RESULTS OF THE EIA

ENVIRONMENTAL IMPACT ASSESSMENT OF THE EXTRACTION OF MARINE AGGREGATES IN THE EXPLORATION ZONE OF THE BELGIAN PART OF THE NORTH SEA

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ABSTRACT

Deze paper beschrijft de opmaak van een MER voor de geplande zandextractie op de Noordzee van zowel de Vlaamse Overheid afdeling Kust en afdeling Maritieme Toegang als Zeegra vzw. Er worden 4 exploitatiesectoren voorgesteld binnen exploratiezone 4. Er zal een totaal volume van 35 miljoen m³ geëxtraheerd worden over 10 jaar. De effecten worden beoordeeld voor twee scenario's: gelijkmatige zandwinning over alle 4 sectoren en een worst-case strategie met zandwinning enkel in sector 2.

De belangrijkste vastgestelde effecten zijn:

Er treedt een verandering op in de zeebodemtopografie: voor scenario 1 een verdieping van 0,75 m en voor scenario 2 ongeveer 2,5 m. Voor het benthos is er een rechtstreeks tijdelijk biotoopverlies en mortaliteit (gerelateerd aan de oppervlakte) door de extractie van zandsubstraat. Effecten op vissen en vogels zijn wellicht klein. Door in de afbakening van de 4 extractiesectoren in de exploratiezone 4 rekening te houden met andere menselijke activiteiten, is er geen impact te verwachten van de zandextractie op deze activiteiten. De invloed van de bijkomende zandwinningsschepen op het omgevingsgeluid boven en onder water is evenwel verwaarloosbaar t.o.v. de volledige scheepvaartactiviteiten. Het cumulatieve effect (door de windturbineprojecten) inzake sedimenttransport en verschuiving van visfauna dient voldoende gemonitord te worden. Er zijn geen significante andere cumulatieve of grensoverschrijdende effecten.

Ce document décrit la préparation d'une EIE pour l'extraction du sable sur la mer du Nord à la fois par la gouvernement flamand Département Côtière et Departement Accès Maritime que par l'association Zeegra. Il ya quatre secteurs d'exploitation proposésdans la zone d'exploration 4. Il y aura un volume total de 35 millions de m³ extrait en 10 ans. Les effets sont évalués pour deux scénarios: l'extraction uniforme sur les quatre secteurs et une stratégie maximaled'extraction seulement en secteur 2.

Les principaux effets sont définis:

Il y aura un changement dans la topographie des fonds marins: un scénario d'approfondissement de 0,75 m pour scénario 1 et d'environ 2,5 m pour le scénario 2. Pour le benthos, il ya une perte d'habitat temporaire et une mortalité directe (liée à la surface) par l'extraction du substrat de sable. Effets sur les poissons et les oiseaux seraient de petite taille. Par la définition des quatre secteurs d'extraction dans la zone d'exploration 4 déjà en tenant compte des autres activités humaines, il n'ya aucune incidence prévue de l'extraction de sable sur ces activités. L'influence supplémentaire de l'extraction sur le bruit ambiant dessus et en dessous de l'eau est négligeable par rapport à l'effet des activités marins existants. Les effets cumulatifs (par l'extraction et par les projets d'éoliennes) sur le transport des sédiments et du transfert de la faune piscicole devraient être adéquatement surveillée. Pas d'autres impacts importants (cumulatifs ou transfrontières) sont détectés.

PROJECT DESCRIPTION

Motivation of the application

During the following years the three initiators (Flemish Department of Mobility and Public Works, Coastal Divisionand Maritime Access Division and Zeegra) will require sufficient quantities of good quality sand from the North Sea because of the following initiatives:

- The Integrated Coastal Security Plan (GKVP) approximately 15 million m³ (Coastal Division);
- The "OW plan Oostende" , an integrated project to increase the security of Ostend, about 1.5 million m³ of sand (Coastal Division);
- To maintain a total volume (all zones, 1 to 4) of approximately the same as the total volume currently extracted in the operating zones 1 to 3 (Zeegra)
- To continue to deliver the same quality of sand, depending on the demand on the market (Zeegra)
- a number of modifications to or extensions of existing infrastructures, such as further development of the stern island of Zeebrugge; the LNG terminal in the port of Zeebrugge; infrastructure in the North Sea (working on quay walls, ...); heightening of the level of existing areas within the North Sea harbours (Maritime Access Division).

Spatial situation of the project in relation to other users

The total area of the sector (s) should not exceed 46 km². Within the exploration zone 4, 4 sectors were defined with a total area of approximately 45.664 km². The exact definition of these four sectors is the result of an optimisation process based on the following criteria:

- availability of the required granulometric characteristics;
- avoidance of biologically valuable areas;
- avoidance of conflict with other socio-economic users (minimum distance of 250 m from cables);
- for the sake of workability, sufficiently large and geometrically simple areas are proposed.

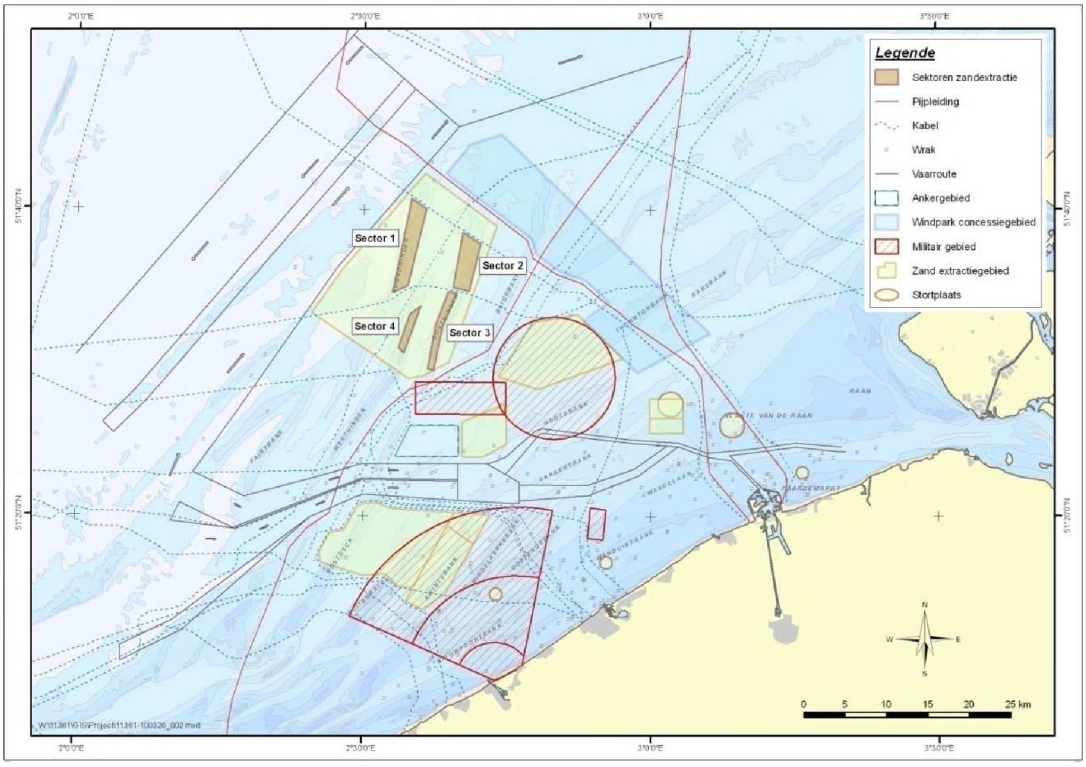

Figure 1: Overview of the location of exploration zone 4.

Summary of the requested volumes

Table 1 summarizes the volumes that are requested per initiator as well as the total volume, the maximum volume per 3 years, per year and per 3 months.

Initiator	*Total (10 years)*	*Average (year)*	*Maximum (3 years)*	*Maximum (year)*	*Maximum (3 months)*
	(m^3)	*(m^3)*	*(m^3)*	*(m^3)*	*(m^3)*
Coastal Division	20.000.000	2.000.000	10.000.000	4.000.000	1.500.000
Zeegra	12.000.000	1.200.000	4.200.000	1.500.000	750.000
Division of Maritime Access	3.000.000	300.000	2.000.000	1.000.000	650.000
Totaal	**35.000.000**	**3.500.000**	**16.200.000**	**6.500.000**	**2.900.000**

Table 1: Summary of the requested volumes.

Period and phasing of the project

This EIA is based on a total period of 10 years. This is the maximum period for which a concession can be obtained. The implementation of beach nourishment as part of the Integrated Coastal Security Plan is foreseen for the period 2010-2015. The implementation of the OW-Ostend plan is currently scheduled for 2012. The activities of Zeegra have a fairly constant character during the license period. This means that essentially, except in case of extreme weather conditions, sand will be dredged during the entire year. For the volumes requested by the Division of Maritime Access, at the moment it is impossible to estimate in which years sand will actually be dredged and used.

Description of the aggregate extraction process with a hopper

The process for extraction of sand (or gravel) consists of the following steps:

- The vessel departs from the port to the sand mining area for which a license has been issued;
- The dredging vessel, which in practice in Belgium will be a hopper, carries out the sand extraction activities.
- After the dredging process is finished, the ship sets course to the zone where the sand is unloaded.

4 ship types are considered, depending on the hopper volumes (2.500 m^3, 5.000 m^3, 7.500 m^3 and 12.500 m^3).

Legal and policy boundary conditions

The exploitation of sea sand and gravel is covered by the Law of June 13th, 1969 on exploration and exploitation of non-living resources of the territorial sea and the continental shelf. This law was substantially amended by the Law of January 20th, 1999 on the protection of the marine environment in marine areas under the jurisdiction of Belgium and the Law of April 22nd, 1999 concerning the exclusive economic zone of Belgium in the North Sea.

For the implementation of the Law on the Marine Environment (1999) and taking into account the federal plan for sustainable development two royal decrees were drafted:

- i.e. the procedural decision on the conditions, the geographical boundaries and allocation procedure of concessions for exploration and exploitation of minerals and other non-living resources in the territorial sea and continental shelf,
- and the decision rules on environmental impact assessment (EIA Decree).

Compared with some other European countries, the extraction of marine aggregates along the Belgian coast is quite limited. The management of sand and gravel is an assignment of the Federal Department of Economy.

The occurrence of storms is one of the major natural threats in the North Sea Region. The objective of the Integrated Coastal Security Implementation Plan (GKVP), which is currently in its final development phase, is to provide sufficient protection against flooding from the sea for the entire Flemish coast. Because sand suppletion is a very important measure in the current and future coastal defense policies, the policy on coastal protection is a major guiding factor for the need for extraction of aggregates in the Belgian Part of the North Sea.

Description of the alternatives

The exact definition of the four sectors within exploration zone 4 is the result of an optimisation process based upon different criteria, hence there is no alternative to the project site within exploration zone 4 that could be considered in this EIA.

Since out of economic considerations (loss of time, more fuel costs, ...) it is not inconceivable that there would be a preference for increased extraction in nearer areas and that there would be a preference to extract in a particular area because in this area high-quality sand is found, it is useful in the context of this EIA that two strategies are put forward:

- A strategy which assumes that the sand is dredged evenly on all four sectors;
- A worst-case strategy which assumes that the sand is only dredged in a specific sector, namely sector 2.

The environmental impact for each of these two strategies will be calculated. The environmental effects will be calculated for each of the 4 types of hoppers described above.

EVALUATION OF THE ENVIRONMENTAL IMPACTS

Soil & water

Lowering of the seafloor will cause a number of permanent physical effect such as: changes in the hydrodynamic processes, changes in the seafloor composition due to the exposure of underlying layers, and effects related to a disturbed sediment balance. In addition, a number of temporary physical effects occur during sand extraction (increase in turbidity, impoverished water quality,...). It is important to consider these potential effects against the background of the natural changes.

For the sand extraction within exploration zone 4, 2 dredging strategies are proposed, that will lead to different changes in seafloor topography.

- Scenario 1: a total needed volume of 35 million m³ would imply an extraction of about 0.75 m spread over the four sectors ;
- In the worst-case scenario 2, a total needed volume of 35 million m³ would imply an extraction of about 2.5 m in sector 2 alone;

It is expected that when material is removed, it will not be replenished by sediment supply from elsewhere, but more likely it will be compensated with material locally available. The average lowering due to sand extraction will not be bigger than the variations in height due to natural adaptation of the seafloor to the hydrodynamic circumstances.

The total lowering of 0.75 m (scenario 1) or 2.5 m (scenario 2) will be spread over a total period of 10 years. This means a (simplified) average lowering of 7,5 cm per year or 2,5 cm per year. These 'average' lowerings should however be put in the context of the technical minimum extraction depth of at least 20-50 cm for dredgers.

By removing the top layer of the seafloor, layers with a different grain size can become exposed at the surface.

Considering the relative size of the lowering (about 0.75 m in case of scenario 1 or about 2.5 m in case of scenario 2) with respect to the natural variations in sand dune heights (2-3 m), and with respect to the water depth (20-30 m), no significant changes due to sand extraction are expected in the overall current velocities, wave heights, current directions or ebb/flood dominance. Of course, local changes can occur.

Offshore sandbanks provide a natural protection of the coastline by breaking large waves before they reach the coast, and by increasing bottom friction what leads to reduced wave action at the coastline.

By lowering the offshore sandbanks an increased risk in beach and dune erosion can arise, as bigger waves can propagate in shallow water. However, this effect is most likely not significant considering the location of the Hinderbanks so far offshore in great water depths.

A first morphological effect of extraction on the sediment is the persistent presence of dredge marks. The BMM (2006) reports periods of 6 months to 4 years. A second effect is the potential influence of the lowering on the formerly prevailing sediment transport patterns (acceleration of erosion). In order to advance the recovery of the total height of the bank via natural regeneration processes, it is recommended to choose the extraction zones in areas with higher sediment dynamics, so that the surface will regenerate faster (BMM, 2006). These dynamic areas are characterised by the presence of important sand dunes (especially in the northern part of the Hinderbanks). In addition should be sought for areas were deposition occurs, instead of areas where erosion prevails. In the ideal case this would mean that the rate of extraction should be adapted to the rate of regeneration (Van Lancker et al., 2009a, 2010). In other words, the extraction should be kept within the natural variability.

It is recommended to continue research on the overall sand balance of the BPNS in order to be able to make conclusive statements on natural variations in size and direction of sand transport, especially near the Hinderbanks. There is still room for investigations about e.g. the significant influence of extreme storm events on the transport balance.

One of the main indirect effects of sand extraction is the formation of a sediment or turbidity plume and the resulting increased turbidity in the water column. What is of major importance is the translation of the potential temporary increases in turbidity and of the temporary effects due to deposition of sediment plumes, into effects on fauna and flora.It is expected that the temporary increase in turbidity related to sand extraction will be smaller than the concentrations that occur naturally during storms.

In case of the project area, the radius in which sedimentation occurs will be restricted to the zone of the banks where the benthic richness is anyhow smaller than in the swales. Such as the potential turbidity effect, also the sedimentation of the turbidity plume is considered not significant for both scenarios.

For both scenarios no significant effects are expected on the quality of the water column.

A monitoring program for bathymetry and hydrodynamics seems proper, and could be inspired on the monitoring strategy of the Kwintebank. Supplementary, some control on the changing seafloor grain-size distribution can be useful by taking a limited number of sediment samples.

Fauna, flora & biodiversity

Benthos

The extraction of marine aggregates in the project area causes a direct and indirect impact on the benthos. The most important biological effect is the direct loss of benthos species and individuals due to the removal of the sand from the seafloor. Additionally there can be indirect effects as a result of the removal of the sandy substrate, a change in sediment composition (loss of habitat), a change in the seafloor topography and the occurrence of sediment plumes.

The depth of the extraction mostly depends on the method that is being used. In the proposed project a Trailing Suction Hopper Dredger will be used, which sucks the top 20-50 cm of the seafloor through a suction pipe into the vessel. This way of operation has a large impact on the benthic fauna in the extraction zone, because the marine benthos is primarily present in the top 20 cm of the marine sediment.

In both cases the total area with habitat loss (46 km² and 14 km²) is small compared to the area of the BPNS (3600 km²). Moreover the sand extraction is limited to the tops of the sandbanks and does not happen in the gullies. These gullies are much richer in number of species, diversity and biomass.

A shift in the sediment composition can lead to a shift in the benthic communities that live on the sediment. Due to the proposed sand extraction a change from very course sand to more medium course sand can be expected. The effect of this shift is however rather modest.

High turbidity of the seawater can cause negative effects for certain suspension feeders. The filter mechanisms that this organisms use to sieve suspended food particles from the water can get constipated. But certain suspension feeders like the Muscle are for example also capable to filter seaweed from sediment rich water, which suggest they cope with increased turbidity.

Most organisms are adapted to this natural dynamics. And because sand extraction will generally only take place during good weather conditions, there is no cumulative effect with the increased water turbidity during a storm. The impact on the benthos will therefore be modest. Only the frequency of the occurrence of raised sediment concentration in the water can increase during the sand extraction.

The deposition of the suspended sediment in the plumes can also cause a negative impact on the benthos, by covering it with sediment. The extent of the impact depends on the species. However the sedimentation rate caused by the sand extraction project is limited and the sedimentation occurs mainly on the less biological valuable sandbank tops.

Fish

The potential impact of the sand extraction is relatively smaller than the impact on the benthos. Fish are more mobile organisms and can migrate more easily to less disturbed areas. The most important effects are loss of habitat and the impact of sedimentation.

The Westhinder sand bank, partly inside the project area, provided a spawning area for Herring species in the past. It is not known if the area still has this function. Also the gravel fields surrounding the Hinderbanks are possible important fish habitats. However this valuable gravel fields are not affected by the sand extraction. The impact of the sand extraction is limited to the sandbank tops.

Sediment plumes can cause a negative effect on certain fish species, but most fish species show evasive behaviour in case of increased suspension levels. The sediment concentration due to the sand extraction is also comparable with the natural concentration during a storm.

Birds

The extraction activities cause a loss of benthic biomass and density on the sandbanks. However the study area is of minor importance for benthos-eating seabirds that stay on the Hinderbanks in winter. The impact on the availability of food is small.

Increased turbidity of the seawater caused by sediment plumes can affect certain seabirds that hunt on sight like Auk and Tern. But the effect is temporarily and local. Quantitative research about the effects on the hunting success of seabirds is limited.

The extraction activities in the study area can cause disturbance of the present seabirds. The extent of the disturbance depends on the time of the extraction and the importance of the extraction site as a bird habitat.

Considering that the number of ships involved in the sand extraction is very small compared to the total traffic near the study area, it can be expected that the impact of the sand extraction is modest.

Air & climate

The expected total emission of NOx, SO2, hydrocarbons and fine dust during sand extraction for a certain time period is determined by the number of ship loads needed (depending on the ship type with particular bin volume), the emission per kWh engine power and the total time needed for extraction. The used power depends on the type of the ship (smaller ships have a smaller engine power and lower speed). The expected emission was calculated for the two scenarios (extraction distributed over four sectors or restricted to one sector), and for different ship types with a bin volume varying between 2,500 m^3 and 12,500 m^3.

From the calculations can be concluded that ships with a bin volume of 7,500 m³ give the smallest polluting emission. Smaller ships have a lower fuel consumption because of smaller engine power and therefore less emission, but have to travel more because of their smaller bin volume, what makes their total yearly emission larger. Bigger ships have to travel less frequently, but have a bigger engine power and therefore a larger emission. Ships with a bin volume of 7,500 m³ are the ideal compromise between fuel consumption and travel frequency.

The difference in emission between the two proposed dredging scenarios is minimal (less than 3% difference), because the difference between the two scenarios is only determined by the difference in travel distance which is only 1,6 km. Scenario 1 would lead to slightly higher emission values because of the larger distance between the harbour and the four sectors.

If we compare the average emission over one year for the national sea shipping traffic of SO2, NOx and fine dust in 2007, with the predicted emission due to the proposed dredging activities in exploration zone 4 for an average year (for scenario 1), than it is observed that the predicted emission of NOx and fine dust makes up only 10% of the values of 2007. Only scenario 1 was compared, as it would lead to the largest predicted values. The predicted emission of SO2 for scenario 1 makes up about 20% of the total values of the year 2007. In the future, however, the emission of SO2 will strongly reduce due to the stricter EU measures.

Interaction with other human activities

As figure 1 shows, there is a very intensive use of the limited area of the BPNS.

Fishing

Since there can be fishing within the sand extraction concession areas, there is no strict loss of fishing grounds in the BPNS due to aggregate extraction. Moreover, the benthic fisheries focus more on the slopes and gullies between the sandbanks, while the sand and gravel mainly takes place on the tops of the sandbanks. However, no data are available on the activity of sea fishing in the project area. One can therefore consider that there is no significant geographical influence on fisheries to be expected in the sand extraction area.

Multi-functionality can also be pursued in time. By arrangements between sand extraction activities and fishing at sea, the influence of sand activities on the sea fisheries in terms of time allocation (economic impact) are minimized. In conclusion, no significant adverse impacts is expected on fisheries and mariculture.

Navigation

Sand extraction in the exploration zone 4 will cause a number of ship movements back and forth of the area. Given the limited time for sand extraction within the area, the sand extraction does not provide adverse conditions on the (economic) use of the exploration zone 4 by any form of shipping.

Military activities

There is no geographical overlap between exploration zone 4 and designated areas for military operations. Within exploration zone 4 itself therefore no effect is expected. The dredging vessels, going to and from exploration zone 4, may impede military operations. Just like any other shipping movements, however, these ships will be requested to stay outside the military zone during the limited period when military activities are carried out.

Windfarms

There is – by Law - no geographical overlap allowed between sand extraction zone 4 and the zone for wind farms. The closest distance between the area for wind farms and the tip of sector 2 (sector closest) is still more than 5 km. There is therefore no likely impact of sand extraction on the wind farms.

Cables and pipelines

An activity such as sand is not very compatible with the presence of cables or pipes because the pipes can be exposed by the extraction of sand or even damaged. These fiber optic cables are often buried fairly superficial, with a typical depth of 0,5 - 1 meter below the seabed. There is a safety zone to 250 m on both sides of each cable to avoid such damage.

Therefore, the choice and designation of the four sectors is considering the location of the three cables: By that definition of the sectors no impact is expected from the sand extraction on the existing cables and pipelines.

Noise & vibrations

Underwater noise

The underwater sound will during operation be determined by the noise of the centrifugal pump (or by the suction pipe when the pump is attached in the suction pipe) and by the sound of the sediment in the suction tube. When the dredging process is complete, the sand will be transported to the storage area. The sound is then determined by the engine noise and is function of the frequency of shipping. Peak level between 80 and 200 Hz in shallow coastal waters rises up to 177 dB (re. 1µ Pa) at 1 m from the ship, attenuated to 130 dB (re. 1µ Pa) at 190 m from the ship (Beaver Mackenzie). The total sound pressure level under water at 1 m from a suction hopper dredger could vary between 172 dB

(Beaver Mackenzie) and 188 dB (Gerardus Mercator). With the current background noise level at the Thornton Bank, the continuous sound of a suction hopper dredger can be observed to a distance of about 20 km from the dredger. However, the real impact zone will depend on the contribution of natural sounds.

Noise above water

The specific sound in the open air of the suction activities was determined for one suction hopper dredger. The noise calculation results in a noise propagation from 1 km to obtain a contribution equal to the current background noise level. However, the real impact zone will depend on the contribution of natural sounds. For distances of several kilometers to the suction hopper dredger (e.g. the coastline and the Be/Ne-border), the noise contribution of the suction hopper dredger will be not audible to the human ear.

Noise due to shipping

During the operational phase there will be an increase of shipping by transporting sand from the exploration zone (4) to the storage area. Besides the temporary augmentation of the background noise by a passage of a ship, the total noise impact will be determined by the number of transports. The number of transport movements depends on the hopper volume of the dredger and the amount of sand that wants to mine within a specified period. The influence of these additional ships at the current ambient noise is generally insignificant compared to the current amount of shipping.

Noise during discharge

The storage area is usually situated near the ports where there is already a higher noise level compared to the residential areas. The addition noise emission during unloading of the dredger is relatively low so that the specific noise during discharge will be negligible.

Risk and safety

Shipping

While for the existing concession zones 1-2-3 hopper volumes of about 2,500 cubic meters are deployed, it will probably economically interesting in the more distant exploration zone 4 to exploit larger vessels. As the hopper volume increases, the number of loads, and thus the sailing frequency is reduced.

Based on the expected number of payloads for an average year and a worst case scenario "for three months, based on perceived quantity of material required for that period (four types of vessels with different hopper volume), the percentage increase in hazardous movements for sand extraction can be calculated.

Based on the number of hours per type of sailing vessel (hopper volume),this can be recalculated to a total figure for sailing hours. The figures for the maximum of 3 months were extrapolated to a full year.

Type (hopper volume in m³)	Average (year)	Maximum (3 months)
2.500	8.247,12	27.333,31
5.000	3.436,30	11.388,88
7.500	2.114,65	7.008,54
12.500	1.178,16	3.904,76

Table 2: Estimation of the number of sailing hours for an average year and a worst case scenario of three months.

The basis for the relative risk of collision is further assumed (Marin, 2009) in which an average attendance of 55 ships in the BDNZ assumed. Based on the number of sailing hours for sand extraction, an additional relative intensity of these 55 vessels are calculated.

Type (hopper volume in m³)	Average (year)	Maximum (3 months)
2.500	1,7%	5,7%
5.000	0,7%	2,4%
7.500	0,4%	1,5%
12.500	0,2%	0,8%

Table 3: Estimation of the percentage increase of intensity of traffic for an average year and a 'worst case' scenario of three months.

The additional maximum probability of collision is estimated based on an approximate quadratic relationship (very conservative) with the total intensity (Marin, 2009).

Type (hopper volume in m³)	Average (year)	Maximum (3 months)
2.500	7,4%	44,5%
5.000	2,9%	11,3%
7.500	2,1%	6,0%
12.500	1,5%	3,3%

Table 4: Assessment of percentage increase in collisions for an average year and a worst case scenario of three months.

The table above reflects immediately that for the maximum scenario (on a period of 3 months), larger ships will have to be used (than a type with hopper volume 2500 m³ or 5.000 m³). When you select for instance a hopper type with volume of 2,500 m³ would, approximately 12 crossings per day and the parallel deployment of more ships would be needed, which is unrealistic.

These estimates of percentage increases should be considered in absolute value by considering an average number of collisions per year. If such collisions are estimated at 14,5 (Leroy et al, 2006), it means the sand extraction is causing an absolute increase of 0,2 collisions per year (average situation, 12,500 m³ hopper volume, 1.5% increase) and 1, 6 collisions per year (maximum of 3

months, 5,000 m³ hopper volume, 11.3% increase). Such absolute values are probably in the order of accuracy of these calculations.

Sand mining can only be carried out when good weather conditions prevail. This has a consequence that all figures mentioned are certainly upper limits.

Oil

Oil spills caused by sand extraction will occur primarily by an unforeseen loss of oily substances from a ship sand (mainly diesel). When studying the impact of oil pollution the following aspects should be taken into account: the weather conditions during the pollution, the type of oil, the amount leaked and the place where the leak occurred. These features will determine the extent of the spill, the current influence and how quickly it will fall apart, emulsifying, evaporation, diffusion and sinking (Ecolas, 2006). The risk of oil discharges is proportional to the intensity (accidental loss during sailing) and the probability of collision (accidental loss due to a collision).

One may say that the approximate average frequency of oil spill for the BPNS of once every 31 years (Marin, 2009), due to the increase in shipping for sand, is rising to a frequency of once every 30,9 years to once every 29,5 years. This is a negligible increase in the same order of magnitude as the accuracy of these estimates.

Since April 2005 the new "North Sea Emergency Plan" is in force. The contingency plan describes the organization of assistance and coordination of operations during emergency situations or serious accidents in Belgian waters. In addition, the plan possesses an operational and practical character.

Monitoring of potential oil spill is already done by the BMM. Through observation in the air, the condition of the sea and all the activities happening at sea are followed closely. The flights will guarantee the immediate detection of abnormal situations, such as discharges of polluting substances or the presence of floating objects adrift (BMM website, 2010).

Seascape and cultural heritage

The exploration area is located approximately between 35 and 55 km from the coastline. Because of the curvature of the earth, everything up to about 62 meters above sea level disappears below the horizon at a distance of 35 km. At a distance of 55 km, this happens to all objects up to a height of 97 meters. These calculations are done for an observer on the dike at a height of 10 m. The dredging activities will not be visible from the coast and the impact on the landscape experience will be zero.

The low increase of traffic does not lead to a significant impact on the sea view. Given the limited impact of sea traffic on the perception of the landscape, the visual impact of the project on elements of the landscape atlas along the coastline will also be negligible. Regarding to maritime archaeology,

there are no known wrecks located in the four proposed areas for sand extraction. The project will thus again have no impact.

Cumulative effects

The possible effects of several simultaneous projects in combination with existing human activities at sea can lead to cumulative effects.Taking into account the location of exploration zone 4, the discussion of the cumulative effects can be limited to the discussion of the effects related to the activities of the Belwind project. The Belwind project obtained a concession zone for a large windmill farm (330 MW) on the neighbouring Bligh Bank.

There is a potential cumulative effect concerning the influence of both projects on the overall sediment transport on the BPNS. For the Belwind project meanwhile, monopile foundations have been chosen, while especially for gravitational foundations, a lot of sand has to be excavated and stored elsewhere. At this moment, no well-founded statements can be done about the presence of a cumulative effect concerning the overall sediment transport on the BPNS. It is therefore recommended to tune the monitoring campaigns of both the sand extraction activities and the wind farm activities, in order to study the potential cumulative effects during the realization of the projects. Numeric modelling of the hydrodynamics and sediment transport can help to better understand these complex processes in the future.

Several windmill farms are planned on the nearby Thorntonbank, Bligh Bank and Bank zondernaam (C-Power, Belwind, Eldepasco). This projects cause a loss of benthic habitat and benthic communities. The cumulative effect of the sand extraction with this windmill projects is limited. The total affected area is relatively small compared to the whole BPNS. Moreover the effects caused by the sand extraction are not permanent.

The construction and exploitation of the windmill farms in the nearby concession zone can cause a possible indirect cumulative effect on the fish fauna in the study area. Certain zones around the windmills will be restricted for fishery activities. The restriction can cause a change in the fishery intensity in other areas, also around the Hinderbanks. The overall effect of such a change is difficult to determine and adequate research is necessary.

In relation to seabirds the most important cumulative effect under consideration is disturbance due to ship traffic. However, the chance that the windmill projects and the sand extraction cause a significant increase of ship traffic at the same time is rather small. Thus, cumulative effects are not likely to appear.

There is a potential cumulative effect on the air quality due to emission of polluting matter during the activities of both the Belwind as the presented project. As the Belwind project has a positive influence on air quality, the cumulative effect is smaller than the individual effect of the sand extraction project.

The potential interaction with other human activities is first and foremost by geographical factors (i.e. activities that take place at the same location or close together so that one activity is affected by another activity). Given the fact that sand exploration and the Belwind project are not geographically overlapping, it is already clear that there is little to no cumulative effects to be expected.

Cumulative effects of the specific noise from the wind farms with those of the suction hopper dredger are limited to those under water, within the safety area of the wind farms. This area was under the wind farm projects already eliminated as a valuable area for marine fauna.

The type of noise source for the transport of sand from the exploration area (4) to the storage area is similar to that of the current shipping. Offshore is the argument that the additional transport intensity is negligible compared with the current fleet in the vicinity of the navigation route. The noise contribution of the transport during the project implementation is so small that there is no cumulative effect expected on the current shipping noise, both above and under water, as offshore and onshore.

Potential cumulative impacts refer to both an increased risk of collision and a heightened risk of oil spills, both due to a slight increase in intensity of shipping by sand and wind farm and the presence of the wind farm (collision with a turbine). A full blown calculation of the cumulative effect (both in terms of collision and oil spill) of both projects requires a numerical simulation that is outside the scope of this EIA. In approximation it can be stated that the cumulative effect will amount to the sum of the impact of each project. By closing the area for wind farms to shipping to a slight increase in the intensity of traffic is expected in the exploration zone 4. The activities within the sectors for sand extraction are so far away from the wind farm on Bligh Bank that no significant negative impact is expected regarding the likelihood of a ship collision (sand dredger) on a wind turbine on the Bligh Bank. Moreover sand mining takes place dominantly in good weather, lowering the chance of problems with navigation.

Cross-border effects

There are no cross-border effects.

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