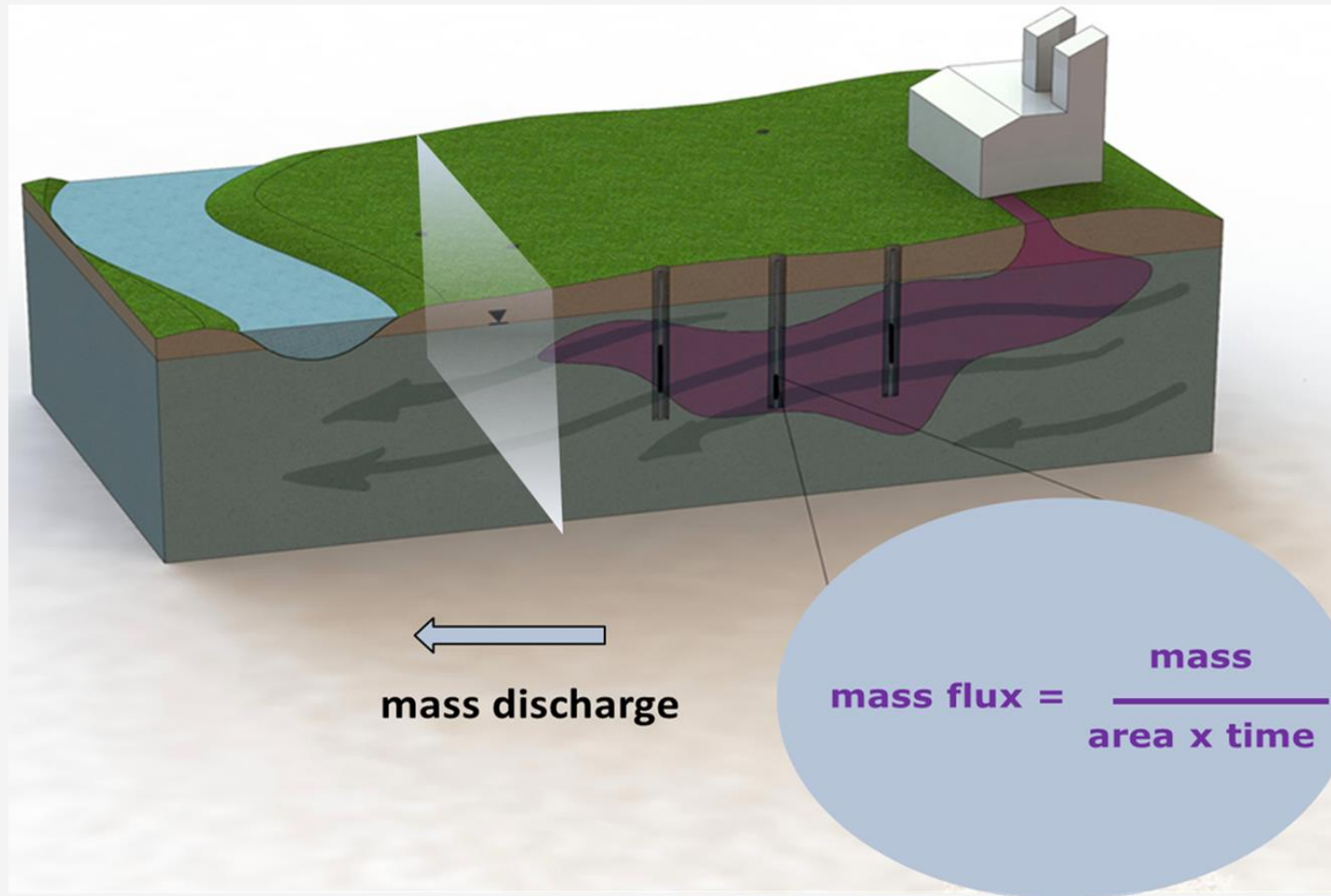
# Direct groundwater flux monitoring

iFLUX simultaneously monitors the groundwater flux and mass flux of contamination



- Groundwater flux
  - Flow rate
  - Direction
  - Vertical
  - Horizontal
- Groundwater level
- Groundwater quality
  - Point source
  - Diffuse pollution

# Groundwater & mass flux concept



<https://www.itrcweb.org/GuidanceDocuments/MASSFLUX1.pdf>



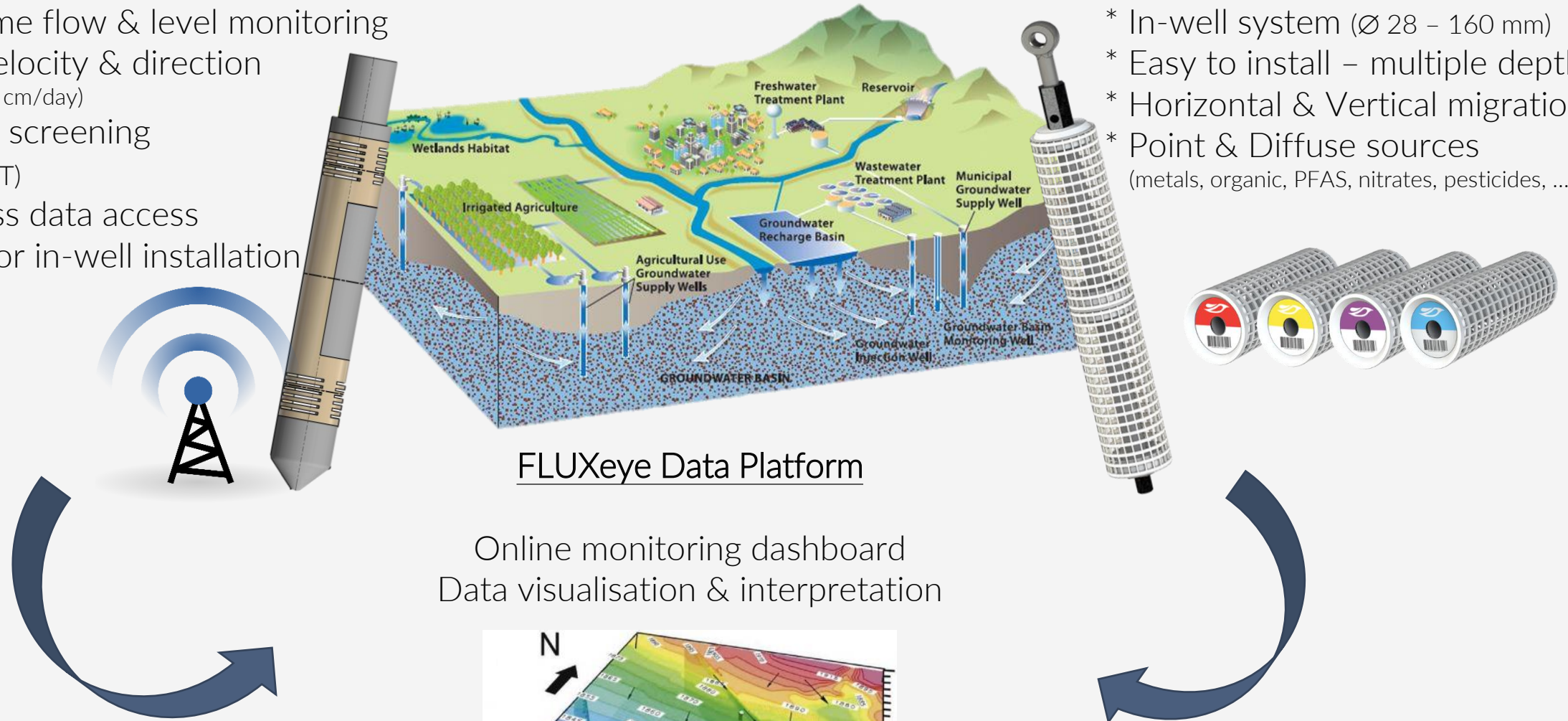
# iFLUX Services

Remediation  
Agriculture  
Infrastructure  
Environment



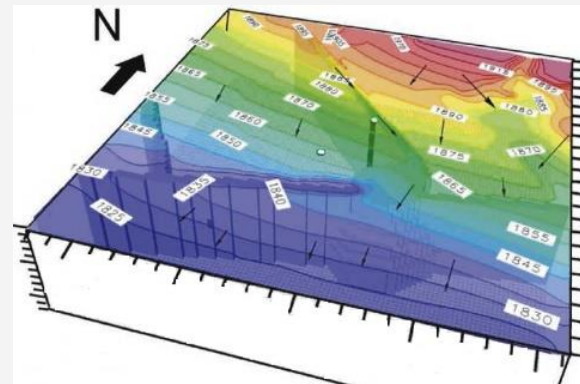
## iFLUX Sensing

- \* Real-time flow & level monitoring
- \* Flow velocity & direction  
(0,5 - 500 cm/day)
- \* Quality screening  
(pH, EC, T)
- \* Wireless data access
- \* Direct or in-well installation



FLUXeye Data Platform

Online monitoring dashboard  
Data visualisation & interpretation



## iFLUX Quality Sampling

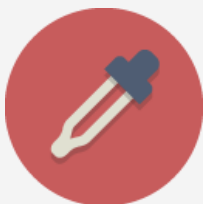
- \* In-well system ( $\varnothing$  28 - 160 mm)
- \* Easy to install - multiple depths
- \* Horizontal & Vertical migration
- \* Point & Diffuse sources  
(metals, organic, PFAS, nitrates, pesticides, ...)





# iFLUX Passive sampling

80+ projects in 13 countries across EU towards cost-efficient site remediation



Patented and validated



Captures 90% of all pollution types



Accurate measurement of mass flux and direction of spreading



Potential remediation cost reduction up to 30%





# iFLUX Sensing solutions

Prototype testing in-the-field



# iFLUX sensor overview



## Direct vertical sensor

- 1 bidirectional flow sensor
- Temperature sensor
- River bed prototype V2.0

## In-well vertical sensor

- 1 bidirectional flow sensor
- Temperature sensor
- Well  $\varnothing > 40$  mm
- Treewell prototype v1.0



## Direct horizontal sensor

- 2+ bidirectional flow sensors
- Temperature / pressure / moisture sensor
- Prototype v3.0

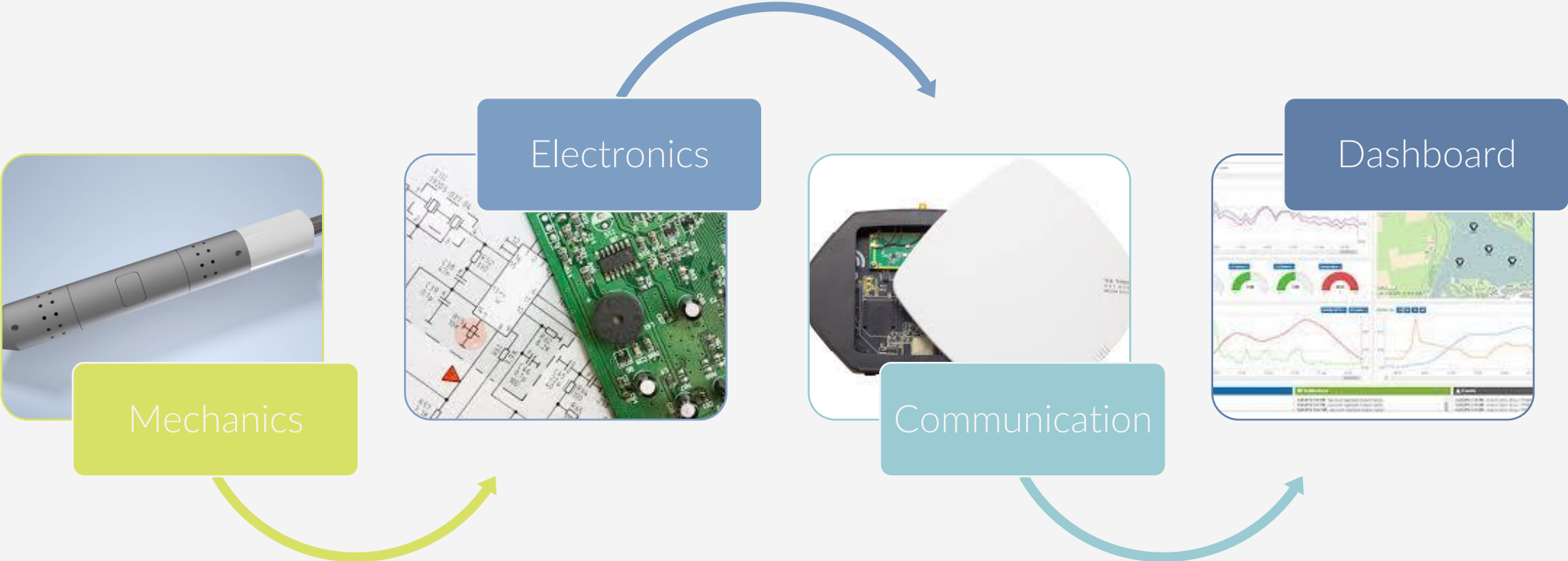
## In-well horizontal sensor

- 2+ bidirectional flow sensors
- Magnetometer/ gyroscope
- Well  $\varnothing > 100$  mm
- Prototype V1.0

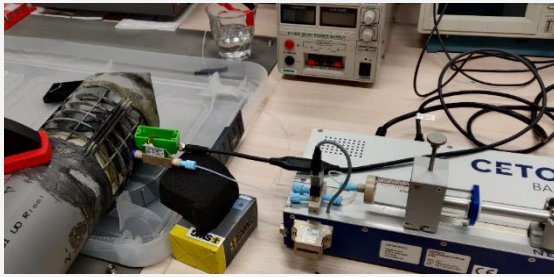




# iFLUX sensor – development roadmap

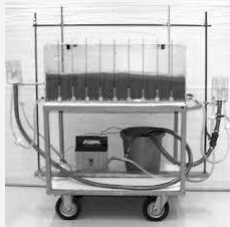


# iFLUX sensor – testing cycle



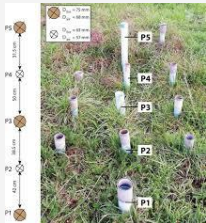
Calibration bench

- Calibrate sensor chips & probes
- Pre & post contaminant exposure calibration & cleaning



Sandbox lab

- Test & validate sensor probes
- Different aquifer sands, flow rates, position of sensor devices
- Short & long term testing



Controlled field site

- Perform real subsoil testing & validation
- In depth exposures, short & long term
- Pumping tests to vary & control flow rates



Case study validation

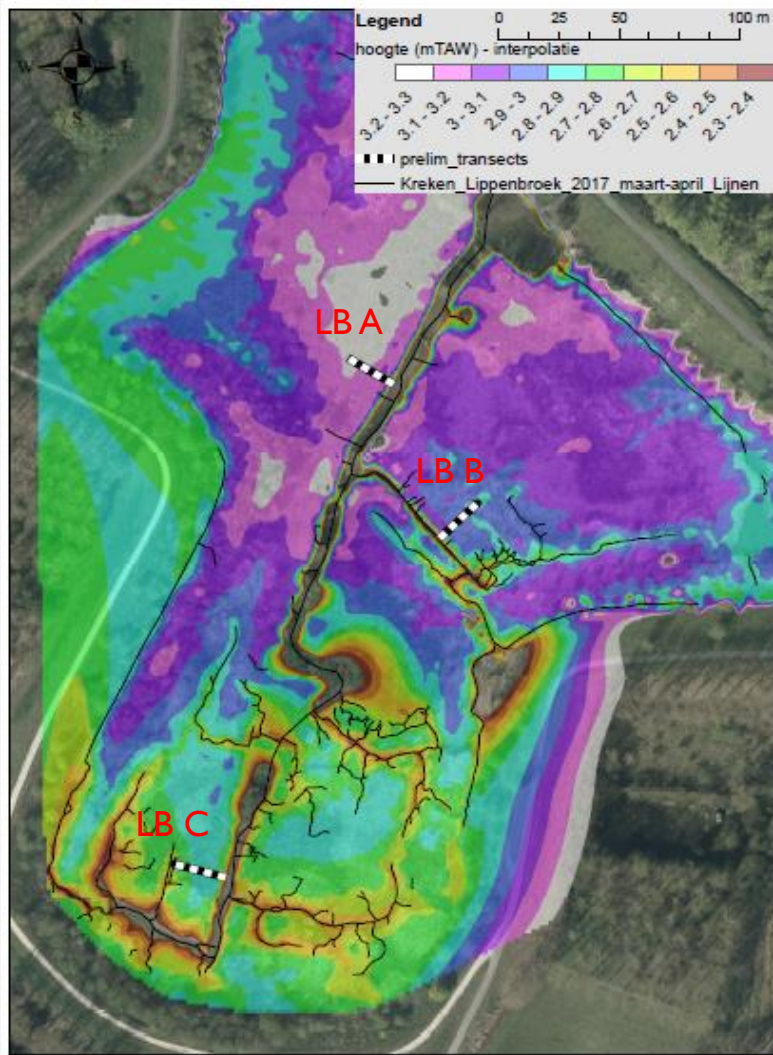
- Real validation cases for end-users/clients
- Exposure to natural or current conditions
- Short & long term exposure



# Pilot demonstrations



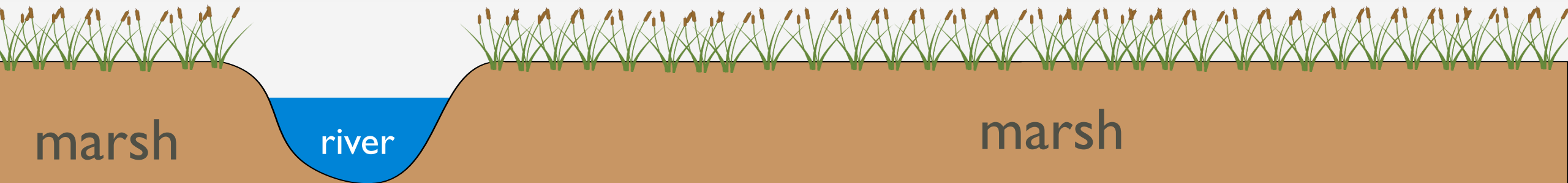
# Restored freshwater marsh Lippenbroek, Belgium





# Tidal marshes

Drowned land of Saeftinghe, The Netherlands





# Centuries of large-scale land reclamation

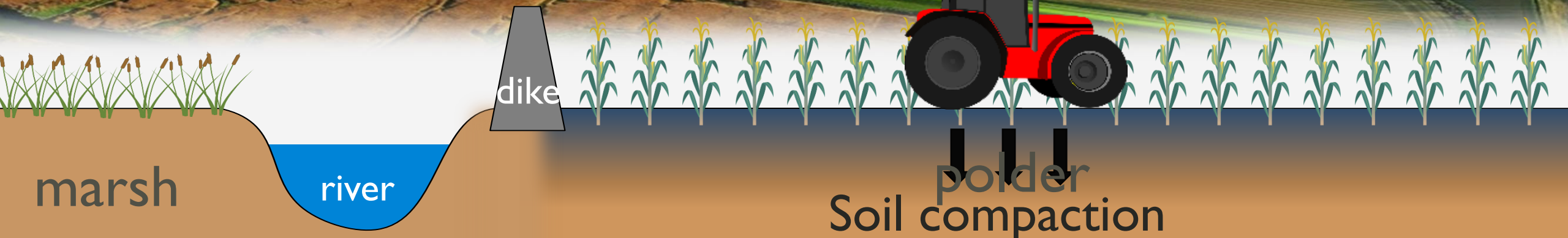
Hedwige-Prosperpolder, Belgium & The Netherlands





# Centuries of large-scale land reclamation

Hedwige-Prosperpolder, Belgium & The Netherlands



marsh

river

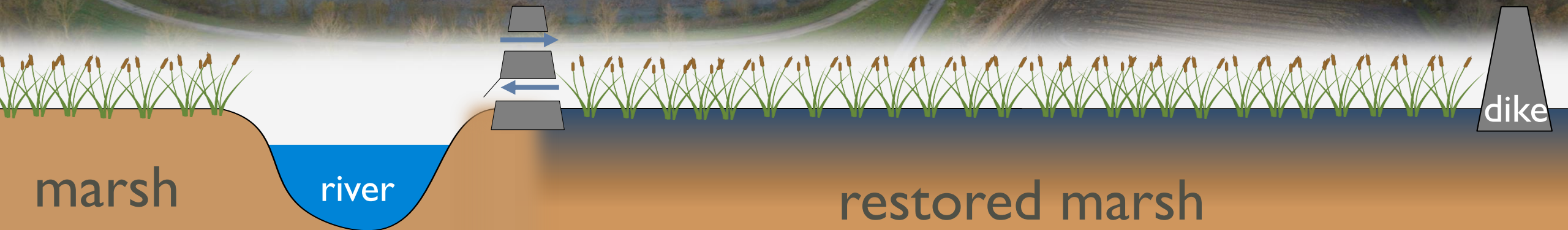
dike

polder  
Soil compaction



# Tidal marsh restoration

Lippenbroek, Belgium



marsh

river

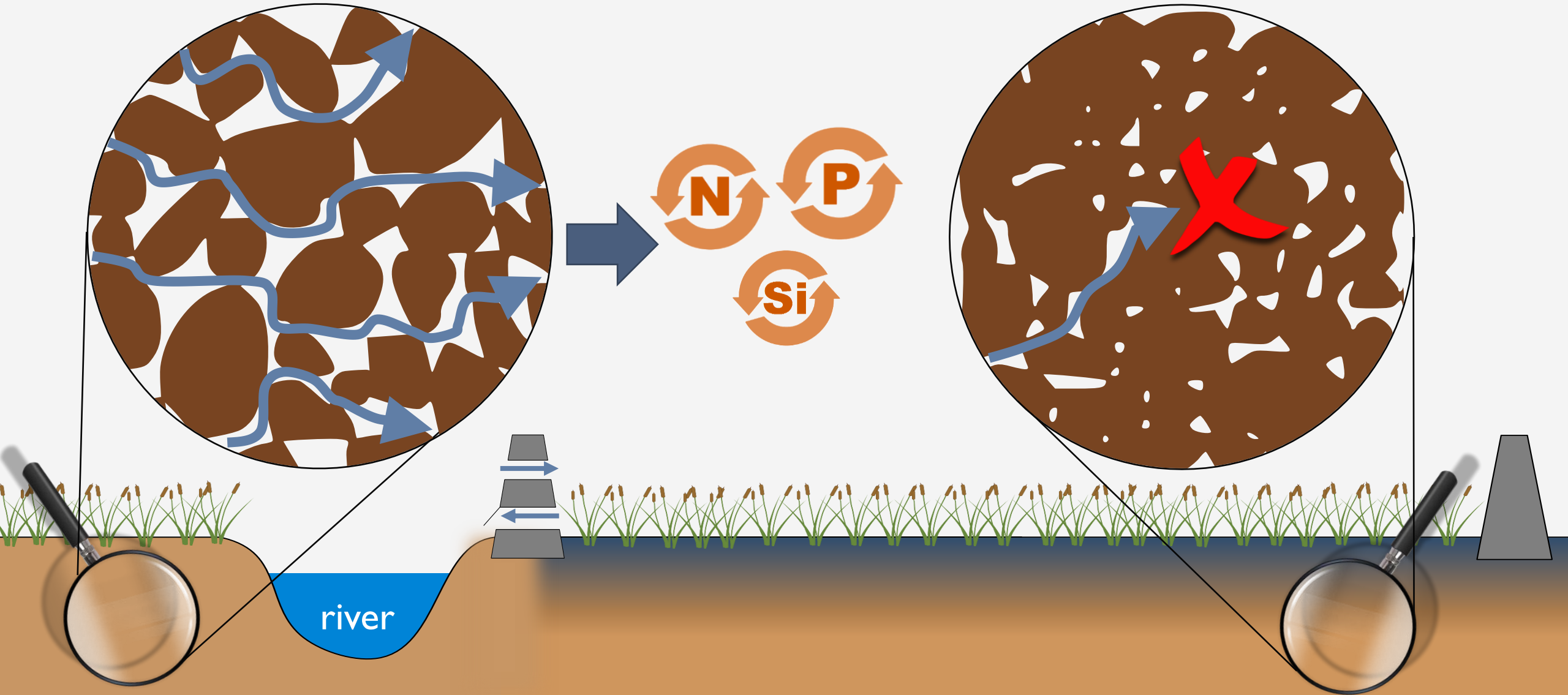
restored marsh

dike

# Soil compaction by agricultural land use

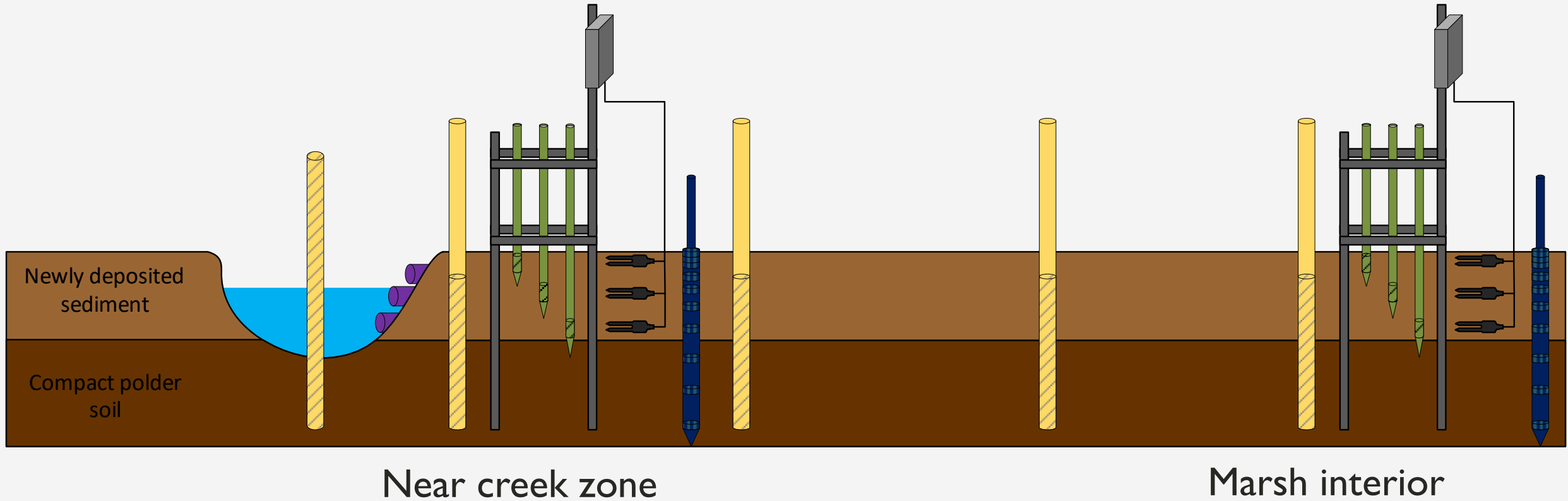
Natural marsh

Restored marsh

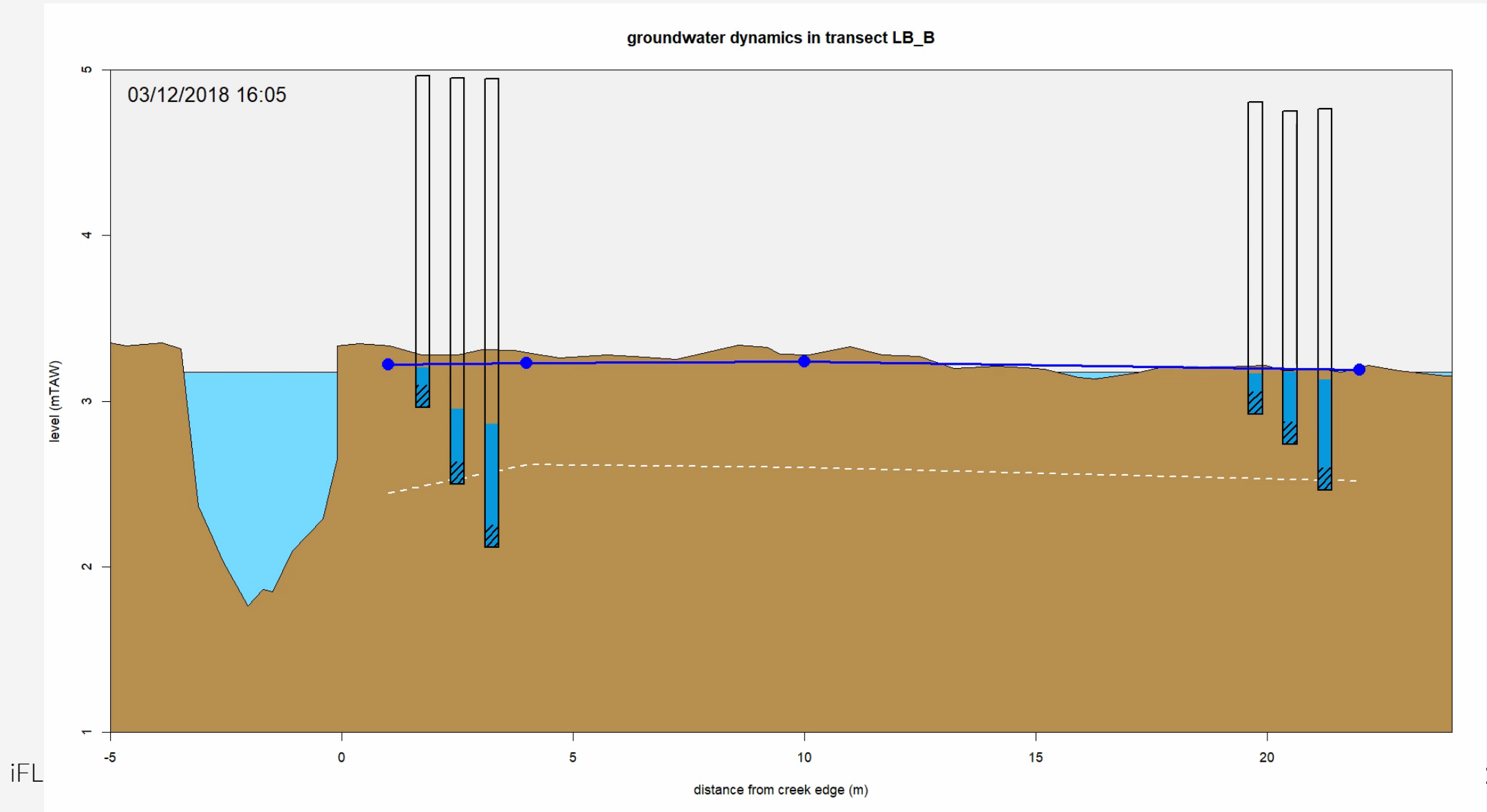




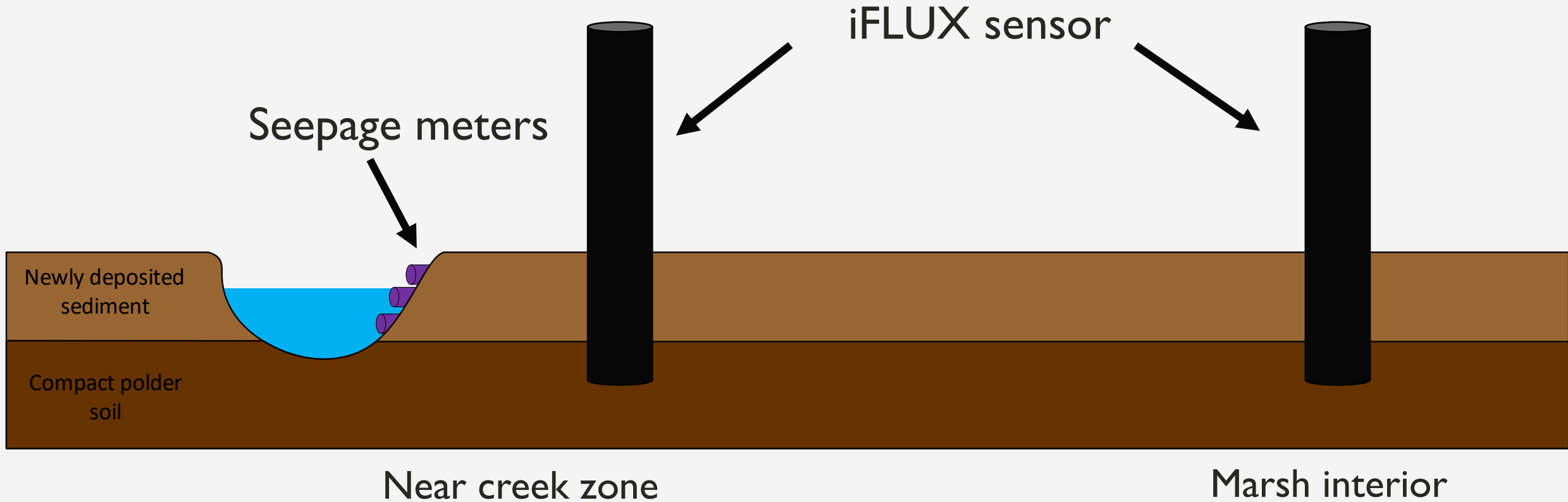
# Field set-up



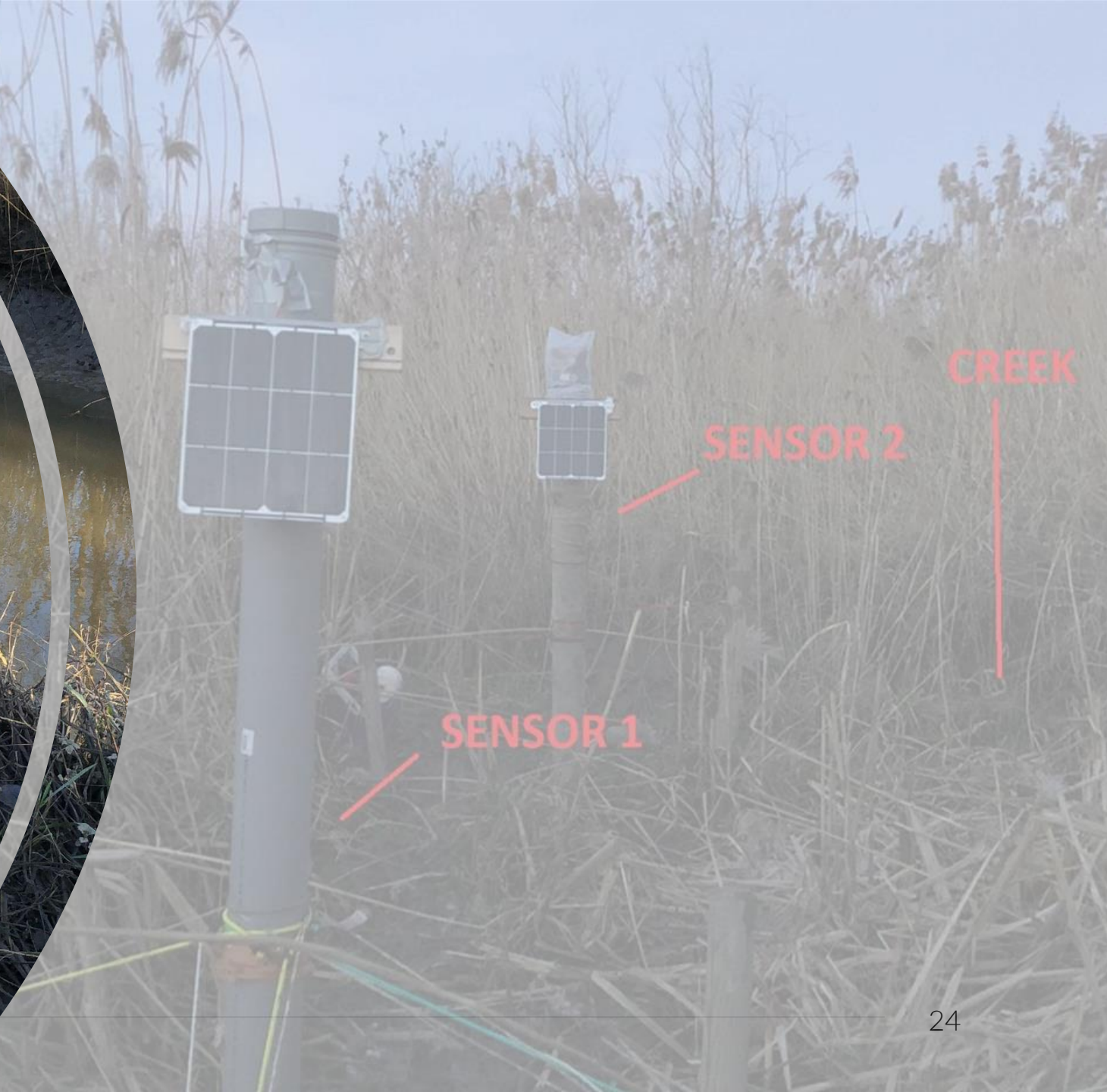
# Groundwater drainage



# Real time flux measurements

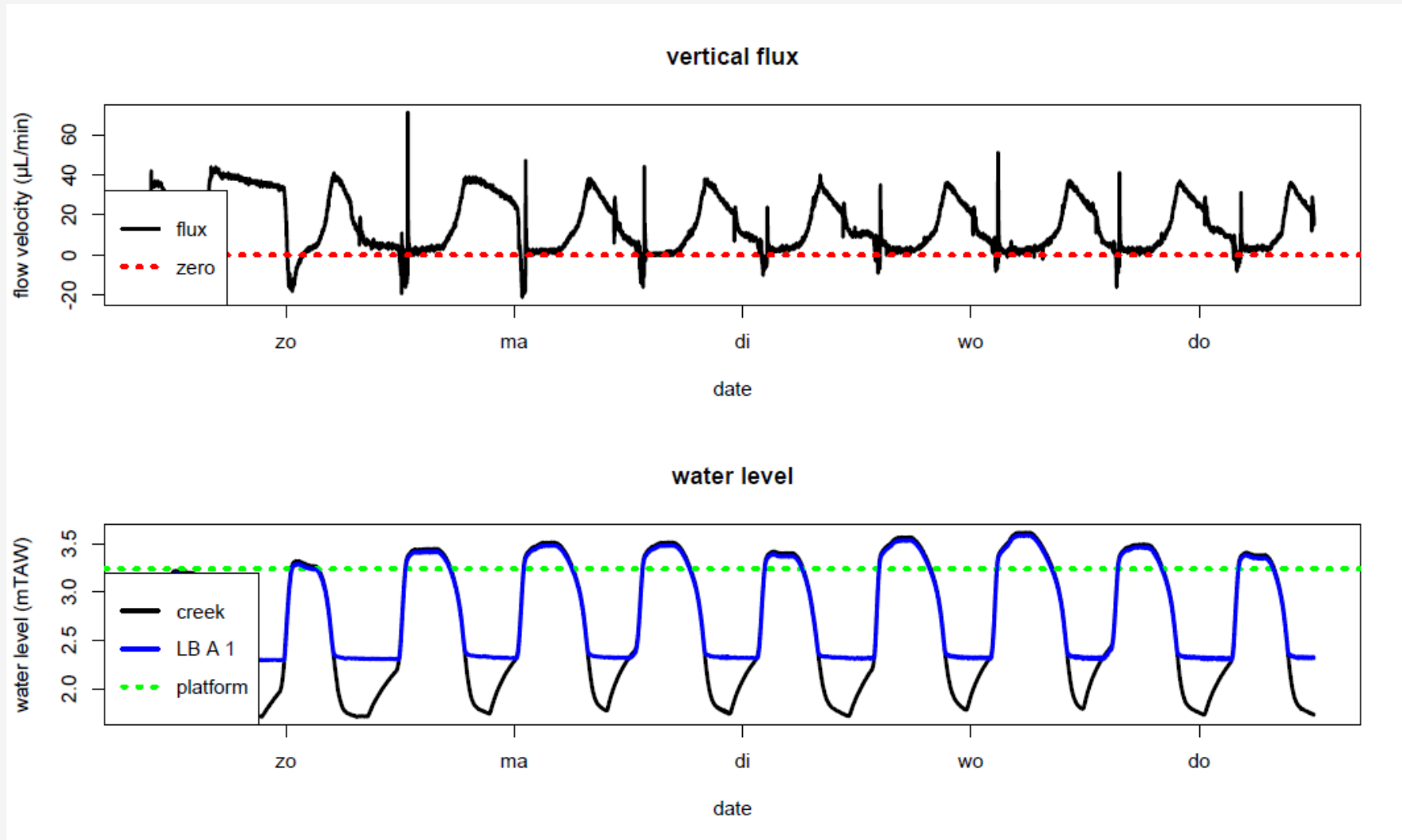




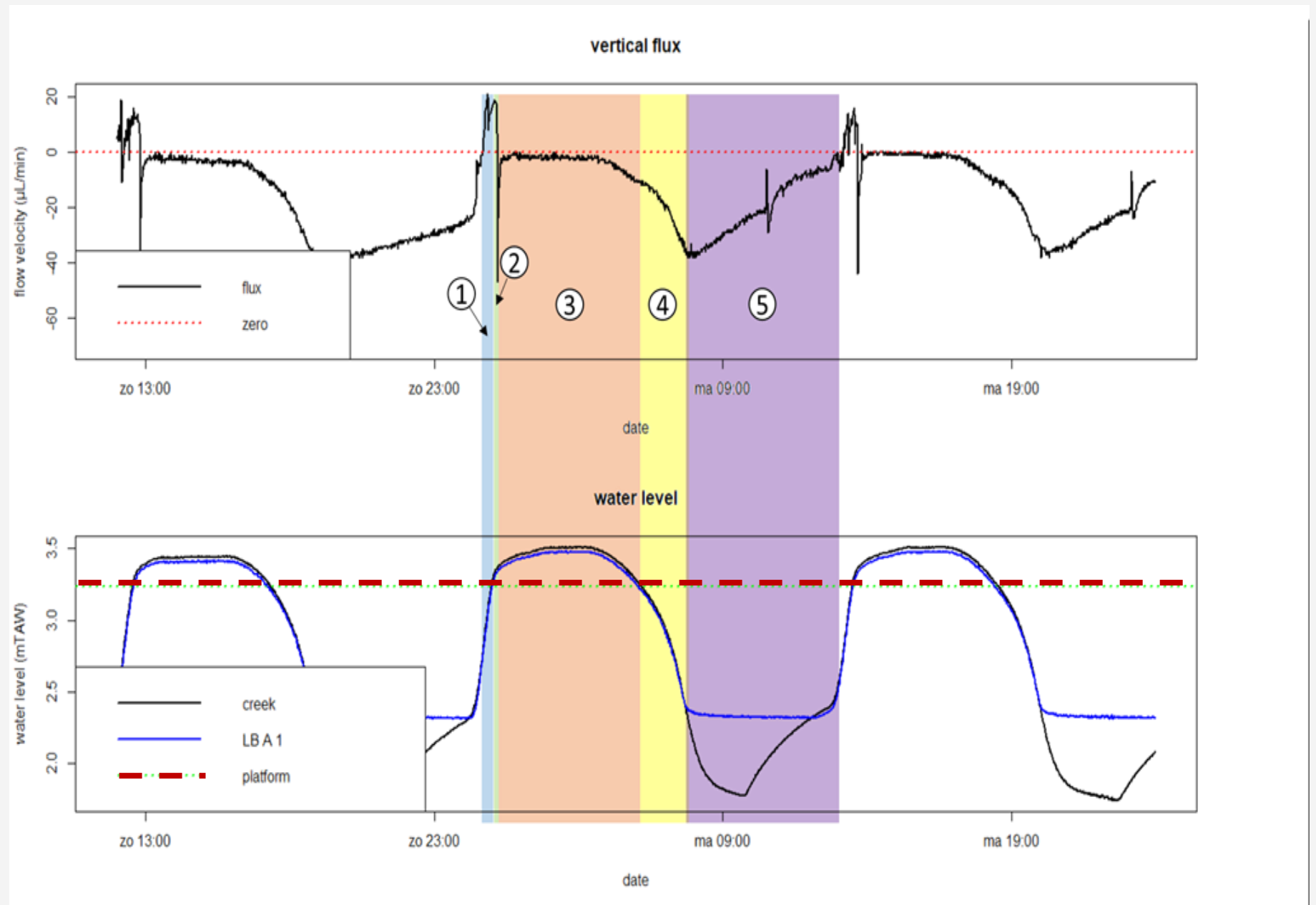




# Direct-push installation - Vertical flux near the creek

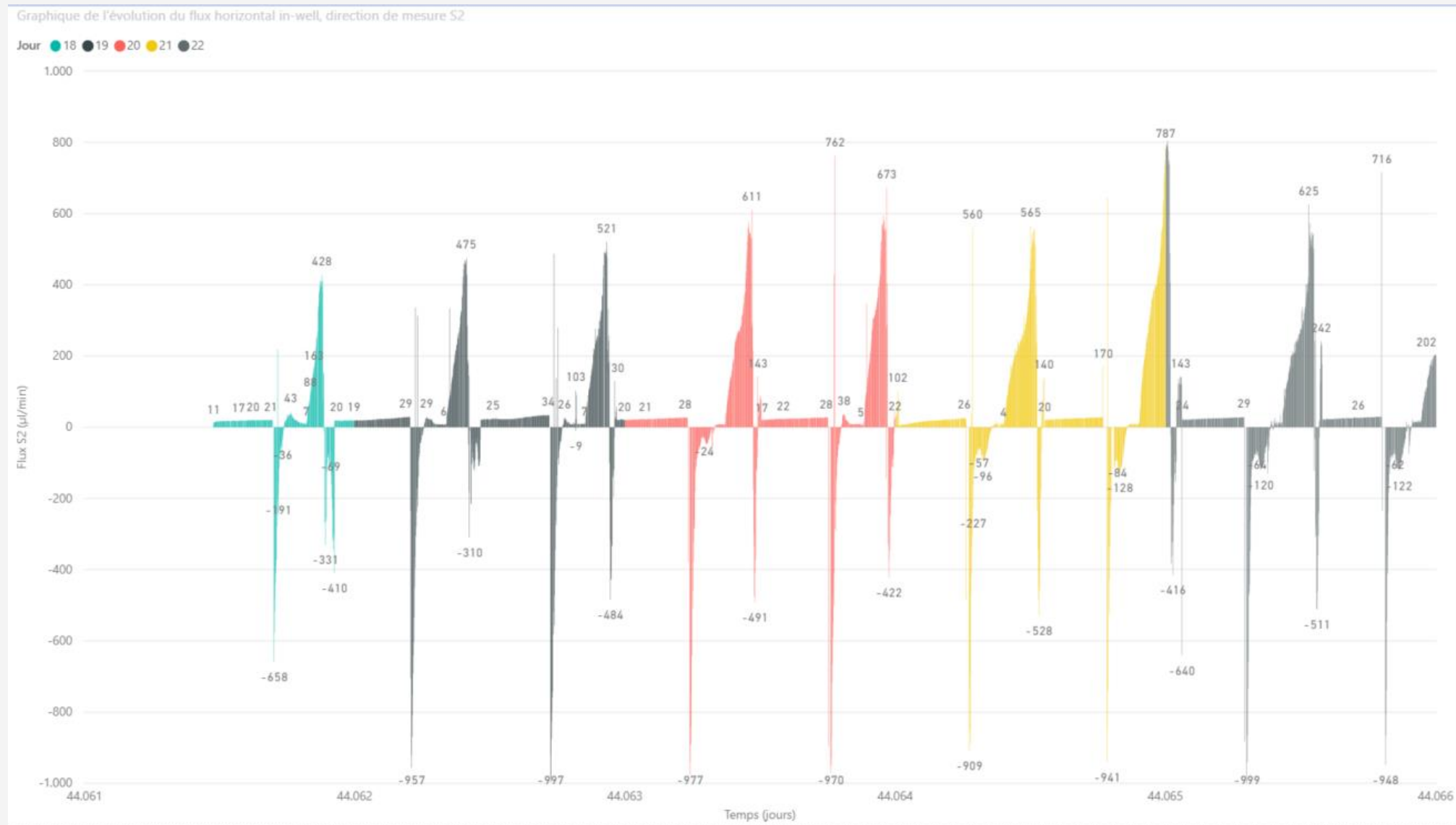


# Vertical flux



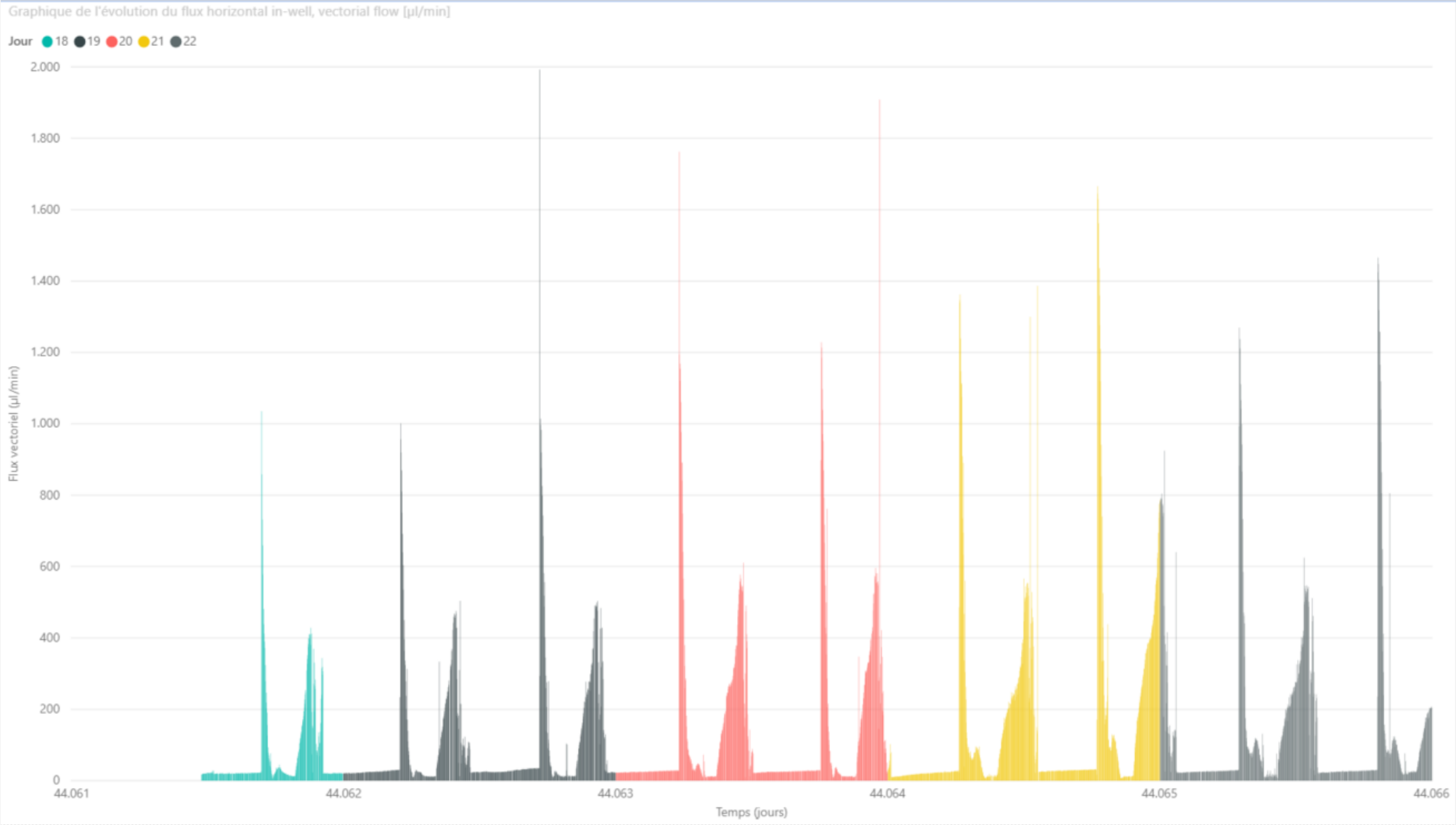


# In-well installation: Horizontal flux perpendicular to creek





# In-well installation: Calculated total flux

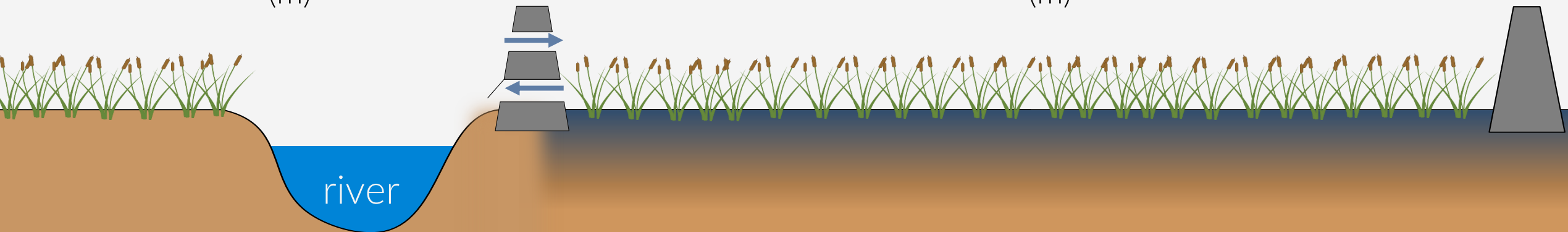
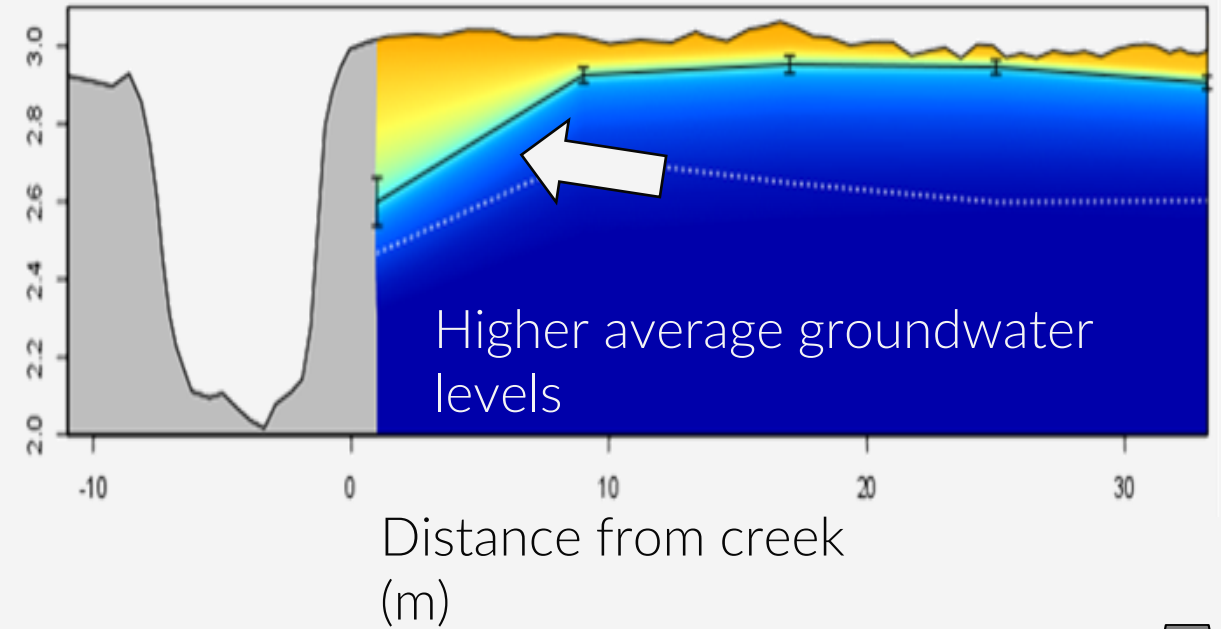
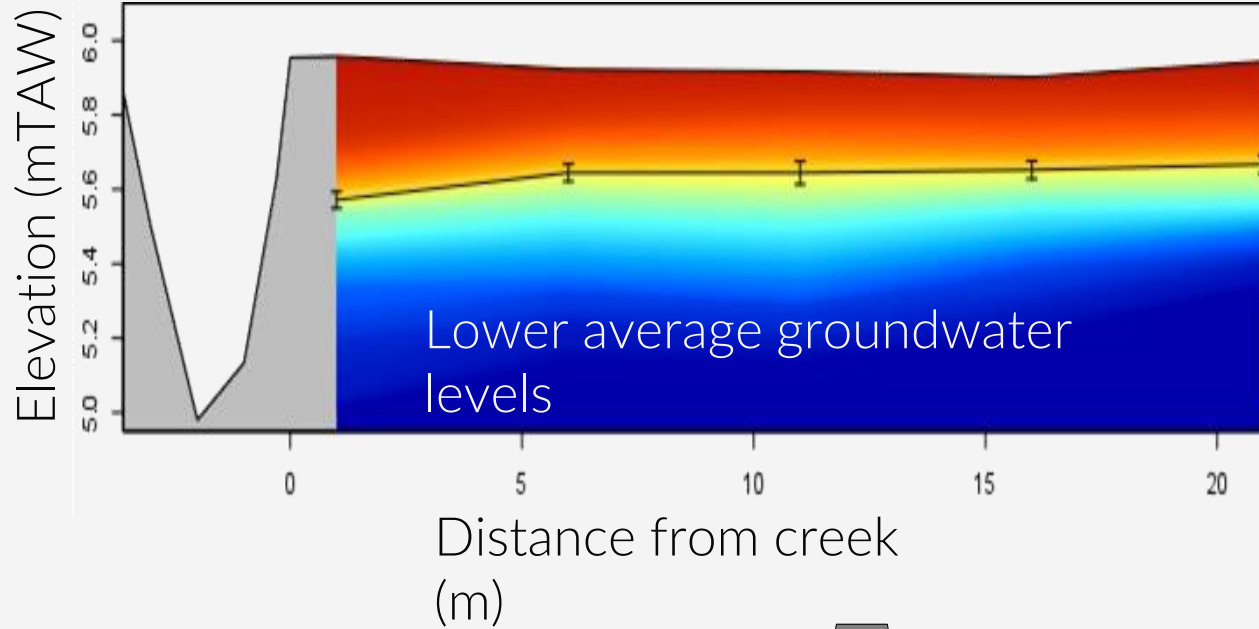




# Reduced groundwater dynamics

Natural marsh

Restored marsh



# RESANAT PROJECT: DE LIEVE





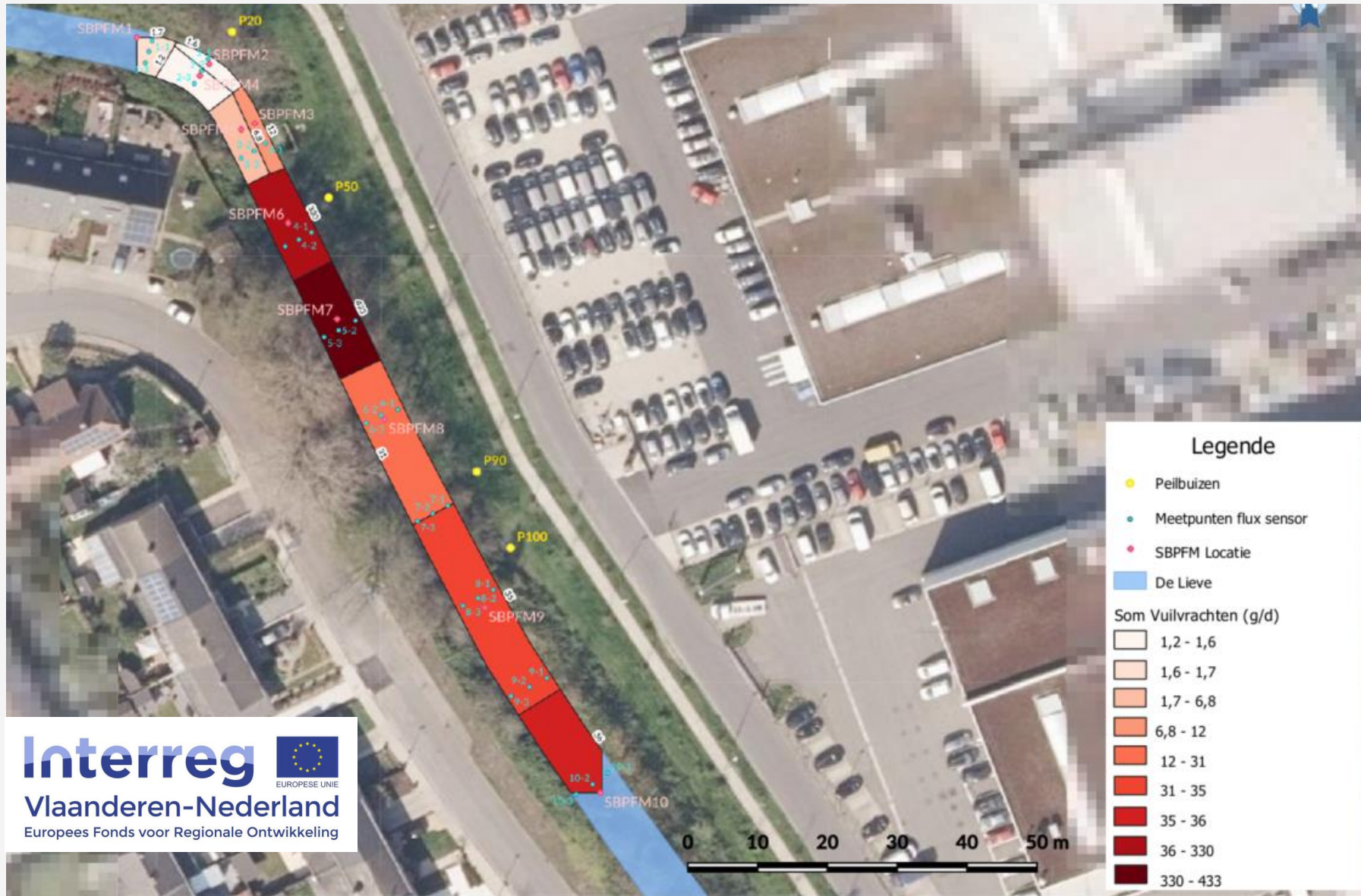






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 Vlaanderen-Nederland  
 Europees Fonds voor Regionale Ontwikkeling

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 Europees Fonds voor Regionale Ontwikkeling



A workshop filled with various tools and equipment. The background is a wooden wall with numerous tools hanging on it, including hammers, wrenches, and saws. Shelves on the right side are filled with organized toolkits and other equipment. The overall scene is a well-stocked, professional workshop.

# iFLUX Services



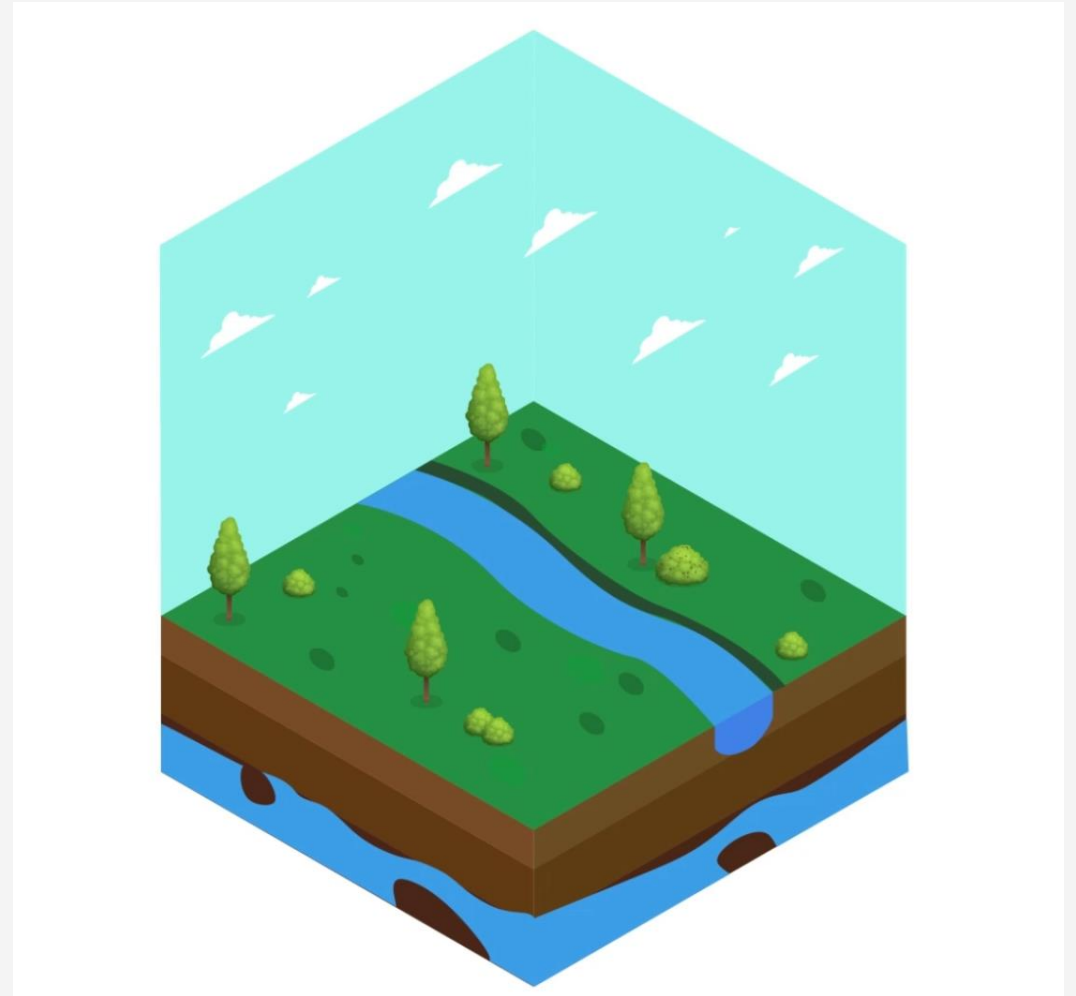
# REMEDIATION



- *Calculate source strength*
- *Optimize remediation design*
- *Shorten after care monitoring*
- *Manage your environmental liabilities*

# ENVIRONMENT

- *Estimate (ground)water retention potential to bridge periods of drought*
- *Forecast and manage groundwater supply and limitations*
  - *Investigate large-scale water infiltration capacity*



# AGRICULTURE



- *Monitor diffuse spreading of environmental contaminants*
- *Manage groundwater depletion*
- *Set-up smart drainage systems*



# INFRASTRUCTURE

- *Set-up smart dewatering systems*
- *Investigate local infiltration capacity*



# NEW PILOT?








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iFLUX



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