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The Masterplan Coastal Safety: a wave of opportunities

*In depth coastal research and
state of the art maritime technology*

VLIZ Noordzee excursie Thornton
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Content



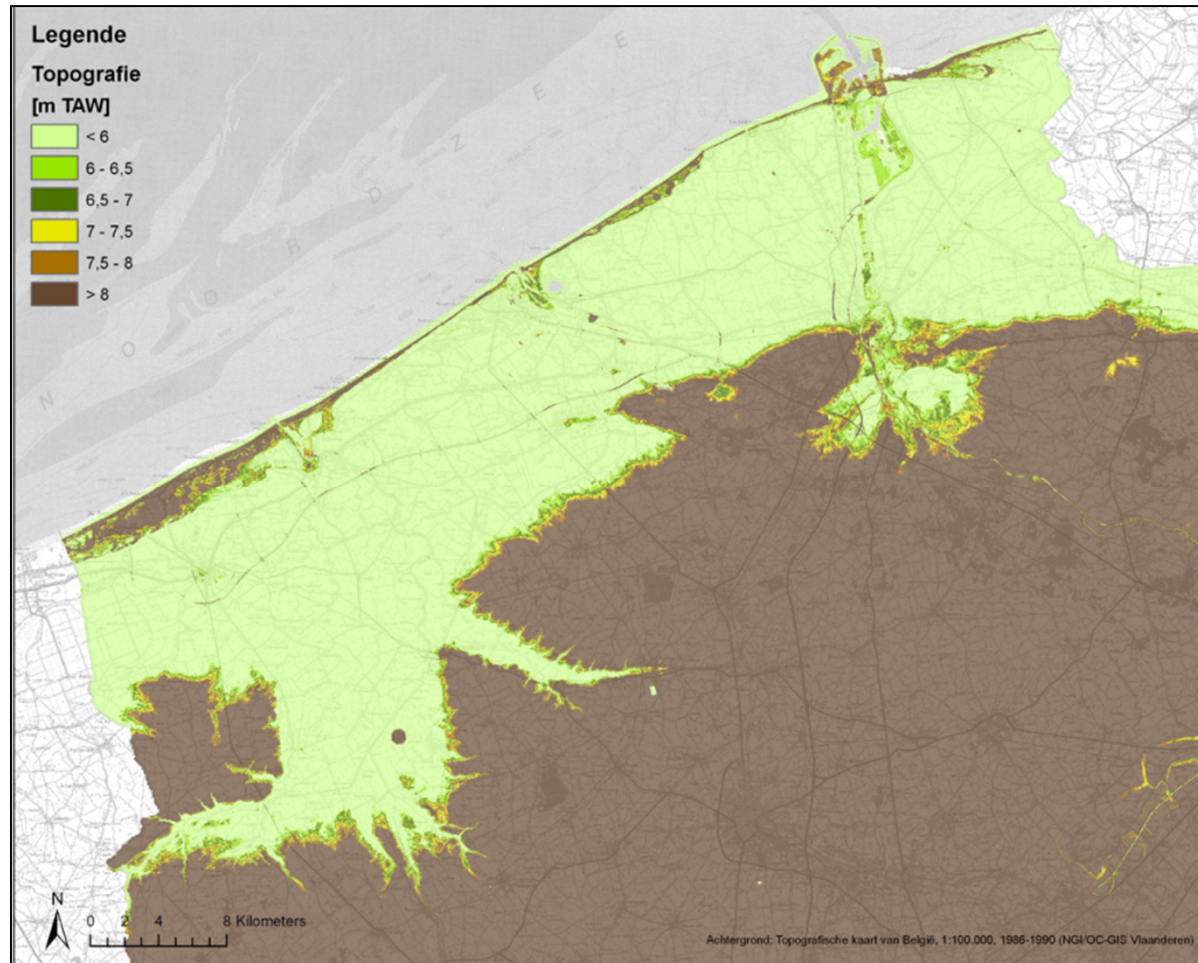
- Masterplan Coastal safety
- Underpinned by wide and detailed academic/scientific research & study (1st & 2nd Safety Check)
- Implementation through intensive monitoring strategies
- State of the art cases such as:
 - Nourishment program
 - Flood barrier
 - Stilling wave basin
 - Seadike reflecting wave concept
 - Nature expansion



Masterplan Coastal Safety



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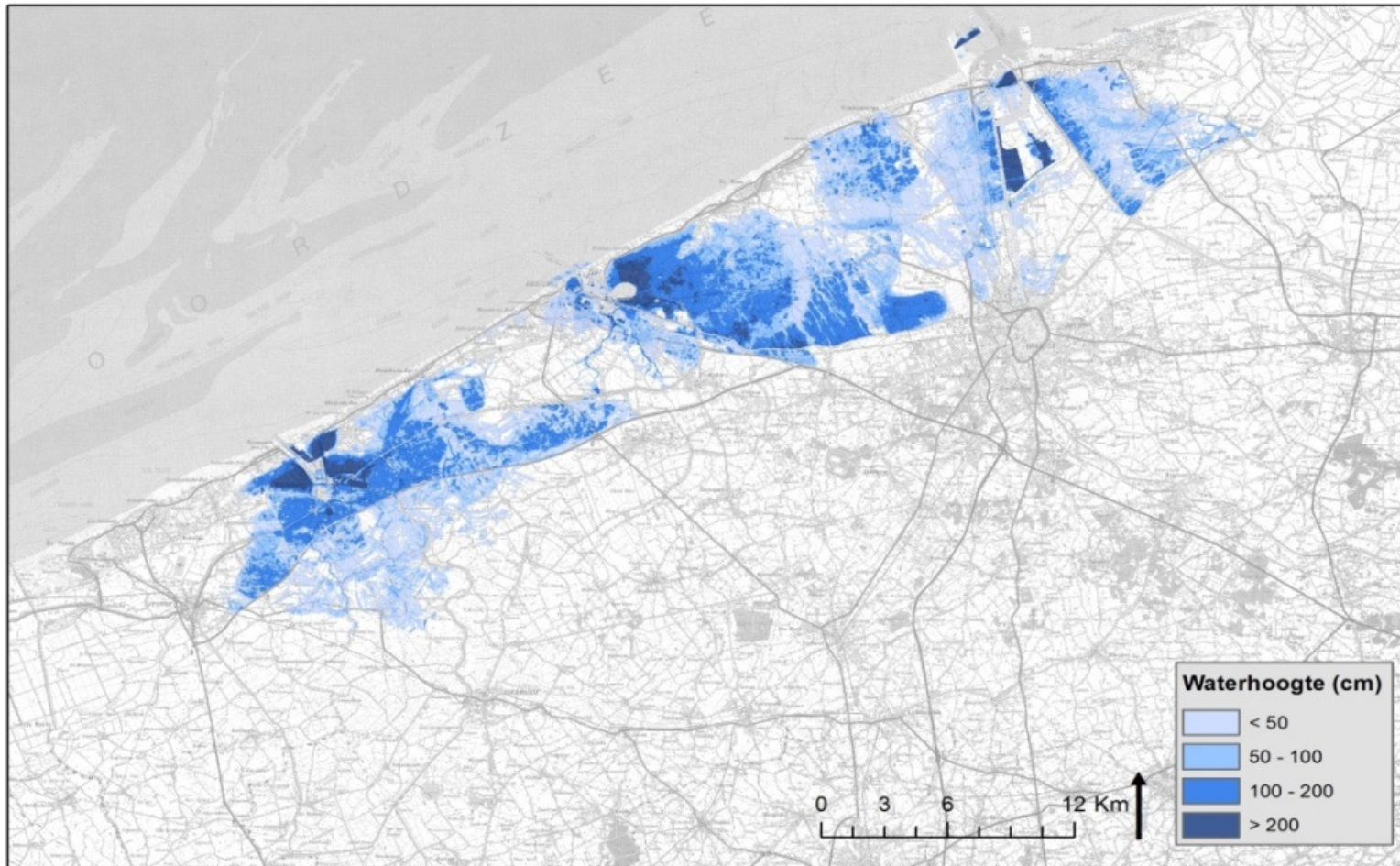


More than 85% of the polders beneath +5m TAW (average storm)

Masterplan Coastal Safety



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Flood map of a 1000 year storm event

Masterplan Coastal Safety



- 1/3th of the Belgian coastline is not sufficiently protected against severe storm events.
- The Integrated Master Plan for Coastal Safety has been set up which forms the basis for the development of the seafront along the Belgian coast in the nearby and distant future (up till 2050) with safety against flooding as its main objective.
 - estimated sea level rise in 2050: 30cm
- Proposed measures were approved on June 10th 2011 by the Flemish government
- Estimated cost: € 300M (under estimated maintenance cost)

Scientific research & study



- First safety check (2007 till 2011)

Norm: No fatalities due to a 1000 year storm

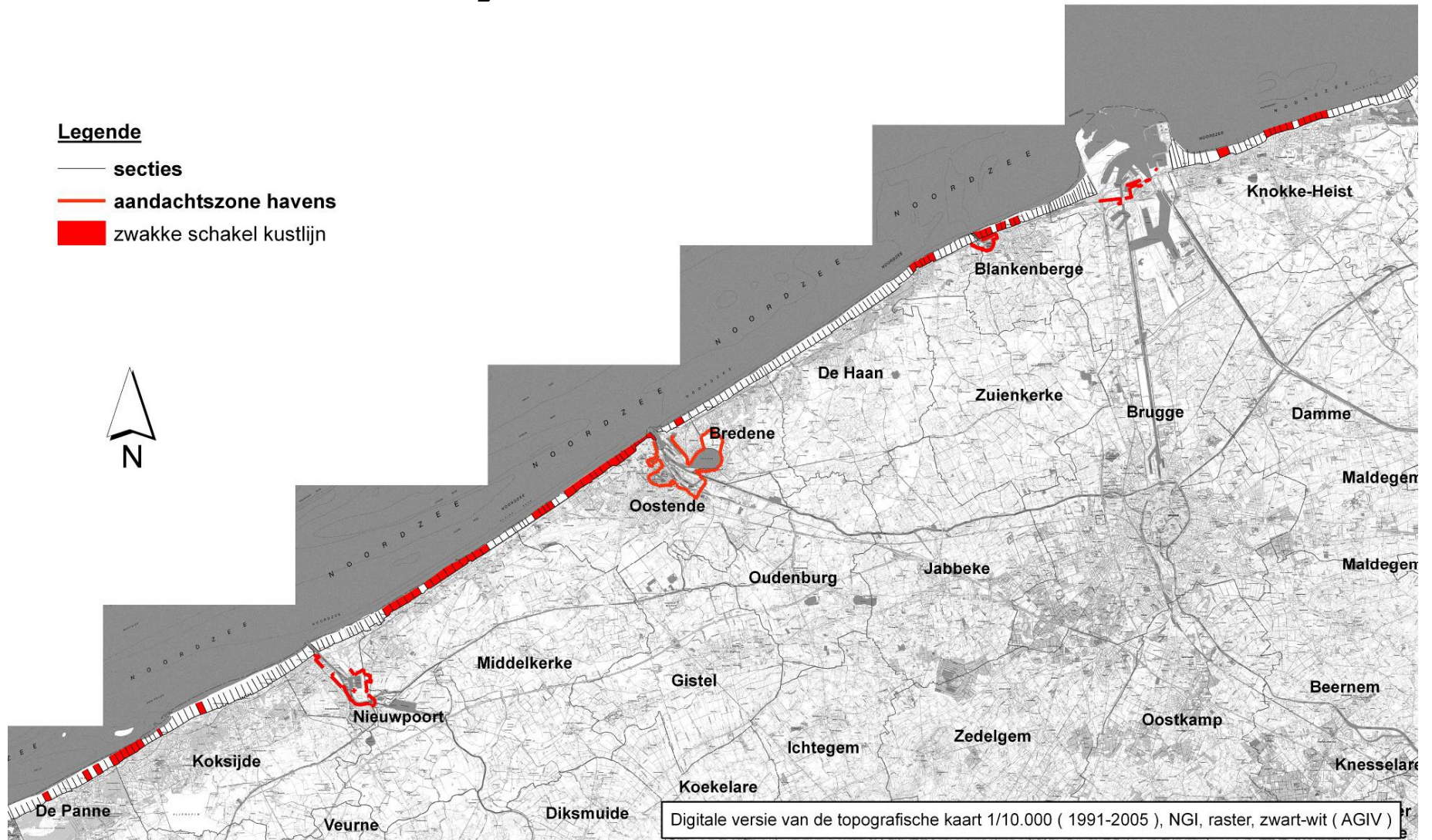
Limited overtopping across the safety line: 1l/m/s

No breaching of dunes and dikes

No dune erosion that damages residential properties

Scientific research & study

- Outcome First Safety Check



Scientific research & study



- Tweede veiligheidstoetsing (2016-2017) van de 255 kustsecties
- Voortraject :
 - ✓ Update toetsingsmethodologie
 - ✓ Update hydraulische randvoorwaarden
 - ✓ Verzamelen data

Scientific research & study



- Voortraject toetsing - Methodologieboek
 - ✓ Beschrijving van modellen (Xbeach, SWASH), aannames,...
 - ✓ Gebaseerd op uitgevoerd onderzoek sinds 2007
 - ✓ Uitgebreid validatietraject
 - ✓ Deel van de opdrachtdocumenten voor de toetsingsopdracht
 - ✓ Leidraad voor ontwerp nieuwe zeewering



Scientific research & study



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- Voortraject toetsing –
Hydraulisch
Randvoorwaardenboek
 - ✓ Golfhoogte en waterpeil per
kustsectie voor een 1000-
jarige storm
 - ✓ 1000-jarige storm statistisch
bepaald: 14 jaar bijkomende
golf-, getij- en winddata
verwerkt
 - ✓ Document voor toekomstig
ontwerp van zeewering

1000-jarige storm in Oostende:

- waterstand 6,88 m TAW
- golfhoogte op -5 m TAW: ca. 5 m



Intensive monitoring strategies



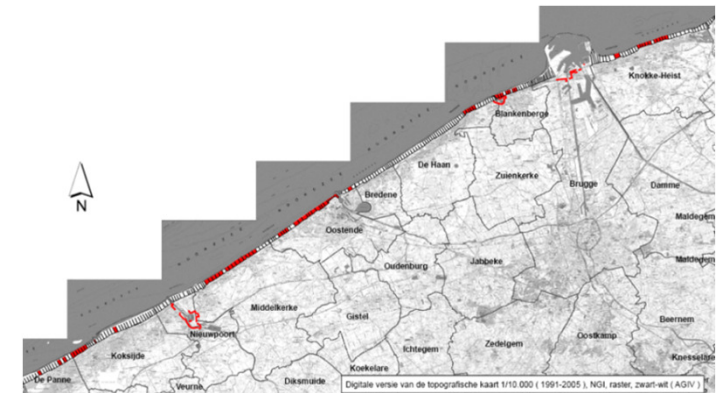
- Topography (LiDAR) & Bathymetry
- Hydrodynamic monitoring
- Ecological monitoring



eg. pilot foreshore nourishment Mariakerke

- Argus system: camera morphological changes
- Intensified bathy, DTM, current and wave monitoring
- Ecological monitoring (model input profile / grain size; output cf. species)

Results (preliminary)



Nourishment program



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Nourishment program



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Nourishment program

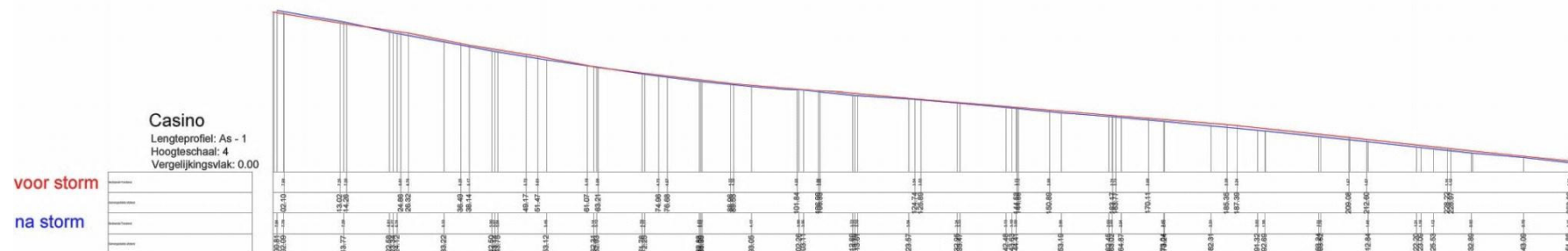


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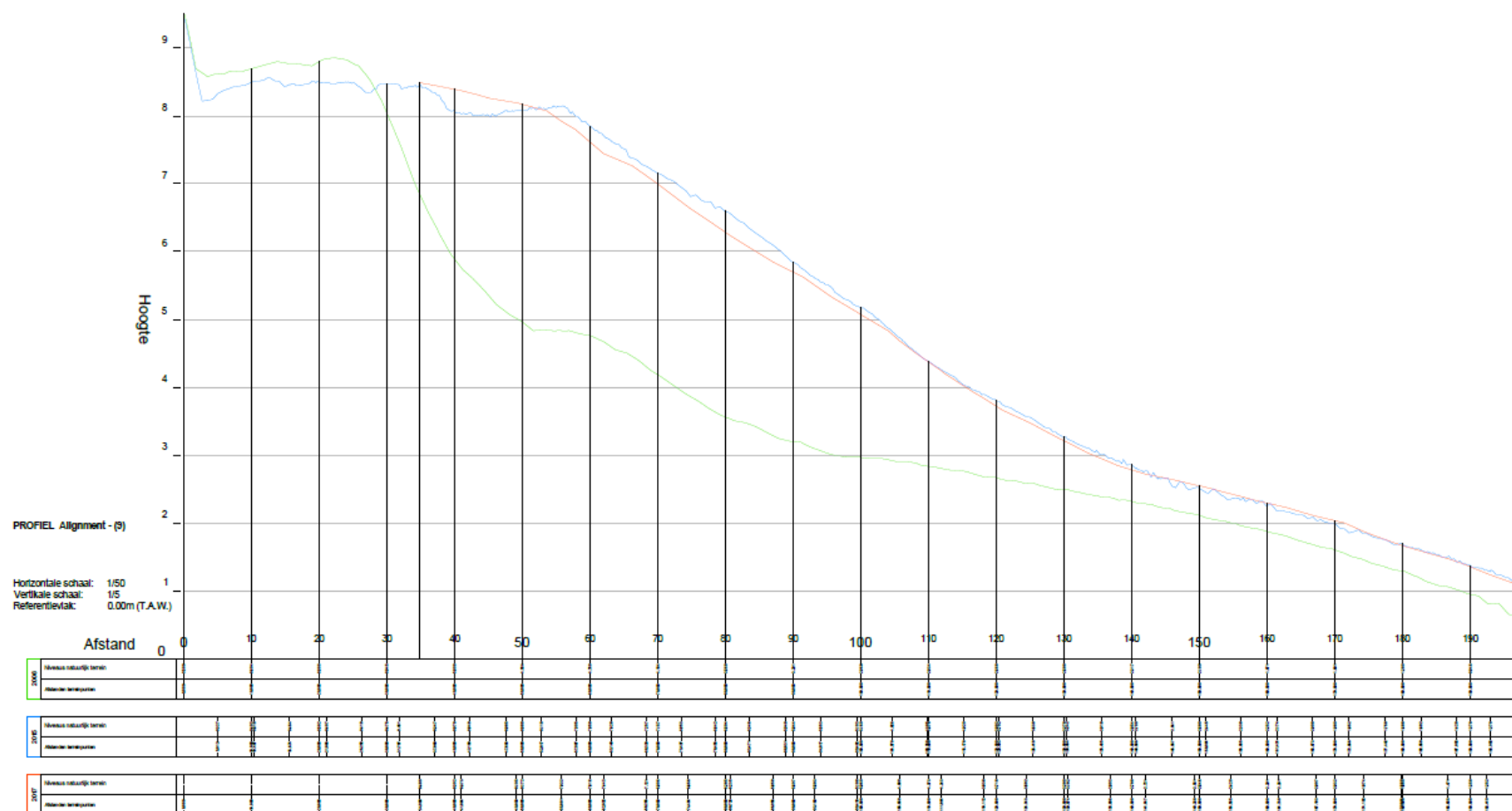
Nourishment program

- Involved communities : De Panne – Koksijde – Westende – Middelkerke – Raversijde – Mariakerke – Oostende – De Haan – Blankenberge – Knokke-Heist
- Up to now: 8,5 million m³ of wich over 4 million m³ sept. 2013 – sept. 2014 and 1,5 million m³ march-apr 2017
- Foreshore nourishments : decrease maintenance



Nourishment program

- Knokke 2006-2017



Storm surge barrier



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- Positioning: Nieuwpoort



Storm surge barrier



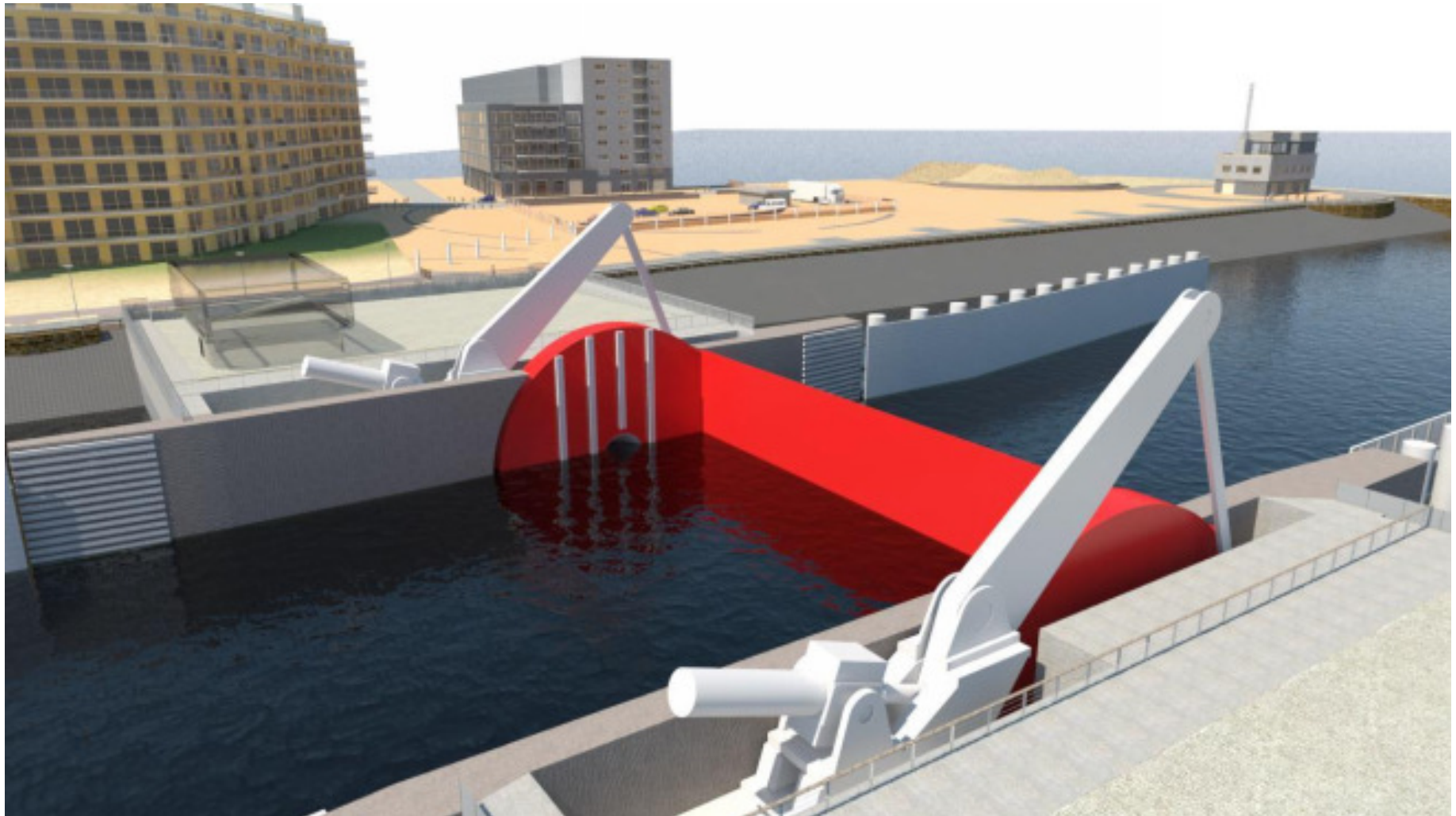
- Preconditions
 - Achieve a movable barrier
 - Passage width 38 m
 - Unlimited vertical clearance
 - Protection against a 1.000-year storm (in 2100)
 - Water level: + 7,64mTAW - Wave height Hs: 2,20m
 - Offer resistance to a + 8m storm (in 2100)
 - Water level: + 8,64m TAW - Wave height Hs: 2,50m

Storm surge barrier



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- Draft showing:



Storm surge barrier



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Stilling wave basin



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Seadike reflecting wave concept



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- New sea wall Wenduine

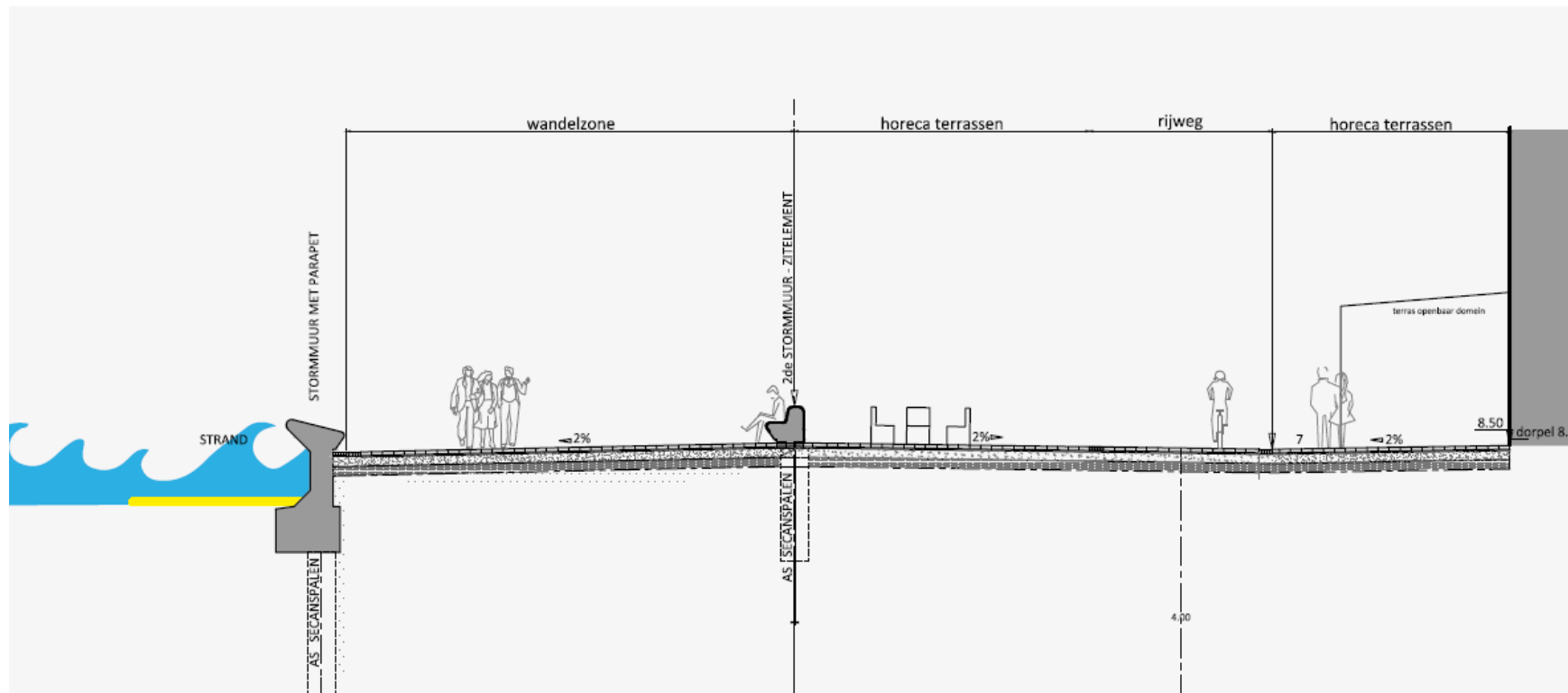


Seadike reflecting wave concept



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- Principle



Seadike reflecting wave concept



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- Design:
 - Design storm: 1000 year annual recurrence interval storm: target value of discharge $q = 1 \text{ l/s/m}$
 - During +8,0 m Superstorm: no breaching tolerable ($q < 100 \text{ l/s/m}$)
 - Failure probability design of 1 %
- Physical scale models: optimal geometry of wave return walls and measure forces on wave return walls



Seadike reflecting wave concept



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- Realisation – seaside wave return wall with parapet



Seadike reflecting wave concept



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- New sea wall Wenduine - detail

