

Beneficial Use (BU) of sediments from an EU perspective

From waste to resource

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Short bio Dr. Arjan Wijdeveld



- Geochemist
- Employed at Deltares, an independent knowledge institute in NL (<https://www.deltares.nl/en>)
- Chair of the SedNet (the European Sediment network) workgroup on Sediments in Circular Economy (<https://sednet.org>)
- Member of CEDA (the EU part of WODA) Environment Commission (<https://dredging.org>)
- Chair of CEN/TC 444/WG 1 (European ISO standardization of Environmental characterization of solid matrices) (<https://www.cencenelec.eu>)

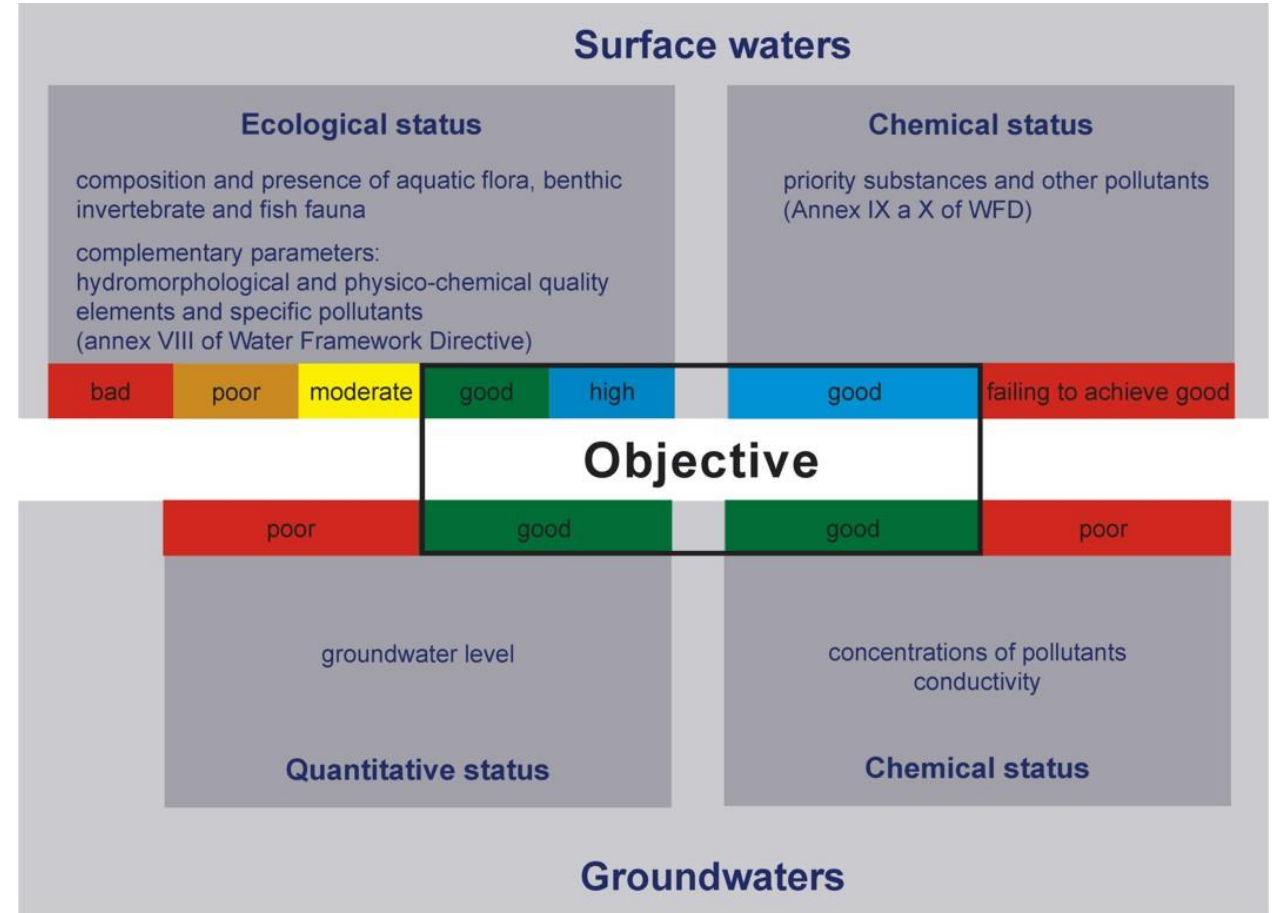


Short background on the relevant EU legislation frameworks

The **Water Framework Directive**:

- Key is the **ecological status**, based on biological quality elements
 - Supported by complementary parameters
- But also legally binding is the **chemical status**
 - Now 45 priority substances, ranging from metals, persistent organic pollutants to pesticides
 - One out, all out

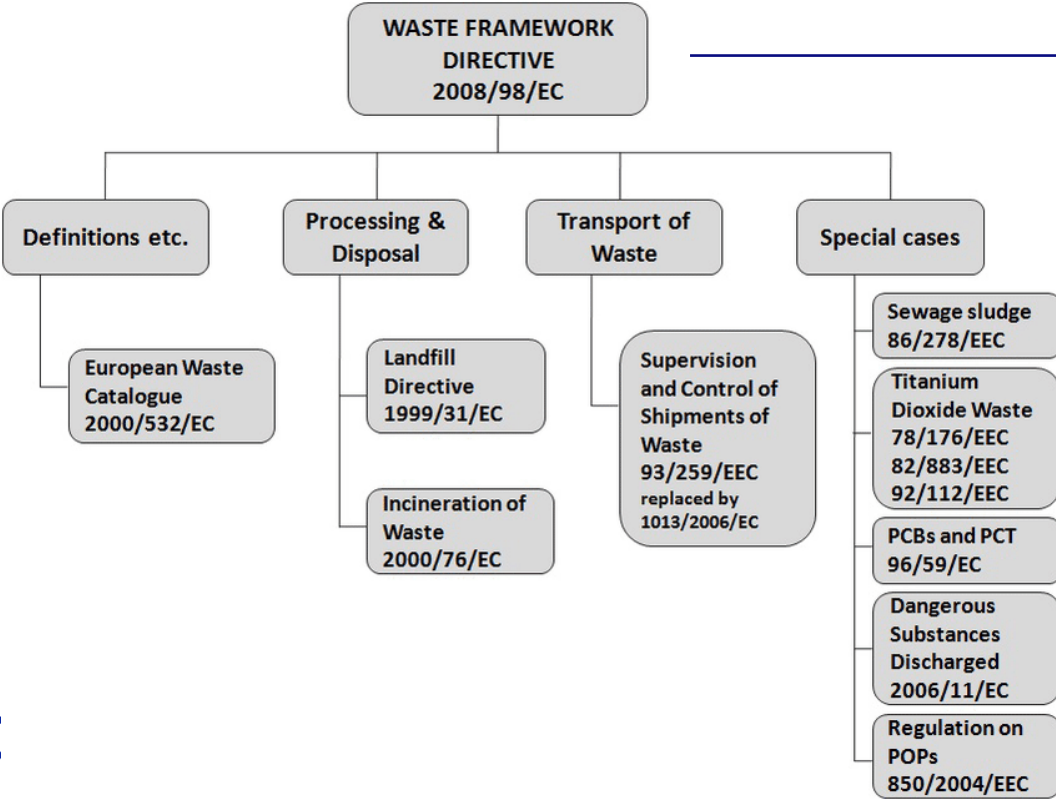
The chemical status is only defined for **water**,
not for sediments.



Short background on the relevant EU legislation frameworks

The **Waste Framework Directive**: **Sediments**, when dredged, are a **waste**.

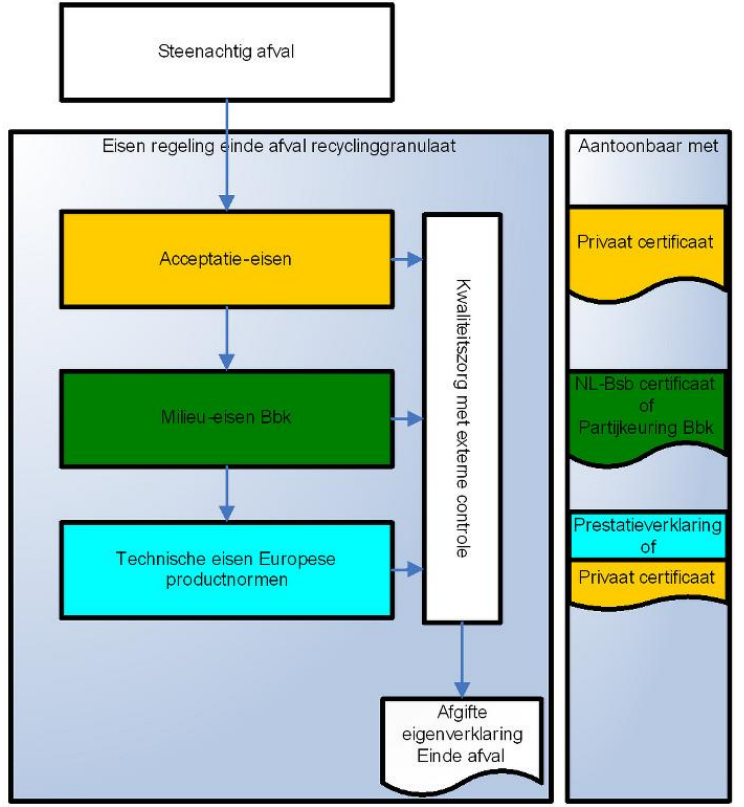
From **sediment** as a **waste** to ... **End of waste**



waste

classifications

End of waste



Short background on the relevant EU legislation frameworks

While the Waste Framework Directive is EU wide, the 'End of waste' definition of sediment is country specific.

An examples for the possibility for BU for 5 sediments in 4 EU countries:

Take home message:

- BU for 2-3 out of 5 sediments is possible in France and Ireland
- BU for 5 out of 5 sediments is possible in Flanders and the Netherlands

Even with EU wide frameworks, BU of sediments is country specific.

metals	Irish Upper level b					Flemish Secondary resource					French Level 2 (N2)					Dutch Bbk (class B)				
	Example 1	Example 2	Example 3	Example 4	Example 5	Example 1	Example 2	Example 3	Example 4	Example 5	Example 1	Example 2	Example 3	Example 4	Example 5	Example 1	Example 2	Example 3	Example 4	Example 5
Antimony																				
Arsenic	25%	17%	18%	63%	42%	7%	5%	5%	18%	12%	35%	24%	25%	88%	59%	19%	10%	19%	43%	27%
Barium																				
Cadmium	89%	14%	27%	151%	90%	21%	6%	11%	64%	38%	86%	24%	47%	265%	157%	17%	3%	16%	46%	24%
Chromium	81%	17%	25%	134%	96%	8%	2%	2%	13%	9%	54%	11%	17%	89%	64%	16%	3%	4%	27%	18%
Cobalt																				
Copper	48%	36%	57%	69%	48%	14%	10%	17%	20%	14%	58%	43%	69%	85%	59%	25%	13%	44%	32%	20%
Lead	74%	35%	49%	57%	40%	13%	6%	9%	10%	7%	81%	38%	54%	62%	44%	26%	10%	23%	18%	12%
Molybdenum																				
Nickel	35%	46%	48%	57%	42%	8%	11%	12%	14%	10%	28%	37%	39%	46%	34%	1%	1%	1%	1%	0%
Selenium																				
Tin																				
Vanadium																				
Zinc	194%	39%	52%	139%	92%	64%	13%	17%	46%	30%	144%	29%	39%	104%	69%	28%	4%	9%	19%	11%
overall	194%	46%	57%	151%	96%	64%	13%	17%	46%	38%	144%	43%	69%	265%	157%	28%	17%	44%	46%	27%

What do we mean with BU of sediments in the EU?

First, what do we do with **sediments as a waste**?

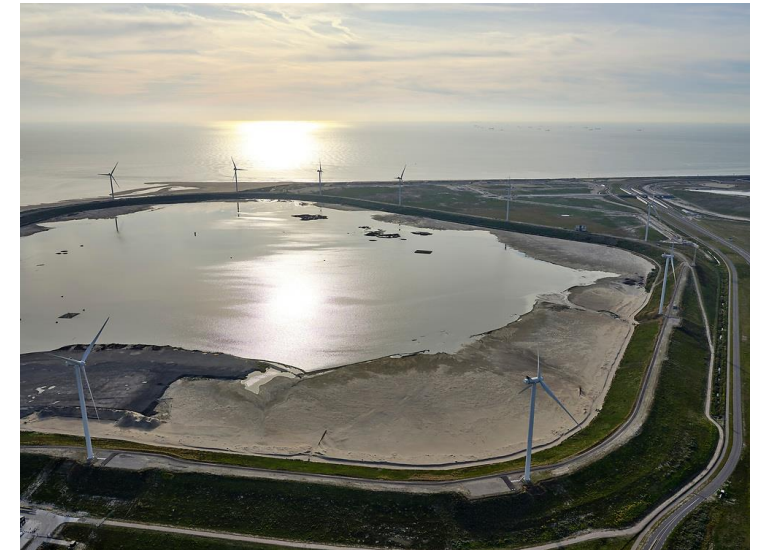
- If 'clean', dumping at sea (close to the cost) is +/- 4 euro/m³,
- The most cost-effective solution (+/- 15 euro/m³) for **contaminated sediments** is an under water confined disposal facility (CDF).
- If under water disposal is not feasible, dewatering and land filling of the filter cake is relative cheap (+/- 40 euro/m³, excluding landfilling).

Other solutions (a mix of immobilization and remediation) like:

- Chemical Immobilisation
- Bioremediation
- Phytoremediation
- Thermal Desorption
- Sediment washing and sand separation
- Ex-situ High Temperature Processing

... are **mostly applied on a smaller scale**, mainly due to:

- cost (>60 euro/m³),
- long timescales of solution (**years**), and/or
- lack of market for the products (**BAU**).



What do we mean with BU of sediments in the EU?

BU within OSPAR and HELCOM

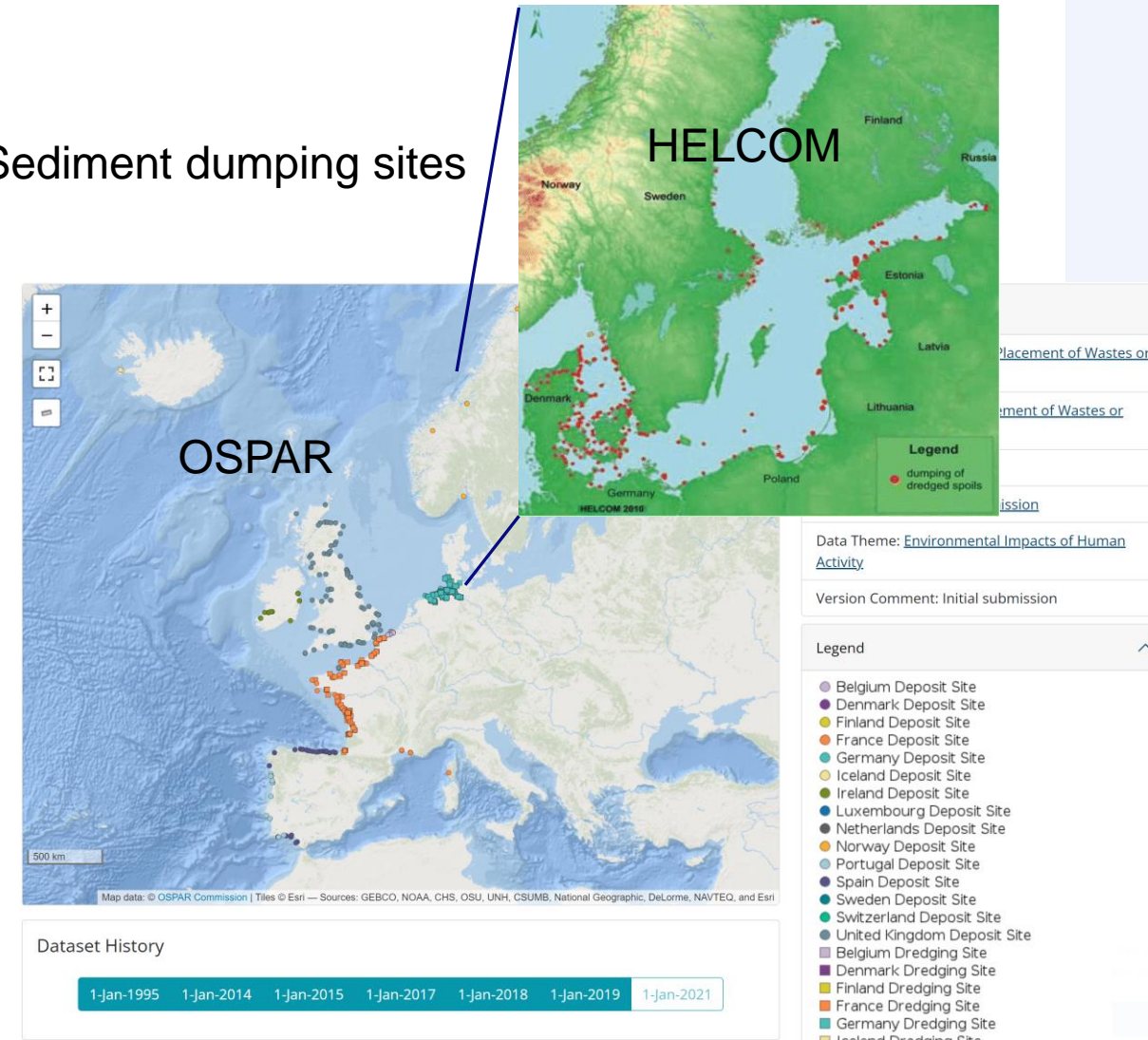
In the European part of the Atlantic (OSPAR) **110 mln. to 150 mln. tonnes of marine sediments** are dredged and dumped on a yearly basis. The amount of sediment classified as **beneficially used** in this period varied between **5 mln. and 50 mln. tonnes**.

For HELCOM The reported dredged and dumped volume for the Baltic Sea varied between **7 mln. tonnes and 23 mln. tonnes**, with a **beneficial use of 6.6 mln. - 8.6 mln. tonnes**.

<5% to 100% of the sediment is Beneficially Used on a yearly base.

The variation is partly due to lack of coordination between dredging and BU projects.

Sediment dumping sites



What is holding back BU of sediments in the EU?

What is holding back BU of sediments?

Most often **not the contamination levels**

- In NL 95% of the sediments meet the 'end of waste' criteria

What is most often mentioned are the **direct cost**.

- Primary resources (gravel, sand, clay) are cheap
- Dumping of sediments (at sea) is cheap
- Separation of sediments (especially for sand and clay) is expensive

Other **barriers**.

- Even when meeting end of waste criteria, sediments are seen as a waste (NIMBY)
- The Business as Usual (BAU) chain is well developed
- Liability, the use of sediments for coastal defense requires adaptation of design and safety standards

What is often forgotten

Non direct cost or **indirect benefits**

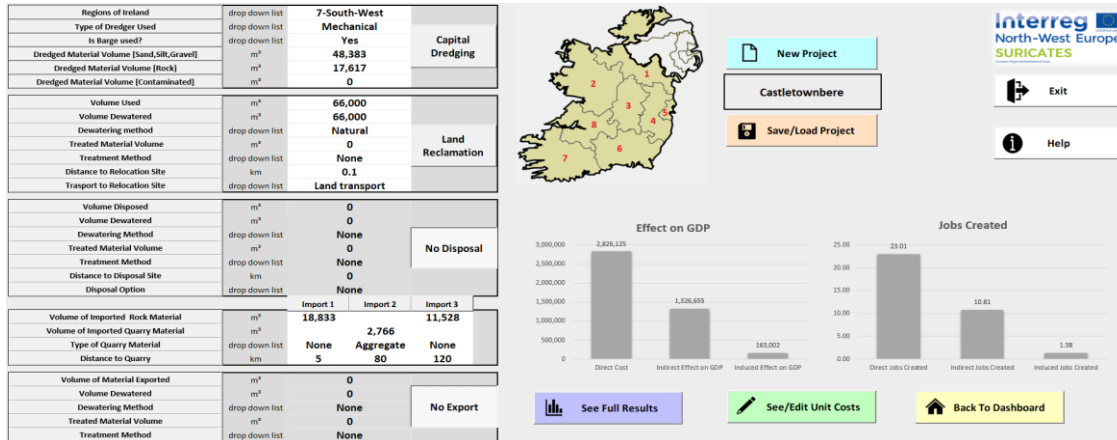
- Impact on GDP and job creation
- Not paid cost for BAU (like multiple dredging cycles)

Other **enablers**

- The LCA of all activities related to dredging and dumping versus BU
- The need for nature compensation and habitat restoration
- ... climate change

What is holding back BU of sediments in the EU?

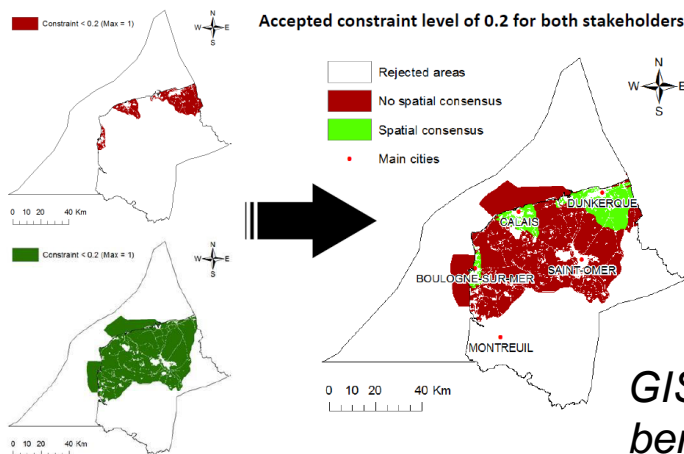
Redefine value for BU – considering social economical impacts



Scoring Business As Usual (BAU) and Beneficial Reuse Option (BRO)

	BAU	BRO
Total scores (%)	37	41
Validity check	Valid default weightings BAU score	Your valid BRO score
Component scores		
ENERGY %	-4	5
WASTE %	52	49
ENVIRONMENT %	32	50
SOCIETAL %	68	60
ENERGY	[Progress bar]	
WASTE	[Progress bar]	
Environment	[Progress bar]	
SOCIETAL	[Progress bar]	

Economic modeling of secondary benefits on GDP



GIS with stakeholder's views on the benefits and drawbacks of sediment use.

What is holding back BU of sediments in the EU?

The use of an environmental footprint indicator (CircSed) to define value for BU



Bij hydraulisch transport wordt het af te voeren overschot aan water. Vervolgens wordt de afvoer bestemming (meestal een opslaginrichting) toegepast en nog niet voor transport van de afvoer optie kunnen zijn. Hydraulisch transport wordt toegepast wanneer er al sprake is van een slurry verontreinigde gr...

Kosten en baten	
Transportkosten	0.50
Emissies	
CO2-equivalent transport	0.64



De snijkopzuiger is een continue gravend baggerwerktuig en is verankerd door middel van een spud (werkpaal) en zijdraden. De snijkop bevindt zich ter plaatse van de mond van de zuigleiding. Met de snijkop wordt de grond losgesneden en als een grond-watmengsel met één of meerdere in het schip opgestelde pompen opgezogen en via een drijvende leiding en walleiding naar het stort geperst. In het geval van grote baggerdiepten wordt de snijkopzuiger wel voorzien van een onderwaterpomp. Het principe van de snijkopzuiger (wijze van voortbewegen, ladderophanging van zuigbuis, graafkop bevestigd aan zuigmond) wordt gebruikt voor verschillende typen snijkoppen die ten behoeve van milieuvriendelijk baggeren door Nederlandse aannemers en de industrie zijn ontwikkeld.

Kosten en baten	
Kosten uitvoering	3 euro / m ³
Emissies	
CO2-equivalent uitvoering	3.00 kg CO2-eq / m ³
Volumes	
Volumevermindering	0.00 %

Eigenschappen:
 Grijs: Milleusch
 Motor: Dieselmotor

tool with inputs

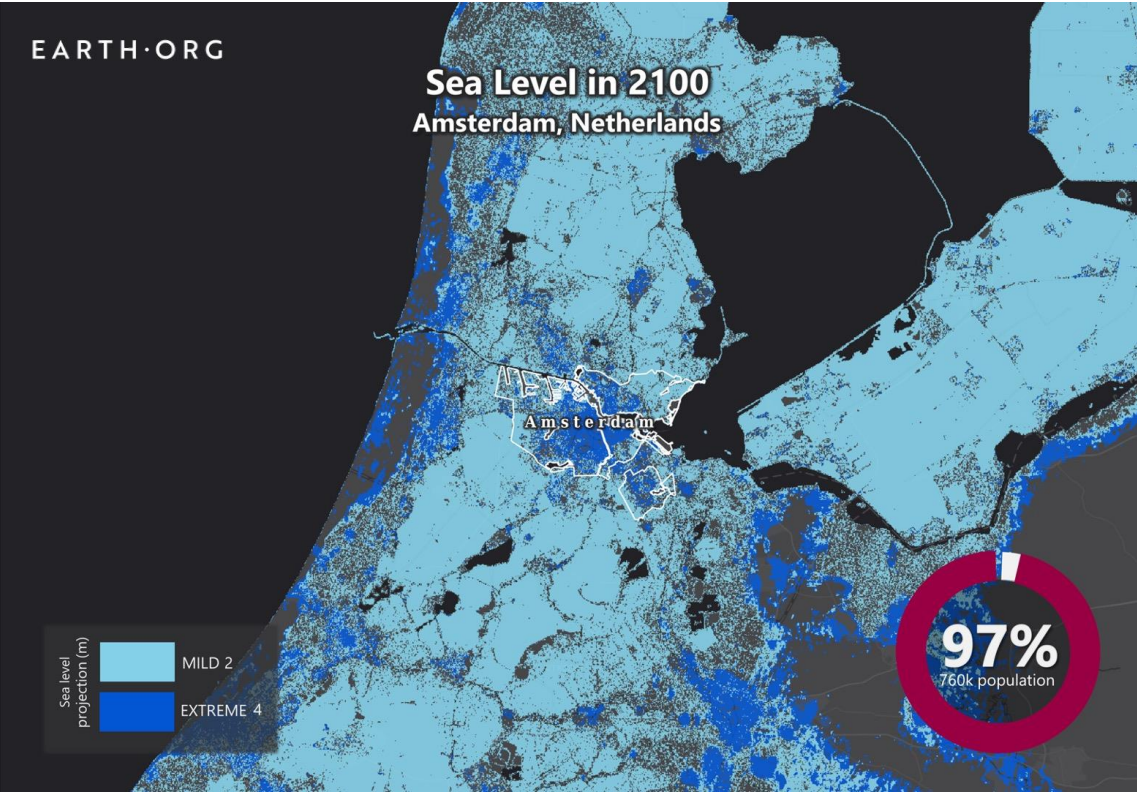
→ fact sheets

→ preferred BU sediment options

Impact of climate change on the Netherlands

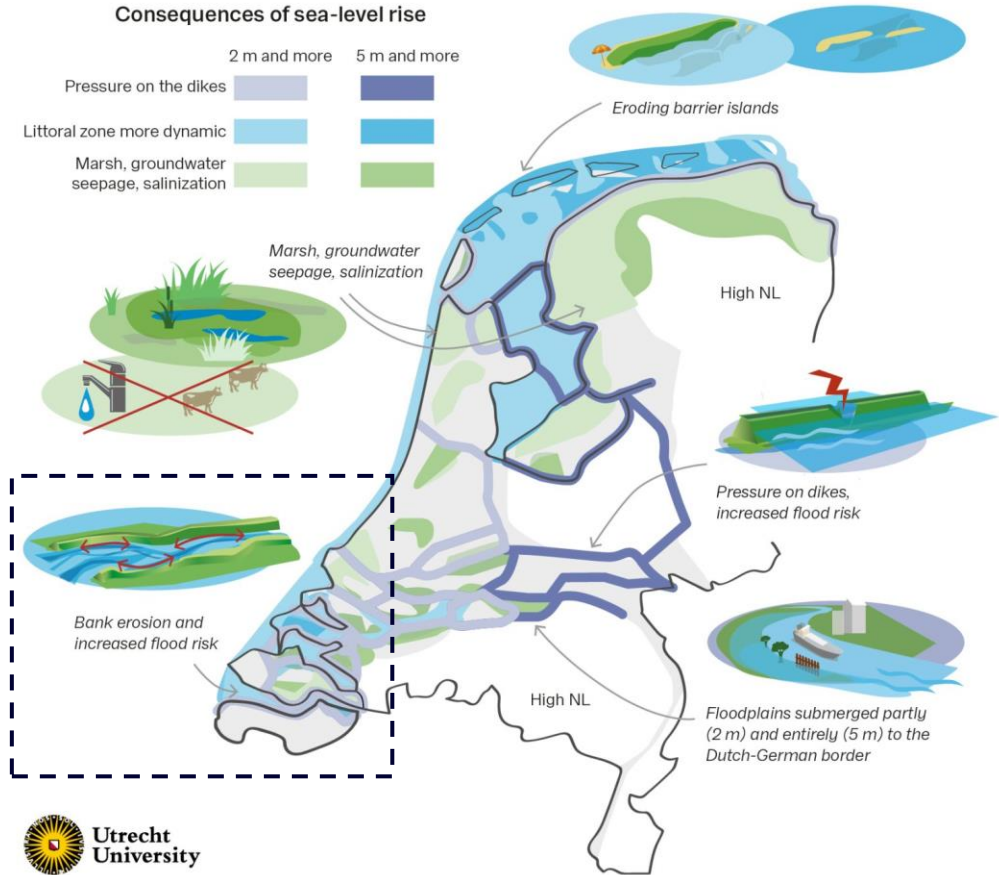
Sea level rise projections by 2100 for two scenarios with the amount of rise in meters indicated (mild = 2m; extreme = 4m).

Population displacement indicated at the bottom right.



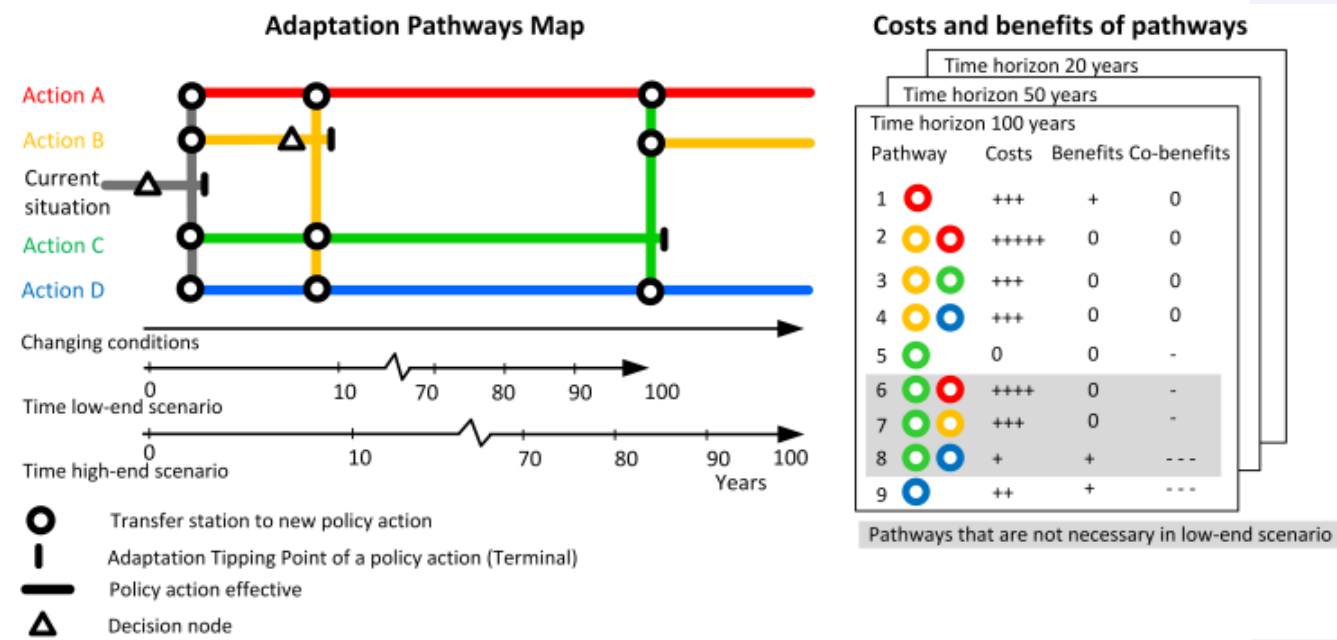
Deltares

Impacts sea level rise (2 and 5 m) on land use



Impact of climate change on sediment management

Use of adaptative pathways, explore tipping points were BAU is no longer feasible.



Current Situation

Problem: Lack of sand



Action B (current adaptation)

Short term solution: Sand suppletion



Action C (transfer to a new policy)

Tipping point: sea level rise
Adaptation: 'Grow along' dikes

MIRT Verkenning
Zandhonger Oosterschelde

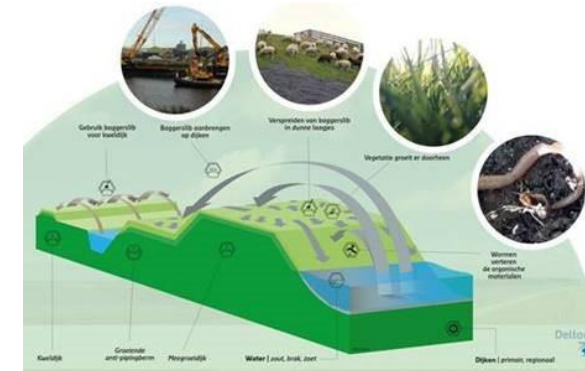
milieueffectrapportage

hoofdrapport



Voorstudie - Suppletie Middengebied
Oosterschelde

Plan van Aanpak, versie 3



Wrap up

In conclusion, for the future (+/- 2100)

BU of sediments is no longer a choice, it is compulsory.

