After Gas

From extraction to restitution:

Exploring a Design Framework for the future of new perspective in Groningen after the closure of gas field



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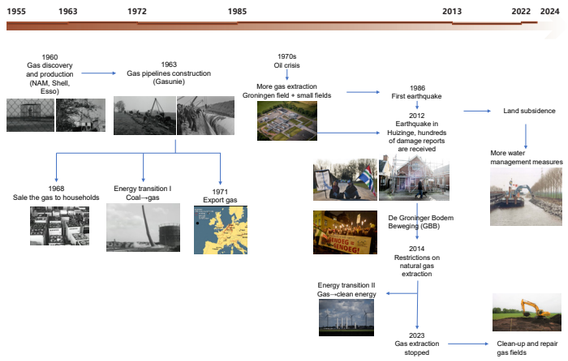
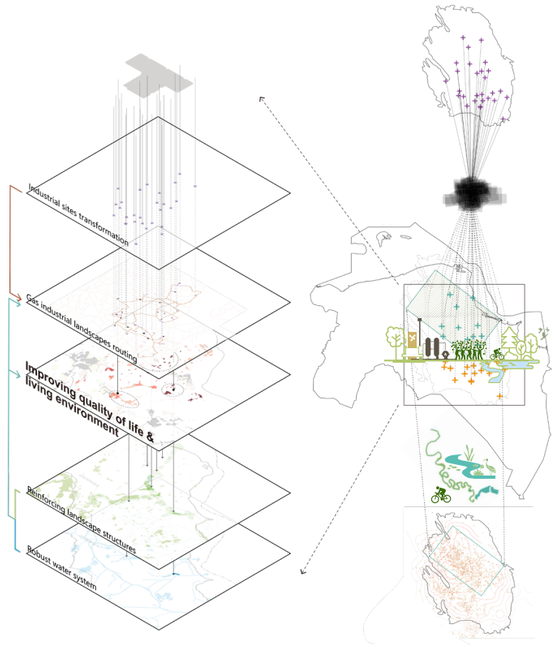
Flowscapes Lab: Landscape Architecture Principles - Scale Continuum

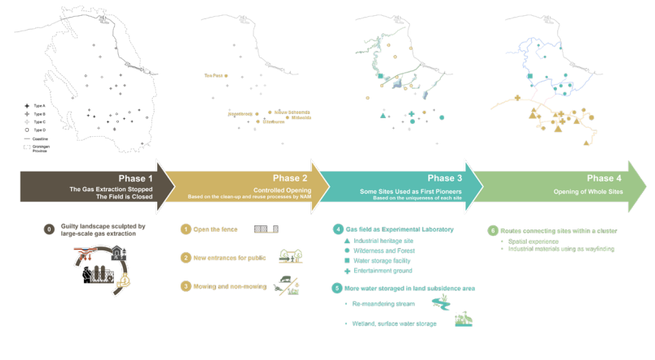
Presentation structure



The gas extraction story



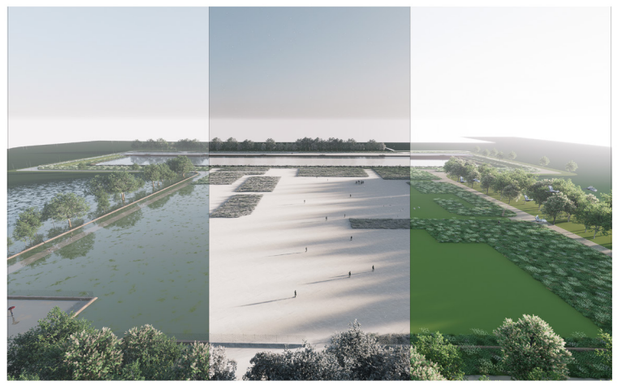
Embracing the guilty landscape



Design framework



Problems caused by long-term gas extraction



Design exploration

The story of gas extraction



From " No Cheers" to "A Historic day"





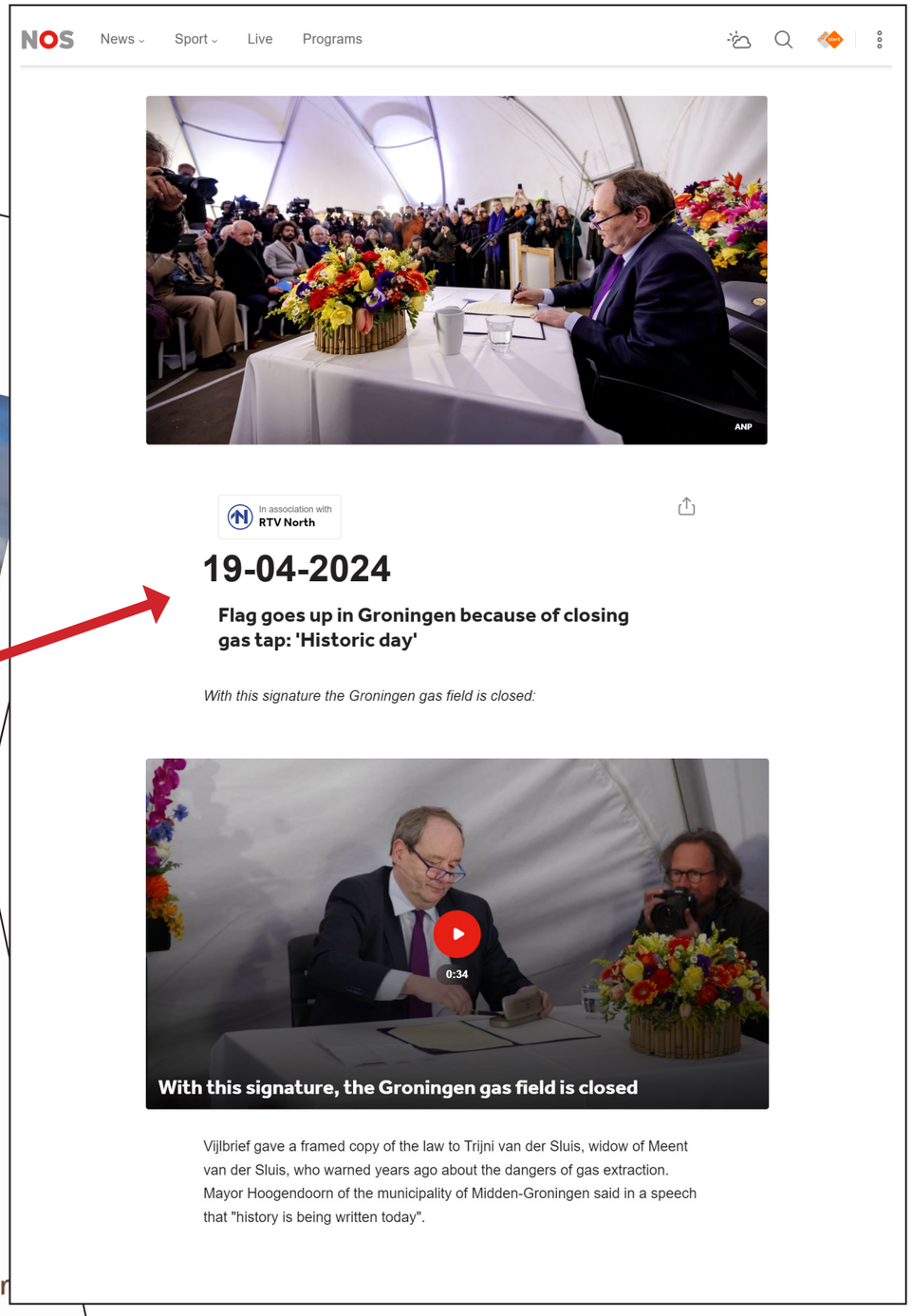


Groningenveld definitief dicht! Hang komende vrijdag samen met de GBB de vlag uit!

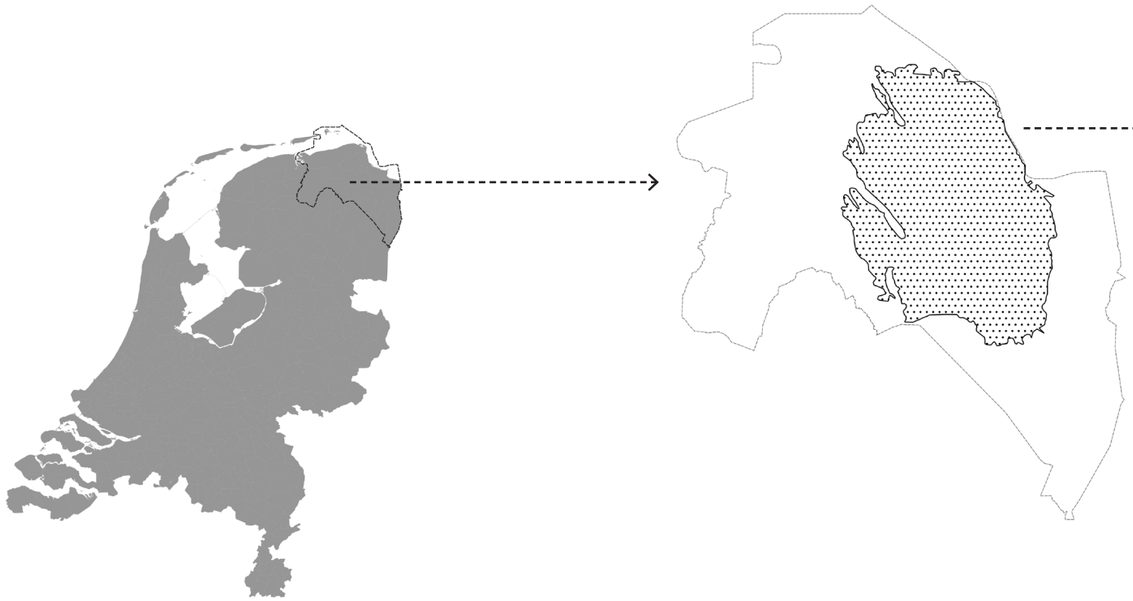
Gepubliceerd: woensdag 17 april 2024

OPROEP: Hang komende vrijdag samen met de GBB de vlag uit! De wet voor het beëindigen van de gaswinning is dinsdagavond aangenomen in de Eerste Kamer. Komende vrijdagmiddag wordt de wet symbolisch in Groningen ondertekend. Het definitief sluiten van het Groningenveld is daarmee een feit! We willen gezamenlijk bij dit historische moment stilstaan en hangen daarom de Groningse...

Groninger Bodem Beweging

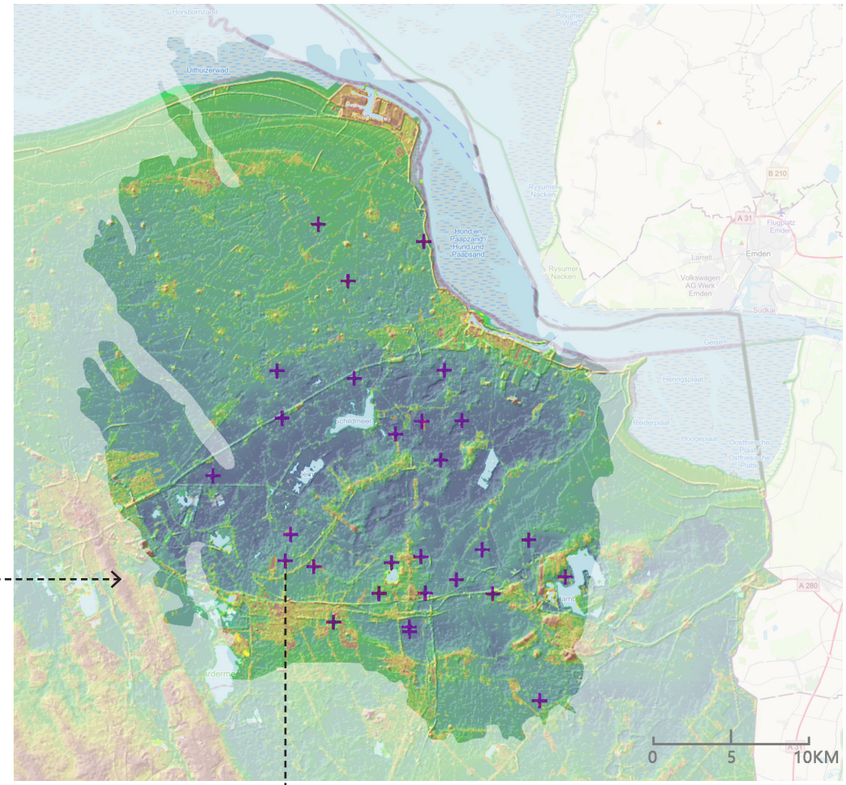


Research focus



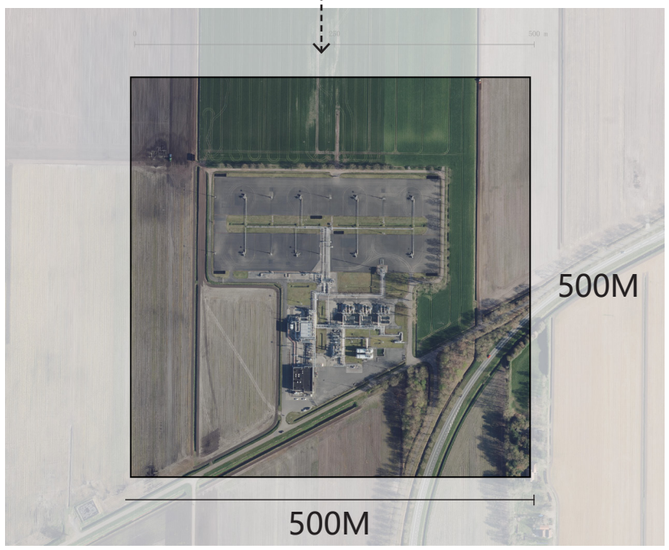
Location

Focus region

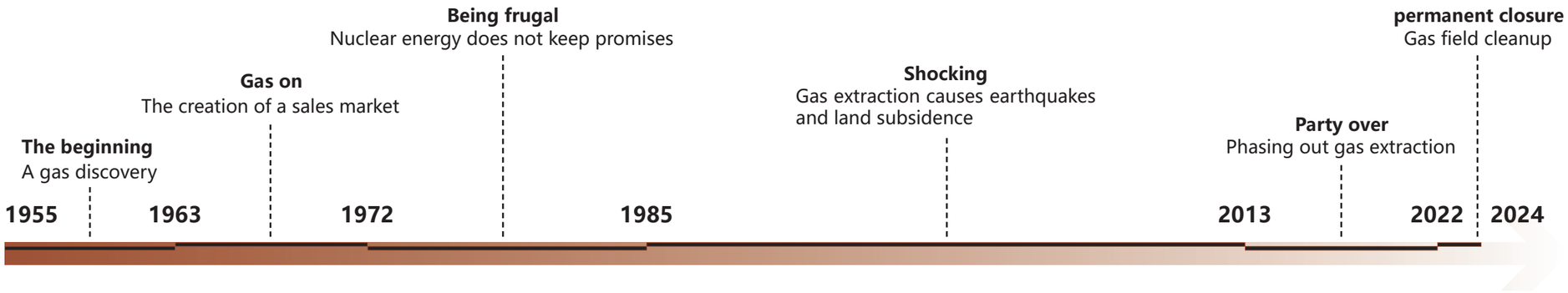




Focus site



The Groningen gas extration timeline and related events



1960
Gas discovery and production (NAM, Shell, Esso)



1963
Gas pipelines construction (Gasunie)



1968
Sale the gas to households



Energy transition I
Coal→gas



1971
Export gas



1970s
Oil crisis

More gas extraction
Groningen field + small fields



1986
First earthquake

2012
Earthquake in Huizinge, hundreds of damage reports are received





Land subsidence

More water management measures



De Groninger Bodem Beweging (GBB)



2014
Restrictions on natural gas extraction

Energy transition II
Gas→clean energy

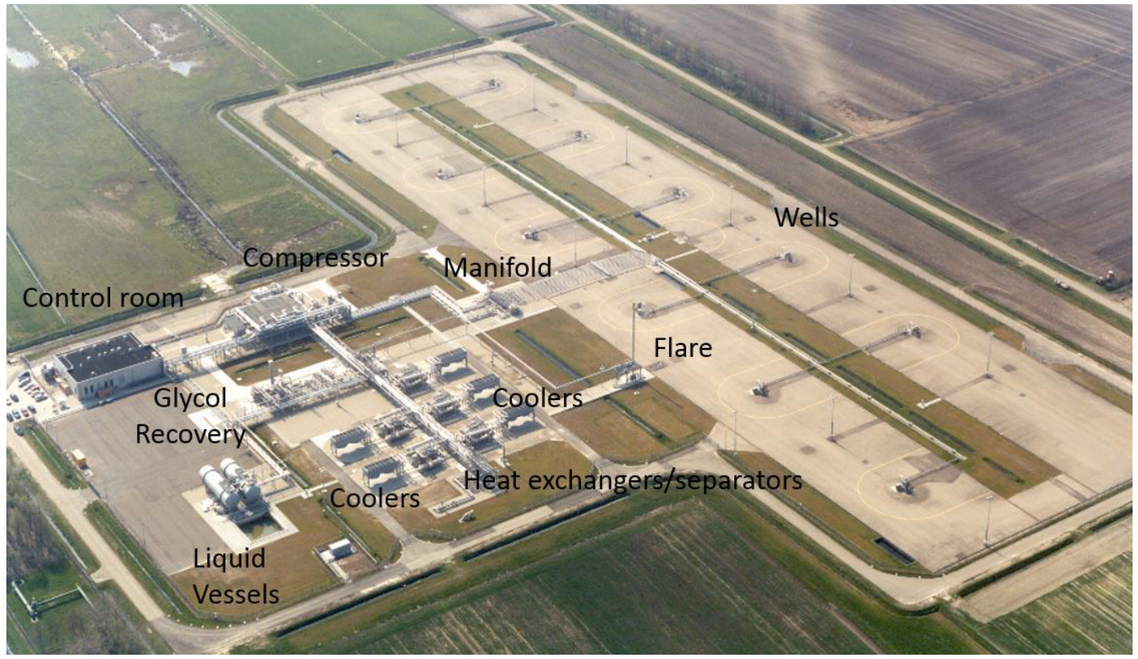


2023
Gas extraction stopped



Clean-up and repair gas fields

Beginning with natural gas extraction



Overview of a production cluster location.
Image from: NAM



Eyes view

Enclosure/Forest



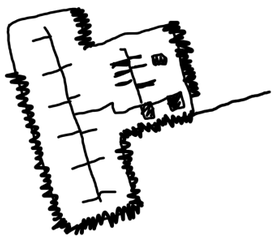


Open/Farmland

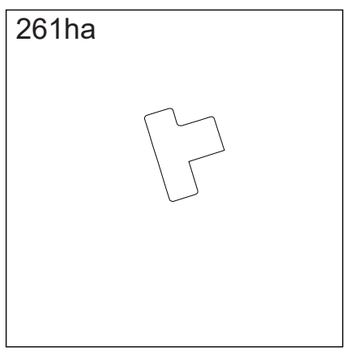


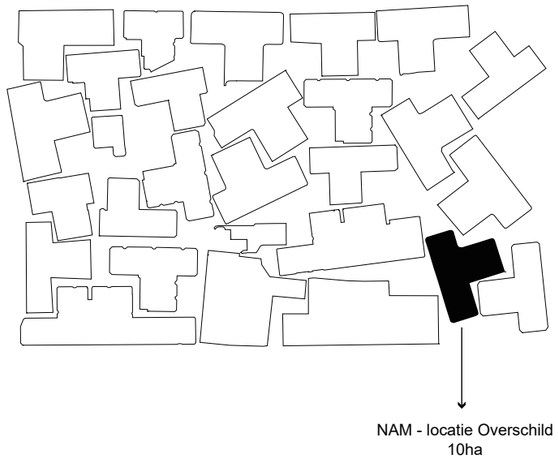
NAM-location Overschild

Open/Extraction wells field



Enclosure/Tree lines







Overschild surroundings

Contrasts in the surroundings



A gas production site in Groningen rural area presents in different scales





















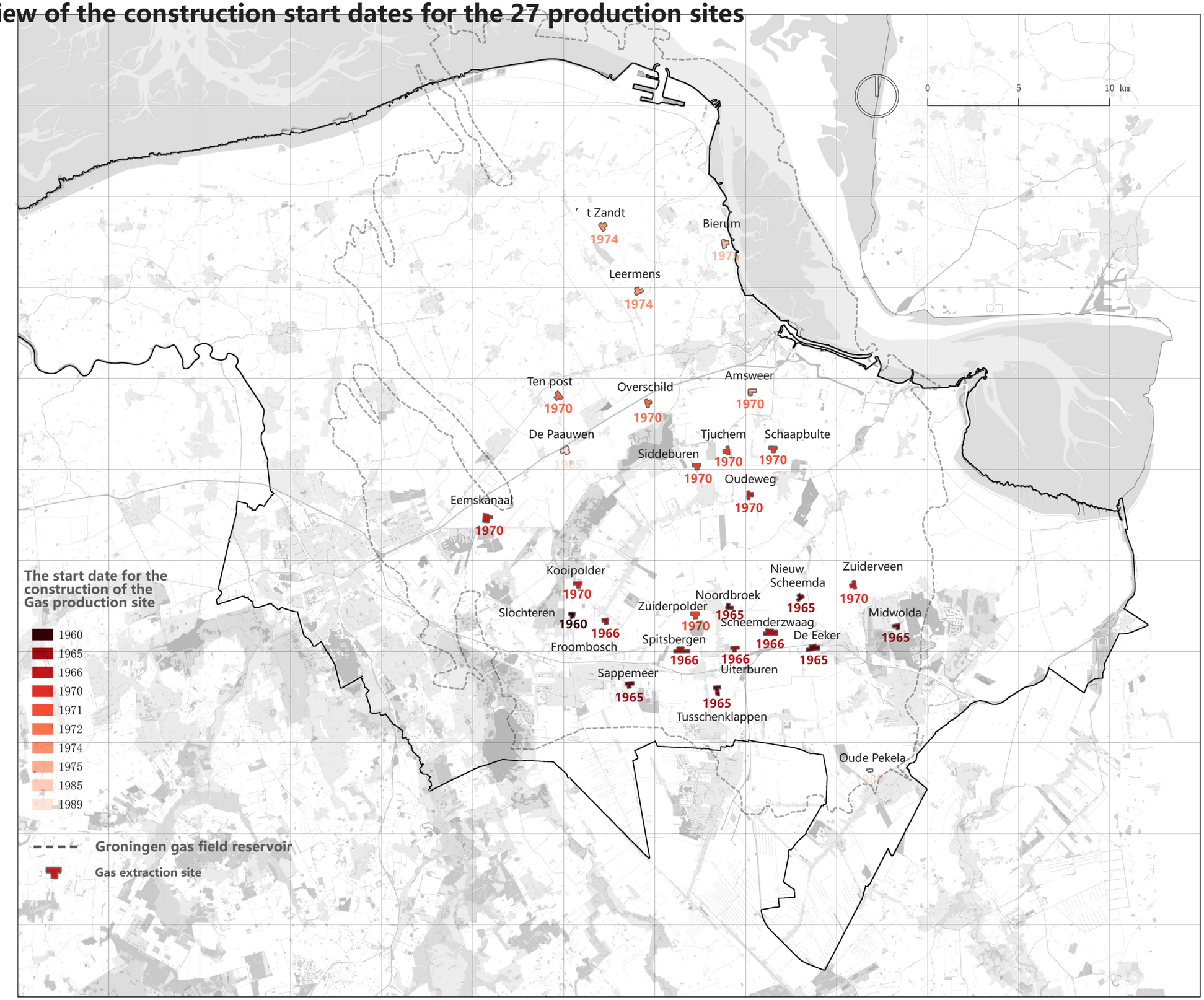






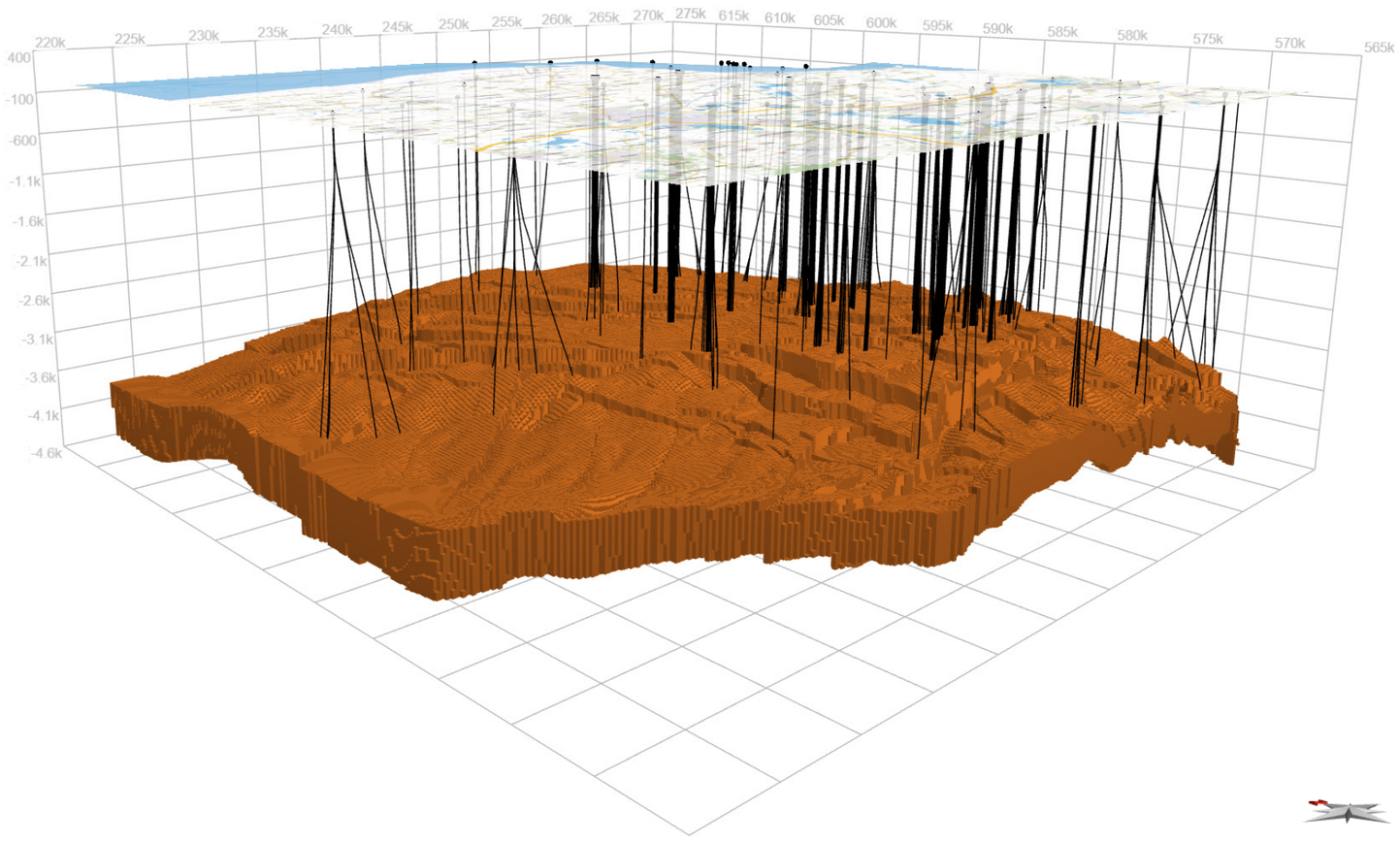

N
0
500m

An overview of the construction start dates for the 27 production sites

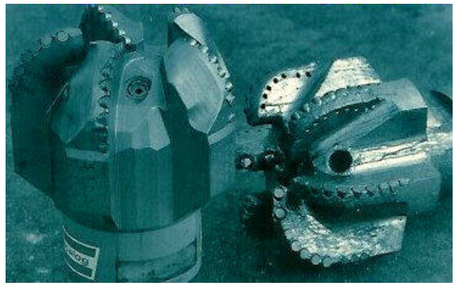


Things happened underground

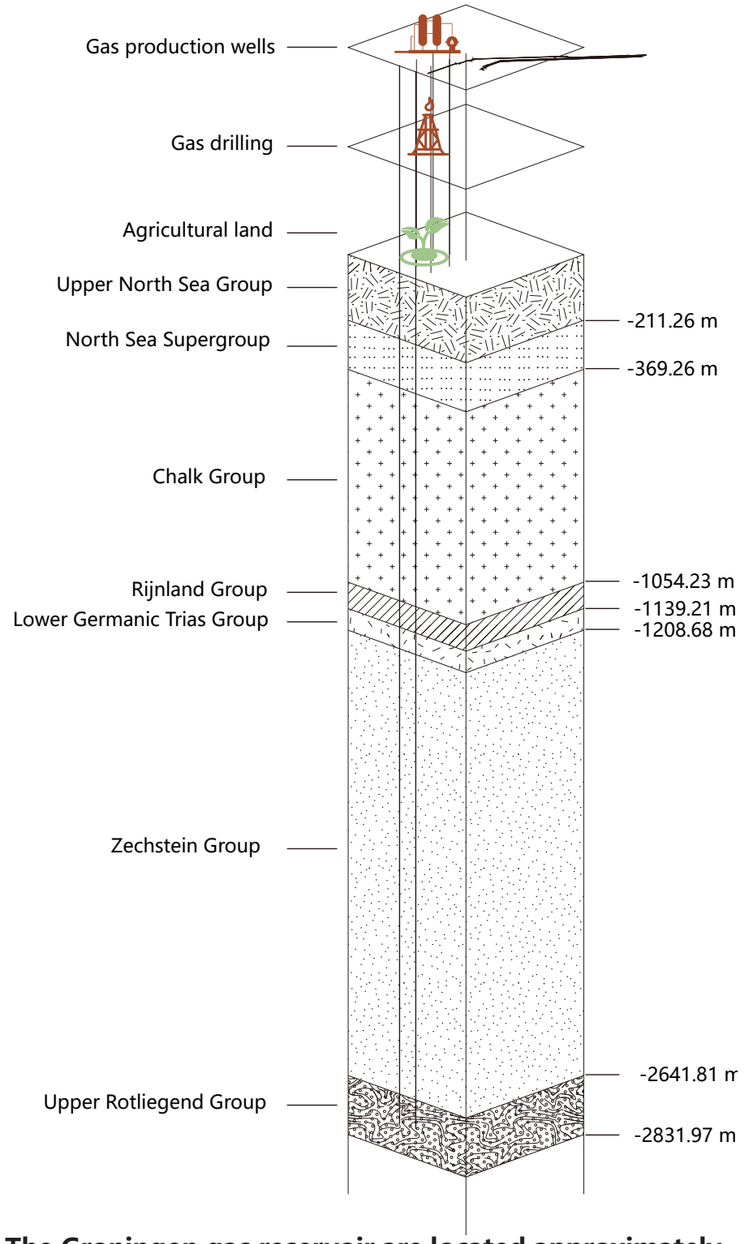
3D model of Groningen gas reservoir











The Groningen gas reservoir are located approximately 3 kilometers below the surface, and the extraction wells and infrastructures built on agricultural lands.

The distribution of gas extraction site

27 gas production locations

occupy

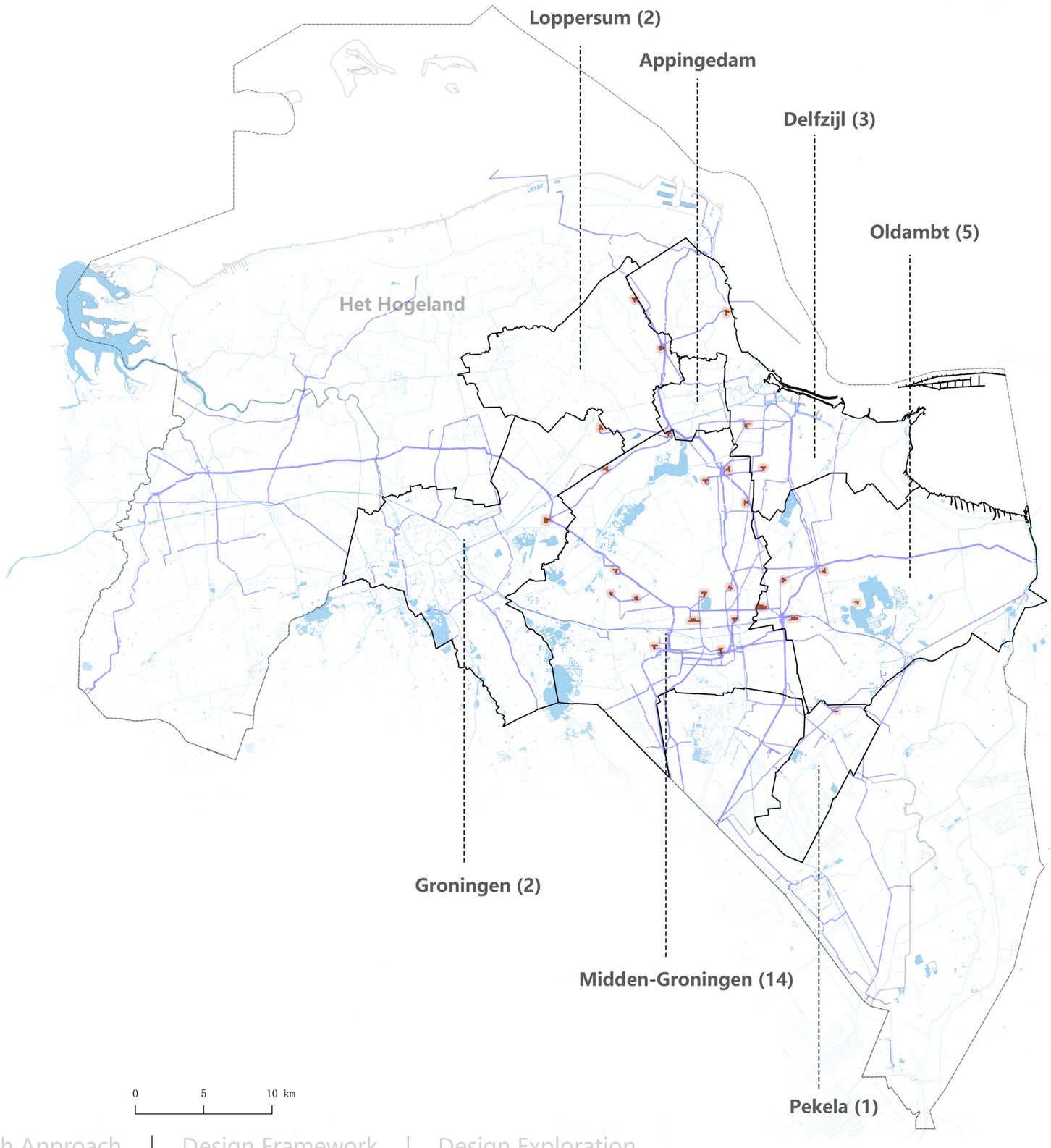
261 hectares

within

7 municipalities

sharing

1 plot system

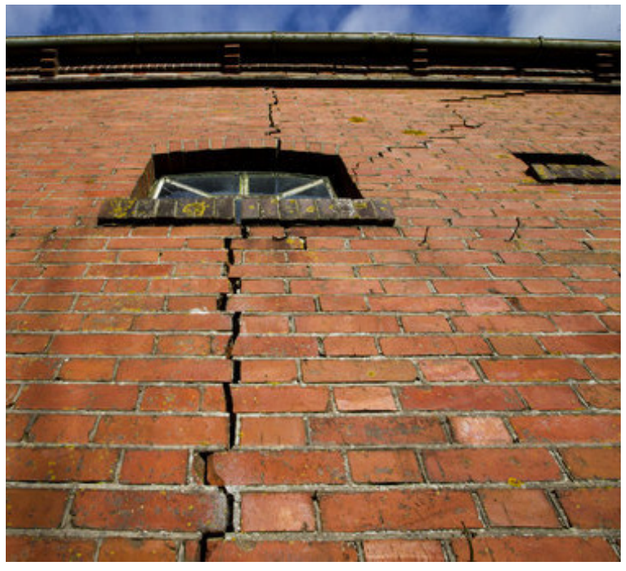




Earthquake | Land subsidence | Gas extraction location

Crack | Flood | Transformation

Living life



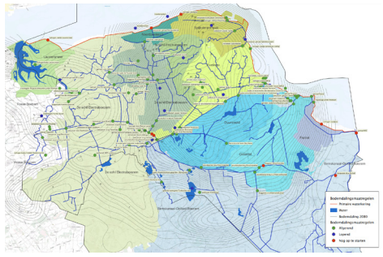






















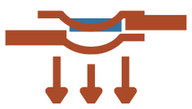








Gasquake

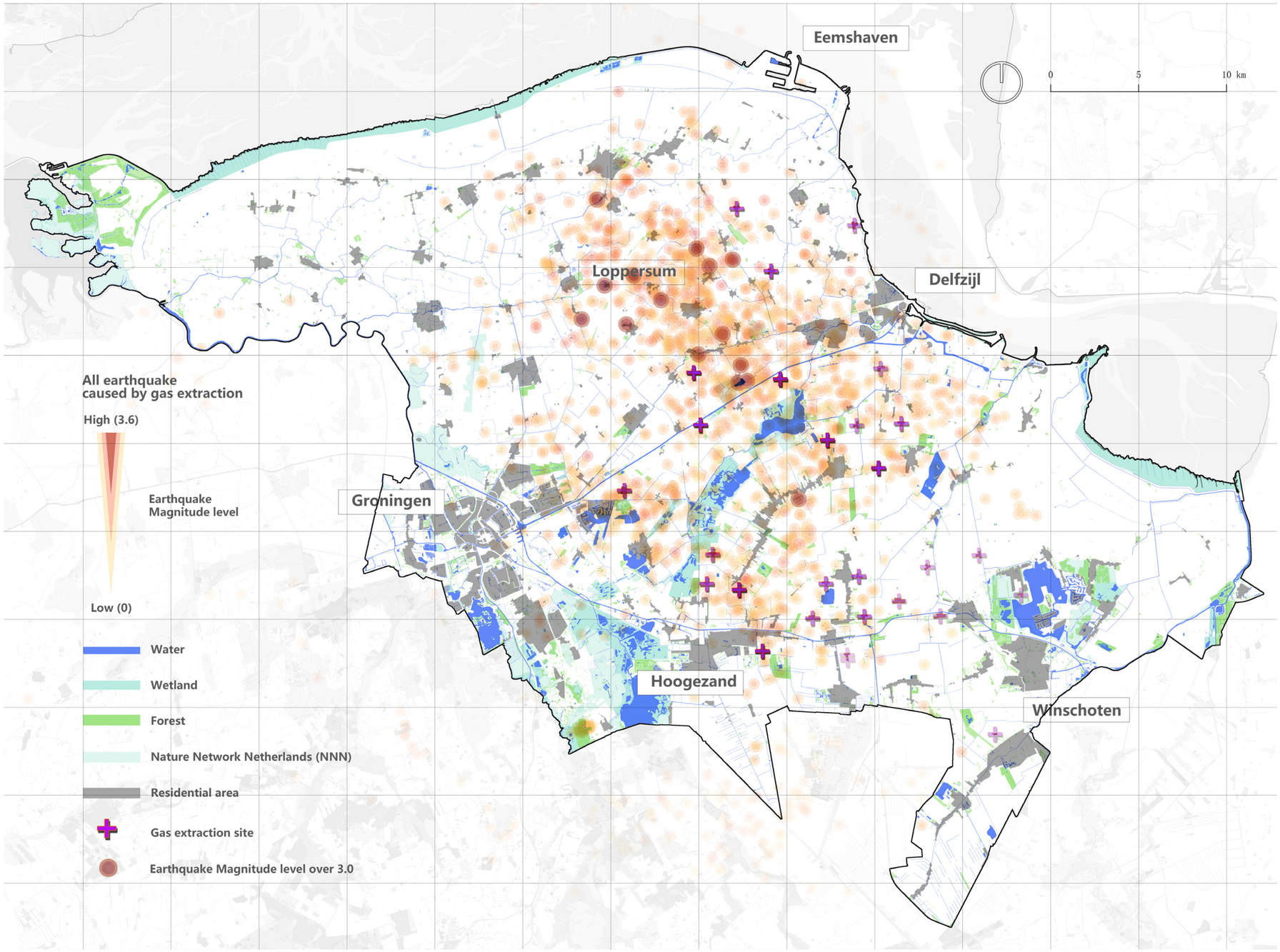


Land subsidence



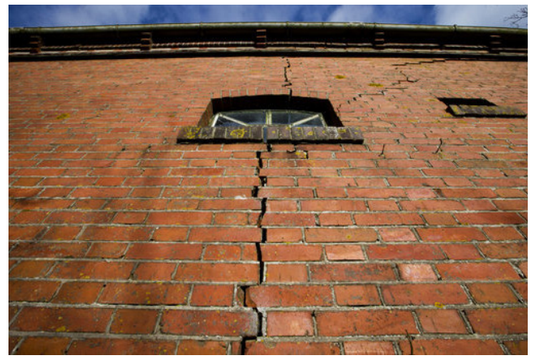
Gas field clean up and reuse

Map of all earthquakes in Groningen gas field region

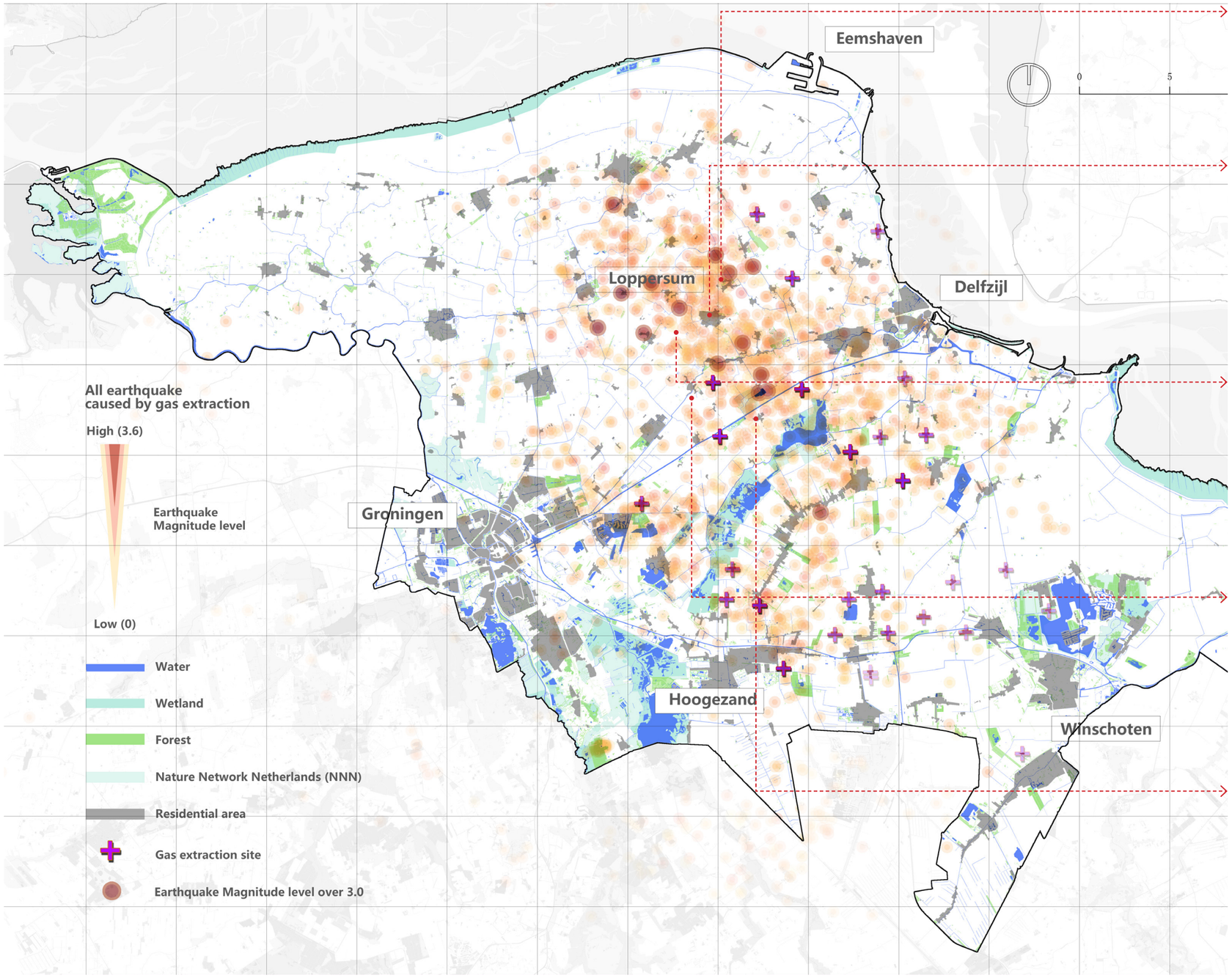








Current measures - Reconstruction work



Zeerijp



Loppersum



Stedum



Tenpost

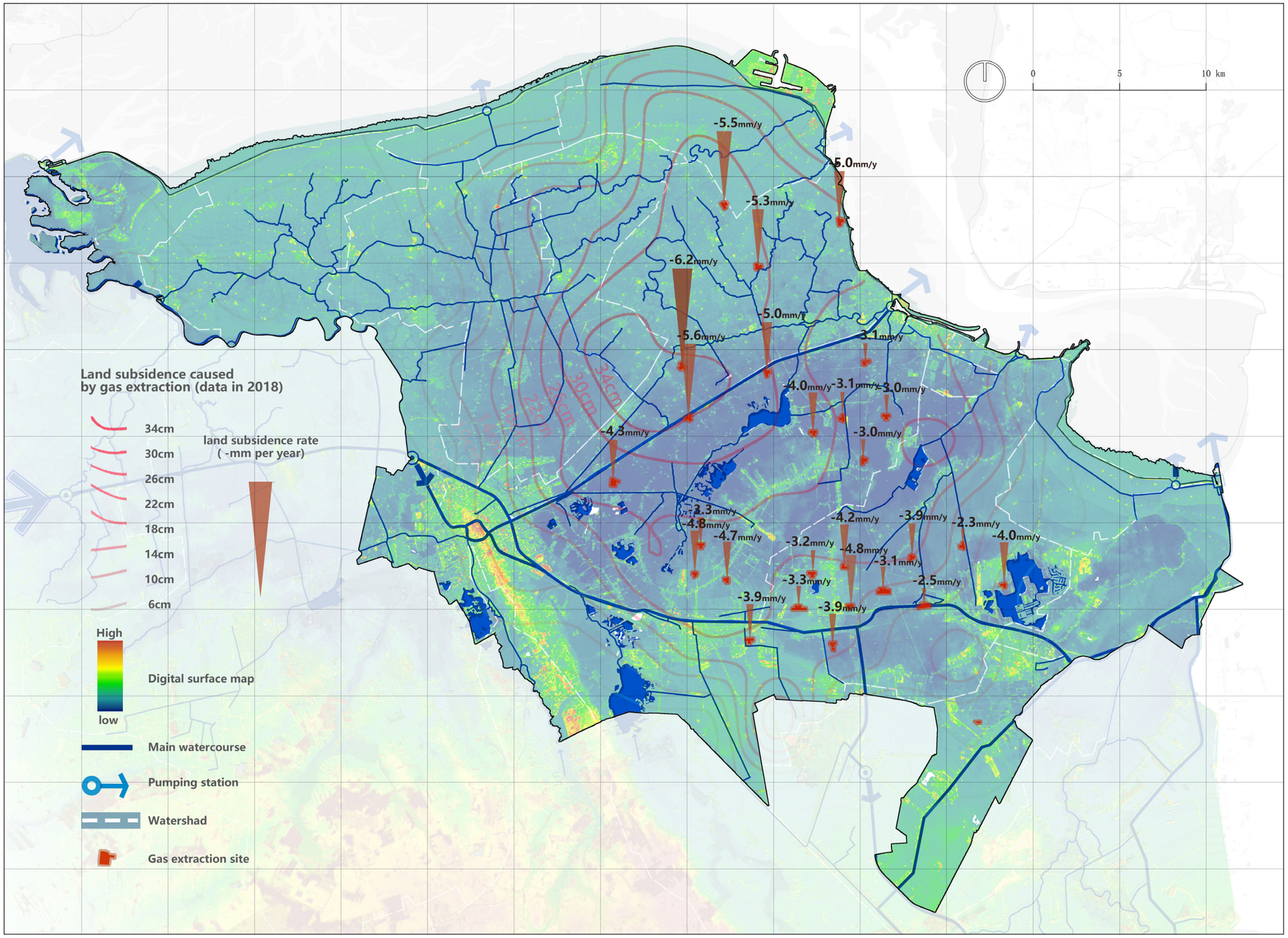


Overschild

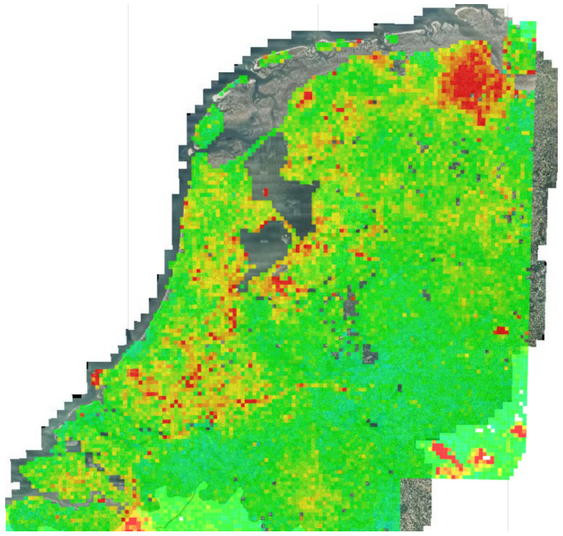


Map of all earthquakes in Groningen gas field region

Land Subsidence

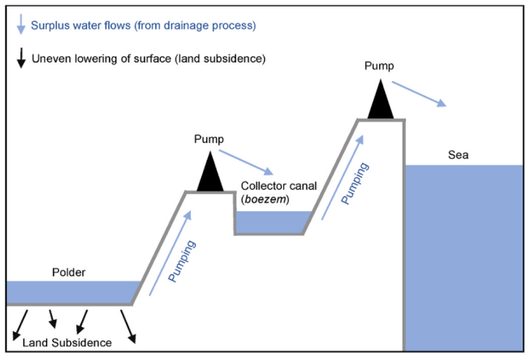


Mapping of main watercourses, land subsidence contour line and subsidence rate data observed in each gas extraction location in Groningen



Land subsidence map Netherlands
Image from: bodemdalingskaart.nl

The largest subsidence takes place in the Loppersum area. Since the start of gas extraction in 1963, the ground there has sunk 37 cm.



Cross-section of drainage process which illustrates how the discharge of surplus water is complicated by land subsidence
Image from: Hannah Porada, 2024

Current measures - Further adjustments to the water management

Increased vulnerability to climate change

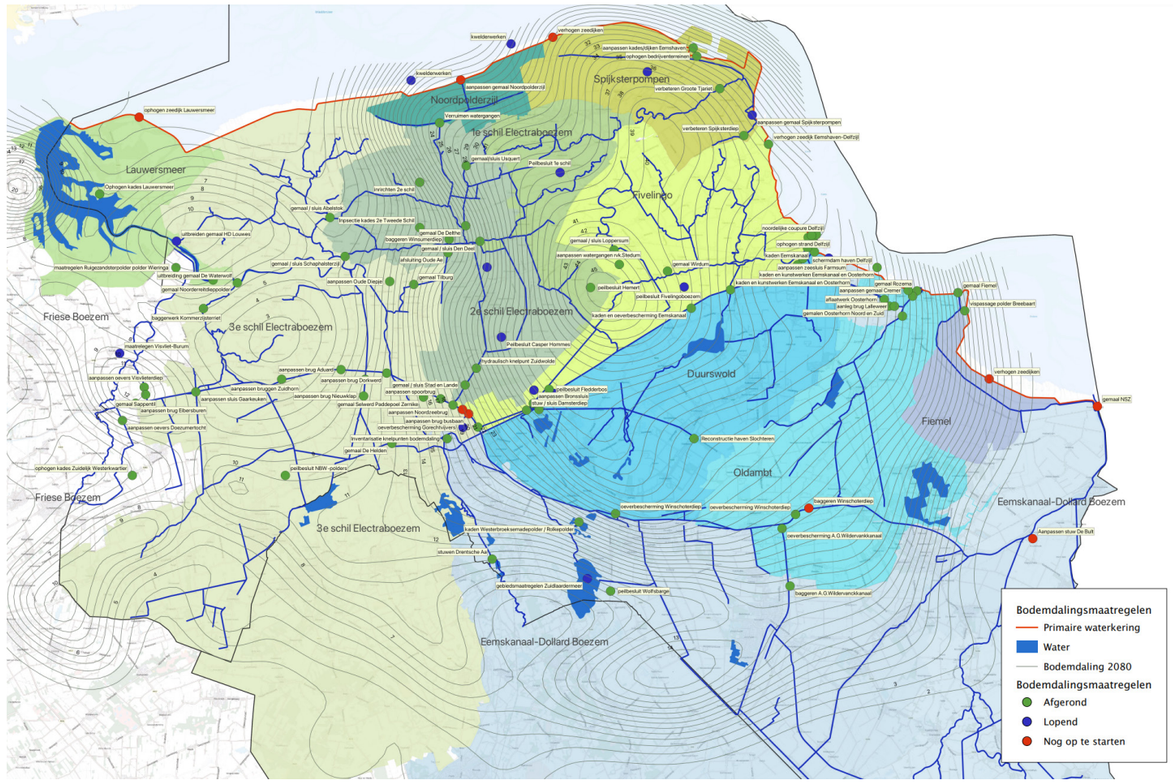


Water stay in the polder during winter time
Image from: Winter water image - Waterschap Noorderzijlvest

"There is still a lot of water, especially in Drenthe and in some polders. It **takes longer** there before the water levels drop again. The water needs time to drain.

The tide is currently good and we can discharge the water to the Wadden Sea under free fall. In recent months we have had to pump a lot of water with our drainage pumping stations due to bad tides. In 2023, the Waterwolf ran once as many pumping hours as in 2022. A record amount of water was discharged from the Cleveringa locks in 2023. **We have not discharged so much water into the sea in the past 20 years.**"

-Waterschap Noorderzijlvest



Land subsidence measures taken by the waterboard Noorderzijlvest amid NAM-predictions until 2080
Image from: Land Subsidence Committee



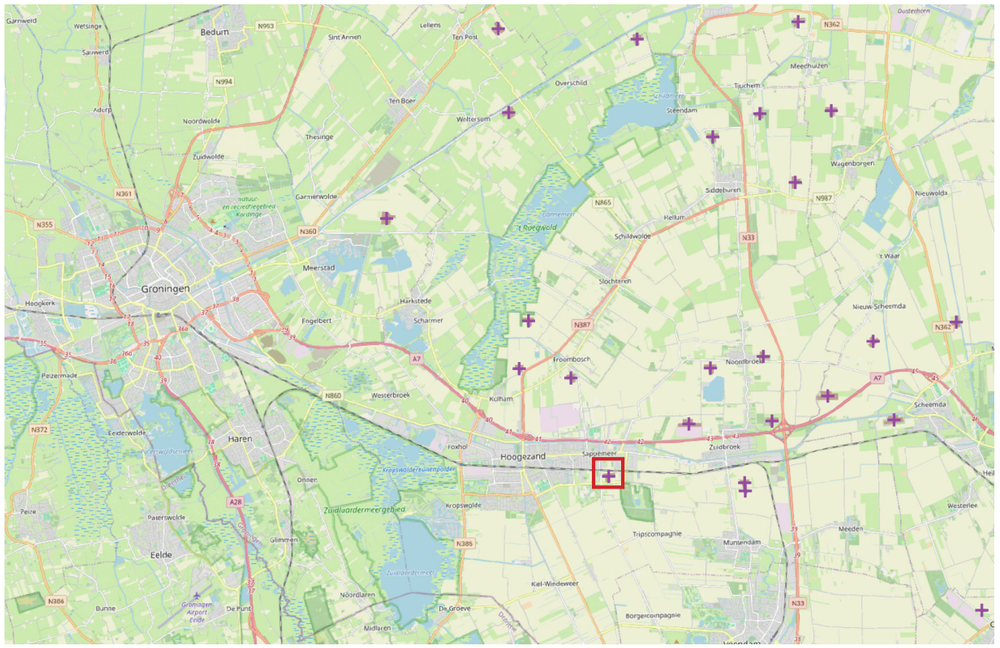
Adjustment of pumping stations Gemaa Den Deel



Adjusting the Eemskanaal quays

Gas extraction site

Site visiting



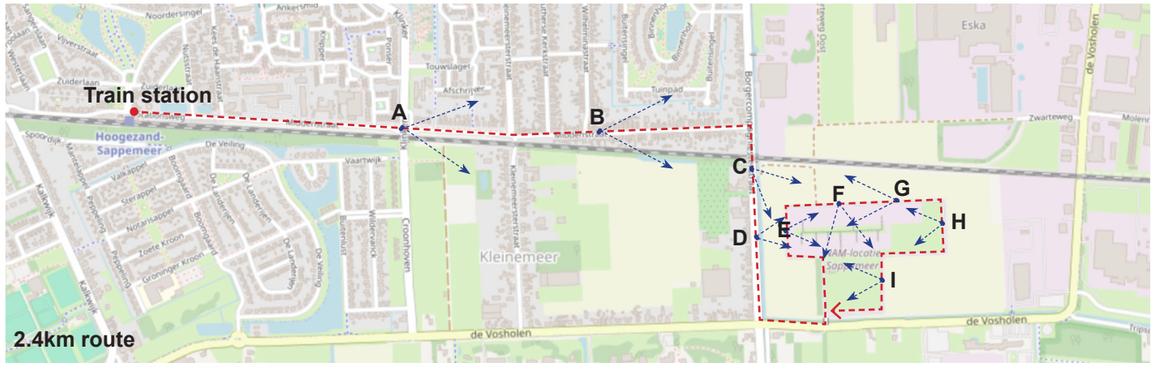


2007



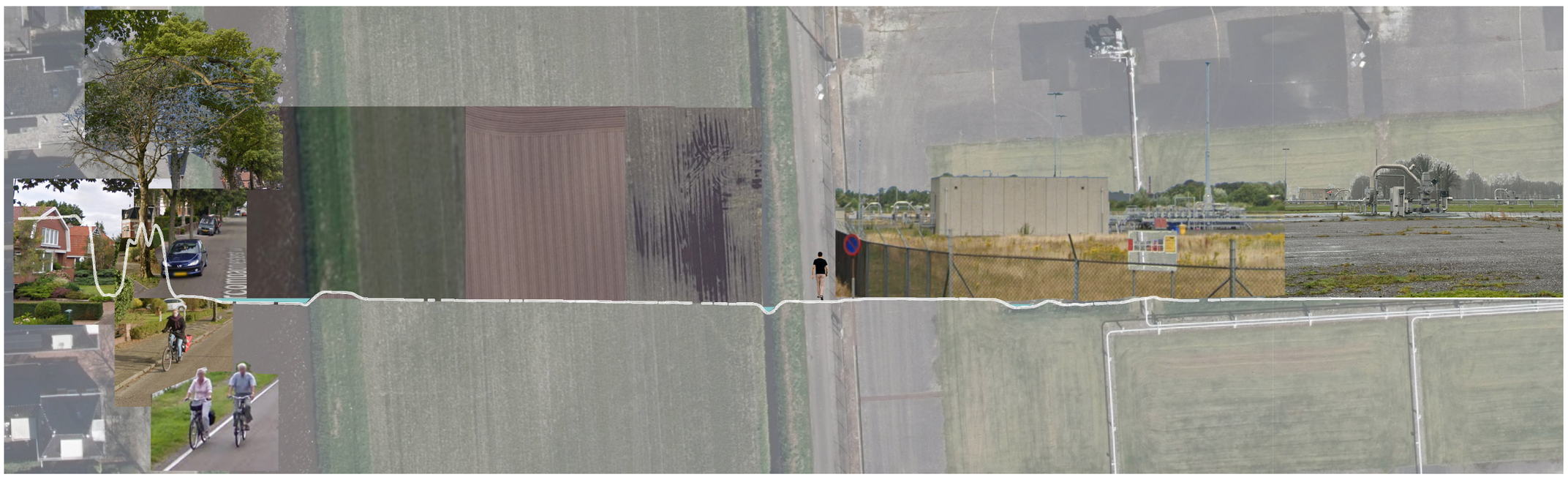
2023

A satellite gas extraction location - Sappemeer





Gas extraction site
A satellite gas extraction location - Sappemeer



Less than 100 meters apart, shows two different atmospheres.

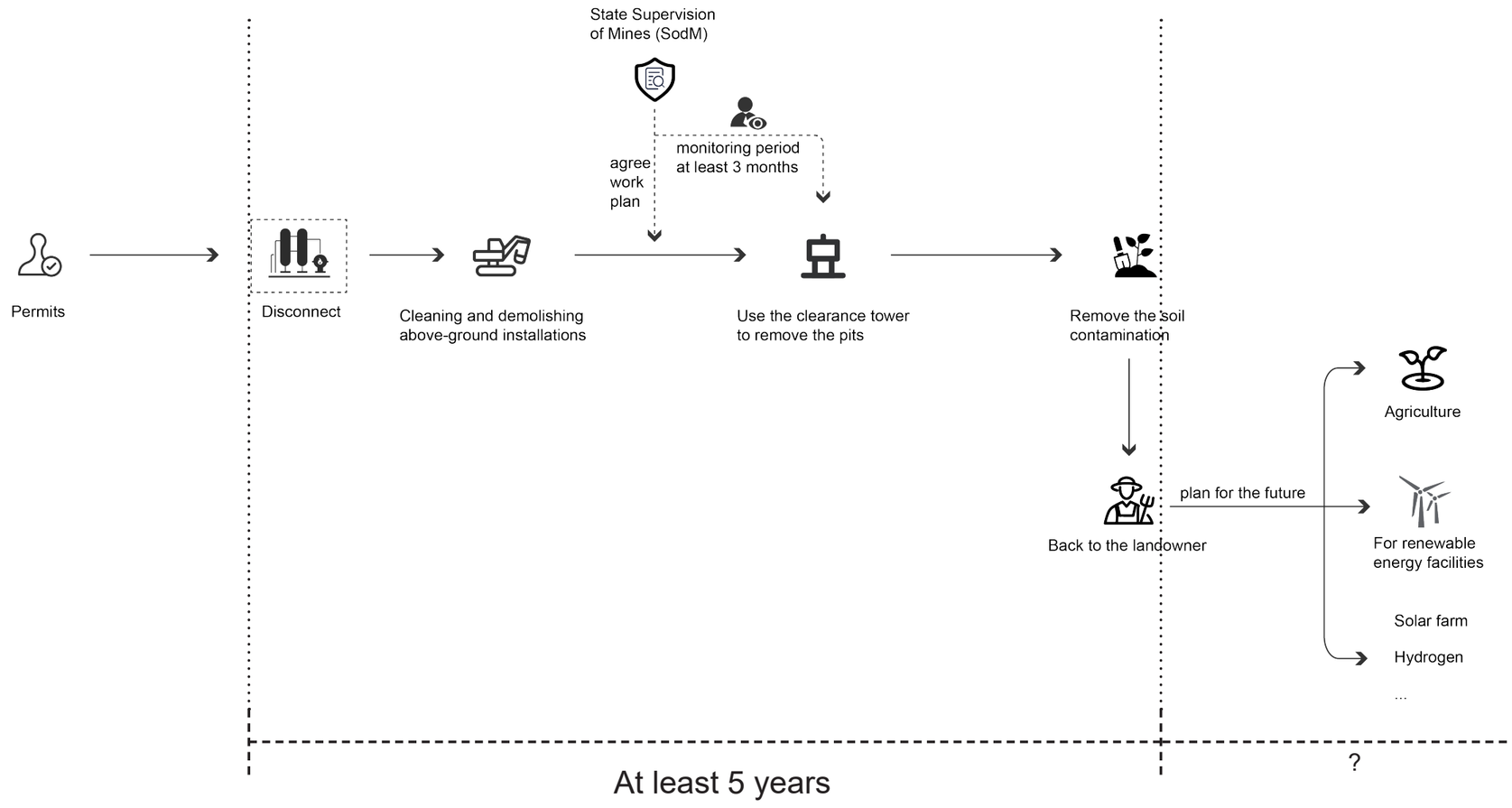


Within the enclosure, only the birds are joyful.

Current measures - Clean up and reuse process

Gas extraction site Uiterburen time-lapse.
Image from: Topotijdreis.nl/satelliet





Clean up and reuse processes
Source: author, based the information provide by NAM

Gas extraction site

Current measures - Clean up and reuse process














Current measures - Clean up and reuse process

Phase 1: From production site to containment

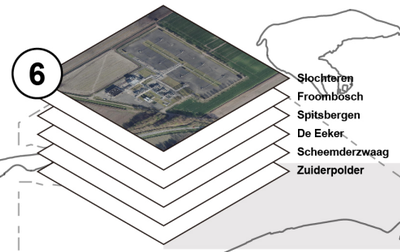
Phase 2: Cleaning and demolition of above-ground facilities

Phase 3: Removal of pits

Phase 4: Clean-up, recovery & handover

Type A

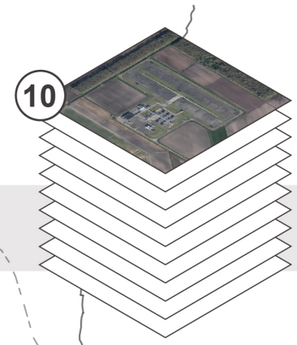
Sites on standby until April 2024



- Slochteren
- Froombosch
- Spitsbergen
- De Eeker
- Scheemderzwaag
- Zuiderpolder

Type B

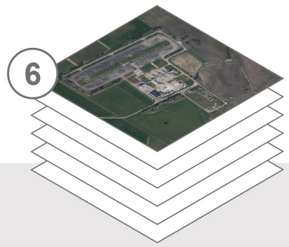
Closed & on the list of clean-up



- Kooipolder
- Zuiderveen 2021
- Tusschenklappen 2024
- Oude Pekela-1
- Oudeweg
- Siddeburen 2024
- Tjuchem
- Schaapbulten
- Amsweer
- Bierum

Type C

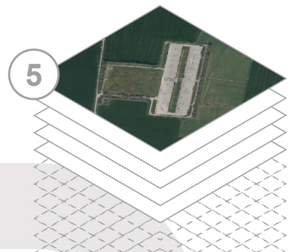
Cleaned-up & Some instruments still remain (production wells)



- Eemskanaal 2022
- Sappemeer 2021
- De Paauwen 2022
- Overschild 2022
- Leermens 2024
- 't Zandt 2021

Type D

Final clean-up stage



- Ten Post 2022
- Uiterburen 2020
- Noordbroek 2021
- Nieuw-Scheemda 2022
- Midwolda 2022

The process from closing to returning to the landowner takes about **five years**

Categorisation of extraction sites by order of planned clearance
Draw by author, based the information provide by NAM

Problem conclusion

The Groningen gas field was permanently closed by April 19, 2024



Natural Gas extraction

Gas extraction in Groningen over 60 years

Industrial Pattern

+

Technology & Material

+

Territory

Land subsidence

Seismic activity

Problems

NAM

Compensation

Water management

Reconstruction works

Gas field clean up and reuse

Current measures

After Gas field closure

A More Fragile Ecosystems

Tradition

Modern

NEW

The Harm to the Cultural Landscape

The Erased Industrial Identity

New Problems

What might be the future of these sites?

Zuidbroek, Groningen



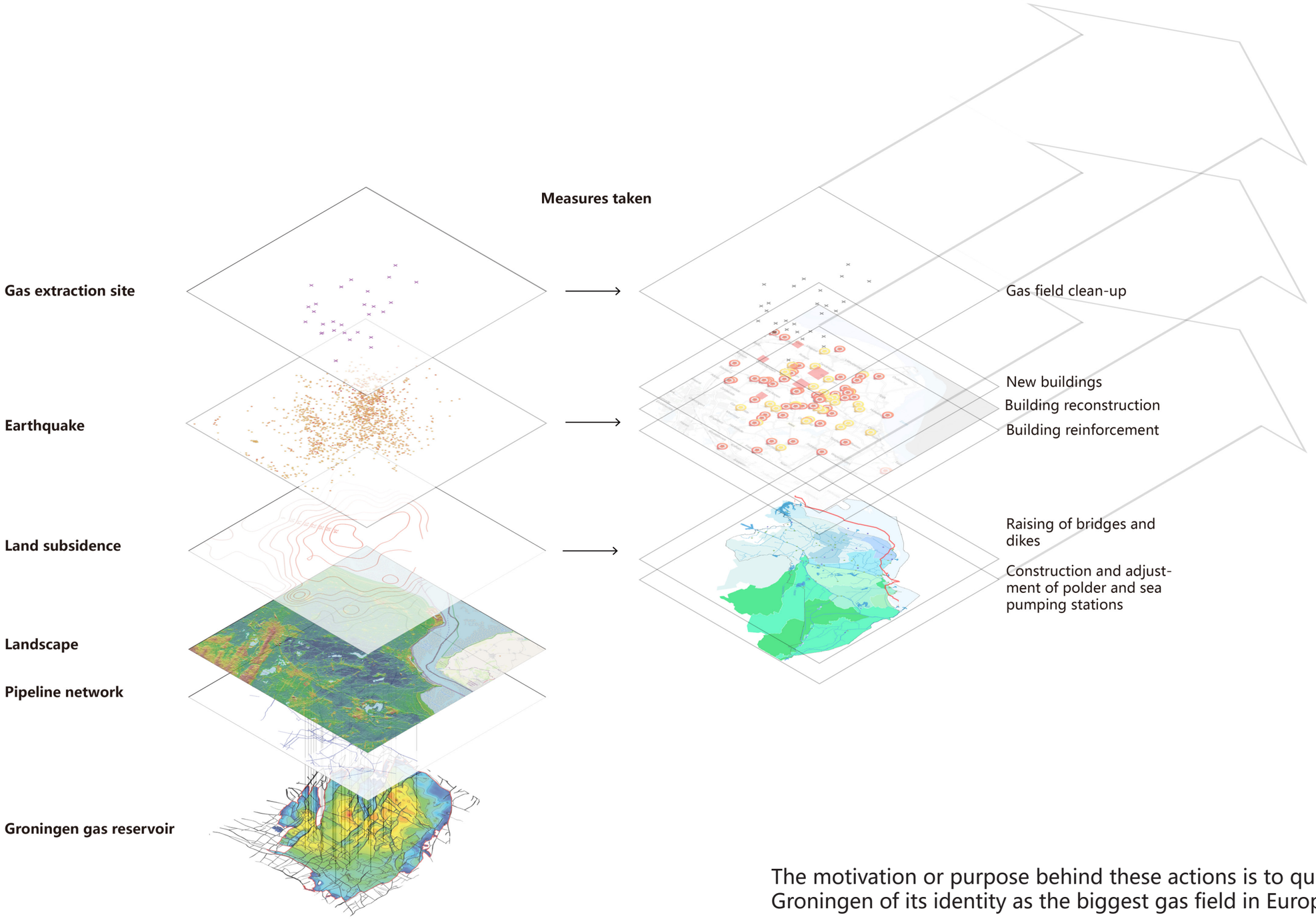


Sappemeer, Groningen









The motivation or purpose behind these actions is to quickly rid Groningen of its identity as the biggest gas field in Europe.

-GUILTY LANDSCAPE-

Armando's art integrated with Kamp Amersfoort. A photographic reproduction of the Guilty Landscape.

Photos are exhibited in Kamp Amersfoort from 19 April 2015 - 2019





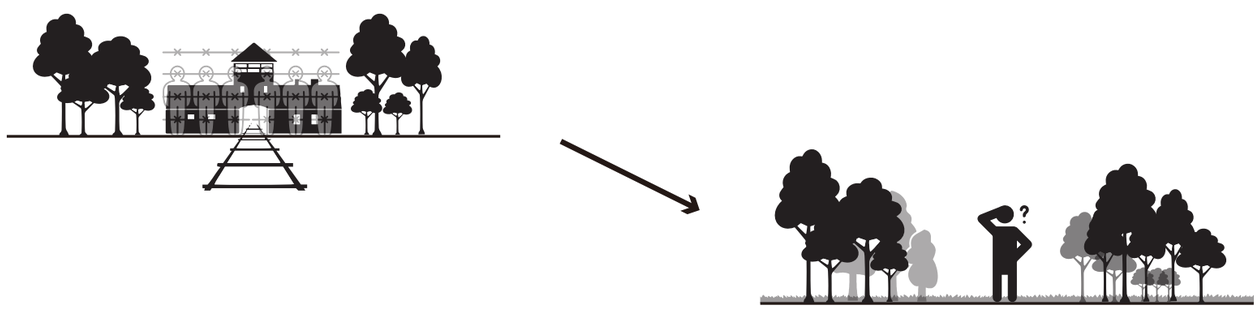


"A guilty landscape is a landscape that has witnessed events, and it is a fact that the most gruesome acts are often performed in landscapes, in glorious nature ... The aforesaid landscape never takes offence, is even shameless enough to go on growing as usual, it is a disgrace, I shall never tire of talking about it. "

--- Armando, Die Wärme der Abneigung.
Translated from the Dutch by Anne Stolz. Frankfurter Verlagsanstalt, Frankfurt am Main 1987.



Painting by Armando titled "Guilty Landscape" featuring the "guilty trees"

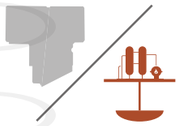


The core of the Guilty Landscape concept is about forgetting and denial

In fact, Armando declares **the landscape itself to be guilty, not of having allowed the atrocities to happen, but because it has erased every trace of them and refuses any further testimony**. 'Many edges of a wood. Many guilty trees. The air is filled with guilt here, tree by tree', he wrote in his Diary of a perpetrator from 1973.



Groningen Gas Field Region



Gas Extraction Industry



Technical Land

With Long Term Development

Natural Process

Unstable
Vulnerable

Palimpsest

Contradiction
Missing

Bodliy Experience

Disharmony
Discontinuity

Earthquake

Land Subsidence

Destruction of Historic Buildings

Reconstruction of New Housings

Gas field clean up

New Streetscape in Village

Industrial Field / Ruin / Vacant Land / FarmLand

Guilty Landscape

Environmental Issues

Socio - cultural Issues



'Where traces vanish is where the guilty landscape resides'

It can also be the start of a change for the better by **Engagement**

(Emotion&Memory)
Awareness
Action
(Design Interventions)
Concern
(Bodily Experience)

At times, we craft beauty; while at others, we sculpt guilt.

But there is another way to build with guilt and start change for better.

"The flooding disaster that hit the Netherlands in 1953 resulted in the famous Delta Works, which boosted numerous initiatives to rebuild the country's infrastructure to ensure people would be safe. Do the Groningen earthquakes provide a similar opportunity?"

---Kirsten Hannema, 2019

Gas extraction start →



A pride of gas extraction

1959 2009

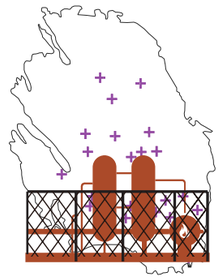
→



There is nothing to celebrate. Look at all the misery.

2019

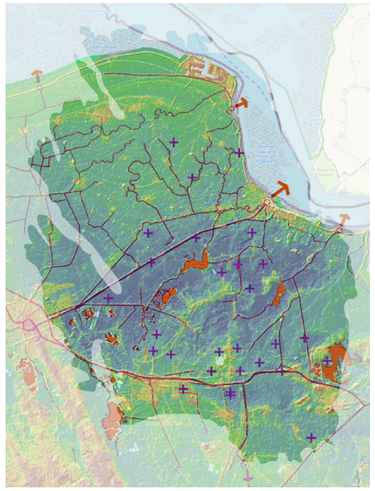
? - - - →



From a single artistic monument to commemorative places?

2024

? - - - →





In June 2009, a giant gas molecule art monument in the central reservation of the A7 near Kolham was placed for celebrating 50 years of gas extraction in the Slocteren by NAM.

Photo: Detlef Schobert



In May 2019, 'Het Andere Monument'(The Other Monument) was placed along the A7 near the Engelbert. The Earthquake Monument shows the other side of the coin: the misery caused by earthquakes because of gas extraction.

Photo from : Menterwolde.info



One of the gas extraction site that has been cleared, and gas wells still remain.

Photo: Catrinus van der Veen

What are the potential new opportunities in the Groningen gas field area

?

Main Design Question:

How can **landscape-based transformation strategies**
be applied to the Groningen gas fields region after gas extraction ended
to create **meaningful public spaces**,
address environmental and social impacts,
and help enhance **a new identity** for Groningen?



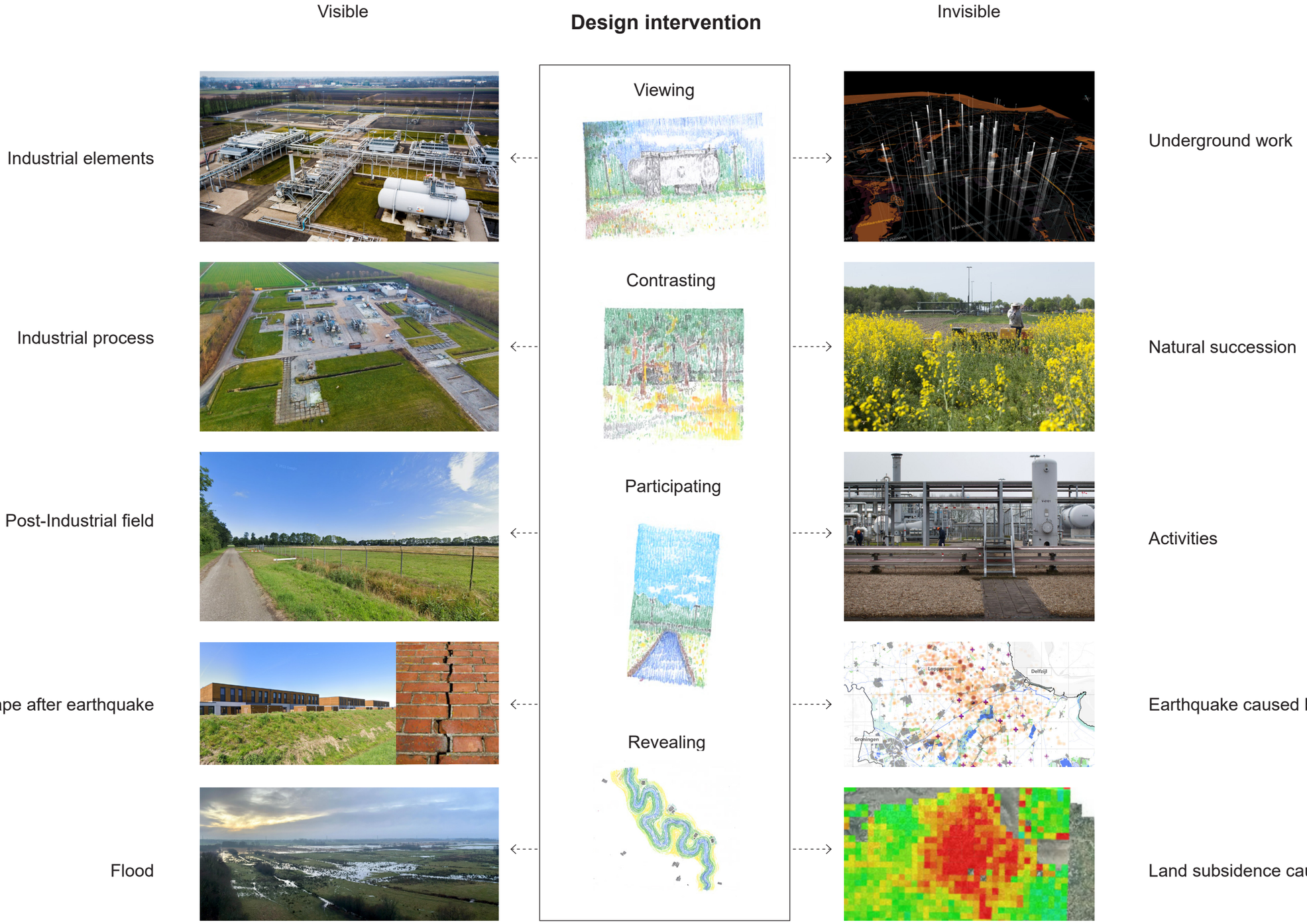




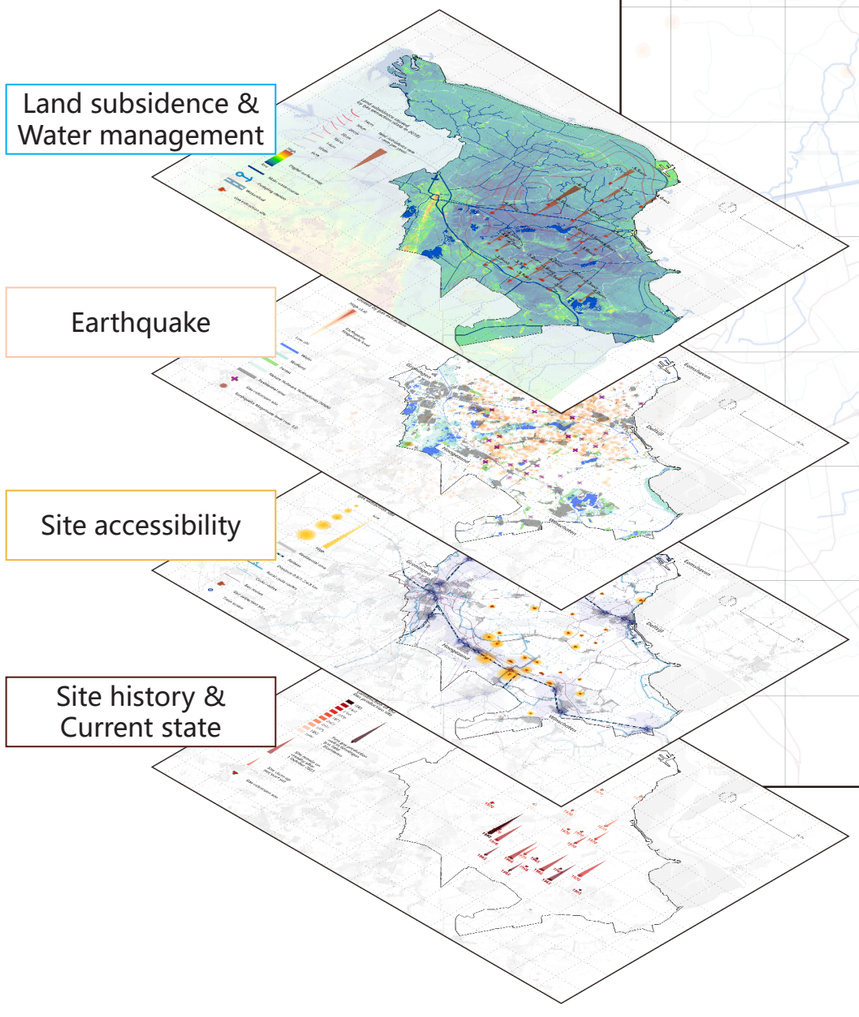
Guilty Landscape Principles

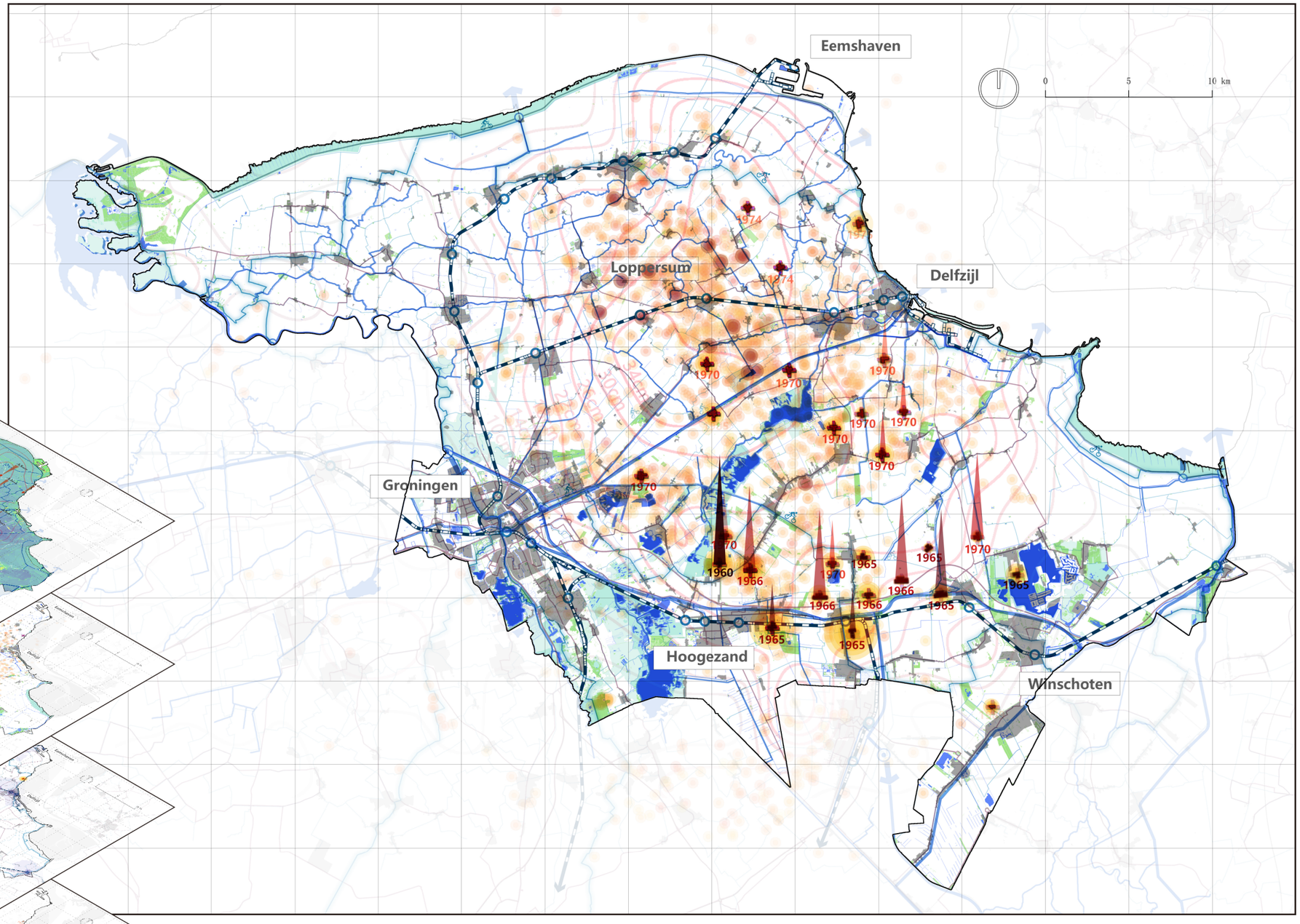
Visible & Invisible works

Instead of erasing the site's memory, the goal is to preserve and showcase the visible and invisible work that took place.

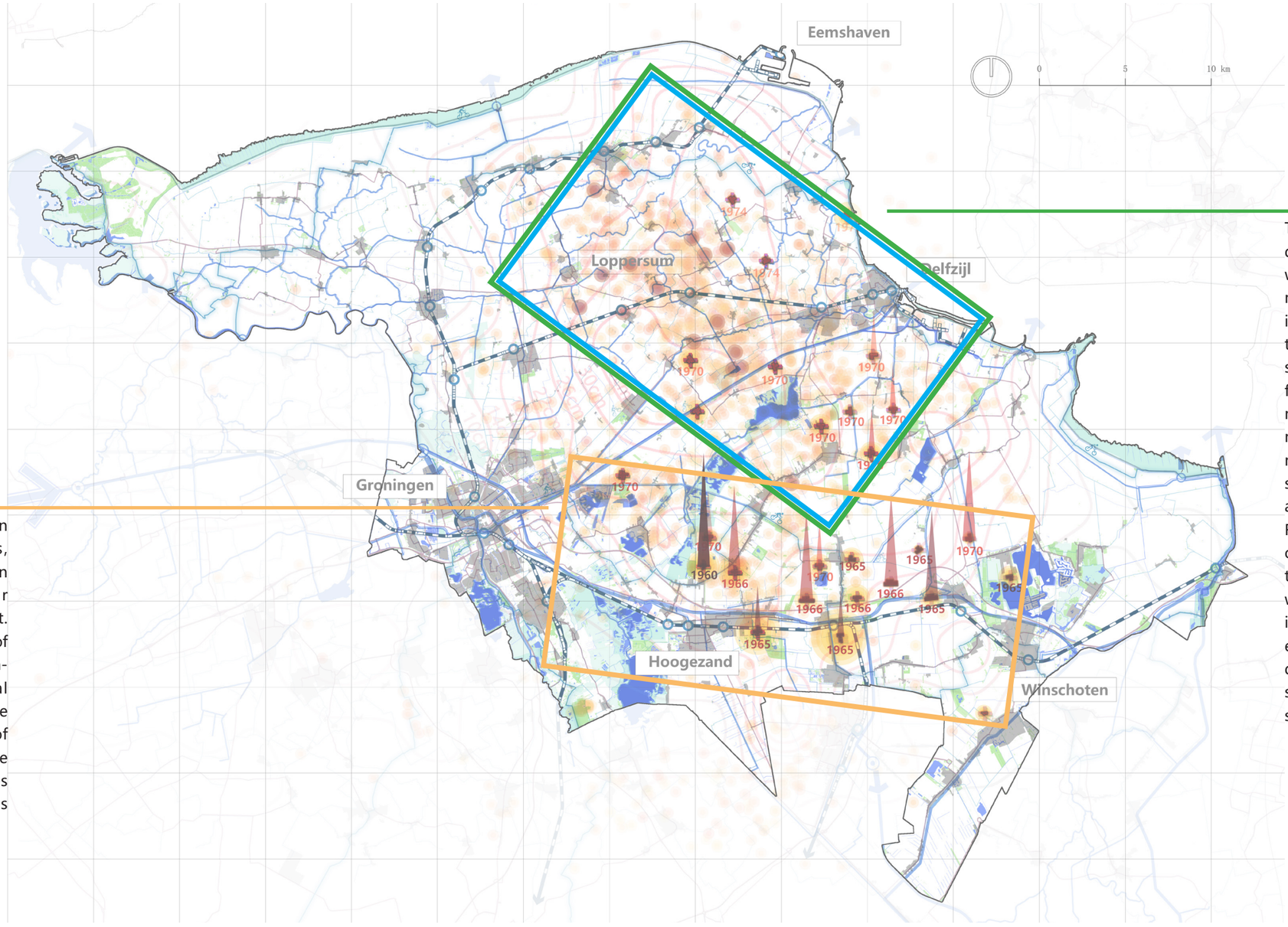


Seek for potential opportunities in the gas field region





Future possibilities in different area



Green- blue belt

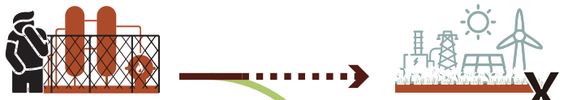
The future landscape development in this area will primarily focus on water management and ecological improvement. This means that there will be more rainwater storage locations in the future, connected to form a new blue-green ecological network. Additionally, this network will be linked to surrounding villages, enhancing accessibility and well-bing. Regarding the transformation of gas extraction sites, the transformation in this area will more actively address issues related to subsidence, earthquakes, and ecological diversity. Appropriate design strategies will be selected to spatially express these issues.

Urban belt

For clusters of gas extraction sites located in urban areas, future industrial transformation processes will place greater emphasis on the urban context. This includes the development of city parks welcoming to all, open-air museums with educational components, and commemorative gas extraction parks. In terms of strategy selection, there will be a preference for reuse strategies that utilize existing site materials and enhance industrial identity.

Research objects and assignments

Opportunity



Guilty landscpes

Focus on what will happen anyway?

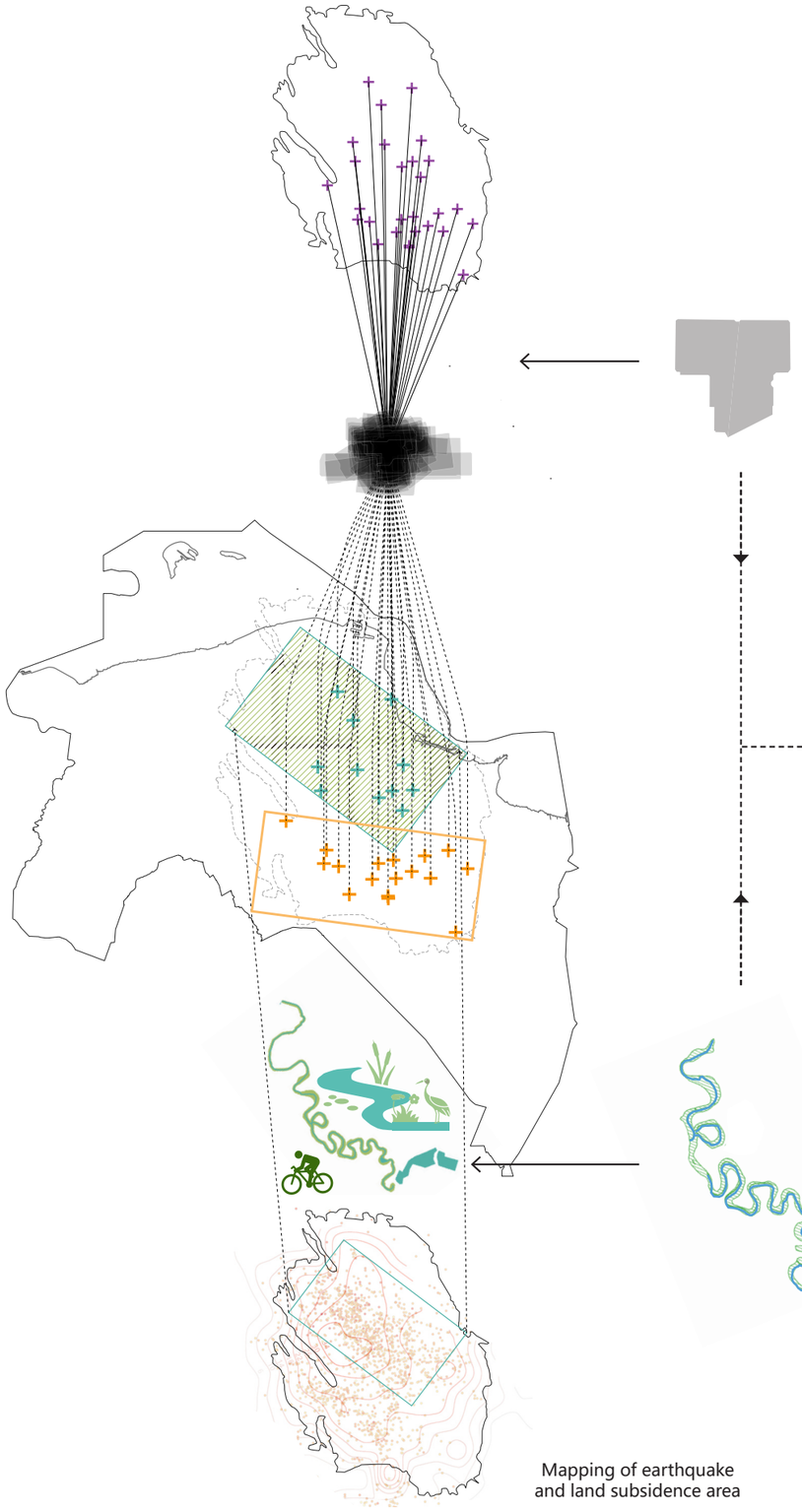
or



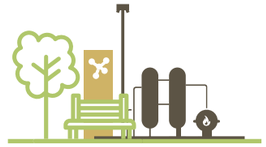
Give shape to things that wouldn't happen otherwise, yet are urgently needed.

Embracing Guilty Landscapes to Form A New Regional Identity

Distribution of gas extraction sites



Mapping of earthquake and land subsidence area



Industrial Landscape

= Industrial heritage

Places of memory

Leisure destination



Embracing The New Identity



Stream Valley Landscape

= Dealing with problems due to land subsidence

Public space intertwining earthquake-disturbed village and nature

Water retention area

Natural monument

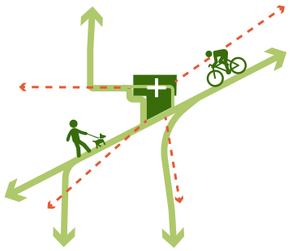
Leisure destination

Measures taken in different field and in different scale level

A Park For Everyday & The Big Day

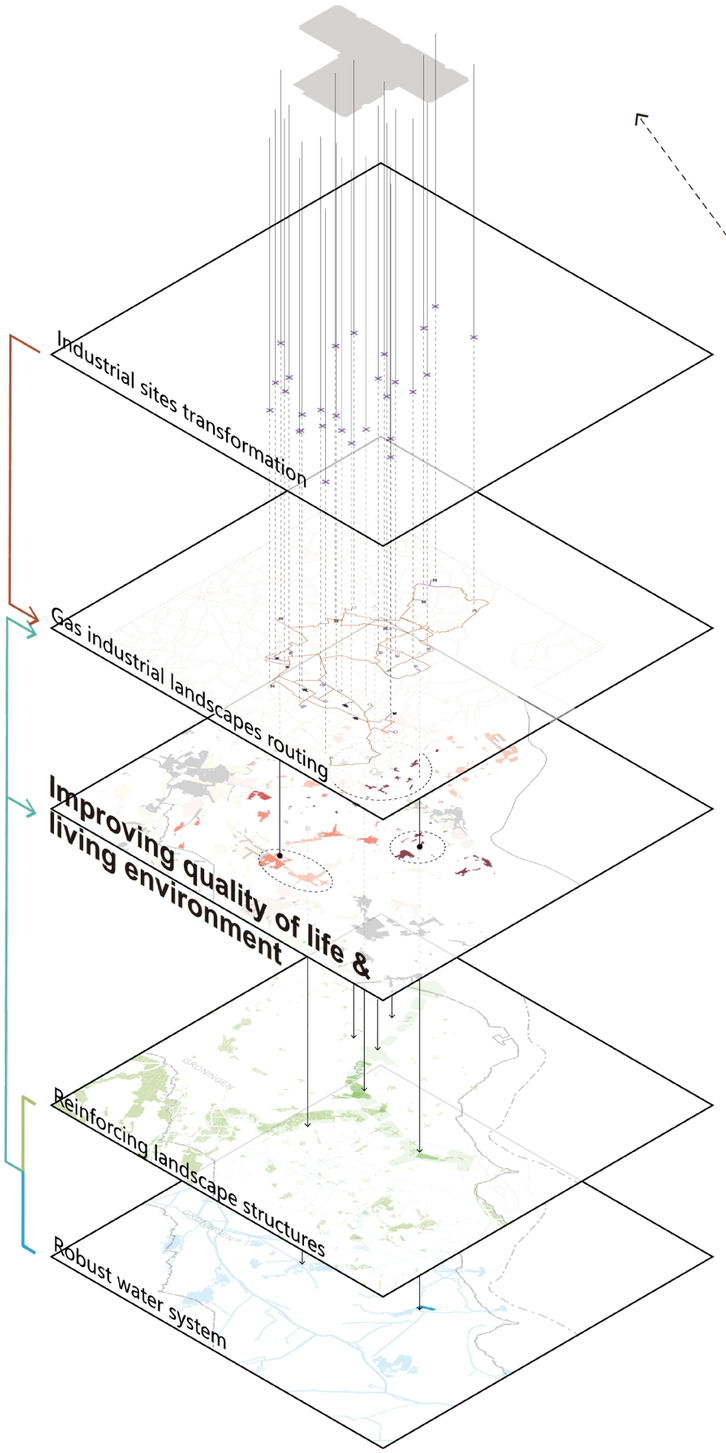


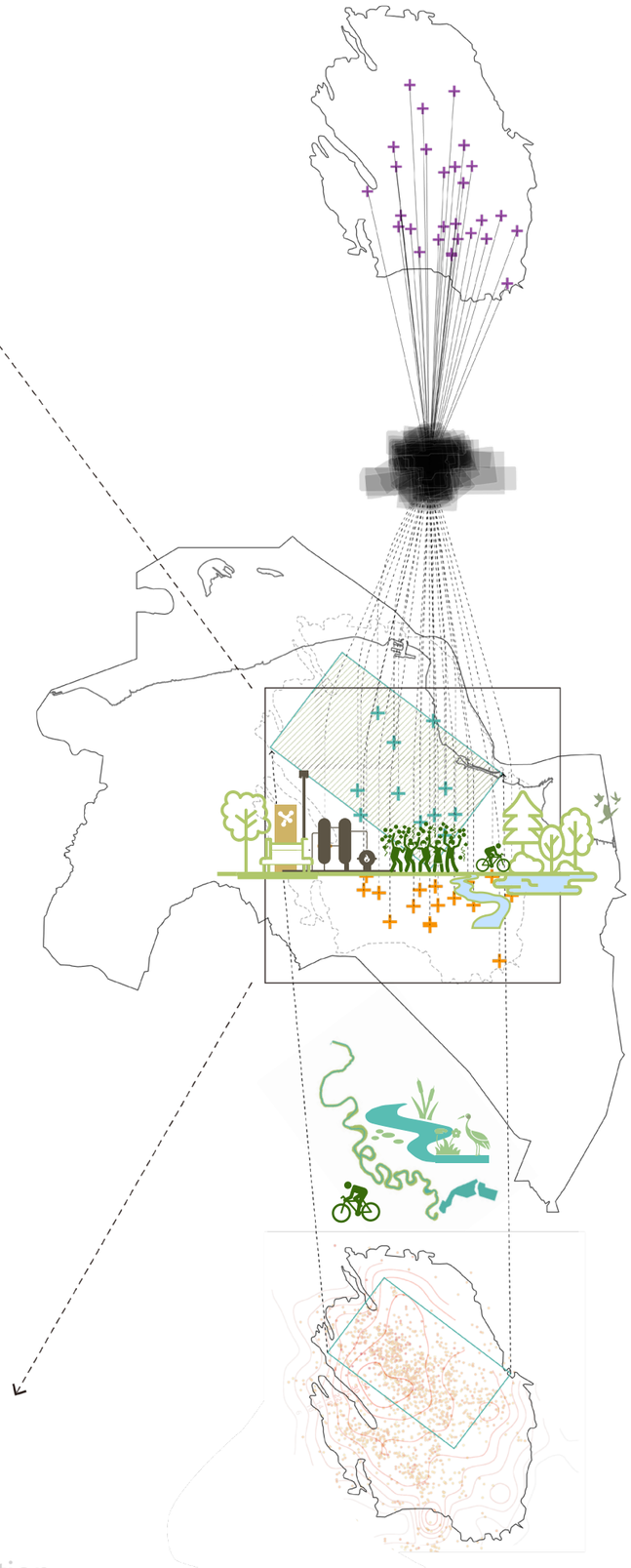
Open Up and Reach Out



Embrace Groningen’ s Natural Network



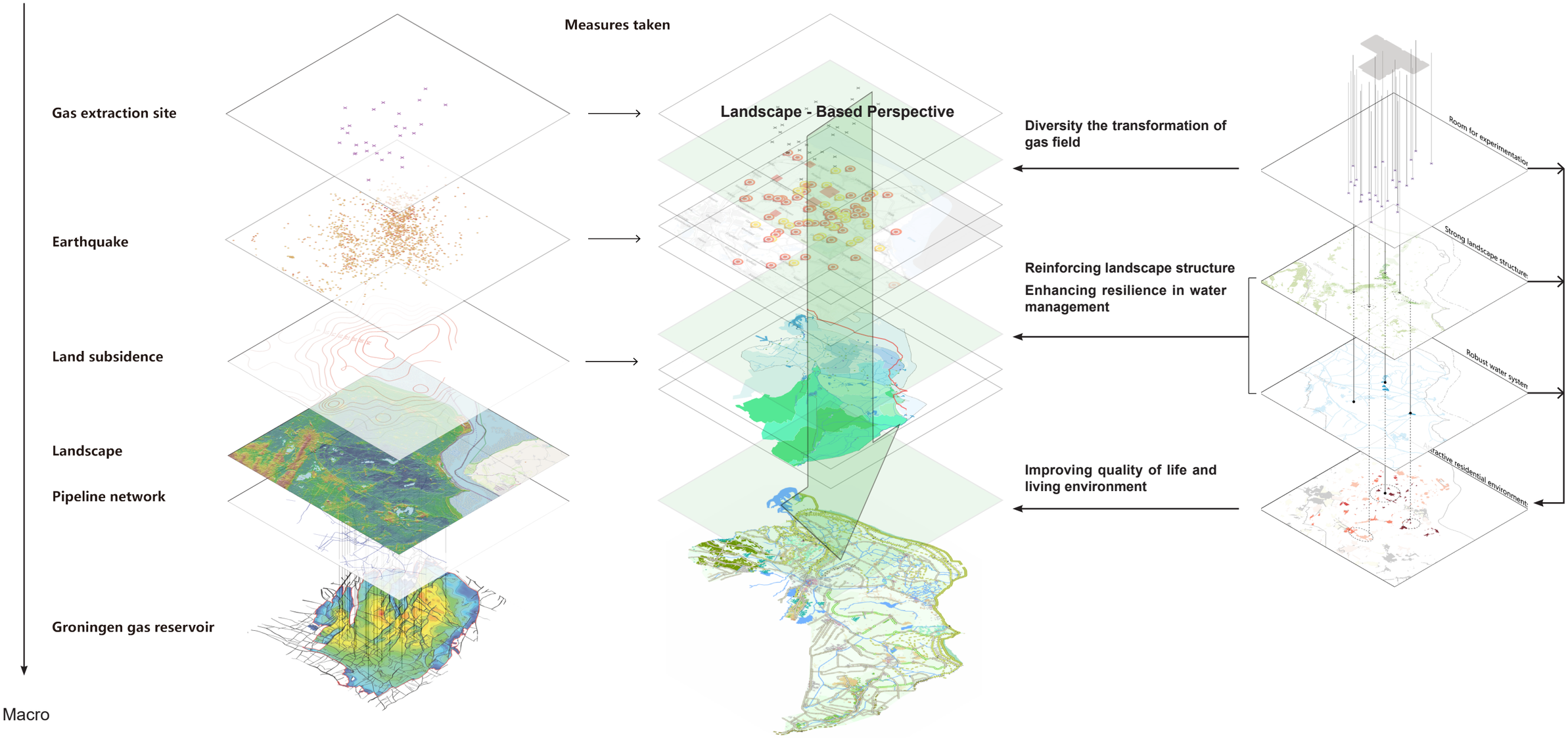




Scale Continnum

Possibilities and responsibilities in the LA field

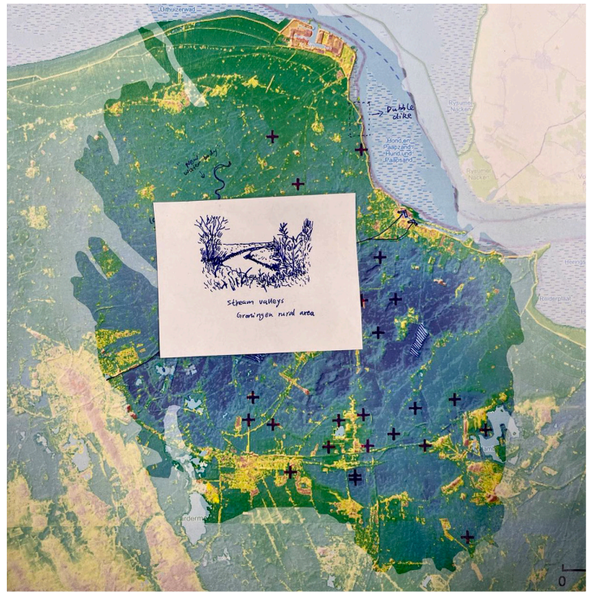
Micro



Macro

Future design focus in three concern

Regional Landscape



Industrial location



Activities

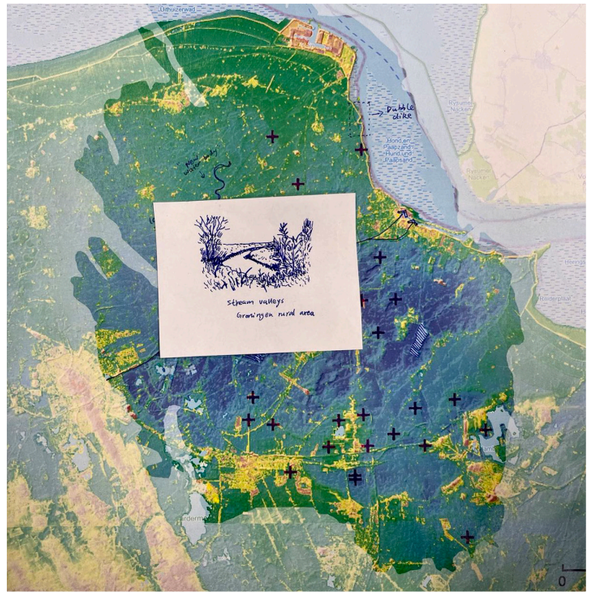




An Identity <---------- A Story <---------- An Emotion

Opportunity to the regional Landscape

Regional Landscape

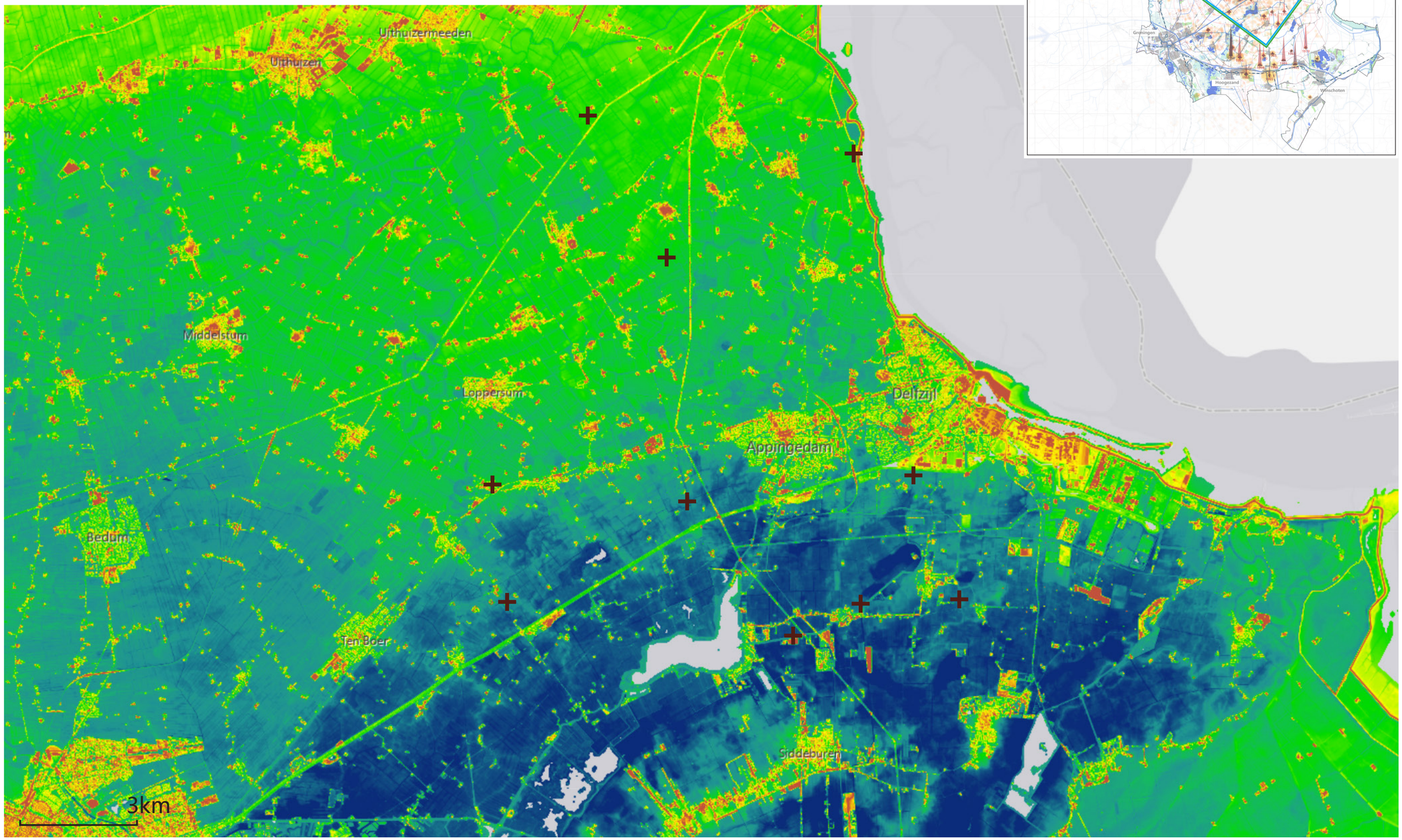


Industrial location

Activities

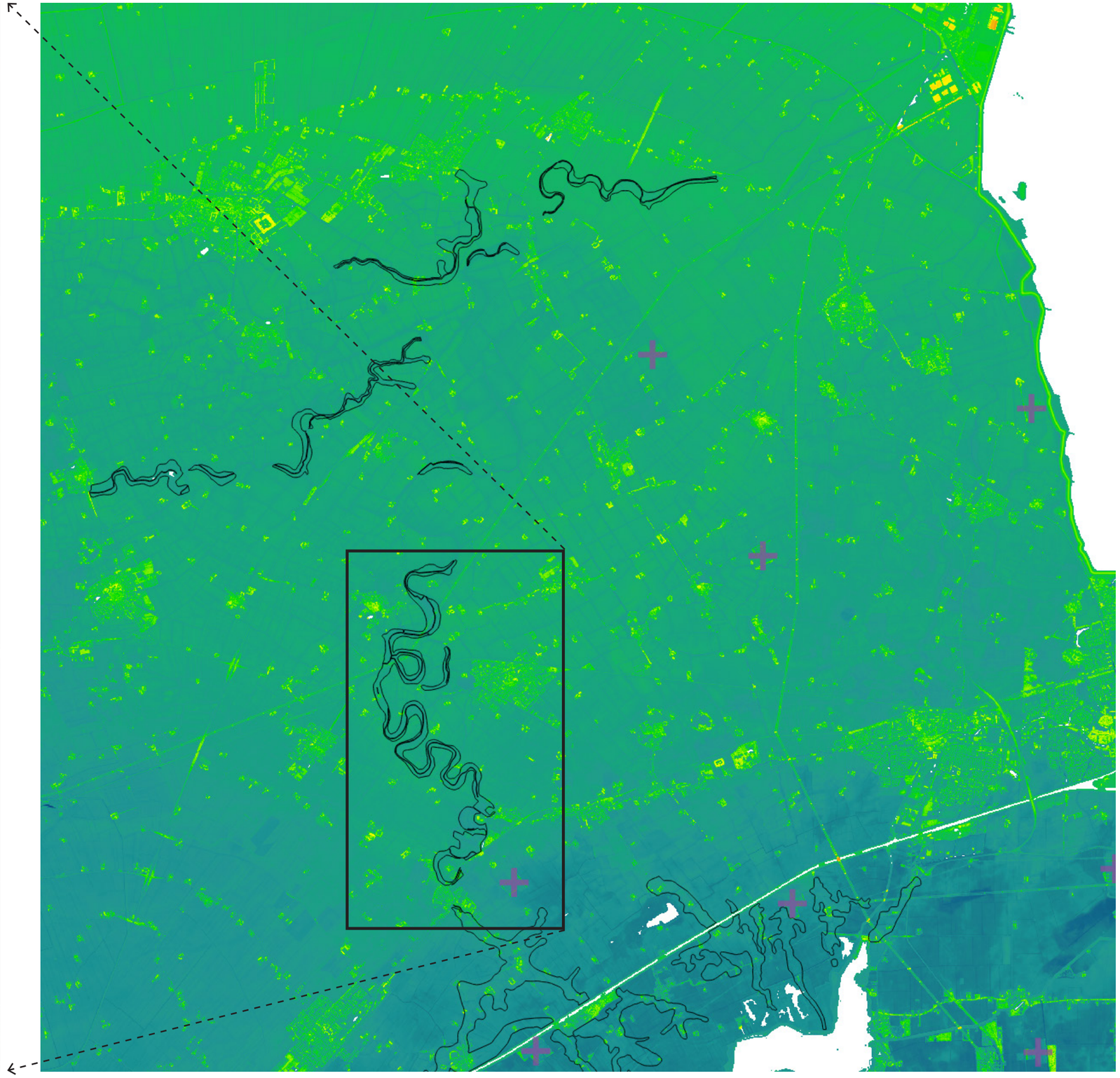
An Identity <---------- A Story <---------- An Emotion

After gas - provide opportunity to the regional Landscape



After gas - provide opportunity to the regional Landscape





After gas - provide opportunity to the regional Landscape

The restoration of stream valleys

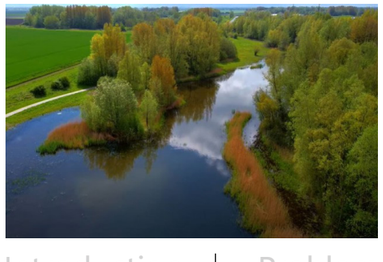
By reintroducing flooding meadows and meandering streams, we can not only enhance the region's resilience to future climate change but also improve outdoor living environments for residents in the area, creating a place for outdoor leisure and recreation.

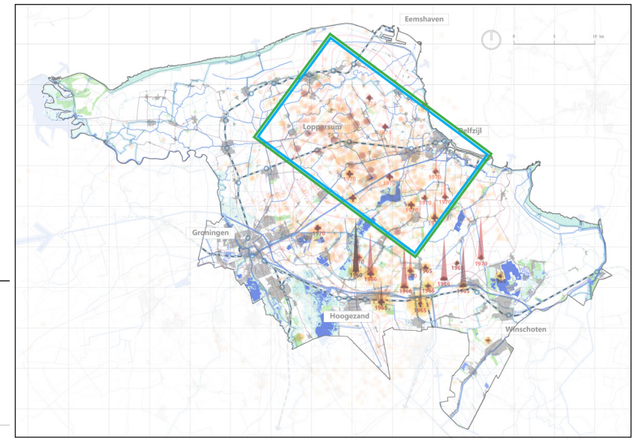


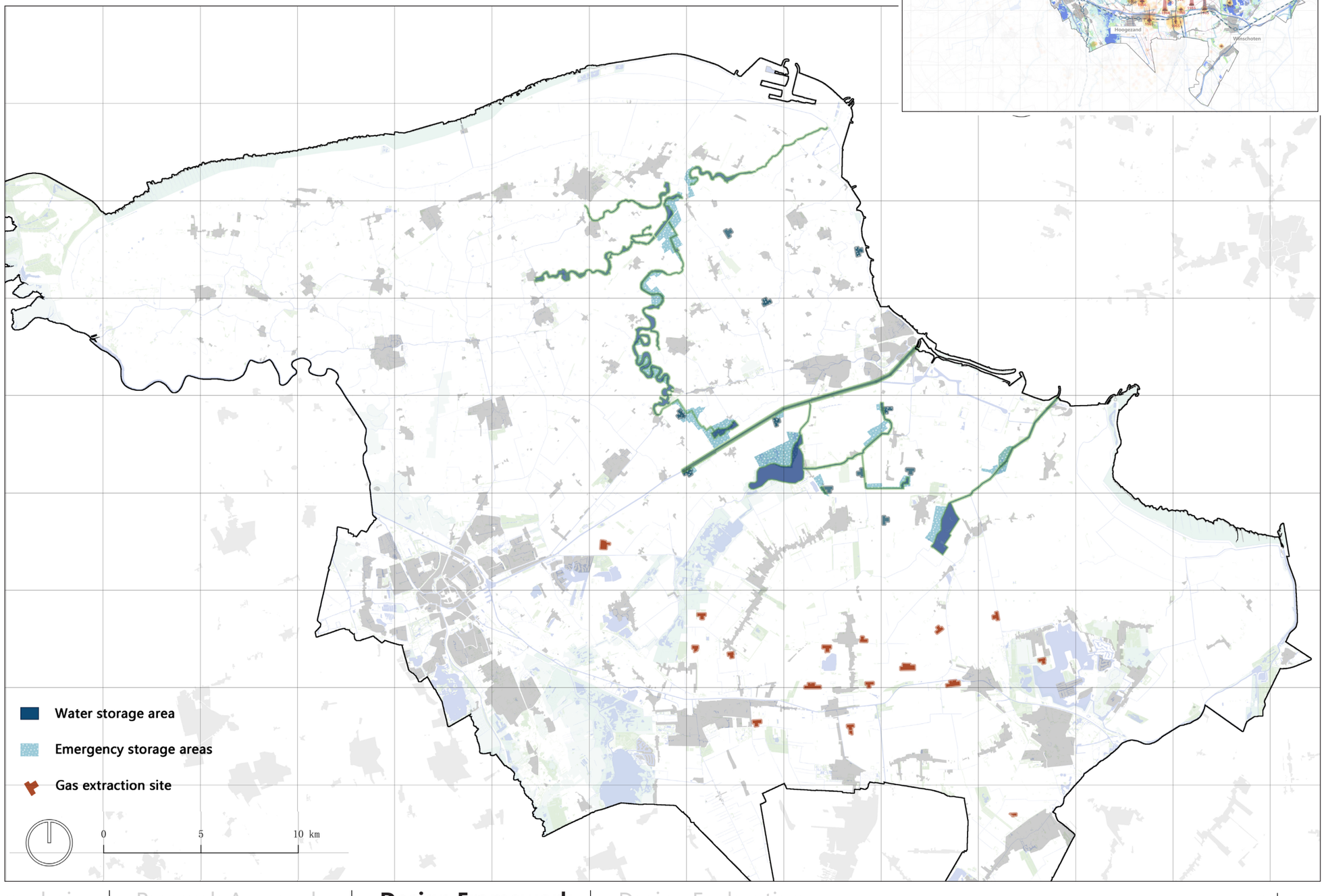








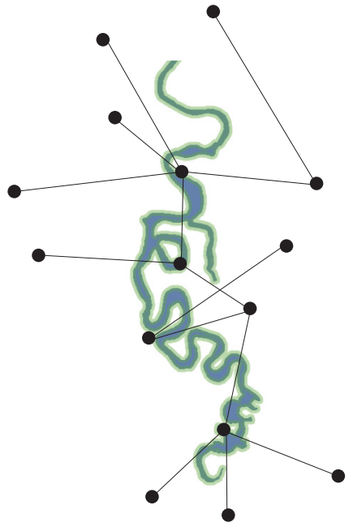




After gas - provide opportunity to the regional Landscape

Better location for new communities

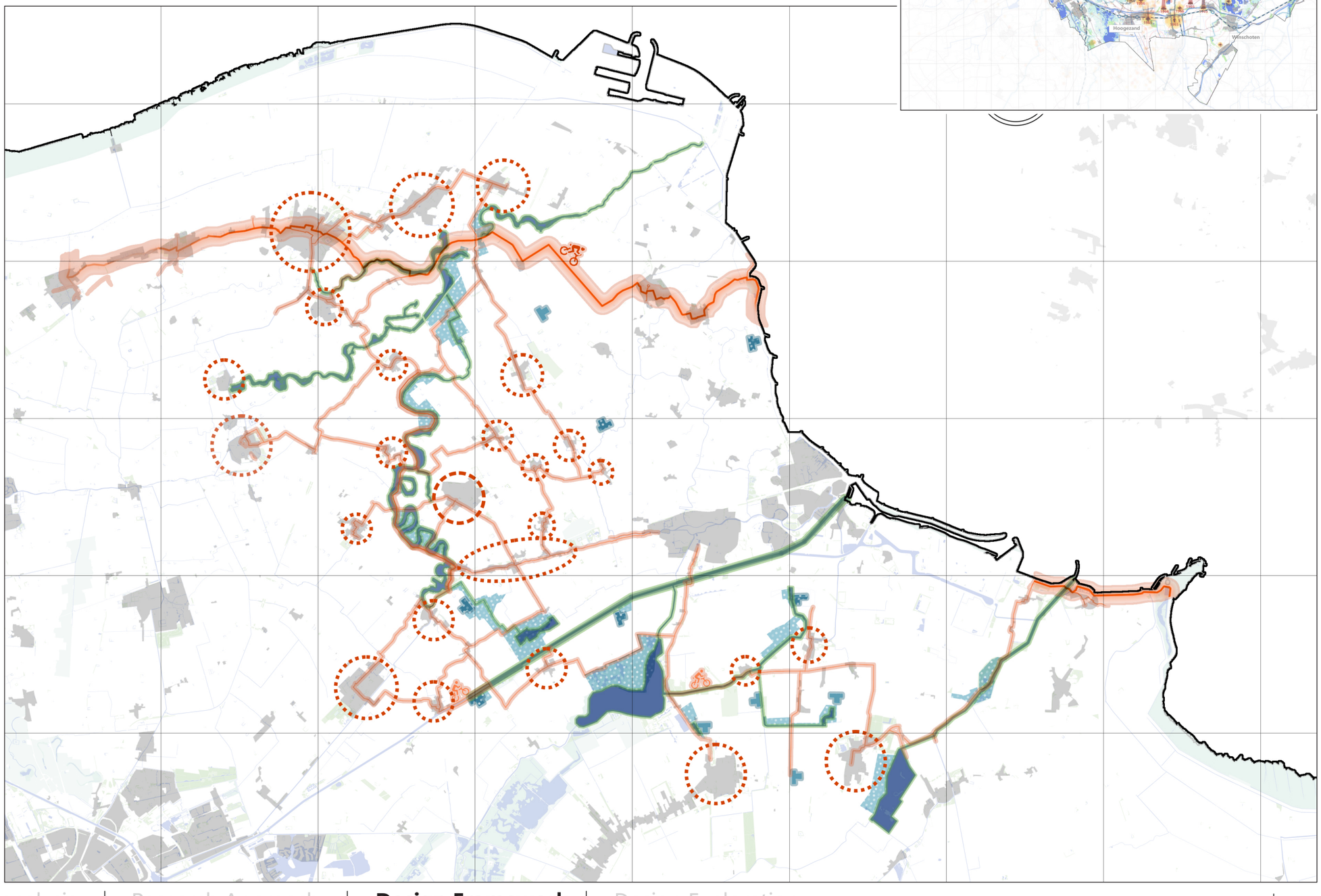
Furthermore, in future considerations for new community developments, site selection could prioritize locations closer to these enhanced green infrastructures.

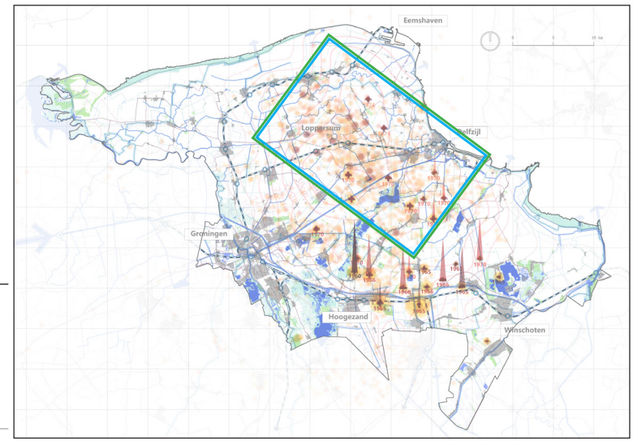












After gas - provide opportunity to the regional Landscape

A industrial heritage routing

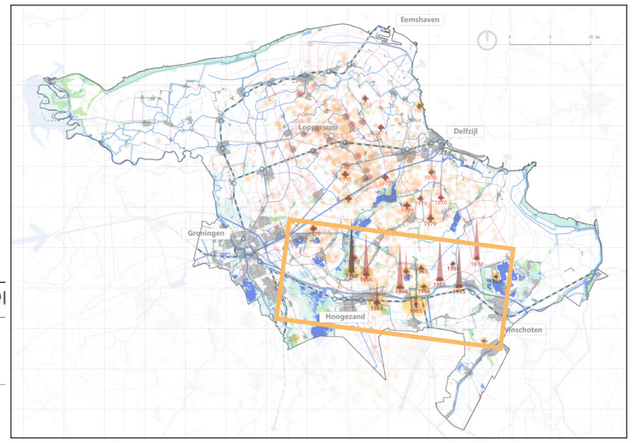


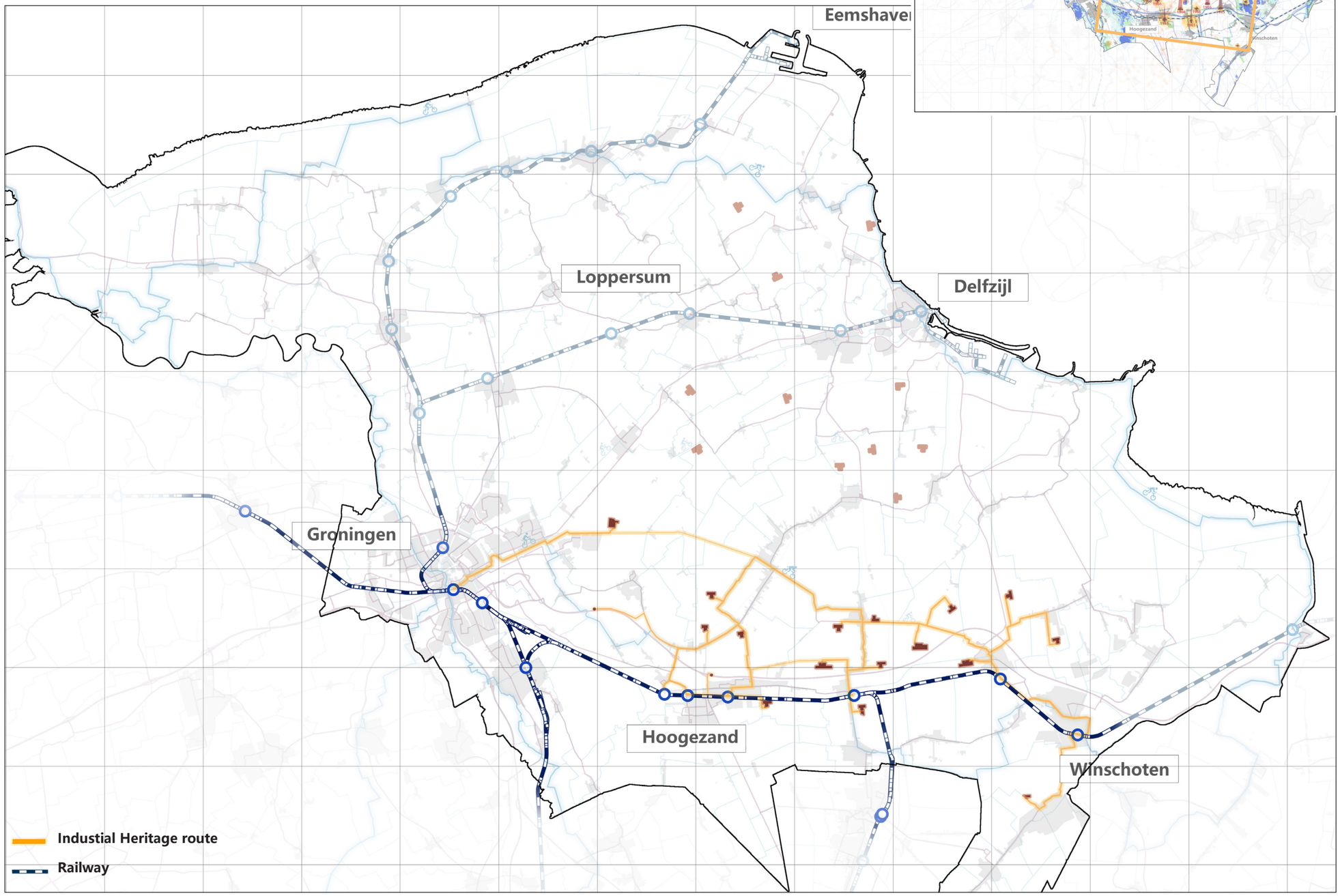












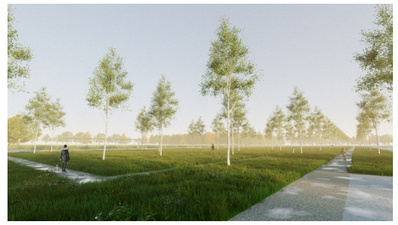
After gas - Embracing the Guilty Landscape enhancing regional identity

Stream valley





Parks





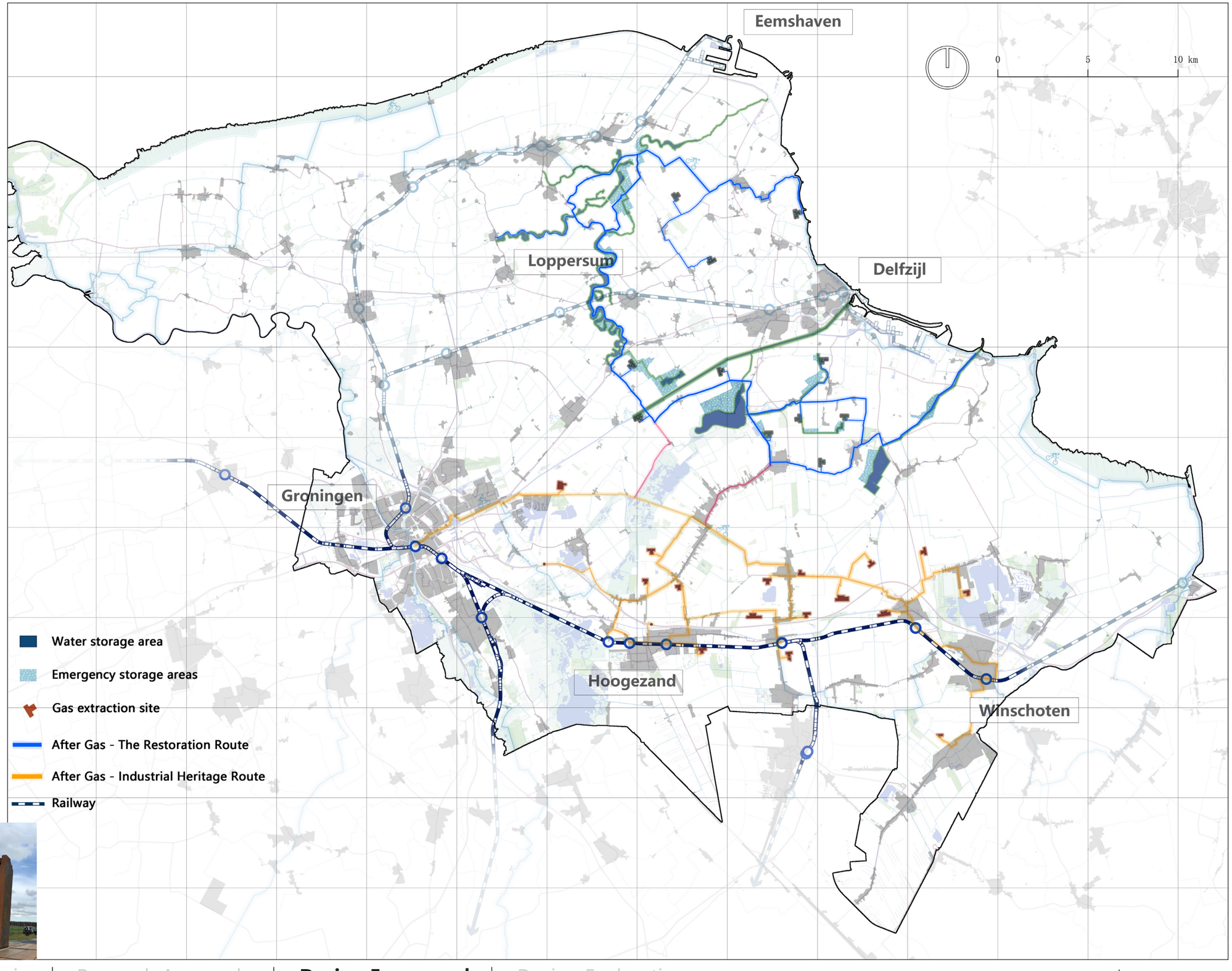
Industrial nature



Landmarks







Opportunity to the gas extraction sites

For enhancing the regional identity, the transformation of these gas extraction industrial sites is a crucial component.

Regional Landscape

Industrial location

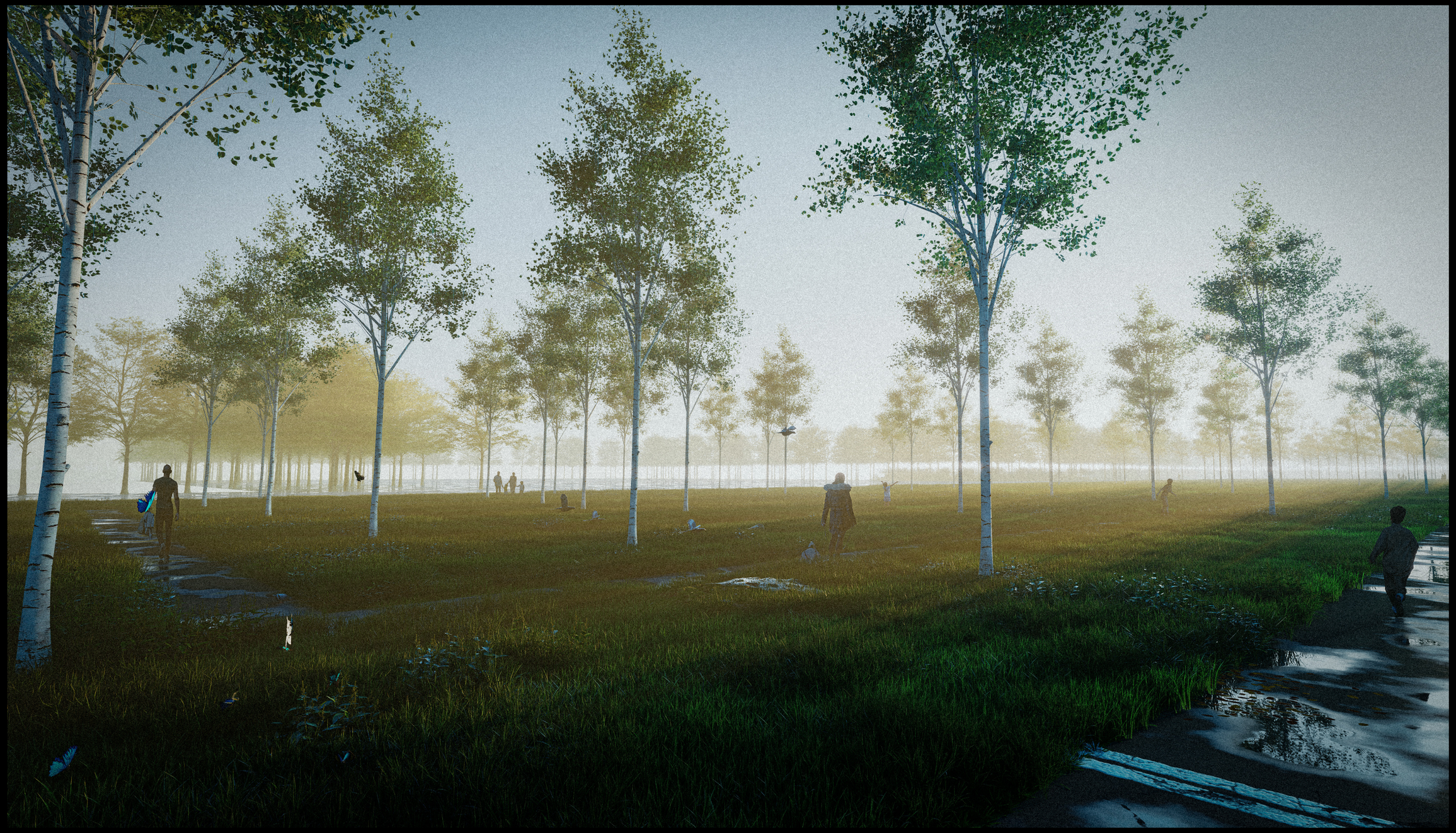


Activities





An Identity <---------- A Story <---------- An Emotion



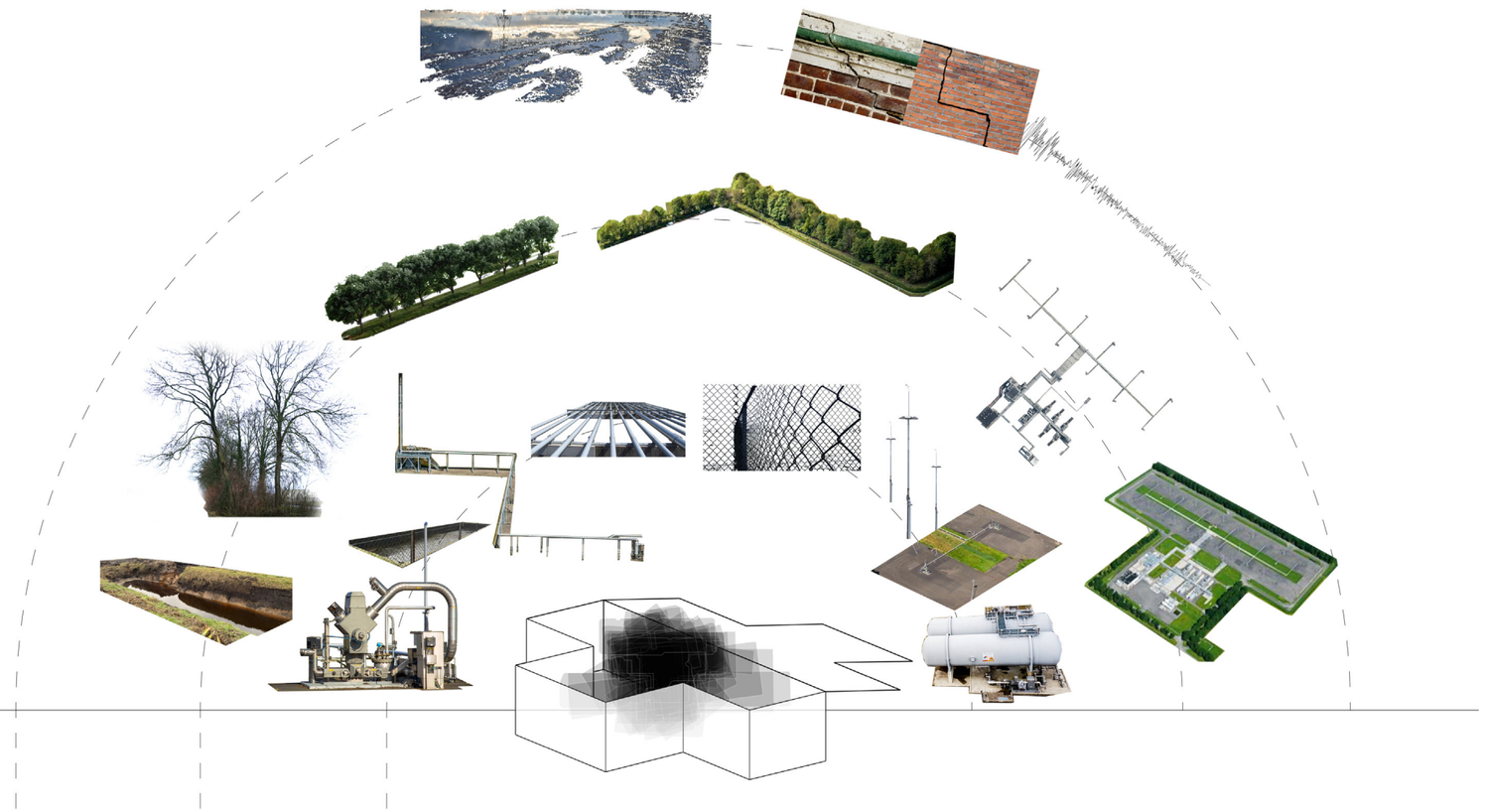
Build With Guilt
Embracing the Guilty Landscapes
-
Provide opportunity to gas extraction site

Site materials

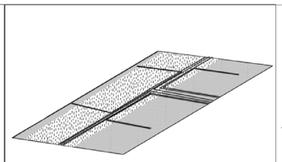
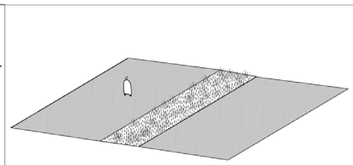
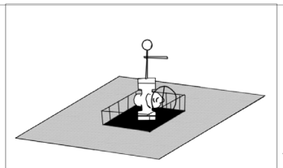
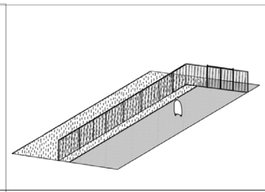
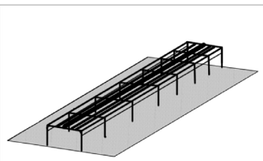
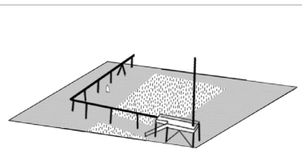
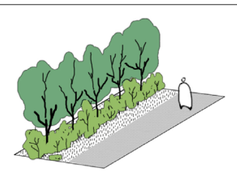
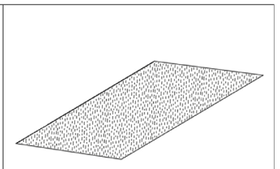
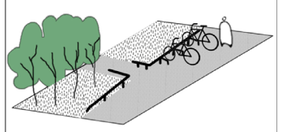
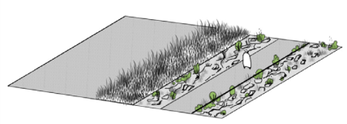
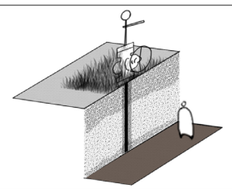
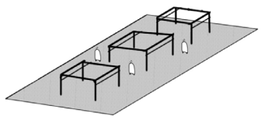
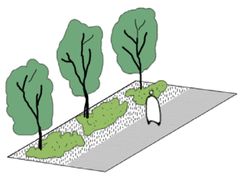
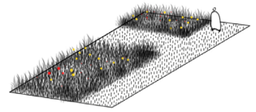
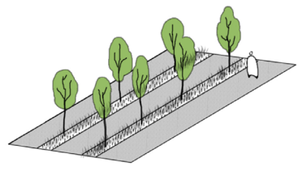
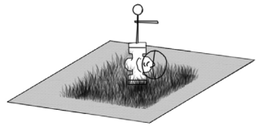
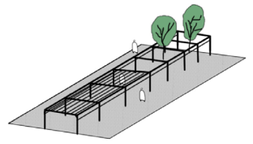
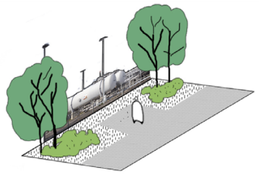
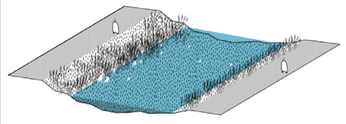
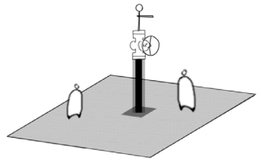
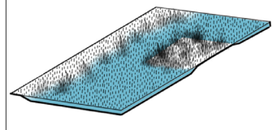
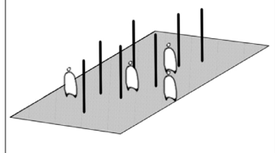
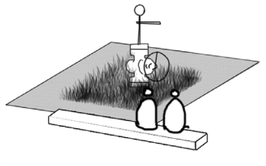
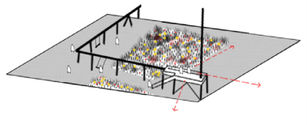






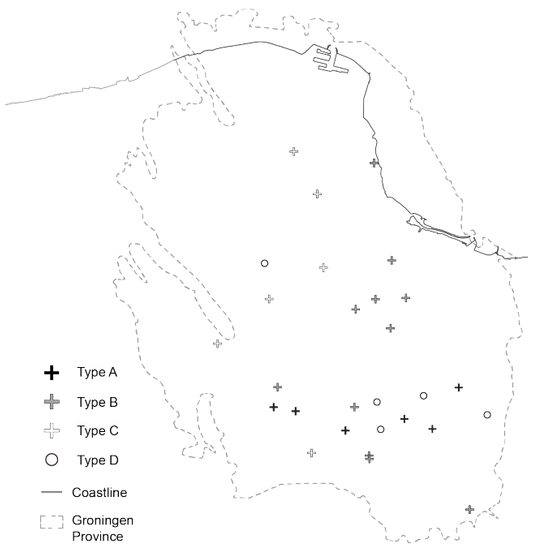


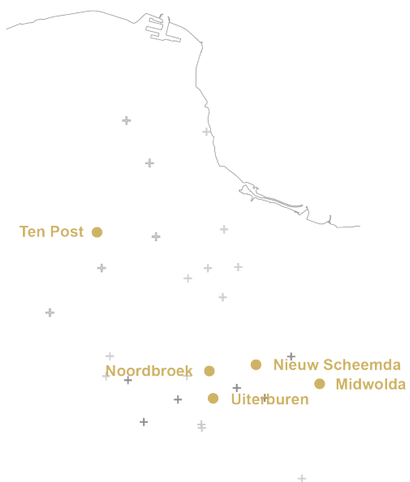
Design guideline

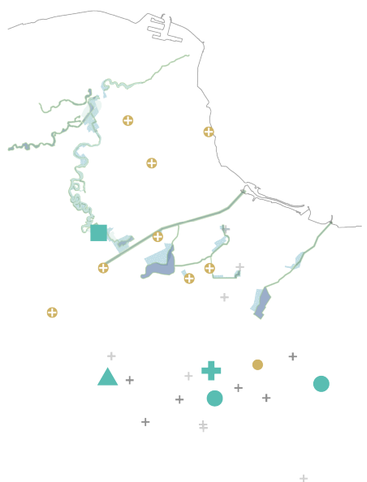
Design Action	Industrial Materials						Natural Materials	
	Piple	Concrete Pavement	Gas well	Fence	Support structure	Flare tower/Tanks	Trees	Meadows
Open & Retaining								
Cutting								
Framing								
Excavating								
Viewing								

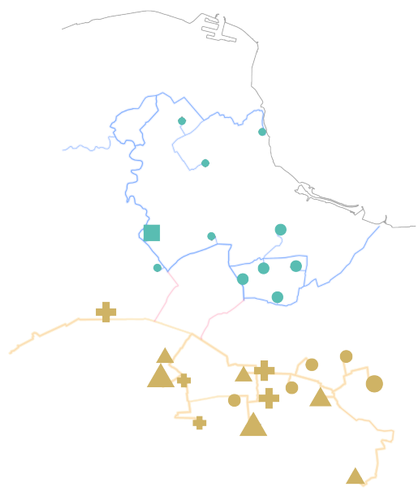
Design the transformation process

Time-Phase Planning









Phase 1
The Gas Extraction Stopped
The Field is Closed

Phase 2
Controlled Opening
Based on the clean-up and reuse processes by NAM

Phase 3
Some Sites Used as First Pioneers
Based on the uniqueness of each site

Phase 4
Opening of Whole Sites

0 Guilty landscape sculpted by large-scale gas extraction



1 Open the fence



2 New entrances for public



3 Mowing and non-mowing



4 Gas field as Experimental Laboratory

- Industrial heritage site
- Wilderness and Forest
- Water storage facility
- Entertainment ground

5 More water storaged in land subsidence area

- Re-meandering stream



- Wetland, surface water storage



6 Routes connecting sites within a cluster

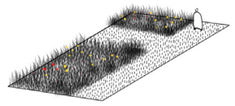
- Spatial experience
- Industrial materials using as wayfinding

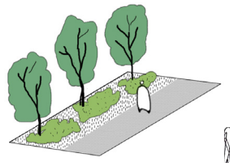
Phase 2 Controlled Open

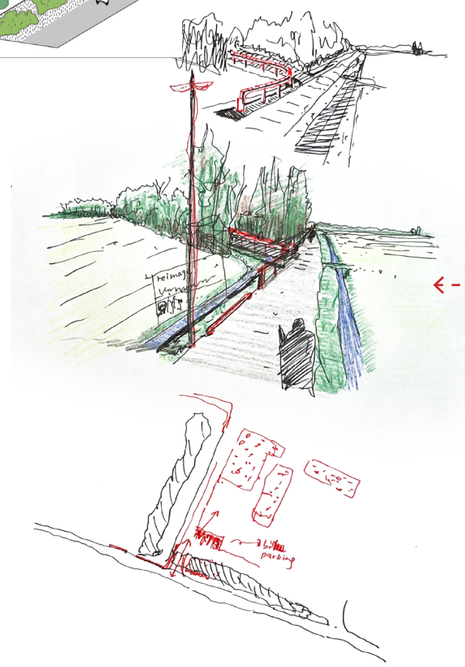
Open & Retaining



Cutting



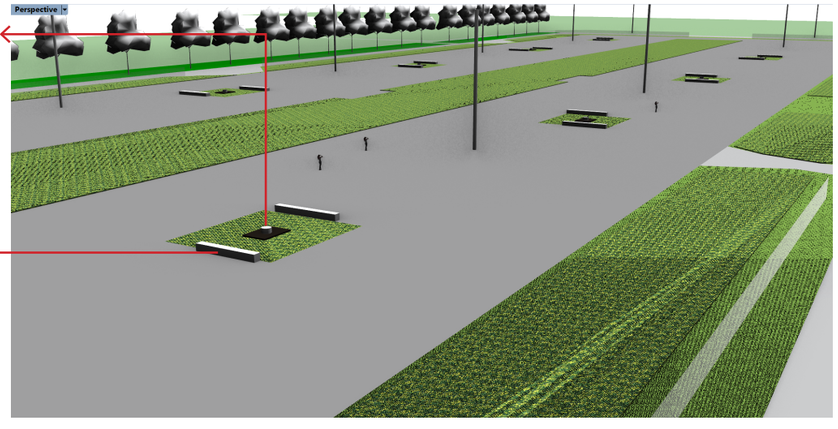


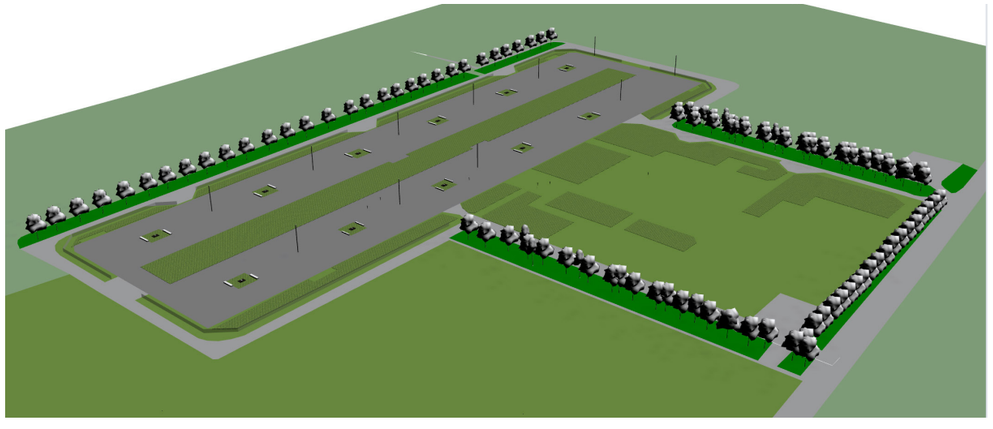








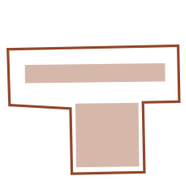


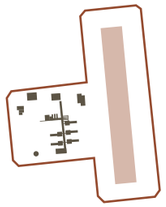


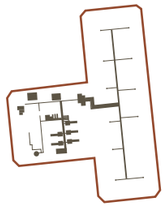


The new gas park is also used for a number of sporting activities by utilizing the extensive leftover paved concrete surfaces

Design guideline for the gas extraction sites transformation







Site Type

Cleaned

During cleaning

Clean-up has not yet begun

Site Context

Tracing industrial history

Pattern Historical significance

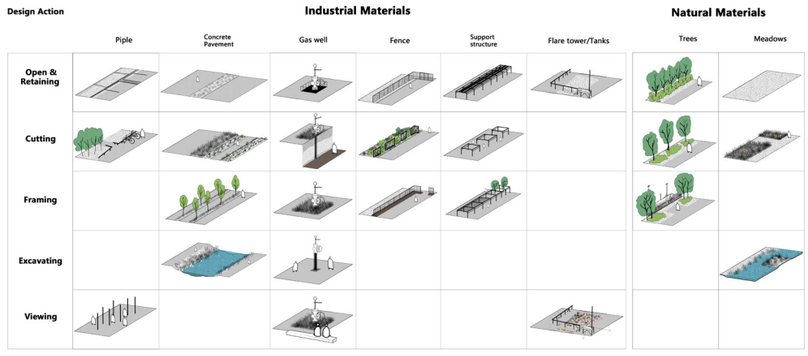
Site Location

Green-blue Belt Area

Urban Belt Area

Deciding what to represent

Design Intervention



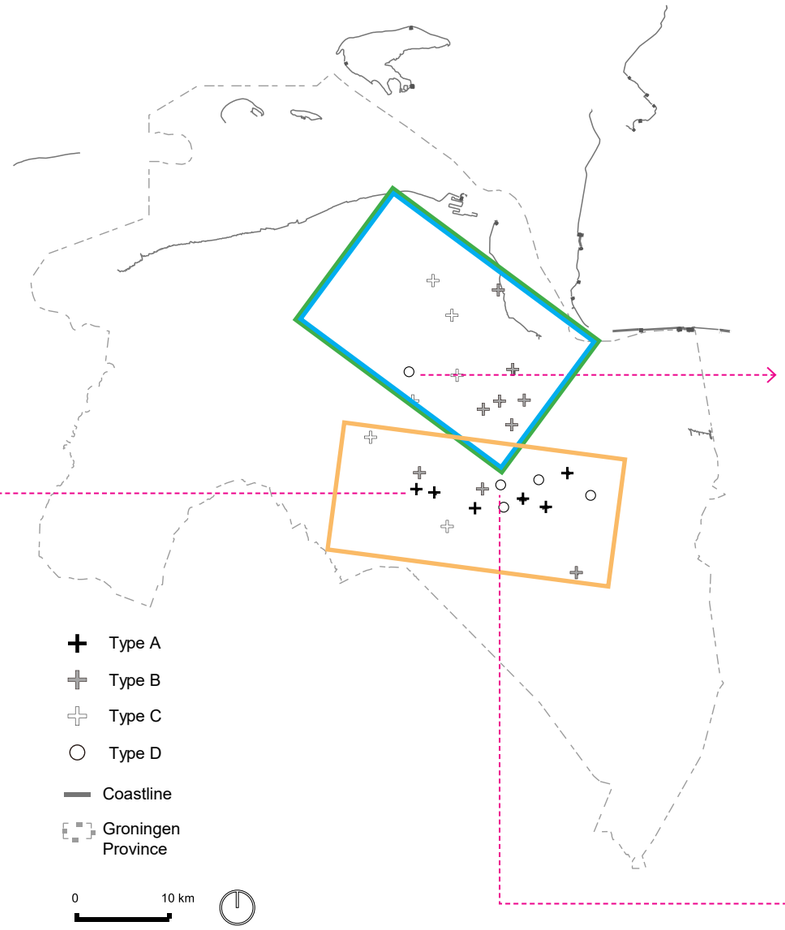
Selection of test sites

“What will future gas extraction sites look like?

Site Status (Type A):
Gas extraction stopped after 2024
The clean-up process hasn't started yet.

First gas extraction site in Groningen **Slochteren**





Site Status (Type D):
Gas extraction stopped after 2019
In phase 3 of the clean-up process

Ten Post Located in the areas with the most severe land subsidence

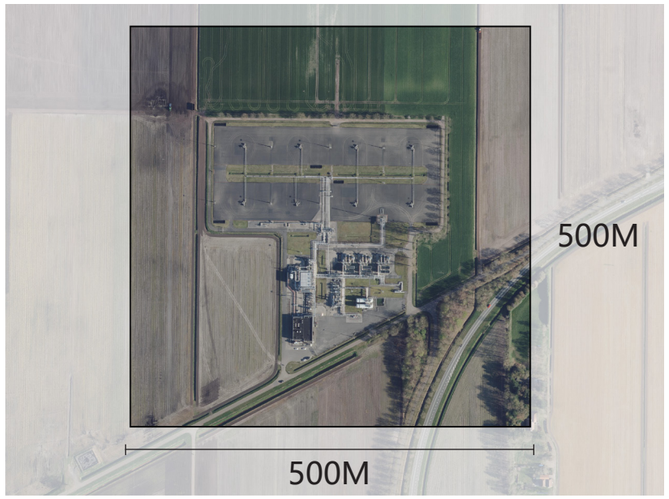


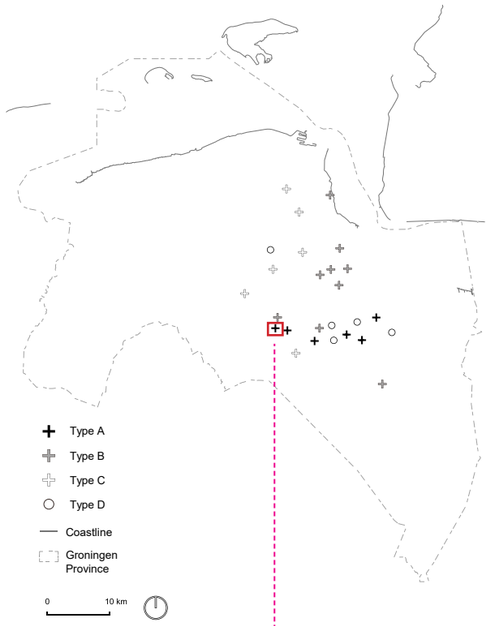
Site Status (Type D):
Gas extraction stopped after 2008
In phase 3 of the clean-up process

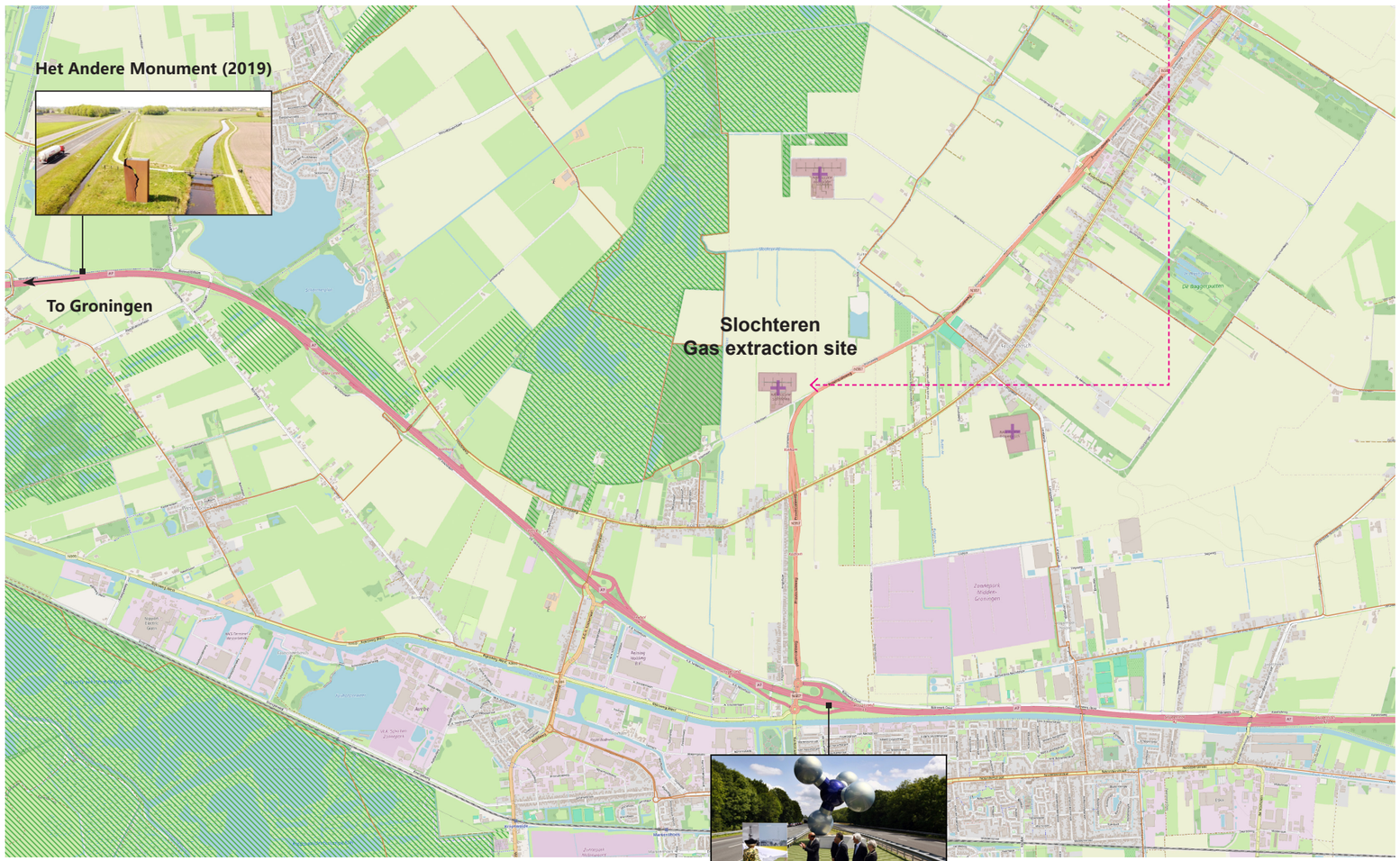
Noordbroek Located near residential areas, it is one of the first sites to begin cleanup.



Test site 1 - Slochteren







The location of Slochteren

Gas molecule art monument (2009)



The discovery of the Groningen gas field on farmer Boon' s land in 1959. Slochteren 1 is being drilled.



Aerial photo of Slocteren in 2018

Test site 1 - Slochteren



Natural reserve landscape



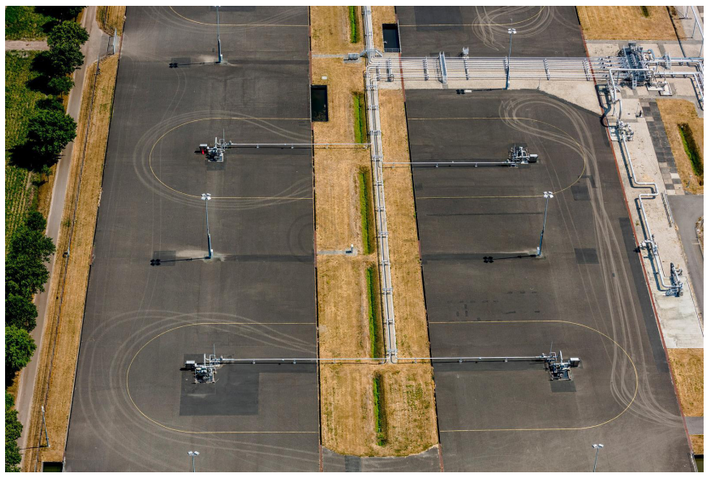
Dorpsbos Kolham

Agricultural landscape



Farmland

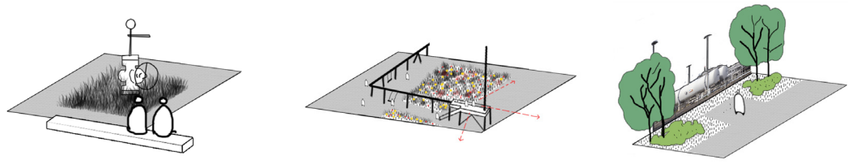
Gas extraction landscape

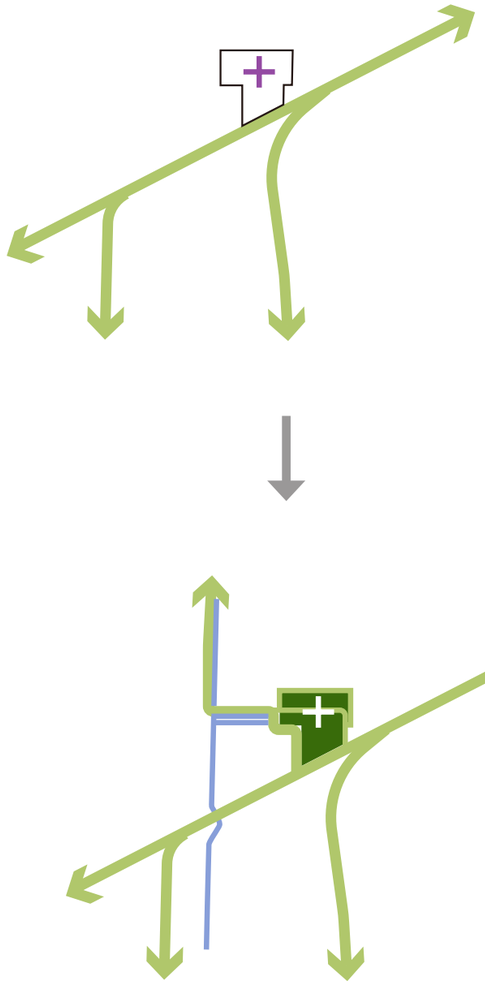


Slochteren gas production site

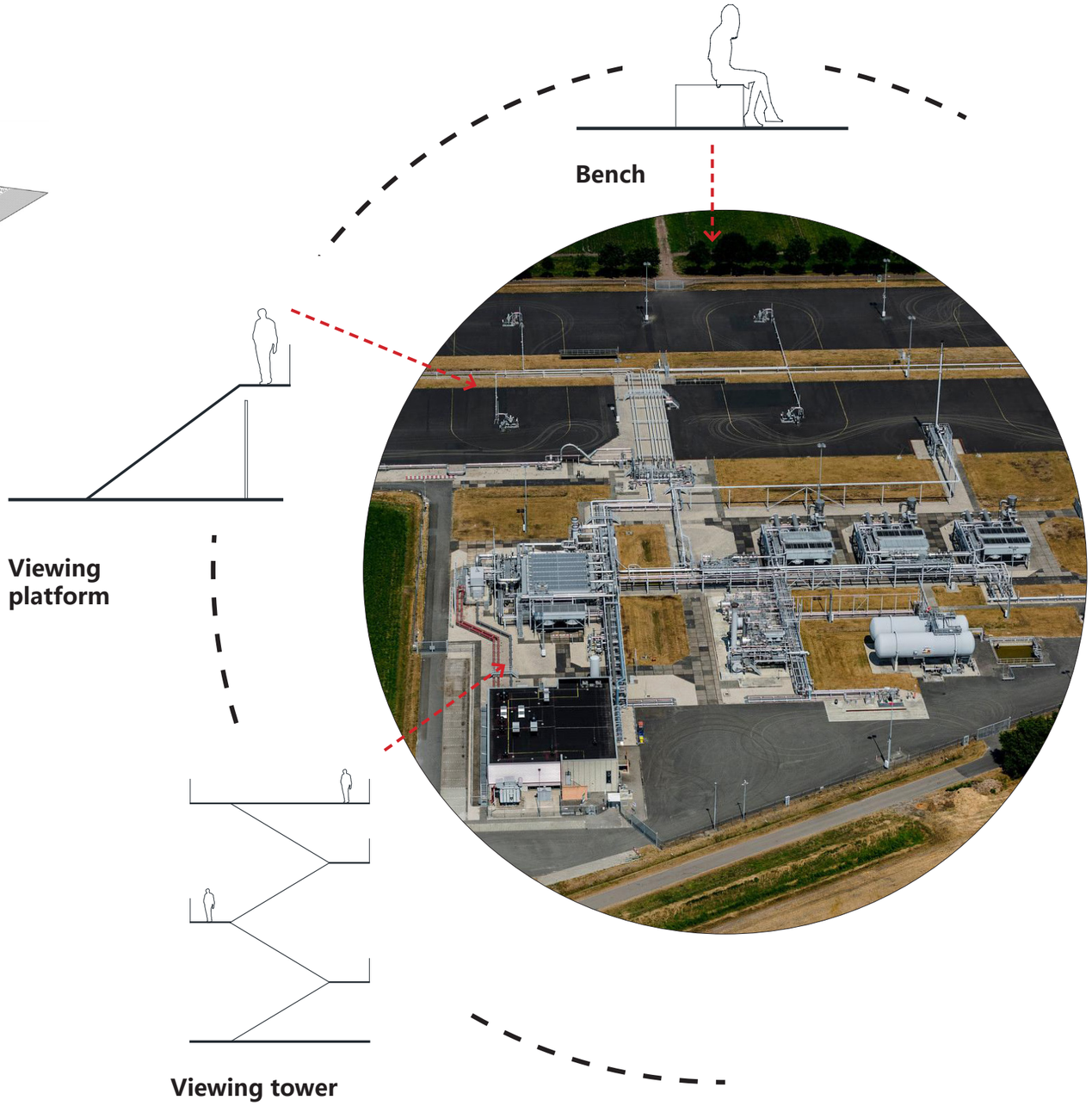
Design concept - Slochteren

Viewing



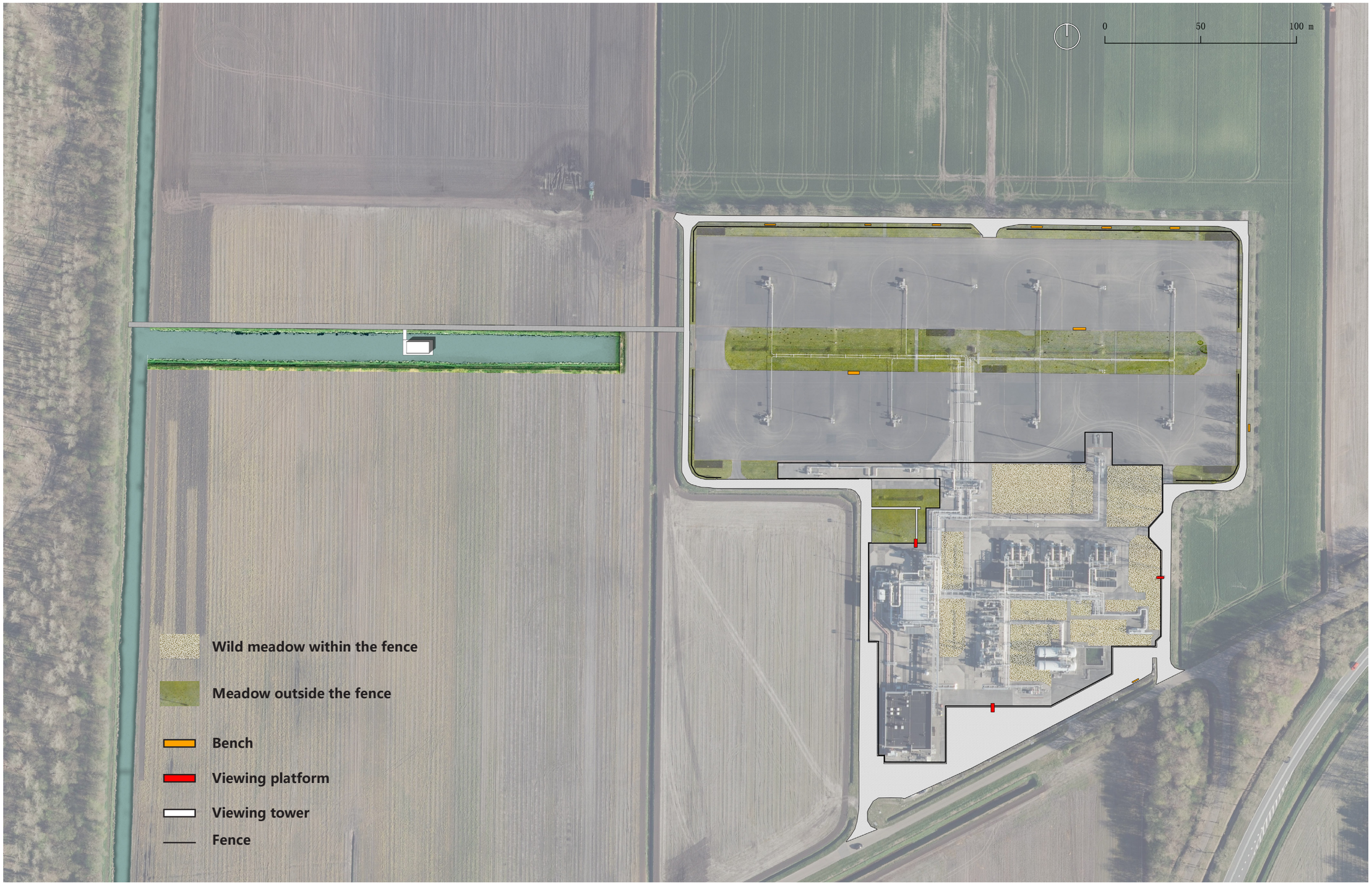


Connecting



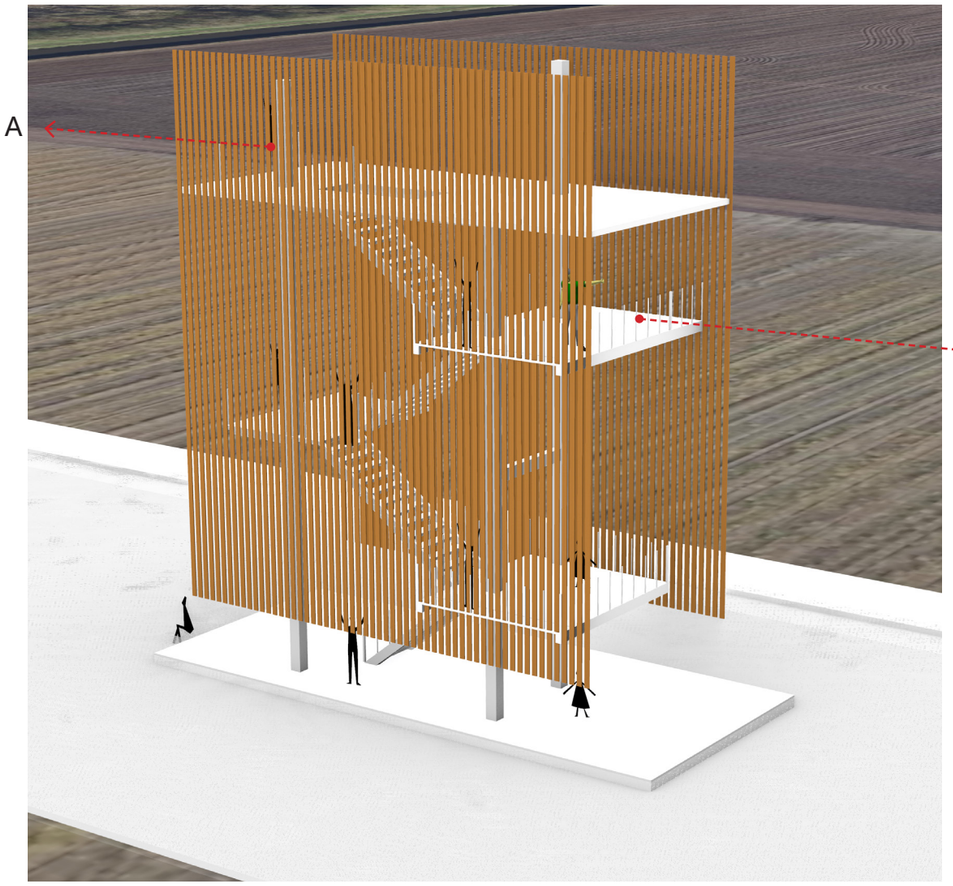
Different way of observing the gas site

Test site 1 - Slochteren

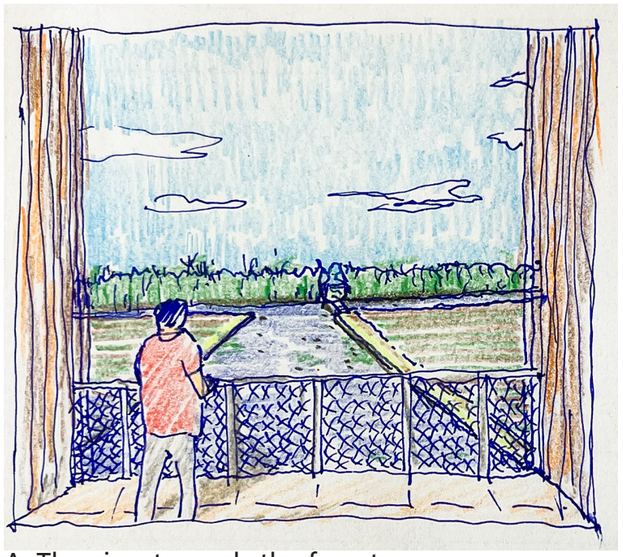


Test site 1 - Slochteren

The veiwing tower, situated amidst the fields, offers visitors an experience of viewing the gas extraction site from different heights. This framed view creates a contrast between nature and industry, providing a unique perspective.



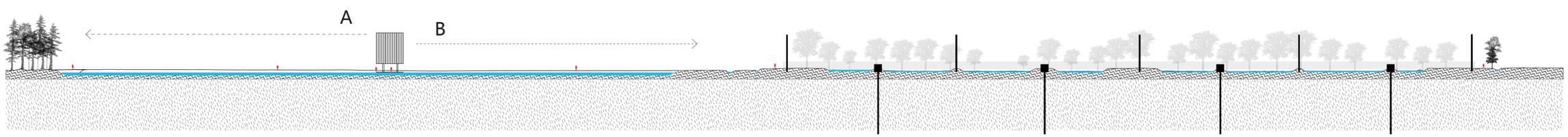
The viewing tower



A: The view towards the forest



B: The view towards the gas extraction site



0 | 125M | 250M | 375M | 500M | 600M





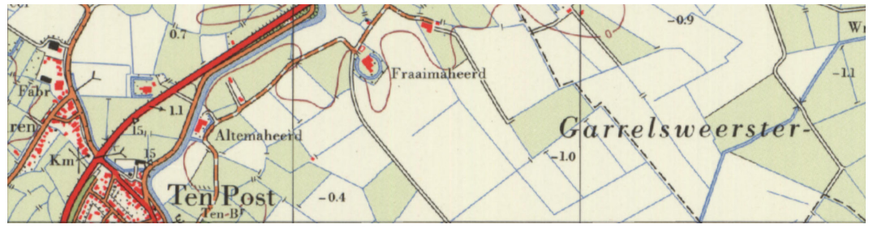

WELL-12

Test site 2 - Ten post

Gas extraction location_Ten Post



The site history of Ten Post



When this site is used as agricultural land



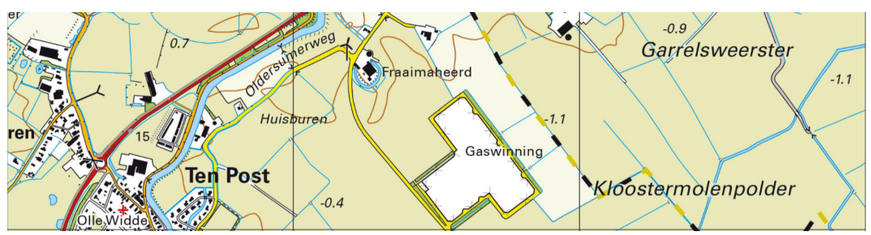
When this site is used as an extraction site for gas production



When this site facilities were cleared



When the industrial trace was erased



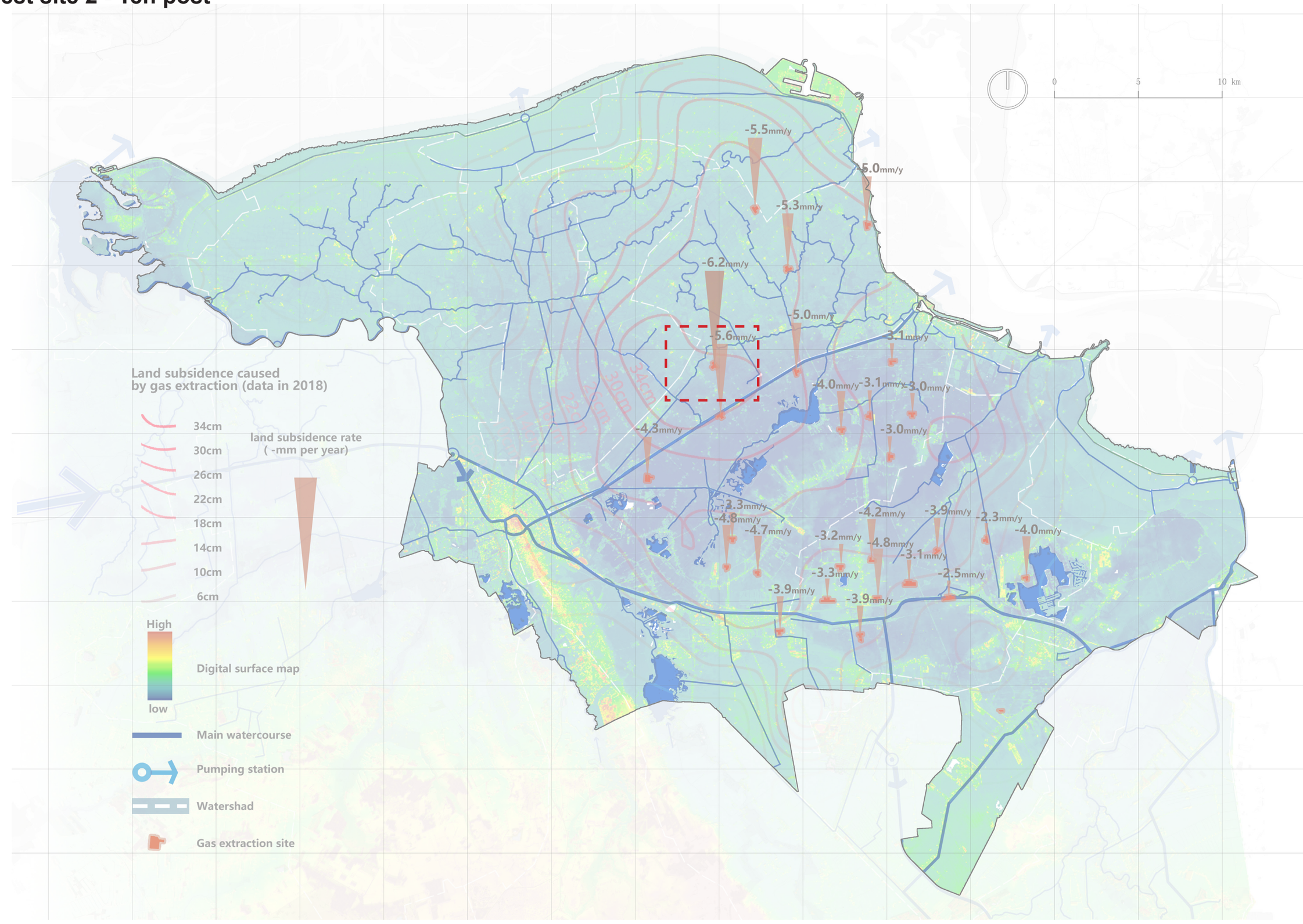
Before 1970

1970-2019

2019-2020

2020 - 2024

Test site 2 - Ten post

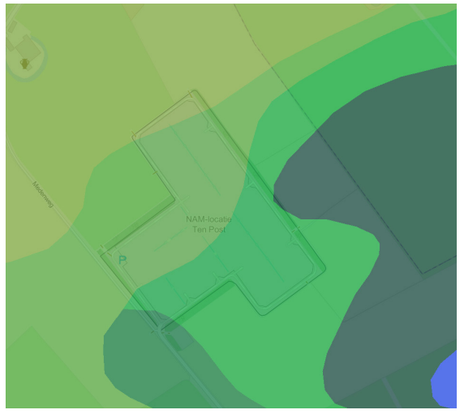


Test site 2 - Ten post



The spatial quality of Ten Post gas extraction site in 2010 (up) and 2022 (below)

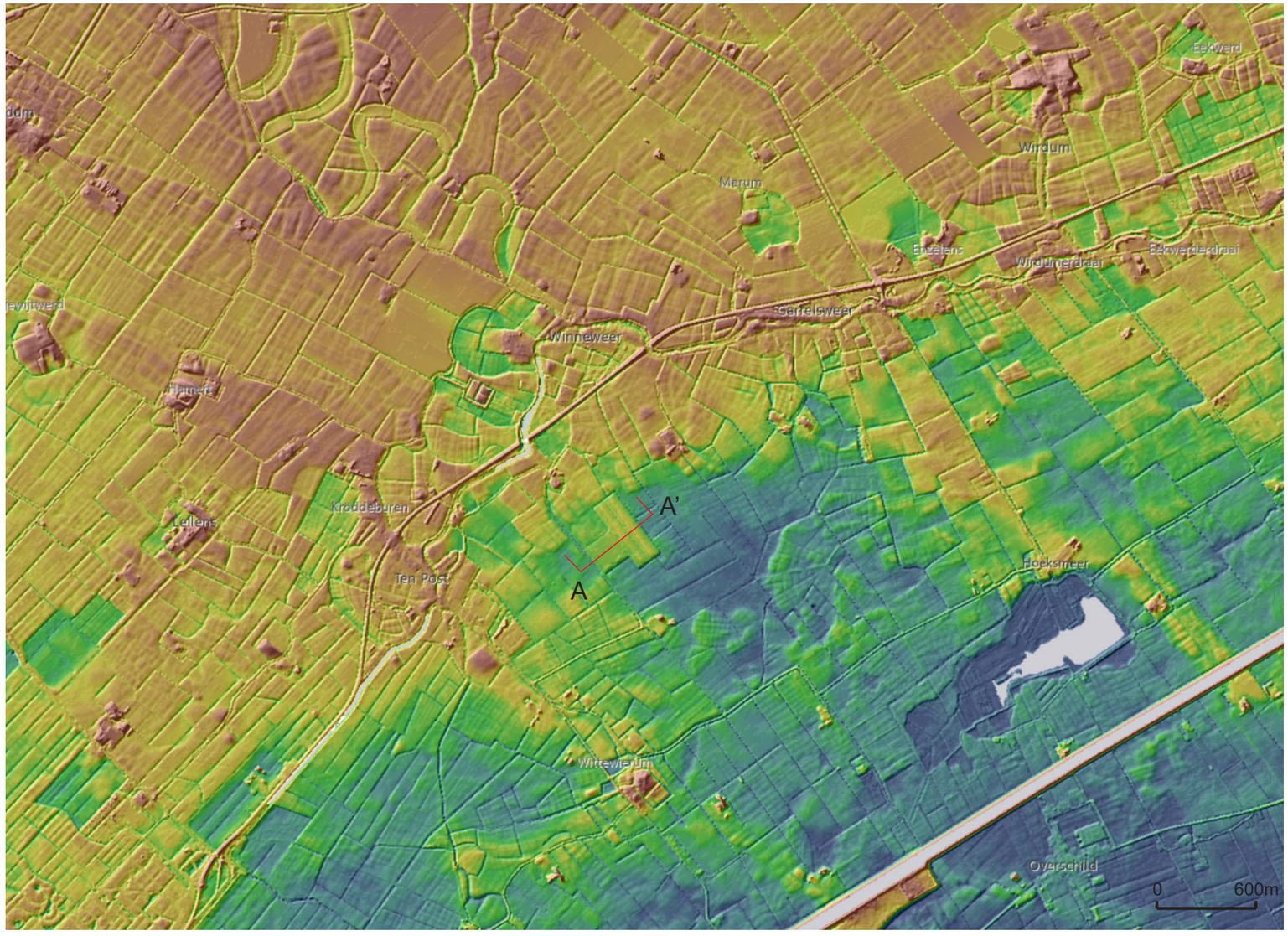
Test site 2 - Ten post



Soil type: sea clay



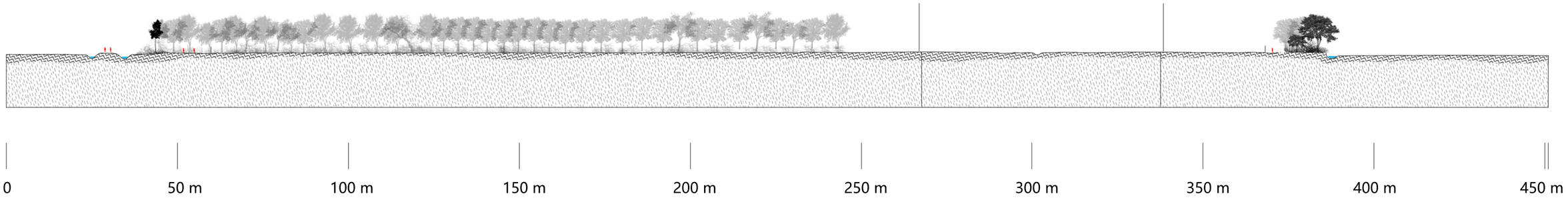
Summer water level: 133cm
Winter water level: 38cm



A

Topographical map

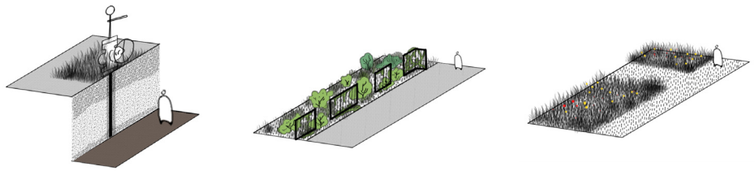
A'



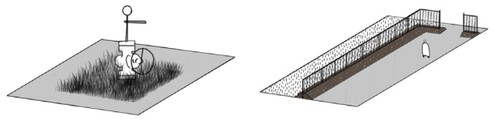
Design concept - Ten post

Revealing the impact of land subsidence

Cutting



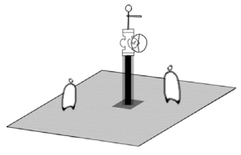
Framing



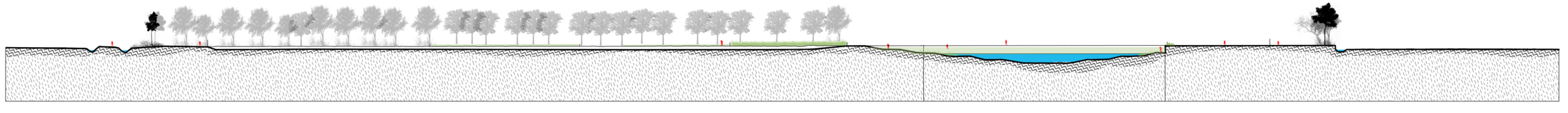
Excavating



Viewing





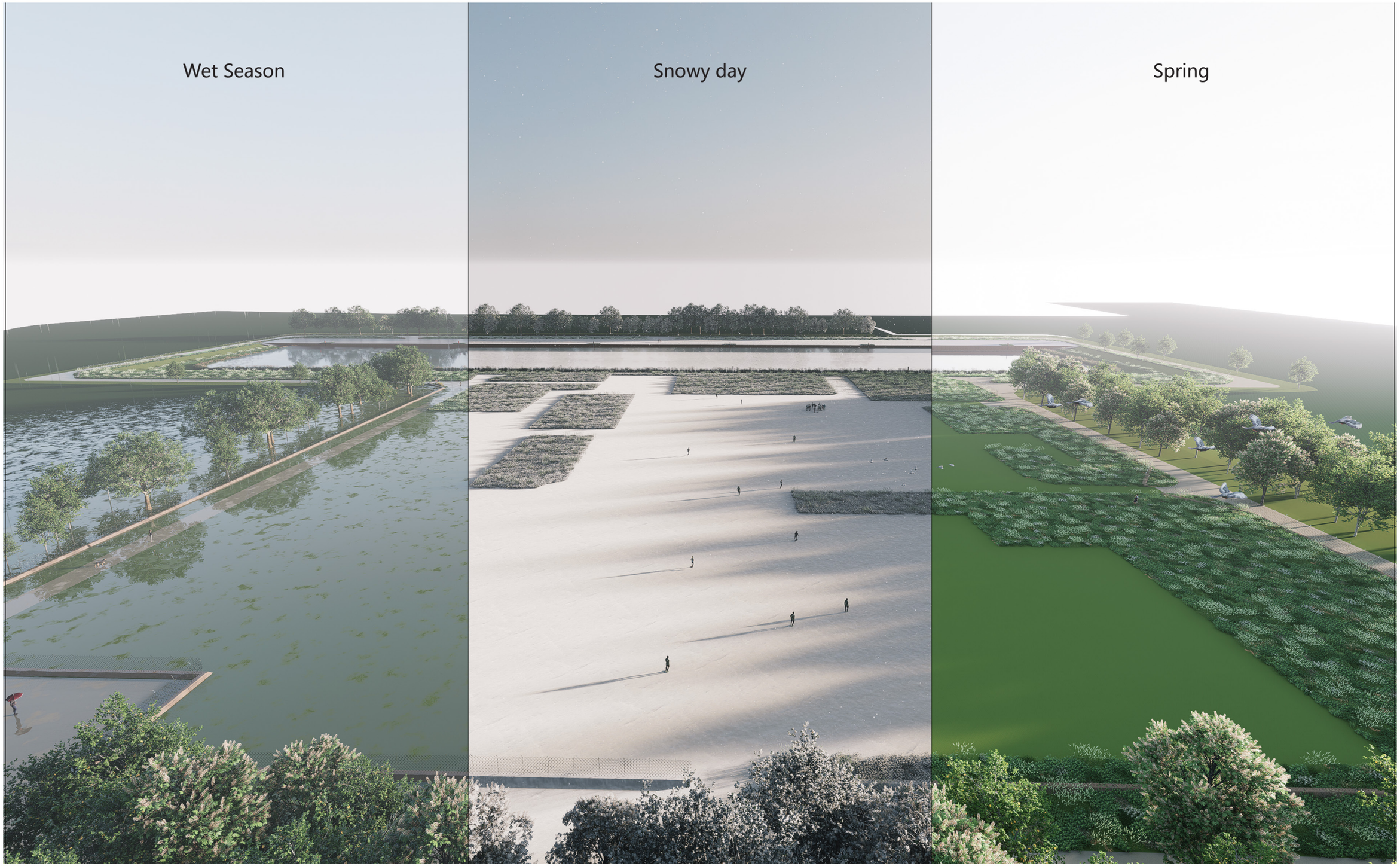


0 | 50 m | 100 m | 150 m | 200 m | 250 m | 300 m | 350 m | 400 m | 450 m

Spatial experience - Ten post

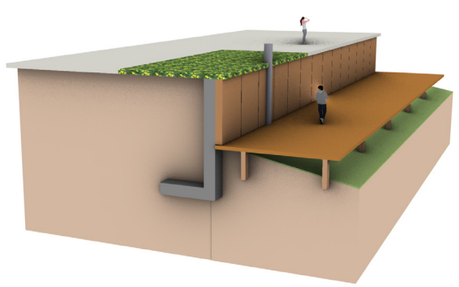


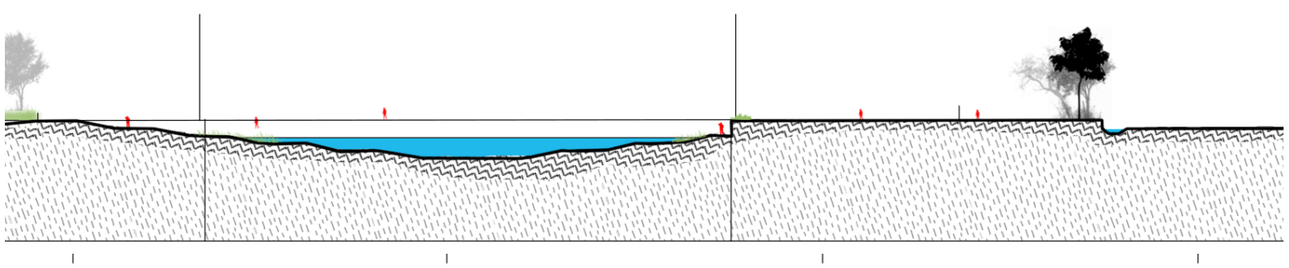
Spatial experience - Ten post



Spatial experience - Ten post

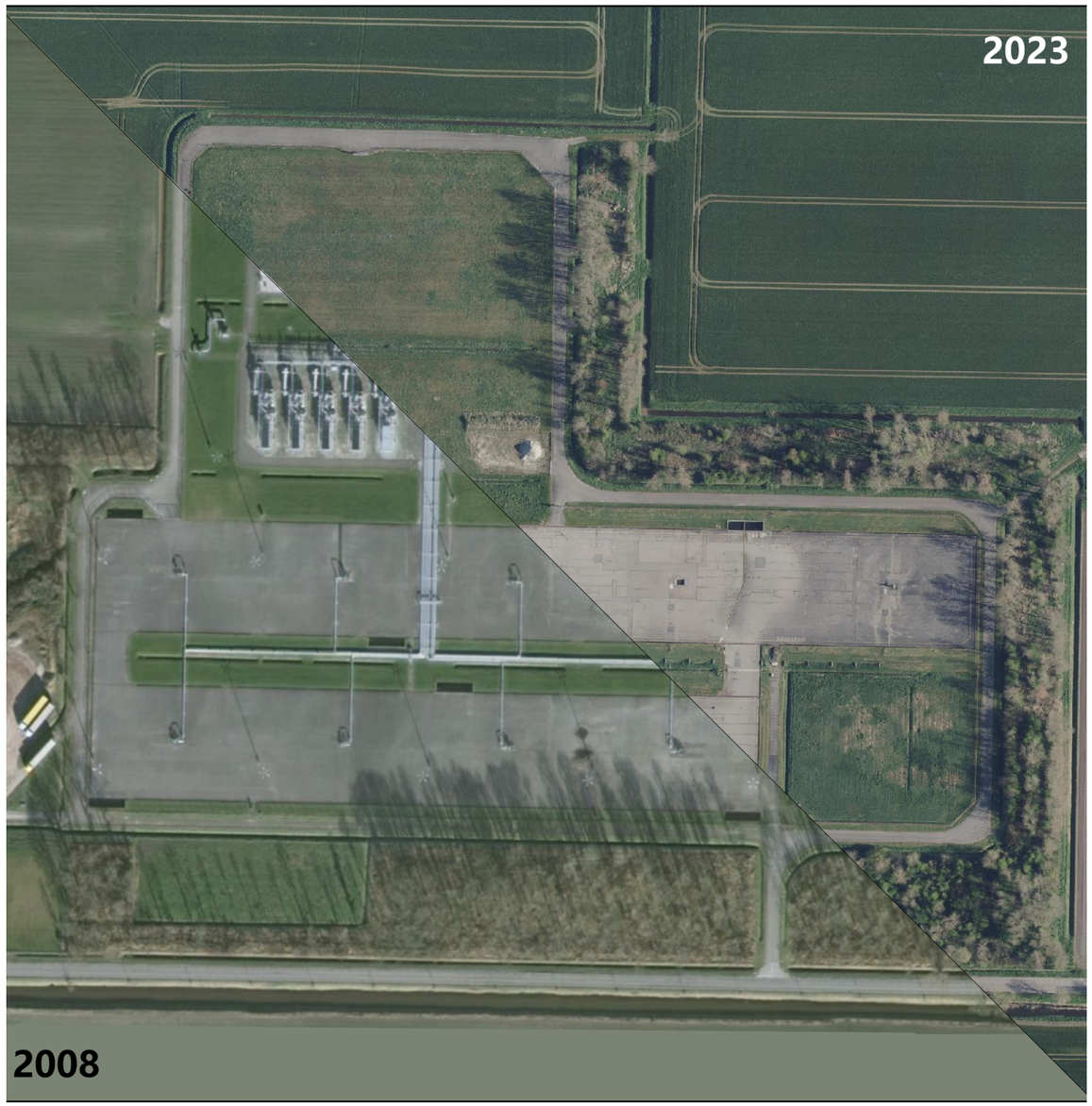






Test site 3 - Noordbroek

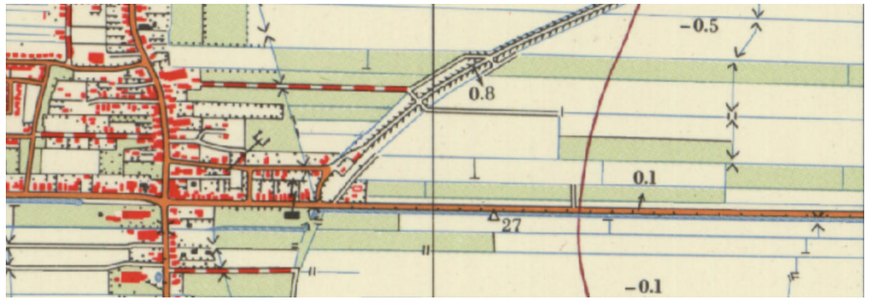
Gas extraction location_Noordbroek



N 0 50 100

The site history of Noordbroek

Before 1965



When this site is used as agricultural land



When this site is used as an extraction site for gas production

1965-2008





2008 - 2024



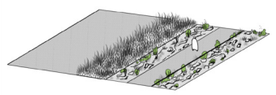


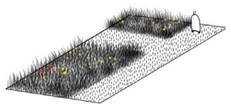
When facilities were cleared and industrial trace was erased

Design concept - Noordbroek

Integrating daily life into memorial spaces

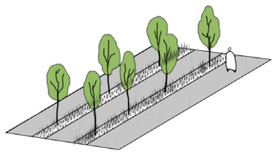
Cutting

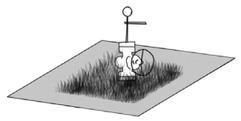


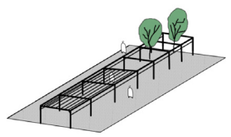


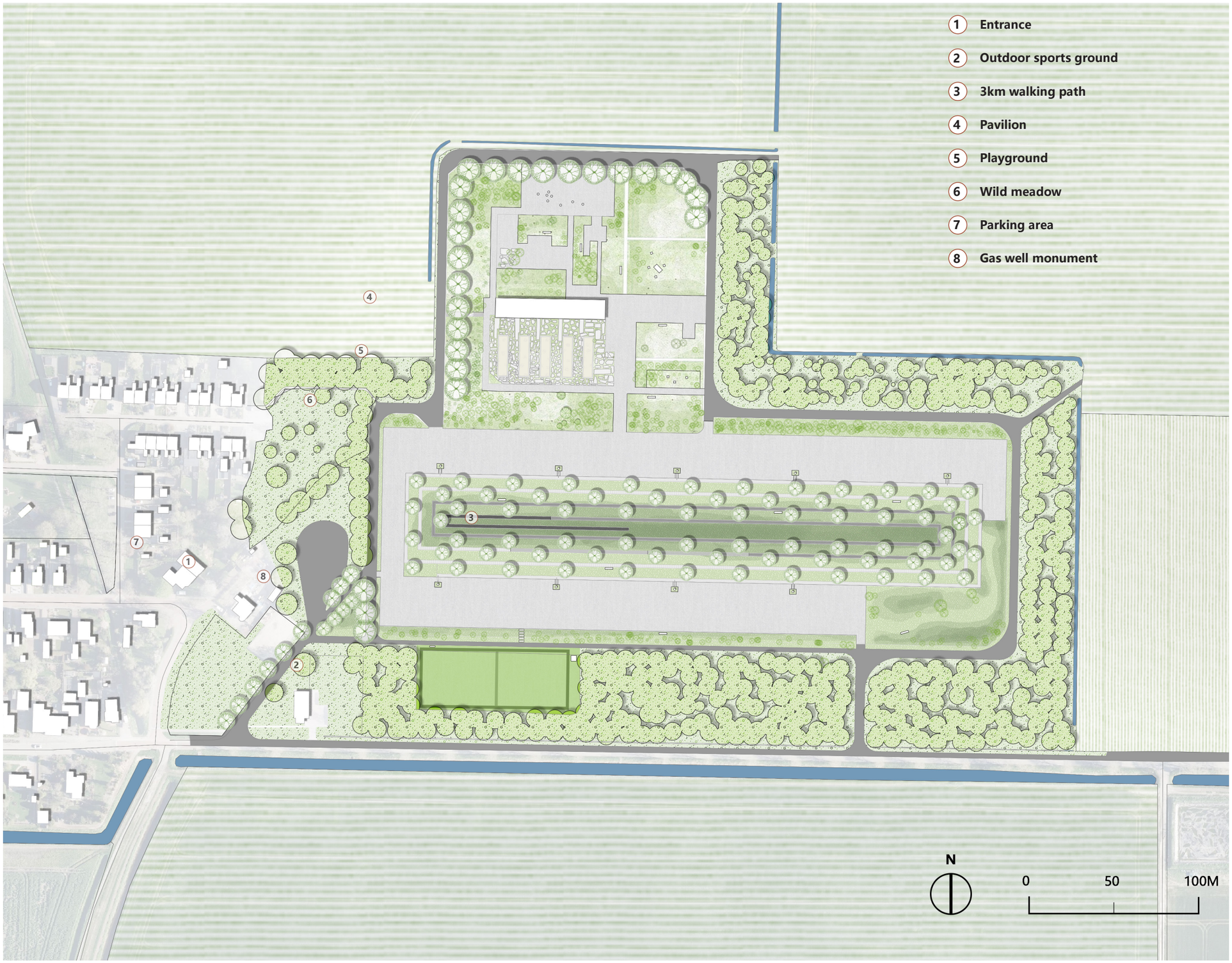


Framing





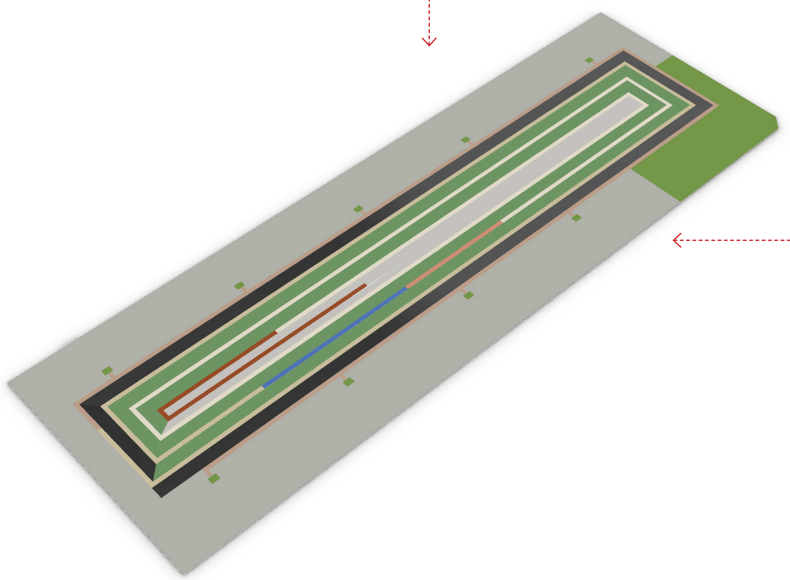


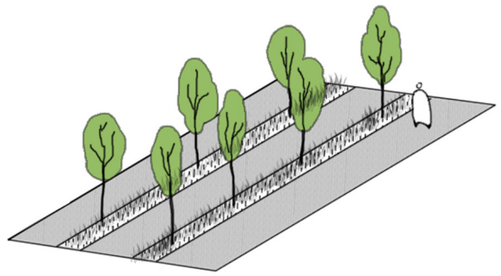


Design concept - Noordbroek

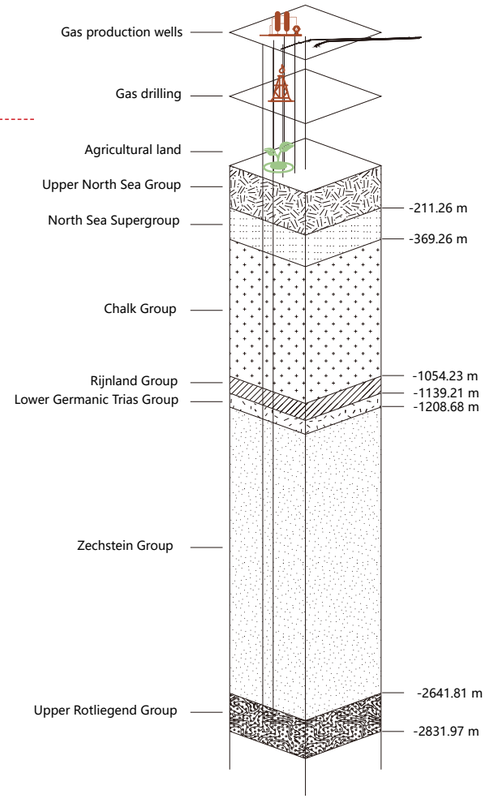
Represent the length of the underground invisible pipe work







Native tree species, such as silver birch, are planted between the paths, bringing natural vitality back to the site.



A 3km path

The underground 3km pipeline is represented on the concrete pavement in the form of a pathway. Different materials are used in the paving design to represent various geological layers.

Test site 3 - Noordbroek

Design Intervention: plants and grow with time


Sorbus aucuparia


Sambucus nigra


Quercus robur


Phragmites australis


Ranunculus repens


Jacobaea vulgaris

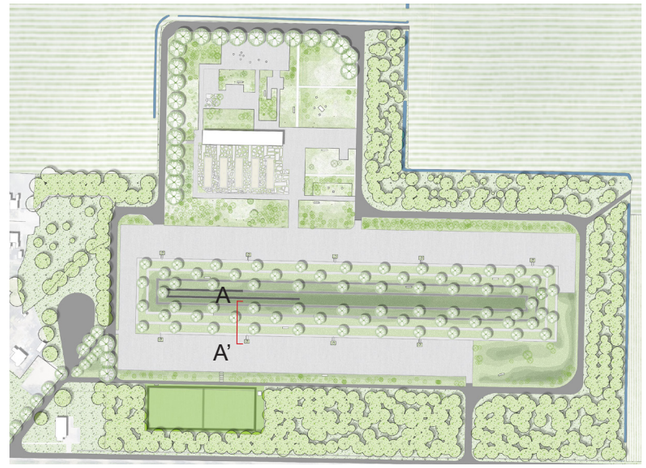

Taraxacum officinale

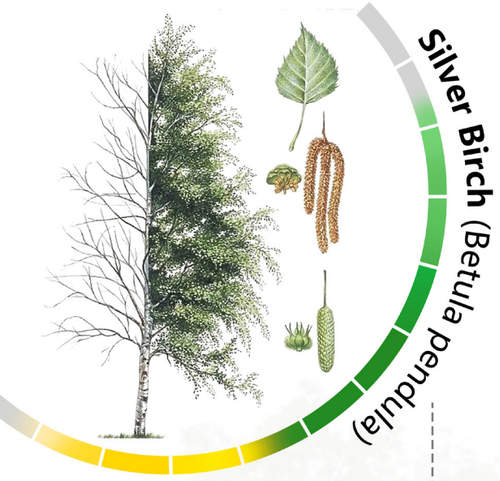

Achillea millefolium


Cosmos bipinnatus


Anthriscus sylvestris


Buddleja davidii





Spatial experience - Noordbroek



Spatial experience - Noordbroek

A perspective view the sunken path





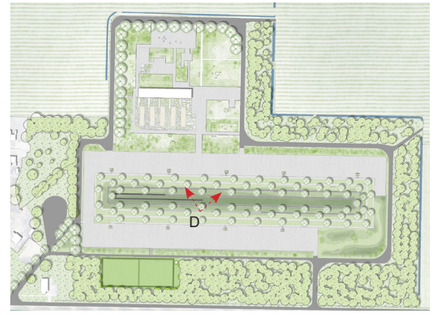
Spatial experience - Noordbroek

As time progresses, the birch trees and other plants gradually grow, with the canopy forming an upper boundary, creating a comfortable space with shadow. During this period, the lush vegetation becomes the dominant visual element.



Spatial experience - Noordbroek

During the rainy season, the lower-lying areas will be filled with water. This also serves as an expression of the land subsidence caused by gas extraction.





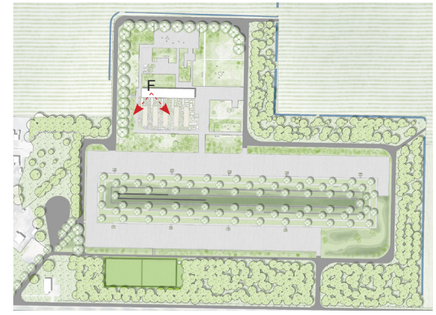
Spatial experience - Noordbroek

The pavilion is situated on the location of original industrial structure, providing a space for people to reflect. The broken paving materials in front of the pavilion come from the concrete removed during the construction of the 3 km pathway.



Spatial experience - Noordbroek

The spontaneous growth of plants in the gaps of the paving. Design translates the industrial traces into an outdoor playground, providing relaxation and entertainment for nearby residents and children.





Spatial experience - Other location



Reimagining how landscapes can grow with industrial ruins in other locations

A framework that engages everyone

Gas extraction industry

NAM

Municipalities

provincie groningen

Water boards

Waterschap Noorderzijlvest

Hunze en Aa's

Residents

Farmers / Entrepreneurs

Interest groups / Area parties

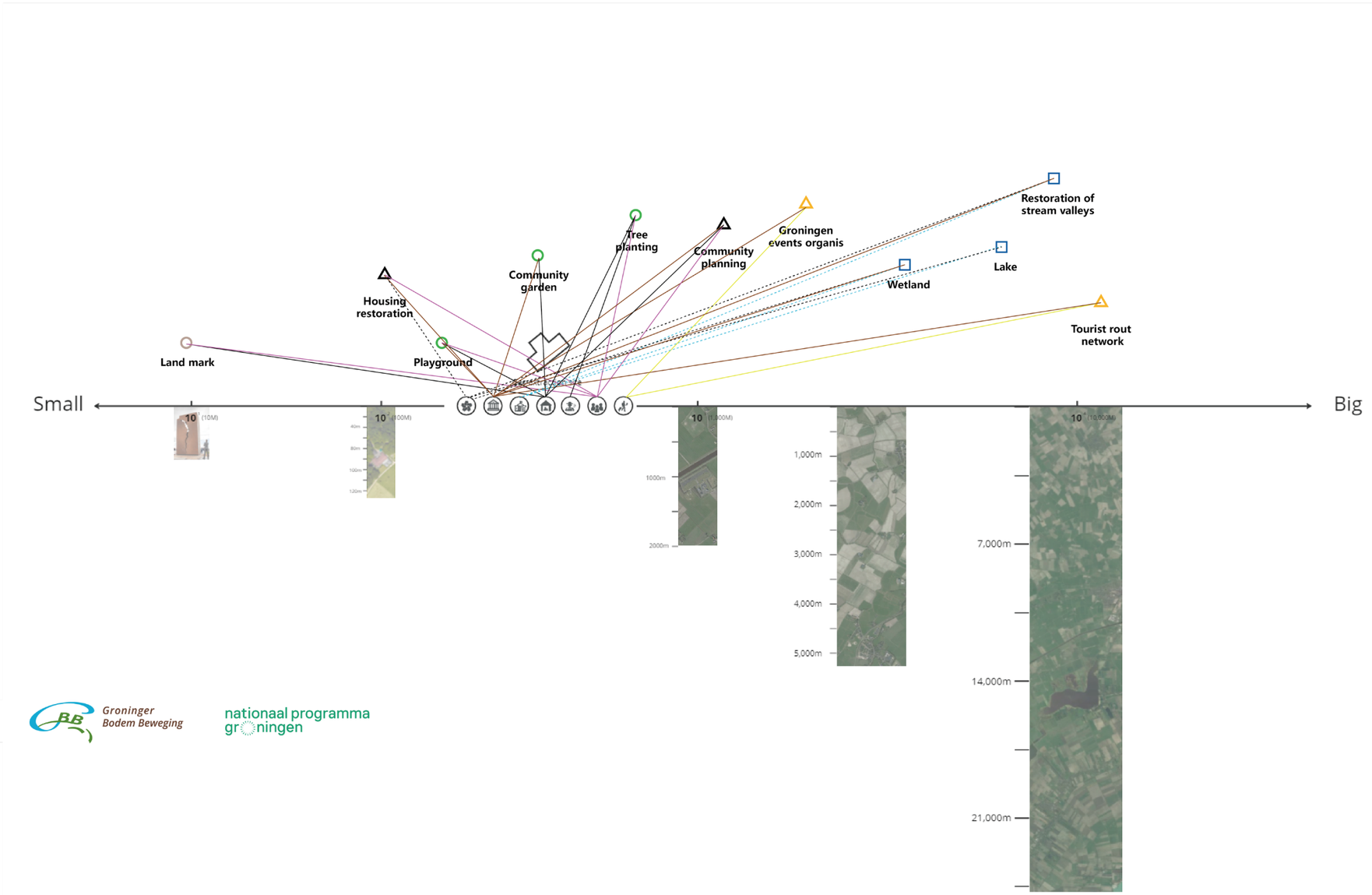
Trees for All

SPONSLAND

Groninger Bodem Beweging

nationaal programma groningen

Visitor



A framework that engages everyone

Trees for All

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into a mini forest. Then you can apply to this fund for up to €5,000.

Half of the amount made available by Vandebron is intended for applicants from all over the Netherlands. The other half is for its own customers. “We want to give people the opportunity to do something accessible themselves. So that they don’t have to wait for their municipality for sustainability. It’s special to see that it often brings local residents together as well.”

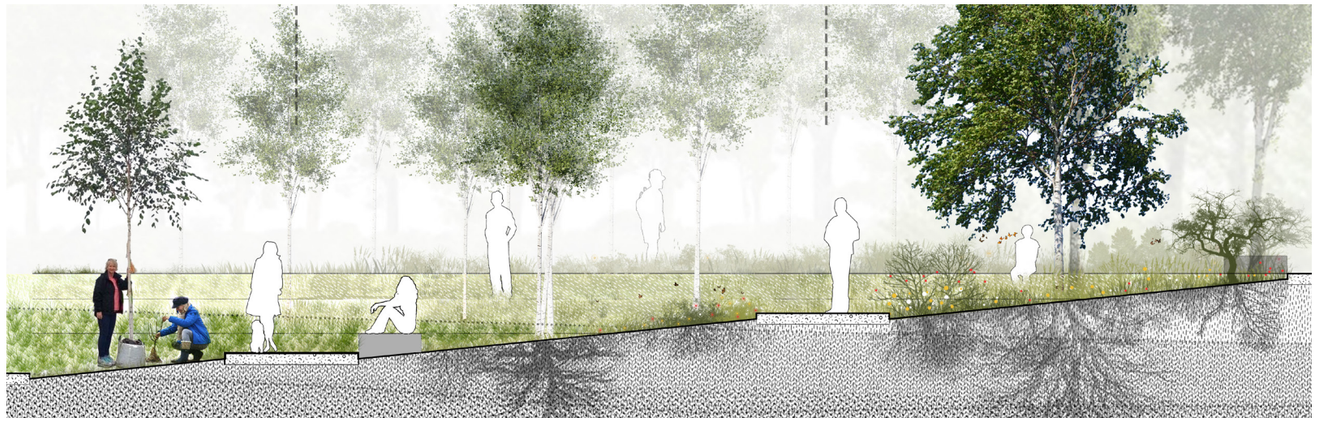


Residents

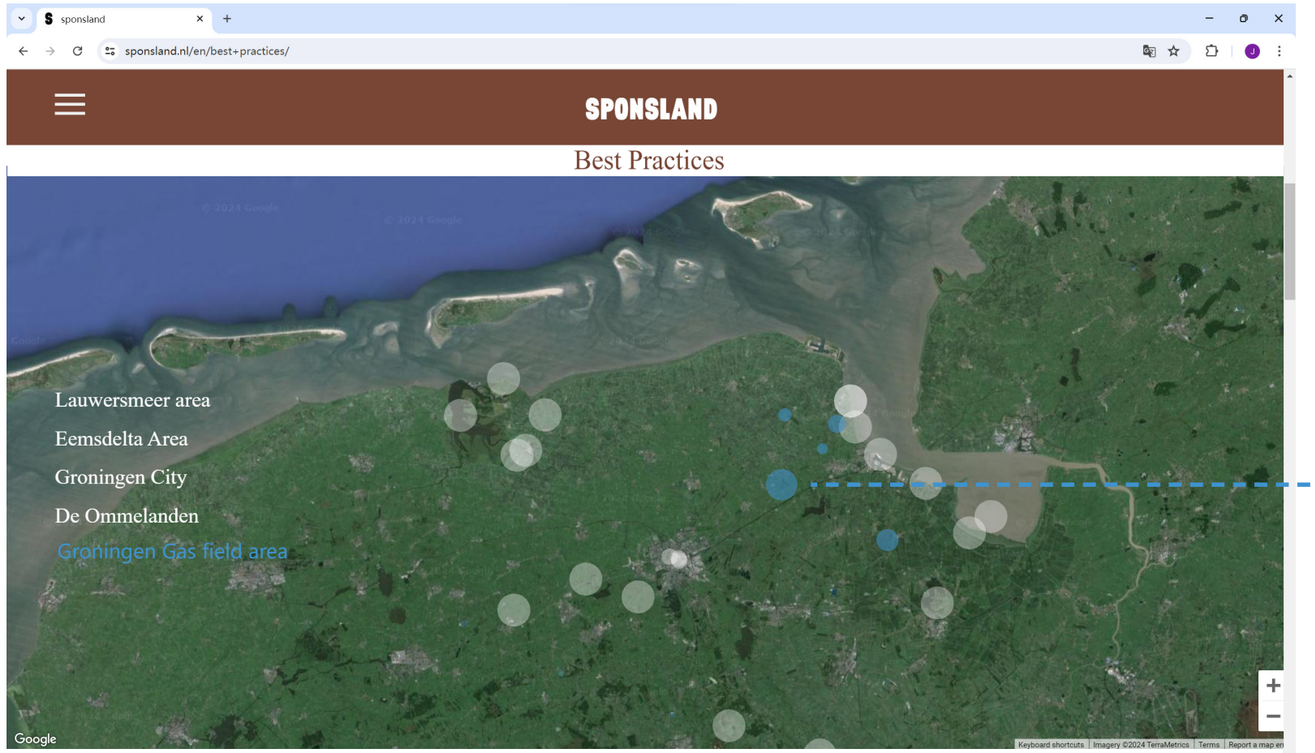
+

Interest groups /
Area parties





A framework that engages everyone



All projects



De Ommelanden

At a rock's throw distance from the city of Groningen lies the contiguous nature reserve De Onlanden for almost 10 years. Between the stream valleys of the Eelderdiep and the Peizerdiep lies wet low moorland.



De Ommelanden

In the Netherlands it often rains. A large share of that rainwater disappears into the sewer. When it rains too much, sewers can flood, with too little rain the much needed rainwater disappears.



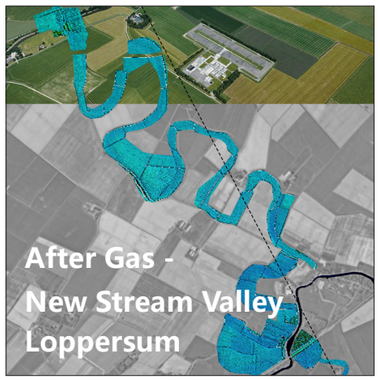
De Ommelanden

The restoration of stream valleys is a reaction to the channelling of almost all Drentse streams. This was done in the early 20th century.

Coming soon...



Ten Post



Loppersum

After Gas Design the future of Groningen gas field

Though the Landscape architecture lenses

Thanks for Your Attention!