Oosterschelde
Morphodynamics out of balance

A side effect of the civil engineering masterpiece "Deltaproject"

Eric van Zanten,
Ministry of transport, public works and watermanagement,
Department Zeeland

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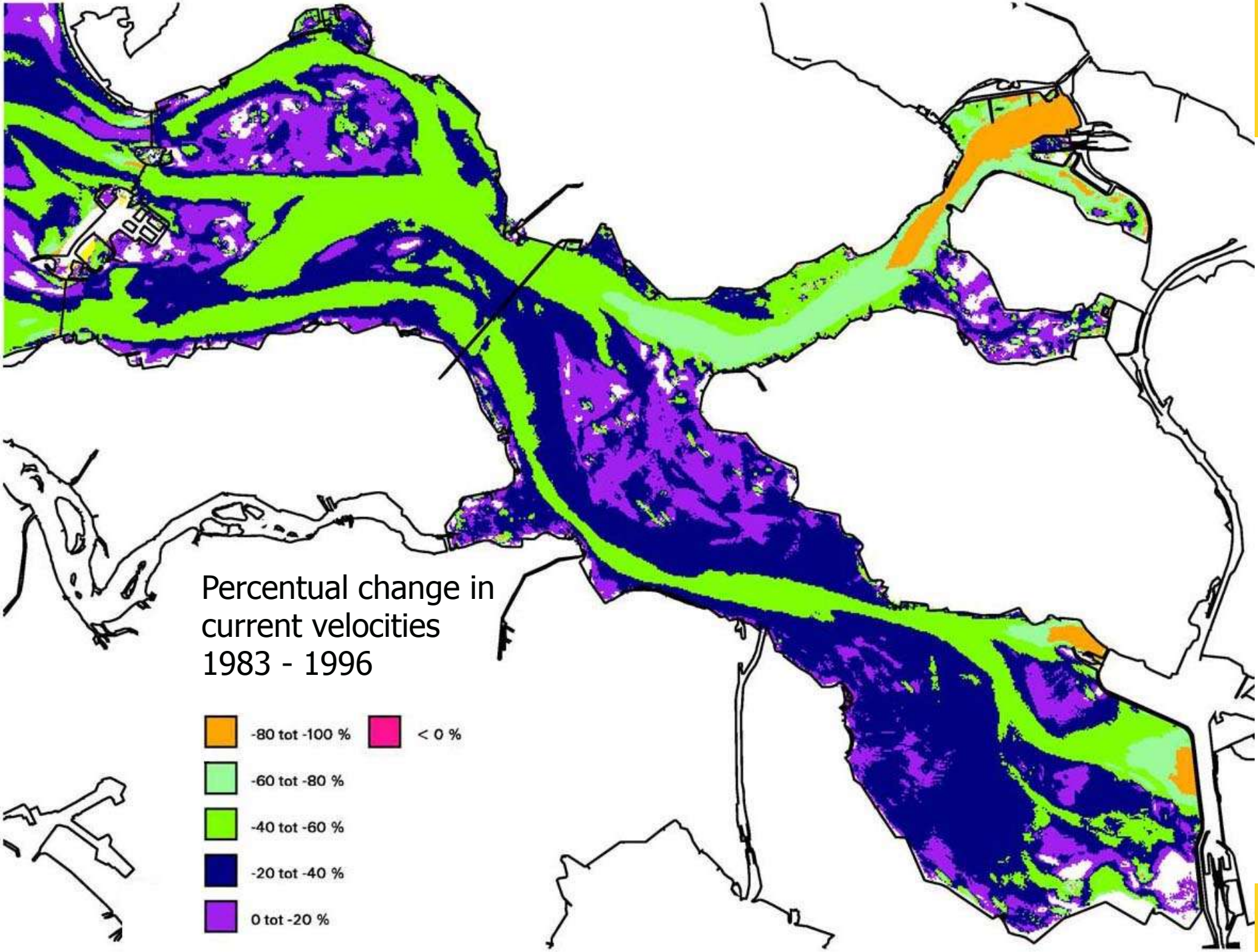
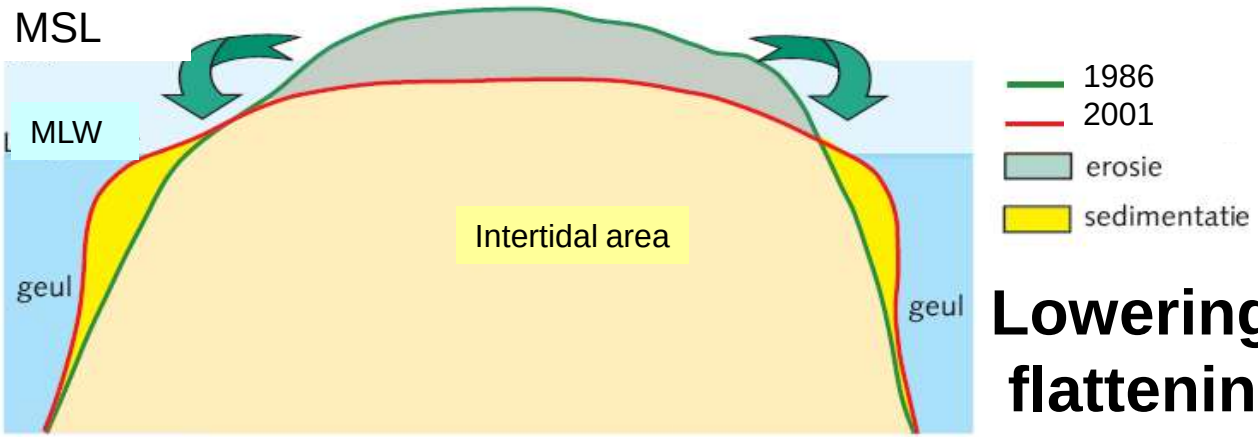
Deltaproject
Constructions Oosterschelde

Major changes

	Pre barrier	Post barrier
Surface (km2)	452	351
Tidal flats (km2)	183	118
Salt marshes (km2)	17	6
Mean tidal range (m)	3,7	3,25
Mean tidal volume (10^6 m3)	1230	880
Max flow velocity (m/s	1,5	1
Sediment influx	Marine and riverine	non


Percentual change in
current velocities
1983 - 1996
-80 tot -100 %
< 0 %
-60 tot -80 %
-40 tot -60 %
-20 tot -40 %
0 tot -20 %

Erosion of Tidal flats



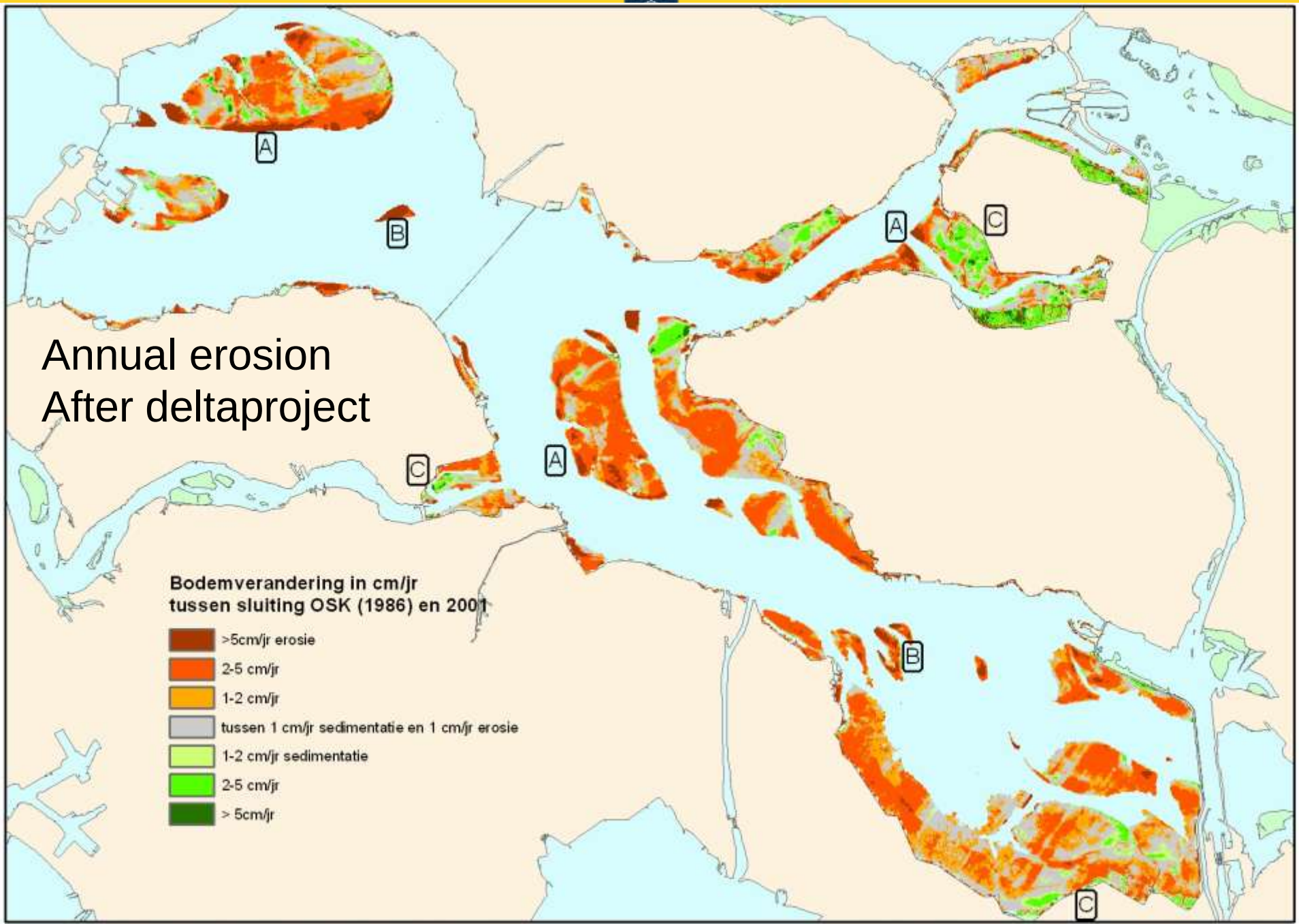
Lowering and flattening

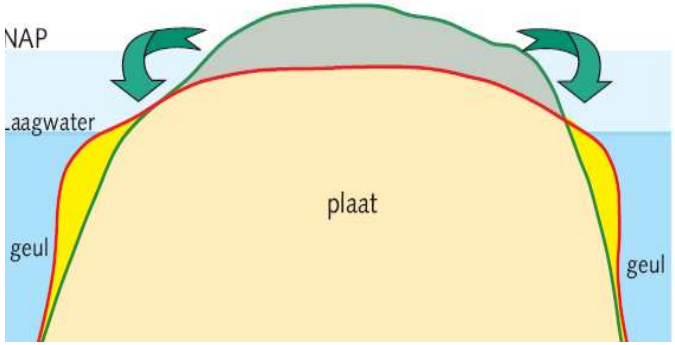
Drowning of 50 ha → 100 ha a year

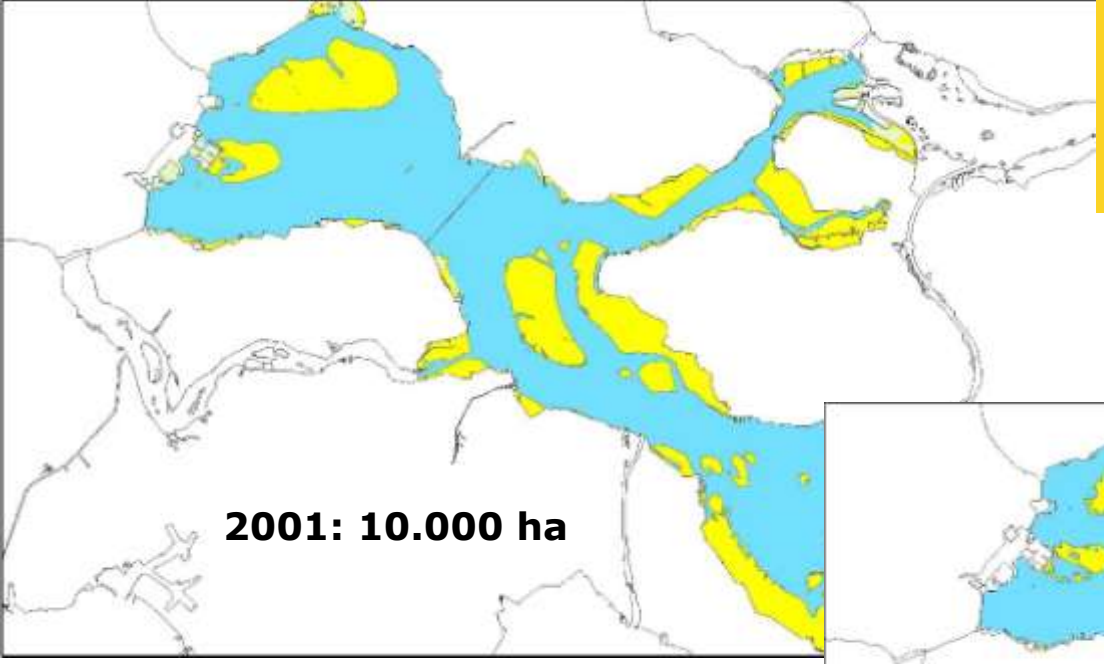
Loss of 1 million m^3 sand a year

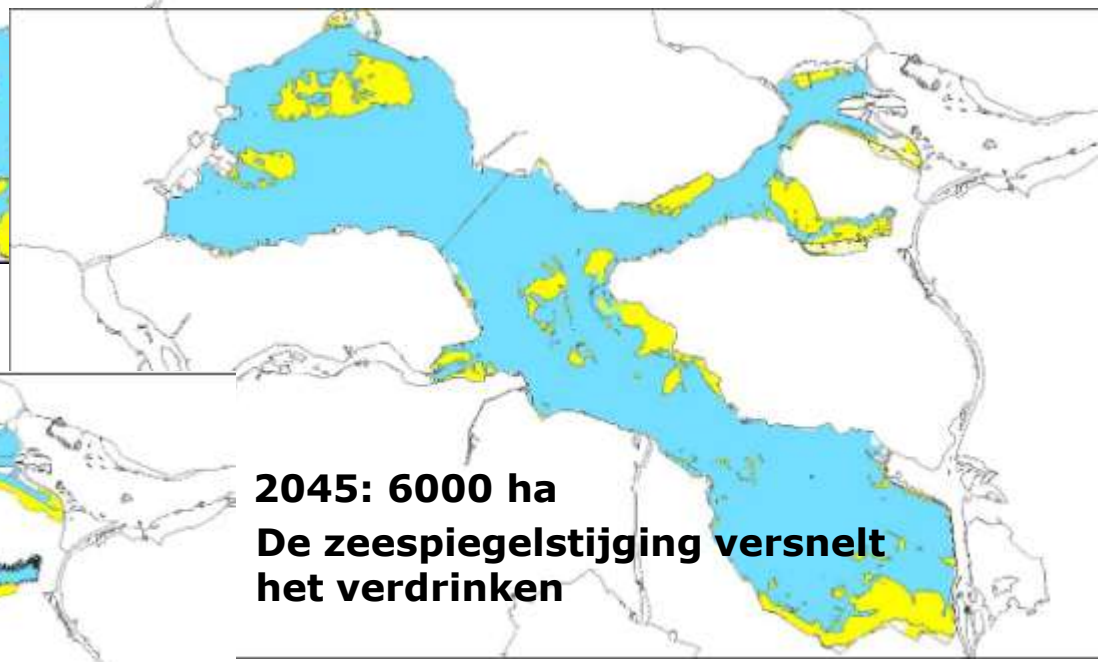
Overall inbalance 400 – 600 milj. m^3 sand.

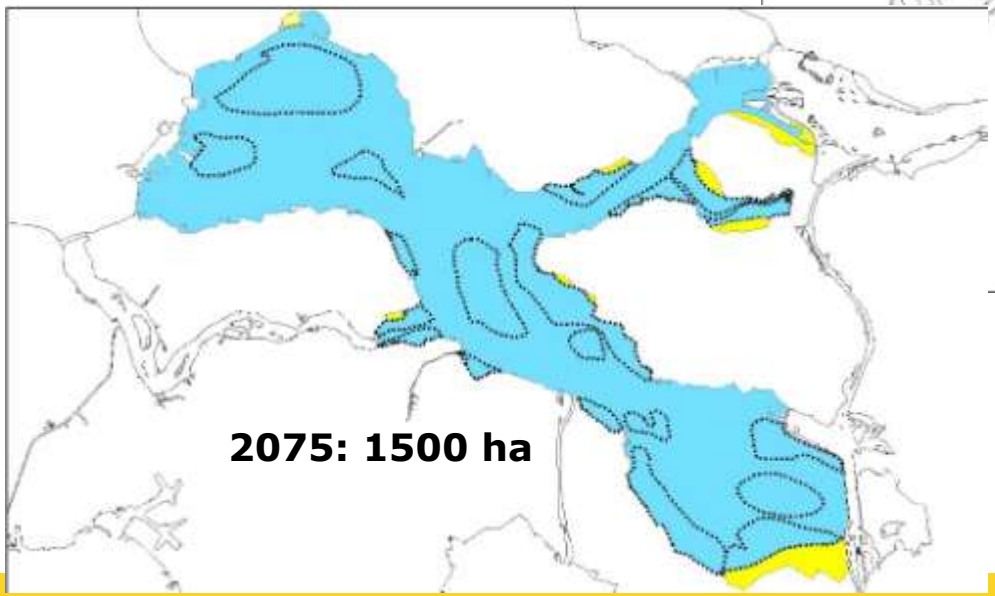
Reservoir intertidal flats only 140 milj. m^3


Annual erosion
After deltaproject
A
B
C
Bodemverandering in cm/jr
tussen sluiting OSK (1986) en 2001
>5cm/jr erosie
2-5 cm/jr
1-2 cm/jr
tussen 1 cm/jr sedimentatie en 1 cm/jr erosie
1-2 cm/jr sedimentatie
2-5 cm/jr
> 5cm/jr


NAP
Laagwater
plaat
geul
geul


2001: 10.000 ha

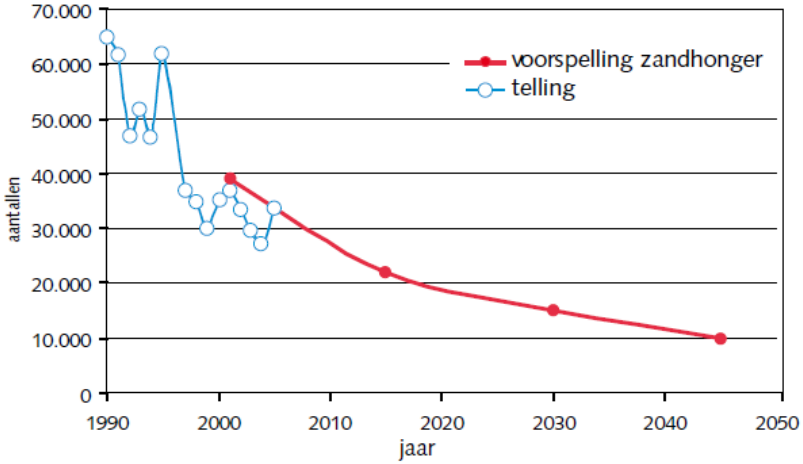

2045: 6000 ha
De zeespiegelstijging versnelt het verdrinken


2075: 1500 ha


Seawalls slowly lose wave absorbing foreland
Extra enforcement necessary in + 30 years
Costs depend on erosion, and climate change

Intertidal nature disappears

- Wadernumbers will drop
- Quality of SPA will decrease

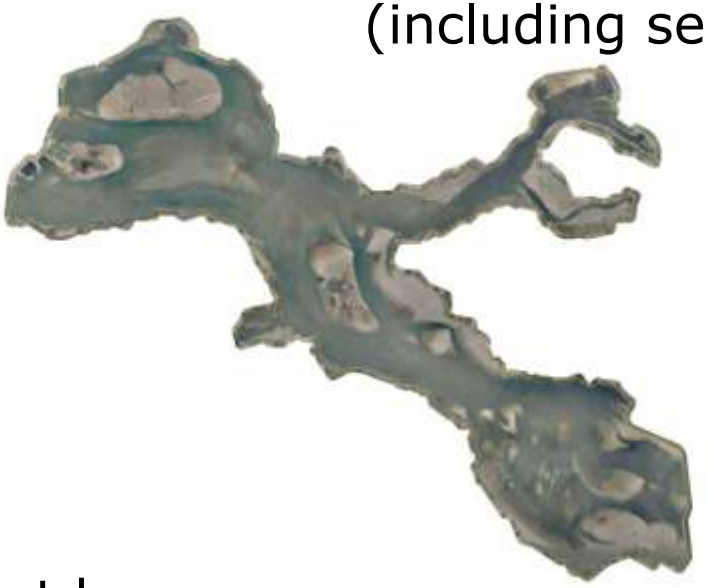


Measures

Restore morphodynamic equilibrium?

Fill up the channels?
needs 400 Mm3?
High investments
Big impact on
Shellfish fisheries
And shipping

Remove dams and barrier?
Equilibrium restored?
High investments
(including seawall enforcement)



Partial equilibrium

Optimize the barrier
Temporary positive effect by an increased tidal difference

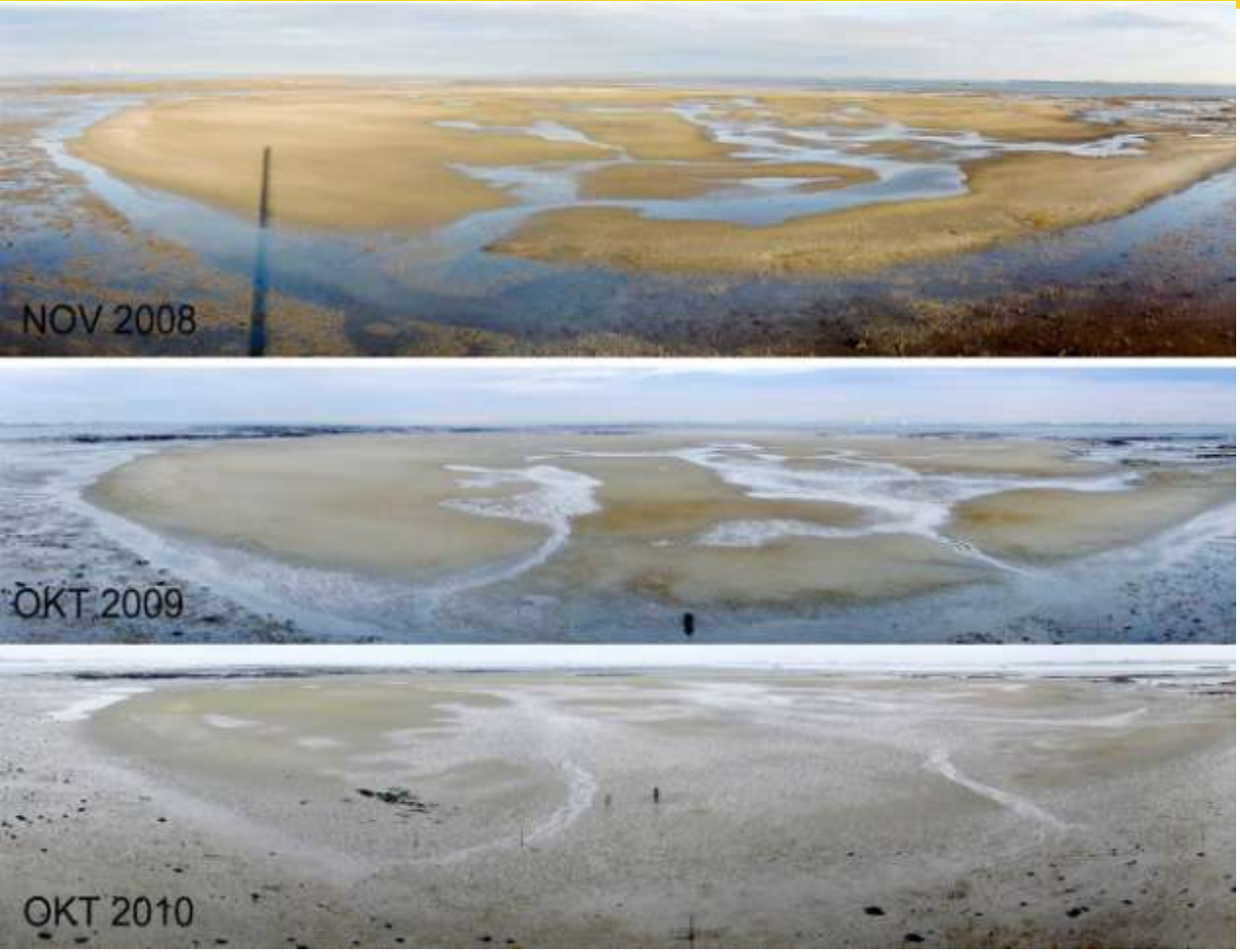
Dropped!

Measures

Prevention of erosion or restoration of loss

Nourishments of intertidal flats
Foreshore protection
Common for coastal defense,
But never tested on tidal flats

Nourishment Galgeplaat (2008)



Promising!

Bathymetry

Erosion of the higher part

Other parts stable

Transport to N to NE

Ecology

Benthic fauna:

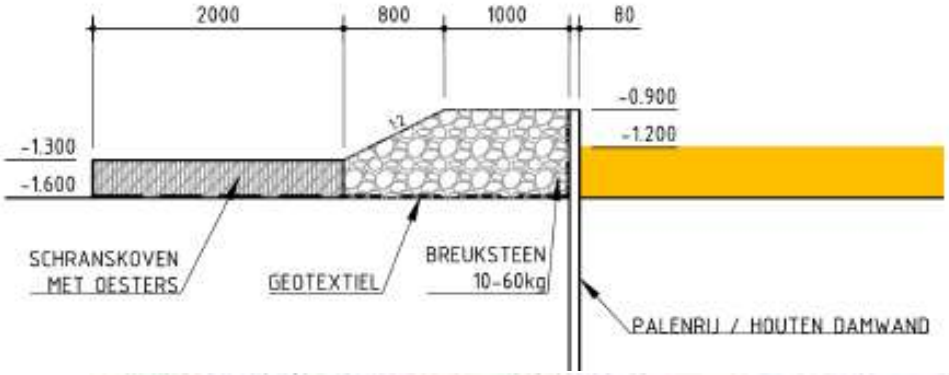
- most species returned
- low biomass

Waders on 50%

of pre nourishment

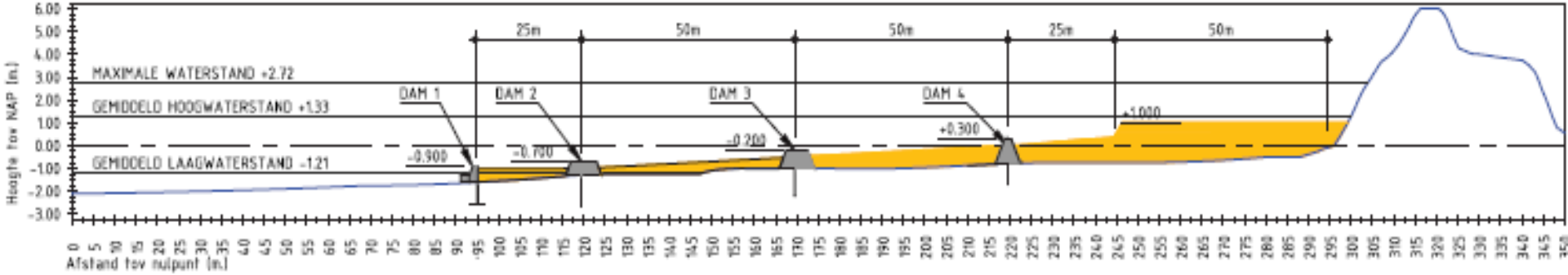
situation

Test Schelphoek



Nourishment with fore shore protection

- Will the protection increase the lifespan of the nourishment
- Execution starting in September



Seawall reinforcement by nourishment at sophiapolder?

Reinforcing Stone revetment or nourishing the dunes?

- **Nourishment is a real option**
  - **(275.000 m3 of sand in two stages)**
- **Nourishment probably 10-20% more expensive**
- **Reinforcement leads to nuisance campiste and harbor**
- **Reinforcement leads to need for compensation for loss of habitat**
- **Nourishment offers flexibility (sealevel rise, adjustment normative storm surge)**

Take home messages

- The deltaproject led to a decreased tidal exchange in the Oosterschelde;
- This led to a slow but widespread erosion of the tidal flats;
- The erosion will lead to extra investments in flood safety;
- The erosion will lead to a drop a quality of the SPA;
- Nourishment is probably the only reasonable measure;
- Different forms of nourishment are momentarily tested by Rijkswaterstaat.