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# The North Sea

character, processes, interventions, challenges,  
policies, projects and long term visions.

October 10, 2024  
Jeroen de Vries  
LE:NOTRE Institute

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# The North Sea

**Character**

**Interventions**

**Challenges & solutions**

**Strategy and policy**

**Landscape plans and interventions**

**Visionary plans**

Photo: Windwerk Terschelling



# North Sea from Centre to Edge

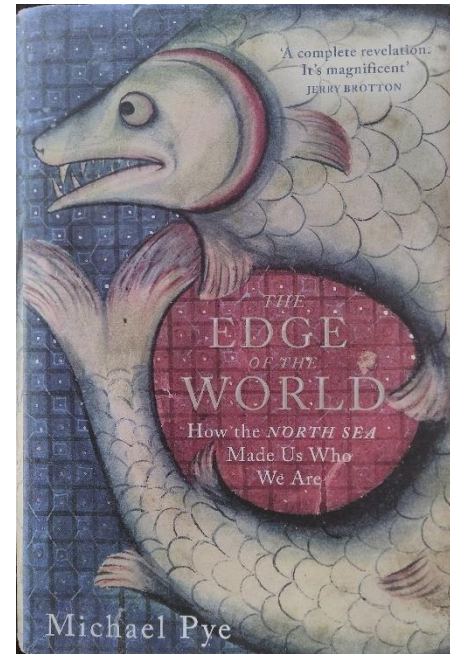
this new idea of seaside came between us and the story of the sea

the seaside was becoming a destination, not a harbour on the way to somewhere else over the water

and it was a playground, not a place of work and war

it was hard to imagine that there had once been a world that centred on the sea itself.

over the years even the coastline was fixed in a place as it never used to be when high winds could make a storm out of the sand, and high tides could break deep into the land



(Michael Pye, 2014)





# North Sea from Centre to Edge

- Trade
- Fishery
- Oysters, Muscles and Cockles
- Sand quarrying



Source: Mesdag panorama, The Hague



Wilbers-Visser'sophetstrand-Schevingen-1852

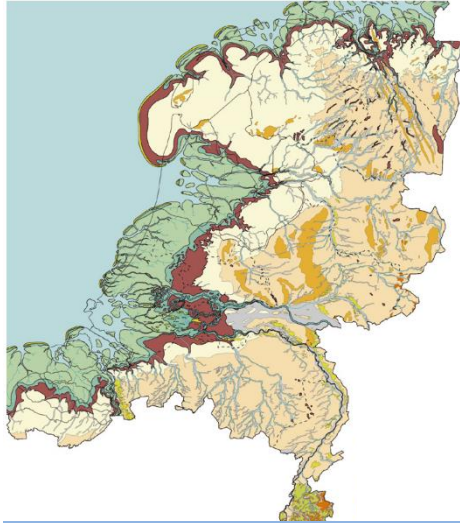
- Dunes waterpurification (19th century)
- Polders agriculture production:  
(also bulbs on „geestgronden“)



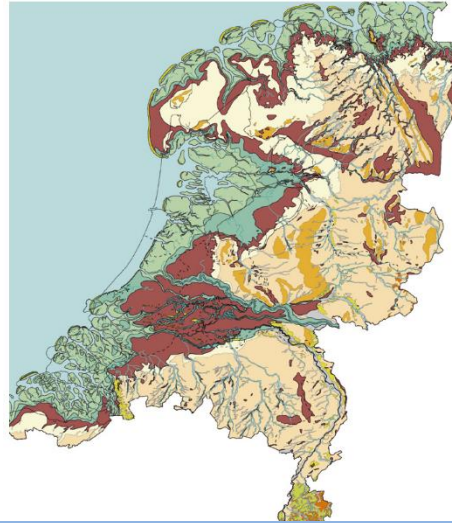
# History of tidal lagoon landscape NL



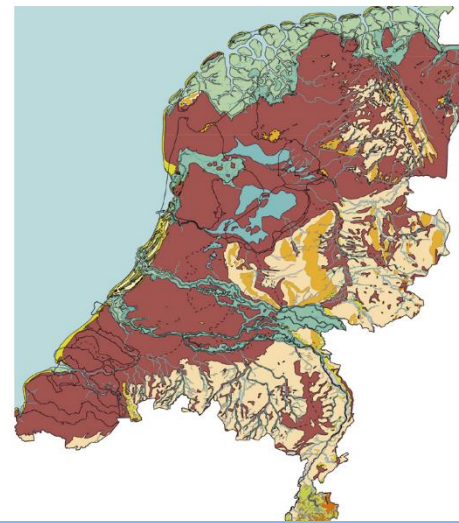
5000 BC



3850 BC

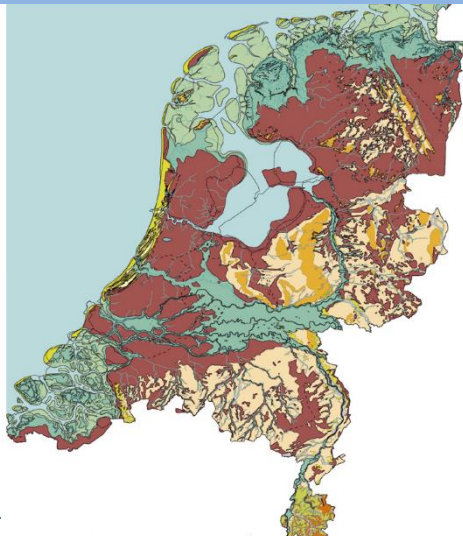


1500 BC

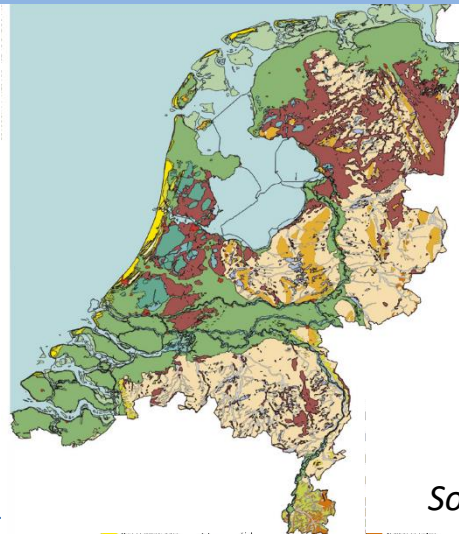


Landscape  
dominated  
by tide  
and floods

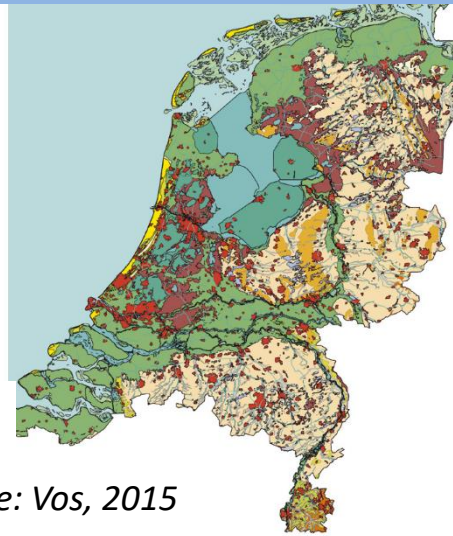
800 AD



1850 AD



2000 AD



sand

peat

clay

Source: Vos, 2015



# Characteristics of North Sea

- Dynamics coastal landscape
- Processes of silting up of harbours
- Coastal sediment and erosion: dynamic coastline
- Big tidal difference
- Sea is partly quite shallow - Doggersbank
- Effect of the narrow channel -NW wind / Spring tide - > Spring floods



# Character of the North Sea

## Dynamic landscape

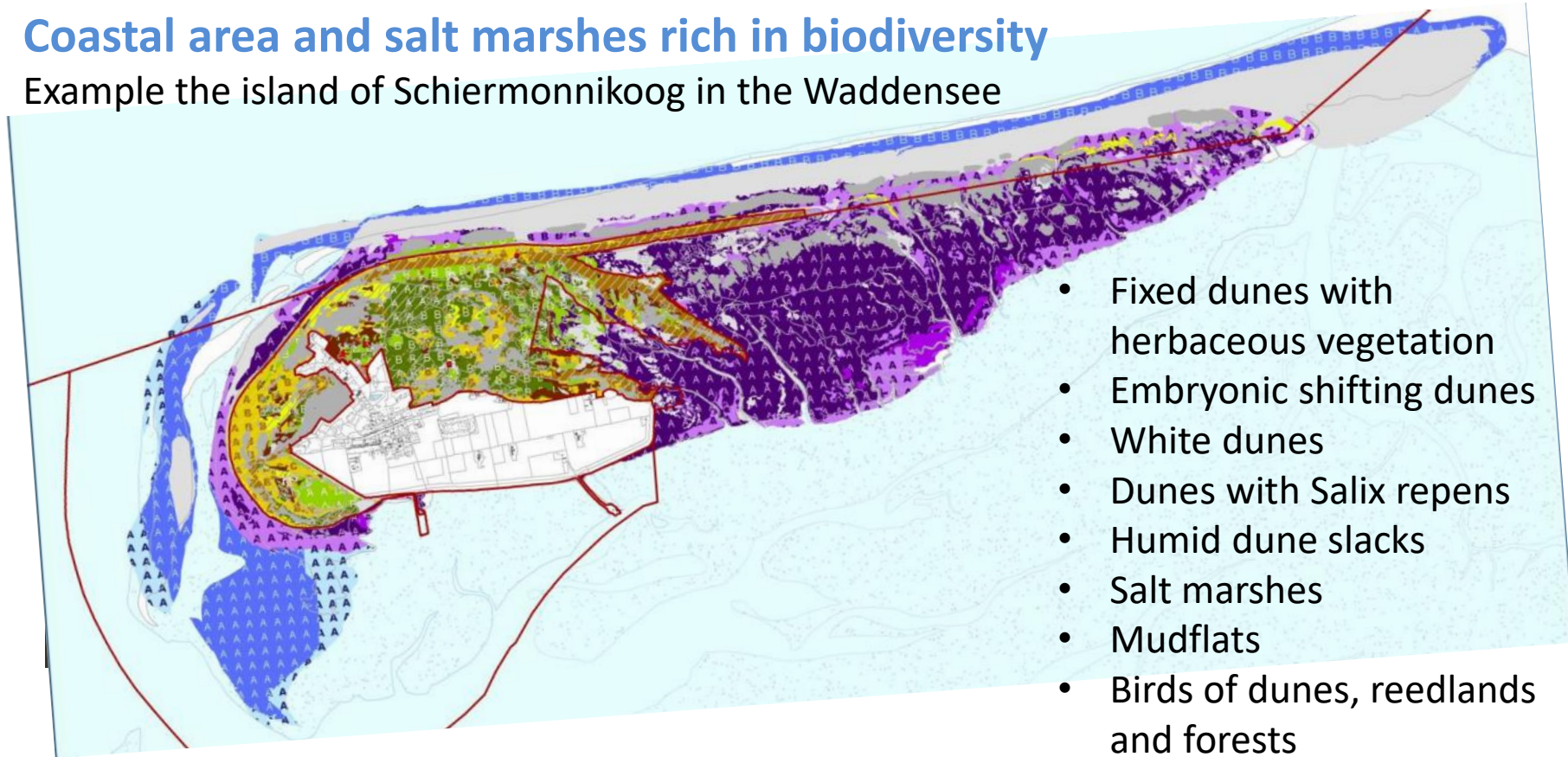
Example the island of Schiermonnikoog in the Waddensee



# Character of the North Sea

Coastal area and salt marshes rich in biodiversity

Example the island of Schiermonnikoog in the Waddensee



- Fixed dunes with herbaceous vegetation
- Embryonic shifting dunes
- White dunes
- Dunes with *Salix repens*
- Humid dune slacks
- Salt marshes
- Mudflats
- Birds of dunes, reedlands and forests
- Roost for many migrating birds (6-12 mill / year)

Map with habitats on Schiermonnikoog,

Source: Dienst Landelijk Gebied / Staatsbosbeheer, 2016. Natura 2000 Beheerplan Schiermonnikoog (6), (Management plan Schiermonnikoog), p 432





# Character of the North Sea - Waddenzee

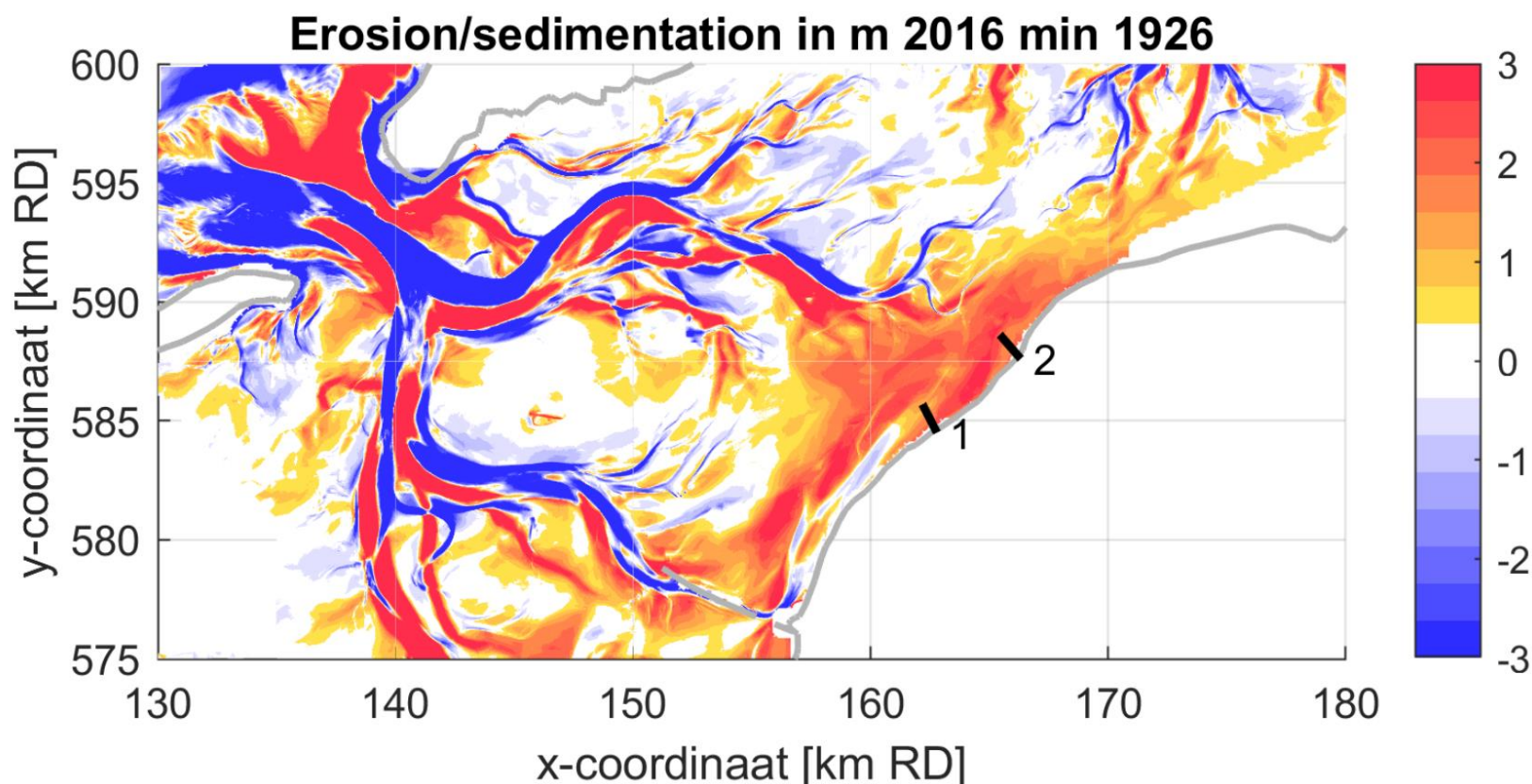


Figure 2-6. Total erosion (blue) and sedimentation (red) in [m] over the period 1926 to 2016 over the study area.

Source: Baptist, M. et al. 2019a



# Coastal experience – “Flow”

- experience of complete absorption in the present moment
- caused by complexity of the perceptions
- free from worries, playfulness, relaxation

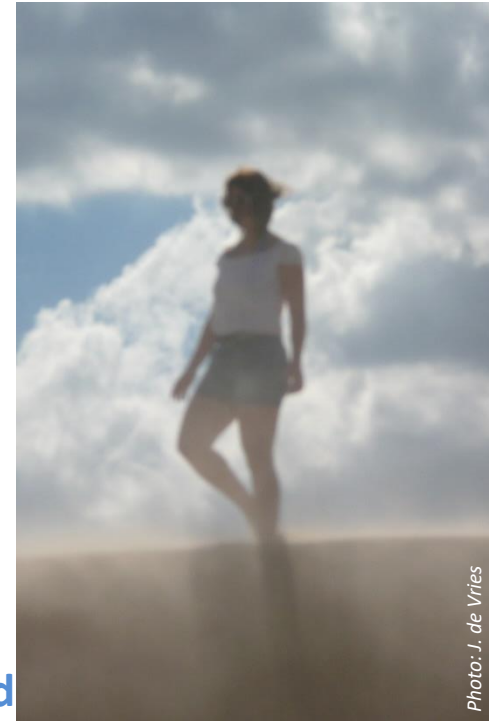


## Dynamic Coastal Landscapes

Unstructured, not organised – not to be grasped by the mind

Sensory experience ; drifting sand, winds, waves

Overwhelming in size, that surpasses the human measures



J. Nakamura, J. , Czent M. 2012, Flow Theory and Research, DOI: 10.1093 /oxfordhb/ 9780195187243.013.0018



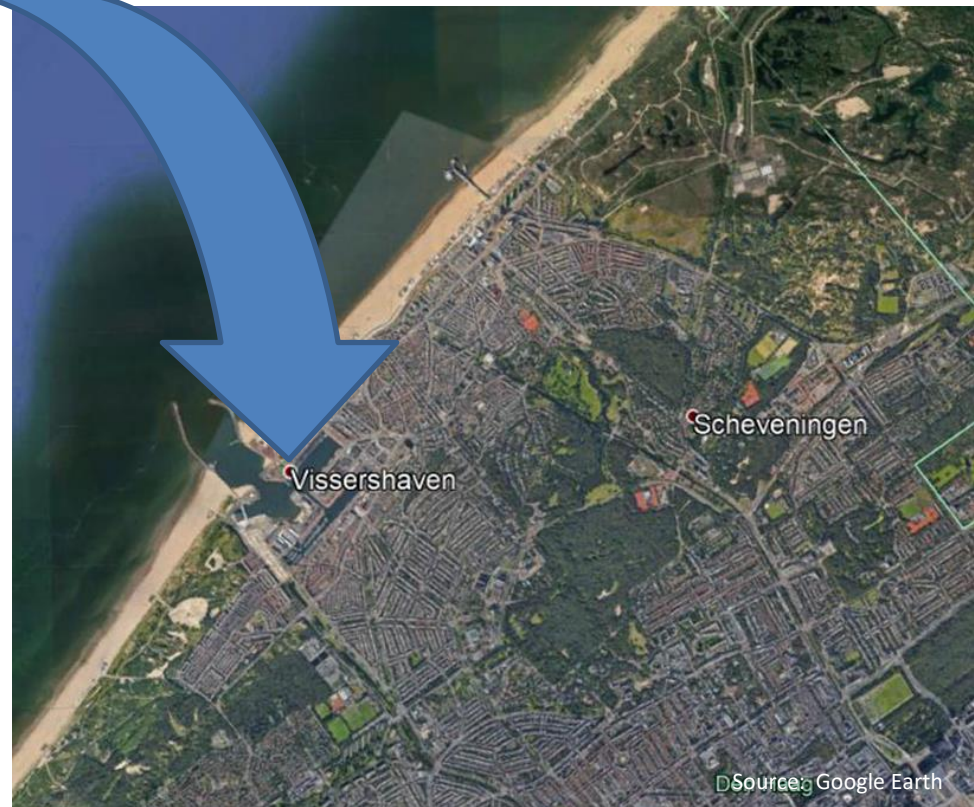


# Interventions – Fisher harbours

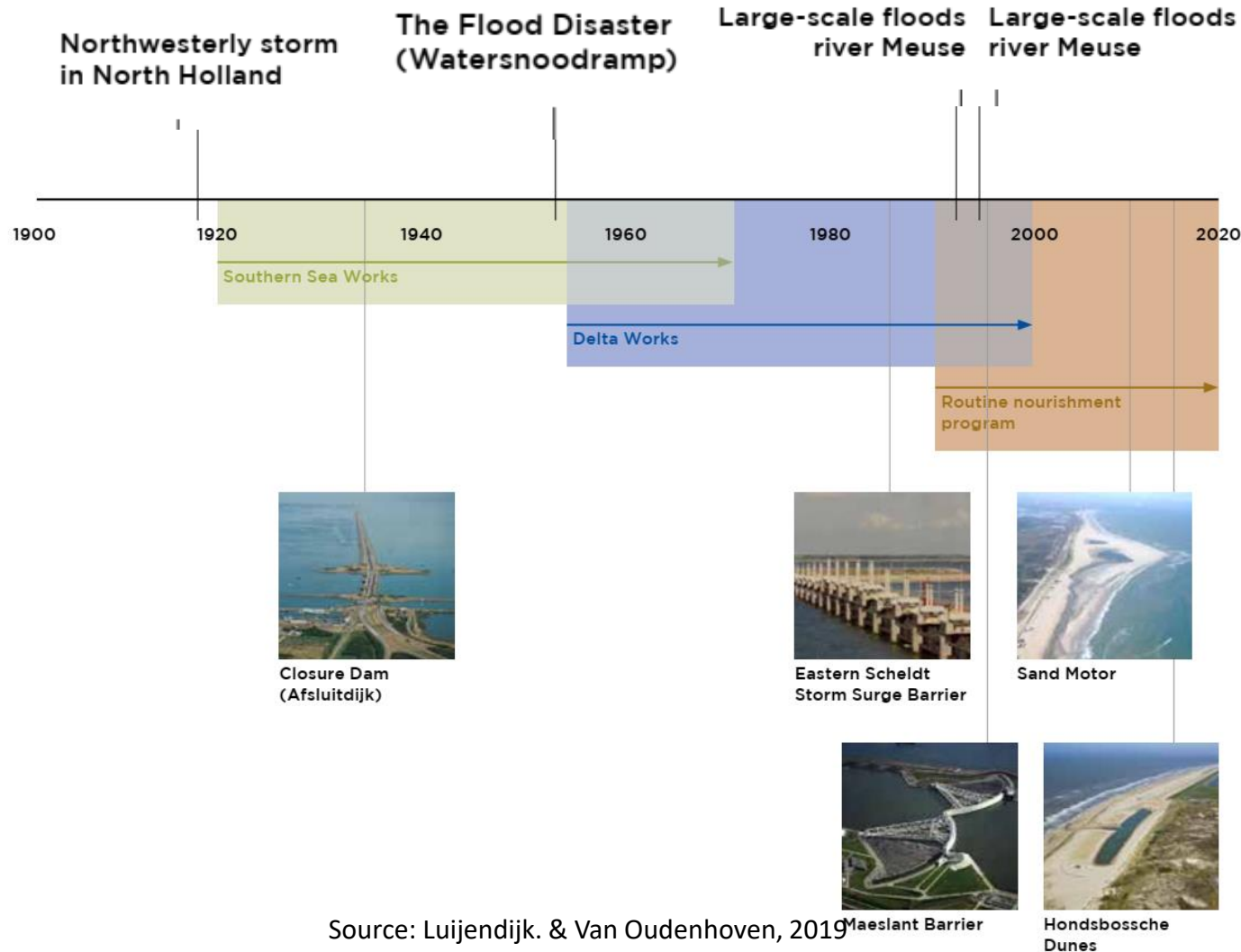
- Harbours – for fisherboats along the coast, e.g. Scheveningen in 1904



Mesdag Panorama, The Hague



# Timeline events and interventions

Source: Luijendijk. & Van Oudenhoven, 2019

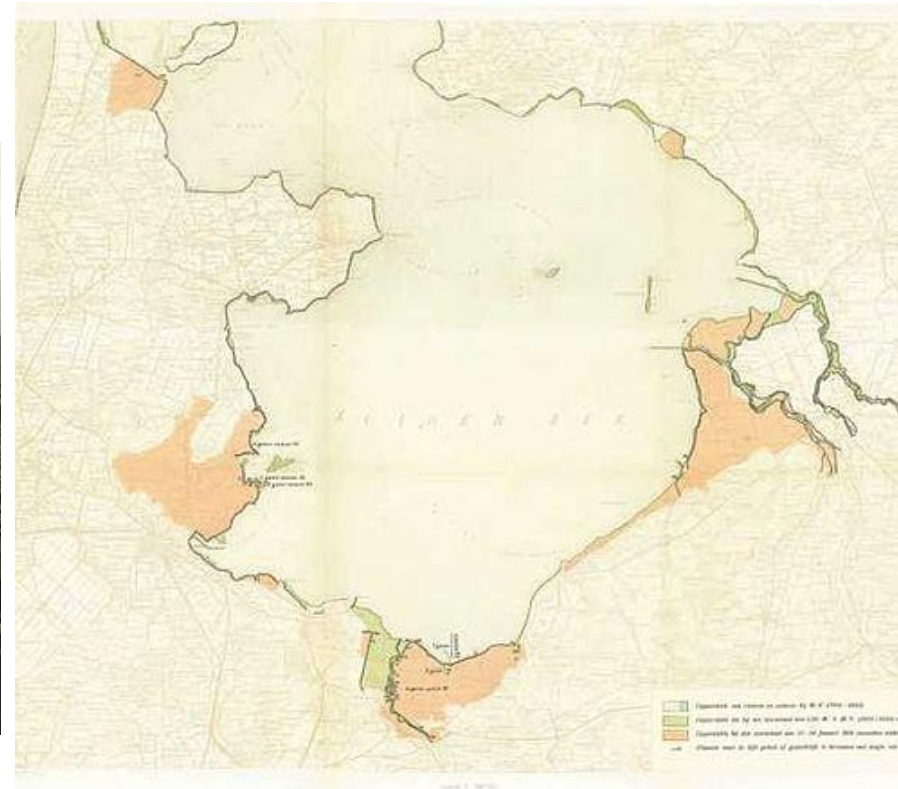


# Floods with national impact - 1916

- Zuiderzee 1916 - > Afsluitdijk - > IJsselmeer



Kees Hofker (1886-1936) - [SFA022813700, Het Leven, Spaarnestad Photo]  
The flood of 1916. Soldiers and civilians are deployed to establish emergency sea defences. Sacs filled with clay and sand are placed and covered with soil.  
Anna Paulownapolder, Netherlands, 1916.



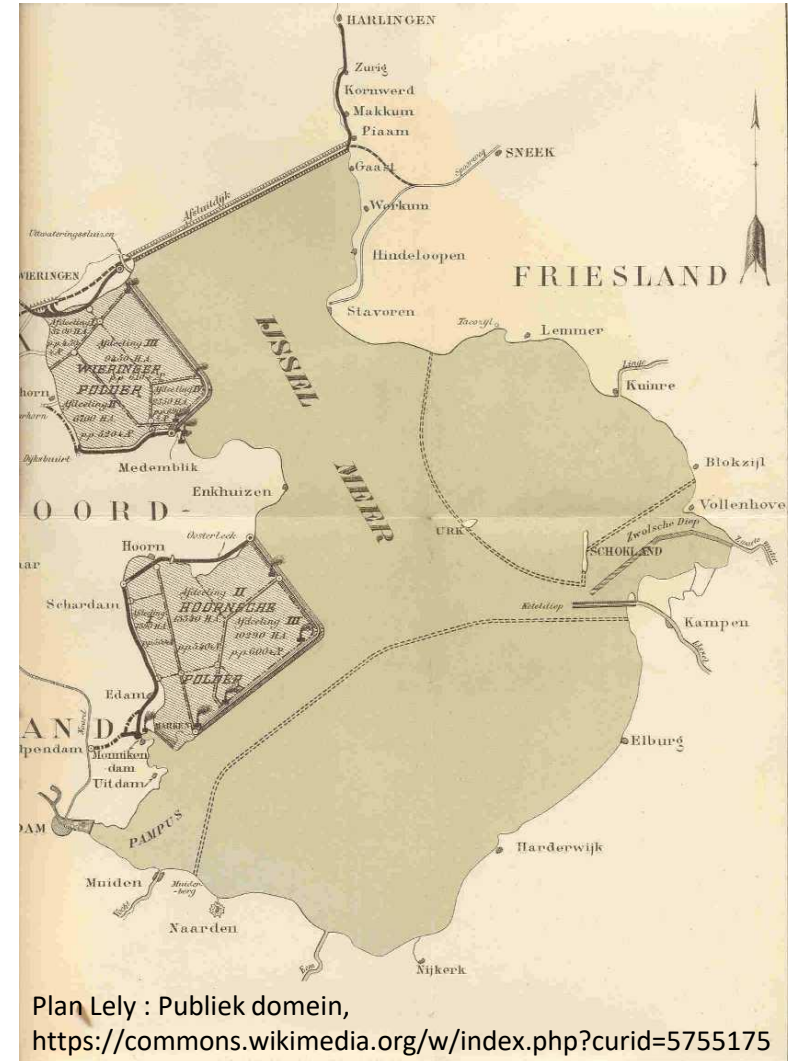
Source: Rijkswaterstaat: Verslag over den stormvloed van 13/14 januari 1916, 's-Gravenhage (NL) 1916

# Floods with national impact - 1916

- Zuiderzee 1916 - > Plan Lely
- Afsluitdijk - > IJsselmeer



Kees Hofker (1886-1936) - [SFA022813700, Het Leven, Spaarnestad Photo]  
The flood of 1916. Soldiers and civilians are deployed to establish emergency sea defences. Sacs filled with clay and sand are placed and covered with soil.  
Anna Paulownapolder, Netherlands, 1916.





# Floods with national impact - 1953

## ■ Flood disaster 1953



Source images: De Ramp", Nationale Uitgave  
Februari 1953, Vereniging ter Bevordering van het  
Boekhandelwezen.



# Interventions

- Deltaplan
- Deltaworks 1958 - 1987
- Storm Surge Defences –  
Maeslandkering 1997
- Opening of sea defences  
(migrating fish – Salmon,  
brackish water)



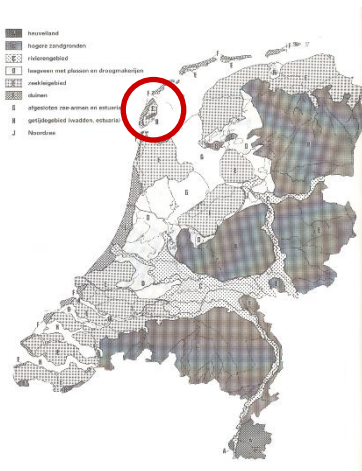
Source: <https://watersnoodmuseum.nl/kennisbank/deltawerken/>





# Nature reserves – tidal landscape

- De Slufter – Island of Texel
- 1 million visitors per year



Source: Topografische kaart van De Slufter op Texel, 400 pixels/km. Samengesteld door [Jan-Willem van Aalst](#) op basis van de GML open geodata van de [BRT/Top10NL](#) (basisregistratie Topografie, Kadaster), vrijgegeven door Kadaster onder de Creative Commons BY licentie. Additionele gegevens uit [BAG](#) uit de [Open Street Map](#) en uit de [Risicokaart](#).





# Question on Character of North Sea

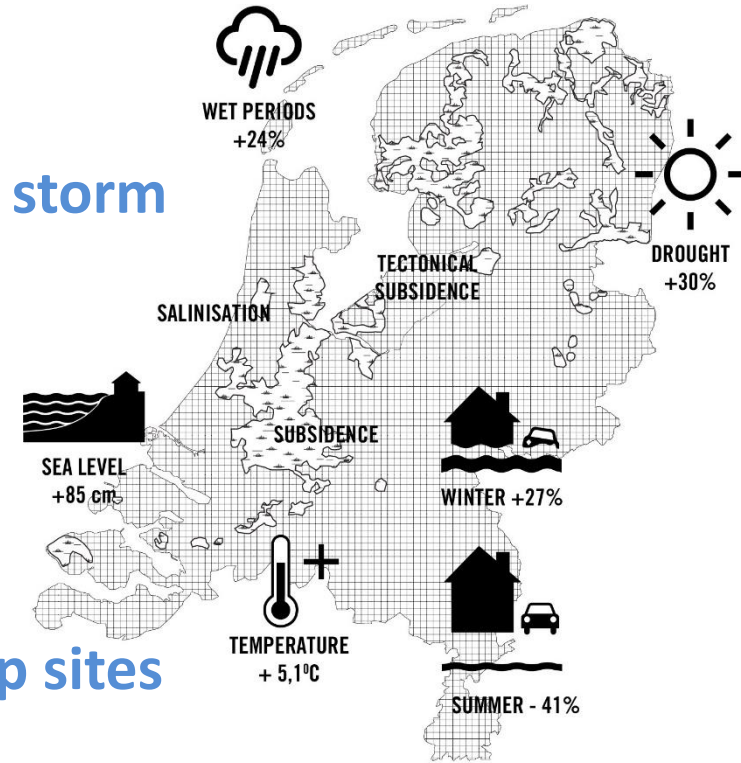
What do find the most characteristic  
aspect of the North Sea  
when you compare it with your own  
experiences of coastal landscapes?





# Current challenges

- Sea level rise (climate change)
- More frequent storms (climate change), storm surges
- Salinisation of coastal area
- Riverbed flooding
- Demand for and development of built up sites
- Increasing mass tourism: peak days with traffic jams
- Short season – economic imbalance



Source image: ZUS, 2016



# Sea level rise and storms (climate change)

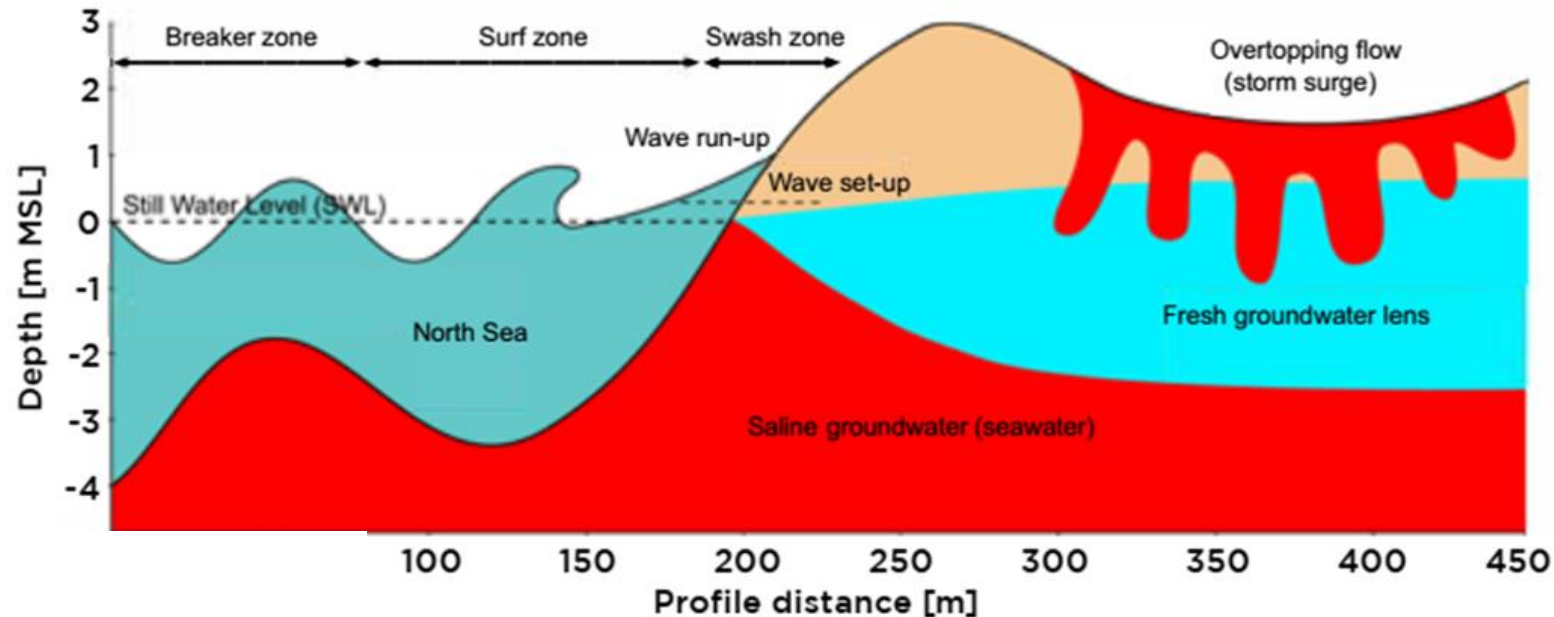
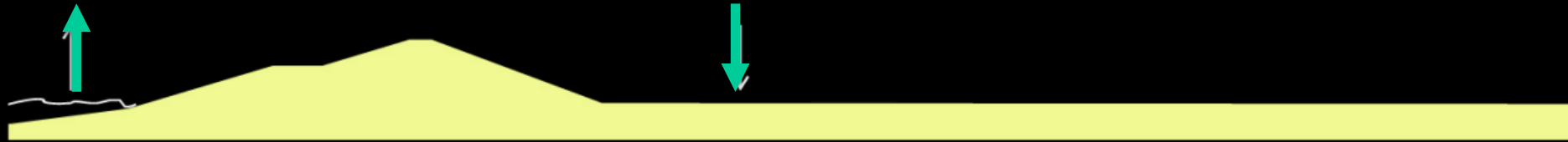


Figure 2.  
Illustration of coastal  
hydrodynamic  
processes at the  
measurement site.

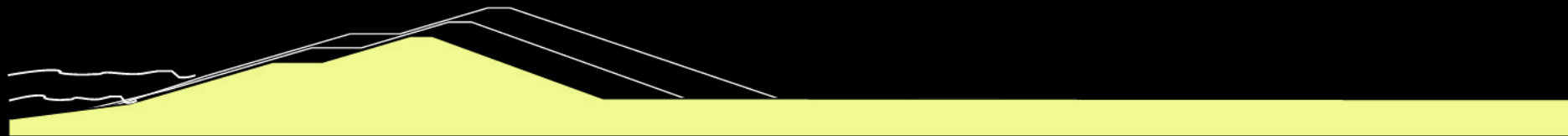
Luijendijk & Van Oudenhoven 2019



## Current challenges



**THE RISE OF THE SEA LEVEL AND LAND SINKING REQUIRES INTERFERENCE. THE DIKES ARE MADE HIGHER**



**REPEATED RAISING OF THE DIKES RESULTS IN AN UNDESIRABLE FUTURE IMAGE**



**THEREFORE: BROADENING OF THE COASTZONE**

Source: OKRA landscape architects



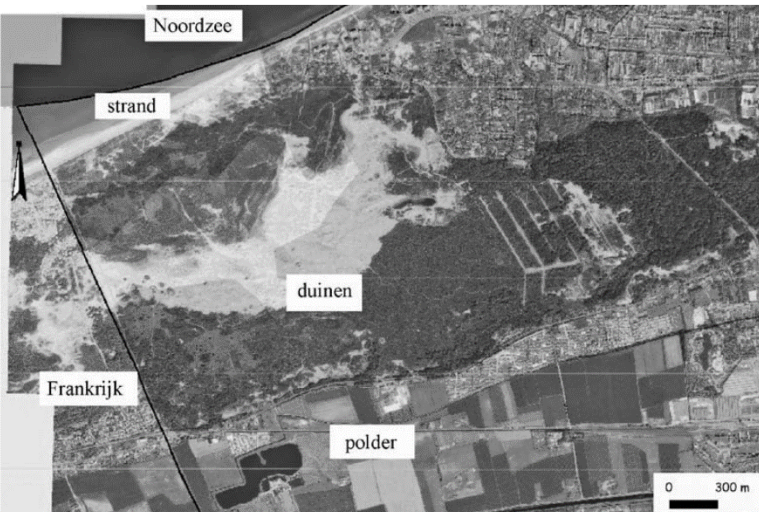
# Sea Defences from technical to ecological and nature based

- Dykes – e.g. Hondsbossche zeewering starting from 1880
- 1927 Afsluitdijk
- 1953 Deltaworks
- Slufter on the island of Texel (nature development)
- Sand suppletion, e.g. Hondsbossche Duinen 35 million m<sup>3</sup> in 2015; Sand motor
- Dredging to keep harbours accessible – Silt motor near Harlingen
- Stormvloedkering Maaslandkering – Flexible sea defense in river Maas.
- Opening of sea defences (fish migration – Salmon, brackish water)
- Hedwiger polder

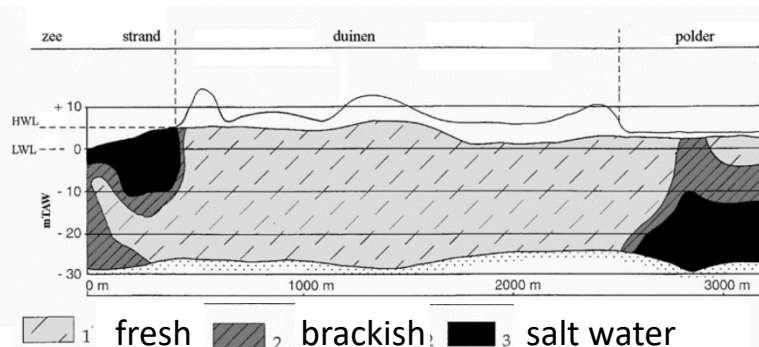




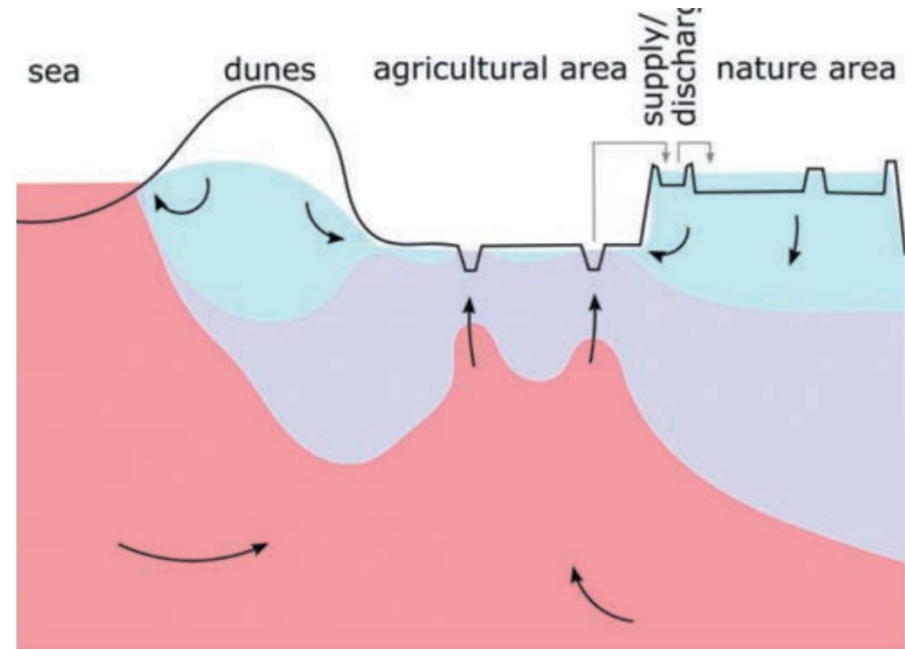
# Brackish / salt water



Figuur 1: Luchtfoto van het studiegebied, grenzend aan de Frans-Belgische grens.



Figuur 2: Verdeling tussen zoet (1), brak (2) en zout (3) water onder het strand, duinen en polders van het westelijke Belgische duingebied (naar Lebbe en Pede, 1986). Basis van het freatische pakket is de Formatie van Kortrijk (4), mTAW is het Belgische referentieniveau (2,36 meter onder gemiddeld zeeniveau), HWL en LWL zijn respectievelijk de hoogwater- en laagwaterlijn.



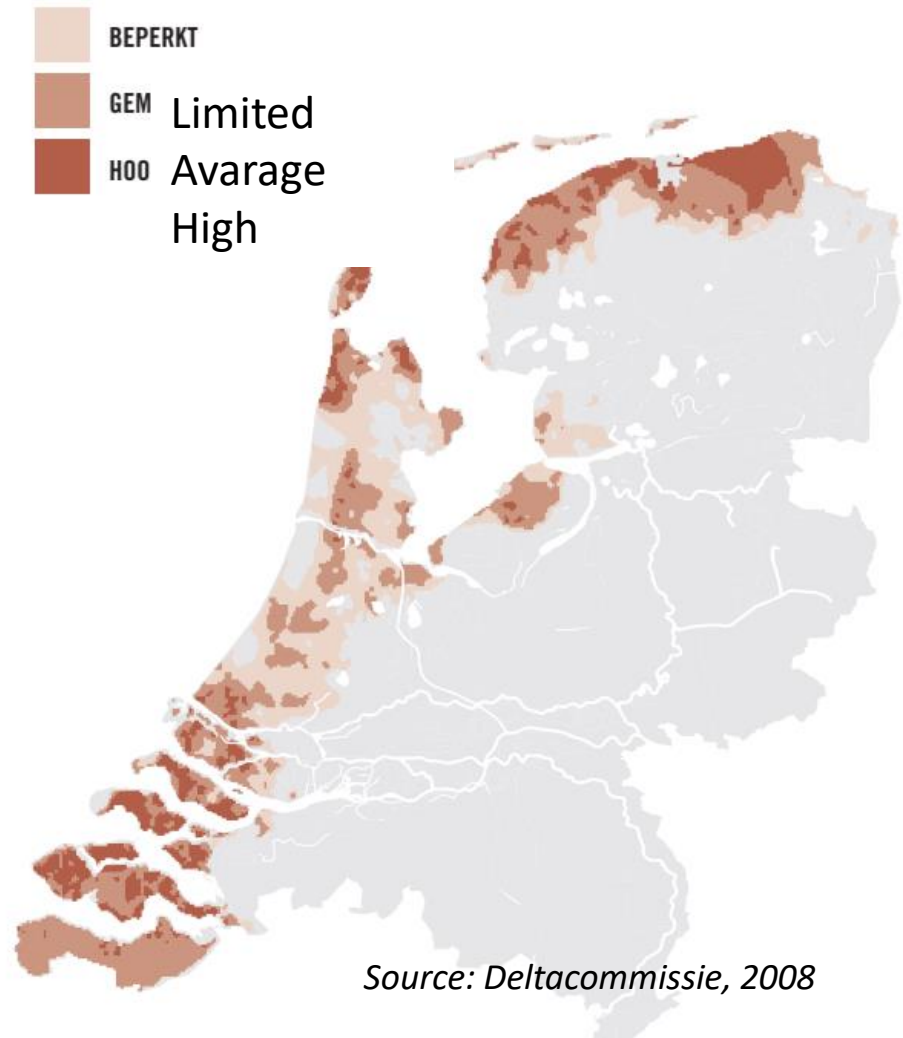
**Afbeelding 1:** Schematische illustratie van de saliniteit van het grondwater in laag Nederland. De aanvulling van zoet grondwater (lichtblauw) zorgt voor de vorming van regenwaterlenzen. Deze zijn dun in gebieden met veel zoute (rood) of brakke (paars) kwel. Het oppervlaktewaterniveau in polders wordt beheerd door te bemalen of water aan te voeren via boezems. Gewijzigd naar Oude Essink e.a. (2010) en Witte e.a. (2012).

4

Vandenbohede, A. Lebbe. I Stromingen 14 (2008) nummer 2:  
Zoet-zout verdeling onder het strand: niet zo evident als het lijkt.



# Brackish / salt water- forecast NL 2050







# Measures related to salinisation

- Raising groundwater level in polders: peat soil preservation, more counterpressure fresh water, other types of crops
- Raising waterlevel in nature areas
- Fresh water catchment areas in the coastal zone
- Developing brackish crop production



*Cranberry production Canada / USA*  
*Source: Karres and Brands 2016*

# Pressure urban and recreational sprawl



Photo: J. de Vries

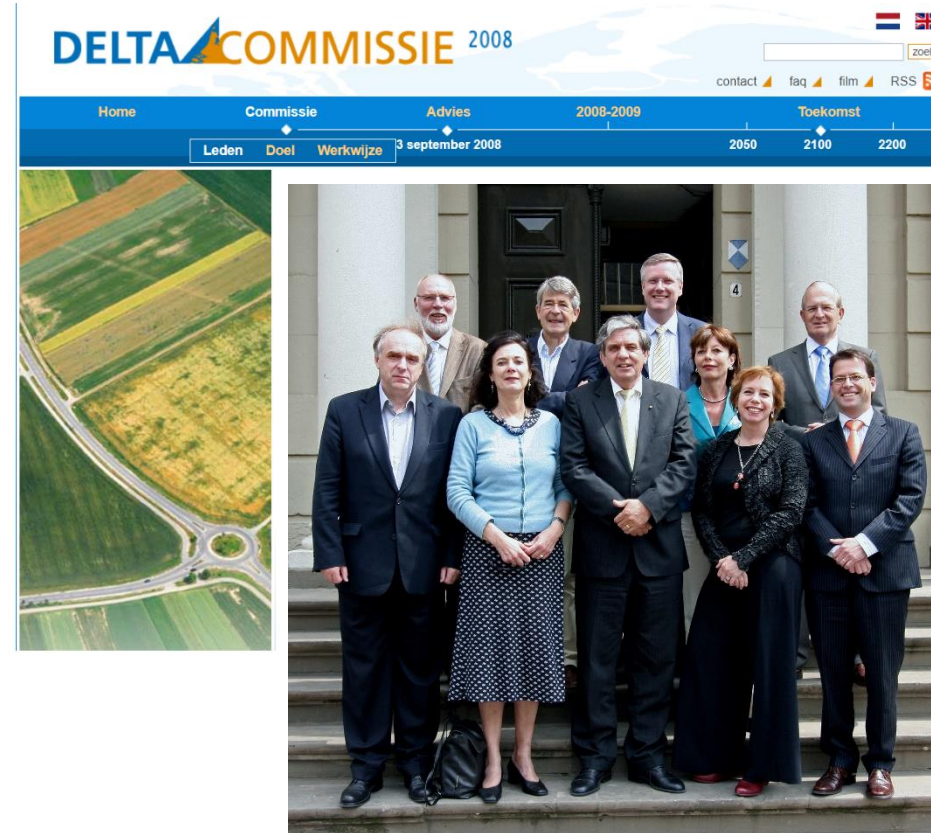
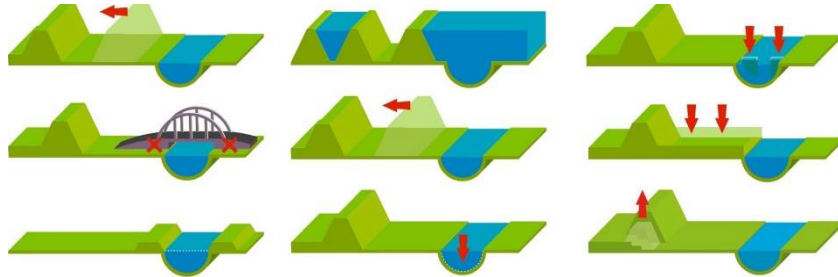
De Panne:  
leveling the dunes



# Governance – Policies in the NL



- Deltaplan 1957
- Room for the river 2006 -2017
- Deltacommittee 2007 - 2008
- Deltacommissioner
- Research combination Deltares
- Research for the coast: H+N+S - Kustatelier





# Coastal Defense + Spatial Quality

## Atelier Kustkwaliteit – H+N+S

H+N+  
S+ +



MENU

### KUST- VERSTERKING + RUIMTELIJKE KWALITEIT

PROJECTLEIDING ATELIER  
KUSTKWALITEIT, NEDERLANDS  
KUSTGEBIED

OPDRACHTGEVER

+ DELTAPROGRAMMA  
+ STIMULERINGSFONDS  
VOOR DE CREATIEVE  
INDUSTRIE

LOCATIE

+ NEDERLANDS  
KUSTGEBIED

SCHAAL

+ L

PERIODE

+ 2011-2013

THEMA

+ WATER & RUIMTE

PARTNERS

+ TU DELFT

Atelier Kustkwaliteit deed ruim twee jaar lang ontwerpend onderzoek naar de mogelijkheden om met behulp van veiligheidsmaatregelen voor de lange termijn de ruimtelijke kwaliteit, ecologie en de economie van de Nederlandse kust een impuls te geven. Het samenwerkingsverband resulteerde in een onafhankelijke werkplaats gericht op het ontwikkelen, ontwerpen, verdiepen, verspreiden en bediscussiëren van nieuwe

- <http://www.hnsland.nl/nl/projects/atelier-kustkwaliteit>



# Principles for the Coast NL

- Strengthen the coast in a way that the **natural dynamic** (current, tide, wind, salt – fresh water) can contribute to it (Nature Based Solutions);
- Aim for an **adaptive coastal system** instead of a fixed situation: soft measures, temporary use and a changeable coastal landscape are preferred;
- From an **ecological and economic** lens the coastal fundament is a very productive and profitable system. Reinforcement of the coast can optimise this.
- Apply coastal defences in a way that these result in **differentiation of coastal towns and landscapes**.

Source: Atelier Kustlandschappen





# Principles for the Coast NL

## Draft National Strategy 2019, *currently a new strategy is in development.*

Aim: risk of death due to flooding is equal to or less than 1:100.000.

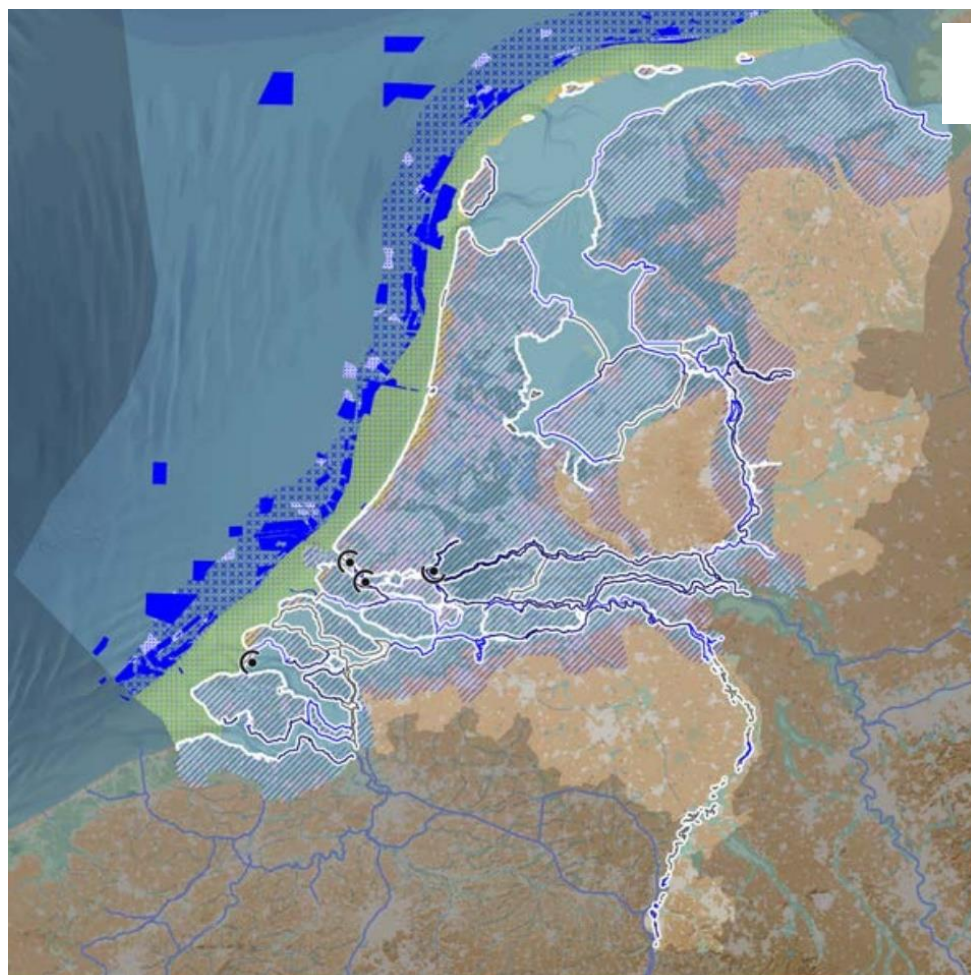
### Tasks

- **Maintaining, strengthening and reserving** sufficient space for primary flood defences, dunes, coastal foundations and storm surge barriers, to prevent flooding
- Reserving sufficient space for **sand dredging** to maintain the coastal foundations and to ensure water safety
- Maintaining and reserving sufficient **space for the rivers** and river-widening measures
- **Mitigating the consequences** of flooding via smart spatial planning and good contingency planning

Source: Draft National Strategy on Spatial Planning and the Environment, 2019.



# Principles for the Coast NL National Strategy 2019



**National Interest 14: Guaranteeing water safety and climate resilience  
(including vital infrastructure for water and mobility)**

## Strengthening task for flood defences and water safety

- Large-scale strengthening task
- Medium-scale strengthening task
- Limited strengthening task
- No strengthening task
- Strengthening task to be determined and/or current project
- Existing storm surge barrier
- Area where consequences of flooding must be mitigated

## Coastal foundations and sand dredging

- Coastal foundation
- Allocated sand dredging area
- Search area sand dredging up to and including 21
- Reserved sand dredging area for the long term

Source: Draft National Strategy on Spatial Planning and the Environment, 2019.



# Examples of interventions, projects and plans

- Art interventions (Bruno Doedens & Beaufort)
- Sea defences in combination with urban planning, tourism and nature development





# Art interventions: Beaufort, BE



Photos: J. de Vries



# Art interventions: Beaufort



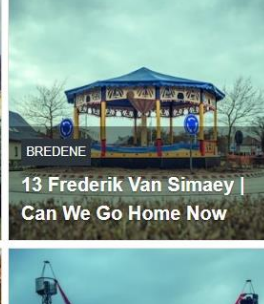
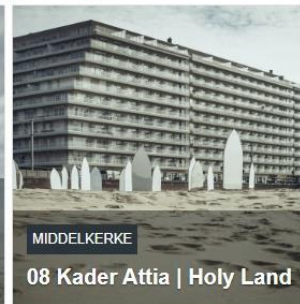
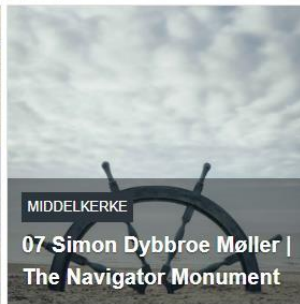
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the Belgian Coast

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CONCEPT ARTWORKS VISIT BEAUFORT THE COAST

search 🔍

## The Artworks



<https://www.beaufort2018.be/nl/kunstwerken>



# Island of Terschelling 'Panneland'



Voor het Oerol Festival op Terschelling maakte de landschapskunstenaar Bruno Doedens een tijdelijk landschap waarin kunst de dynamiek van de natuur onthult

SLeM

Bruno Doedens

Dialogue with the landscape

Participation of the public

Oerol festival from 2008 on

Drifting sand

Showing the natural dynamics of landscape



Photos: Blauwe Kamer





# Art interventions SLeM Bruno Doedens



Photos: Ben ter Mull- Van Hall Larenstein Uni





# Sand suppletion - Sandmotor



21,5 milllion m3 sand

expected life time 20 yrs

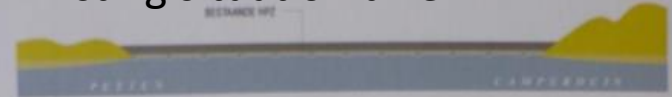
Source: Luijendijk, A. & A. van  
Oudenhoven (eds), 2019, p 24

# New Hondsbossche Duinen

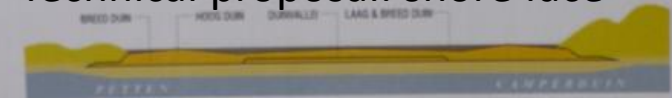


Former dike in concrete and basalt  
Natural approach of sea defence  
35 million m<sup>3</sup> sand  
New Dune Landscape – 300 m wide  
Coastal foundation broadend  
Dynamic landscape

Existing situation dike



Technical proposal: shore face



Design: attractive natural landscape



West 8 Urban Design and Landscape in collaboration with Svasek Hydraulics, Witteveen & Bosch, Altenburg & Wymenga ecologisch onderzoek





# Hondsbossche See Defence



Source: [www.petten-aan-zee.nl](http://www.petten-aan-zee.nl)



# Sea Defense – Mud Motor

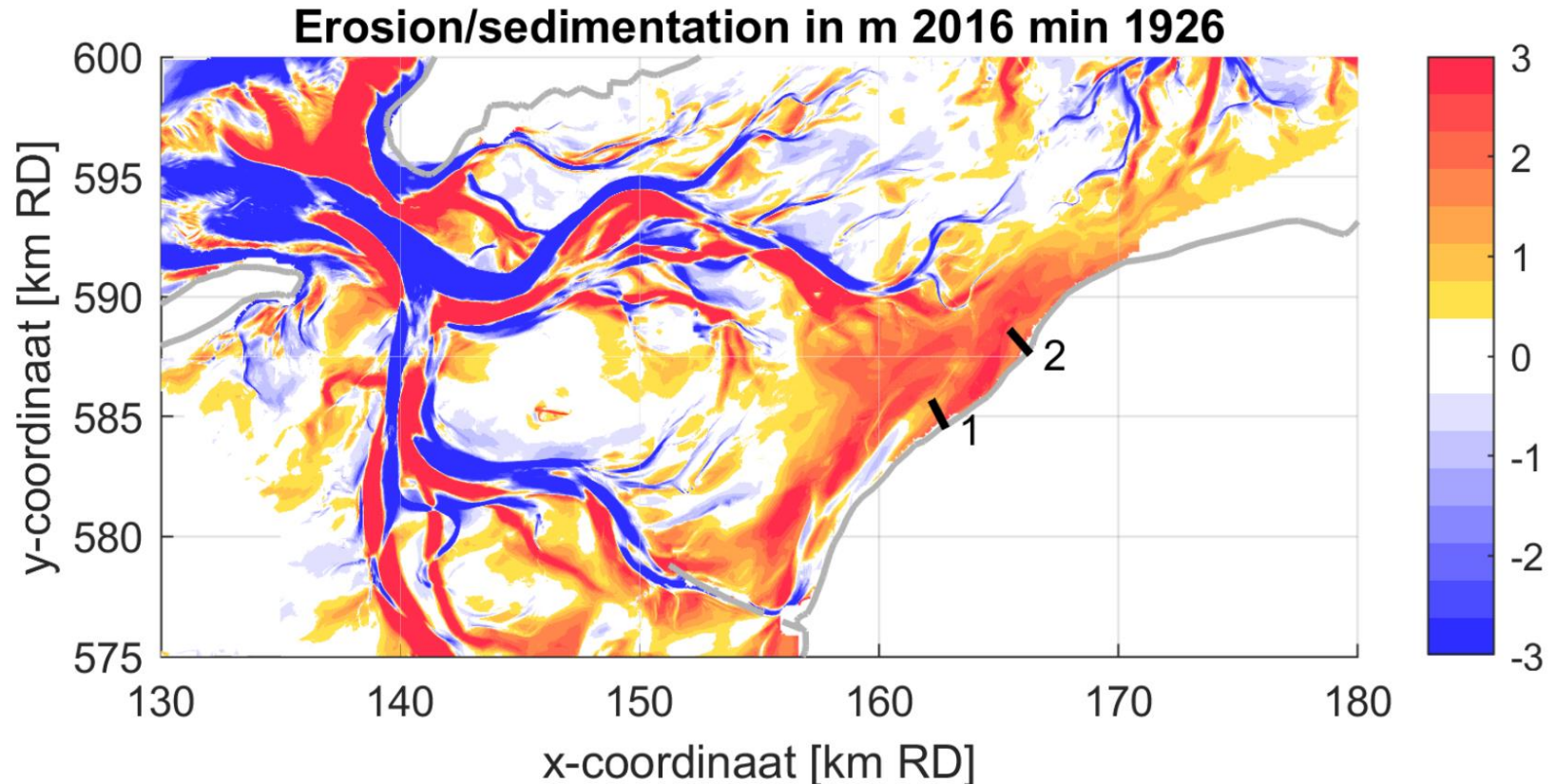


Figure 2-6. Total erosion (blue) and sedimentation (red) in [m] over the period 1926 to 2016 over the study area. The historic bed levels of the two black transects are visualised in Figure 2-7.

Source: Baptist, M. et al. 2019a





# Sea Defense – Mud Motor

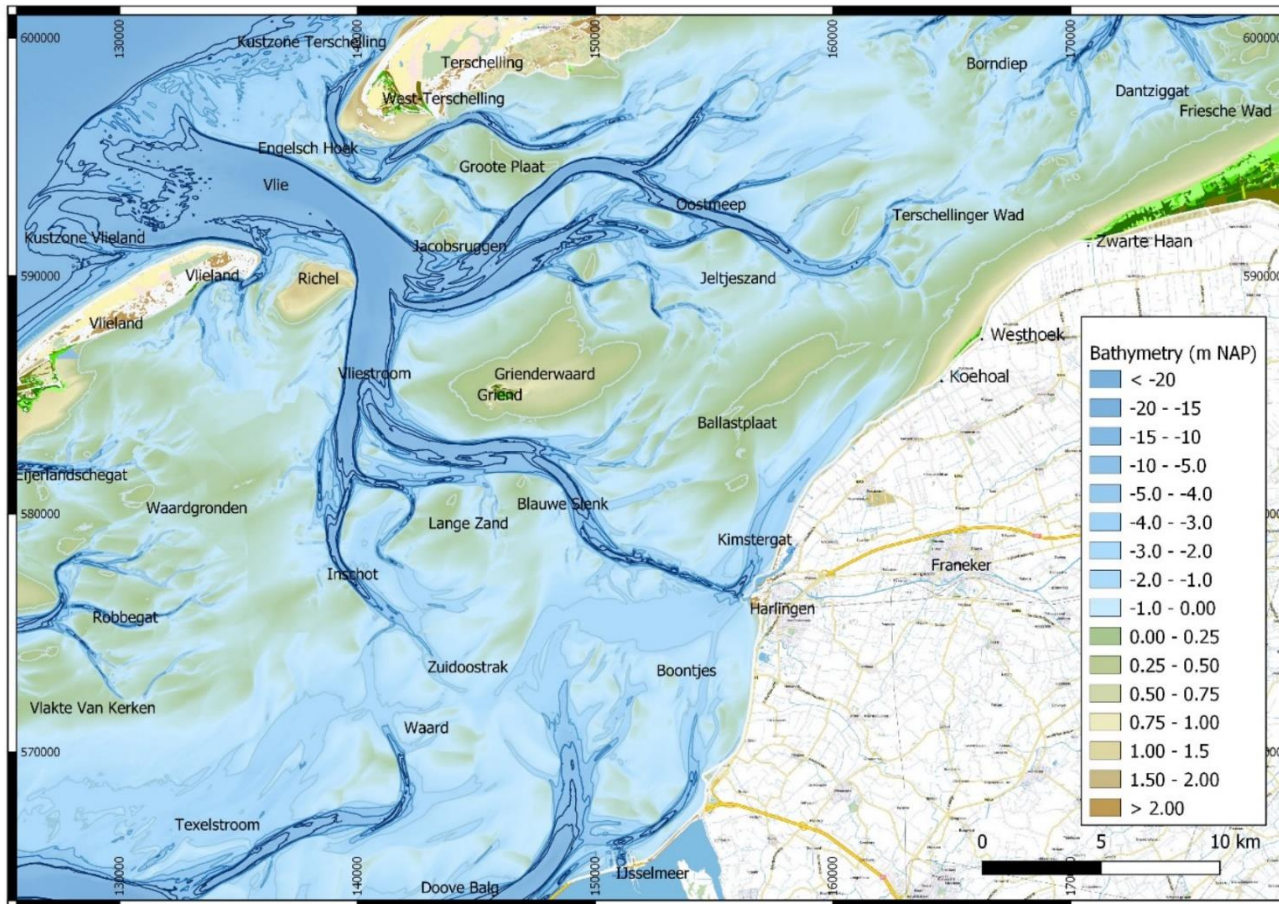


Figure 2-1. Map with names of intertidal flats, channels and salt marsh location in the area of interest. Bathymetry from 2010. The Mud Motor salt marsh is situated between Koehoal and Westhoek, the control salt marsh is situated at Zwarte Haan (in the north east corner of the map). Bright green colour (not in the colour map) indicates vegetation.

Source: Baptist, M. et al. 2019a





# Sea Defense – suppletion – Mud Motor

## The Mud motor

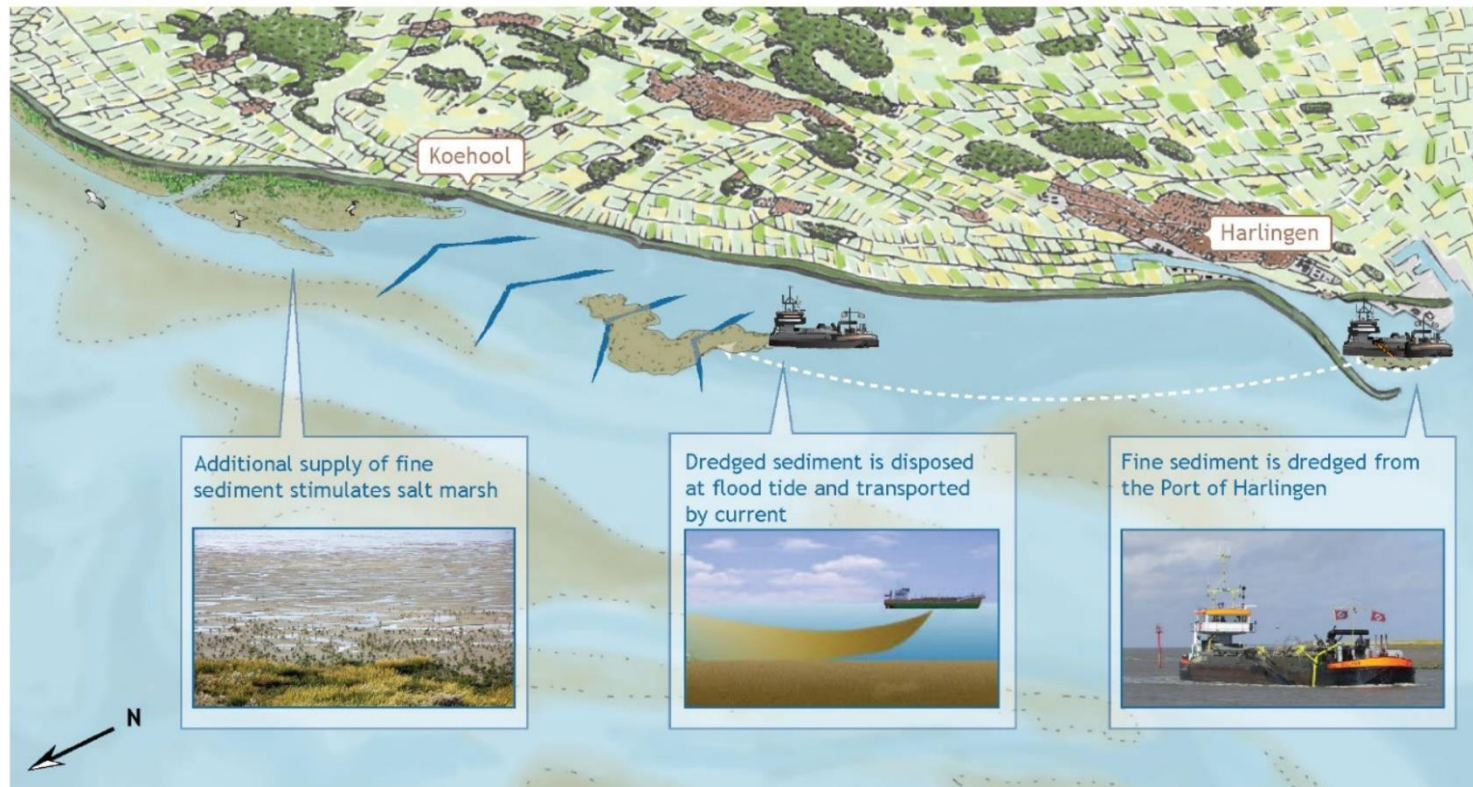
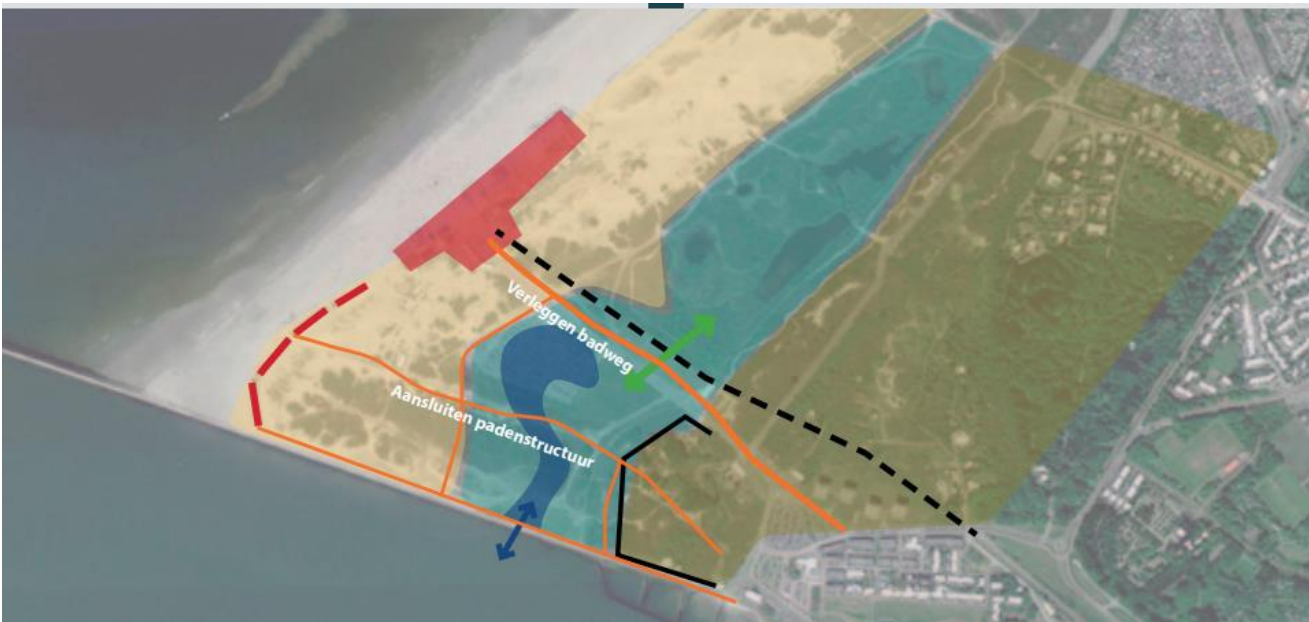


Figure 1-1. The principle of the Mud Motor approach.

Source: Baptist, M. et al. 2019a

# Masterplan Hoek van Holland

- 4 seasons & accessibility & branding
- ecological restoration: marsh, grey dunes
- development: hotel, housing



*Design : Ben Kuipers Landscape architect, Jos van de Lindeloof landscape architect, Evert Pronk architect (BINT), Ecology Hans Lucas*

*Images: 190612-Masterplan-Hoek-van-Holland-aan-Zee*



# Masterplan Hoek van Holland

source: <https://benkuipers.nl/project/hoek-van-holland-aan-zee/>



190612-Masterplan-Hoek-van-Holland-aan-Zee





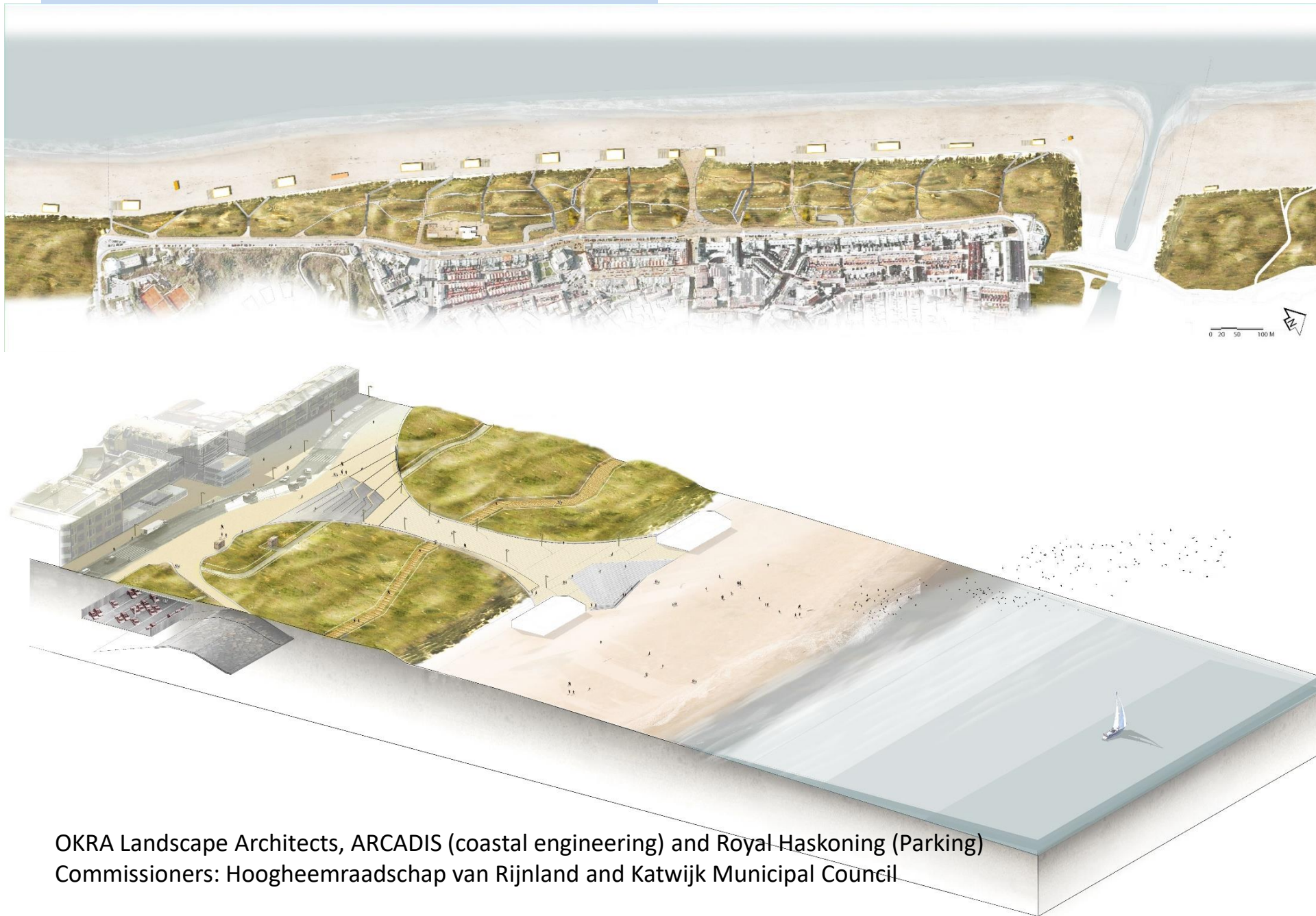
# Katwijk aan zee - OKRA



See also lecture by OKRA: [https://ilias.hfwu.de/goto.php?target=cat\\_23393&client\\_id=hfwu](https://ilias.hfwu.de/goto.php?target=cat_23393&client_id=hfwu)  
OKRA Landscape Architects, ARCADIS (coastal engineering) and Royal Haskoning (Parking)  
Commissioners: Hoogheemraadschap van Rijnland and Katwijk Municipal Council



# Landscape planning and design



OKRA Landscape Architects, ARCADIS (coastal engineering) and Royal Haskoning (Parking)  
Commissioners: Hoogheemraadschap van Rijnland and Katwijk Municipal Council



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# Katwijk aan zee - OKRA



Photos: Jeroen de Vries







# Scheveningen Boulevard



Source: *Blauwe Kamer* magazine, 2012, nr 6.



# Boulevard Scheveningen



Flood prevention: dike in boulevard  
Improvement accessibility walking, cycling  
Separation of traffic modes  
Better connection to sea and pavillions  
Splendid views by curving boulevard  
Constructive parts less than 700 kilogram: safety



Images: Blauwe Kamer magazine, 2012, nr 6.

Design: 2006-2010; Construction 2011-2013

Manuel de Sola-Morales, Fluitman Architecten, Ingenieursbureau Den Haag





# Question on landscape plans

What do you appreciate most in the approach of landscape architects in the Netherlands when drawing up these plans for the coastal zones?



# Conclusions LA - projects

- Integral approach: architecture, ecology, mobility
- Nature based: space for natural processes
- Urban development & sea defence are financing habitat restoration and tourism
- Improving access: walking, cycling
- Participatory processes
- Monitoring of effects: water management, biodiversity

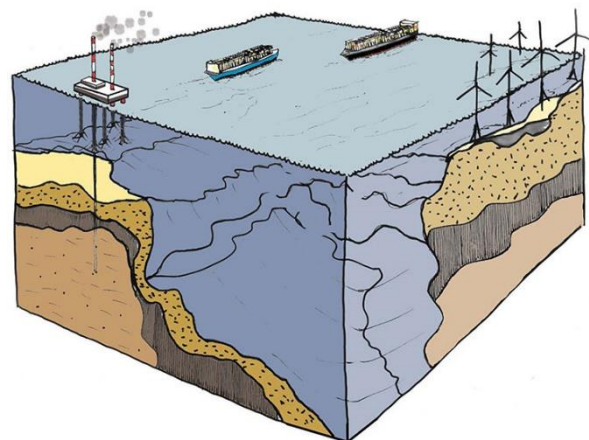




# Visionary plans: NL 2120 NL 2070/ 2300



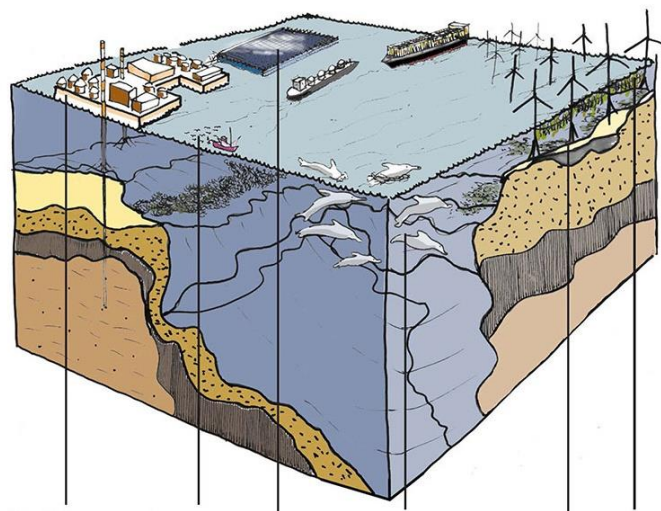
# Netherlands 2120



Windparks

Aquaculture in  
windparks

Floating islands:  
solar and wind



Seaweed culture  
along coast

Oysterbanks

Soft coastline  
defences

Baptist, M. et al, 2019,





# Visionary plans: NL 2300

- Is building higher dikes feasible?
- Should we look for new relations with sea, rivers, nature?
- How much can we trust forecasts of climate change?
- Should we plan for adaptive and flexible landscapes?

Call by the Council for the Environment and Infrastructure NL  
2027 and call by landscape magazine De Blauwe Kamer:  
how will the Netherlands look like in 2070 / 2300?



# Visionary plans: NL 2300

## Four types of strategies

- **ATTACKERS: ZUS and De Haakse Zeedijk**
- **LAND CONSOLIDATION: BRO, Karres en Brands**
- **RADICAL POETS: Buro Lubbers, Rijnboutt**
- **DEFEATISTS: Ro Koster and Hans van Engen**



# NL 2300 - ZUS / Arcadis, TU Delft-SLIKC, Van Oord

Dune metropolis

Polders → Dunes

Erosion & sedimentation processes

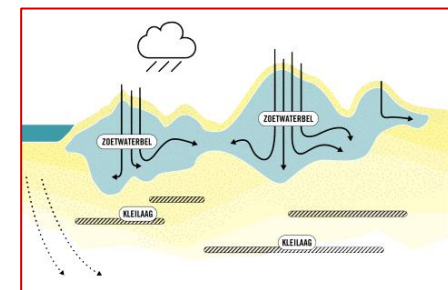
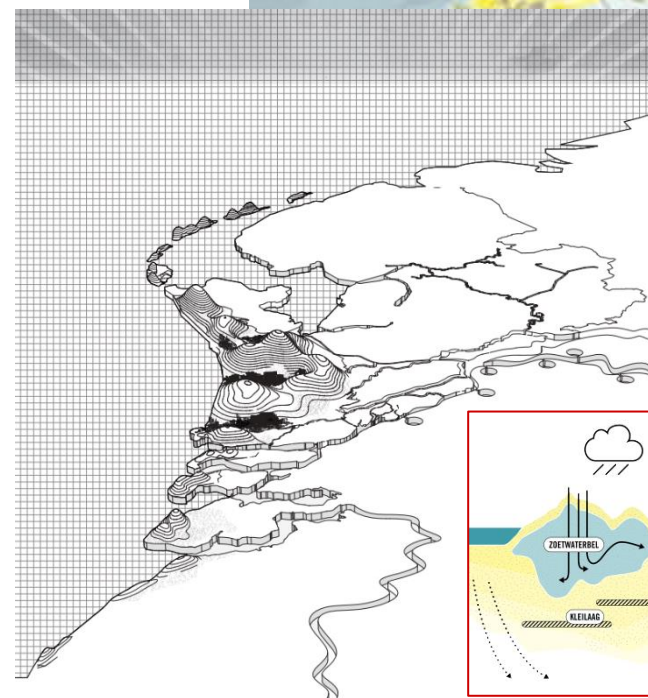
Oosterscheldekering open

Peat polders uninhabitable due to  
subsidence and salinisation.

Haarlemmermeer → super dune  
riots, fresh water processing

De Beemster energy hub -  
intensive vertical agriculture with  
sustainably produced energy.

Source: ZUS, 2016





# NL 2300 - Karres and Brands Landscape architects

## The Seven New Netherlands

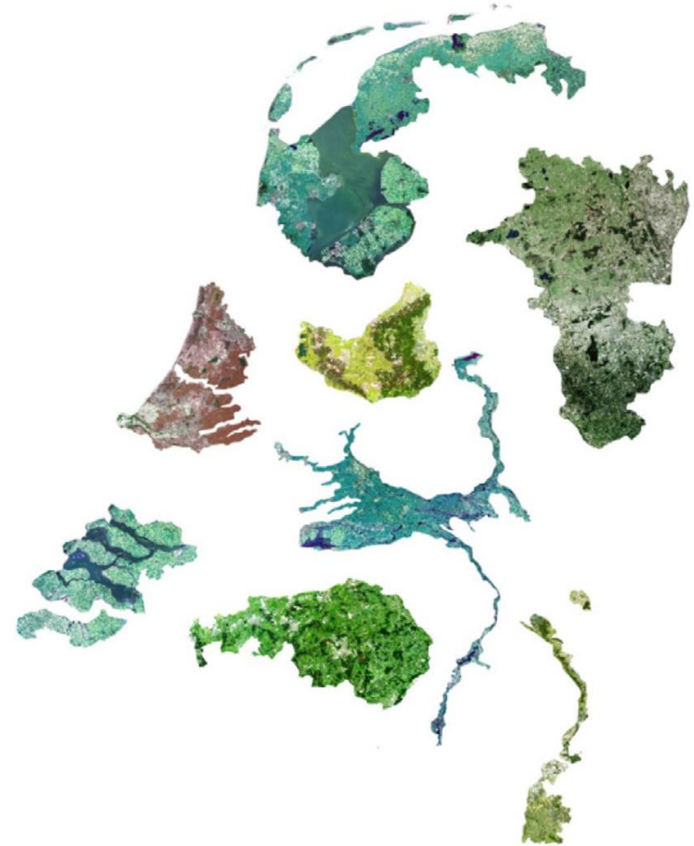
More space for natural processes  
agriculture that responds to natural  
conditions

Wind and solar energy

Relocation of economic functions :  
residential areas from the drain to  
higher sandy soils.

administrative system of seven  
regions.

Each with a specific characteristics of  
landscapes and regions.



*Source: Karres en Brands, 2016*





# NL 2300 - Karres and Brands Landscape architects – part Deltaland



Source: Karres en Brands, 2016





# NL 2300 – BRO

# + 2.5 meter

Land consolidation

Water gets more space

New line of wadden islands

Small cities moved to higher ground

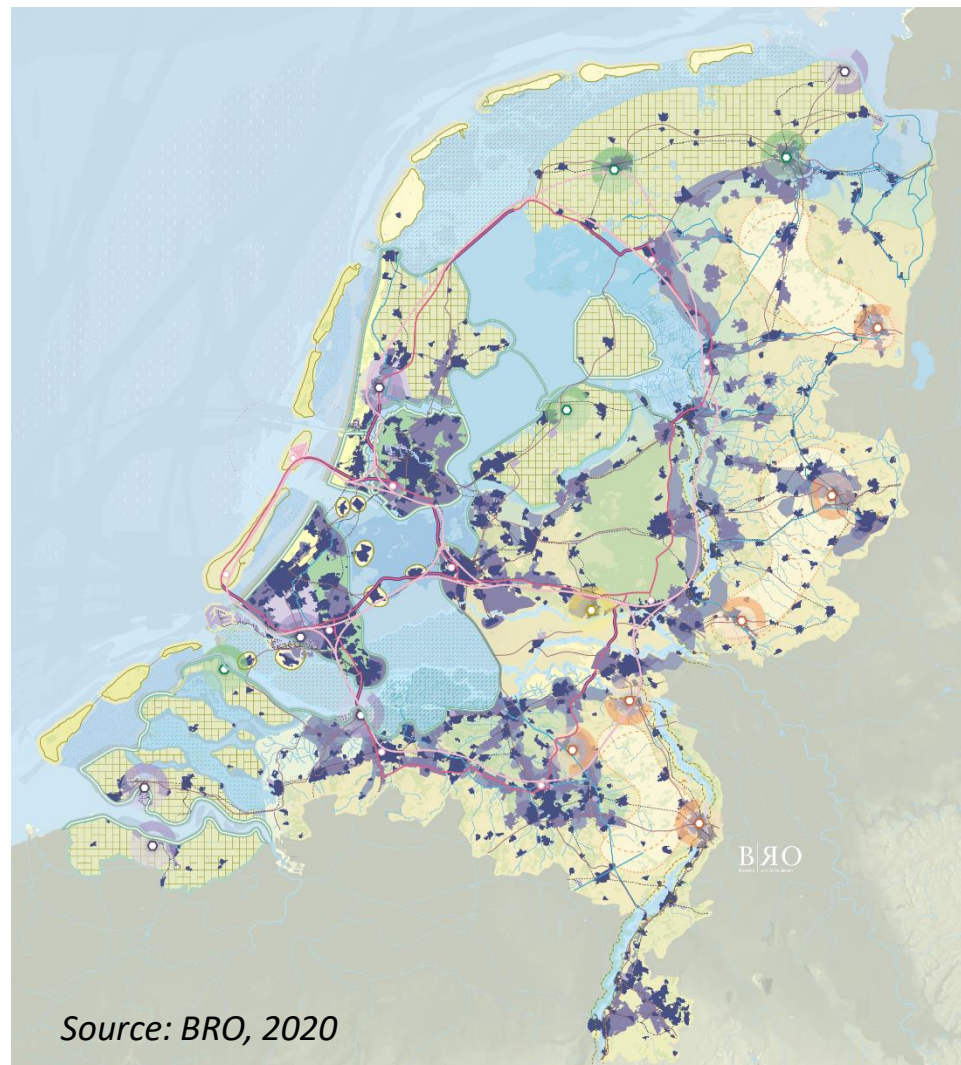
Larger cities are protected

High-speed lines

Industrial food production is given a place in agro-clusters,

Nature is bundled

Landscape parks between cities





# NL 2300 – BRO

## + 5 meter

Land consolidation

Water gets more space.

New line of wadden islands

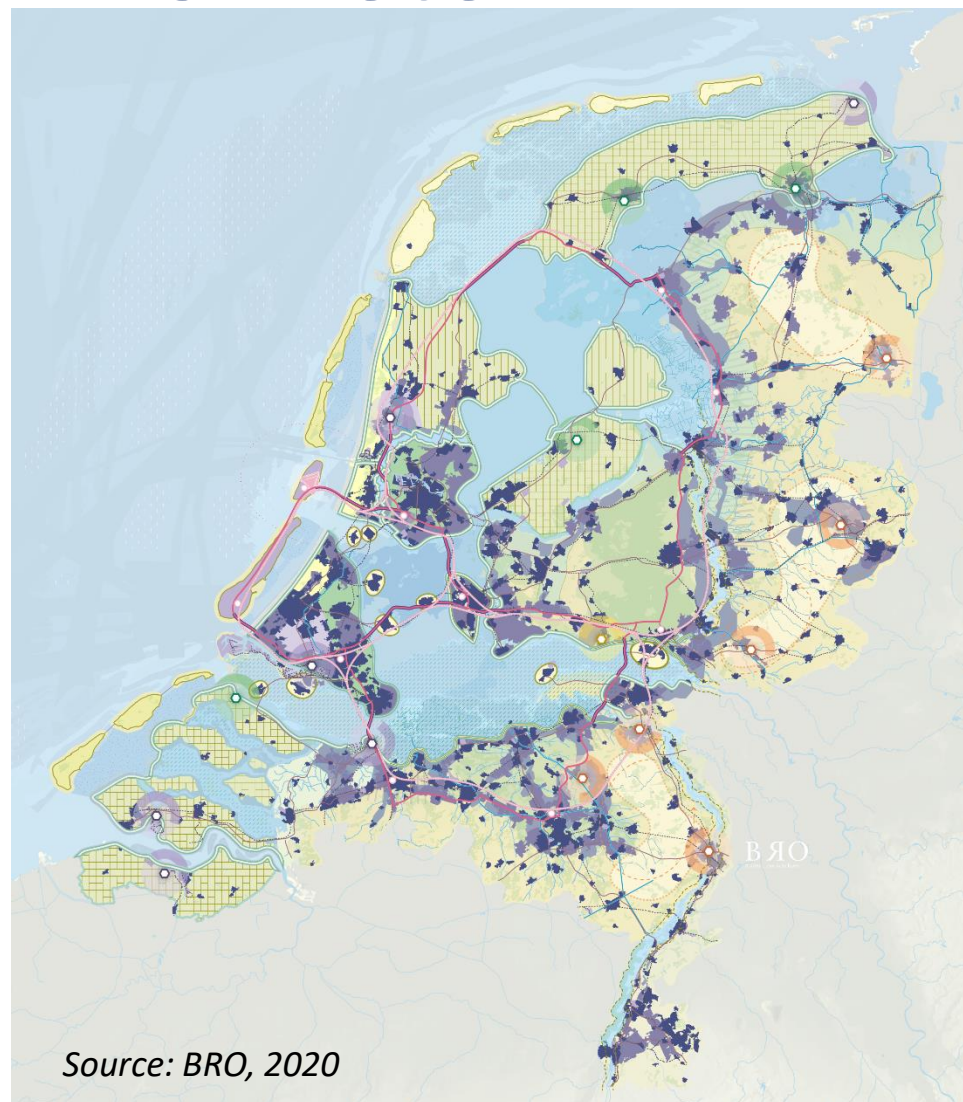
Small cities moved to higher ground

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landscape parks between cities



Source: BRO, 2020





# NL 2300 - Buro Lubbers

## Mondrian delta

Storm flood in 2038 -> millions of fugitives

Destroyed cities not rebuilt

a Mondrian grid of piers and dikes grows  
along with sea level rise.

In grid countless functions: ports, industrial  
areas, aquaculture, energy landscapes and  
floating residential areas.

Parts of old cities saved as islands:

Amsterdam canals, Vondelpark, Bijlmer flats  
form 'The city formerly known as  
Amsterdam'.

Rest of Randstad under water: New Atlantis.



Image: Buro Lubbers



# NL 2300 -Rijnboutu

## The abandoned country

No hard border land –water

Coastline of salt marshes, partly  
new created on the empty farmland

High-tech food production

Flooded polders with marine  
agriculture & floating greenhouses

Circular agroparks in hinterland.

Concentric cities in east

High-rise clusters with data centers  
and control rooms, hyperloop  
network

Sea platforms for solar energy



Image: Rijnboutu





# NL 2300 - Jet ten Voorde

## Air cities

No development in low lands:

- Densification of the higher-lying city centers and urbanized port areas.
- Critical infrastructure in watertight tunnels
- Travel on elevated monorail and aerial cycle paths and boats
- Castles in the air
- Growing seaweed in salt water
- Floating fields



Image: Jet ten Voorde

# NL 2300 - HZ University of Applied Sciences



Tim Hoogkamp, Gino Schier, Patrick van Zweden supervised by  
Lukas Papenborg

## Elysium

Coastline moved to higher sandy area

Half of NL under water

Subtropical climate

Economy with a rich elite

Tourism luxury holidays

Mega-poles Apeldoorn, Eindhoven,  
Brussels and Nijmegen

Products and goods are imported,  
processed and exported via new hub

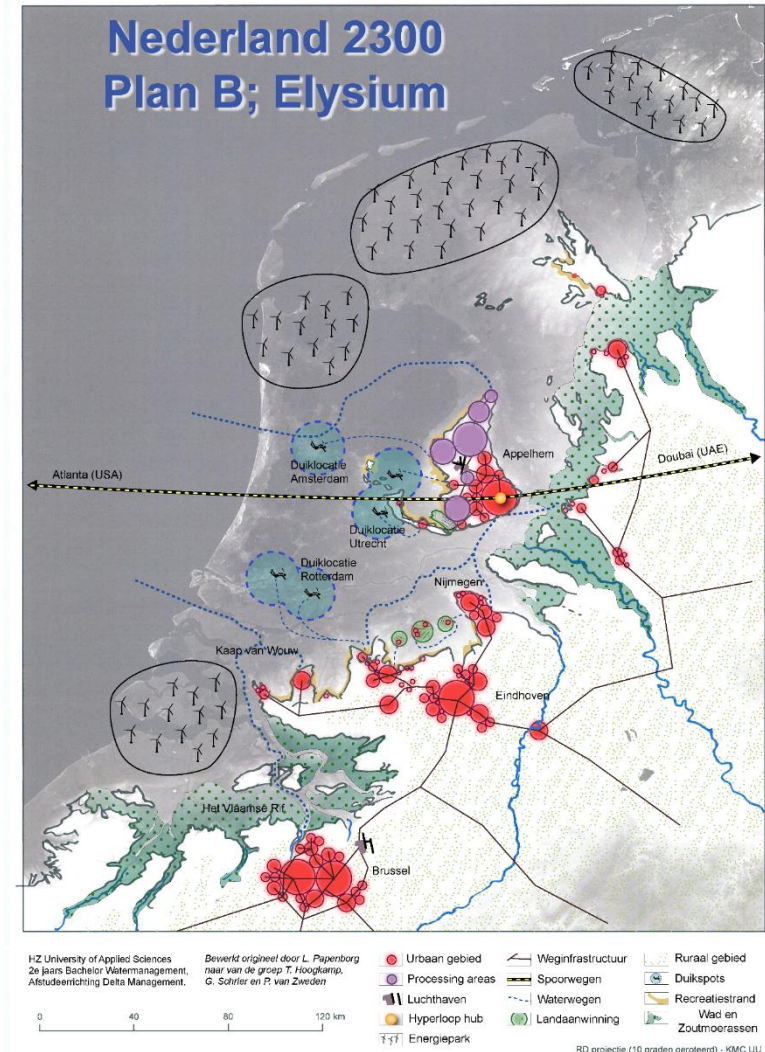


Image: HZ University of Applied Sciences





# NL 2300 - Ro Koster and Hans van Engen

## Hello, wake up!

country disappear in the waves  
migration waves  
loss of fertile lands  
drinking water shortages  
a crisis in biodiversity  
social and political disruption

Main focus: CO2 storage by

- massive forestation
- flooding of peat meadows
- agroforestry along infrastructure lines





# Question on long term strategy

What type of strategy would you  
choose for the coast of the  
Netherlands?





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# The North Sea

October 10, 2024  
Jeroen de Vries  
LE:NOTRE Institute

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Google Earth



Faculté  
d'Architecture  
La Cambre Horta



LE:NOTRE *Institute*  
Linking landscape education, research and innovative practice



ISOCARP  
Knowledge for Better Cities



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