Nabron

Naturally increased levels of Arsenic in the coastal provinces of the Netherlands

Nederlands Instituut voor Toegepaste Geowetenschappen TNO

What is the problem

- **How to deal with naturally occurring high arsenic levels?**
  - Current regulations in the Netherlands: concentrations > intervention value --> then clean-up / remediation
- **Inventory of existing problems of policy-makers**
  - Large area with similar problems : AREA-SPECIFIC
  - Local problems: building permits/ excavations…

Legislation Netherlands

	SOIL	GROUNDWATER
Intervention value (NL)	55 mg/kg d.s	60 ug/l
Guideline value (WHO)	29 mg/kg d.s.	10 ug/l

Advice from National agency for the protection of soils:

- Arrive at an INTEGRATED policy to reduce the threats of naturally occurring substances to a multi-functional landuse
- How: Soil management plan (soil + groundwater)
- Steps:

NABRON

  - increase knowledge
  - inventory of limitations of landuse with respect to As
  - estimate the effects of changes in landuse
  - estimate the effects of changing environmental conditions
  - (monitoring)

NABRON Participants

- TNO
- University
- Private Consultancy
- Coastal provinces
- National Agency

The NABRON project:

- **Aim:**
  To support policy-makers with decision-making of the use of soil, groundwater and stream bed sediments in areas with naturally increased Arsenic concentrations

- **How:**
  SYSTEM-APPROACH and AREA SPECIFIC:
  Why is ‘As’ there? What are the common factors?

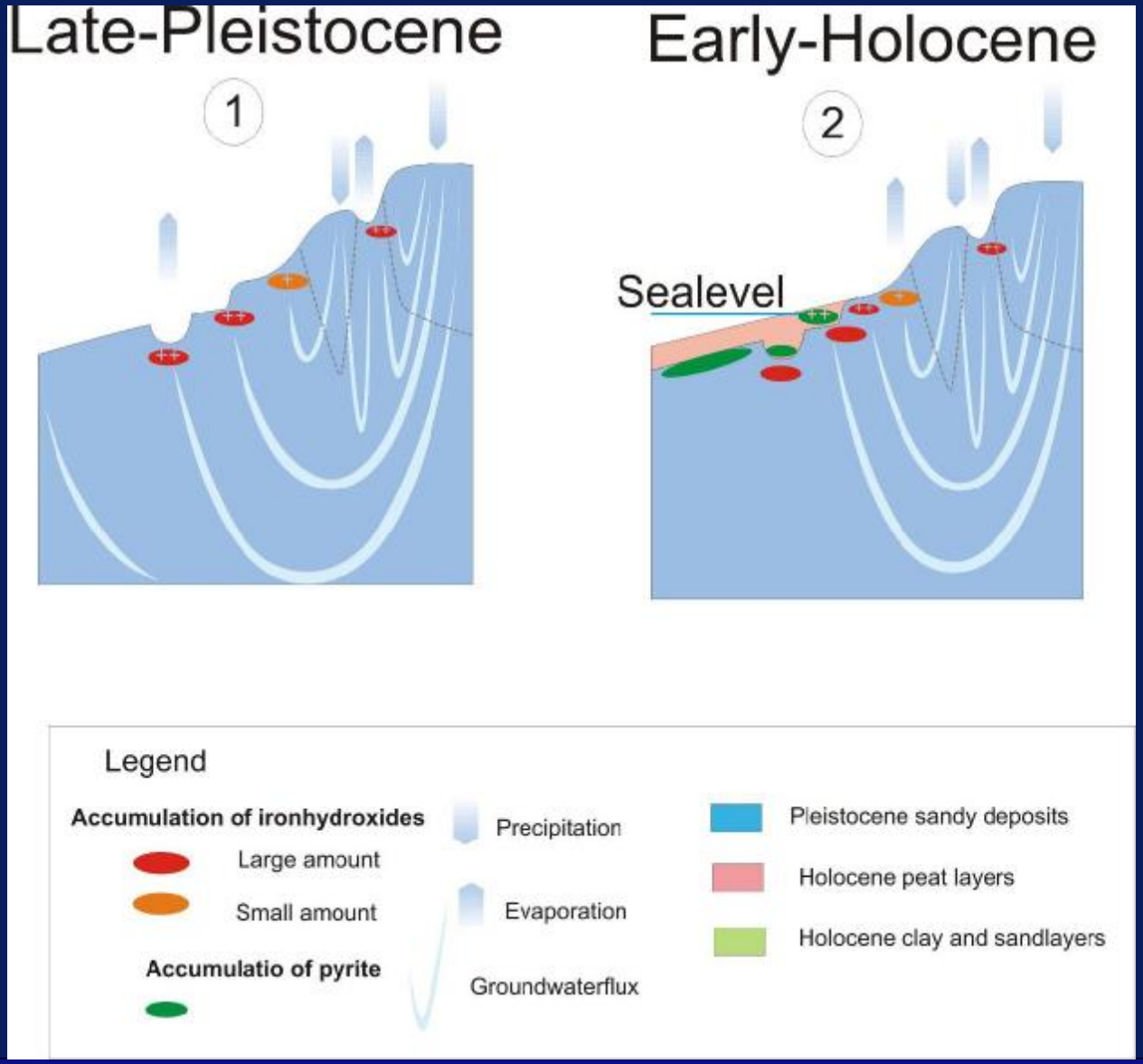
- **Results:**
  - Risk maps
  - Soil management plan
  - Practical guide

Increasing knowledge: occurrence of As in…

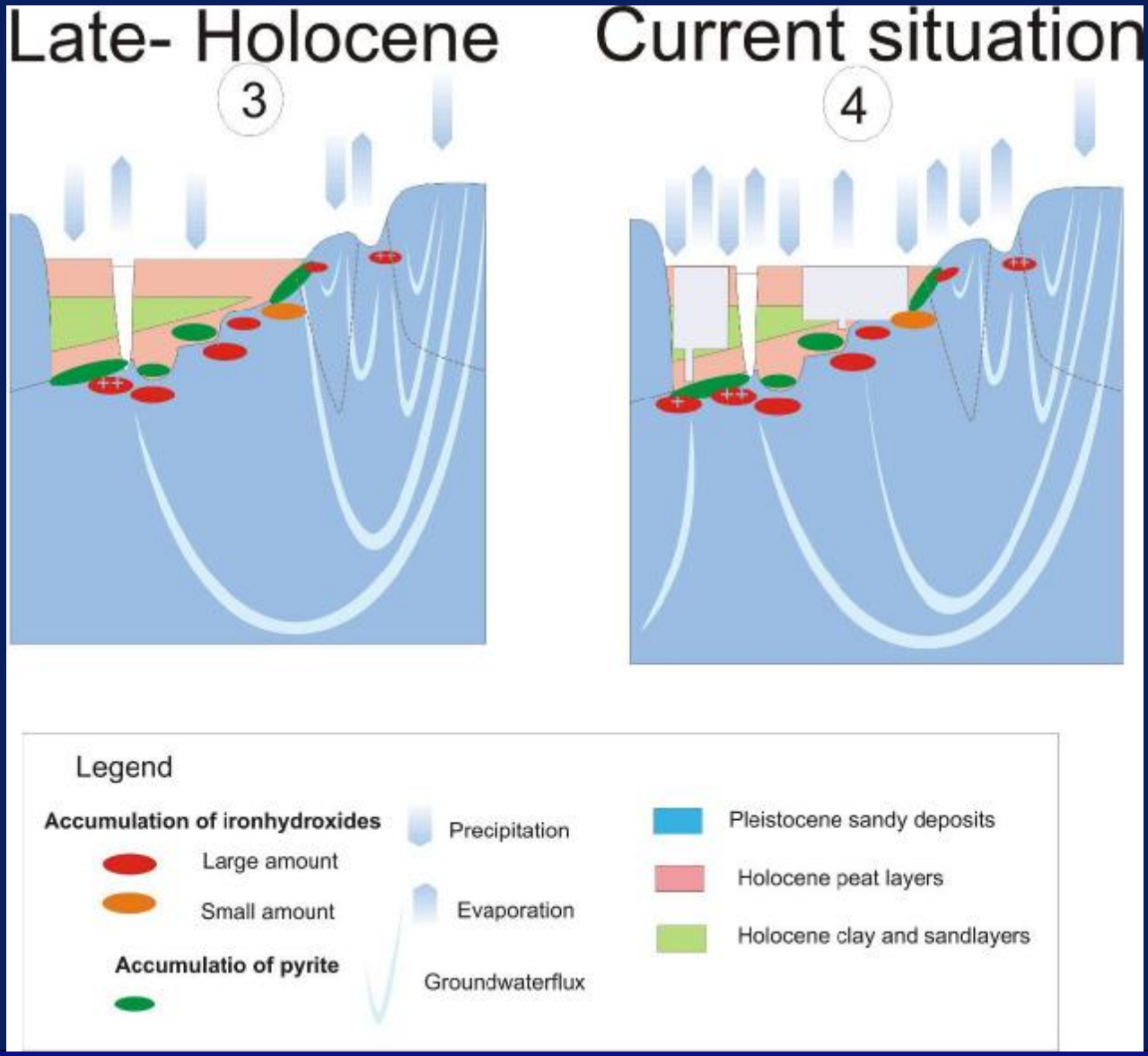
“Pyrite type”

“Iron-hydroxide-type”

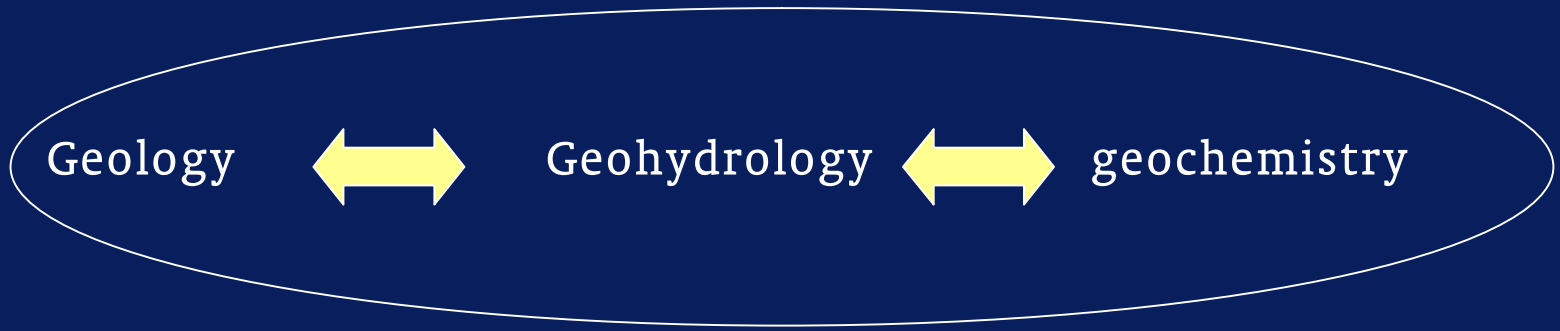
Increasing knowledge: where

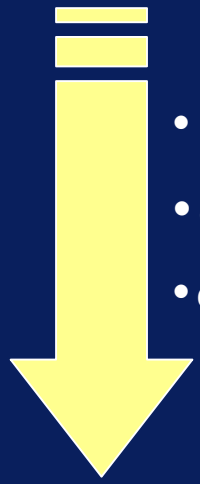


Increasing knowledge: where



Combine knowledge: Integrated approach



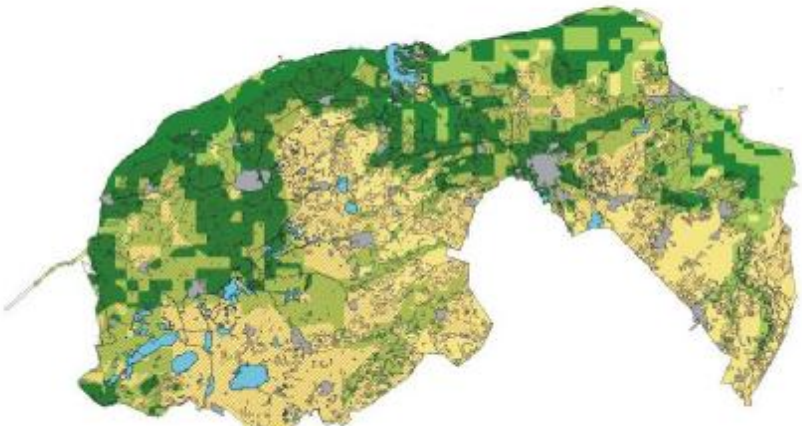


- **Risk maps**
- **effect of environmental conditions**
- **effect of land use**

Soil management plan

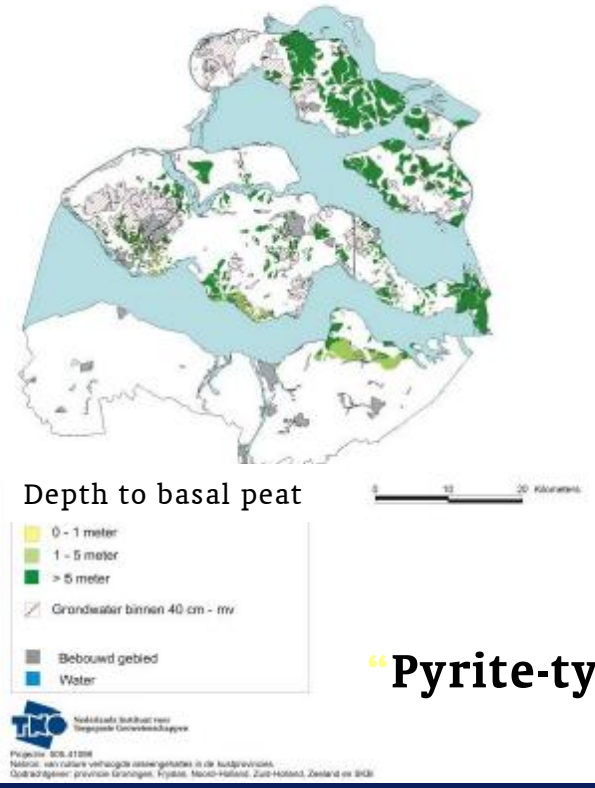
RISK MAP:
Possibility of increasing regulatory values

Regional pattern of high As concentration in the soil and freatic groundwater



"Fe-OOH-type

Regional pattern and depth of high As concentration in peat

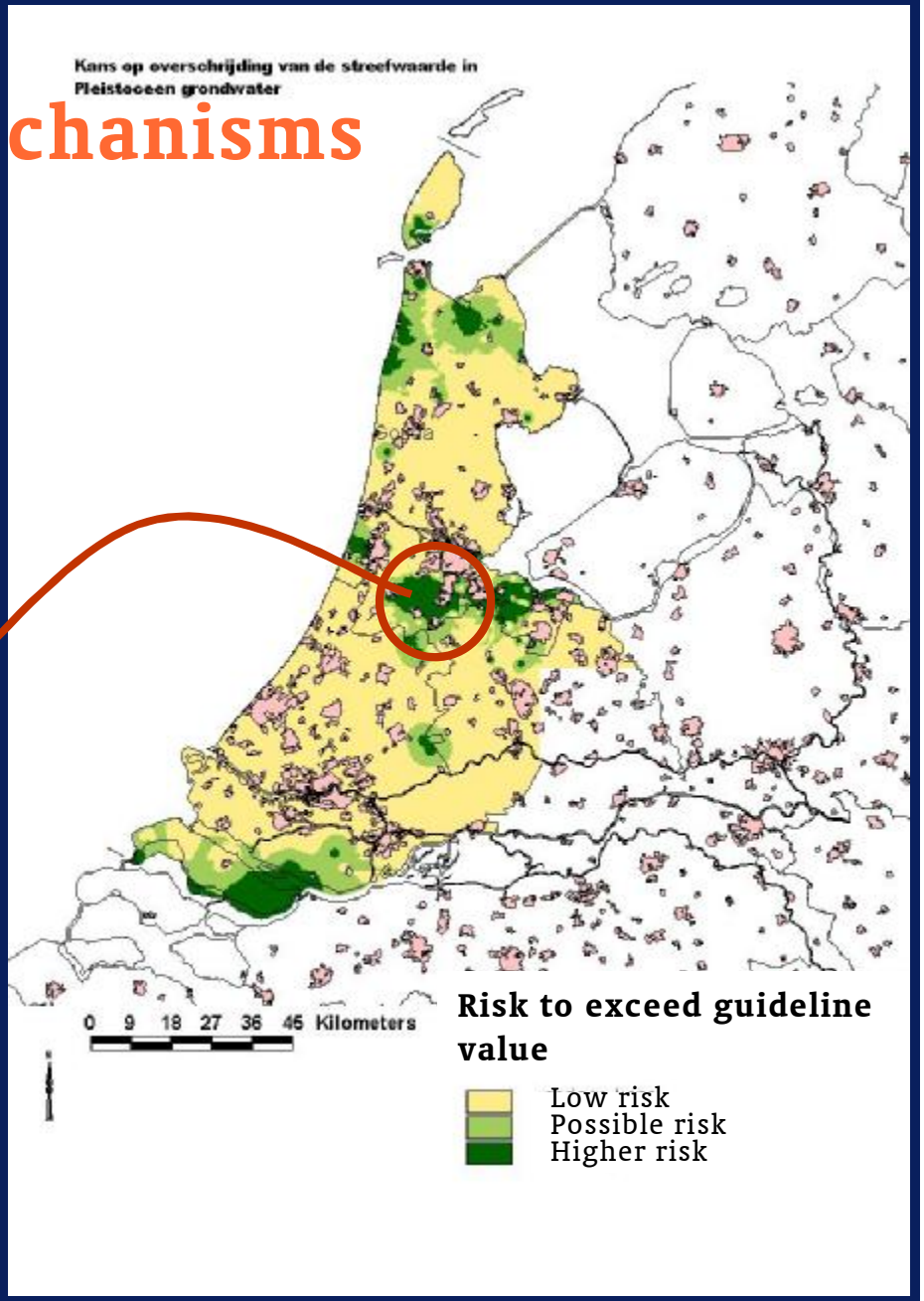


"Pyrite-type

Understanding the mechanisms

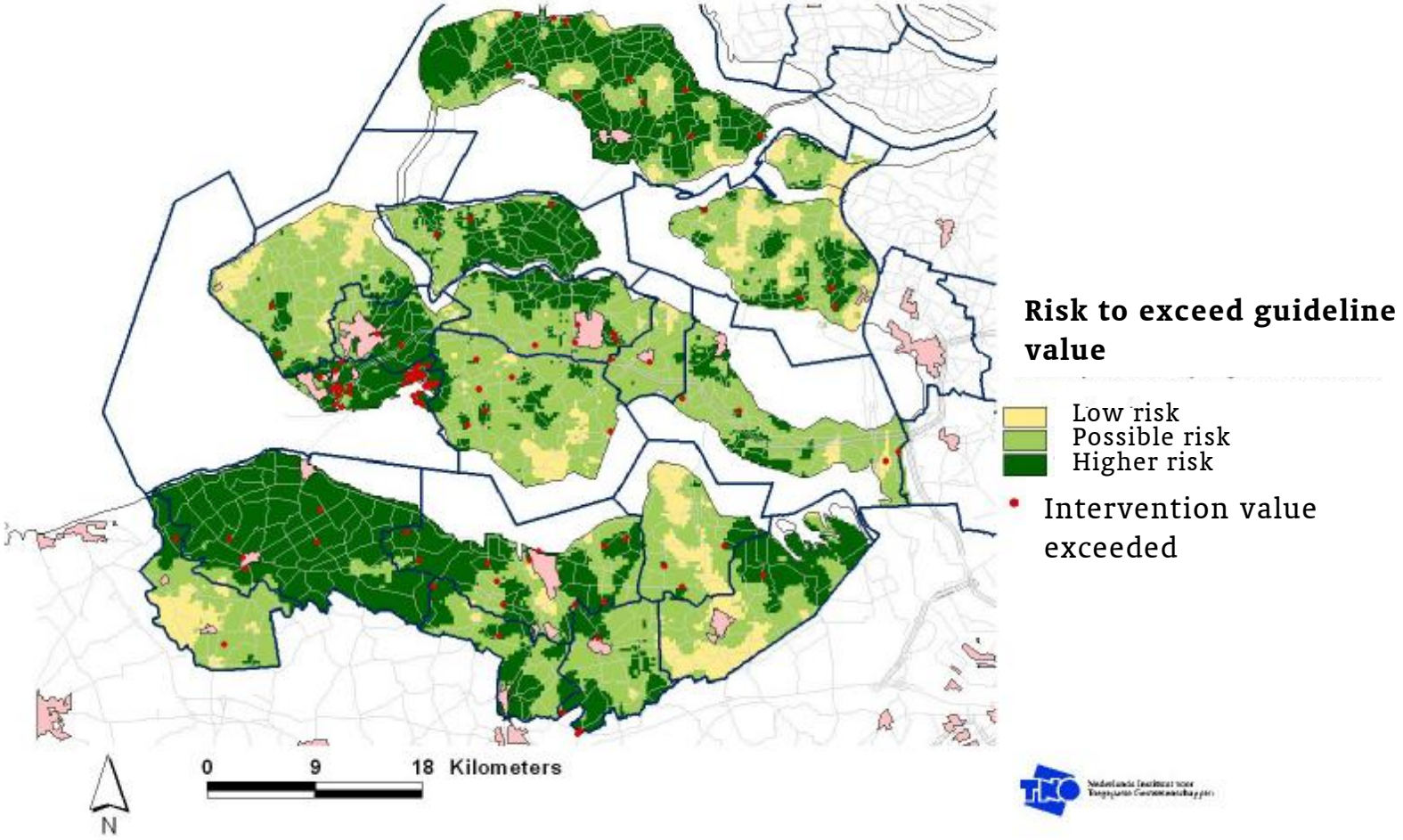
- **Mechanisms explain regional patterns and predict where and at what depth high As-concentration can be expected**

- **Amsterdam area (ice-pushed ridges):**
  - High concentrations in (deep) groundwater in restricted area
  - Area also shows high concentrations in basal peat
  - Bog iron ore at greater depth



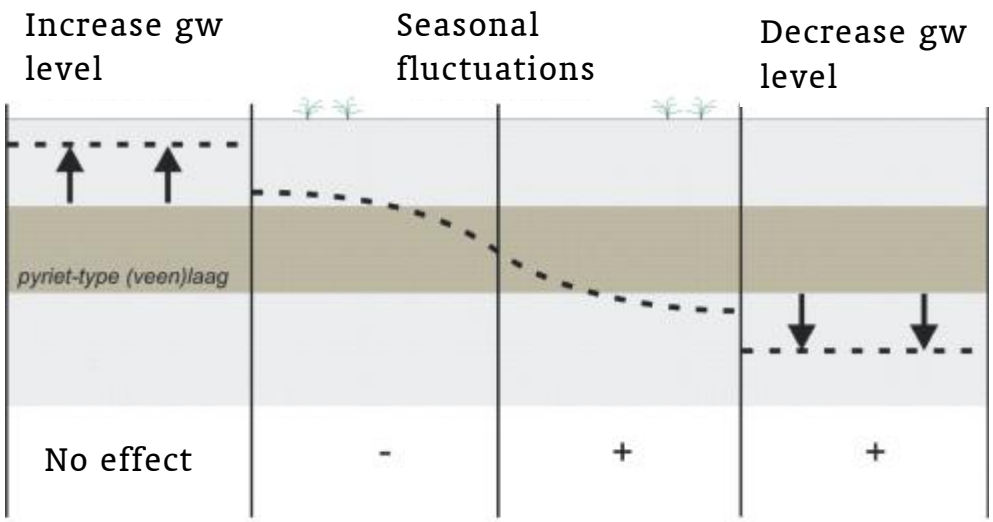
RISK MAP:
Detailed mapping of increased As: Fe-OOH type

Risk of exceeding the guideline value/ intervention value of As in freatic groundwater

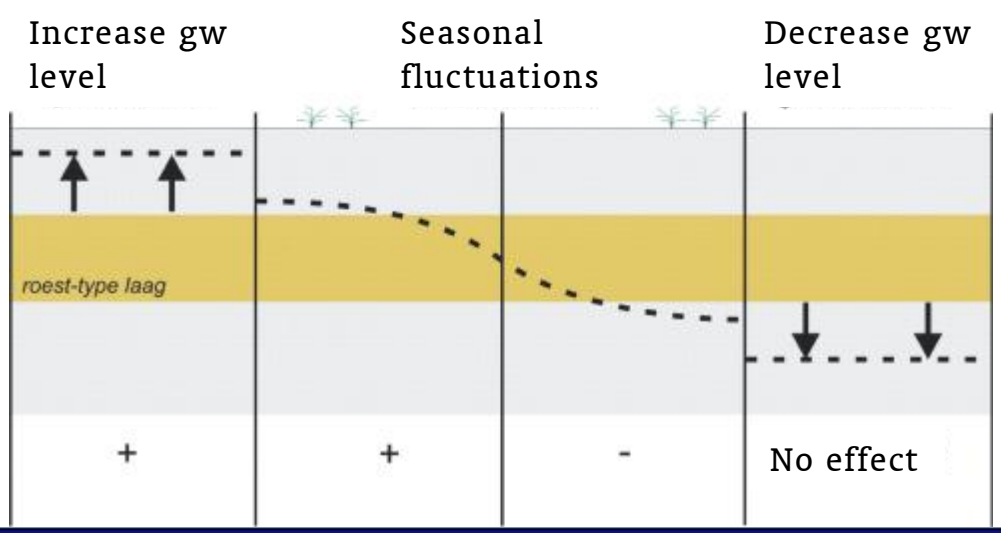


Effect of environmental conditions (1)

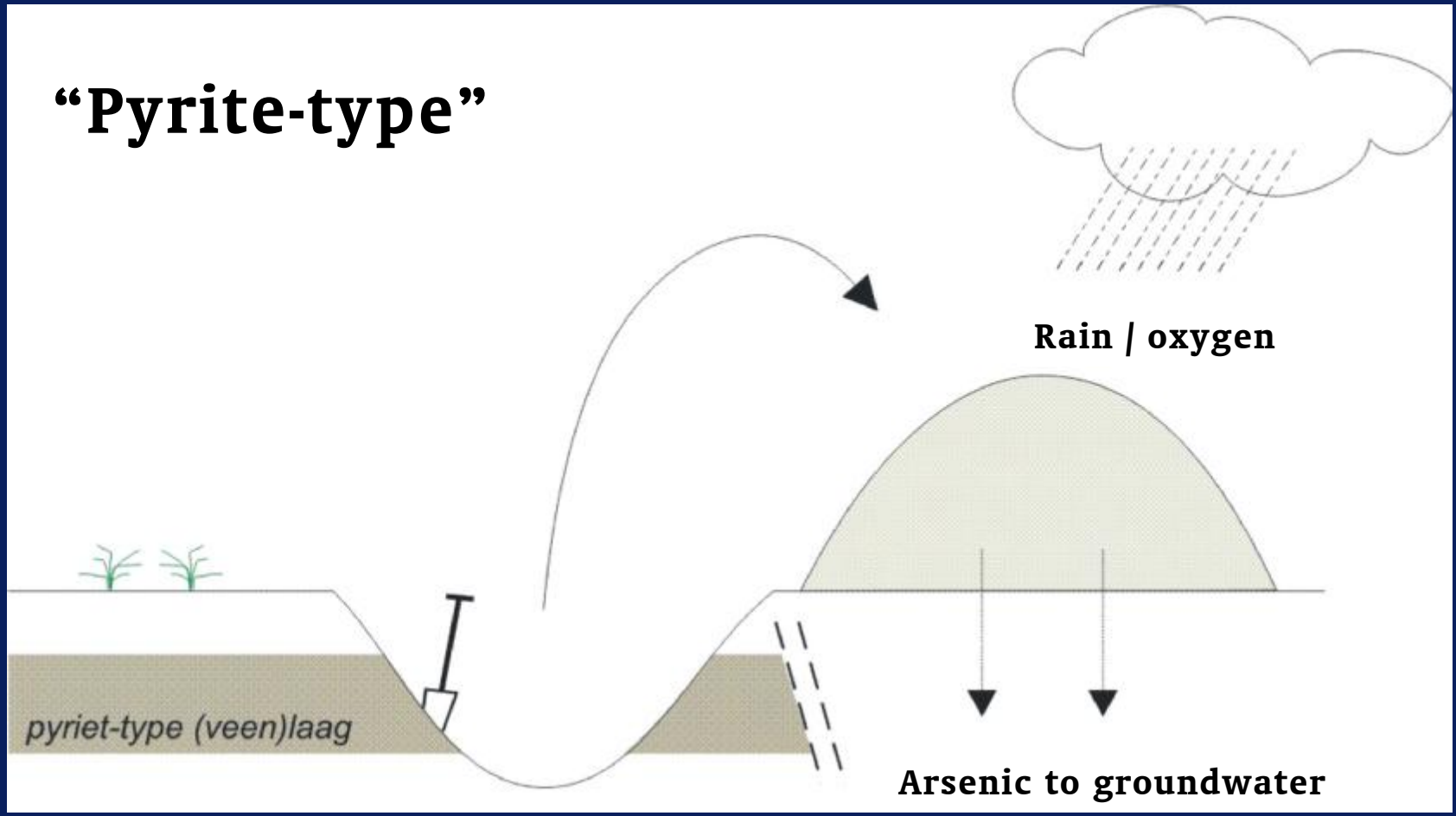
"Pyrite type"



"Fe-OOH type"

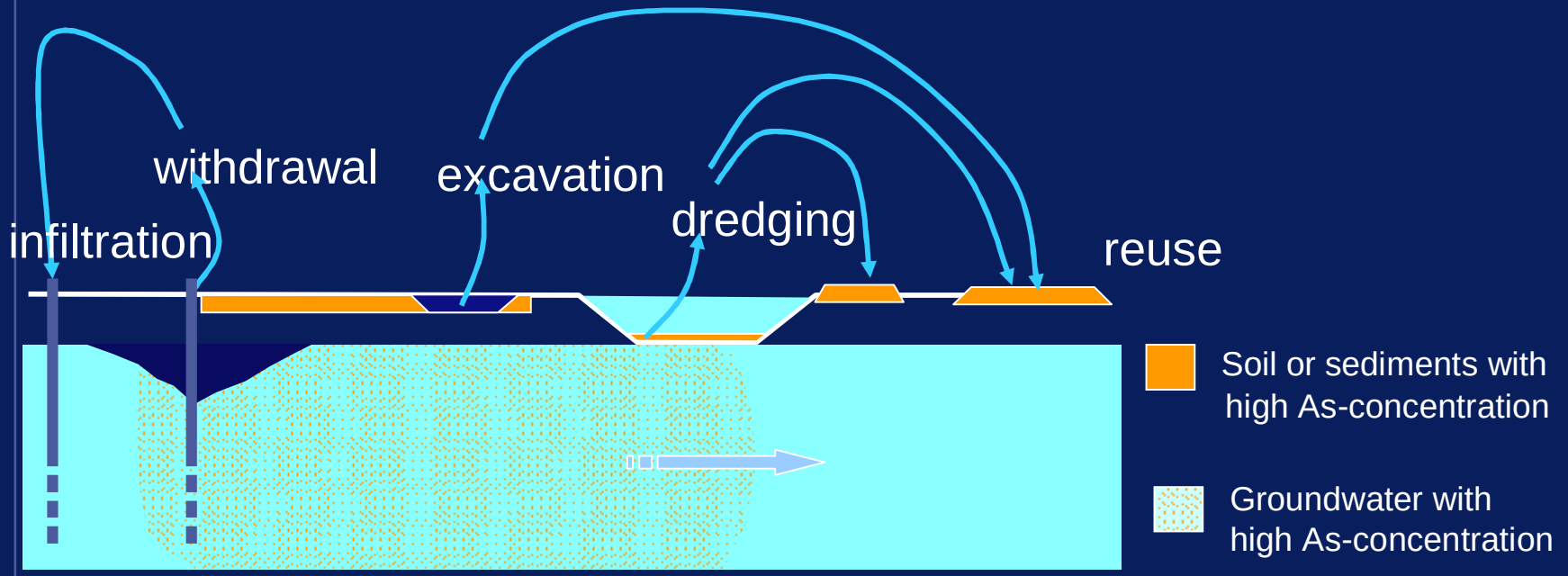


Effect of environmental conditions (2)

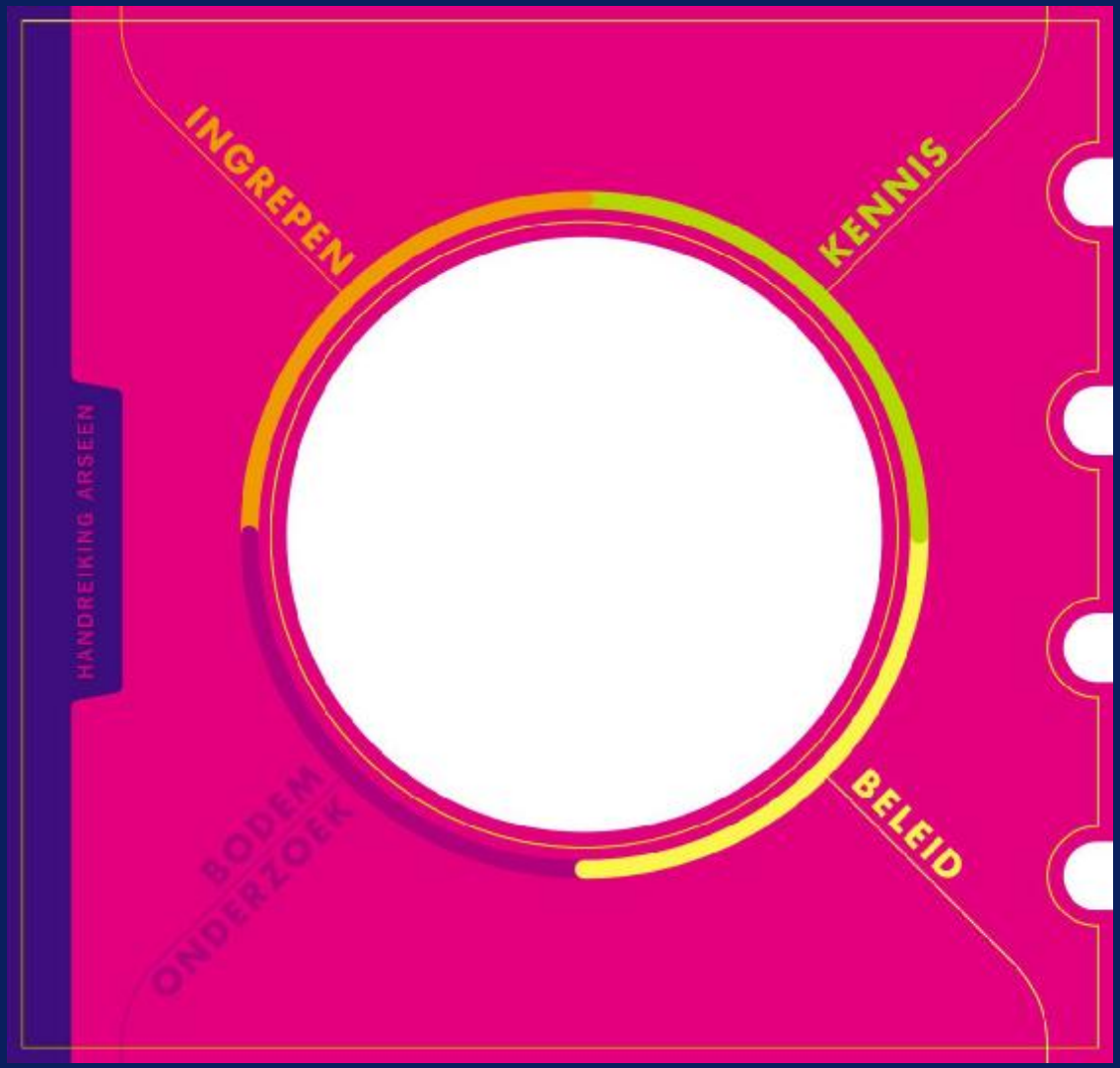


Effect of land use

- **Interventions in As-rich area can contribute to the spread or release of arsenic**



Practical guide for local authorities



Conclusion:

- **A regional approach is needed**
  - Geographical
  - Administrative
- **National standards are not applicable for natural As**
  - AREA-specific (system)
  - As-type dependent
- **Implementation of policy:**
  - Land use based on (human) risks
  - Assess effect of changes in land use