Danish Energy Agency

Strategic Environmental Assessment of Hesselø Offshore Wind Farm (English translation of the non-technical summary, sub-report 1, section 1)

1. NON-TECHNICAL SUMMARY

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This non-technical summary describes the impacts on the environment and population that can be expected from implementing the Plan for the Hesselø Offshore Wind Farm. The summary briefly describes the plan and summarises the key environmental impacts of implementing the plan. The environmental impacts are described in more detail for all issues in sub-reports 2 (offshore) and 3 (onshore).

1.1 Plan for the Hesselø Offshore Wind Farm

In 2018, all the parties in the Folketing decided to build three new offshore wind farms, including Hesselø offshore wind farm, as part of the next step towards achieving 100% renewable energy in the electricity system by 2030. It was decided in the climate agreement of 2020 that Hesselø offshore wind farm should be distributing power to the electricity market by 2027. However, the tender process for Hesselø offshore wind farm was paused in June 2021 after preliminary studies showed the seabed was soft in large parts of the site. In the climate agreement of June 2022, it was decided that Hesselø offshore wind farm would be moved to a site south of the original Hesselø site. No changes have been made to the plan for onshore development. Hesselø offshore wind farm is expected to be completed by the end of 2029.

The plan area for Hesselø offshore wind farm is approx. 166 km^2 in size, and the site for the offshore wind farm is around 30 km from the coast (see Figur 11). It will be possible to install a wind farm with a capacity of at least 800 MW and up to 1,200 MW at the site. The plan does not stipulate the types, size or number of offshore wind turbines or how they will be arranged – the design of the offshore wind farm will be decided in a later project.

On land, implementing the plan involves carrying the power through underground cables that connect to the existing transmission grid. A new onshore high-voltage substation is also planned. The location of this has not been set in the plan, but a site west of Pårup has been proposed in the specific project. From there, power is transmitted and connected to the transmission grid at the existing Hovegård high-voltage substation, from where it can be transmitted to electricity consumers.

The environmental assessment of the Plan for the Hesselø Offshore Wind Farm covers the entire offshore wind farm and transformer platform at sea, the landing cables up to the new coastal high-voltage substation, and the underground cables from the new high-voltage substation to the Hovegård high-voltage substation.

1.2 Impact of the plan on humans and the environment

The purpose of producing an environmental report is to ensure that any significant environmental impacts from implementing the Plan for the Hesselø Offshore Wind Farm are identified, described and assessed.

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A summary is given below of the environmental impacts of the Plan for the Hesselø Offshore Wind Farm, based on part 2 of the environmental report for the plan at sea and part 3 for the plan on land, where the environmental assessments are divided into three main areas:

- People and society
- Biodiversity
- Water

See sub-reports 2 and 3 for a more detailed description of each area.

Figure 11: The Plan for the Hesselø Offshore Wind Farm covers offshore and onshore plant (Danish Energy Agency, 2022).

1.3 People and society – plan at sea

If the Plan for the Hesselø Offshore Wind Farm is implemented, the future offshore wind farm could have a visual impact on the landscape and thus on the population living in or near the surrounding coastal landscapes. The future offshore wind farm could also lead to noise, which could potentially impact human health if the noise from the offshore wind farm can be heard on land. An offshore wind farm could also potentially affect a number of environmental issues that have an impact on people and society, such as:

- Aviation safety.
- Navigation conditions and safety.
- Air and climate.
- Material assets such as raw material areas.
- Commercial fishing.
- Radar and radio links.
- Cultural heritage interests such as marine archaeological finds and the coastal landscape.

The assessed impacts for each of these elements are summarised below.

1.3.1 Visual impact

Offshore wind turbines can have a visual impact both during the day and at night, as they are visible in daylight and are lit up at night.

The distances from the surrounding coasts in Denmark and Sweden to the plan area for the Hesselø offshore wind farm vary from approx. 30 to 73 km. In Denmark, the nearest coasts are the south coast of Anholt, northwest of the plan area, and the coast of North Zealand at Græsted and Gilleleje, south of the plan area. In Sweden, the nearest coast is Kullen, which lies east of the plan area.

To assess the scope of the impact from implementing the Plan for the Hesselø Offshore Wind Farm, photos have been taken from the nearest coasts, and visualisations have been made showing the visual impact from completing a project that implements the plan. When assessing the visual impact on humans, the focus has been on the interplay between the sea and the coastal landscape, with particular emphasis on the landscape experience as viewed from the coast.

The potential visual impact on the surroundings is deemed to vary from a significant impact to no impact. The impact depends primarily on the distance from the coast to the plan area and the size of the wind turbines. The assessments depend, in particular, on whether the views from the affected coasts are already impacted by technical elements, whether the coasts have a natural character, and whether the view out over the sea is important to the overall landscape experience. The assessments carried out show that implementing the Plan for the Hesselø Offshore Wind Farm could potentially result in significant visual impacts from the coast of Anholt and the North Zealand coast at Gilleleje and Heatherhill near Rågeleje. The scope of the impact can only be assessed in connection with the environmental impact assessment report for the specific project. It should also be noted that even if it is possible in a specific project to reduce the visual impact from implementing the Plan for the Hesselø Offshore Wind Farm, the cumulative effect of implementing Hesselø offshore wind farm along with other nearby planned offshore wind projects will be a significant visual impact on the landscape along the North Zealand coast, on Anholt, in Djursland and along the Swedish coast.

Figure 12. Example visualisation from Fornæs Lighthouse in Djursland, showing Hesselø offshore wind farm with 15 MW turbines (corresponding to a total height of 280 metres). Much of the selected view (corresponding to the image) is filled with turbines. The extent of the water surface is thus very large. (NIRAS A/S 2024b)

The visual impact on the experience of the coastal landscapes at night is deemed to particularly affect the landscape on Anholt and on the North Zealand coast at Gilleleje and Heatherhill near Rågeleje, where the breadth of the offshore wind farm along the water surface, and hence of the lights, is large, and where the lights will be perceived as being relatively close. Even though the distance to the southern part of the North Zealand coast and the coast of Djursland and Kullen is greater, and the light impact is not deemed to be as significant as on Anholt, the visual impact of the lights is also deemed to be significant here for the experience of the coastal landscape at night.

1.3.2 Noise (airborne)

Implementation of the plan will result in the installation of an offshore wind farm within the plan area shown in Figur 11. When the offshore wind farm is in operation, the turbines will emit noise – primarily due to the movement of the blades through the air. This noise may potentially impact people living closest to the offshore wind farm. Potential impacts from airborne noise have therefore been assessed for the nearest noise-sensitive areas in Anholt, Djursland, North Zealand and Sweden (Kullen).

Calculations have been made of the airborne noise from an offshore wind farm that can be implemented under the Plan for the Hesselø Offshore Wind Farm. It has been deemed, on this basis, that the plan can be implemented without resulting in noise that exceeds the Danish limit values. For both scenarios (with 15 MW and 20 MW wind turbines), it can be concluded that the assumed source levels on which the calculations of low-frequency noise have been based cannot be increased, as

this may cause the limit value for indoor low-frequency noise to be exceeded. In relation to normal noise there is a larger margin.

The overall assessment is that the Plan for the Hesselø Offshore Wind Farm can be implemented with the stated wind turbine scenarios, without resulting in noise – including low-frequency noise – that exceeds the limit values for noise from wind turbines. However, the levels for the total low-frequency noise are close to the limit value. This factor will be included in the environmental impact assessment of the specific Hesselø offshore wind farm project. However, airborne noise from the Hesselø offshore wind farm is not expected to have a significant impact on the population and human health.

The plan area for Hesselø offshore wind farm lies approx. 33 km from the Swedish coast, and the noise impact on the Swedish coast has therefore also been calculated. The noise contribution from an offshore wind farm that can be implemented under the Plan for the Hesselø Offshore Wind Farm will be far below the Swedish limit values. Sweden does not have a recommended limit value for low-frequency noise, but the calculated noise contribution is below the Danish limit value. Implementing the Plan for the Hesselø Offshore Wind Farm will therefore not give rise to a potentially significant noise impact in Sweden.

1.3.3 Aviation safety

Airports and aerodromes have designated safety zones to ensure that there are no obstacles to aircraft during take-off and landing. The future offshore wind farm will be located at a great distance from the safety zones of the nearest airports and aerodromes. There will therefore be no obvious problems for flights in and out of the three nearest major airports – Aarhus Airport, Halmstad City Airport and Ängelholm-Helsingborg Airport. However, it cannot be ruled out that the latter airport may be affected, as its 55 km MSA surface overlaps with the plan area for Hesselø offshore wind farm.

An offshore wind farm implemented under the Plan for the Hesselø Offshore Wind Farm will be marked in accordance with applicable rules, and the construction work will be planned in collaboration with the Danish Civil Aviation and Railway Authority.

The overall assessment is that it will be possible to implement the Plan for the Hesselø Offshore Wind Farm without significantly impacting air traffic. However, the potential impacts of the Hesselø offshore wind farm on the three airports must be further assessed when the design of the final project for the offshore wind farm has been clarified. This further assessment will take place in connection with the environmental impact assessment of the specific project.

1.3.4 Navigation conditions and safety

Seven shipping routes have been identified which could potentially be impacted by implementing the Plan for the Hesselø Offshore Wind Farm. The impacts will primarily be seen during the operation phase.

Of the seven shipping routes, Route 3 is the one that will be most affected, as it runs right through the plan area for the offshore wind farm. Given the size of the offshore wind farm that implementation of the Plan for the Hesselø Offshore Wind Farm allows, there cannot be a fixed shipping route through the area after the

offshore wind farm has been built. An alternative route passing to the north of the plan area has been proposed.

The less busy north-south Route 4, which crosses the western part of the plan area for Hesselø offshore wind farm, is also expected to use alternative routes outside the plan area. An alternative route passing to the east of the plan area has been proposed.
The probability of a collision between ships and wind turbines is estimated to be low, corresponding to less than one collision every 200 years. Changing the routes could lead to a slight increase in the number of collisions between ships. However, due to the low traffic intensity on these routes, this increase is deemed to be negligible and not greater than the risk assessed for the original planning area.

Possible relocation of the shipping routes must be discussed with the Danish Maritime Authority in connection with planning a specific project for Hesselø offshore wind farm. A risk assessment of navigation conditions and safety must also be performed in connection with a specific project.

1.3.5 Marine archaeology

Implementing the Plan for the Hesselø Offshore Wind Farm could potentially affect marine archaeological finds and sites such as wrecks and settlements. Based on the archival inspection (Dalicsek, 2023), a total of 27 potential wreck locations have been identified within the plan area for the wind farm. Twenty-two of the identified locations were found using the database for Finds and Ancient Monuments (FAM). Ten positions were identified from the Wreckage Guide, of which six matched with FAM sites. Three of these six were noted as certain wreckage positions. From the geoarchaeological seabed analysis for the cable corridor, two SSS anomalies were also found.

In connection with the marine archaeological analyses, preservation zones have been proposed for potential finds in the plan area, which can be changed or nullified following further investigations. Potential marine archaeology finds will therefore not prevent implementation of the Plan for the Hesselø Offshore Wind Farm.

Impacts on marine archaeology interests are very location-specific. Impacts on specific potential marine archaeology finds are therefore not assessed at plan level.

1.3.6 The coastal landscape

Implementation of the Plan for the Hesselø Offshore Wind Farm could impact the character and experience value of the coastal landscape, and the extent of this impact has therefore been assessed. The value of the open Danish coasts and the interplay between the sea and coast have been emphasised in the assessments.

All of Anholt, the entire North Zealand coast and the entire east coast of Djursland have been designated as landscapes worthy of preservation. This means that the landscapes have been attributed special value, and special attention must be paid to preserving and strengthening the nature of the landscape, including its visual character and experience value. The landscape may therefore be vulnerable to visual impacts.

Large parts of Anholt and some areas along the North Zealand coast and the east coast of Djursland are also protected for various purposes, and preserving the views out to sea from the coast is a recurring theme.

Cultural environments have also been designated along the North Zealand coast and the east coast of Djursland. The cultural environments and the value they add to the landscape are not deemed to be vulnerable to visual impacts from Hesselø offshore wind farm. However, large parts of Kullen have been designated as particularly valuable cultural environments, adding a special experience value to the landscape at Kullen. Kullen has also been designated a nature reserve, with a focus on the area's nature and landscape value. Together, these add great value to the landscape at Kullen, and it is deemed to be vulnerable to visual impacts from an offshore wind farm that can be implemented under the plan.

The visibility of the offshore wind farm is deemed to be extensive from these landscapes, impairing the visual character of the coastal landscapes, including the views that are key to the value attributed to them. Overall, implementation of the Plan for the Hesselø Offshore Wind Farm is therefore deemed to have a significant impact on the landscapes along the North Zealand coast, the east coast of Djursland, on Anholt and at Kullen.

1.3.7 Air and climate

Overall, implementation of the Plan for the Hesselø Offshore Wind Farm is deemed to contribute positively to meeting the Danish Climate Act target of a 70% reduction in CO_2 emissions by 2030 compared to 1990.

When Hesselø offshore wind farm begins operation, the share of wind power supplied to Danish consumers will increase. The offshore wind farm will thus help to displace electricity produced from fossil energy sources, further decreasing average CO_2 emissions from electricity. How large the reduction in greenhouse gas emissions will be as a result of wind turbine production depends on how the other electricity in society is produced and which fuels or energy sources are displaced. Where electricity generation from green energy sources, including wind turbines, displaces coal, oil or natural gas, there will be a large reduction in CO_2emissions.

A reduction in greenhouse gases over a period of 30 years will have a positive impact on the climate with medium intensity and duration. This reduction will occur in a climate characterised by high vulnerability and potentially irreversible trends. Hesselø offshore wind farm is therefore deemed to have a significant positive impact on the climate.

1.3.8 Commercial fishing

The implementation of Hesselø offshore wind farm will impact commercial fishing in the plan area during both the construction and operation phases. The potential impacts will be limitations on commercial fishing operations in the plan area due to temporary and permanent safety zones, and impacts on fish resources due to sediment spillage when installing foundations and laying cables and loss of/changes to habitats due to the installation of foundations for offshore wind turbines and the transformer platform. The foundations and protective materials around these and above the cable grid will form artificial reefs, which can serve as new habitats for a number of fish species, including cod, while other species associated with other seabed types will have their habitats reduced.

As shown in Figur 13, bottom trawling is very intensive in the south-eastern part of the plan area. There is also high intensity bottom trawling in a trawl corridor in the centre of the plan area and in a sub-area of the plan area for the landing cables. The remaining part of the wind turbine area is fished to only a limited extent, and trawl fishing is less intense in the southern part of the plan area for the landing cables.

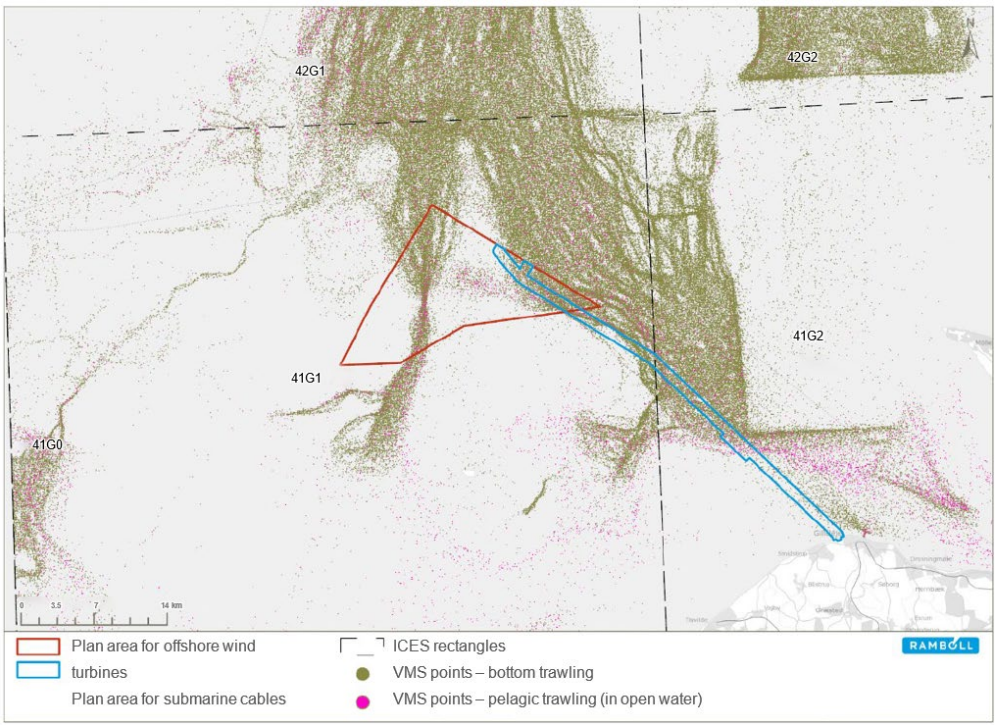

Figure 13. Map of the plan area for Hesselø offshore wind farm with data points showing where bottom trawling and trawling in open water occur.

During the construction phase, the general assessment is that the impact will not be significant for fishing with pelagic trawls, nets, seines and other gear (traps and pots etc.), as such fishing is either limited, or it is deemed that it can take place in surrounding areas. Excluding fishing operations, especially in the central and south-eastern part of the plan area, will have a negative effect on bottom trawling. It is therefore deemed that exclusion from the plan area during the construction phase will have significant consequences for bottom trawling.

During the operation phase, the general assessment is that the impact will not be significant for fishing with pelagic trawls, nets, seines and other gear (traps and pots etc.), as such fishing is limited, and is actually not covered by the Cable Order (Executive Order no. 939 of 27 November 1992). Fishing using bottom-dragging equipment is expected not to be permitted over the cables in the offshore wind farm or the landing cables during the operation phase, in line with the provisions in the Cable Order (Executive Order no. 939 of 27 November 1992). A permanent ban on bottom trawling in the offshore wind turbine area will have significant consequences for commercial fishing. In principle, fishing can be diverted to other fishing areas, but not without negative consequences, particularly for bottom trawling, which will permanently lose a fishing ground for the Norway lobster. It is therefore deemed

that exclusion from the offshore wind turbine area, and generally above landing cables, for fishery using bottom-dragging equipment, will have significant consequences for bottom trawling.

1.3.9 Radar and radio links

Implementation of the Plan for the Hesselø Offshore Wind Farm may impact radar coverage, for meteorological radar, aviation radar, ship radar systems etc. As a general rule, the closer an offshore wind turbine is to a radar system, the greater the likelihood that the turbine will affect the radar. Offshore wind turbines can also affect radio communication, including radio chains, if placed in the sight lines of the radio chains.

Implementation of the Plan for the Hesselø Offshore Wind Farm may lead to disruptions to civil radar systems, resulting in minor or no potential impacts on the weather radar system at Stevns and Virring Skanderborg. The impact can be assessed more precisely when the specific dimensions of the wind turbines in a future project are known.

As for ship radar systems and radio chains, the impact is deemed to be minor or zero.

1.3.10 Raw material areas

An offshore wind farm could have an impact on the possibility of extracting raw materials at sea, for example if the offshore wind farm is located in existing or potential areas for extraction of raw materials, as this can potentially impact on the future acquisition of raw materials.

The plan area for Hesselø offshore wind farm does not overlap with or border on existing raw material extraction areas. Implementation of the project the plan forms the basis for will therefore not affect the possibility of extracting raw materials in this part of the Kattegat.

The potential impact from the Plan for the Hesselø Offshore Wind Farm only concerns a small number of raw material resources and a single development zone. Overall, raw material areas are deemed to not be vulnerable, as there are other areas where the same resource can be extracted. The conclusion is therefore that implementation of the Plan for the Hesselø Offshore Wind Farm will have an insignificant impact on raw material areas.

1.4 People and society – plan on land

Implementation of a project under the Plan for the Hesselø Offshore Wind Farm could lead to visual or noise impacts on the population around the onshore facilities. The onshore facilities may also impact cultural interests in the form of archaeological finds and landscape characteristics. There will also be an impact on land areas, as some will be used for high-voltage substations, and a potential impact on material assets such as valuable agricultural land and raw material areas. These matters are therefore summarised in this section on people and society on land.

1.4.1 Landscape and visual impact

The Plan for the Hesselø Offshore Wind Farm allows for power from the future offshore wind farm to be connected to the existing transmission grid at the Hovegård high-voltage substation near the village of Hove. The plan also includes

the possibility of establishing a new high-voltage substation south of Gilleleje. The location of this has not been set in the plan, but a site west of Pårup has been proposed.

A new high-voltage substation west of Pårup and expansion of the Hovegård high-voltage substation may lead to visual impacts on the local community living near the substations and the landscapes in which the facilities are established.

It will be possible to place a new high-voltage substation west of Pårup at a certain distance from built-up areas. It is therefore deemed that there will be no significant visual impact on the population around the area where a high-voltage substation could be located. This conclusion is based on the fact that a high-voltage substation can be integrated into the landscape, and that the visual experience of the plant will therefore also be minor when moving through the landscape, along roads and paths etc.

In relation to the expansion of the Hovegård high-voltage substation, the experience of the landscape around Hove is already impacted by high-voltage towers and cables, as technical elements. The substation area is generally not visible as it is concealed by vegetation, but it is visible to some extent during the winter months (see Figur 14 and Figur 15).

Figure 14. The landscape southwest of Hovegård high-voltage substation, looking from Hove Møllevej towards the substation area. (Photo: NIRAS A/S)

Figure 15. The landscape north of Hovegård high-voltage substation, looking from Lundevej towards the substation area. (Photo: NIRAS A/S)

In the long term, there is expected to be no impact on the local population in terms of visual experiences in the area, as the extent and nature of the technical impact on the landscape will not differ significantly from the impact due to the existing substation. However, for several years following the expansion, the substation will be more clearly visible and the visual impact may be significant. This will particularly affect the experience of the landscape in Værebro Ådal. This impact will diminish as newly planted vegetation around the substation area grows.

From the village of Hove, it is expected that an expanded high-voltage substation will be hidden by buildings in most areas. However, an expanded high-voltage substation will most likely be visible from the northern periphery of the village, which has a clear view of the substation area. This impact will diminish as new vegetation planted around the substation grows, concealing it from the surrounding area.

There are two hiking routes near Hove – the Hove route, which is a scenic route, and the Church route, which is a cultural route. If expansion of the Hovegård high-voltage substation requires rerouting of these hiking routes, both of which pass nearby the existing substation area, it is deemed that this will have no significant impact on the experience of the churches located along the Church route, or of the landscape on the Hove route.

1.4.2 Noise

This section summarises the noise impact from onshore facilities that the Plan for the Hesselø Offshore Wind Farm allows. Noise from onshore facilities the Plan for the Hesselø Offshore Wind Farm allows for has only been described for the operation phase, as the noise impact from the construction phase will be assessed in connection with implementing a specific project.

High-voltage substations are expected to be in operation around the clock, every day of the year, and noise may be emitted from various technical installations within the substation areas.

The plan involves building a new high-voltage substation south of Gilleleje in the Municipality of Gribskov. It is expected that the new high-voltage substation can be built on open land, where the recommended noise limit values can be met.

The Plan for the Hesselø Offshore Wind Farm also involves connection to the existing Hovegård high-voltage substation. This substation is located just north of the village of Hove, in an area designated for technical installations in the local plan. The plan does not set a specific location for the area where the existing substation will be expanded, but the noise impact of a specific project has been calculated and included in the environmental impact assessment report for onshore facilities, and also in this environmental report as a possible scenario that can be implemented within the framework of the plan. The assessment is based on the assumption that noise suppression is employed and stricter noise requirements are applied to components. Noise barriers are already in use at the Hovegård high-voltage substation, and an example can be seen in Figur 16. Exactly which plant will have noise suppression in connection with the expansion of the Hovegård high-voltage substation must be decided in relation to a specific project.

Even if noise suppression is deployed at the expanded high-voltage substation, given the location of the existing plant close to homes, it is deemed that operation of the scenario analysed will mean that some of the nearby properties cannot be used as homes. In order to implement the Plan for the Hesselø Offshore Wind Farm without exceeding the recommended noise limits, it may therefore be necessary to purchase the nearest properties in order to prevent them being used for housing.

Based on the above, it is deemed that it will be possible to implement the Plan for the Hesselø Offshore Wind Farm without significant noise impacts on the surroundings.

Figure 16: Noise barriers (noise walls) at the existing Hovegård high-voltage substation.

1.4.3 Land and soil areas

Land use and flood risk have been described in the areas where land might be permanently designated for the installation of high-voltage substations. A brief summary of these descriptions is presented below.

Zone status
The review of the zone status shows that it is possible to implement the Plan for the Hesselø Offshore Wind Farm without affecting holiday home areas or areas within existing or planned urban zones. It will primarily be areas in rural zones that will be affected by the onshore facilities in the Plan for the Hesselø Offshore Wind Farm.

Finger Plan

The Hovegård high-voltage substation will be expanded within the transport corridor in the Finger Plan. Changes to and expansion of the Hovegård high-voltage substation will require new planning before implementation. A national planning directive is therefore being developed which will provide the necessary planning foundation.

Planned land use by the municipality
A review of the planned land use by the municipality shows that the plan can be implemented without overlapping with urban built-up areas, industrial areas or technical installations. There are several low-lying areas in the region for a new high-voltage substation, particularly in the area near the Hovegård high-voltage substation, but it is deemed to be possible to establish a new high-voltage substation outside the identified low-lying areas. The low-lying areas near Hovegård high-voltage substation are part of a larger contiguous area, and although implementation of the plan will mean that nature restoration will not be possible in these areas, they are deemed to constitute an insignificant part of the large Værebro Ådal region, which has the potential to be developed in future nature restoration projects.

Flooding
It is deemed to be possible to build a new high-voltage substation and expand the Hovegård high-voltage substation without significant risk of the areas being flooded in connection with heavy rain events and future sea level rises.

1.4.4 Landscape and cultural heritage

Landscape
The Plan for the Hesselø Offshore Wind Farm does not specify the location for a new high-voltage substation, but the environmental impact assessment report for the specific project assumes a location west of Pårup. The landscape types and terrain around Pårup are shown in Figur 17. The map also shows an example project proposal that could be implemented under the Plan for the Hesselø Offshore Wind Farm. The area around Pårup is open agricultural landscape to the west and northwest, more characterised by vegetation and delimitation to the east, and higher and more mixed undulating landscape to the southwest. To the north, dense holiday home areas along the coast bound the landscape and stand in sharp contrast to the agricultural landscape.

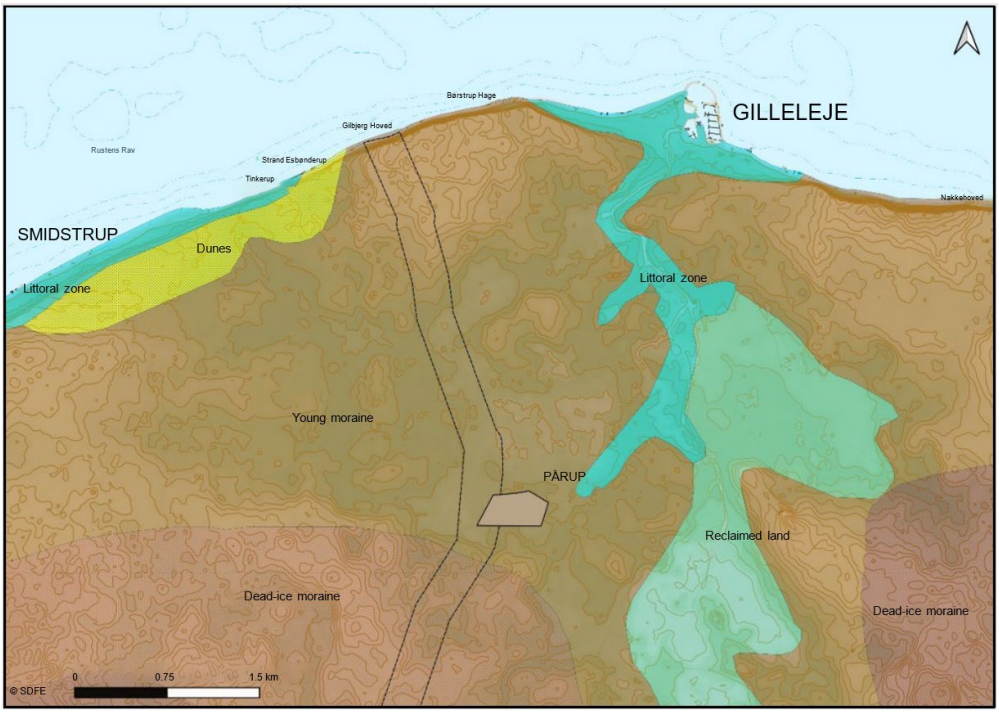

Figure 17. Figure showing landscape types and terrain around Pårup, including how the terrain is lower around Pårup, and rises into more undulating terrain to the southwest and along the coast. The map also shows the study area for a project that could be implemented under the Plan for the Hesselø Offshore Wind Farm. The brown shaded area shows an example location for the substation west of Pårup.

The landscape around the Hovegård high-voltage substation is highly impacted by the existing substation. The substation area is largely concealed by vegetation, so that it is only minorly visible, and primarily locally around the substation. Photos of the landscape together with the existing substation are shown in Figur 14 and Figur 15.

Overall, the Plan for the Hesselø Offshore Wind Farm is deemed to be feasible, without significant impact on the surrounding landscapes. However, a new high-voltage substation and expansion of the existing high-voltage substation at Hove will have a significant impact on the surrounding landscapes for some time. The impact will be reduced as the concealing vegetation becomes fully established and reaches sufficient height and density to have a visually concealing effect.

Cultural heritage and archaeology
In the area where the Plan for the Hesselø Offshore Wind Farm can be implemented, there are protected areas, ancient monuments, cultural environments, cultural heritage areas, protected stone and earth dikes and heritage-listed buildings. Impacts can be avoided by building onshore facilities away from these, or by passing under protected areas etc. using horizontal directional drilling. If the latter, horizontal directional drilling must be done at a depth that ensures impacts on any ancient monuments in the earth are avoided.

In addition to the known ancient monuments, there may also be hidden ancient monuments in the earth. Before construction work can commence, the responsible

museums will perform an archival check of the area planned for development, and assess, based on this, whether any excavations are needed to map out unknown ancient monuments. If it is not possible to avoid construction work in areas with underground ancient monuments, or to drill under these at such a depth that impacts can be ruled out, such ancient monuments could be excavated and preserved for posterity.

Based on the above, it is deemed that the Plan for the Hesselø Offshore Wind Farm can be implemented without significant impacts on cultural heritage and archaeology.

1.4.5 Material assets

Onshore facilities for a future offshore wind farm may have impacts on material assets, including agricultural operations and raw material interests.

There are several areas in the plan area that have been designated as particularly valuable agricultural land in the respective municipal plans. However, the particularly valuable agricultural areas are not necessarily linked to the soil's cultivation quality.

If cable systems are established on agricultural land, it will potentially result in crop losses. Structural damage may also occur in the soil during construction work, so that soil fertility is reduced in the following years. After the construction work, it will be possible to continue agricultural operations above the cables – subject to certain limitations. Against this background, it is deemed that the Plan for the Hesselø Offshore Wind Farm can be implemented without significant impacts on particularly valuable agricultural areas.

There are several resource excavation areas or resource interest areas in the region where the Plan for the Hesselø Offshore Wind Farm is to be implemented. It is deemed that implementation of the plan will not have a significant impact on resource excavation areas or resource interest areas, as the area required for a cable installation is so limited that it will be possible to route cable installations outside these areas.

1.5 Biodiversity – the plan at sea

Construction of an offshore wind farm implementing the Plan for the Hesselø Offshore Wind Farm could potentially impact marine biodiversity, including marine life on the seabed, marine mammals and fish, and birds and bats living near the sea. The protected Natura 2000 sites could also potentially be affected. The assessments made of these issues are summarised in the following sections.

1.5.1 Seabed flora and fauna

The plan area for the Hesselø offshore wind farm contains both hard and soft seabeds. Bottom flora and fauna associated with these two types of seabed are thus also found in the area.

Surveys of seabed flora and fauna in the plan area show that several species are found in connection with the hard seabed in the cable corridor area. Both red and brown algae grow on the stony bottom, and there are several animal species, such as mussels, starfish, crustaceans, moss animals, coral animals and sea sponges. No plants have been registered on the soft seabed, but several animal species,

including brittle stars, mussels, heart urchins and Polychaete worms. Examples images of flora and fauna from the field studies of the hard seabed are shown in Figur 18.

Figure 18. Images of flora and fauna associated with the hard seabed within the plan area for the cables that will carry power from the offshore wind farm to shore. A: Red algae and serrated wrack brown algae. Breadcrumb sponge can be seen as a yellow mass in the bottom right corner. B: Clawed fork weed is the primary species growing on the stone. Filamentous algae are growing on the clawed fork weed. C and D: Species such as spiny starfish, hydrozoans and dead man's fingers (a soft coral). Both images show calcareous red algae. Photos: DCE, Aarhus University.

Based on the estimated sensitivity of the species and seabed communities in the plan area for the Hesselø offshore wind farm, the initial conclusion is that implementing the Plan for the Hesselø Offshore Wind Farm will only result in small or negligible potential impacts on species and communities as a result of stirred up sediment and organic matter, electromagnetic fields, underwater noise and temperature.

Implementing the plan and building an offshore wind farm could impact seabed life during the construction and operation phases. The potential impacts during the construction phase could result from temporary loss of habitat, sediment spillage, sediment deposits, disturbances and environmentally hazardous substances. During the operation phase, seabed life could potentially be impacted by invasive species, changes in currents, water exchange, water quality etc., as well as changes to and permanent loss of habitats. Most of these potential impacts will be minor or insignificant for seabed-based flora and fauna. Only impacts resulting from sediment spillage during the construction phase and changes to soft and hard seabed communities might be more extensive, and these are therefore described below.

Soft-seabed communities
Implementation of the Plan for the Hesselø Offshore Wind Farm will result in parts of the seabed occupied by soft-seabed communities within the plan area being used for wind turbine foundations, and changes to soft seabed areas.

It is expected that wind turbine foundations will be protected by rocks to prevent erosion of the seabed around the wind turbines. This is called erosion protection, and is a standard practice in most offshore wind farms. Establishing erosion protection will introduce a new hard seabed substrate within the plan area for the offshore wind farm, in areas where only soft-seabed substrate currently exists.

Only a very small part of the total soft-seabed habitat in the plan area will be used for foundations and erosion protection. The exact area size will not be known until wind turbine size, foundation type and the number of offshore wind turbines have been decided. Given that the proportion of the area with soft-seabed habitat that will be taken up is very small, the positive impact on biodiversity and the addition of more habitats to the area, the loss of habitat is not deemed to have a negative impact on the soft-seabed community. This is despite the fact that the soft-seabed community has a high sensitivity to habitat changes.

Hard-seabed communities
Before the cable is laid on the seabed, it may be necessary to move large rocks to level out the rock bottom in a band 1-1.5 metres wide. When subsequently covered with rocks, the physical conditions for the hard-seabed communities will be restored. The rocks will form structures that can create suitable habitats for anchored flora and fauna, which can become re-established and thus restore the biological structure and function of the reef. The potential impact on hard-seabed communities will therefore not be permanent, but a temporary impact for the time it takes the associated flora and fauna to become re-established in the area.

Implementation of the Plan for the Hesselø Offshore Wind Farm is deemed to potentially result in a moderate impact, as there will be a medium-duration, but not permanent, impact on a small part of a marine habitat that is only found in Danish waters to a limited extent.

Sediment spillage
Implementing the plan to build an offshore wind farm could lead to sediment spillage and subsequent sediment deposits as a result of construction work in the seabed. Sediment spillage will primarily occur in areas with a soft seabed.

The bottom fauna found in areas with a soft seabed generally tolerate being covered, as they live in conditions where natural sedimentation occurs to some extent. Most of the species living in or on a soft seabed will therefore become re-established in the area relatively quickly once construction work ends. The potential impact on soft seabed bottom fauna due to sediment spillage and deposits is therefore deemed to be ‘not significant’.

Hard-seabed communities are generally more sensitive to being covered with sediment than soft-seabed communities. Given that hard seabeds reefs are only found in the plan area for the cable corridor, hard seabed flora and fauna may experience sediment deposits in connection with cable laying and horizontal directional drilling near the coast. In the assessment of impacts on reefs in the designation basis for Natura 2000 site no. 195, it is assumed that in areas with

reefs (both within the Natura 2000 site and contiguous reefs outside the Natura 2000 site), cables will be laid on the surface. This will avoid sediment spillage which could impact nearby habitats, as only large rocks will be moved to level the seabed before the cables are laid. Given the assumptions that horizontal directional drilling at the coast will stop approx. 100 metres from the nearest identified reef, and that cables in sandbanks will be laid using trenching, it is deemed that the potential impact on hard-seabed communities due to sedimentation will be very limited in both extent and thickness.

1.5.2 Marine mammals

Implementation of the Plan for the Hesselø Offshore Wind Farm will only lead to minor or insignificant impacts on marine mammals due to stirred up sediment, underwater noise from ship traffic, airborne noise, electromagnetic fields, underwater noise from operating offshore wind turbines and habitat changes due to the introduction of hard-seabed substrates.

The primary impact on marine mammals will be in the scenario where the offshore wind turbines are built with pile foundations – where underwater noise generated by driving of pile foundations for the wind turbines impacts marine mammals. The impact of underwater noise on marine mammals will be greatest close to the noise source and decrease with increasing distance. Underwater noise could lead to changes in behaviour at a great distance. Closer to the noise source, temporary hearing loss (TTS) may occur, and the sounds will be so loud very close to the noise source that permanent hearing loss (PTS) and damage to tissue other than hearing organs may occur.

The presence of installation vessels and the underwater noise generated by construction activities will mean that there will be no marine mammals in the immediate vicinity of the construction activities. It is therefore deemed that the environmental impact in the form of temporary (TTS) and permanent (PTS) hearing damage in seals and porpoises will be negligible.

For both porpoises and seals, the underwater noise may lead to brief, temporary changes in behaviour, and the impact is deemed to be moderate.

Assessment in relation to Annex IV of the Habitats Directive
Based on current knowledge, it cannot be ruled out that the plan area constitutes a breeding area for porpoises. The breeding area may therefore be affected by underwater noise from construction activities. Once offshore wind farms have been built, no negative impacts on the porpoise breeding area are expected. The exclusion of commercial trawling from the offshore wind farm may even contribute to better protection of food sources for porpoises in the area, and this may have a positive impact.

The overall conclusion regarding porpoises in relation to the Annex IV protection is that implementation of the Plan for the Hesselø Offshore Wind Farm will not damage or impair breeding and resting areas for the species, as the potential expected impacts will only be brief and temporary, and only result in a temporary displacement of porpoises during the construction work. The Plan for the Hesselø Offshore Wind Farm also does not include any likely scenarios where there is a risk of porpoises being deliberately killed.

1.5.3 Fish

The Kattegat represents potentially important spawning and nursery areas for many fish species. The soft seabed found throughout most of the plan area for the Hesselø offshore wind farm is a nursery area for dab, plaice and whiting. There are important spawning areas for cod north and east of the plan area, but no indications that the plan area contains such areas.

In the parts of the plan area with a soft seabed, there are species such as dab, plaice, whiting, sprat, herring and greater weever, while the species in the parts of the plan area for the submarine cables with a hard seabed include goldsinny wrasse, dab, whiting and various species of goby.

Impacts on fish from the construction and operation of an offshore wind farm allowed under the Plan for the Hesselø Offshore Wind Farm will primarily result from sediment spillage, underwater noise and changes to and loss of habitats. These are described below.

Sediment spillage
High concentrations of sediment in the water can reduce fish's visual foraging and also oxygen uptake by clogging the gills. However, the impact from sediment spillage varies among the different fish species, and is typically related to where the fish live. Fish that live near the seabed are more tolerant of sediment in the water phase than fish living in open water.

The most likely response to high concentrations of sediment in the water phase will be that the fish flee from the area while the construction work is ongoing. Afterwards, the fish will most likely return. Given that the duration of the elevated sediment concentrations in the water phase will be short, and that sediment deposits are expected to have a very limited geographical spread around construction work, the overall impact on fish stocks from sediment spillage and deposits is deemed to not be significant.

Underwater noise
Underwater noise can impact fish at all life stages, the most vulnerable being fish eggs and larvae, as well as fish with swim bladders such as herring, sprat and cod species. Fish that are close to the pile driving areas are at risk of fatal damage, permanent hearing loss, tissue damage or changes in behaviour. For fish that are further away from the noise source, the primary response is likely to be that the fish vacate the noise-affected area during the periods when the noise from construction activities is most intensive. The fish will quickly return when construction work has ended. For the most sensitive species, such as herring, sprat and cod, hearing loss may occur (but will be temporary). The requirement that pile driving in connection with the installation of wind turbine foundations must start slowly will give fish time to leave the area before the construction work begins at full strength.

Based on the above, and given that the ramming time for offshore wind turbine foundations will be short, the overall impact on fish and fish stocks due to underwater noise is deemed to not be significant.

Habitat impact
During the construction phase, laying cables on the seabed will lead to temporary loss of fish habitats, while taking up parts of the seabed for wind turbine

foundations and protection around the turbines will permanently change habitats, with areas with a soft seabed being converted into areas with a hard seabed.

Laying cables in the plan area will lead to a temporary impact in the form of disturbances and short-term destruction of existing fish habitats. Landing cables will have to be laid through several types of fish habitats – with both soft seabeds and reefs. Irrespective of whether the cables are laid in or on top of the seabed, it is expected that the seabed will be restored following the laying. For areas with reefs, in particular, the impact will be of extended duration, but in the early stages of succession, the reef will serve as a hiding place for fish and crustaceans, and although it will take several years before the reef can qualify as a 'climax community', it will maintain a large part of its functionality throughout the period. Fish will therefore be able to use an evolving reef, and various fish species associated with reefs will rapidly return from nearby hard seabed areas to an evolving reef area in the intervening period.

Against this background, and given that the various fish habitats are spread over large areas in and around the plan area and in the Kattegat in general, and that the identified habitats in the plan area are not unique among the fish habitats in and near the plan area, the impact on fish and fish stocks due to disturbances and loss of habitats is deemed to not be significant.

Limiting trawling in the plan area may lead to an increase in local populations, particularly of bottom-dwelling fish that are exploited commercially, because the fishing pressure in the area will be reduced.

1.5.4 Birds

1.5.4.1 Migratory birds

The plan area for Hesselø offshore wind farm is not located near the commonly known migration routes for birds. Yet new observational data suggests that a wide variety of species are observed in the plan area, and some are common species in the area. For the commonly occurring species, the risk of collision has been assessed.

The species studied all exhibit high evasion rates and therefore have little risk of collision with wind turbine blades. The common species of migratory birds also belong to robust populations that are either stable or increasing. It is therefore deemed unlikely that implementation of the Plan for the Hesselø Offshore Wind Farm on its own, or together with the expected cumulative effects from other offshore wind farms, will lead to enough deaths or disturbances to negatively impact the populations of the migratory birds studied.

1.5.4.2 Resting seabirds

Based on existing data, the modelled displacement estimates and the uncertainties inherent in the assessments, it is deemed that displacement of seabirds from the new plan area, including impact zones, will not adversely affect the total migratory bird populations of the species studied. Implementation of the Plan for the Hesselø Offshore Wind Farm is deemed to not conflict with the provisions of the EU's Conservation of Wild Birds Directive.

It is recommended that a population model be developed for sensitive seabird species, which can be used in future to more accurately assess the impact of

displacement on the population, in order to better estimate the expected impact of planned offshore wind farms.

1.5.5 Bats

Bats were observed during a brief period in spring and a brief period in autumn. It is therefore assumed that there are migratory bats. Most sightings are of Nathusius' pipistrelle, common noctule and parti-coloured bats. There was only a single bat sighting in the summer on Hesselø itself, and therefore no signs of breeding activity on Hesselø (WSP, 2023). Given that the plan area lies more than 30 km from large land areas, it is not expected that it will be used by foraging bats.

Building offshore wind turbines in the plan area at Hesselø may pose a risk to species migrating across the southern Kattegat. In the preliminary results from the bat monitoring at Hesselø, migrating bats have been observed. Preliminary data suggests that bats migrate on relatively mild and quiet nights. Data from investigations at Kriegers Flak offshore wind farm suggests that bats avoid migrating across the sea when wind speeds exceed 5 m/s (Christensen & Hansen, 2023).

If the majority of bats avoid flying at wind speeds above 5 m/s, there is a high probability they will avoid collisions with wind turbine blades, as offshore wind turbines often have a cut-in speed of 3-5 m/s, and do not start rotating until the wind speed exceeds the cut-in speed. However, not all offshore wind turbines have a cut-in speed of 5 m/s, and preliminary data from the monitoring reveal that some bats fly at wind speeds greater than 5 m/s. There is therefore a risk of bats colliding with wind turbine blades following implementation of the Plan for the Hesselø Offshore Wind Farm. A preventive measure is therefore assumed involving cut-in speed for wind speeds where bats migrate in the plan area. The scope of migrating bats and cut-in speed details must be investigated and determined in the context of a specific project.

Assessment in relation to Annex IV of the Habitats Directive
Assuming that the preventive cut-in speed measure is implemented so that offshore wind turbines stand still when the wind speed is so low that bats will migrate in the area, it is deemed that implementation of the Plan for the Hesselø Offshore Wind Farm cannot lead to deliberate killing or disturbance of bats.

Implementation of the Plan for the Hesselø Offshore Wind Farm is also deemed to not have an impact on the ecological functioning of breeding and resting areas for migrating bats.

1.5.6 Natura 2000 sites

Implementation of the Plan for the Hesselø Offshore Wind Farm may affect protected nature sites and species, as the plan sets the framework for future construction projects. To ensure that the plan is not in conflict with the EU's nature protection directives, the Habitats Directive and the Conservation of Wild Birds, an assessment has been made of potential impacts on Natura 2000 sites and birds.

1.5.6.1 Marine mammals (N128 and SE0420360)

In several of the possible scenarios for implementation of the Plan for the Hesselø Offshore Wind Farm, it has been calculated that the propagation of underwater noise will impact marine mammals such as seals and whales (porpoises). In relation to impacts on Natura 2000 sites which have marine mammals in the

designation basis, assessments have been made in relation to site N128 *Hesselø with surrounding reefs* and site SE0420360 *Northwest Skåne sea area*.

The Danish Energy Agency's guidelines for underwater noise stipulate that noise must be limited to a level, below which there is no risk of permanent hearing damage in seals and whales. Even in the noisiest scenario for pile driving in the seabed, the noise will not cause hearing damage (temporary or permanent) in seals or porpoises.

However, porpoises and seals may show behavioural responses at lower noise levels. These changes most frequently manifest as an escape response, whereby the animals flee from the sound source. The animals return again after some time, but with extended continuous periods of noise, the impact will lead to displacement of the animals from their habitats. This can impact their condition (fitness), chances of survival and fertility. It can ultimately lead to a decline in population.

Seals
In the noisiest scenario, seals, which are included in the designation basis for Natura 2000 site N128, may be impacted by noise in parts of their core area, leading to temporary displacement from a small part of the core area.
Due to the short duration, it is deemed that the impact will not lead to a risk of injury to seals in the designation basis, nor to a risk of harming the integrity of the Natura 2000 site.

Porpoises
In the noisiest scenario, it is calculated that porpoises may exhibit changes in behaviour up to 12.4 km from the sound source. The Swedish SE0420360 Natura 2000 site is only 11 km away from the eastern part of the plan area. The specific conservation objectives for the site are that no underwater noise may occur in areas with porpoises. Noise propagation leading to changes in behaviour in the Natura 2000 site will thus harm the integrity of the site.
It is possible to dampen the noise by using a double bubble curtain and hydro sound damper. This will reduce the distance at which porpoise behaviour is affected to 9.1 km, eliminating the risk of harm to the integrity of the Natura 2000 site.

1.5.6.2 Birds in Natura 2000 sites (SE0420360)
Red-throated diver and black-throated diver are on the designation basis in Natura 2000 site SE0420360. A potential impact has been identified which could displace divers from small areas of the Natura 2000 site, and this displacement could result in a small reduction in the number of divers (5 individuals). Based on the minimal potential reduction in the number of divers, it is deemed overall that there is no risk of harm to the population.

1.5.6.3 Resting seabirds outside Natura 2000 sites
Implementing the Plan for the Hesselø Offshore Wind Farm entails several likely scenarios where large offshore wind turbines are evenly distributed throughout the plan area. A number of seabirds are sensitive to disturbances from rotating wind turbines and withdraw from these areas.

The plan area for the Hesselø offshore wind farm is not an important marine area for most resting seabird species. For the razorbill and common murre, one model showed that the plan area was of higher importance. However, the number of birds

in the area was modest compared to the size of the populations, and there were large fluctuations in the number of birds observed over the years.

Based on existing data, the modelled displacement estimates and the uncertainties inherent in the assessments, it is deemed that displacement of seabirds from the new plan area, including impact zones, will not adversely affect the total populations of the seabird species studied.

1.5.6.4 Migratory birds

The plan area for Hesselø offshore wind farm is not located near the commonly known migration routes for birds. Yet new data suggests that a wide variety of species are observed in the plan area, and some are common species in the area. For the commonly occurring species, the risk of collision has been assessed. It is deemed unlikely that implementation of the Plan for the Hesselø Offshore Wind Farm together with the expected cumulative effects from other offshore wind farms will lead to enough deaths or disturbances to negatively impact the populations of the migratory birds studied.

1.5.6.5 Marine habitats related to the plan area for landing cables

The assessments carried out show that significant impacts on marine habitats can be avoided through detailed planning of the construction work in connection with a project that can be implemented within the framework of the plan. The installation work must be planned in detail, particularly near the coast, where the plan area for the landing cables passes Natura 2000 site no. 195 and where cable laying will impact reef and sandbank marine habitats. Areas with reefs must also be restored immediately after the landing cables have been laid, to avoid harmful impacts.

1.6 Biodiversity – the plan on land

Establishing the onshore facilities when implementing the Plan for the Hesselø Offshore Wind Farm could potentially impact biological diversity on land, including protected nature and protected species and their habitats. The protected Natura 2000 sites on land could potentially also be impacted. These matters are therefore summarised in this section on biodiversity on land.

1.6.1 Protected nature and protected species

In areas where onshore facilities may be established when implementing the Plan for the Hesselø Offshore Wind Farm, there are nature sites covered by section 3 of the Danish Nature Conservation Act, protected forest areas, protection lines, and sites designated as areas of natural interest in the municipal plans. There are also many habitats for protected species.

The Plan for the Hesselø Offshore Wind Farm covers a large area on land, making it possible to avoid construction work in most nature areas on land. Where this is not possible, the few remaining impacts can be minimised through detailed planning of the construction work. It is therefore deemed that the plan can be implemented without significant impacts on protected nature areas.

The protected species found in the area where the Plan for the Hesselø Offshore Wind Farm can be implemented include species listed in Annex IV of the EU Habitats Directive, which are therefore covered by special protection. It is deemed that it will be possible to implement the plan without impacting breeding and resting

areas for Annex IV species. This assessment has been based on the assumption that measures will be taken to reduce the impact for certain Annex IV species.

In addition to the Annex IV species, implementing the Plan for the Hesselø Offshore Wind Farm may also impact other protected species, including protected species and species on the Danish 'red list' that are considered to be endangered or rare. These species primarily depend on section 3-protected natural habitats, protected forest areas, hedgerows etc. The plan makes it possible to preserve many of the nature areas where protected species live and forage, and where this is not possible, construction work can be planned so as to avoid any significant impacts on the protected species. For example, if construction work has to be carried out close to breeding grounds for rare birds, impacts can be avoided by doing the work outside the breeding season for the specific species.

1.6.2 Natura 2000 sites

While a plan area has been designated at sea for Hesselø Offshore Wind Farm, there is no well-defined plan area on land. In order to limit the number of Natura 2000 sites on land that could be impacted by implementing the Plan for the Hesselø Offshore Wind Farm, the separate Natura 2000 assessment (NIRAS 2024) (summarised in sub-report 3) is based on the assumption that the onshore facilities will be located within the ellipse shown in Figur 19. It will therefore be the Natura 2000 sites within the ellipse which could potentially be impacted by implementation of the Plan for the Hesselø Offshore Wind Farm.

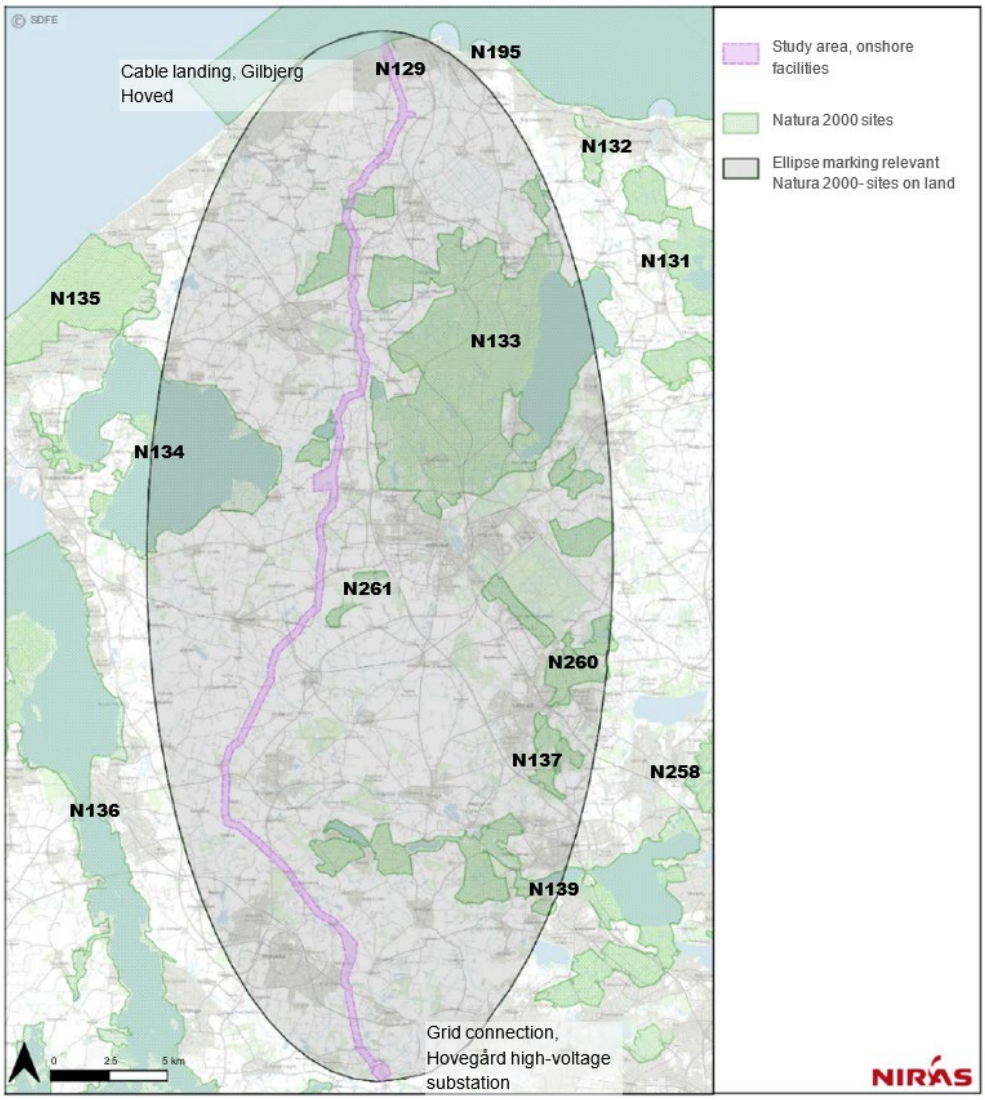

Figure 19. The ellipse shown encompasses the Natura 2000 sites on land that are included in the Natura 2000 assessment carried out. The ellipse is based around a straight line between the landing point at Gilbjerg Hoved and the grid connection at Hovegård high-voltage substation. The ellipse has a maximum width of 10 km, and narrows at the landing point and at Hovegård high-voltage substation. The study area for onshore facilities has been added to the figure as an example of a project that could be implemented under the Plan for the Hesselø Offshore Wind Farm.

Tabel 1.1 lists Natura 2000 sites that lie within the designated area in Figur 19. The Natura 2000 sites have been designated to protect a number of species and natural habitats, and these are referred to as the sites' designation basis. For each Natura 2000 site, Tabel 1.1 specifies what the site has been designated to protect (habitats, species and birds).

As explained in the review of Natura 2000 sites at sea in section 1.5.6, it must be assessed whether the plan or project – on its own or in combination with other plans or projects – could result in significant or harmful impacts on the designation basis for Natura 2000 sites.

Table 1.1: Overview of species and habitats in each Natura 2000 site included in the Natura 2000 assessment. 'X' indicates that there are natural habitats and/or species in the designation basis, while '–' indicates that there are no natural habitats or species in the designation basis for the given site. Species in the designation basis that could potentially be impacted by implementation of the Plan for the Hesselø Offshore Wind Farm are shown in parentheses.

Natura 2000 sites	Natural habitats	Species	Birds
129: Gilbjerg Hoved	X	X (crested newt)	-
133: Gribskov	X	X (green shield-moss, large white-faced darter, narrow-mouthed whorl snail, Desmoulin's whorl snail, brook lamprey, river lamprey, crested newt)	X (white-tailed eagle, osprey, red kite, marsh harrier, honey buzzard, spotted crake, kingfisher, black woodpecker, woodlark and red-backed shrike)
134: Arresø, Ellemose and Lille Lyngby Mose	X	X (large white-faced darter, narrow-mouthed whorl snail, Desmoulin's whorl snail, crested newt)	X (Eurasian bittern, white-tailed eagle, common merganser, osprey, marsh harrier, kingfisher)
260: Tokkekøb Hegn, Grønholt Hegn and Ny Hammersholt	X	-	-
261: Freerslev Hegn	X	-	-
137: Kattehale Mose	X	X (large white-faced darter, crested newt)	-
139: Øvre Mølledam, Furesø and Frederiksdal Skov	X	X (large white-faced darter, Graphoderus bilineatus, narrow-mouthed whorl snail, Desmoulin's whorl snail, crested newt)	X (Eurasian bittern, red kite, spotted crake, kingfisher, black woodpecker)

The separate Natura 2000 assessment (NIRAS 2024) examines whether it is possible to establish the onshore facilities in the Plan for the Hesselø Offshore Wind Farm without significant or harmful impacts on the designation basis for the Natura 2000 sites listed in Tabel 1.1. The Plan for the Hesselø Offshore Wind Farm covers a large area on land, making it possible to avoid construction work in most Natura 2000 sites on land. Where it is not possible to avoid passing through a Natura 2000 site, it is assumed that passage will be effected using horizontal directional drilling. It is also assumed that substations will not be built in Natura 2000 sites. It is deemed that the few possible impacts that could occur as a result of implementing the plan can be minimised through detailed planning of the construction work, such that there will be no harm to species or natural habitats in the designation basis. For example, impacts can be avoided on breeding birds in the designation basis for Natura 2000 sites 133, 134 and 139 by avoiding construction work near the nests of these species during breeding seasons. Alternatively, impacts can be avoided by performing the construction work outside the breeding seasons for these species.

Overall, it is deemed that the Plan for the Hesselø Offshore Wind Farm will not have significant or harmful impacts on the designation basis for Natura 2000 sites on land.

1.7 Water – plan at sea

Realisation of the Plan for the Hesselø Offshore Wind Farm may potentially affect currents, wave conditions, water exchange and water quality at sea. The seabed may also be affected, as construction work could stir up and disperse sediment in the water. The assessments of these issues are summarised in the following sections.

1.7.1 Hydrography

Sea hydrography covers parameters such as water level, currents, wave conditions, water exchange, stratification and mixing of the water column. Based on experience from other offshore wind projects, it is deemed that none of these conditions will change significantly as a result of implementing the Plan for the Hesselø Offshore Wind Farm. Compared with the natural dynamics of the Kattegat in relation to waves and currents, the potential impact on hydrography is therefore deemed to not be significant.

1.7.2 Seabed character and sediment

Implementation of the Plan for the Hesselø Offshore Wind Farm may impact seabed sediment, as a result of excavation, drilling or similar activities resulting in sediment being stirred up. Changes may also occur during the operation phase as a result of changes in current and wave conditions, both locally and regionally. For example, locally in the form of increased erosion around foundations, and regionally in the form of reduced wave energy.

The extent of sediment suspension in the water phase and subsequent sedimentation due to implementation of the project of the Plan for the Hesselø Offshore Wind Farm allows, will depend on the specific project design of the Hesselø offshore wind farm. However, experience from the construction of offshore wind farms shows that increased sediment deposition will occur during a limited period, and only locally around the construction work. It is deemed that it will be possible to build the offshore wind farm without the marine construction work resulting in significantly elevated sediment concentrations in the water column or significant sedimentation.

Implementing the Plan for the Hesselø Offshore Wind Farm will mean that wind turbine foundations and the surrounding erosion protection introduce hard seabed material into the plan area for the offshore wind farm (the naturally occurring seabed is a soft and sandy bottom). The area of soft seabed which the wind turbine foundations will replace will be of minor size and will not significantly impact the area of soft seabed at the site. The hard seabed material which the wind turbine foundations and erosion protection will introduce can potentially have a positive impact on local flora and fauna, as it will form habitats for species of sedentary flora and fauna that provide food for fish and birds.

Large areas in the coastal part of the plan area for landing the power cables are covered by reefs. It is deemed that it will be possible to implement the Plan for the Hesselø Offshore Wind Farm without significantly impacting seabed character.

In relation to the shape of the coastline, burying or trenching power cables in the coastal part of the plan area may briefly change local sediment transport, but not to an extent that will change the shape of the coastline. In coastal areas with reefs, where the cables may be laid on top of the seabed and covered with rocks, the installation work can be done in such a way that changes to current and wave conditions do not cause significant changes to the shape of the coastline.

Overall, it is deemed that implementing the Plan for the Hesselø Offshore Wind Farm will not result in significant impacts on seabed character and sediment.

1.7.3 Water quality (water area plans and marine strategy)

Sea water quality determines the general environmental state of the sea and the living conditions of marine flora and fauna.

In Denmark, legislation on marine water quality is covered by the environment targets in the EU Water Framework Directive and the Marine Strategy Framework Directive. The assessments in relation to these directives are summarised in the following sections.

1.7.3.1 Water area plans

The EU Water Framework Directive is implemented in Denmark through the water area plans. The water area plans are a general plan to improve the Danish aquatic environment, and aim to ensure Denmark's coastal waters, lakes, streams and groundwater are in a good environmental state. A good environmental state is achieved when both the ecological and chemical state are good.

Building an offshore wind farm, as provided for in the Plan for the Hesselø Offshore Wind Farm, could affect water quality during the construction work by raising concentrations of suspended sediment, changes and disturbances to the seabed and spillage of environmentally hazardous substances.

It is deemed that the higher concentration of suspended sediment which may occur due to construction work in the seabed will not have a significant impact on water quality. This is because the plan area for the offshore wind farm lies in an open region in the Kattegat where the nutrient content in the water phase is not critical, and because there is high water exchange in the area. The construction work will also only take place for a limited period of time. The release of xenobiotic substances from suspended sediment is also expected to be low.

Given that there are deemed to be no significant impacts on water quality resulting from implementing the Plan for the Hesselø Offshore Wind Farm, there deemed to be no elements in the plan that will prevent compliance with the requirements of the Water Framework Directive on attaining good ecological and chemical state.

1.7.3.2 Marine strategy

The plan area for the Hesselø offshore wind farm is covered by Denmark's Marine Strategy, and therefore by the goal of achieving a good environmental state for 11 parameters that are key in relation to impacts on the sea state (see Box 1).

DENMARK'S MARINE STRATEGY

Denmark's Marine Strategy has been formulated based on the EU Marine Strategy Framework Directive.

The aim of the marine strategy is to help create a healthier and better marine environment, for the benefit of

1. Biodiversity
2. Non-indigenous species
3. Commercially exploited fish stocks
4. Marine food chain
5. Eutrophication
6. Seabed integrity
7. Hydrographic changes
8. Pollutants
9. Pollutants in fish and shellfish for human consumption
10. Marine waste
11. Underwater noise

Box 1. Denmark's Marine Strategy and the 11 parameters for which a good environmental state must be attained.

The assessments performed show that the Plan for the Hesselø Offshore Wind Farm can be implemented without any significant impact on the 11 parameters. The Plan for the Hesselø Offshore Wind Farm will therefore not delay or impede achievement of a good environmental state in the plan area and in the Kattegat/North Øresund marine area in general.

1.8 Water – plan on land

Building onshore facilities in connection with implementing the Plan for the Hesselø Offshore Wind Farm will entail construction work that could impact nearby surface water (watercourses and lakes) and groundwater deposits. The assessments of these issues are summarised in the following sections.

1.8.1 Surface water

There are many protected lakes and watercourses in the area between the planned landing point on the north coast of Zealand for the cables from the offshore wind farm (Gilbjerg Hoved) and the Hovegård high-voltage substation. There are objectives in relation to some of these watercourses in the water area plans – generally that they should attain a 'good state' by 2027.

When implementing a project as provided for in the Plan for the Hesselø Offshore Wind Farm, it is expected that it will be possible to avoid crossing lakes covered by these objectives, but not possible to avoid crossing several watercourses. It is assumed that watercourses will be crossed using horizontal directional drilling, where the cables are run under the watercourse to avoid any physical impacts on the watercourse. When performing horizontal directional drilling, there is a potential risk of drilling mud accidentally leaking. Drilling operations will be thoroughly planned before horizontal directional drilling is performed, and an emergency preparedness plan will be formulated. It is therefore assumed that in the event of an accidental leak, horizontal directional drilling will be quickly halted, and any impacts from this are deemed to be local and brief. It is also assumed that only additives that do not pose a risk to the aquatic or soil environment will be used in the drilling mud. Based on the above, the risk of impacts on watercourses is deemed to be very small, and impacts from implementing the Plan for the Hesselø Offshore Wind Farm are deemed to be negligible.

When implementing the Plan for the Hesselø Offshore Wind Farm, it will be possible to handle surface water from the planned station areas such that there is no impact on watercourses or lakes.

Based on the above, the overall assessment is that the Plan for the Hesselø Offshore Wind Farm can be implemented without any significant impact on lakes and watercourses. It is also deemed that the Plan for the Hesselø Offshore Wind Farm will not impair the state of or prevent objectives from being met in lakes and watercourses covered by objectives.

1.8.2 Groundwater

There are various area designations for the protection of groundwater and drinking water deposits in the area on land where the Plan for the Hesselø Offshore Wind Farm may be implemented. Based on experience from similar facilities, cable installations are not deemed to have the potential to impact groundwater conditions on their own. By taking various measures to protect groundwater deposits in connection with installation work, it is deemed that the plan can be implemented without impacting the quality or quantity of groundwater resources – whether shallow or deep.

The Plan for the Hesselø Offshore Wind Farm allows for construction of a new high-voltage substation and expansion of the existing Hovegård high-voltage substation. Water collected under outdoor components containing oil may contain oil, metals etc. In connection with a specific project implemented under the Plan for the Hesselø Offshore Wind Farm, it must therefore be ensured that water that could be contaminated with oil or the like is handled in line with the applicable legislation, so there is no risk of impacts on groundwater resources.

Hovegård high-voltage station is located in an area with special drinking water interests, and activities have been carried out at here which may have led to soil contamination. However, any soil contamination will be handled in line with applicable legislation for construction work in contaminated soil. It is therefore deemed that the excavation work done in the substation area under the plan can be carried out without risk of groundwater contamination.

The overall assessment is that the Plan for the Hesselø Offshore Wind Farm can be implemented without significant impacts on groundwater deposits, and without impairing their condition or preventing fulfilment of objectives for groundwater deposits covered by these.

1.9 Cumulative factors

In addition to impacting various environmental conditions on its own, the Plan for the Hesselø Offshore Wind Farm may also lead to environmental impacts in combination with other plans and projects. The combination of impacts from implementing the Plan for the Hesselø Offshore Wind Farm and other known plans or specific projects is referred to as cumulative effects, and the cumulative impacts for relevant environmental conditions at sea and on land are summarised below.

1.9.1 For the plan at sea

If the Plan for the Hesselø Offshore Wind Farm is implemented, construction of the wind farm is expected to commence in 2028, and the farm can be fully operational by the end of 2029.

The plans and projects deemed to be relevant in relation to possible cumulative effects for the marine part of the Plan for the Hesselø Offshore Wind Farm primarily concern other offshore wind farms in the Kattegat (see Figur 110). In addition, a coastal protection project is being planned off the north coast of Zealand, and the Danish Environmental Protection Agency is planning to establish cavity-forming reefs in Natura 2000 site no. 195, which the plan area for the landing cables for Hesselø offshore wind farm passes by. The following section describes whether implementation of the Plan for the Hesselø Offshore Wind Farm can lead to cumulative effects in combination with these plans and projects.

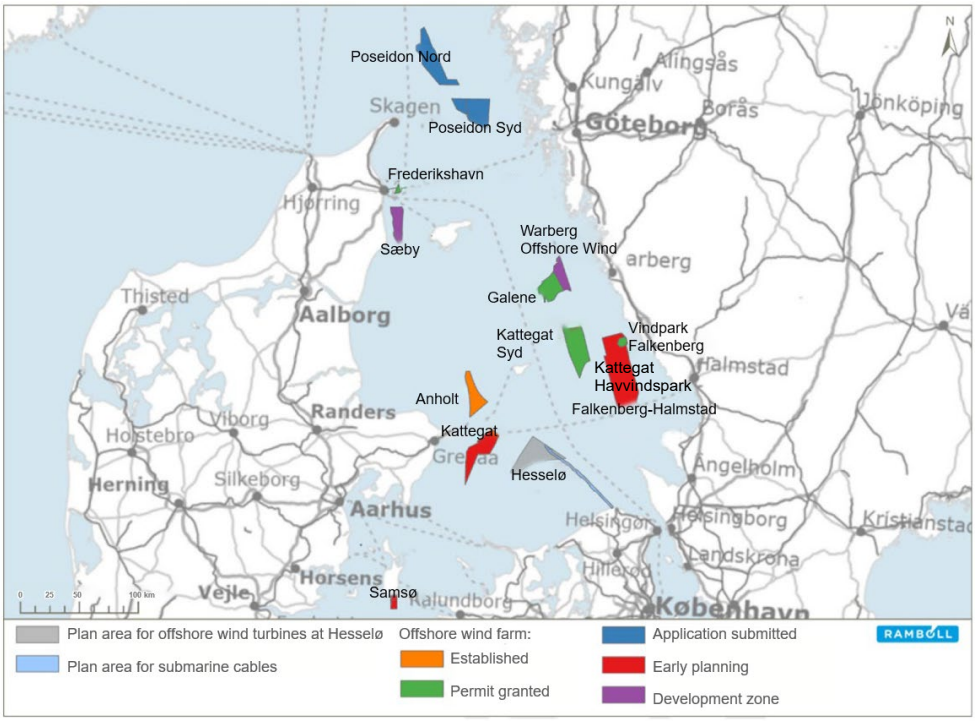

Figure 110. Map showing planned and established Danish and Swedish offshore wind farms in the Kattegat. Legends can be found in sub-report 2, section 3.1, 'Methodological approach'.

Other offshore wind farms

In addition to Anholt Offshore Wind Farm, which has been built and is in operation, a number of other offshore wind farms are being planned near the plan area for Hesselø offshore wind farm (see Figur 110). Based on the expected time schedules, the Danish Kattegat offshore wind farm and the Swedish Galene, Kattegat Syd and Vindpark Falkenberg offshore wind farms have construction phases that could potentially overlap with the construction phase for Hesselø offshore wind farm. The operation phases for all existing and planned offshore wind farms are expected to coincide with the operation phase for Hesselø offshore wind farm.

The planned offshore wind farms can contribute to a cumulative impact on the landscape and visual factors in combination with implementation of the Plan for the Hesselø Offshore Wind Farm. If the other planned offshore wind farms are built, this is expected to result in significant cumulative impacts on the visual experience

of the landscape along the North Zealand coast, on Anholt and at Kullen during the day. From here, the interplay between Hesselø offshore wind farm and wind turbines in the Kattegat Syd and Kattegat offshore wind farm plan areas will broaden the overall picture of offshore wind turbines on the water surface to a large extent. At night, the cumulative effect is deemed to have a significant impact on the coast of North Zealand and on Anholt, as there will be a very broad band of flashing lights in the night sky. From the Danish coast of Djursland, it is especially the cumulative Kattegat plan that will impact the visual experience.

The Hesselø and Anholt offshore wind farms combined will potentially have a noise impact on homes on Anholt. However, the assessments carried out show that the total noise contribution from a future Hesselø offshore wind farm and Anholt offshore wind farm will be able to meet the applicable noise limits for both low-frequency noise and broad-spectrum noise. In addition, noise contributions on Anholt and North Zealand from the planned Swedish offshore wind farms cannot be ruled, but due to the great distance, there will most likely be no cumulative noise impacts.

Commercial fishing in the Kattegat could potentially experience a stronger impact if the plans for the Swedish Galene and Kattegat Syd offshore wind farms are implemented. Depending on how large a part of the plan area for Galene and Kattegat Syd will be temporarily or permanently closed to fishing at the same time as the plan area for Hesselø offshore wind farm is temporarily or permanently closed, a number of fishing grounds may be lost, especially for bottom trawlers. In addition, there is a full or partial ban on fishing in three areas of the Kattegat east of the plan area for Hesselø offshore wind farm. The aim of the ban is to increase the cod population in the area by preventing loss of cod due to by-catch (BEK nr 979 af 21/06/2020). These three areas can also contribute to a significant cumulative impact on commercial fishing in the Kattegat in connection with implementing the Plan for the Hesselø Offshore Wind Farm.

It is primarily during the construction phase of future projects that marine mammals are impacted, and cumulative effects may occur if the construction phases overlap, and if monopiles are driven into the seabed. This applies if the pile-driving overlaps in time (such that marine mammals are displaced from a larger area than would be the case during construction of Hesselø offshore wind farm alone) or if the construction phases take place consecutively (such that marine mammals are displaced in parts of the Kattegat for a longer period of time). Assuming that the impact from four other planned offshore wind farms (Kattegat, Kattegat Syd, Galene and Vindpark Falkenberg) in the Kattegat is on a par with the impact expected from Hesselø, the number of animals disrupted by temporary construction activities can be expected to be five times higher than for Hesselø alone. It is deemed that the cumulative effects from other projects in the conservation area for the Belt Sea population will not reach a level that could have a negative impact on the total porpoise population.

Other offshore wind farms in the southern Kattegat could increase the total impact on migrating birds passing through the area. Offshore wind farms built in the Kattegat between Djursland and Falkenberg will have the greatest impact on migratory birds, as migration routes for land-based birds are expected to overlap with these offshore wind turbine areas. If a larger proportion of the flyway population is exposed to risk of collision with turbine blades, a larger proportion is also at risk of dying as a result of collision with turbine blades. It is deemed unlikely

that implementation of the Plan for the Hesselø Offshore Wind Farm together with the expected cumulative effects from other offshore wind farms will lead to enough deaths or disturbances to negatively impact the populations of the migratory birds studied.

Building and operating other offshore wind farms in the Kattegat will, in the same way as Hesselø offshore wind farm, displace seabirds from parts of the Kattegat so that possible foraging areas are lost. The total area from which seabirds will be displaced may therefore be larger when the effects from other offshore wind farms in the Kattegat are taken into account. If all facilities in the Kattegat that are planned or seeking permits are built, and assuming that divers are displaced from offshore wind farms by a distance of up to 10 km, the total area from which divers are displaced will be just a few per cent of the total overwintering area in the Kattegat. It is deemed that displacement from a very small part of the total overwintering area in Northern Europe will not significantly impact the total population of divers in Northern Europe.

1.9.2 For the plan on land

During the construction phase of the project provided for in the Plan for the Hesselø Offshore Wind Farm, other projects which involve noisy or dust-generating activities, increased transport, traffic disruptions or climate impacts, during construction or operation, may contribute to cumulative impacts greater than those from implementation of the plan alone. Even if the impacts from the project alone are not considered to be significant, overlap with the construction or operation of other projects may lead to cumulative impacts which could alter the outcome of the assessment.

The currently known plans and projects which could have cumulative impacts with the Plan for the Hesselø Offshore Wind Farm and are therefore deemed to be relevant in relation to the part of the plan covering facilities on land include climate adaptation in Stenløse and planned road projects (new Græsted-Gilleleje road, Frederikssund motorway and motorway in the Ring 5 transport corridor). For all these projects, it is deemed that it will be possible to avoid or minimise cumulative impacts by coordinating construction activities. In relation to construction work on Hovegård high-voltage station and the Frederikssund motorway and a possible future motorway in the Ring 5 transport corridor, all these projects will involve many construction activities over an extended period in the same geographical area. The expanded Hovegård high-voltage substation and the planned road projects could also lead to cumulative impacts on the population during the operation phase in terms of noise and visual effects. With respect to cumulative noise impacts, it is assumed that the noise impact from the expanded Hovegård high-voltage substation will be able to comply with the Danish Environmental Protection Agency's recommended limit values and therefore not lead to significant noise impacts. The planned Frederikssund motorway will be built with noise barriers on the section that passes Hove, and noise calculations made during environmental studies of the Frederikssund motorway show that the Environmental Protection Agency's recommended limit values for road traffic noise will be observed in Hove. It is therefore deemed that there will not be significant cumulative noise impacts on the population, as the same homes will not be exposed to the highest noise levels from both the Frederikssund motorway and the expanded high-voltage substation provided for in the Plan for the Hesselø Offshore Wind Farm.

Given that there is no specific time schedule or land allocation for the project provided for in the Plan for the Hesselø Offshore Wind Farm, this leads to uncertainties in relation to potential overlaps in impacts from the construction and/or operation phases, and hence the potential cumulative impacts. It is therefore deemed to be not possible to make an exhaustive assessment of the potential cumulative effects that could arise. A more detailed and in-depth assessment of potential cumulative impacts will have to be made as part of the environmental impact assessment for the specific project, where more detailed knowledge will be available.