European Dredging Association
25th Anniversary Conference
Bibliothèque Solvay
15 November 2018

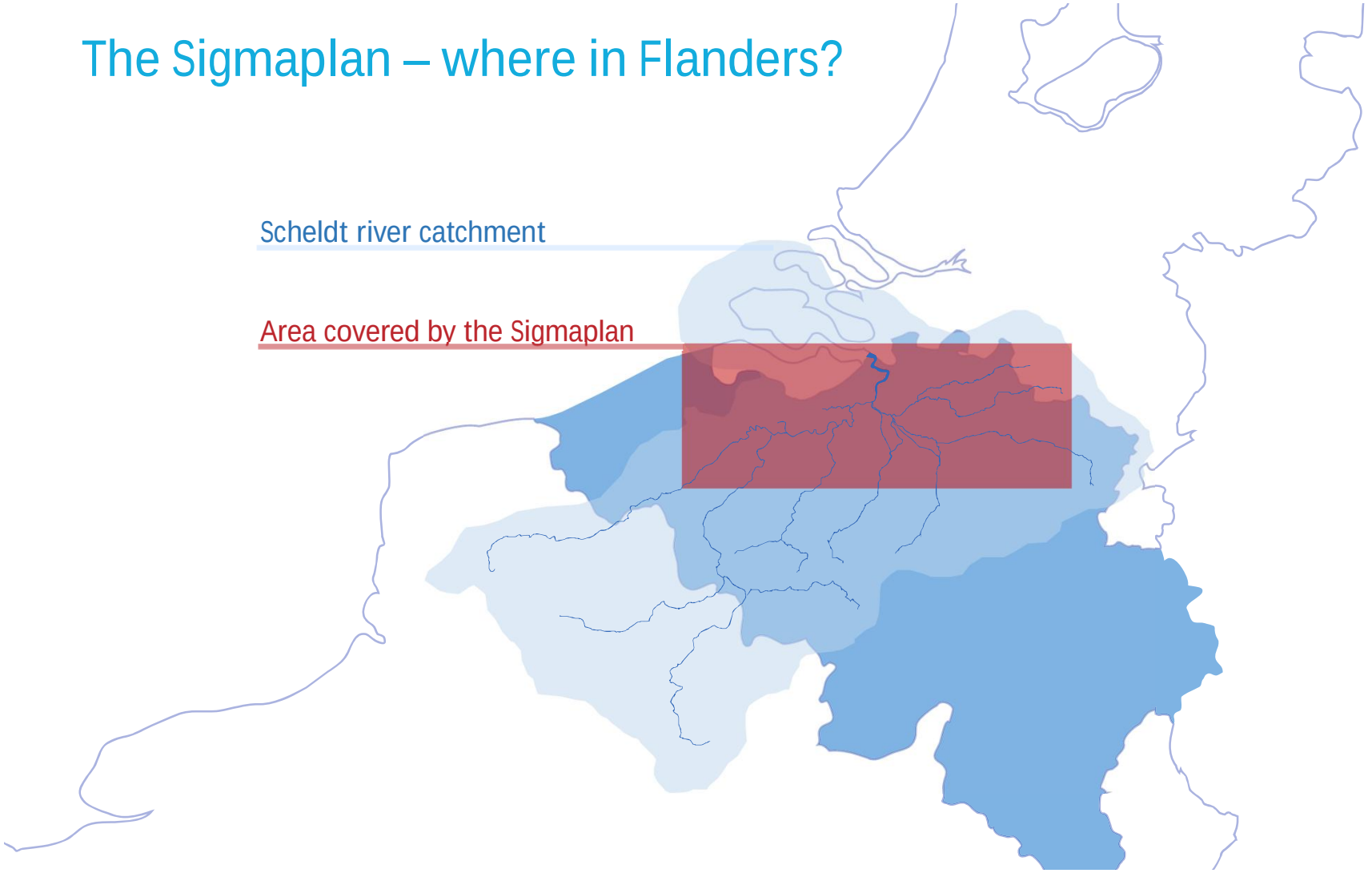
Sigmaplan

ir. Wim Dauwe
Flemish Waterways plc

Flemish Waterways plc (De Vlaamse Waterweg nv)

Sigmaplan

The Sigmaplan – where in Flanders?



Reason for the original Sigmaplan
Storm tides and serious flooding in the past (1953 and 1976)

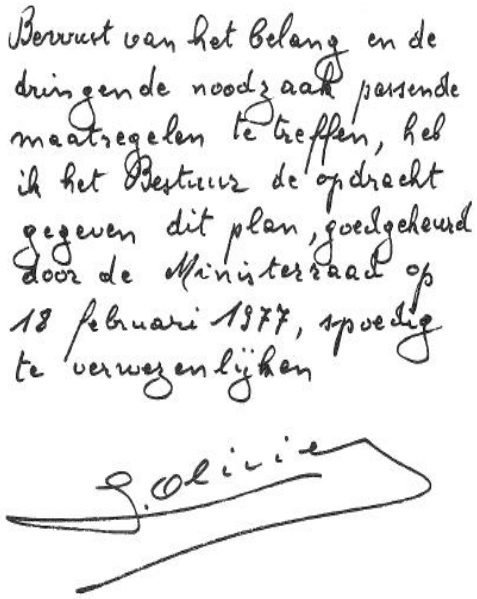
Sigmaplan by analogy with the Deltaplan in the Netherlands

MINISTERIE VAN OPENBARE WERKEN
BESTUUR DER WATERWEGEN

PLAN OLIVIER

voor de

beveiliging van het zeescheldebekken tegen stormvloeden op de noordzee



Bewust van het Belang en de dringende noodzaak passende maatregelen te treffen, heb ik het Bestuur de opdracht gegeven dit plan, goedgekeurd door de Ministerraad op 18 februari 1977, spoedig te verwezenlijken

G. Olivier

Sigmaplan

1976

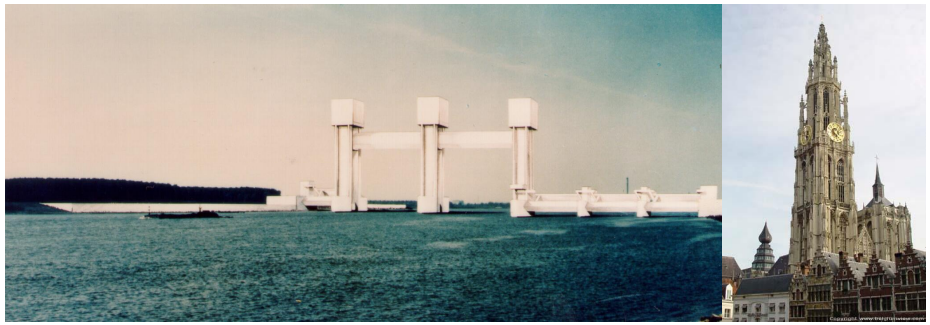
Again a lot of damage and victims by floodings in the provinces of East Flanders and Antwerp

↓

"Doing nothing is not an option"
Belgium launches the Sigmaplan
Decision by the Belgian government
on 18 February 1977

The original Sigmaplan

- Three measures for a better protection against storm floods
  - Raising and strengthening 500 km of embankments
  - Building of 13 flood control areas (1,130 ha)
  - Building of a storm surge barrier in Antwerp



Sigmaplan

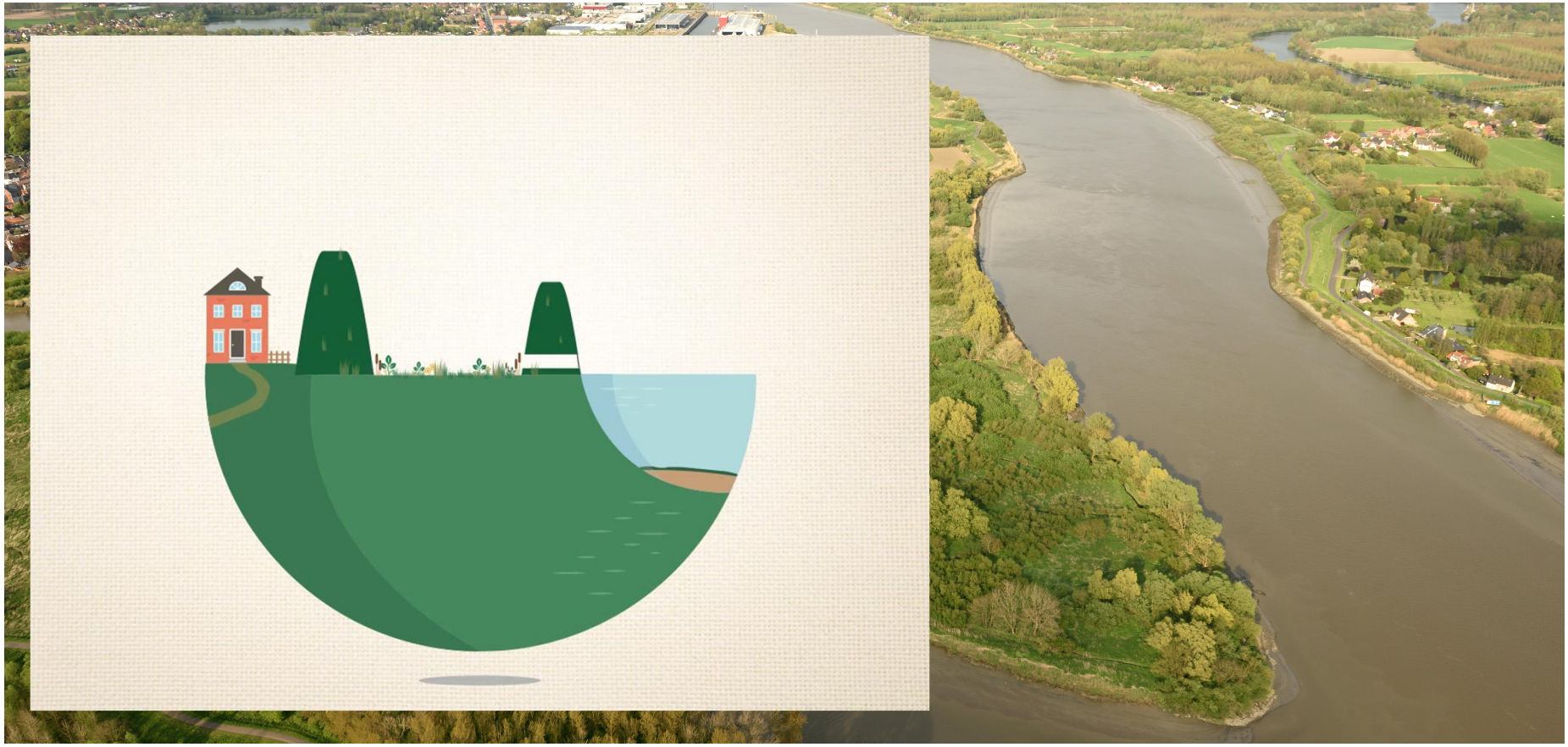
The original Sigmaplan

- Three measures for a better protection against storm floods
  - Stronger and higher of 500 km embankments
    Mostly finished
  - Building of 13 flood control areas (1,130 ha)
    Finished (last one in 2015)
  - ~~Building of a storm surge barrier in Antwerp~~
    Construction of the barrier was postponed

Sigmaplan

Polders van Kruibeke - inauguration

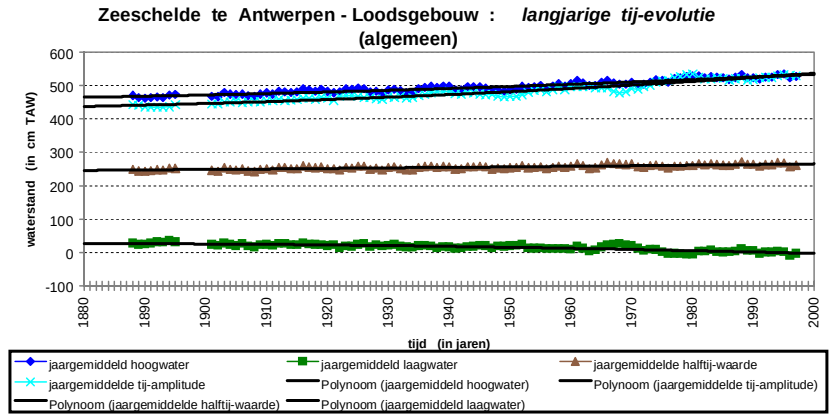
Controlled Flood Area (Tielrodebroek, Hamme)

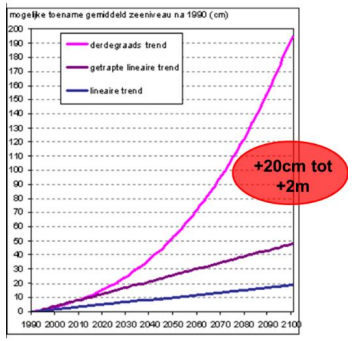


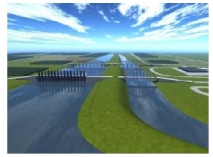
Controlled Flood Area (Tielrodebroek, Hamme)

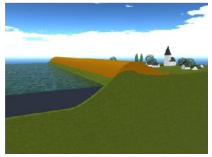
Controlled Flood Area (Tielrodebroek, Hamme)

Controlled Flood Area (Zennegat, Mechelen)









The updated Sigmaplan
Why the plan needed updating?

- New insights and developments
  - The original Sigmaplan was not yet completed
  - Vision on water management: more room for the river
  - Effects of climate change (sea level rise)
  - Implementation of nature conservation objectives
    - Natura 2000
    - Water Framework Directive
    - Long-term vision for the Scheldt Estuary
    - Flemish nature preservation laws
- An update for the Sigmaplan was necessary
  - Decision was taken by the Flemish government on 22 July 2005

Sigmaplan

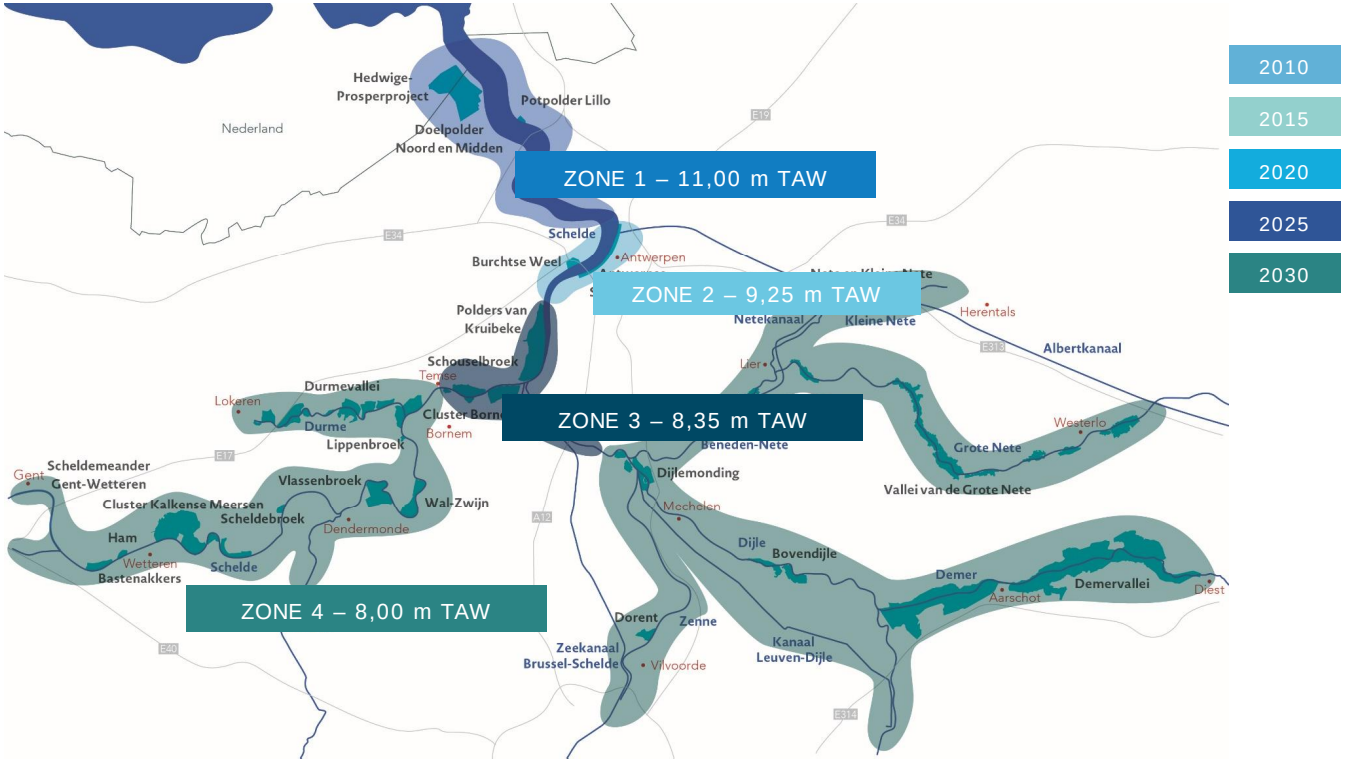
The updated Sigmaplan
Some figures

- Several project areas
  - 645 km of dikes and quays
  - 2,500 ha of controlled flood areas
  - 5,100 ha of nature development
- Budget: 1 billion €
- Phased implementation between 2005 and 2030

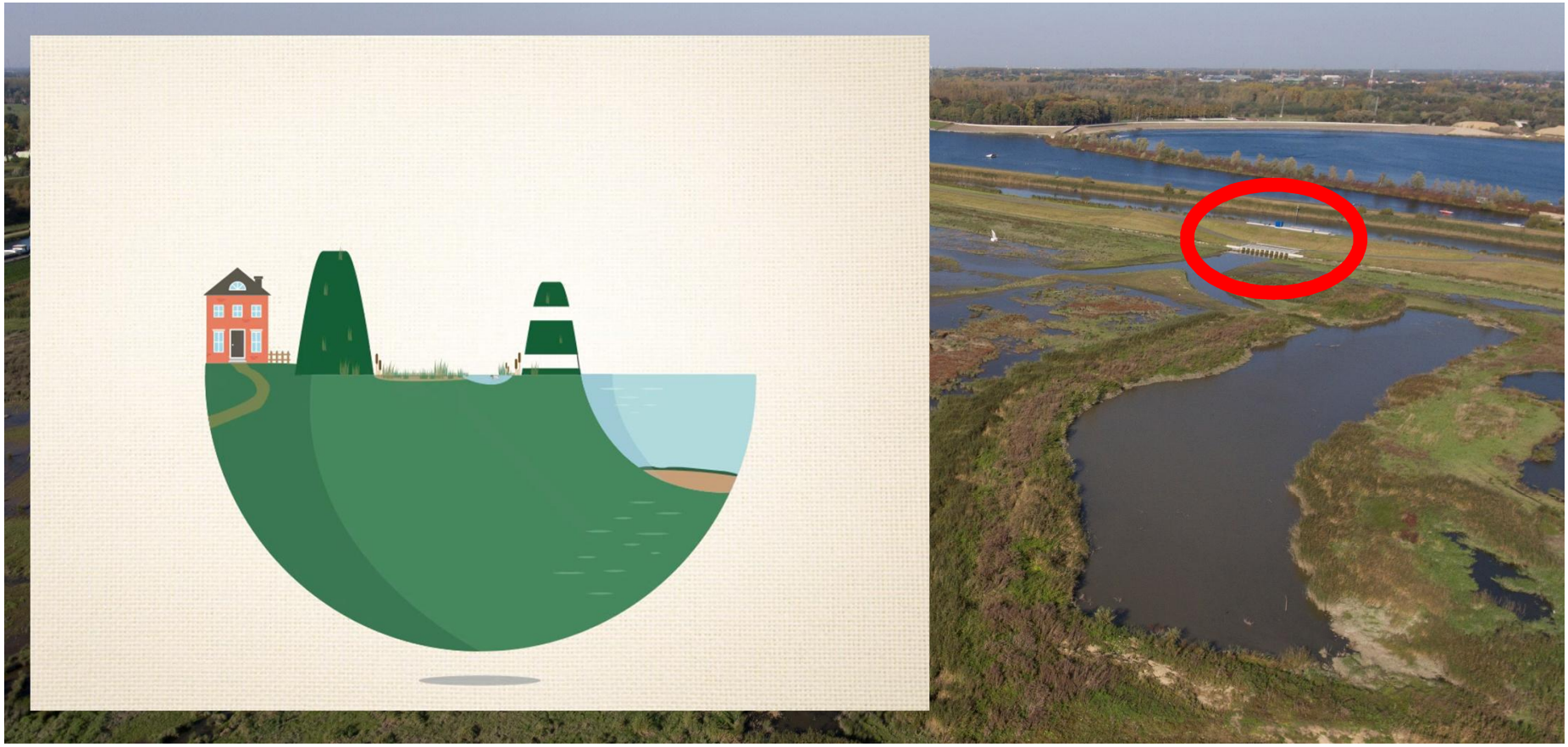
Sigmaplan

The updated Sigmaplan
Phased implementation

The updated Sigmaplan
Phased implementation



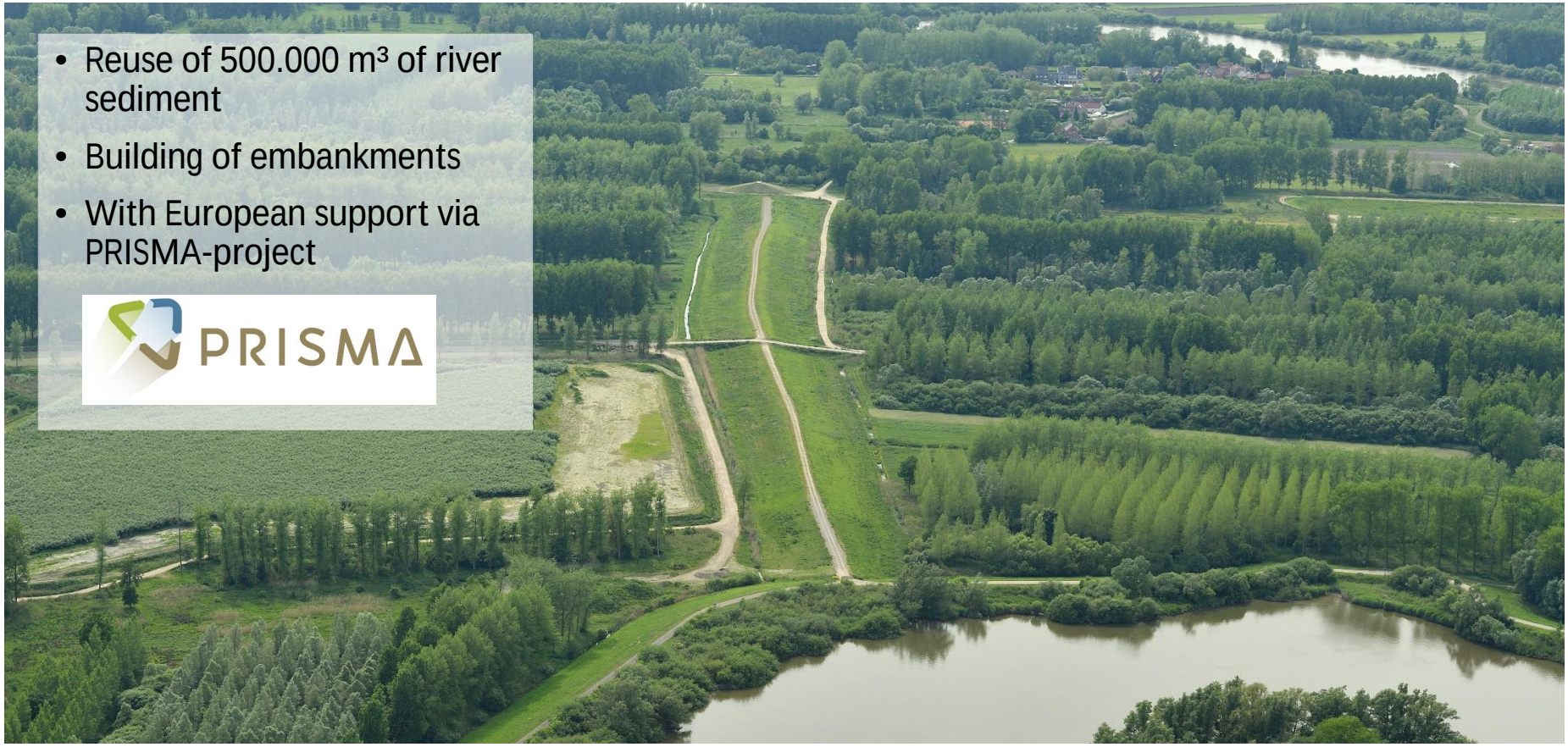
Innovative approach
Controlled flood areas with reduced tides – Zennegat (Mechelen)



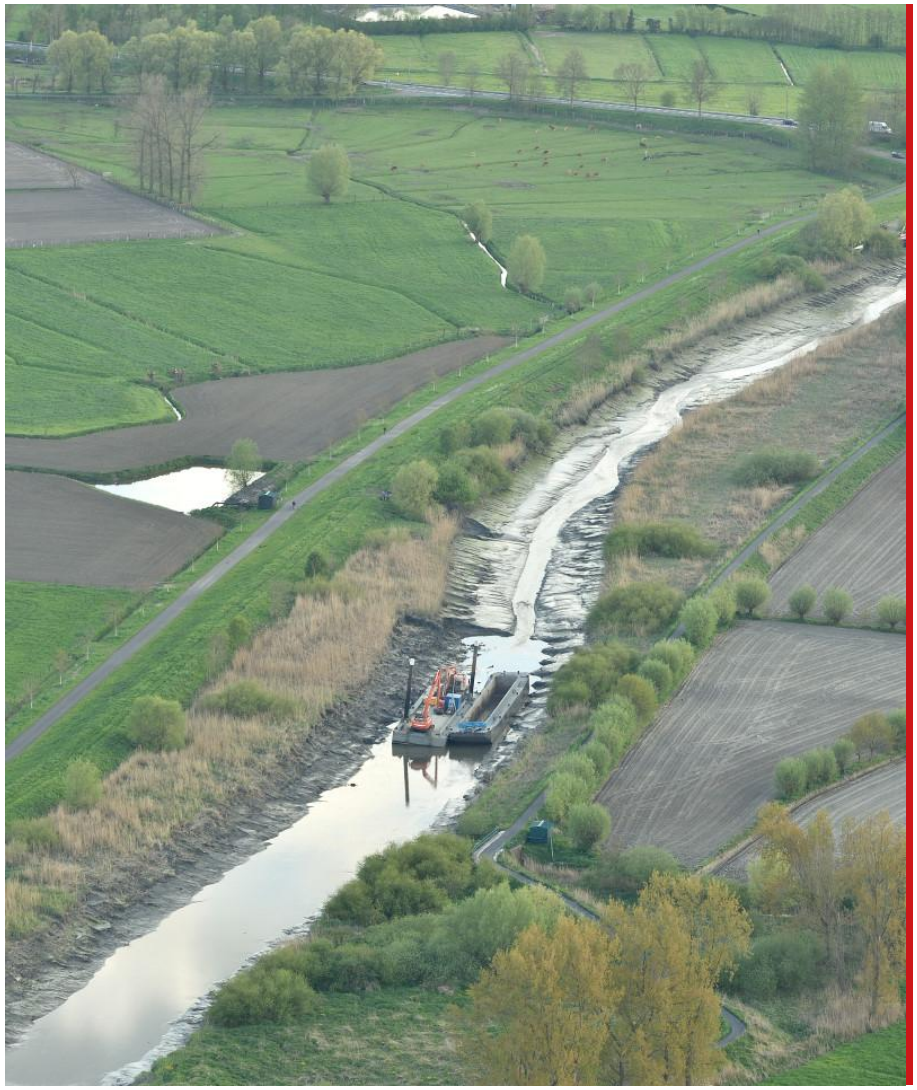
Innovative approach
Controlled flood areas with reduced tides – Zennegat (Mechelen)

Innovative approach
Controlled flood areas with reduced tides – Zennegat (Mechelen)

Innovative approach
Stabilisation techniques of the quays in Antwerp



Innovative approach
Building dikes with reuse of sediments



Beneficial sediment reuse to improve flood defense

- Implementation of the Sigmaplan entails a lot of construction material
- Maintenance dredging works are necessary (Durme, Upper Sea Scheldt)
- Combination of dredging and embankment construction works has many advantages

Sigmaplan

Beneficial sediment reuse to improve flood defense

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Sigmaplan

Beneficial sediment reuse to improve flood defense

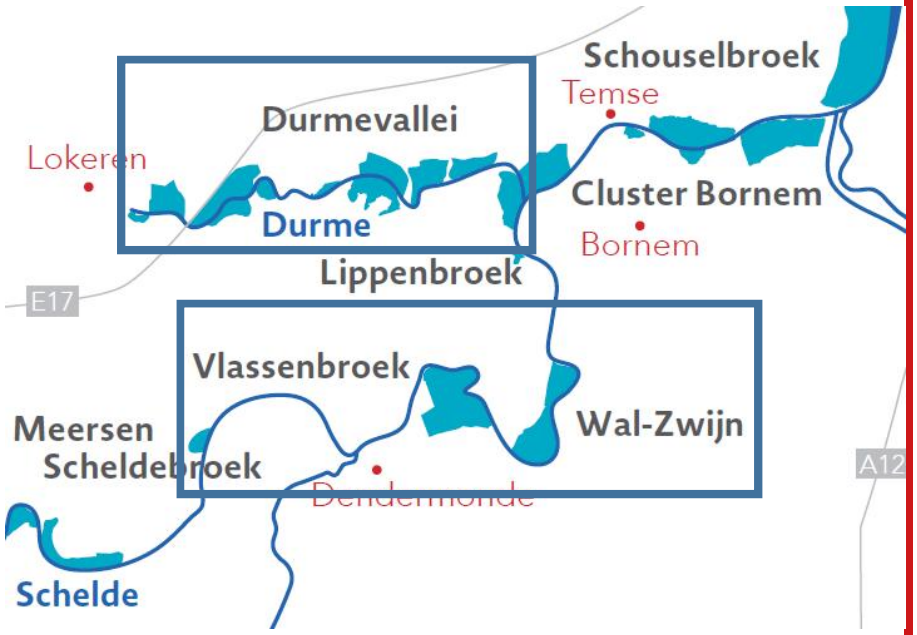
- Reuse of sediments as core material and cover material is an opportunity
  - Case 1: Common reuse of river sediment in embankment construction

Sigmaplan

Beneficial sediment reuse to improve flood defense

- Reuse of sediments as core material and cover material is an opportunity
  - Case 1: Common reuse of river sediment in embankment construction
  - Case 2: Reuse of fine grained sediments

Sigmaplan



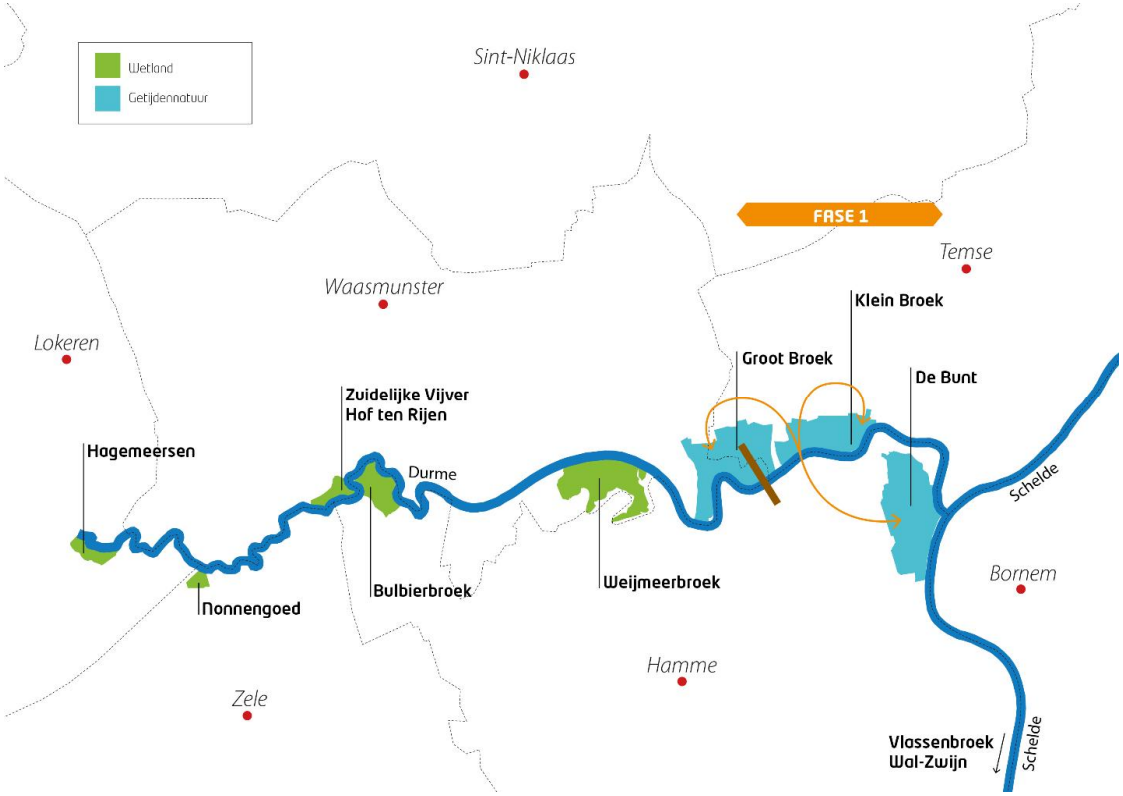
Beneficial sediment reuse to improve flood defense

- Reuse of sediments as core material and cover material is an opportunity
  - Case 1: Common reuse of river sediment in embankment construction
  - Case 2: Reuse of fine grained sediments
- Involvement in several project areas
  - Durme: De Bunt, Klein en Groot Broek en Potpolder IV
  - Vlassenbroek en Wal-Zwijn

Sigmaplan

Beneficial sediment reuse to improve flood defense
Case 1: Common reuse of river sediment in embankment construction

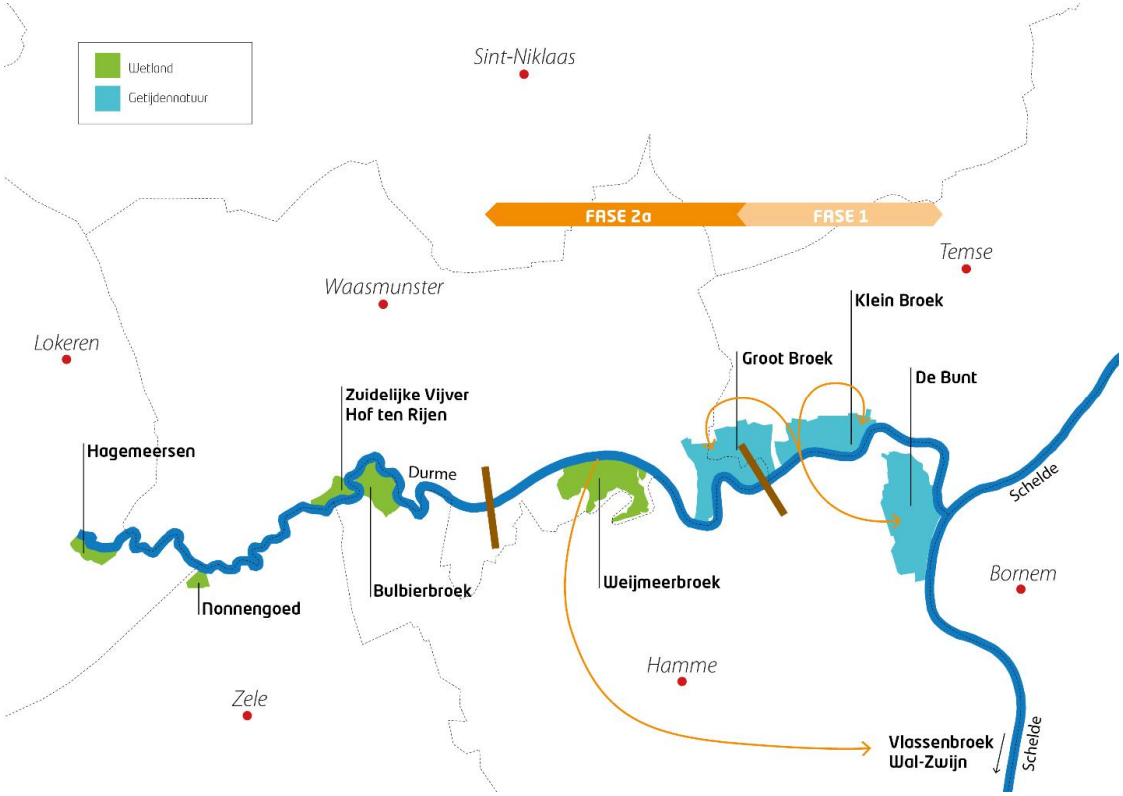
- Dredging works are part of the Durme river restoration plan
- Dredging in several phases
- Phase 1:
  - 2012-2013
  - Trajectory 4,5 km
  - Volume 410,000 m³



Sigmaplan

Beneficial sediment reuse to improve flood defense
Case 1: Common reuse of river sediment in embankment construction

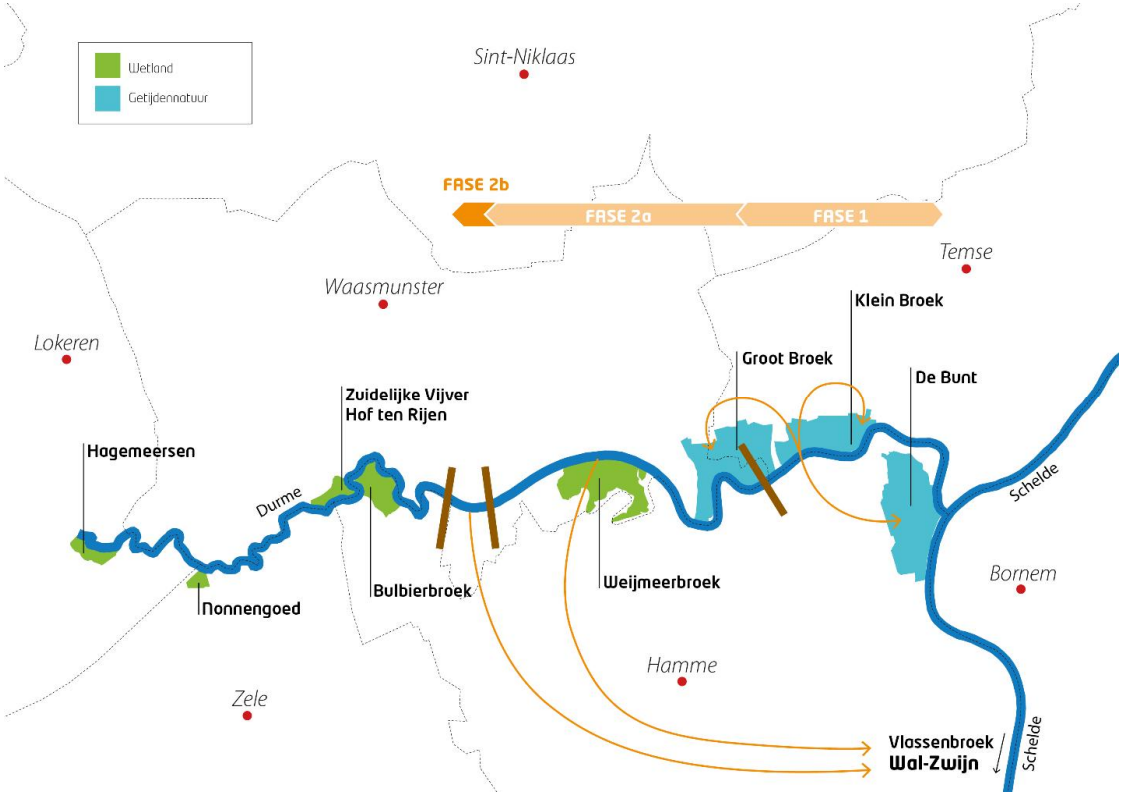
- Dredging works are part of the Durme river restoration plan
- Dredging in several phases
- Phase 2:
  - 2013-2015
  - Trajectory 4,5 km
  - Volume 450,000 m³



Sigmaplan

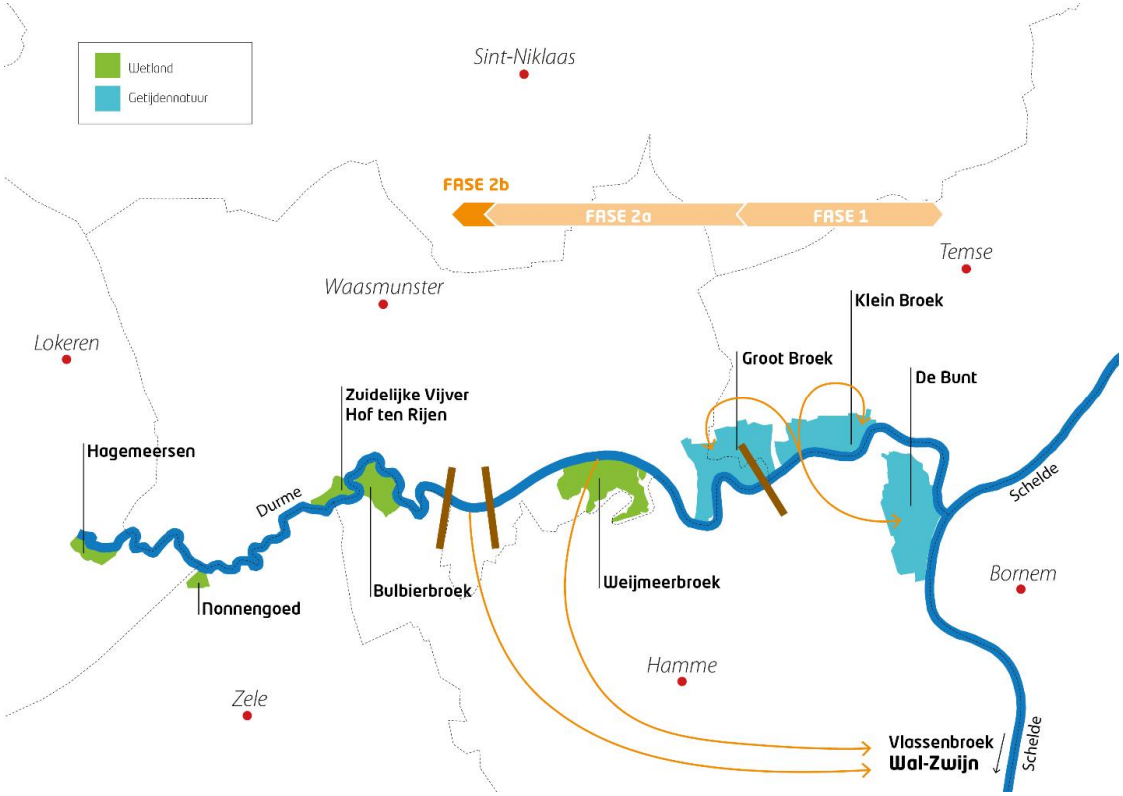
Beneficial sediment reuse to improve flood defense
Case 1: Common reuse of river sediment in embankment construction

- Dredging works are part of the Durme river restoration plan
- Dredging in several phases
- Phase 2b:
  - 2015-2016
  - Trajectory 1 km
  - Volume 70,000 m³



Beneficial sediment reuse to improve flood defense
Case 1: Common reuse of river sediment in embankment construction

- Dredging works are part of the Durme river restoration plan
- Dredging in several phases
- Phase 2b:
  - 2015-2016
  - Trajectory 1 km
  - Volume 70,000 m³
- In total +/- 1,000,000 m³



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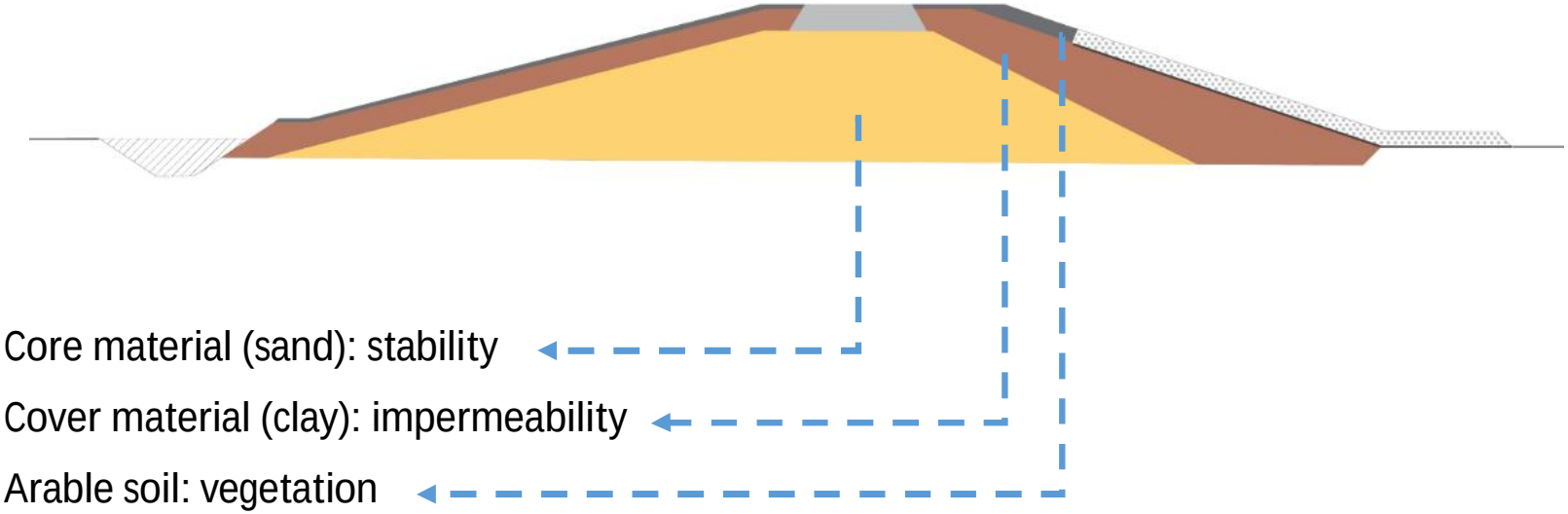
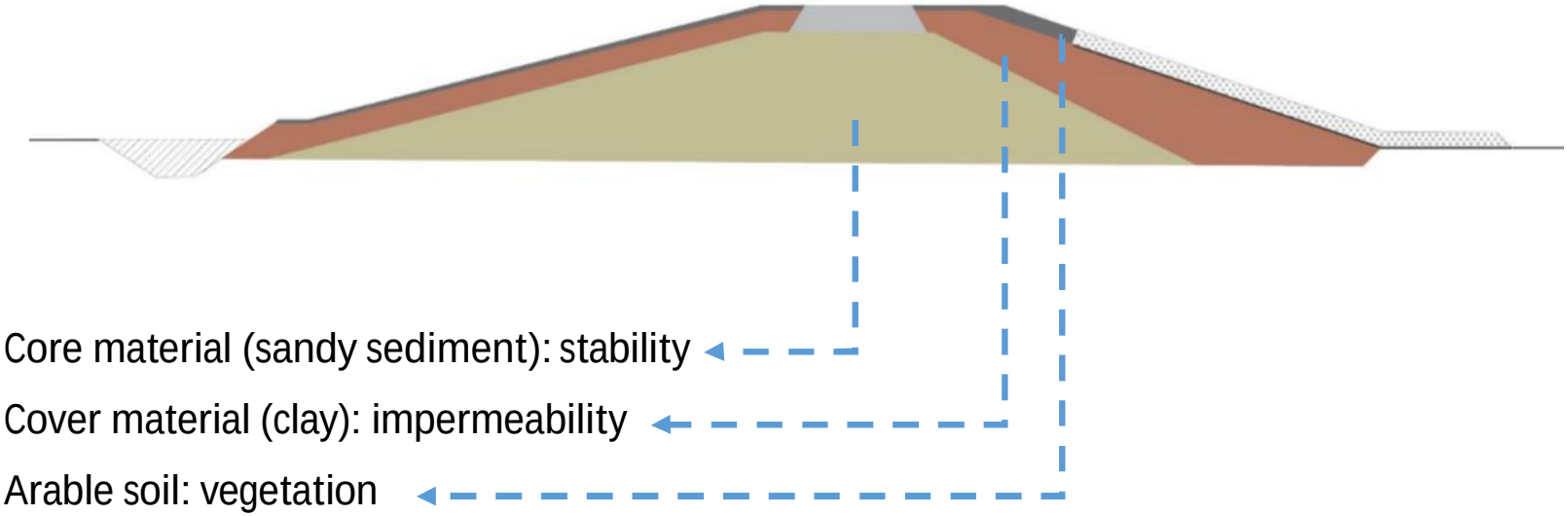
Beneficial sediment reuse to improve flood defense
Case 1: Common reuse of river sediment in embankment construction



- Core material (sand): stability
- Cover material (clay): impermeability
- Arable soil: vegetation

Sigmaplan

Beneficial sediment reuse to improve flood defense
Case 1: Common reuse of river sediment in embankment construction



- Core material (sandy sediment): stability
- Cover material (clay): impermeability
- Arable soil: vegetation

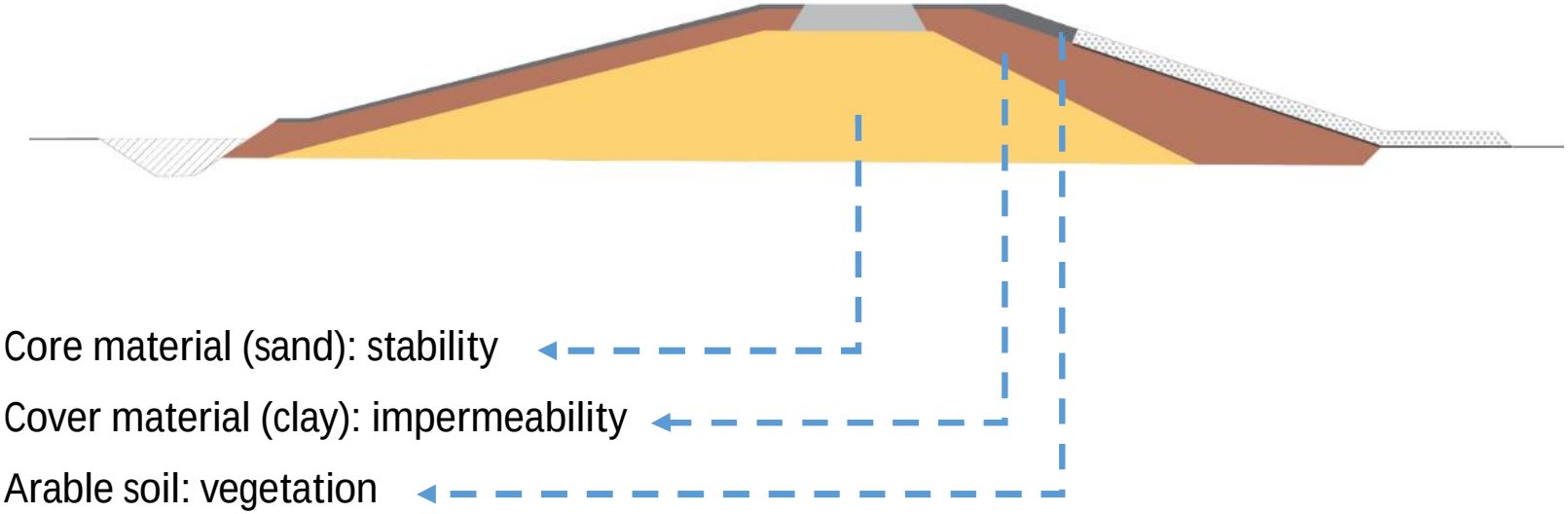
Sigmaplan

De Bunt

De Bunt

De Bunt

Beneficial sediment reuse to improve flood defense
Case 2: Reuse of fine grained sediments without intermediate storage



- Core material (sand): stability
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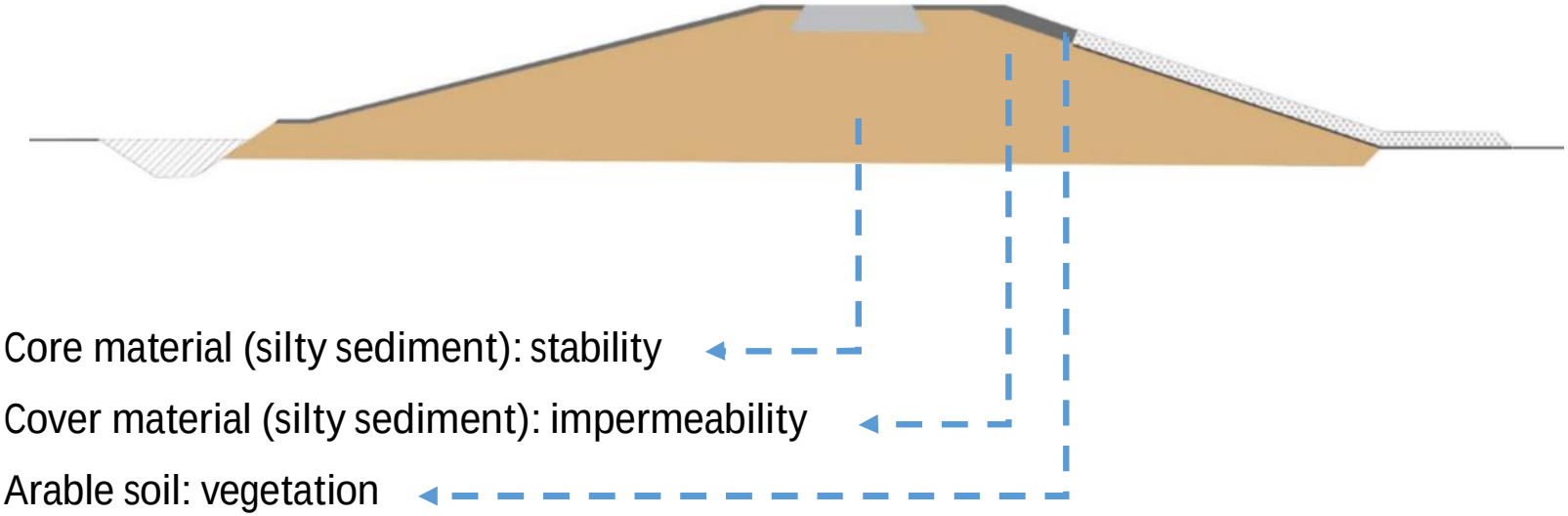
Sigmaplan

Beneficial sediment reuse to improve flood defense
Case 2: Reuse of fine grained sediments without intermediate storage



- Core material (silty sediment): stability
- Cover material (silty sediment): impermeability
- Arable soil: vegetation

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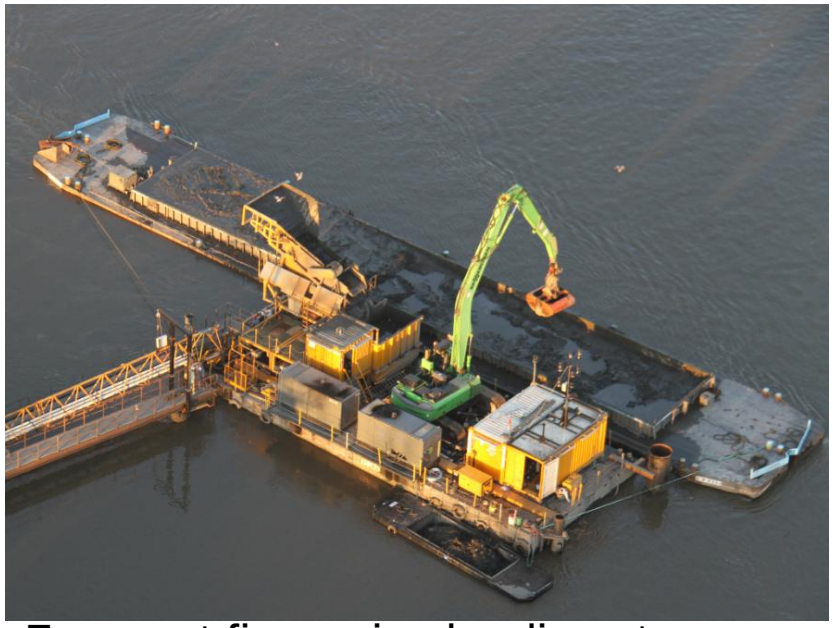
Vlassenbroek
Innovative construction method in a European framework



Transport fine grained sediments

Transport through pipelines

Sigmaplan

PRISMA

2 Mers Seas Zeeën
INTERREG IV A
FRANCE - ENGLAND - VLAANDEREN - NEDERLAND

"Investing in your future"
Crossborder cooperation programme
2007-2013 Part-financed by the European Union
(European Regional Development Fund)

Vlassenbroek
Innovative construction method in a European framework

Adding additives

Building the floodbank instantly

Sigmaplan

PRISMA

2 Mers Seas Zeeën
INTERREG IV A
FRANCE - ENGLAND - VLAANDEREN - NEDERLAND

"Investing in your future"
Crossborder cooperation programme
2007-2013 Part-financed by the European Union
(European Regional Development Fund)

Vlassenbroek
Result

200.000 m³ sediments used for a 2 km long floodbank

Sigmaplan

PRISMA

2 Mers Seas Zeeën
INTERREG IV A
FRANCE - ENGLAND - VLAANDEREN - NEDERLAND

"Investing in your future"
Crossborder cooperation programme
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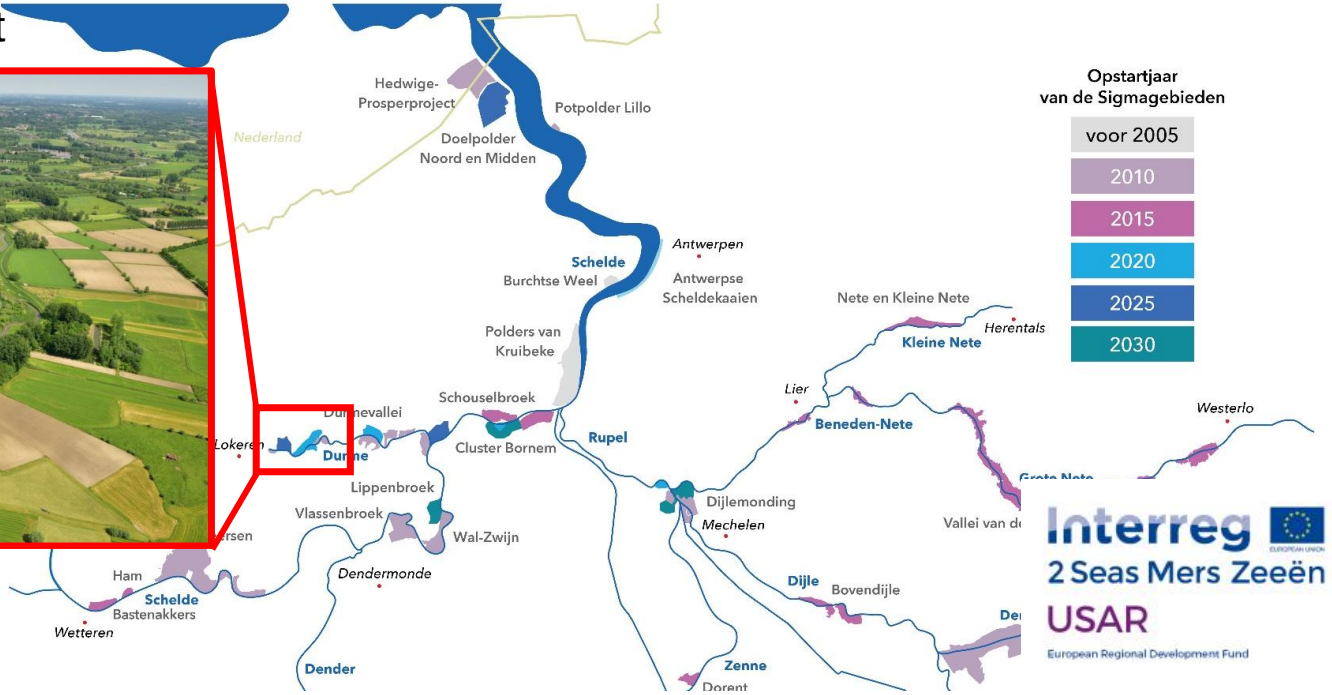
Potpolder IV
in a European framework: USAR ‘Using Sediments as a resource’

- Renovation of a flood area; constructed in the ‘40s
- River Durme; a tributary of the River Scheldt
- Prone to tidal movement

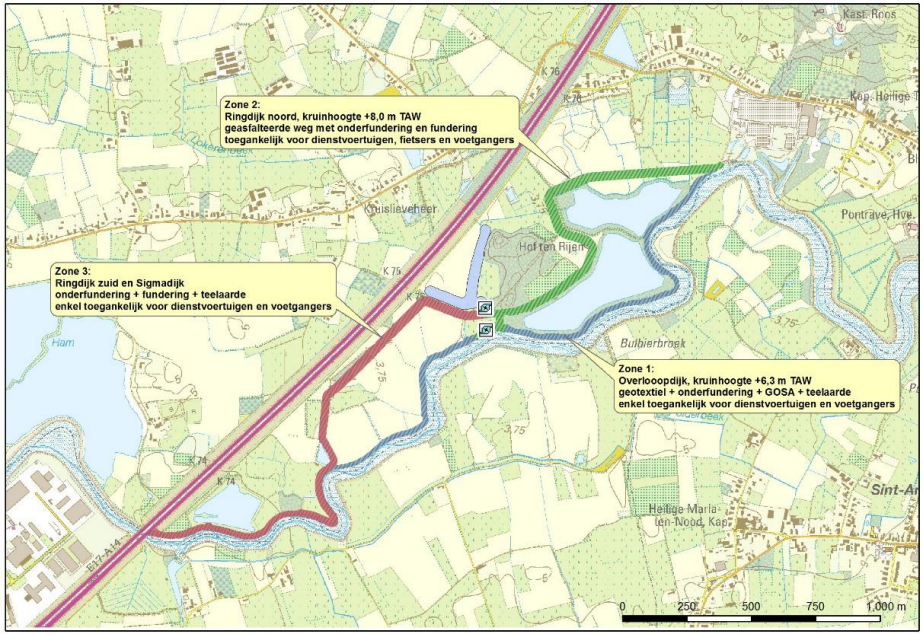


Sigmaplan

Interreg
2 Seas Mers Zeeën
USAR
European Regional Development Fund

Potpolder IV
in a European framework: USAR ‘Using Sediments as a resource’

- Renovation of a flood area
  - Design of new ringdyke
  - Design of overflow dyke
  - Design of new pumping stations
  - Final surface of renovated flood area: 60 hectares



Sigmaplan

Interreg
2 Seas Mers Zeeën
USAR
European Regional Development Fund

Potpolder IV
in a European framework: USAR ‘Using Sediments as a resource’

- Maintenance dredging works upstream

Sigmaplan

Interreg
2 Seas Mers Zeeën
USAR
European Regional Development Fund

Thank you for your attention!