SedNet Working Group template

SedNet White paper on Circular Economy and Beneficial Use of Sediments

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Contents

The White paper project, its content and target public

Why a SedNet white paper on Circular Economy?

A “guide that informs concisely about a complex issue and presents the issuing body's philosophy on the matter. It is meant to help readers understand an issue, solve a problem, or make a decision” (Wikipedia).

Similar documents are already issued by sediment management operators (ports, waterways) and industries (CEDA, PIANC). They often include reducing the waste generation by their activities and demonstrate that they can be developed in a sustainable and circular framework, saving mineral resources and promoting future beneficial use projects.

SedNet supports fully this objective but promotes also the integration of sediments in its own perspective: incorporating sediment issues, challenges and knowledge into European strategies to support the achievement of a good environmental status and developing new tools for sediment management, at the river basin scale, including adaptation to climate change. SedNet focuses more specifically on 1) Embedding these topics in (EU) policy, 2) promoting academic and applied research supporting these topics and 3) Looking at sediment in a broader basin-system frame.

Contents of a SedNet white paper on Circular Economy

Based on the first WGCE activities, there is still a need for a one shop stop source on circular options. We must build on existing initiatives and complement them with our own approach.

Several topics are not yet dealt with in depth. They give the opportunity for specific spotlight chapters (defining ‘value’ to ecological potential of sediment, CO_2 and CH_4 accounting of sediment use, salinity and beneficial use, emerging contaminants monitoring – the list is open).

Target of a SedNet white paper on Circular Economy

Offering a non-technical summary and precise reference for policy making, economic planning and public information. Promote the paper at EU, government, regional and local level. Offering a reference framework to researchers considering Circular Economy applications. Involve the industry, NGOs, schools (including middle and high school education) and citizens.

Break the barriers between traditional fields (operations, land planning, public budgets) to demonstrate the potential benefits of circular economy strategies, beyond their apparent cost.

Definitions of concepts

One of the main questions often discussed is whether dredged sediment legally is considered waste. The European Waste Framework Directive (WFD) 2008/98/EC offers the following:

Art. 2 Exclusions from scope

Sediments relocated inside surface waters for the purpose of managing waters and waterways or of preventing floods or mitigating the effects of floods and droughts or land reclamation shall be excluded from the scope of this Directive if it is proved that the sediments are non-hazardous.

Conclusion: Sediments that come out of the water fall under the WFD

Art. 2 Definitions

***Waste**: any substance or object which the holder discards or intends or is required to discard.*

Conclusion: Sediments that are dredged and come out of the water are waste unless they are dredged for direct use, without any processing (dehydration, grain size sorting or any other).

Art. 2 Definitions

***Re-use**: any operation by which products or components that are not waste are used again for the same purpose for which they were conceived;*

***Treatment**: recovery or disposal operations, including preparation prior to recovery or disposal;*

***Recovery**: any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy;*

***Recycling**: any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations;*

Conclusion: Dredged sediments that come out of the water can be recovered or recycled

Art. 4 Waste hierarchy

The following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy:

(a) prevention;

(b) preparing for re-use;

(c) recycling;

(d) other recovery, e.g. energy recovery; and

(e) disposal.

Synthesis

1 Is dredged material a waste or not?

- Relocation is not waste, hazardous material is waste[1].
- If there is no destination for use on land, it is waste; if there is direct use in a project, it is not waste, though this interpretation of the Directive is not accepted in some Member states.
- Dewatering is possible as process for making it fit for direct use. However, further management of extracted water has to comply water policies, including the WFD.
- Dredged material submitted to further processing, such as stabilisation, has another status, i.e. a product derived from waste, and is submitted to specific regulations.
- WFD allows to implement an end-of-waste procedure which, if successful, leads to an end-of-waste-status. Such procedures are country specific, as there is no EU to end-of-waste status for sediments. With circular economy policies and laws, these approaches should be facilitated. Waste origin should anyhow remain traceable.

2 Waste to resource

- If it is useful and functional, it is a resource. It may replace unrenewable resources (example: manufactured soil production to replace natural topsoil).
- Let's talk about 'use' of sediments
- Beneficial use: Mitigation of anthropogenic manipulations, sparing of natural resources, sustainability of the intended use
- Problem: portfolio of known relevant contaminants and risks is changing (e.g. PFAS)
- Some degree of contaminant dissipation is implicitly accepted
- Even non-hazardous and inert sediments suffer from their waste status
- Valorisation: cost analysis category, economic term

3 Circular Economy

- Re-introducing sediment into the system
- E.g. Bird islands, offshore nourishing of the delta, ecosystem services, flood protection, coastal resiliency, soil creation (restructuring or increasing the thickness) with non-hazardous sediments -> economic value
- Taking dredged material out of the water to keep the floodplains sustainable, either for flood safety reasons or to provide sediment supply to the floodplain
- Offset of using dredged material in place of excavated natural soils for landfill covers or brownfields reclamation. This is where LCA helps
- Sparing resources may be one aspect of circular economy
- CE is connected to the waste property...
- CE aims at avoiding waste.

[1] However, hazardous sediments in water may be submitted to waste rules. In the Waste directive, Article 2-3: "Without prejudice to obligations under other relevant Community legislation, sediments relocated inside surface waters for the purpose of managing waters and waterways or of preventing floods or mitigating the effects of floods and droughts or land reclamation shall be excluded from the scope of this Directive **if it is proved that the sediments are non-hazardous**."

Beyond the initial "mass balance" approach to CE, need for defining 'value' to ecological potential of sediment

Ecological potential of sediments is about clean sediments.

Need of cases studies of uses in different countries.

Need for knowledge about the causes of the differences in legislation in different regions/countries?

Defining 'value' to ecological potential of sediment

A starting point could be the SedNet 2015, Krakow, session ". Mapping and assessment of sediment related ecosystem Services"

Invited key-note: Mapping and assessment of ecosystems and their services (MAES) - Leon Braat, Alterra Wageningen UR, NL

Another recent initiative (2018) is the SedNet Workgroup on Sediment Quantity, focusing on sustainable sediment management, which is to find implementable sediment management solutions: (*only a selection*)

- Carefully balancing social, economic and environmental values;
- Embracing the whole soil-sediment-water system (integrated solutions);
- Respecting natural processes and functions;
- Not resulting in unwanted impacts elsewhere in the river-sea system (up- or downstream), not now, nor in the future;

Building on ecosystem Services and Sustainable sediment management, what can be the contribution of this group?

- Can we provide examples or case studies?
- Do we have tools to define;
    - ecosystem services (Apitz, 2012; Baveye et al., 2016; Maes et al., 2018, van der Meulen and Maring, 2018; European Commission, 2019),
    - Sustainable sediment management for water bodies (and at what scale / under which conditions)?

How can we help with finding a balance between social, economic and environmental values?

Recommendation: Appoint 2 persons to work with the Sediment quality workgroup to work on the topic. Link with the ECOSTAT work in progress (CIS document on sediment management in the context of WFD) / Chapter 3 is dealing with this issue.

Incorporating CO_2 and CH_4 balance of sediment use in CE balance and funding, benefit or risk?

CO_2 and CH_4 are mentioned here as the most often reported GreenHouse Gases (GHG) but other ones may be included.

Sediments as a rule contain a high organic matter content which break down to CO_2 and CH_4. This can have both positive (GHG sink) and negative (breakup and release) effects on GHG balance, according to sediment management considerations.

Changing the conditions, like when dredging, can impact both the release of stored gas and the formation rate of new gas (by enhancing or prohibiting organic matter degradation)

We discussed the impact of dredging on the emission of greenhouse gases and if the decision to dredge and how to dredge should be part of a CO_2 footprint assessment.

There is limited measurement data, but especially in the choice of the dredging technique and the application of sediment a difference can be made.

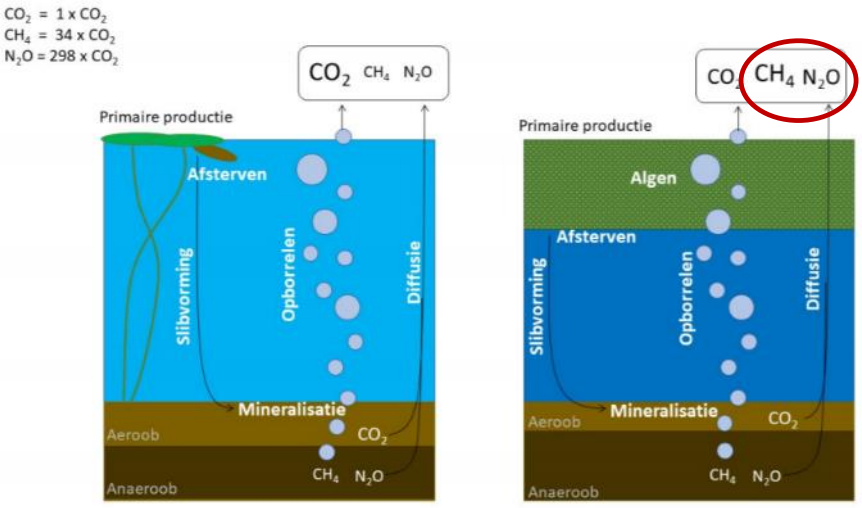
While we do not have a fitting LCA, the idea is worth exploring.

Progress since October 2019:

Publication of Dutch white paper on the topic of greenhouse gas emission from sediment: https://tinyurl.com/v4mlvsl

- A comparison of the potential extra CO_2/ CH_4 release from sediments when dredged with the dredging fuel consumption has been made
    - Dredging contracts include fuel consumption as source for CO_2 emission (and reward low emissions), but do not evaluate the impact of dredging on sediment carbon loss,
    - GHG release rate is climate dependent and dredging impacts may differ between countries.
- Gas emission balance for confined sediment disposal site.
- +/- 5% of the total Dutch greenhouse emission comes from sediment in lakes and waterways.
- A 100 ha lake has an emission of 457 ton CO_2-equivalent per year
- Eutrophication worsens the greenhouse gas emission
- Lack of data to establish clear emission pathways

(The paper does not address the impact of dredging)

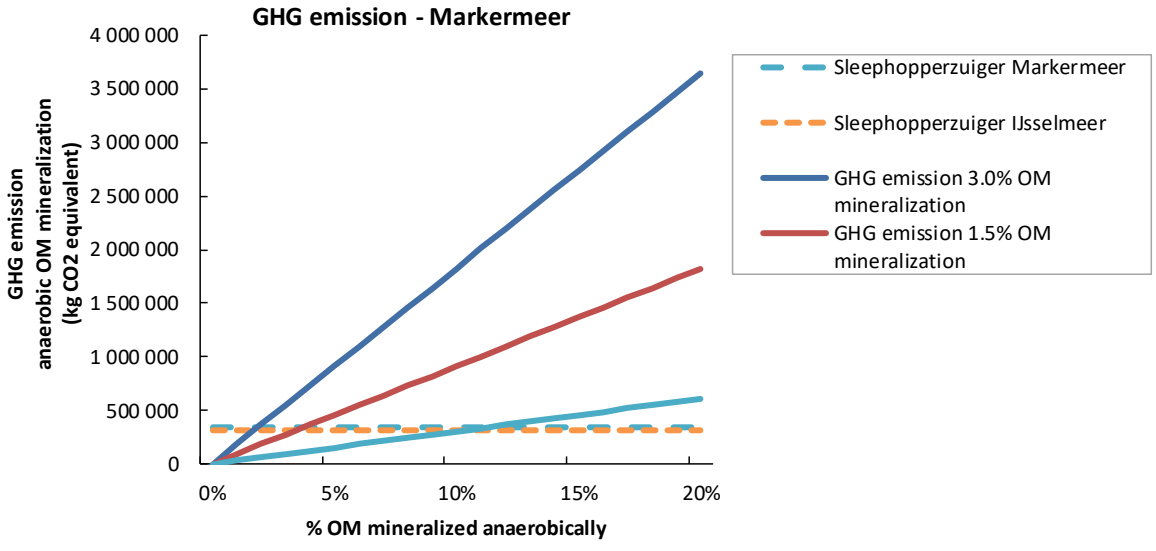


Progress, potential extra CO_2/ CH_4 release from sediments due to dredging.

Dredging CO_2 emission

	Markermeer
Hoeveelheid (m^3)	40.000
Afstand (km)	10
Gebruikt materieel	Sleephopperzuiger
Bodemsoort	Zand/slib
Tool	DuboCalc 5.1
Gebruikte database	Nationale Milieudatabase
Totaal CO_2 eq. (ton)	**342,7**

Greenhouse gas emission by dredging compared to OM degradation



Progress, gas emission balance for confined sediment disposal site

Measurements

Calculations

	limit (ton/year)	measured (sediment to water) (ton/year)	measured (water to air) (ton/year)
Methaan (CH4)	100	12.200	<100
Carbondioxide (CO2)	100	33.500	<100

The measurements illustrate the emission gap between sediment to water and water to air due to:

- Oxidation of CH_4 to CO_2 in water
- Dissolution of CO_2 as HCO_3^- (bicarbonate) -> acidification!

How to proceed with white paper on ?

Translation of Dutch white paper (does not include impact of dredging)?

Other emission figures of CO_2/CH_4 from undisturbed and disturbed sediments -> who?

Inclusion of dredging fuel consumption as comparison -> fuel consumption or saving for other dredging methods?

Who will participate in writing the white paper on incorporating CO_2 and CH_4 balance of sediment in sediment management and dredging?

-> proposition to include sediment management

Setting up a synthetic catalogue of beneficial use options.

The 38 case studies currently available from the CEDA web site (CE WG) are all relevant for the SedNet WG, and it is not desirable to build our own catalogue. The different approaches and objectives of SedNet may be reflected by a header page on the SedNet WGCE site, with cross links to the CEDA WGCE catalogue. Acceptability by CEDA of such links will be discussed by members belonging to both WGCE groups (lead: Arjan). A classification of options may be proposed on the SedNet page according to source (marine, waterways or reservoirs), salinity or volume criteria.

It seems possible to prepare concept case studies (not yet realised), for the SedNet page only.

New realisations by SedNet WGCE members may be prepared also under CEDA format and submitted to CEDA for posting. No IP-sensitive data should be included. SedNet reference should be included if submitted to CEDA.

Similar initiatives:

- CEDA: https://dredging.org/ceda-working-group-on-beneficial-use-of-sediment-wgbu/203
    - Especially the case study format:
    - https://dredging.org/resources/ceda-publications-online/beneficial-use-of-sediments-case-studies
- PIANC (1992 and 2020 update)

https://www.pianc.org/publications/marcom/beneficial-uses-of-dredged-material-a-practical-guide

Also many guidelines, pilot tests and case examples:

- SedNet library https://sednet.org/library/
- EU INTERREG programs (SURICATES, USAR, PRISMA, CEAMaS, …)
- USA examples like
    - San Francisco Bay https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/dredging/beneficialreuse.pdf
    - Great Lakes https://www.epa.gov/greatlakes/contaminated-sediment-great-lakes
    - Superfund sites

From WGCE3 and WGCE4 group work:

The 38 case studies currently available from the CEDA web site (CE WG) are all relevant for the SedNet WG, and it is not desirable to build our own catalogue.

The different approaches and objectives of SedNet may be reflected by a header page on the SedNet WGCE site, with cross links to the CEDA WGCE catalogue. Acceptability by CEDA of such links will be discussed by members belonging to both WGCE groups.

A classification of options may be proposed on the SedNet page according to source (marine, waterways or reservoirs), salinity or volume criteria. Or on how the projects reduce unrenewable resources, use sediments as a raw material, reduce landfilling etc…

It seems possible to prepare concept case studies (not yet realised), for the SedNet page only.

New realisations by SedNet WGCE members may be prepared also under CEDA format and submitted to CEDA for posting. No IP-sensitive data should be included. SedNet reference should be included if submitted to CEDA.

A SedNet catalogue of beneficial use options:

Choices: Based on the CEDA catalogue =>

What do we want to add? Pilots, projects ?

What format do we want to use?

Do we want to host the case files at SedNet (link), or contribute to CEDA/PIANC/…?

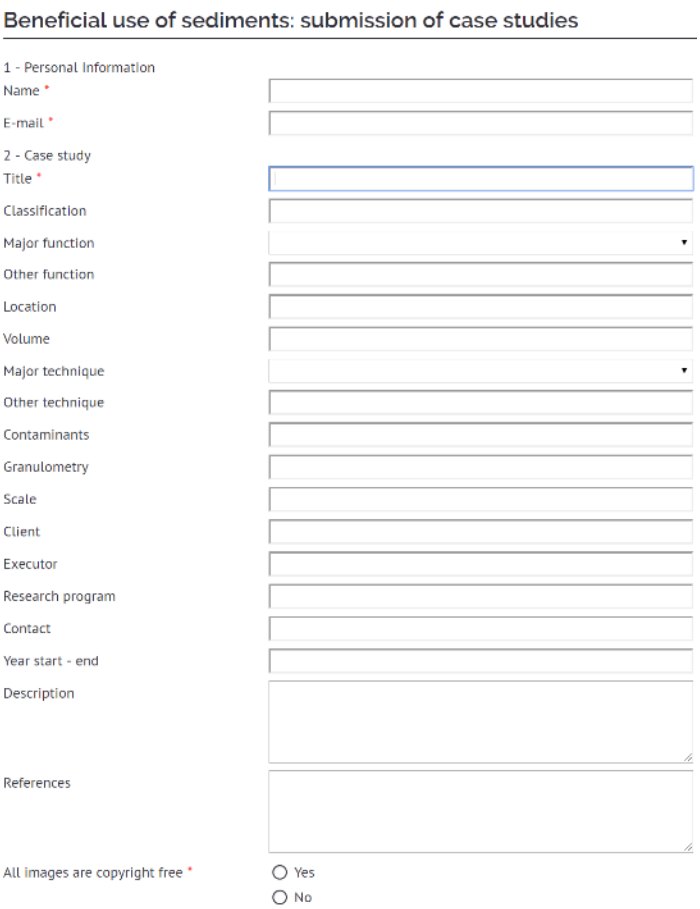
Actions:

Selecting a host and a format

Contribution of case studies: define SedNet scope

Who will contribute/edit ?

The CEDA template


Beneficial use of sediments: submission of case studies

1 - Personal Information
Name *
E-mail *
2 - Case study
Title *
Classification
Major function
Other function
Location
Volume
Major technique
Other technique
Contaminants
Granulometry
Scale
Client
Executor
Research program
Contact
Year start - end
Description
References
All images are copyright free *
Yes
No

Categories:

Completed projects (CEDA, PIANC)
Pilot tests carried for demonstration purposes
Concept projects (detailed design but no realisation yet)
Commercial applications already in use/progress

Applications:

Propositions for beneficial use types:

Environmental enhancement
Sustainable relocation
Habitat creation and improvement
Agriculture
Recreation

Rehabilitation of borrow pits
Engineering uses
Flood and coastal protection
Construction (including roads)
Own needs of port or waterways operators
Any other application type ?
Port Expansion
Land reclamation in general
Amenity development (using dredged sediments); similar to port expansion, but for leisure use.
Amenity development is a subset of land reclamation
Quarry backfill/reclamation/rehabilitation
Freshwater sediments for soils (true circular reuse?)
Flood defences – coastal resiliency
Is (mitigating) land subsidence is a subcategory to agriculture or land reclamation?
Brownfield Development /Remediation/Economic revitalisation
Organic matter could be used as energy source - for burning.
Road and other infrastructure
Waterway banks
Concrete creation
Degraded soil restoration (increase thickness and quality)
Replacement of unrenewable resources
Ecological restoration
Urban Sediment Management

Propositions for case studies classification:

Possible classification on saline/fresh water
Classification for their content in organic matter, especially for agricultural use. Type of OM is also key (reactivity)
Classification on grain size ? gravel, sand and sludge
Classification on source: reservoirs, marine, waterways
Differentiating on organic and inorganic
Salinity, OM, clay, sand... (nature of the sediment)
Presence of clay minerals with high swelling and shrinkage potential also limits applications
Contamination level as a classification (same as waste?)

Maybe starting from key essential characteristics of the sediment, a tree of options could arise ...

=> Any other application type ?

Salinity and beneficial use

Topic to be initiated if agreed

Emerging contaminants monitoring for beneficial use

Topic to be initiated if agreed

Public perception of dredged sediments and consequences for beneficial use

Topic to be initiated if agreed

References

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