MANABAS COAST

Baseline Assessment for all pilots

An initial activity of WP2 is a description and baseline assessment of each study pilot that will be used as the baseline to assess progress during the project and can aid in the future cooperation between the study pilots. The assessment also serves to establish the status of mainstreaming of NbS into the pilots. The assessment survey is divided up into three parts: 1) Description of the pilots, 2) Questions concerning how the enablers are currently addressed in the pilots, and 3) Brief questions about the MANABAS framework (inspired by ISBAM).

Part 1: Pilot description

Our aim is to mainstream nature-based solutions on the different coasts of northwest Europe. Therefore we need a description of the coastal system. This is divided into two sections: A) description of the coastal (natural) system of the pilot, and B) description of the governance system.

Name of pilot: Zandmotor (Sand Motor)

Location of pilot:

Please include a satellite map/orthophoto or aerial photo of the area in order to see vegetation, houses, gully's. bars etc. Provide coordinates for the center of the map and the corresponding coordinate system

Location and satellite image of the Sand Motor are shown in resp. Figure 1 and 2.

MANABAS COAST

Figure 2. Location of the Netherlands (left) and location of the Sand Motor (right, indicated by the red circle). (source: Google Maps)
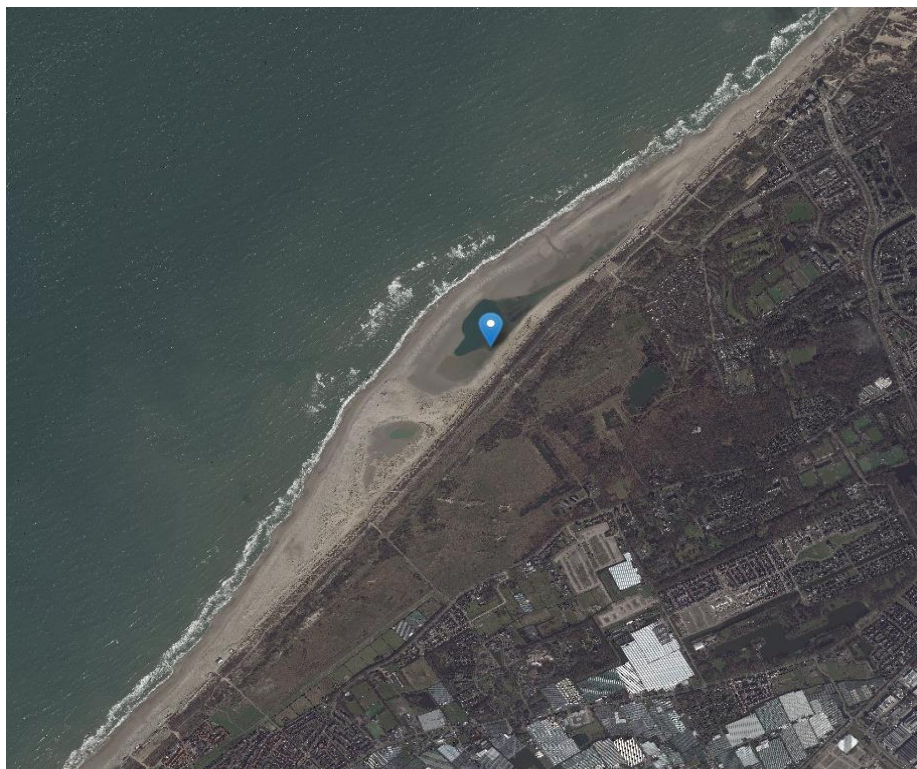

Figure 1. Satellite image of the Sand Motor on 3/15/2023. (source: satellietdata-portaal.nl)

MANABAS COAST

Coordinates of the Sand Motor are 52.0503752, 4.1675948,3574 (based on Google Maps).

Pilot aims/objective:
- Long-term coastal flood risk management through implementation of mega nourishments
- Creation of additional benefits through implementation of mega nourishments for coastal functions such as nature and recreation
- Innovation of nourishment schemes by means of mega nourishments

Which nature-based solutions will you be working with in MANABAS?
- Monitoring of a mega nourishment (Sand Motor) as an alternative to 'traditional' nourishment schemes consisting of beach and shoreface nourishments.

A. Description of the coastal system

Please briefly describe those areas that are relevant for your pilot:

1. The landscape including geology, morphology, and biology.

The Central Holland coast is characterized by a concave shape on the long time scale. In 2011 the Sand Motor was constructed as a mega nourishment along this coastal cell, located between the harbor entrances of Scheveningen (The Hague) and Rotterdam. The Sand Motor consists of approximately 21.5 million m³ of sand and its construction impacted local morphology and biology (Huisman et al., 2021). Since its construction the Sand Motor integrated in a natural way in the surrounding coastal environment. The Sand Motor integrated a natural way in the surrounding coastal landscape. Typical morphological features of the Dutch coastal system such as dunes, beaches and shore-parallel sand bars were formed after construction (Pluis et al., 2023).

2. The hydrodynamic forcing from tide, water level, wind and waves. If possible, include some statistical values

De Schipper et al. (2016) provide information on the hydrodynamic (storm) climate in the surrounding of the Sand Motor:

'Sea basin, and as a result the wave climate is wind sea dominated
with annual mean wave height Hs of 1.3 m and wave periods typically
in the order of 5–6 s (De Schipper et al., 2016). Energetic storm events in autumn
and winter are often from the south-west and north, causing
wave incidence to be highly oblique. Storms with a return period of

once in a year have a significant wave height offshore of about 4 m. The mean tidal range at the location of the Sand Engine is 1.7 m and the horizontal tidal velocities have an amplitude of O (0.5 m/s).'

3. Which current NBS solutions are already present (it ca be a non-engineered original landscape)

The Dutch coast is characterized by a sandy shoreface consisting of natural shore-parallel bars, sandy beaches, and coastal dunes. Groins were constructed in the past (ever since the 18th century) to preserve the position of the coastline. Before construction of the Sand Motor, beach and shoreface nourishments (structurally since 1990) were carried to mitigate shoreline erosion.

4. Describe how study pilot is monitored.

Yearly coastal measurements are carried out as part of the JarKus measurements (Yearly Coastal Measurements, since 1965) on the national scale. Additional bathymetric and topographic surveys were carried out several times a year as part of monitoring of the Sand Motor. Sand and salt spray is monitored in the adjacent dune area. Benthic communities are monitored to keep track of restoration of the ecological recovery after the construction of the Sand Motor. At last, vegetation at the Sand Motor is studied to investigate the growth of vegetation.

5. Describe the sediment dynamics: Macro or micro sediment budget, conceptually or detailed volumetric monitoring. Include any dredging

Sediment dynamics of the Sand Motor are shown in Figure 3. Sand is naturally dispersed by natural forces such as wind, tide and waves (Huisman et al., 2021; Pluis et al., 2023). Sand is transported in northward and southward direction and into the adjacent dune area.

![Interreg North Sea logo] ![Co-funded by the European Union logo with EU flag]
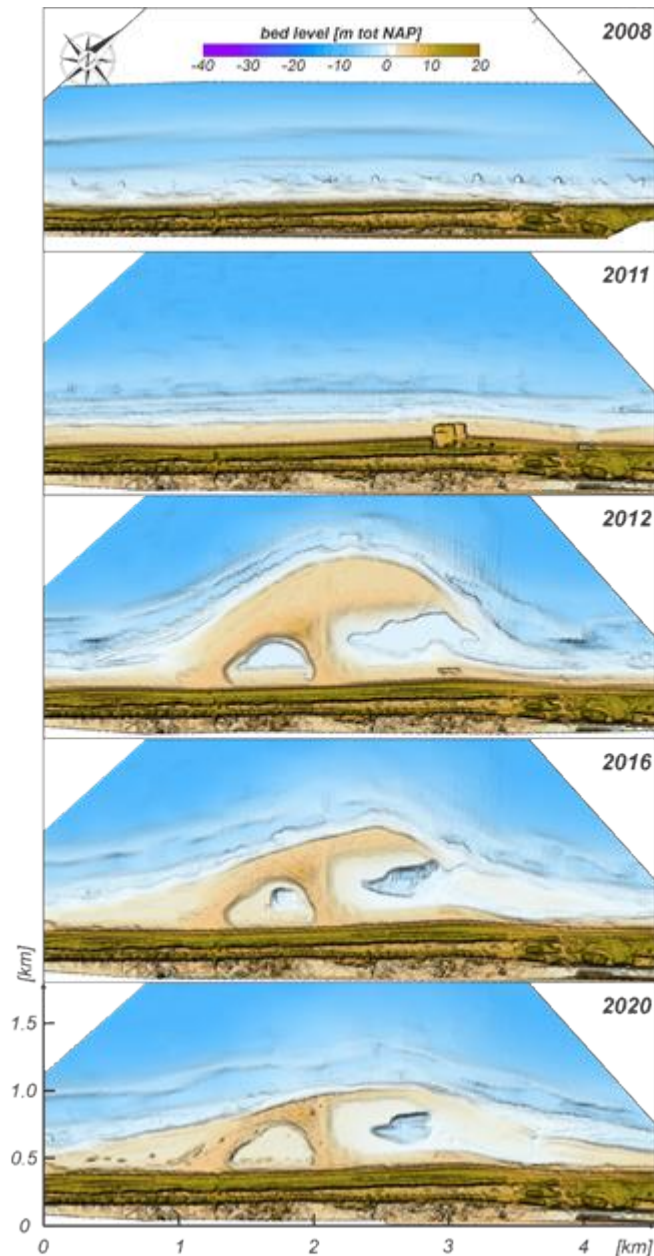
MANABAS COAST

Figure 3. Morphology of the Delfland coast before and after construction of the Sand Motor. In 2008 the natural coastal system present here is shown. In 2011 reinforced sandy flood defenses arevisible in the dune area. In 2012 the Sand Motor is present along the Delfland coast. (Pluis et al., 2023)

6. Long term trends. These could be chronic erosion, long-term subsidence or trends in mean sea level.

The Dutch is characterized by structural erosion due to a deficit of sand and sea level rise.

7. Describe the current coastal protection being used in the study pilot.

The Sand Motor provides a natural way of protecting the coast. Therefore beach or shoreface nourishments are not expected to be carried out in the upcoming years.

8. Describe the current risk of flooding and erosion.

In terms of <u>erosion risk management</u>, due the presence of the Sand Motor beach and shoreface nourishments are not required in the upcoming years in order for the coastline to keep in place

In terms of <u>flood risk management</u>, the risk at flooding is significantly low. The dunes are expected to be resilient against a 1 : 30.000 year storm.

9. Which human activities impact your coastal system?

Beach bars and beach cabins are located next to the Sand Motor. These constructions limit the transport from the Sand Motor to the dune area. Furthermore the lagoon of the Sand Motor is used for watersport activities.

10. Describe important culture and historical aspects in the study pilot

Coastal flood and erosion risk management has always been a point of concern at the location of the Sand Motor. Therefore groins were constructed at this part of the coast. The dunes provide vital protection for flooding of several important cities in the Netherlands such as The Hague (where the parliament is seated), Delft and Rotterdam (famous for its harbor infrastructure).

B. Description of the governance context

Please briefly describe those areas that are relevant for your pilot:

11. Who are the landowners of the land?

National real estate agency / national government

MANABAS COAST

12. What are the main land uses in the pilot area (ie agriculture, nature reserve, infrastructure),

Recreation, nature, coastal safety

13. What are the current laws and regulations that govern the use of nature-based solutions in the pilot (i.e Natura 2000, planning)?

Nature conservation act, environment and planning act (2024) that will be successor of the water act (among others)

14. What is the current status of using nature-based solutions in your pilot area (ie to what extent are they mainstreamed into existing policy?)

Sand motor was established as a pilot mega nourishment as an alternative to the current nourishing practice. We are still learning but also implementing knowledge in our coastal practices. On the national scale the lessons learned from the sand motor were implemented in the design of Hondsbossche dunes (see pilot). Currently the concept of meganourishments is being examined in the coastal preservation program. On the international scale lessons were implemented in the Bacton case (UK).

15. What are the current goal conflicts (ie protecting cultural vs natural areas, or protecting private land vs municipal-owned land, or agricultural uses vs nature preservation?) How are these dealt with?

recreation is conflicting in several ways:
- Kitesurfing on the lagune is very popular but the lagoon is disappearing due to the natural forces
- Breeding birds and seals are being disturbed by recreation on the sand motor.

16. How are the stakeholders identified and involved

At the time of the construction we don't know very well. There were some discussions which led to good cooperation, but after 10 years it's almost back to normal coastal cooperation.

17. Briefly describe the socio-economic development in the area.

In rebel (2021) the socio economic value of the area is described as follows:

> *The Sand Engine clearly attracts recreational users, and specific target groups: while the Sand Engine is less popular with beach visitors, the area attracts people looking for space, tranquillity and nature. Due to favourable*

conditions, the Sand Engine lagoon also has an unexpected attraction for kite surfers.

It has been shown that the Sand Engine has a positive effect on the perception of visitors. Because of its recreational function, the Sand Engine also represents a considerable economic value. However, only part of the economic value can be attributed to the Sand Engine, because the Sand Engine has not demonstrably led to an increase in the number of visitors (compared to before 2011) and it is uncertain how future-proof that value is.

18. What do you experience as the main barriers to mainstreaming NbS in your pilot?

We have a clear coastal policy focused on preservation of the coastline position in the short term (5 year). There is no clear policy for large scale nourishments (like the sand motor) (Pluis et al., 2023)

C. Implementation scheme

Please describe your timeline for implementing NbS during MANABAS and beyond (i.e. starting point, estimated finalization, monitoring period)

Monitoring of The Sand Motor is continued for the next five years. Lessons learned from the Sand Motor are shared within the MANABAS-Coast projects within the framework of work package 2 with other coastal authorities. Experiences are being used to interpret the results of the Sand Motor and implement the concept of mega nourishments (i.e. Sand Motor nourishments) within the framework of Dutch coastal policy and the Dutch coastal nourishment program.

Part 2: Enabler Assessment

Please consider the barriers identified in Part 1B (question #18). The enablers below are meant to be ways to overcome these barriers. However, these enablers are not set in stone and will be further developed, augmented and /or changed during the MANABAS Coast project. There may be other enablers that are more important in certain pilots or for mainstreaming NBS. We will explore these during our project. In this assessment we want to get an initial idea of how these proposed enablers by EcoShape play out in your pilot and for mainstreaming NBS on a large scale.

MANABAS COAST

Enabler 1: Technology and system knowledge

- Which types of technology or systems knowledge are important in your pilot? (i.e. Sediment cell, salt marsh protection, salt marsh dynamics, sand nourishment, enhanced dune development)

  System knowledge based on morphological development, development of benthic communities and integration of mega nourishments within the natural surrounding landscape is essential to understand the behavior of mega nourishments such as the Sand Motor, as an alternative to traditional, small-scale nourishments schemes.
  Technology is being used to gather data and understand its behavior, i.e. collecting bathymetric data using jet ski surveys, drones are used for measuring topography and monitoring vegetation. Also an ARGUS system was installed. Numerical models such as Delft3D are used to predict the morphological development of the Sand Motor and validated using the previously mentioned measurements.

- Are there any knowledge and technology gaps in your pilot that need to be addressed? Please briefly describe.

  In terms of knowledge, we want to understand the continued interaction between the development of the Sand Motor and the dune area.

MANABAS COAST

Enabler 2: Multistakeholder approach

- Who are the main stakeholders in your pilot?

  Before and after the construction the main stakeholders include the national government, local government (province of the South Holland & municipalities) and science institutions.
  At this point in the pro9ject (ten+ years after construction) stakeholder management is focused on the local coastal community composed of local stakeholders such as citizens and leisure businesses (kitesurfschools). For the monitoring program of the Sand Motor a key stakeholder are nature conservation agencies.

- How will you engage your stakeholders in the project?

  We will use monitoring results in other projects with these stakeholders.

Enabler 3: Management, monitoring, and maintenance

- What routines does your pilot have in place for management, monitoring and maintenance of the NbS?

  We have been monitoring since the construction of the Sand Motor in 2011. Management of the Sand Motor was done mainly by the province of South Holland.

- How do you measure the success of your pilot? Do you have any indicators for successful mainstreaming of NbS?

  We still have many professional visitors ('water-related delegations') from all over the world visiting the Sand Motor. There are a lot of recreational visitors especially walking, horse back riding and kite surfers. Experiences from the Sand Motor pilot were implemented in the design of the Hondsbossche Dunes (coastal defences) in the North of the Netherlands and in the sand reinforcement in Bacton (UK).

Enabler 4: Institutional embedding

- How do current institutional arrangements already facilitate mainstreaming of NbS? Please describe and mention the key institutions

  Since 1990 the policy of dynamic coastal preservation is in act in the Neth-

MANABAS COAST

erlands. Ever since then coastline erosion is mitigated by means of implementation of nourishment schemes ('sand as a natural building block for our coast').

Furthermore extensive collaboration exists between Rijkswaterstaat (as part of the national government), waterboards and nature conservation agencies to manage and maintain our coastline in a natural way.

Furthermore, extensive coastal reinforcements of dune areas have been carried out in the last 10 – 15 years. The reinforcements were dominantly designed by extending and heightening of coastal dunes, which form a natural barrier against coastal floodings.

- How committed is your organization to mainstreaming NbS within MANABAS Coast and after the project ends?

  Rijkswaterstaat is committed to mainstreaming NbS in several ways. First off, we are responsible for managing and maintaining the coastal systems (in collaboration with water boards). Lessons learned from MANABAS-COAST are expected to contribute to our management and maintenance policy. Secondly, we advise policy makers at the Ministry. Participation in the MANABAS-COAST project is expected to contribute to policy advise about the Dutch coast on a national coast.

Enabler 5: Business Case

- Do you face problems with funding in your pilot? Please briefly describe, including the general sources of funding.

  Limited problems. Currently we are not allowed to apply for EU-funding.

- How will your pilot and/or continued mainstreaming be funded after the MANABAS Coast project?

  Continued monitoring of the pilot after 2026 is not certain at this point. Continued mainstreaming is expected to take place within 1) the coastal policy framework such as the knowledge program sea level rise (as part of the national Delta program) and 2) within the coastline preservation program from an operational perspective.

Enabler 6: Capacity building

- What types of capacity building would your pilot need in order to facilitate mainstreaming of NbS?

We expect limited capacity building to be required for the pilot itself. Mainstraining of the concept is still required for implementation in Dutch coastal policy and practice (see previous question).

Enabler ranking

To what extent are the above enablers important for mainstreaming NbS in your region? Please rank (1 is least important, 10 is most important)

Enabler 1: Technology and system knowledge

1 2 3 4 5 6 7 8 9 10

Enabler 2: Multistakeholder approach

1 2 3 4 5 6 7 8 9 10

Enabler 3: Management, monitoring and maintenance

1 2 3 4 5 6 7 8 9 10

Enabler 4: Institutional Capacity

1 2 3 4 5 6 7 8 9 10

Enabler 5: Business case

1 2 3 4 5 6 7 8 9 10

Enabler 6: Capacity Building

1 2 3 4 5 6 7 8 9 10

Suggestion for additional enablers

Are there any aspects of mainstreaming enablers from your pilot that you can already suggest? If so please briefly state these:

On the basis of the sources studied and interviews conducted (policy evaluation 2021), the researchers come to five recommendations.

MANABAS COAST

1. Draw up a vision for the future of the Sand Engine. The Sand Engine will disappear in the long term, just as it has been designed. That need not be negative, but it will mean that the nature and recreational value will also disappear. And coastal protection will require a follow-up to the Sand Engine. This could be regular replenishment, or another large-scale replenishment.
2. Continue to disseminate the lessons learned from the Sand Engine (internationally).
3. Evaluate the current monitoring programme (the MEP).
4. Continue to monitor the Sand Engine. Also consider where and how monitoring is currently organised, and investigate whether this can be effectively combined.
5. Reassess the management agreements and record them in the long term, in line with the future vision from recommendation 1.

Part 3 MANABAS mainstreaming framework (inspired by earlier work e.g. ISBAM)

Within MANABAS Coast we are working on a framework that helps in mainstreaming NBS. To develop this framework, we need information on the pilots as well as the ambitions and goals of the different organization involved. We build on work already done in the past such as the ISBAM approach, which was developed in the Interreg BwN project (see also the brochure in the appendix for a further explanation or online). Just as the enablers, the MANABAS mainstreaming framework is still a work in progress.

As a starting point for the MANABAS framework, 3 leading principles from ISBAM are evaluated. We would like to know if these principles can also be applied across the entire northwest Europe coasts and how they can be improved. .

Three leading principles have been identified that are deemed important to enable mainstreaming of NBS:

MANABAS Coast principle 1: "Act at a landscape (system) scale, including both the natural and socio-economic system/context"

- Do you identify with this principle?
  Yes we do. Use the surrounding coastal system as guideline to manage the coastal system in a natural way.

- Is this principle applied (to a certain degree) within your pilot? And within your organization? If yes, how?

MANABAS COAST

Yes, because the design of the Sand Motor is based on shoal attachments that occur naturally along the Dutch coast.

- In managing your assets, how are the system-wide effects and benefits taken into account?
  Not yet, the system is managed on a national scale (~100 kms) (through the coastal preservation policy) in compensating for sediment losses on this scale. Furthermore, local sediment losses are compensated by implementing beach and shoreface nourishments (~ 1 kms). However, such a policy is not yet fully developed on the scale of coastal cell (~ 10 kms).

- On a scale from 1 (room for improvement) to 10 (superb), do you think your organization adheres to this principle? Why?

  1 2 3 4 5 6 7 8 9 10 >> 7. There is already a national coastal preservation policy in act since 1990 using NbS (sand nourishments). However, there is still room for improvement and optimization on the scale of a coastal cell and for nature & economy.

MANABAS Coast principle 2: "Integrate management of multiple assets and functions within the landscape system context"

- Do you identify with this principle?
  Yes, nature recreation and coastal safety are integrated; the landscape system context consists of the dunes, beach and sandy shoreface, in which waves, tide, wind and vegetation together define the movement of sand.

- Are relevant organisations/institutions efficiently cooperating to jointly address system-wide challenges? If yes, which challenges and how?
  When the pilot was conducted we were, but now we are mostly back to our own separate businesses (RWS- basic coastline, municipality – beaches for recreation, waterboard for dune safety, nature conservation – habitats and species)

- If you see room for improvement in the integrated management of multiple landscape assets, what would be the necessary steps to take according to you? Briefly state
  Asses our goals and the way they are connected to natural processes (movement of sand) together before we decide how to maintain our assets. Track coastal dynamics on a system-scale / landscape-scale besides the small scale where coastal interventions are traditionally designed for.

- On a scale from 1 (room for improvement) to 10 (superb) how much is this principle applicable to your organization?

MANABAS COAST

1 2 3 4 5 6 7 8 9 10 >>>>5

MANABAS Coast principle 3: "Embrace and leverage upon the natural dynamics of the system"

- Is this principle applicable to your situation/organization?
Yes very much in our sandy coastal policy

- What are the main natural processes that should be considered? Are these well-known with all the stakeholders?
known by most of the stakeholders

- How are using natural processes incorporated in the management practices within your organisation?
Sandy maintenance of the coastline. Design of sand nourishments is based on erosion and deposition rates.

- On a scale from 1 (room for improvement) to 10 (superb) how much is this principle applicable to your organization?

1 2 3 4 5 6 7 8 9 10 >>>>>8

Additional MANABAS Coast mainstreaming questions:

- In your view, what is essential in the mindset or way of working of people (policy makers, managers, professionals, general audience) to promote mainstreaming of NBS? Do stakeholders need more information on mainstreaming?
Focus on possibilities instead of impossibilities.

- What other leading principle(s) would you suggest?

1. Include nature as an enabler. How can we make coastal interventions more environmental-friendly and nature-friendly.
2. Track coastal change on a system-scale to better understand large scale coastal dynamics in order to design appropriate coastal interventions.

- How can we make these principles more applicable to the context of pilots?

- Finally: What does mainstreaming mean for your pilot? Please briefly describe.

MANABAS COAST

Implementation of the concept of a mega nourishments within Dutch coastal preservation program ('coastal practice toolbox') and Dutch coastal policy. The latter requires a policy for monitoring and mitigating large-scale sand losses.