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### 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:**

East Frisia Wadden Sea (Muddy case), Niedersachsen, Germany.

**Location of pilot:**

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Fig 1: Satellite image of German bight, pilot area (dashed orange line).



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Fig. 3: Overview of Nature-based Solutions  
[taken from Eekelen (2020); p. 266, modified by NLWKN]



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### 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.**

On its Northern side the German Federal State Lower Saxony borders the North Sea. The coastal lowlands of Lower Saxony represent an important economical, agricultural, cultural and ecological area. Due to height levels ranging from below to a few meters above mean sea level, about 6,600 km<sup>2</sup>, 1/7th of the total state area, is flood prone by storm surges. The main coastal protection elements on the mainland coast are main dikes and storm surge barriers. In case of main dikes, on significant stretches of the coastline additional protection elements such as dike forelands and secondary dike lines are present. These elements in combination with the main dike form a coastal protection system of varying shape depending on the particular local situation. The coastal protection system provides flood protection for 1.2 million inhabitants. By these elements a flood protection line with a total length of 610 km is formed.

Behre (2004, 2007) describes the development of the Southern North Sea coast line for the last 10,000 years. He shows human settlement activities and coastal protection measures in reaction of different transition and regression phases.

Schwarz (1996) and Kramer et al (1999) describes the development of dike construction and land reclamation during the last 1,000 years.

The pilot area East Frisia is located in the Northwestern part of Lower Saxony (see maps above; Fig. 1 & 2).

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

The prevailing wind direction is Northwesterly wind. These wind directions lead to highest surge at the Lower Saxony coast.

The wave climate at the mainland coast depends on location and bathymetry of the wadden area in front, and can be distinguished between lee-situated (generally south of the islands) and exposed (influence of tidal inlets).

Table 1: Tidal water levels of East Frisian gauge stations

<b>gauge station</b>	<b>MHW<sub>11/20</sub></b>	<b>MLW<sub>11/20</sub></b>	<b>highest observed HW</b>
	[mNHN]	[mNHN]	[mNHN]
Emden, Neue Seeschl.	1,49	-1,81	13.03.1906 5,17
Norderney Riffgat	1,23	-1,24	16.02.1962 4,10
Bensersiel	1,43 *	-1,35 *	13.03.1906 4,77

\* = 2000/2009

As shown in table 1, the tidal range varies along the coastline from 2.5 m to 3.3 m. The location of the gaugestation is indicated in Fig. 2.

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

- Growing and stabilization of salt marshes,
- Integration of vegetated foreshore / foreland,
- Clay ripening and consolidation,
- Restoring tidal dynamics.

**4. Describe how study pilot is monitored.**

Remote sensing: Laserscanning, aerial orthophotos. On the spot field surveys.

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

In the pilot we will use the concept of micro-sediment budget and monitor detailed height developments and derived volumetric changes.

In general, dredging activities are of minor relevance, since in most cases re-suspension methods are used to maintain harbours and waterways.

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

Sea level has been observed at gauge Norderney for a longer period. Records starting begin of 20<sup>th</sup> century are analyzed and an increase of MHW level of approx. 0,3 mm / yr can be derived from this data. The change of MLW level is

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less. Most salt marsh area are showing an erosional trend, exemptions are locations characterized by a bight situation or in lee of infrastructure, e.g. harbour jetties.

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

A main dike line protects the inhabited low-lying hinterland in combination with a foreland that in some areas consists of a summer dike and summer polders. In most foreland coastline sections an additional erosion protection is located (brushwood groynes / stone groynes or foreland revetments) to prevent or reduce erosion of the foreland/salt marsh.

**8. Describe the current risk of flooding and erosion.**

The area in front of the dike is flood prone and regularly flooded during storm surges. The coastal protection system consisting of the following elements (foreland-(summer dike)- main dike – (2<sup>nd</sup> dike line)) fulfills the legal standard. For the hinterland the probability of flooding is very small.

In some parts of the mainland coast, erosion of the foreland is an ongoing process and constantly performed maintenance work reduces the loss of foreland areas.

**9. Which human activities impact your coastal system?**

- Coastal protection,
- Nature conservation measures,
- Harbour maintenance / shipping traffic,
- Agricultural use (cattle pasture),
- Tourism.

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

The pilot area is man-made (land reclamation e.g. by groyne systems and dike constructions). The land reclamation has been conducted since 1000 years. Nowadays, the forelands are part of the national park, FFH-area, and bird protection area.

**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?**

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The foreland /salt marshes and mud flats are real estates of Land Niedersachsen (State of Lower Saxony) and Bundesrepublik Deutschland (Federal Republic of Germany), respectively. In harbour areas and settlements, the ownership structure is more complex, but the foreland management plan(s) are aiming for foreland and saltmarsh areas only.

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

Nature reserve, coastal protection, agriculture, tourism (in a very limited extend)

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

- National Park Law (NWattNPG),
- Natura 2000 (FFH- and EU Birds Protection Directive),
- German Federal Nature Conservation Act (BNatSchG),
- Lower Saxony Dike Act (NDG),
- Environmental Impact Assessment Act (UVPG).

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

All mentioned solutions (see related question in part 1 ‘Pilot description’) are already used in a various extend in the pilot area. Their use was discussed, condition and location specific agreed, and laid down in several integrated foreland management plans.

The update of these integrated management plans will bring nature based solutions (NbS) one step further to mainstreaming under the actual conditions, e.g. climate change related sea level rise. The NbS fit into existing policy described in the Lower Saxony climate change adaptation strategies (MU 2021) and Master Plan Coastal Protection - Mainland Coast Lower Saxony-Bremen (NLWKN 2007).

**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?**

Nature reserve vs. coastal protection:

(erosion protection vs. natural dynamic) and (restoration of foreland vs. conservation of mud flats)

**16. How are the stakeholders identified and involved**

The Interreg Vb NSR-project C5a carried out a stakeholder analysis for the area of the dike board Esens-Harlingerland. Additionally, the working groups that contributed to the existing foreland management plans will be involved in the updating processes.





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An updated stakeholder analysis will be part of MANABAS Coast activities. The planned updated integrated management plan will involve a working group of relevant stakeholders (Local Contact Group).

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

Starting approximately 1,000 years ago, the agricultural economy enabled the development of this landscape (land reclamation and polder construction). The very fertile marsh soil gave high income and led to economic wealth which was the basis for new dike constructions and new polders.

In East Frisia, the change from an agricultural and fishery dominated economy towards a more industrialized region started in the beginning of the 20<sup>th</sup> century. After the 2<sup>nd</sup> world war this change towards industrialization accelerated supported by a better infrastructure and enforced by the parallel change of farming toward a mechanization and a modernization.

Economically, East Frisia is next an above-average agricultural sector strongly service-oriented, which is largely due to the high importance of tourism, in particular on the East Frisian islands. Industrially, the region is very dependent on a few large companies in the automotive, wind energy and shipbuilding sectors. Compared to the national average, the added value in this sector is rather low (Bohnhoff et al. 2012).



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

Assessment and weighting of protected biotopes of the same level on the background of FFH/Natura 2000 – regulations

### C. Implementation scheme

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

10/2022 - 03/2023	Preparation Kick-off
04/2023 - 12/2023	Hiring new staff member and planning pilot East Frisia
01/2024 – 12/2024	Installation Local Contact Group/Stakeholder involvement Defining monitoring sites and measures Starting external monitoring activities
01/2025 – 12/2026	Working on update of integrated foreland management plan including climate change adaptation
01/2027 – 06/2027	Finalizing monitoring reports and management plan Preparation of final conference
06/2027 – 09/2027	Final reporting in MANABAS
06/2027 – 12/2028	Continuing of monitoring (if necessary) and refining of foreland management plans
Follow up	Adopt the integrated foreland management plans including climate change adaptation to adjacent areas in Lower Saxony

## 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.*

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### 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)

-> salt marsh protection, salt marsh dynamics, foreland protection

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

-> **optimization of geometry and type of construction of the groyne system** to reduce the erosion of salt marsh cliffs and reestablish salt marsh areas.

-> **reshaping of established foreland in lower saltmarsh** by engineering new landscape – reducing height level, creating morphological features, and reducing artificial drainage. Which height level is necessary taking re-sedimentation and lifespan of the measure into account? Do morphological features need to be created or should the local system reshape the new area? Inundation and draining depend on hydraulic boundaries: Minimal needs of hydraulic drainage system to avoid negative developments, e.g. scouring or insufficient tidal influence?

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-> **biological barrier effect of different components** (e.g. the groyne system or the drainage system) are unknown in respect to their extend and relevance. If relevant, which construction type has minor negative effects? Are alternative solutions or additional elements suitable to solve this issue?

-> **grazing of foreland to reduce floatsom impact on the dike** – reduction of biomass on the foreland is an established measure to reduce the volume of biomass that will be deposited on the seaward dike slope during storm surges and can damage the grass cover layer of green dikes. Parametrization of intensity of stock on the foreland to achieve reduction of floatsom, carefully maintain the biotope of the upper saltmarsh and avoid a too intensive agricultural land use of the foreland.

### **Enabler 2: Multistakeholder approach**

- Who are the main stakeholders in your pilot?

From the predecessor INTERREG Vb NSR project C5a and the former working groups that elaborated the existing foreland management plans, stakeholders are in general the following organizations: National park administration, dike boards, NLWKN, estate office, nature conservation organization (NGO's), farmers. A detailed stakeholder analysis will be executed in the next project phase.

- How will you engage your stakeholders in the project?

It is planned to install a group of stakeholders working together on an updated foreland management plan. This group will be invited and steered by NLWKN and supported by findings and results of MANABAS Coast.

### **Enabler 3: Management, monitoring, and maintenance**

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

The existing integrated foreland management plans are in place and give guidance for maintenance of the foreland. Monitoring of the development of biotopes and morphology is realized by remote sensing systems and field survey on a regular basis. On specific parts of the mainland coast a measure related intensified monitoring is in place.

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- How do you measure the success of your pilot? Do you have any indicators for successful mainstreaming of NbS?  
If one foreland management plan is updated by taking NbS into account to adapt to climate change effects, the pilot is successful. Transferring the results of the updated management plan to adjacent areas in East Frisia or nearby regions in Lower Saxony will be the best indicator for successful mainstreaming.

### **Enabler 4: Institutional embedding**

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

The Lower Saxony Climate Change Adaption Strategy and the Master Plans Coastal Protection of Lower Saxony refer to NbS in the context of coastal protection and climate change. NLWKN is the responsible organization for preservation and maintaining the foreland.

Existing foreland management plans already include NbS. The yearly routine of defining and allowing the maintenance measures of the foreland is based on these integrated foreland management plans. Key institutions are the National Park Authority and NLWKN.

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

NLWKN is committed to NbS to a high degree. As former partner of the forerunner INTERREG Vb NSR project Building with Nature, NLWKN has been working on mainstreaming NbS since several years. In Lower Saxony the Masterplans Coastal Protection and the Climate Change Adaptation Strategy refer to the use of NbS in multiple situations.

### **Enabler 5: Business Case**

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

At the moment, no financial problems regarding funding of the pilot are recognizable



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

In future, the updated integrated foreland management plans will support and facilitate the work of the relevant stakeholders to a higher degree than today.

Therefore, NLWKN as responsible organization has a high interest to finance and, if necessary, update the management plans.

Financing will be possible on a shared state/federal level which divides the costs between the state of Lower Saxony and the German federal government.

### **Enabler 6: Capacity building**

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

We see the need of training of new staff members in applying NbS. This promotes NbS and implement the knowledge permanently in the organization.

### **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**



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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:

Cloud2Coast-method: Continuous dialogue and whole system approach (see homepage [Start - Cloud to Coast \(c5acloud2coast.eu\)](http://c5acloud2coast.eu) )

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



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*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:*

**Note:** When answering the following questions, we interpret 'your organization' as our branch of NLWKN in Norden.

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**
- Is this principle applied (to a certain degree) within your pilot? And within your organization? If yes, how?  
**Yes**, integrated foreland management plans are in place These plans cover the 'system' foreland and include the socio-economic context. For the sandy system (islands) the sediment budgets (balance) is taken into account as well as adjacent socio-economic system.
- In managing your assets, how are the system-wide effects and benefits taken into account?

### **Qualitative assessment**

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

Not all possible benefits are taken into account, e.g. additional effects on biodiversity





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

- Do you identify with this principle? **Yes**
- Are relevant organisations/institutions efficiently cooperating to jointly address system-wide challenges? If yes, which challenges and how?

Insufficient status of saltmarshes due to degeneration and sediment deficits. Win-Win-Situation: Creation of new saltmarsh areas and usage of dredged clay for coastal protection measures.

- 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:

Elaboration of objectives to be pursued by nature conservation and coastal protection and the measures required for this purpose, e.g. for the preservation of salt marshes, without additional compensation for the measure.

- 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

The principle is very well applicable to our organization, the challenge are conflicting interests, partially given by law (Dike act vs. Natura2000).

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

- Is this principle applicable to your situation/organization? **Yes**
- What are the main natural processes that should be considered? Are these well-known with all the stakeholders?

Main natural processes:

- Energy flux and sediment budgets,
- Succession of plant communities,
- Soil formation processes

Whether well-known with all the stakeholders or not: This question can be answered at the end of the project...

- How are using natural processes incorporated in the management practices within your organisation?



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Long term monitoring is the basis of all management decisions in coastal protection, e.g. start of planning, or choose of boundary conditions.

- 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

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?

**Panta rei.** Change and dynamics are parts of human life and society, and of coastal systems. We have to define the limits that we are willing to bear.

- What other leading principle(s) would you suggest?  
The “**Continuous dialogue – approach of C5a**” that will support a cooperation of the most relevant stakeholder towards an efficient cooperation and mutual understanding.
- How can we make these principles more applicable to the context of pilots?
- **Finally: What does mainstreaming mean for your pilot? Please briefly describe.**  
Establish integrated and climate proof foreland management plans in our region and beyond. Getting the developed NbS measures accepted and implemented on the ground.

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