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GAZ-SYSTEM S.A.

Document type

Report

Date

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BALTIC PIPE OFFSHORE PIPELINE – PERMITTING AND DESIGN

ESPOO REPORT - DENMARK

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NON-TECHNICAL SUMMARY

The Baltic Pipe is a strategic gas infrastructure project that will enable the transport of gas from fields in Norway to the Danish and Polish markets and beyond. The Baltic Pipe project is planned and implemented as a collaboration between GAZ-SYSTEM S.A., the Polish gas transmission company and Energinet, the Danish operator of transmission systems for natural gas and electricity. The entry of the pipeline into service is planned for 2022.

The subject of this report is the offshore of the pipeline that connects Denmark and Poland, as well as the analysis and assessment of transboundary impacts related to the pipeline section under Polish jurisdiction. The undersea pipeline is a key element of the entire Baltic Pipe project. The Espoo report and procedure are an integrated part of the environmental impact assessment (EIA) procedures and approval processes in the respective countries of origin. Based on the results of each country EIA report, the Espoo report analyses the extent to which activities originating in each country could have a transboundary impact on environmental and socio-economic receptors in neighbouring countries.

Due to the nature of the Baltic Pipe project, resulting from the fact that it is being implemented in an area that is subject to the jurisdiction of three countries, the environmental impact assessment documentation, especially the assessment documentation relative to the transboundary context was drafted in a way as to ensure the maximum methodical coherence, while maintaining the differences resulting from contrasts in national legal systems and administrative practice in individual countries. This approach was also applied by the authorities that are to conduct the environmental impact assessment proceedings in a transboundary context, which was expressed, for example, in the joint positions of the Espoo contact points that provided guidance for carrying out the mentioned proceedings. At the same time, this report, in accordance with the requirements of the Espoo convention and national law, should serve as a presentation of the information that will allow the country that will host the planned undertaking to evaluate the possible transboundary impact on the environment. Consequently, the document must reconcile two important guidelines - to reflect the information contained in the environmental impact assessment report, especially the information that concerns transboundary impacts, and to maintain coherence between Espoo reports for specific parts of the Baltic Pipe project under different national jurisdictions. In effect, some of the information contained in the environment impact evaluation report created for the needs of national procedures can be found in different form. However, there will always be a coherence in information between the parts of the relevant environmental impact assessment report and this report.

The main conclusions are summarised for Poland in the below table.

<table>
<thead>
<tr>
<th>Affected Party (AP)</th>
<th>Party of Origin (PoO) Poland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>The pipeline route crosses the boundary between the Polish and Danish exclusive economic zone.</td>
</tr>
<tr>
<td></td>
<td>Potential long-range project impacts include sediment dispersion and underwater noise. Modelling of sediment dispersion shows that significant transboundary impact is unlikely due to the limited duration and range. Significant transboundary impacts on marine mammal and fish populations caused by underwater noise from munitions clearance (detonation) can be avoided by applying mitigation measures.</td>
</tr>
<tr>
<td></td>
<td>In the part of Danish waters that border Poland, no Natura 2000 sites were delineated. Considering the nature of the impacts generated as a result of the pipeline and the distance between pipeline in the area of Polish waters and the Danish Natura 2000 areas, the possibility of transboundary impacts on the Danish Natura 2000 sites is excluded.</td>
</tr>
<tr>
<td>Country</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Sweden</strong></td>
<td>The pipeline route crosses the boundary between the Polish and Danish exclusive economic zone. Potential long-range project impacts include sediment dispersion and underwater noise. Due to the distance between project implementation site in Polish waters and the Swedish EEZ, a distance of 54 km at the closest point, there is no risk of transboundary impacts. None of the potential impacts is large enough, nor has the duration and intensity that could cause impacts on Swedish waters. The pipeline route crosses the Swedish Natura 2000 site “Sydvästskånes utsjövatten”. It is concluded that no activities originating in Poland can have a significant transboundary impact on this site.</td>
</tr>
<tr>
<td><strong>Germany</strong></td>
<td>The Baltic Pipe route does not cross German waters. Potential long-range project impacts include sediment dispersion and underwater noise. Modelling of sediment dispersion shows that significant transboundary impact is unlikely due to the limited duration and range. Significant transboundary impacts on marine mammal and fish populations caused by underwater noise from munitions clearance (detonation) can be avoided by applying mitigation measures.</td>
</tr>
</tbody>
</table>

Overall, no impacts from the Baltic Pipe project that originate in Poland will lead to any significant transboundary impacts in Denmark, Sweden, and/or Germany.

**Baltic Pipe entire route throughout the Baltic Sea**
It has been concluded in the report that cumulative impacts from the Baltic Pipe project in combination with other plans and projects in the Baltic Sea region can be ruled out.

Cumulative impacts caused by the Baltic Pipe project itself when considering all impacts from the entire project have also been assessed. Landfall construction is planned to occur simultaneously in the nearshore areas of Poland and Denmark, but due to the distance between the landfall areas, cumulative impacts can be excluded. Offshore construction will occur as a continuous, linear process. Potential short-term impacts during offshore construction have been assessed not to be significant. As pipe-lay will occur as a continuous, linear process, cumulative impacts within the project are unlikely. Long-term or permanent impacts have been assessed not to be significant in any given country nor in the entire project area. As such, cumulative impacts from the project as a whole can be excluded.
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<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS</td>
<td>AIS - Automatic identification system</td>
</tr>
<tr>
<td>ALARP</td>
<td>ALARP – As Low As Reasonably Practicable</td>
</tr>
<tr>
<td>API</td>
<td>(Industry norms issued by) American Petroleum Institute</td>
</tr>
<tr>
<td>BWM</td>
<td>Ballast Water Management Convention Ballast water management convention</td>
</tr>
<tr>
<td>C-POD</td>
<td>Passive hydracoustic detection device</td>
</tr>
<tr>
<td>CPT</td>
<td>Cone penetration test Cone penetration test</td>
</tr>
<tr>
<td>CPUE</td>
<td>Catch per unit effort Catch per unit effort</td>
</tr>
<tr>
<td>CRA</td>
<td>Construction risk analysis Construction risk analysis</td>
</tr>
<tr>
<td>DA</td>
<td>Disputed Area</td>
</tr>
<tr>
<td>DEA</td>
<td>Danish Energy Agency Danish Energy Agency Energistyrelsen</td>
</tr>
<tr>
<td>DK</td>
<td>Denmark, Danish</td>
</tr>
<tr>
<td>DP</td>
<td>Dynamic Positioning</td>
</tr>
<tr>
<td>DPS</td>
<td>Dynamical Positioning System</td>
</tr>
<tr>
<td>ECA</td>
<td>Emission control area Emission control area</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency Environmental Protection Agency Miljøstyrelsen</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FAR</td>
<td>Fatal accident rate Fatal accident rate</td>
</tr>
<tr>
<td>FCG</td>
<td>Flooding, cleaning and gauging Flooding, cleaning and gauging</td>
</tr>
<tr>
<td>GE</td>
<td>Germany, German</td>
</tr>
<tr>
<td>GES</td>
<td>Good environmental status Good environmental status</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse gas(es) Greenhouse gas(es)</td>
</tr>
<tr>
<td>GT</td>
<td>Gross Tonnage Gross tonnage</td>
</tr>
<tr>
<td>GWP</td>
<td>Global warming potential Global warming potential</td>
</tr>
<tr>
<td>HAZID</td>
<td>Hazard identification Hazard identification</td>
</tr>
<tr>
<td>HELCOM</td>
<td>Helsinki Commission, Baltic Marine Environment Protection Commission</td>
</tr>
<tr>
<td>ID</td>
<td>Internal diameter Internal diameter</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>IGV</td>
<td>International guidance values</td>
</tr>
<tr>
<td>IMO</td>
<td>International Maritime Organization</td>
</tr>
<tr>
<td>IR</td>
<td>Individual risk</td>
</tr>
<tr>
<td>IUCN</td>
<td>International Union for Conservation of Nature</td>
</tr>
<tr>
<td>KP</td>
<td>Kilometre point</td>
</tr>
<tr>
<td>KPI</td>
<td>Kilometre point interval</td>
</tr>
<tr>
<td>MARPOL</td>
<td>International Convention for the Prevention of Pollution from Ships</td>
</tr>
<tr>
<td>MEG</td>
<td>Monoethylene glycol</td>
</tr>
<tr>
<td>NECA</td>
<td>Nitrogen emission control area</td>
</tr>
<tr>
<td>NIS</td>
<td>Non-indigenous species</td>
</tr>
<tr>
<td>NSP</td>
<td>Nord Stream Pipeline</td>
</tr>
<tr>
<td>NSP2</td>
<td>Nord Stream Pipeline 2</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment (EIA)</td>
</tr>
<tr>
<td>OSPAR</td>
<td>Convention for the Protection of the Marine Environment of the North East Atlantic</td>
</tr>
<tr>
<td>SPA</td>
<td>Special protection areas</td>
</tr>
<tr>
<td>PAM</td>
<td>Passive acoustic monitoring</td>
</tr>
<tr>
<td>PCI</td>
<td>Projects of Common Interest</td>
</tr>
<tr>
<td>EN</td>
<td>Poland, Polish</td>
</tr>
<tr>
<td>PLONOR</td>
<td>Pose little or no risk to the environment</td>
</tr>
<tr>
<td>PM</td>
<td>Particulate matter</td>
</tr>
<tr>
<td>POM</td>
<td>Particulate organic matter</td>
</tr>
<tr>
<td>PSU</td>
<td>Practical salinity unit</td>
</tr>
<tr>
<td>PTS</td>
<td>Permanent threshold shift</td>
</tr>
<tr>
<td>QRA</td>
<td>Quantitative risk assessment</td>
</tr>
<tr>
<td>RAC</td>
<td>Risk assessment criteria</td>
</tr>
<tr>
<td>RDW</td>
<td>Water Framework Directive</td>
</tr>
<tr>
<td>ROV</td>
<td>Remotely operated vehicle</td>
</tr>
</tbody>
</table>
SAC Special Areas of Conservation *Special Area(s) of Conservation*

SCI Sites of Community Interest *Sites of Community Interest*

SD Subdivision *Subdivision*

SE Sweden, Swedish

SEAC Submarine exercise area coordinator *Submarine exercise area coordinator*

SECA Sulphur emission control area *Sulphur emission control area*

SEPA Swedish Environmental Protection Agency *Swedish Environmental Protection Agency Naturvårdsverket*

AP Affected party

SAC Special Areas of Conservation *Special areas of conservation*

SP Party of Origin (PoO)

SPA Special protection areas *Special Protection Areas*

SPL Sound pressure level *Sound pressure level*

SSC Suspended sediment concentration *Suspended sediment concentration*

TBM Tunnel boring machine *Tunnel boring machine*

TNT Trinitrotoluene

TOP Top of pipe *Top of pipe*

TSS Traffic separation scheme *Traffic separation scheme*

TTS Temporary threshold shift *Temporary threshold shift*

EU European Union


UXO Military explosive objects, *Unexploded ordnance*

VMS Vessel management services *Vessel management services*

EEZ Exclusive economic zone

TW Territorial waters

WWII World War II

PAH Polycyclic aromatic hydrocarbons
1. **INTRODUCTION**

1.1 *Reading guide*

This report comprises the Espoo documentation of the Baltic Pipe project. The report is based on the project design of March 2019. Any difference in the project description and associated assessments compared to the Danish Espoo report is due to optimizing the design, that has arisen since the Danish report was published, hence the numbers presented in this report are approximate and rounded. Report contains a description of the project-related transboundary environmental and socio-economic impacts, which are caused by project impacts generated in Poland and potentially affecting the marine territories (EEZ and/or territorial waters) of Denmark, Sweden and Germany.

The Espoo report has originally been conceptualized to serve as common report for all the three countries of origin: Denmark, Poland and Sweden. However, since the publication of the Espoo report in each country is bound to the national EIA process and these processes will start at a different time in each country, each country is producing their own report. All three reports will contain an identical sequence of chapters. This applies especially to chapters 2-6, which contain basic information about the Baltic Pipe project, such as project description, legal framework and Espoo process mechanisms, as well as a chapter on risk assessment and the assessment methods used. The central part of this report in Chapter 7 deals with the assessment of transboundary impacts. The assessment chapters are organized by environmental/ socio-economic receptors that are likely to be affected by various project pressures. For each receptor the assessment results are presented, with information on the expected transboundary impact Sweden, Denmark and Germany. The results of the assessment are summarized in the conclusion of Chapter 1.1.

The Espoo report and procedure are an integrated part of the EIA procedures and approval processes in the respective countries of origin.

1.2 *Project background and justification*

The Baltic Pipe is a strategic gas infrastructure project, with the goal of creating a new natural gas supply corridor on the European market. The project will ultimately make it possible to transport gas from fields in Norway to the Danish and Polish markets, as well as to customers in neighbouring countries. If required, the Baltic Pipe will enable the reverse supply of gas from Poland to the Danish and Swedish markets. The offshore pipeline between Denmark and Poland is an important part of the overall Baltic Pipe project.

The Baltic Pipe project is planned and implemented as a collaboration between GAZ-SYSTEM S.A., the Polish gas transmission company and Energinet, the Danish operator of transmission systems for natural gas and electricity.

The Baltic Pipe project consists of five key components (see Figure 1-1):

1) A new gas pipeline in the North Sea (length 120 km) from the Norwegian offshore gas fields to the Danish coast. In the North Sea, the pipeline ties in to the existing Europipe II pipeline connecting Norway and Germany.

2) A new gas pipeline is planned, which extends over approx. 220 km across Jutland, Funen, and southeast Zealand in Denmark.

3) A new compressor station (CS Zealand) at the Danish shore in Zealand.

4) An offshore pipeline in the Baltic Sea linking Denmark and Poland for bi-directional gas transmission, with Sweden as transition country (see Figure 1-1).

5) The necessary expansion of the Polish gas system to receive gas from Denmark.
Figure 1-1 Schematic representation of the five major components of the Baltic Pipe project.

The main objective of the Baltic Pipe project is to further strengthen supply diversification, market integration, price convergence and security of supply in primarily Poland and Denmark and secondarily in Sweden, Central and Eastern Europe and the Baltic region.

For these reasons the Baltic Pipe project was included in the first list of Projects of Common Interest (PCI), drawn up by the European Commission in 2013, and in the subsequent list adopted by the European Commission on 18 November 2015, underlining its regional importance. The Baltic Pipe is project No. 8.3 in the Union list of projects of common interest (Annex VII, (8), 8.3).

Because of the PCI status, the project may benefit from accelerated planning and permit granting, a single national authority for obtaining permits, improved regulatory conditions, lower administrative costs due to streamlined environmental assessment processes, increased public participation via consultations, and increased visibility to investors.

The anticipated construction time is approximately 2 years, and the gas pipeline is planned to be ready for operation in 2022.
2. LEGAL FRAMEWORK AND ESPOO CONSULTATION PROCESS

A linear transnational project such as the Baltic Pipe project must comply with numerous international conventions as well as directives and laws on the EU and national levels. This chapter provides an overview of the legal framework and national approval processes, which apply to the Baltic Pipe project and which also contains the procedures to be followed under the Espoo Convention. Separate national approval procedures are applied in Denmark, Sweden and Poland.

2.1 The Espoo Convention and Espoo consultation process

2.1.1 The Espoo Convention

The "Convention regarding the Environmental Impact Assessment in a Transboundary Context from February 25, 1991" (Espoo Convention) sets out the obligations of the contracting Parties to assess the environmental impact of certain activities at an early stage of project planning. It also lays down the general obligation of States to notify and consult one another on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries.

According to the Espoo Convention a transboundary impact is, "any non-global impact within the jurisdiction of the Party due to the planned activities, the physical cause of which is wholly or partially located on the area under the jurisdiction of the other Party."

The Party of Origin (PoO) is the Contracting Party or Parties to the Convention, under whose jurisdiction the planned operation is to take place. In this case, it includes Denmark, Sweden, and Poland.

The Affected Party (AP) is a Contracting Party or Parties to the Convention that may be exposed to a transboundary impact of the planned activities. In relation to the Baltic Pipe project Denmark, Sweden and Poland are both APs and PoOs, while Germany is AP, only.

The convention states that the PoOs shall, consistent with the provisions of the convention, ensure that APs are notified of a proposed activity, such as a large-diameter oil and gas pipelines (#8 - Appendix 1 of the conventions) that is likely to cause a significant adverse transboundary impact.

2.1.2 The Espoo consultation process

The consultation process foreseen under the Espoo Convention’s Articles 3-6 is coordinated by the Espoo Focal Points in each of the PoOs. The consultation process consists of the following major steps:

- **Notification in accordance with Article 3**: For a proposed activity listed in Appendix I that is likely to cause a significant adverse transboundary impact, the Party of origin shall, for the purposes of ensuring adequate and effective consultations under Article 5, notify any Party which it considers may be an affected Party as early as possible, and no later than when it informs its own public about said proposed activity.

- **Preparation of the environmental impact assessment documentation (Espoo report) pursuant to Article 4**: The Party of origin shall furnish the affected Party, as appropriate through a joint body where one exists, with the environmental impact assessment documentation. The concerned Parties shall arrange for distribution of the documentation to the authorities and the public of the affected Party in the areas likely to be affected and for the submission of comments to the competent authority of the Party of origin, either directly to this authority or, where appropriate, through the Party of origin within a reasonable time before the final decision is taken on the proposed activity.
• **Consultation pursuant to Article 5:** The Party of origin shall, after completion of the environmental impact assessment documentation, and without undue delay, enter into consultations with the affected Party concerning, among other issues, the potential transboundary impact of the proposed activity and measures to reduce or eliminate its impact. Consultations may relate to:

(a) Possible alternatives to the proposed activity, including the no-action alternative and possible measures to mitigate significant adverse transboundary impact and to monitor the effects of such measures at the expense of the Party of origin;

(b) Other forms of possible mutual assistance in reducing any significant adverse transboundary impact of the proposed activity; and

(c) Any other appropriate matters relating to the proposed activity. The Parties shall agree, at the commencement of such consultations, on a reasonable timeframe for the duration of the consultation period. Any such consultations may be conducted through an appropriate joint body, where one exists.

• **Final Decision pursuant to Article 6:** The Parties shall ensure that, in the final decision on the proposed activity, due account is taken of the outcome of the environmental impact assessment, including the environmental impact assessment documentation, as well as the comments thereon received pursuant to Article 3, paragraph 8, and Article 4, paragraph 2, and the outcome of the consultations as referred to in Article 5. The Party of origin shall provide to the affected Party the final decision on the proposed activity, along with the reasons and considerations on which it was based. If additional information on the significant transboundary impact of a proposed activity, which was not available at the time a decision was made with respect to that activity and which could have materially affected the decision, becomes available to a concerned Party before work on that activity commences, that Party shall immediately inform the other concerned Party or Parties. If one of the concerned Parties so requests, consultations shall be held as to whether the decision needs to be revised.

The consultation process and content of the environmental impact assessment documentation for the Baltic Pipe project is considering recommendations given from the Economic Commission for Europe (UNECE, 1996) and the European Commission (European Commission, 2013).

The consultation process was initiated in February 2018, when the GDOŚ, in its capacity as a point of contact for the Espoo convention, provided the APs with written notification and an information document regarding the undertaking, which indicated the planned length of the undertaking, outlined the scope of the EIA report, and fulfilled the requirements of the Espoo convention regarding information on submitted APs and notification. In addition, all Baltic Sea, which are not expected to be affected by the project, received a letter of information.

In Table 2-1 a schedule of the consultation process is presented. As can be seen from the table, all three countries have issued a response. Responses from the individual countries were analysed and included in the subsequent planning process.

**Table 2-1 Milestones of the Espoo Consultation process. DK: Denmark, SE: Sweden, PL: Poland, GE: Germany.**

<table>
<thead>
<tr>
<th>Milestones</th>
<th>Explanation</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Consultations</td>
<td>Espoo informal information meeting:</td>
<td>22/11/2017</td>
</tr>
<tr>
<td></td>
<td>Meeting with Espoo focal points of DK, and PL and point of contact of SE, plus Energinet, Ramboll and GAZ-SYSTEM S.A.</td>
<td></td>
</tr>
<tr>
<td>Notification (Article 3)</td>
<td>GDOŚ send out a written notification and an information card regarding the undertaking to all Affected parties in the Baltic Region. This included DK,</td>
<td>07/02/2018</td>
</tr>
<tr>
<td>Milestones</td>
<td>Explanation</td>
<td>Schedule</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
<td>----------</td>
</tr>
<tr>
<td>Response</td>
<td>SE, and DE. In addition, letters of information were sent to Finland, Russia, Estonia, Latvia, and Lithuania, which are not considered to be APs.</td>
<td></td>
</tr>
<tr>
<td>Responses received from:</td>
<td></td>
<td>Responses received in the following period: 12/02/2018 to 28/03/2018</td>
</tr>
<tr>
<td>Germany: Bundeswehr; and Bergamt Stralsund.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden (Espoo hearing): SEPA (Naturvårdsverket), which conducted a national hearing among institutions and stakeholders from 9 Feb -22 Mar and collected responses, which were sent to the Polish Focal Point.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark: EPA Agency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consultations</td>
<td>Consultations: Focal point meeting of DK, and PL and point of contact of SE</td>
<td>13/06/2018</td>
</tr>
<tr>
<td>Distribution of Espoo report</td>
<td>An Espoo report will be distributed from DK to GE, SE and PL on 08/2 2019 for aligning with the DK EIA consultation phase beginning 15/02 2019. SE and PL will issue their report as soon as the focal points are ready and aligned with their national EIA procedures. GE will thus receive three Espoo reports with shifted consultation phases according to the procedures in the PoO.</td>
<td>25/01/2019 (delivery of Espoo report to DK authorities)</td>
</tr>
<tr>
<td>Final Decision in DK</td>
<td>The Danish Focal Point informs APs of their decision</td>
<td>Expected by the end of July 2019</td>
</tr>
<tr>
<td>Final Decision in SE</td>
<td>No final decision is included in the Swedish Espoo process and therefore no date. Swedish Focal Point informs APs of their decision</td>
<td>-</td>
</tr>
<tr>
<td>Final Decision in PL</td>
<td>The Polish Focal Point informs APs of their decision</td>
<td>Expected by the end of August 2019.</td>
</tr>
</tbody>
</table>

2.2 Further international legal requirements

2.2.1 The EU Habitats and Wild Birds Directives
Together, the Habitats\(^1\) and Birds\(^2\) Directives form the cornerstone of the legislative framework for protecting and conserving wildlife and habitats in the European Union (EU) and establish the EU-wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging developments. The aim of the network is to ensure favourable conservation status for the species and habitats, which form the designation basis of the habitats and bird protection sites, across their natural range.

The Natura 2000 network comprises;

- **Bird sites (special bird protection sites (Pol. (OSO, Eng. Birds sites (Special Protection Areas (SPA))**: sites designated for the protection of rare and vulnerable bird species listed in Annex I of the Birds Directive, as well as of regularly occurring migratory bird species. Ramsar sites are also included, as protected wetland areas with special importance for birds, which were outlines as bird sites in Nature 2000; and
- **Habitat areas (special habitat protection areas (Pol. (SOO, Eng. SAC)/sites of community importance of the European Union (Eng. SCI))**: areas designated by the Habitat Directive for the projection of habitats and species.
- **Strictly protected species**: The Habitats Directives Annex IV contains a list of species that are strictly protected across their entire natural range within the EU, both within and outside Natura 2000 sites.

**Danish**
The main implementation of the Habitats and Birds Directives in Danish legislation is through the Act on Environmental Goals and the Habitats Order, but the directives are also implemented in other parts of Danish legislation, including the Offshore Appropriate Assessment Order.

The Administrative Order on Offshore Appropriate Assessments mentioned above applies to the project that assesses the significance of the project’s impact on Natura 2000 sites, as well as on strictly protected species found in Annex IV.

**Swedish**

**Polish**
The Habitats and Birds Directives were implemented to Polish legislation through the Nature Protection Act and numerous implementing orders to these acts, as they not only determine the habitats and species for which there is legal obligation for protection by means of Natura 2000 site delimitation, but also are the source of Natura 2000 site delimitation.

Another important act implementing these two directives is the Act of October 3, 2008 on the sharing of information on the environment and its protection, public participation in environmental protection and on environmental impact assessments, and it contains the rules and procedures for the appropriate impact assessment for the Nature 2000 area in the Polish legal system.

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3 Ramsar sites are identified as part of the UN Convention of the Wetlands of International Importance especially as Waterfowl Habitat (also known as the Ramsar Convention). In the EU all Ramsar sites are included in the network of Special Protection Areas (SPAs) under the Birds Directive.

4 Consolidated Act no. 119 of 26/01/2017 on Environmental Goals for International Nature Protection Sites (bekendtgørelse af lov om miljømål m.v. for internationale naturbeskyttelsesområder (Miljømålsloven).


6 Administrative Order no. 434 of 02/05/2017 on Impact Assessment of International Nature Protection Sites and Protection of Certain Species at Preliminary Studies, Investigation and Extraction of Hydrocarbon, Storage in the Underground, Pipelines, etc. offshore (bekendtgørelse om konsekvensvurdering vedrørende internationale naturbeskyttelsesområder og beskyttelse af visse arter ved forunderselser, efterforskning og indvinding af kulbrinter, lagring I undergrunden, rørledninger, m.v. offshore).

7 Act of April 16, 2004 regarding environmental protection (Journal of Laws of 2018, pos. 1614 (Ustawa z dnia 16 kwietnia 2004 r. o ochronie przyrody (Dz.

U. z 2018 r. poz. 1614)

8 The Act of October 3, 2008 on the disclosure of environmental information and environmental protection, public participation in environmental protection, and environmental impact assessments (Journal of Laws of 2018, pos. 2081) (Ustawa z dnia 3 października 2008 r. o udostępnianiu informacji o środowisku i jego ochronie, udziale społeczeństwa w ochronie środowiska oraz o ocenach oddziaływania na środowisko (Dz.

U. z 2008 r. poz. 2081)
2.2.2 Marine Strategy Framework Directive
The Marine Strategy Framework Directive\(^9\) (MSFD) aims at achieving Good Environmental Status (GES) of the marine waters of the EU by 2020 and to protect the resource base upon which marine-related economic and social activities depend. The Commission also produced a set of detailed criteria and methodological standards\(^10\) to help Member States implement the MSFD. To achieve GES by 2020, each Member State is required to develop a strategy for its marine waters (Marine Strategy).

Danish
The MSFD is implemented in Danish legislation through the Consolidated Act on Marine Strategy\(^11\). The purpose of the act is to establish the framework for achieving GES in Danish waters. The central instrument in achieving this is the Marine Strategy, which covers all Danish marine waters, including the Danish waters of the Baltic Sea.

Swedish
The MSFD is implemented in Swedish legislation through Chapter 5 of the Environmental Code (1998:808) and the Marine Environment Ordinance (2010:1341). The purpose of the ordinance is to establish the framework for achieving GES in Swedish marine waters, including the Baltic Sea. GES will be achieved through marine strategies involving establishing reference conditions, environmental targets and monitoring programs.

Poland
In Poland, the MSFD was implemented into national law through the Water Law Act\(^12\). According to the aforementioned act Marine Strategy is set of various documents including among others initial assessment of the current status of marine waters\(^13\), determination of good environmental status of waters concerned\(^14\) and National Program of Marine Waters Protection\(^15\) being a program of measures for achieving GES in all Polish marine waters. Assessments required under the MSFD are integrated into the EIA reports.

2.2.3 Water Framework Directive
The Water Framework Directive\(^16\) (WFD) is the legislative framework for protection of water in EU (rivers, lakes, groundwater, inland waters, surface water and coastal waters). The Directive sets a new approach for water management and protection by river basins – the natural geographical and

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\(^11\) Consolidated Act no. 117 of 26/01/2017 on Marine Strategy (bekendtgørelse af lov om havstrategi).
\(^12\) The Act from July 20, 2017 regarding Water Law (Journ. of Laws from 2018, item 2268, with later changes) (Ustawa z dnia 20 lipca 2017 r. Prawo wodne (Dz. U. z 2018 r. poz. 2268 z późn. zm.).
\(^14\) Administrative Order of the Minister of the Environment of February 17, 2017 regarding the adoption of marine water environmental targets (Journal of of Laws, pos. 593) (Rozporządzenie Ministra Środowiska z 17 lutego 2017 r. w sprawie przyjęcia zestawu celów środowiskowych dla wód morskich (Dz. U. poz. 593).
\(^15\) Administrative Order of the Minister of the Environment of December 11, 2017 regarding the adoption of a national marine water protection program (Journal of Laws of 2017, pos. 2469) (Rozporządzenie Rady Ministrów z dnia 11 grudnia 2017 r. w sprawie przyjęcia Krajowego programu ochrony wód morskich (Dz. U. z 2017 r. poz. 2469).
hydrological unit – instead of according to administrative or political boundaries. The overall objective for the Directive is that all waters must achieve “good status”. Good status refers to a good ecological and chemical status. The Directive covers coastal waters up to 1 nautical mile (NM) off the coast for ecological status and 12 NM for chemical status.

**Danish**
The main implementation of the WFD in Danish legislation is through the Consolidated Act on Water Planning\(^\text{17}\) and associated administrative orders\(^\text{18,19}\). A central element of implementing the WFD is river basin management plans, which contain information about how the river basins are affected, monitoring, assessment of the status, environmental targets and measures to achieve the targets.

**Swedish**
The main implementation of the WFD in Swedish legislation is through Chapter 5 of the Environmental Code (1998:808) and the Water Quality Management Ordinance (2004:660). A central element of implementing the WFD is the river basin management plans, containing information about how the river basins are affected, monitoring, and assessment of the status, environmental targets and measures to achieve the targets.

**Polish**
In Poland, the MSFD was implemented into national law through the Water Law Act\(^\text{20}\). The administrative orders associated to this act contain among others the rules for the assessment of water bodies status\(^\text{21}\) and the requirements for monitoring\(^\text{22}\). The assessment of water bodies statues, risk and pressures on individual waters bodies, environmental targets and program of measures for achieving the targets are stipulated by river basins management plans. In this respect plan which has the importance for conducting assessment of impacts of Baltic Pipe is Water management plan for Oder River Basin\(^\text{23}\).

Assessments required under the WFD are integrated into the EIA reports.

### 2.2.4 Helsinki Convention
The Convention on the Protection of the Marine Environment of the Baltic Sea Area (the Helsinki Convention) covers the whole of the Baltic Sea area. Measures are also taken in the whole catchment area of the Baltic Sea to reduce land-based pollution.

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\(^{17}\) Consolidated Act no. 126 of 26/01/2017 on water planning (bekendtgørelse af lov om vandplanlægning).

\(^{18}\) Administrative Order no. 1522 of 15/12/2017 on Environmental Targets for Surface Water and Groundwater (bekendtgørelse om miljømål for overfladevandområder og grundvandsforekomster).

\(^{19}\) Administrative order no 1521 of 15/12/2017 on programmes for river management districts (bekendtgørelse om indsatsprogrammer for vandområdedistriktter).

\(^{20}\) The Act from July 20, 2017 regarding Water Law (Journ. of Laws from 2018, item 2268 with later changes) (Ustawa z dnia 20 lipca 2017 r. Prawo wodne (Dz. U. z 2018 r. poz. 2268 z późn. zm.).

\(^{21}\) Administrative Order of the Minister of the Environment of December 21, 2015 regarding the criteria and means of assessment of the state of bodies of groundwater (Journal of Laws of 2015, pos. 85); Administrative Order of the Minister of the Environment of July 21, 2016 regarding the means of classification of bodies of surface waters and the environmental quality norms for priority substances (Journal of Laws of 2016, pos. 1187) (ozporządzenie Ministra Środowiska z dnia 21 grudnia 2015 r. w sprawie kryteriów i sposobu oceny stanu jednolitych części wód podziemnych (Dz.U. z 2015 r., poz. 85); rozporządzeniu Ministra Środowiska z dnia 21 lipca 2016 r. w sprawie sposobem klasyfikacji stanu jednolitych części wód powierzchniowych oraz środowiskowych norm jakości dla substancji priorytetowych (Dz.

\(^{22}\) Administrative Order of the Minister of the Environment of July 19, 2016 regarding the types and means of monitoring of surface and groundwater bodies (Journal of Laws of 2016, pos. 1178) (Rozporządzenie Ministra Środowiska z dnia 19 lipca 2016 r. w sprawie formy i sposobu monitoringu jednolitych części wód powierzchniowych i podziemnych (Dz. U. z 2016, poz. 1178).

The governing body of the Convention is the Baltic Marine Environment Protection Commission – Helsinki Commission, also known as HELCOM. The present Contracting Parties to HELCOM are Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, and Sweden. One of the most important duties of HELCOM is to make Recommendations on measures to address certain pollution sources or areas of concern. These Recommendations are to be implemented by the Contracting Parties through their national legislation.

The HELCOM Baltic Sea Action Plan was adopted in 2007 (and is updated regularly) and provides a concrete basis for HELCOM work. Its general purpose is to return the Baltic marine environment to a good ecological state by 2021. It sets targets relative to eutrophication, biodiversity, hazardous substances, and economic activities in maritime areas.

2.2.5 The OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic or OSPAR Convention (1992 and 1998) is the current legislative instrument regulating international cooperation on environmental protection in the North-East Atlantic.

In accordance with the provisions of the Convention, the Contracting Parties shall take all possible steps to prevent and eliminate pollution and take the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve marine ecosystems and, when practicable, restore marine areas which have been adversely affected.

Regarding the establishment and dismantling of offshore installations the Contracting Parties are obliged to apply best available techniques and best environmental practices in accordance with the criteria set forth in Appendices I-III of the convention.

2.3 National approval procedure in Poland

2.3.1 The Act on the Investment towards a Liquefied Natural Gas Re-Gasification Terminal in Świnoujście

According to the Act of April 24, 2009 on the Investment towards a Liquefied Natural Gas Re-Gasification Terminal in Świnoujście\(^\text{24}\), the planned pipeline requires a location determination decision, and the aforementioned act constitutes the sole legal foundation for such a decision (Art. 5-14c). The location determination decision can be issued for the entire project for the whole territory of Poland, however, separate decisions regarding location determination for parts of the project can also be issued. The Voivod (government administrative authority for the Voivodeship) is the competent authority for issuing location determination decisions. Individual project infrastructure building components require a building permit in accordance with the requirements specified in the Building Law\(^\text{25}\), and modifications introduced by the Act on the Investment towards a Liquefied Natural Gas Re-Gasification Terminal in Świnoujście. (Art. 15). The Voivod is also the authority that issues construction permits.

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\(^{24}\)Act of April 24, 2009 on the development of a re-gasification terminal for liquefied natural gas in Świnoujście (Journal of Laws from 2017, pos. 2302, with later changes) (Ustawa z dnia 24 kwietnia 2009 r. o inwestycjach w zakresie terminalu regazyfikacyjnego skroplonego gazu ziemnego w Świnoujściu (Dz. U. z 2017 r. poz. 2302 z późn. zm.).

\(^{25}\)Act of July 7, 1994 regarding Construction Law (Journal of Laws from 2018, post. 1202, with later changes) (Ustawa z dnia 7 lipca 1994 r. Prawo budowlane (Dz. U. z 2018 r. poz. 1202 z późn. zm.).
As the project is currently on the list of projects of common interest (PCI), the authority that should coordinate all of the bodies involved in administrative procedures and monitor project preparation is the Minister of Energy.

2.3.2 Environmental Impact Assessment (EIA)

The EIA procedure is subject to the stipulations of the Act of October 3, 2008 regarding the disclosure of environmental information and environmental protection, public involvement in environmental protection, and environmental impact assessments[^26^], as well as the Administrative Order of the Council of Ministers from November 9, 2010 regarding undertakings that can significantly impact the environment.

In the Polish legal system, an EIA is carried in the process of obtaining a decision dedicated to environmental conditions (also referred to as an environmental decision), which concentrates various types of environmental assessments in a single proceeding. Decisions regarding environmental conditions should be made before any type of location decisions are made and building permits are issued, if a location decision is not required (i.e., in cases where a local zoning plan is in effect) for the types of projects listed in the administrative order regarding undertakings that may significantly impact the environment.

The projects outlined in the administrative order, which can always significantly impact the environment, can be found in Appendix I of the EIA directive, while the projects that can potentially impact the environment correspond to the projects found in Appendix II of the directive. The Baltic Pipe project can be found in the first category: according to Art 2., Act. 2, pt. 21 of the administrative order. Thus, the EIA is mandatory.

The competent authority to issue a decision regarding environmental conditions relative to the Baltic Pipe is the Regional Directorate for Environmental Protection in Szczecin (RDOŚ).

The approval procedure comprises several milestones, which are explained in Table 2-2.

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Explanation</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application for the issuance of an environmental decision</td>
<td>According to Art. 69, Act. 2 of October 3, 2008 regarding the disclosure of information and environmental protection, public involvement in environmental protection, and environmental impact assessments, and given that the Baltic Pipe project can potentially impact the environment in multiple countries, the determination of the scope of the EIA is mandatory. This environmental decision application included a Project Information Document, as well as an application for the determination of the scope of the EIA. The Project Information Document includes a project description, and its planned location and impact, according to the requirements found in</td>
<td>15/12/2017</td>
</tr>
<tr>
<td>Milestone</td>
<td>Explanation</td>
<td>Date</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>------</td>
</tr>
<tr>
<td>Determination of scope of EIA</td>
<td>On the basis of the Project Information Document, opinions of the authorities participating in the proceedings and of Affected Parties, the scope of the EIA report has outlined the decision issued by the RDOŚ. This determination specifies testing requirements and the contents of the EIA report.</td>
<td>30/04/2018</td>
</tr>
<tr>
<td>EIA report</td>
<td>The purpose of the EIA procedure is a complex evaluation prior to the implementation of the proposed project of its potentially significant environmental impacts. The EIA report identifies, describes, and assesses the likely significant impacts (direct and indirect) of the project on three of the following environmental areas: physical-chemical, biological, and socio-economic.</td>
<td>Anticipated deadline: by the end of March of 2019.</td>
</tr>
<tr>
<td>Public consultations and the positions of other bodies</td>
<td>Public consultations will take place after the submission of the EIA report and its verification by the RDEP. Due to the fact that the project is subject to transboundary consultations, the public consultation time frames depend on the length of public consultations in Affected Party countries. Polish requirements stipulate a consultation time of 30 days. Other bodies that participate in the proceedings shall publish reports on the impact of the project, and it’s completion requirements.</td>
<td>Anticipated deadline: by the end of May of 2019.</td>
</tr>
<tr>
<td>Decision on environmental conditions</td>
<td>Based on the detailed analysis in the EIA report, the opinions of other bodies.</td>
<td>Expected by the end of August 2019</td>
</tr>
<tr>
<td>Milestone</td>
<td>Explanation</td>
<td>Date</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td>bodies and public comments as well as those received from interested parties, the RDEP will issue a decision regarding the environmental conditions for the Baltic Pipe project. The decision will outline project conditions and requirements.</td>
<td></td>
</tr>
</tbody>
</table>

The information included in this chapter correspond to the information found in Chapter 7 of the Environmental Impact Report. Underwater Baltic Pipeline - Polish section.
3. **PROJECT DESCRIPTION**

This chapter presents the technical design of the Baltic Pipe project and outlines the various activities and phases related to construction and operation. The description of construction activities will geographically focus on the offshore part (Baltic Sea only), which is the point of origin for potential transboundary impact.

3.1 **Pipeline route**

The route for the offshore part of the Baltic Pipe, linking Denmark and Poland, is shown in Figure 3-1. Other route alternatives that have been considered, are described in Chapter 5.

![Baltic Pipe route from Denmark to Poland](image)

**Figure 3-1 Baltic Pipe route from Denmark to Poland**

From Faxe Bugt the pipeline route enters the Swedish EEZ and then re-enters the Danish EEZ/territorial waters around Bornholm. From there, it enters the disputed area between Denmark and Poland, before entering the Polish EEZ/territorial waters. Polish landfall is planned in the vicinity of Pogorzelica near Niechorze (Niechorze-Pogorzelica alternative), or between the villages of Mrzeżyno and Rogowo (Rogowo alternative).

The lengths of the various route segments are shown in Table 3-1.

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27 Agreement on precise border between Denmark and Poland has not been ratified by the time of issue of the Baltic Pipe Espoo report.

28 Data regarding the pipeline length provided in this report are approximate and may change due to detailed technical solutions, including for example forced transfers of the pipeline due to the presence of unexploded ordnance. However, these changes will not affect the result of the entire assessment. The adopted assumptions of the evaluation methodology take into account a certain range of volatility.
Table 3-1 Route length within the different TW and EEZs. The disputed area is an area between Denmark and Poland where the EEZ border has not been agreed. The disputed area extends from Danish TW to the midline between Denmark and Poland.

<table>
<thead>
<tr>
<th>Route section</th>
<th>Route lengths in different TW and EEZs (km)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Danish</td>
<td>Swedish</td>
<td>Disputed area</td>
<td>Poland (Niechorze-Pogorzela variant)</td>
<td>Total</td>
</tr>
<tr>
<td>Proposed pipeline route</td>
<td>108</td>
<td>85</td>
<td>30</td>
<td>51</td>
<td>274</td>
</tr>
</tbody>
</table>

### 3.2 Field surveys

Geophysical and geotechnical surveys have been carried out, starting in October 2017. The survey results are providing the basis for the detailed engineering design of the pipeline system and are used together with environmental surveys for the environmental baseline description and in assessing the possible environmental impacts of the pipeline project.

Additional geophysical and/or geotechnical surveys might be carried out during the pipeline installation phase. This could include a survey for possible UXO (Unexploded Ordnance) objects and other surveys for ensuring an optimal and safe pipeline installation.

#### 3.2.1 Geophysical surveys

The geophysical investigations include multibeam bathymetry, side scan sonar, magnetometer measurements and high frequency seismic investigation of the uppermost 10 m of the seabed.

Geophysical investigations are carried out in a 500 m wide corridor around the centreline of the pipeline route (250 m at each side). Within Natura 2000 sites, the survey corridor has been expanded to 1,000 m around the centreline. In some areas with special challenges related to crossings and the environmental conditions, the survey corridor has been expanded to 2,000 m around the route centreline.

The results of the geophysical surveys are used for optimizing the final route and construction design. This optimisation includes identification of possible UXO objects at the seabed for ensuring that they do not pose a risk to the pipeline (see Section 4.7) and identification of possible cultural heritage objects for ensuring that no damage to these takes place.

#### 3.2.2 Geotechnical surveys

The geotechnical investigations include CPT (Cone Penetration Test) measurements and vibrocore sediment sampling along the route alternatives. In the nearshore areas (less than 10 m water depth), cone penetration tests and vibrocore sampling are carried out at three positions per kilometre. At depths greater than 10 m, cone penetration tests and vibrocore sampling are carried out at one position for every three kilometres of the route. In the landfall areas (onshore and nearshore), geotechnical drilling down to approximately 30 m below surface level is carried out.

### 3.3 Pipeline design

The following sections describe the mechanical design activities for the Baltic Pipe and Section 3.3.4 presents the estimated inventory of materials.

#### 3.3.1 Wall thickness

The pipeline system will be designed in accordance with the DNVGL offshore standard F101 Submarine Pipeline Systems (DNVGL-ST-F101, 2017), and any other national requirements that the authorities may have or disclose during the liaison process (Ramboll, 2017).

The following assumptions have formed the basis for the design of the wall thickness of the pipeline:
pipeline size: 36 inch (fixed inner diameter of 872.8 mm);
- Estimated annual transfer volume: up to 10 billion m³/year;
- Expected input pressure to the onshore network in Poland: 84 barg.
- Design pressure: 120 barg.

The offshore pipeline will be constructed using high-quality carbon steel, commonly used for the construction of high-pressure pipelines. Pipe joints with a length of approximately 12.2 m will be welded together during a continuous pipe-lay process. Steel pipes with standard thickness will be used.

Selected wall thickness found in Table 3-2. They were calculated by taking into account the pipeline integrity hazards along its route. With the required wall thickness, no buckle arrestors are required to prevent propagating buckling (Ramboll, 2018d).

<table>
<thead>
<tr>
<th>Wall thickness criteria</th>
<th>Safety Zone</th>
<th>Unit</th>
<th>Wall thickness [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected API (American Petroleum Institute) wall thickness</td>
<td>Zone 1</td>
<td>mm</td>
<td>20.6</td>
</tr>
<tr>
<td></td>
<td>Zone 2</td>
<td>mm</td>
<td>23.8</td>
</tr>
</tbody>
</table>

3.3.2 Coating

**Internal flow coating**
The line pipe joints will be coated with internal flow coating to limit flow friction. The coating will consist of 0.1 mm epoxy paint.

**External anti-corrosion coating**
External anti-corrosion coating will be applied to the pipeline to prevent corrosion. This coating consists of 4.2 mm polyethylene (PE).

**Concrete weight coating**
The on-bottom stability design complies with the requirements from DNVGL’s recommended practice On-bottom stability design of submarine pipelines (DNVGL-RP-F109, 2017).

Concrete weight coating with a thickness ranging between 50 mm and 120 mm will be applied over the pipeline’s external anti-corrosion coating to provide on-bottom stability. While the primary purpose of the concrete coating is to provide stability, the coating also provides additional external protection against external load, e.g. trawl gear.

To assess the on-bottom stability of the offshore part of the Baltic Pipe as subject to wave and current loading, calculations have been made of how thick a of concrete weight coating is required. The areas where seabed interventions will be required has been identified as well.
While the concrete thickness ranges from between 50 mm and 120 mm, the concrete density is between 2,250 and 3,300 kg/m$^3$. In this report, the following average parameters of the concrete loading coating were adopted: wall thickness of 100 mm at a density of 3 040 kg/m$^3$.

For some sections of the pipeline, stability cannot be proven by weight coating alone. In these areas, the pipeline will be trenched and/or rock dumped for stability purposes. Ideally it will be trenched, but if trench depths cannot be achieved, rock dumping may be used. In addition, in the very nearshore region, rock backfill may be used within the trench (instead of sand backfill).

**Field joint coating**
To facilitate welding of the 12.2 m long steel pipe joints on the installation vessel, the pipe coating is stopped before the steel pipe ends. The cut-back lengths are estimated at 240 mm for the anticorrosion coating and 340 mm for the concrete coating. After completion of the circumferential weld, the bare steel area is protected by a heat shrink sleeve, and the void between the adjacent concrete coatings is filled with moulded polyurethane (PU), either solid or foam.

### 3.3.3 Corrosion protection design
The design of corrosion protection design has been made to comply with the requirements of DNVGL-ST-F101, (2017), DNVGL-RP-F106, (2017), and DNVGL-RP-F103, (2016). The operating temperature is conservatively assumed to equal the maximum design temperature with respect to the technical design, and the external barrier coating is envisaged as 4.2 mm, 3-layer PE coating in accordance with DNVGL-RP-F106, (2017).

External coating will be applied to the pipeline to prevent corrosion. Further corrosion protection will be achieved by sacrificial anodes of aluminium alloy. The sacrificial anodes are a dedicated and independent protection system to that of the anticorrosion coating. The cathodic protection shall provide sufficient anode mass to protect the pipeline during the entire design life (Ramboll, 2017).

For concrete coated pipelines, it shall be ensured that the anodes do not protrude from the coating. Therefore, an anode thickness of 45 mm will be adopted, irrespective of the concrete coating thickness (Ramboll, 2017). The dimensions and properties of the anodes are shown in Table 3-3.

**Table 3-3 Anode properties (Ramboll, 2017).** The anodes consist of aluminium alloy (aluminium-zinc-indium).

<table>
<thead>
<tr>
<th>36 inch pipeline</th>
<th>Anode inner diameter (ID)</th>
<th>Anode thickness</th>
<th>Anode length</th>
<th>Anode weight</th>
<th>Anode current output Buried</th>
<th>Anode current output Exposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>932 mm</td>
<td>45 mm</td>
<td>240 mm</td>
<td>86.41 kg</td>
<td>0.10 A</td>
<td>0.36 A</td>
<td></td>
</tr>
</tbody>
</table>

The Baltic Pipe offshore pipeline has been designed with an anode mass of 1,180 kg/km. This amount ensures a sufficiently large anode surface. The anode consumption has been calculated to
be a maximum of 495 kg/km during the 50-year design life of the pipeline. This corresponds to a maximum anode consumption of 7.9 kg/km/year.

In practice, the release will be much lower as the role of the anodes is to provide back-up protection in case the coating of the pipeline is degraded or damaged. Only a small fraction of this amount will be released.

The recommended composition of the anode material is outlined in Table 3-4.

Table 3-4 Recommended compositional limits for anode materials (DNVGL-RP-F103, 2016).

<table>
<thead>
<tr>
<th>Element</th>
<th>Aluminium-zinc-indium anodes</th>
<th>Min. (%)</th>
<th>Max (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>-</td>
<td>Remainder</td>
<td></td>
</tr>
<tr>
<td>Zn</td>
<td>4.50</td>
<td>5.75</td>
<td></td>
</tr>
<tr>
<td>In</td>
<td>0.016</td>
<td>0.030</td>
<td></td>
</tr>
<tr>
<td>Cd</td>
<td>-</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Fe</td>
<td>-</td>
<td>0.090</td>
<td></td>
</tr>
<tr>
<td>Cu</td>
<td>-</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Si</td>
<td>-</td>
<td>0.12</td>
<td></td>
</tr>
</tbody>
</table>

3.3.4 Inventory of materials
Table 3-5 summarises the expected inventory of materials to be used for construction of the offshore pipeline.

Table 3-5 Use of materials for construction of the offshore pipeline (approximate amounts).

<table>
<thead>
<tr>
<th>Material</th>
<th>Total offshore route (274 km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel [t]</td>
<td>130,137</td>
</tr>
<tr>
<td>Internal flow coating, 0.1 mm epoxy paint [t]</td>
<td>82</td>
</tr>
<tr>
<td>External epoxy coating, 4.2 mm, 3 layers PE [t]</td>
<td>2,866</td>
</tr>
<tr>
<td>Field joint coating, Heat shrink sleeve [no.]</td>
<td>22,427</td>
</tr>
<tr>
<td>Concrete weight coating 100 mm, 3,040 kg/m³ [t]</td>
<td>252,355</td>
</tr>
<tr>
<td>Field joint coating PU [t]</td>
<td>5,878</td>
</tr>
<tr>
<td>Concrete (tunnel elements) [t]</td>
<td>6,000</td>
</tr>
<tr>
<td>Steel, landfalls (tunnel element reinforcement, sheet piles) [t]</td>
<td>1,100</td>
</tr>
</tbody>
</table>

3.4 Construction

3.4.1 Landfall construction in Denmark and Poland
The landfall in Denmark (Faxe S) is located south of Faxe Ladeplads in Faxe Bugt. Two landfall locations for Baltic Pipe are currently considered in Poland. Niechorze-Pogorzela is the preferred landfall location, however, Rogowo is also considered feasible (Figure 3-1). In both Polish landfall locations, the onshore and nearshore routes cross the Natura 2000 sites, and in both locations, routes were optimized to avoid impact on habitats which form the designation basis of the Natura 2000 sites.

For both the Danish and the Polish landfall, tunnelling has been chosen as the preferred landfall construction method. Tunnelling is a method where a lined tunnel is installed, enabling the accommodation of the pipeline and other services as well, such as a fibre optic cable. The hole is drilled using a conventional tunnel boring machine (TBM) with a full-face rotating drill head. As the TBM advances, concrete jacking pipe elements are pushed in behind it, forming a permanent tunnel lining. Pipeline joints will be welded on land and dragged into the tunnel by use of wires installed on a vessel. Since landfall construction activities do not give rise to any impact in a transboundary context, they are not further assessed in this report.
**Faxe S landfall**
The Danish landfall is located at an agricultural field with a 15-17 m high cliff along the beach. The image of the landfall location can be found in Figure 3-3.

![Figure 3-3 Danish landfall location.](image)

**Niechorze landfall**
The area of the landfall location onshore is characterised by wide beach and dunes. The onshore section of Niechorze landfall variant will be located in a forest area. The image of the landfall location can be found in Figure 3-4.

![Figure 3-4 Niechorze landfall](image)

**Rogowo landfall**
The area at the landfall location onshore is characterised by wide beach and dunes and proximity of forest. The onshore section of the Rogowo landfall will be located in a forest area. The image of the landfall location can be found in Figure 3-5.
3.4.2 Offshore construction

Offshore construction includes the following overall activities: seabed preparation, pipe-lay and seabed interventions.

Seabed preparation
When the data from the geophysical and geotechnical surveys have been analysed, the detailed pipeline route will be defined. This route will be selected so that objects resting on the seabed (possible wrecks, munitions objects etc.) will be avoided to the greatest extent possible.

A detailed magnetometer survey covering a corridor around the pipeline route will be executed before seabed interventions and pipe-lay activities are executed. This is to re-assure that no buried munitions objects or similar are present in the area. The magnetometer survey will be planned in agreement with the relevant national authorities responsible for unexploded ordnance (UXO). Since objects resting on the seabed are avoided as much as reasonably practicable when designing the route, the possible occurrence of munitions objects identified from the magnetometer survey is considered an unplanned event. Unplanned events have been dealt with in the risk chapter of this report (Chapter 4).

Pipe-lay
Pipe-lay will take place in different steps and with different methods, which are described in the following.

The pipeline installation method for the deep-water part of the 36” gas transmission pipeline is by S-lay vessel. A typical configuration for which is presented in Figure 3-6.
The coated pipe segments are joined by welding with a pipeline on board the laying vessel, which is then lowered from the ship to the seabed using a boom (stinger) thus adopting an S shape. The critical points when laying the pipeline are the upper bend point on the boom, and the lower bend point at the place where the laid pipeline comes into contact with the bottom. The overbend stresses are controlled by a suitable stinger configuration, while buckling at the sag bend is prevented by tension in the pipeline, provided by tensioners on the lay vessel.

In deeper water (i.e. greater than 20 m water depth) the lay vessel may be provided with a dynamical positioning system (DPS) and powerful thrusters, enabling it to maintain position and move forward.

In shallower water (e.g. less than 20 m water depth), the Dynamic Position (DP) vessel will not be able to operate. In these areas, it is necessary to use a shallow-water lay barge. The lay barge moves forward from under the pipeline by pulling itself on anchors, which are periodically shifted forward by anchor handling vessels.

The final step of pipeline installation is to connect the open end of the offshore pipeline with the open end of the landfall pipeline, which has been installed in the tunnel. This is done by a “tie-in” operation as explained in the following:

Above water davit lift tie-in is an operation in which two laid pipeline sections on the seabed are welded together after being lifted above water using vessel davits. The procedure is shown in Figure 3-7.
Both pipeline ends are provided with pre-installed clamping sections and laid down on the seabed next to each other, with an over length for the tie-in; Davit lift cables are connected to the pipelines, which are lifted and clamped into position; The pipeline ends are cut to measure, aligned, and welded together on the side of the vessel; After application of the field joint coating, the joined pipeline is lowered to the seabed as the vessel moves sideward to avoid overstressing of the pipeline.

The number of davit lift tie-ins will depend on the detailed design of the pipeline installation scenario; i.e. whether part of the offshore route requires installation by a low-water barge. In total two davit tie-in lifts are anticipated.

**Seabed interventions**

**Trenching**

In the coastal area at landings in Denmark and Poland, as well as in shallow waters that are less than 20 m deep, pipelines are expected to be buried in the seabed in order to protect against the risks associated with shipping, or to stabilize the pipeline (load by waves and sea currents). As a
conservative approach, the above scenario was adopted for the assessment of potential impacts related to seabed works. Should the final project assumptions regarding securing and stabilizing the gas pipeline be less demanding for seabed works (ex. excavations in waters with a depth of less than 20 m, displacement between 20 m and 15 m), the gas pipeline project will be optimized to reduce the length of excavations.

This optimization will reduce the potential impact on the environment in this area. Moreover, in order to provide additional protection for the pipeline, it may be necessary to dig into waters with depths greater than 20 m, i.e. at intersections with shipping lanes.

Trenching will take place to at least 2 m below the seabed surface, to ensure at least 1.0 m between mean seabed level and top of pipe (TOP). In shallow waters, coastal sediment transport causes variations in the seabed profile. In these areas, the pipeline will be installed in a tunnel to a greater depth, so that there is at least 1.0 m between TOP and the Lower Envelope Curve (separating the stable seabed from the dynamic surface sediment layer), which will ensure stability during the lifetime of the pipeline. In the Polish section, the pipeline is planned to be buried over a section of approximately 45 km in length (including the section of the pipeline passing through the disputed area).

It is also possible that the gas pipeline will be laid directly on the seabed, and the seabed will only be dug into in several designated places for additional protection, ex. against damage by anchors.

In areas with a water depth of less than approximately 15 m (dredging), trenching can be performed using backhoe dredgers on barges (see Figure 3-8). For this method, the trench is excavated before pipeline installation. The side slope of the trench will depend on the seabed composition, being 1:6 in sand (or other soft sediments) and 1:1 in stiff clay. The bottom of the trench will have a width of 5 m, and the average depth is assumed to be approximately 2. The total width of the pre-lay trench will thus be between 10 m and 30 m, depending on the sediment type (Figure 3-9).

The excavated material will be left on the seabed immediately adjacent to the trench and will be excavated back into the trench after pipeline installation.

Figure 3-8 Typical backhoe dredge for trenching in shallow water.
Figure 3-9 Schematic of a typical trench excavated using a backhoe dredger.

Trenching after pipeline installation is the simplest solution at water depths greater than approximately 15 m, possibly assisted by jetting. Trenching in these areas is planned by post-lay ploughing. Ploughing implies using a pipeline plough deployed onto the pipeline from a vessel located above the pipeline. A tow wire and control umbilical will be connected to the plough from the vessel, which will pull the plough along the seabed, laying the pipeline into the ploughed trench as the plough advances (Figure 3-10). Depending on the seabed conditions, other excavation methods such as cutter suction dredging or trailer suction hopper dredging might be required for parts of the pipeline route. Also, ploughing might be assisted by water jetting.

Figure 3-10 Pipeline plough before being lowered to the seabed from the towing vessel (left) and schematic of a trenching operation using ploughing (right).

The excavated material displaced from the plough trench (also known as spoil heaps) will be left on the seabed immediately adjacent to the trench. Where backfilling is required, the spoil heaps will be pushed back into the trench after pipeline installation.

A principle schematic of a cross section of a trench is shown in Figures 3-11. The depth of the trench will be at least 2 m, with side slopes around 35 degrees. The width of the post-lay trench will depend on the chosen trenching method, seabed types, trenching depth, etc. Based on the assumed dimensions the width of the post-lay trench will be at least 10 m.
Depending on the type of seabed, for some sections of the pipeline route, other dredging methods may be required, such as the use of a cutter suction dredging (CSD), or a trailer suction hopper dredger (TSHD). A mixed technology, i.e. the use of a plough and water jets, can also be used to penetrate the laid gas pipeline.

Using a plough can be supplemented by mechanical mining, especially in areas where limestone is found near the seabed. Along the entire pipeline route, the limestone layer is more than 2 meters below the seabed, however, for some sections of the pipeline, it may be necessary to use mechanical digging.

It is assumed that the use of mechanical digging may be necessary over an estimated total length of approx. 3 km.

A chain cutting trenching machine is used for mechanical digging (see Error! Reference source not found. on the left). The device is embedded in the gas pipeline by cutting out a wedge section underneath it, by means of mechanical mining arms. During the works, the gas pipeline gradually sinks into the excavation behind the dredger (see Error! Reference source not found. on the right). This type of device is able to penetrate the pipelines in sediments of each type, as well as in the ground built of some rocks, including limestone. The unearthed material will be pumped out of the excavation and deposited on the seabed in a place directly adjacent to the excavation, like when a plough is used. The amount of disturbed sludge as a result of using a mechanical dredger is estimated to be the same as from digging with a plough. Digging using this method is slower than using a plough.
Backfilling
Backfilling can be performed either by filling seabed materials and/or materials provided from other sources (in this project rocks from existing quarries) into the trench (artificial backfilling) or by leaving the trench to be gradually filled by sediments due to natural sediment transport mechanisms in the area after installation of the pipeline in the trench (natural backfilling). In this project, backfilling of the trenched pipeline will generally be performed by artificial backfilling using the seabed material excavated from the trench.

Rock installation and concrete mattresses
Rock installation is the use of unconsolidated rock fragments graded in size to locally reshape the seabed, thereby providing support and/or cover for sections of the pipeline system to ensure its long-term integrity. In some areas where trenching is planned, the geological seabed conditions may cause unexpected problems for post-lay trenching. In such areas, it may be required to use rock installation instead as a mean of protection.

Rock installation is planned to be performed by a rock installation vessel, equipped with a flexible fall pipe, which can be lowered into the water beneath the vessel (see Figure 3-12). The pipeline rock strengthening design is shown in Figure 3-13.

Rock installation can be replaced by or used in combination with concrete mattresses. Concrete mattresses will be installed at pipeline and cable crossings to ensure minimum separation between the services.
Figure 3-13 Fall pipe vessel equipped for rock installation (Beemsterboer, 2013).

Figure 3-14 Schematic of strengthening with post-lay rock design.

Crossing of marine infrastructure (pipelines and cables)
The Baltic Pipe route crosses existing pipelines, telecom cables and power cables at the seabed of the Baltic Sea. The infrastructure that will be crossed has been identified after consultation with the relevant authorities in Denmark, Sweden, Germany and Poland.

Before construction of the offshore part of the Baltic Pipe, agreements will be reached with all involved owners of the crossed infrastructure. Also, the exact position of each crossing will be established by detailed geophysical surveys.
A detailed crossing design for each crossing will be prepared. The crossing design will be based on survey results and provide input to the rock installation design.

The crossings will be constructed using pre-lay separation, e.g. rock installation and concrete mattresses. After installation, the Baltic Pipe will be covered to TOP for protection. For both pre-lay and post-lay, a side slope of 1:2.5 is assumed to be sufficient (see Figure 3-14).

Figure 3-15 Schematic of a pipeline/pipeline crossing.

Overview of seabed intervention works
The need for pipeline protection has been established based on a quantitative risk assessment (Ramboll 2018f). The main reasons for the pipeline protection requirements considered in this study is dragged and dropped anchors. Furthermore, the pipeline is expected to be protected by trenching and backfilling in research areas and military areas. At the landfall locations the pipeline requires protection due to the low water depth. Where the water depth is less than 20 m, the pipeline will be trenched into the seabed. It is also possible that the gas pipeline will be laid directly on the seabed, and the seabed will only be dug into in several designated places for additional protection, ex. against damage by anchors.

The lengths of the sections where offshore trenching at water depths less than 12 metres is anticipated are presented in Table 3-6. At each section, the type of seabed material will influence the cross-sectional geometry and therefore determine the volumes that will be handled. The table also shows the lengths to be trenched at water depths greater than 12 m. The trenched volumes are presented in Table 3-7 together with the expected excavated volumes for recovering the TBM nearshore.

Figure 3-15 presents an overview over the various types of anticipated seabed interventions. In the figure it has been assumed that trenching takes place at 0-20 m water depth, in research areas and military areas, and where crossing shipping lanes, and that rock installation takes place where crossing pipelines and cables.

The material that has been dredged and removed due to the tunnelling of the end shaft at landfall will be temporarily stored at the seabed beside the trench, and then backfilled on top of the pipeline after it has been installed.

Rock material for rock installation will be provided directly from existing rock quarries. The inventory of rock volumes for pipeline and cable crossings for the different route sections is shown in Table 3-8.
Table 3-6 Estimated trenching lengths in the various countries of origin.

<table>
<thead>
<tr>
<th>Route section</th>
<th>Trench lengths</th>
<th>Total length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-12 m</td>
<td>12-20 m</td>
</tr>
<tr>
<td>Danish EEZ/TW</td>
<td>15.1 km</td>
<td>41.4 km</td>
</tr>
<tr>
<td>Swedish EEZ</td>
<td>N/S</td>
<td>23 km</td>
</tr>
<tr>
<td>Disputed area</td>
<td>N/S</td>
<td>7.0 km</td>
</tr>
<tr>
<td>Poland EEZ/TW(Niechorze-Pogorzela variant)</td>
<td>0.8 km</td>
<td>approx. 37 km</td>
</tr>
</tbody>
</table>

Table 3-7 Trenching and excavation volumes in the various countries of origin.

<table>
<thead>
<tr>
<th>Route section</th>
<th>Trench volumes</th>
<th>Total volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;12 m</td>
<td>&gt;12 m</td>
</tr>
<tr>
<td>Danish EEZ/TW</td>
<td>332,200 m³</td>
<td>384,940 m³</td>
</tr>
<tr>
<td>Swedish EEZ</td>
<td>N/S</td>
<td>326,600 m³</td>
</tr>
<tr>
<td>Disputed area</td>
<td>N/S</td>
<td>68,000 m³</td>
</tr>
<tr>
<td>Polish EEZ/TW</td>
<td>27,500 m³</td>
<td>350,000 m³</td>
</tr>
</tbody>
</table>

Table 3-8 Protection at pipeline and cable crossings in the various countries of origin.

<table>
<thead>
<tr>
<th>Route section</th>
<th>Cable crossing</th>
<th>Pipeline crossing</th>
<th>Pre-lay</th>
<th>Post-lay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danish EEZ/TW</td>
<td>9</td>
<td>4</td>
<td>Mattresses + 12,000 m³ rock (pipeline crossings)</td>
<td>8,000 m³ rock (pipeline crossing)</td>
</tr>
<tr>
<td>Swedish EEZ</td>
<td>6</td>
<td>N/S</td>
<td>Mattresses</td>
<td>N/S</td>
</tr>
<tr>
<td>Disputed area</td>
<td>1</td>
<td>N/S</td>
<td>Mattresses</td>
<td>N/S</td>
</tr>
<tr>
<td>Polish EEZ/TW</td>
<td>3</td>
<td>N/S</td>
<td>Mattresses</td>
<td>N/S</td>
</tr>
</tbody>
</table>

The numbers are only approximate, as the planned seabed interventions works will be optimised during the detailed design process.

As a base case, the pipeline is expected to be protected in shipping lanes by trenching and backfilling. However, the detailed design studies may conclude that in some areas, rock installation is required. The maximum rock volume to be used (assuming rock installation is used instead of trenching in all shipping lane areas) is 610,000 m³ (based on the concept study; Ramboll, 2017).
In the Figure 3-15, it has been assumed that seabed intervention works take place at a 0-20 m water depth, in research and military areas and where crossings of shipping lanes, pipelines and cables take place. The final seabed interventions design at the shipping lane will be optimized during the detailed design phase.

### 3.4.3 Construction timeline

Construction works are planned to start in the second quarter of 2020 and finish in the third quarter of 2022. Construction works in landfall areas are expected to begin in the fourth quarter of 2020, and work on the seabed should begin in the first quarter of 2021. The laying of the pipeline is planned from the first quarter of 2021 to the first quarter of 2022. Work on the seabed after the laying of the pipeline is planned until the third quarter of 2022. The planned date of commissioning of the pipeline after initial acceptance and putting into service is the October 2022.

With respect to the Polish part of the project, the following is expected (and is subject to changes as the detailed planning progresses):

- **Landfall site preparation:** Fourth quarter of 2020 to third quarter of 2021;
- **Seabed Intervention (pre-lay, post-lay):** Fourth quarter of 2021 to third quarter of 2022;
- **Pipeline Installation:** First quarter of 2021 to first quarter of 2022;
- **Pre-commissioning:** First and second quarter of 2022;
- **Restoring the landfall of the gas pipeline to its original condition:** Third quarter 2022 (after pre-commissioning);
- **Final acceptance:** Third quarter of 2022;
- **Putting into service:** Fourth quarter of 2022
3.4.4 Offshore logistics during construction and operation

The offshore logistics during construction includes numerous activities for preparation and construction of the pipeline. The detailed schedule of the offshore construction will be planned at a later stage, by GAZ-SYSTEM S.A. together with the contractors selected to carry out the work. A possible inventory of equipment is shown in Table 3-9.

Table 3-9 Overview of the use of machinery for the construction works for the entire offshore pipeline.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Equipment example</th>
<th>Power (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trenching and backfilling</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trenching (0-12 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backfilling (0-12 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postlay trenching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backfilling, ploughing</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rock installation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rock installation (sailing)</td>
<td>Fall pipe vessel</td>
<td>6,500</td>
</tr>
<tr>
<td>Rock installation (rock installation)</td>
<td>Fall pipe vessel</td>
<td>3,700</td>
</tr>
<tr>
<td><strong>Pipe-lay</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipe-lay (deep water)</td>
<td>Allseas Solitaire</td>
<td>36,000</td>
</tr>
<tr>
<td>Pipe-lay (shallow water)</td>
<td>Allseas Tog More</td>
<td>3,750</td>
</tr>
<tr>
<td>Pipe-lay (shallow water)</td>
<td>Anchor handling vessels</td>
<td>10,000</td>
</tr>
<tr>
<td>Tie-in (Davit-lift)</td>
<td>Allseas Solitaire</td>
<td>36,000</td>
</tr>
<tr>
<td>Pipe supply</td>
<td>Pipe supply vessel</td>
<td>7,700</td>
</tr>
<tr>
<td><strong>Other marine logistics operations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changing of crew</td>
<td>Helicopter</td>
<td>3,600</td>
</tr>
<tr>
<td>Research</td>
<td>Research ships</td>
<td>7,200</td>
</tr>
</tbody>
</table>

Minor maintenance work on structures made of rock material will be required during operation.

In addition, during the whole period of the pipeline's operation, research vessels for conducting geophysical surveys will be used. Research will take place every year during the first five years of operation and every three years thereafter. Table 3-10 presents the units used during operation.

Table 3-10 Information on vessels to be used during pipeline operation in the Baltic Sea

<table>
<thead>
<tr>
<th>Activity</th>
<th>Equipment example</th>
<th>Power (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>Research ships</td>
<td>7,200</td>
</tr>
<tr>
<td>Replacement of rock material (conservation)</td>
<td>Fall pipe vessel</td>
<td>6,500</td>
</tr>
</tbody>
</table>

3.4.5 Waste generation and waste management

During the construction of the undersea pipeline, certain quantities of waste will be generated, mainly on board ships that are participating in construction works.

Waste management will be implemented in accordance with applicable national and international regulations and standards, including Annex V to the MARPOL 73/78 Convention drafted by the International Maritime Organization (IMO), which defines the Baltic Sea as an area subject to special mandatory remedies to prevent the pollution of the marine environment (MOM 2013). This means that no waste should be thrown into the sea except for: 1) cleaning agents and additives (if not harmful to the environment) contained in the water used to clean the deck and external surfaces, and 2) ground or ground food waste, if the distance from the nearest land is ≥ 12 nautical miles and the vessel is moving.
Due to the similarities between projects, waste from the construction of the undersea section of the Baltic Pipe pipeline will be analogous to waste generated during the construction of NSP pipelines. The types of waste generated during the construction of NSP pipelines are described in Table 3-11.

Table 3-11 Distribution of types of waste from the offshore construction of the NSP project (Nord Stream AG, 2017).

<table>
<thead>
<tr>
<th>Waste type</th>
<th>Weight % of total waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete (from the concrete coating of the pipes)</td>
<td>46%</td>
</tr>
<tr>
<td>Metals (scrap from end millings from the bevelling and welding processes)</td>
<td>25%</td>
</tr>
<tr>
<td>General/domestic waste (combustible; plastic, paper, cardboard, food)</td>
<td>23%</td>
</tr>
<tr>
<td>Chemicals/hazardous (greases, other oils, paints, electric waste, etc.)</td>
<td>3%</td>
</tr>
<tr>
<td>Other (wood from pallets etc.)</td>
<td>3%</td>
</tr>
</tbody>
</table>

Experience from comparable pipeline projects suggests that the total amount of waste when constructing offshore pipelines is approximately 3-4 tonnes per kilometre, i.e. approximately 1000 tonnes for the offshore part of the Baltic Pipe project.

Concrete waste, which comprises the largest part, is typically reused in road construction, and metal waste is recycled. The other types of waste are disposed according to the waste hierarchy in Directive 2008/98/EC on waste (Waste Framework Directive).

The produced waste will be sorted at the source and stored in suitable containers. It will be transported to shore and subsequently transported to licensed waste contractors, which will treat the waste in compliance with local legislation.

Waste management plans will be prepared for vessels participating in the project to ensure that waste water is delivered to approved port reception facilities in compliance with HELCOM requirements.

3.5 Pre-commissioning

Before commissioning of the pipeline, pre-commissioning will be conducted. Pre-commissioning includes the activities described in the following sections.

3.5.1 Flooding, cleaning, gauging and hydrotesting

Hydrotesting is carried out, after all construction activities (pipelay, tie-in and seabed intervention, including crossing construction) have been carried out.

Hydrotesting requires that the pipeline be water-filled using seawater pumped into the pipeline through a simple water winning arrangement that includes filtering. To prevent internal corrosion of the line-pipe steel, the seawater may be treated with oxygen scavenger. Sodium bisulfite (NaHSO₃) is a typical oxygen absorber. For an oxygen concentration of 10 ppm, a dose of 65 mg/l (ppm) is required. In total, approximately 20,000 kg of sodium bisulphite is expected to be required for flooding of the entire pipeline system (Ramboll, 2018b).

The chemicals planned to be used in the pre-commissioning operation include oxygen scavenger (OR-6045), Mono Ethylene Glycol (MEG) and nitrogen gas. According to the OSPAR classification system for offshore chemicals they are all classified as chemicals which are considered to Pose Little Or No Risk to the Environment (PLONOR) (Ramboll, 2018b). The environmental concern related to the chemicals is therefore more related to the fact that the discharged pressure test water will be oxygen depleted rather than the possible residual amounts of the used chemicals.
No other chemical additives are planned to be used in the pressure test water. Ultraviolet treatment may be applied to reduce the number of bacteria present in the pressure test water.

If no other chemicals are used, the test water is environmentally harmless and may be discharged to the sea via temporary discharge lines. The end of the discharge lines will be placed at a minimum of 4 m water depth in Faxe Bugt. The outlet would be provided with a diffuser head, ensuring that any chemicals are diluted to concentrations (of remaining chemicals that are unhareful to aquatic wildlife and local oxygen depletion is avoided. Further treatment of the discharge water is not required.

It shall be documented that there are no dents in the line-pipe wall which could induce failure in the long term or obstruct the passage of cleaning and batching pigs. For this purpose, gauging and calliper pigs are propelled through the pipeline during water filling. The piston used for testing the change in the inside diameter of the pipe is referred to as the intelligent caliper, and is equipped with sensors that measure the internal diameter at a number of points around the circumference.

During and after water filling, the pipeline interior shall be cleaned. Cleaning assemblies include both brush and foam pistons. The latter remove from the pipeline, any brushes that may have fallen out during the cleaning process. The pig trains are normally propelled by the treated seawater pumped in for the purpose of the hydrotesting, but further cleaning by running brush and swabbing pigs in air may take place during and after de-watering. In Figure 3-16, a typical flooding, cleaning, and gauging caliper train is shown.

![Direction of Flow](image)

**Figure 3-17 Example of a caliper train used for flooding, cleaning and gauging. For the present project, four calipers are anticipated.**

The cleaning operation may be facilitated by gel-slug technology. A gel is a plastic fluid with the capability to pick up loose and loosely adhering solids. The gel slug is inserted into the pipeline, followed by an appropriately designed scraper pig. The gel slug is disposed of at the receiving end (in Poland).

The total volume of slugs for flooding, cleaning and gauging (FCG) is approximately 720 m$^3$. The water slugs, used for the FCG operation will have to be collected upon arrival at the Polish landfall, in temporary water storage tanks until disposal according to local regulations. It is envisaged that 2-3 tanks will be required at the Polish landfall (Ramboll, 2018b).

Pipeline debris in front of the dewatering pigs will be collected and deposited at a controlled waste site. Water used for cleaning and gauging will be deposited at a controlled disposal site in Denmark. Mono Ethylene Glycol (MEG) used for conditioning will also be deposited at a controlled disposal site in Denmark or recycled.
3.5.2 De-watering and drying
Pipeline de-watering runs are carried out by means of air-propelled pig trains during or after cleaning, see above.

To dry the pipeline, the following methods may be used, alone or in combination:

- MEG conditioning
- Dry air drying;
- Vacuum drying.

With the MEG conditioning method, a batch of MEG is enclosed between pigs and propelled through the pipeline with compressed air. Residual water will be dissolved in the hygroscopic substance, leaving a film that is mostly MEG.

An alternative procedure, which combines cleaning and drying in one operation, is gel pigging, as described above. Modern gel-forming agents can produce gels from an array of liquid components. By incorporating gels based on hygroscopic fluids, such as MEG, into the cleaning train, the water is removed along with the debris. For this project, the volume of pick-up gel (which will be biodegradable) is expected to be 10-20 m$^3$. The debris and the pick-up gel will be delivered to a controlled waste plant.

Dry air drying utilises the ability of dry air to contain a large amount of water as vapour, whereas vacuum drying relies on the lowering of the boiling point of water at low pressures. For the 250-300 km long Baltic Pipe offshore pipeline, the vacuum pumps will have to work for several days to decrease the pipeline pressure below a few millibar. To limit the required time, vacuum drying is often used as the last step, i.e. after most of the water has been removed by MEG conditioning or gel pigging.

3.5.3 Nitrogen purging and gas filling
To prevent any internal corrosion between pre-commissioning and operation, in case the pipeline is not immediately operational, the pipeline may be filled with a non-corrosive gas, such as nitrogen.

When completed, the pipeline is found in what would normally be the final ‘hand-over’ condition, and the installation or pre-commissioning contractor will de-mobilise.

3.5.4 Pigging and monitoring
As explained above, the pre-commissioning activities entail the insertion of pig trains. As such, temporary facilities for launching and receiving pigs will need to be installed at each landfall, to be removed prior to tie-in of the adjoining onshore sections. As the medium is dry sales gas, no operational caliperging is foreseen, but to monitor the integrity of the pipeline system, inspection caliperging, using intelligent calipers should be carried out at regular intervals. The corresponding bi-directional pigging facilities will typically be installed at the compressor station in Denmark and at the receiving station in Poland.

The internal inspection monitors the following aspects:

- Internal diameter (presence of dents);
- Wall thickness (metal loss due to corrosion).

In addition, external inspections by Remote Operated Vehicle (ROV) and cathodic protection (CP) measurement equipment are carried out at regular intervals, to monitor the general condition of the pipeline, with the as-built survey results serving as a baseline.
The external inspection monitors the following aspects:

- General condition (debris or snagged equipment);
- Free span development (scouring);
- CP performance (functioning of anodes).

3.6 Commissioning and operation

Commissioning entails filling the pipeline with gas for the first time and includes all activities that occur after the pre-commissioning phase until the moment when the pipeline is ready for gas transfer.

After pre-commissioning, the pipeline will be filled with dry air. To prevent a mixture of air and dry gas immediately before injection, the pipeline will be filled with nitrogen (inert gas) which will work as a buffer between the air and gas. Nitrogen will most likely be provided from a mobile nitrogen generation plant.

When adequate separation has been provided by nitrogen, the natural gas is introduced from one end (Danish compressor station). At the opposite end, the air and nitrogen will be discharged through an air silencer or flare, until gas content/traces are detected (Polish receiving terminal).

The air and nitrogen emissions do not cause any environmental impact, and the emission facilities will be designed to ensure that there also will be no health impacts.

3.7 Operation

The expected pipeline life is 50 years. During that period constant supervision of the gas transfer as well as scheduled and unscheduled checks and works related to the maintenance will be carried out.

During pipeline operation technical operations will be conducted with the purpose of ensuring the integrity of the pipeline, in particular maintaining the proper pressure and secure infrastructure.

These activities will include geophysical surveys to control the integrity of the pipeline and the surrounding seabed. Also, calipers will be used for monitoring the wall thickness and the possible corrosion of the pipeline.

Supervision of the gas transfer will be carried out from the project management centre at a location to be designated at a later stage of the project.

3.8 Decommissioning

The estimated lifetime of the high-pressure gas pipeline is about 50-60 years, after which the gas pipeline may be decommissioned. Due to the long period of time for liquidation and the probability of technological development, it is difficult to predict exact methods of liquidation implemented in 60 years.

Below is an overview of the existing legislation and best practice with respect to decommissioning of offshore pipelines. The actual method of decommissioning will be agreed with the relevant authorities in due time before the decommissioning activities. It is not possible to detail the method to be used for decommissioning at this time, as it will depend on the legislative regime as well as the technical options available at the time of decommissioning.

3.8.1 International legislation and best practice

The overriding principle of all international regulations and guidance is that decommissioning activities should not result in any harm to other users of the sea or to the environment (IOGP, 2017).
The process of decommissioning is regulated by international, regional and national conventions and legislation in terms of the removal of installations (primarily concerned with the safety of navigation and other users of the sea) and disposal of materials (primarily aimed at pollution prevention). The primary conventions are noted below:

- **United Nations Convention on the Law of the Sea (UNCLOS), 1982.** Article 60 contains provisions on the construction and removal of offshore installations and requires coastal State authorization for any installation or structure intended to remain on the seabed.
- **London (Dumping) Convention, 1972.** The convention (and the subsequent 1996 Protocol) promotes the effective control of all sources of marine pollution and provides generic guidance for any wastes that may be dumped at sea. New guidelines, which specified different classes of waste, including platforms and other man-made waste, were adopted in 2000.
- **Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention), 1992, 1998.** The OSPAR Convention seeks to prevent and eliminate pollution of the marine environment in the North-East Atlantic from land-based sources, dumping and incineration, and offshore sources. The OSPAR Convention does not include the environment of the Baltic Sea, which is regulated by the HELCOM Commission.

None of the international guidelines provide specific guidance in relation to pipelines or cables (IOGP, 2017). And no specific guidelines exist for decommissioning in the Baltic Sea.

For the North Sea / North Atlantic, Norway and the United Kingdom (UK) have developed guidance notes on decommissioning. They mainly concern decommissioning of offshore installations, but they also address decommissioning of pipelines and cables.

The Norwegian requirements regarding decommissioning of pipelines have been expressed in the Norwegian Parliament White Paper No. 47 of 2001 (Norwegian Parliament, 2001). As a general rule, pipelines and cables may be left in place as long as they do not cause obstruction or present a safety risk for bottom fishing, considering the costs of burial, covering or removal of these items. Final decisions on the disposal are made by the Norwegian authorities. The following disposal solutions are usually considered:

- Clean and leave in situ;
- Burial/trenching;
- Rock installation;
- Removal.

As a response to the above, Norwegian industry guidelines on environmental impact assessment for offshore decommissioning were developed (DNV, 2001). An overview of the various technical options for decommissioning is provided in DNVGL-RP-N102 (2017).

The UK authorities have issued guidance notes on decommissioning of offshore oil and gas installations and pipelines (BEIS, 2017). As these are probably the best developed existing guidelines, they are briefly outlined in the below.

The general approach to decommissioning of pipelines includes the following:

- All feasible decommissioning options should be considered, and a comparative assessment should be made;
- Any removal or partial removal of the pipeline should be performed in such a way as to cause no significant adverse effects upon the marine environment;
Any decision that a pipeline may be left in place should regard the likely deterioration of the material involved and its present and possible future effect on the marine environment; Account should also be taken of other users of the sea and future fishing activities in the area.

Determination of any potential effect on the marine environment at the time of decommissioning should be based upon scientific evidence. The factors to be considered should include (BEIS, 2017):

- The effect on water quality and geological and hydrographic characteristics;
- The presence of endangered, threatened or protected species;
- Existing habitat types;
- Local fishery resources;
- The potential for pollution or contamination of the site by residual products from, or deterioration of, the pipeline.

To evaluate the potential environmental impact, it is necessary to evaluate the contents of the pipeline and outline the cleaning operations that will be undertaken (BEIS, 2017).

Where it is proposed that a pipeline should be decommissioned in place, either wholly or in part, then the decommissioning programme should be supported by a suitable study which addresses the degree of past and likely future burial/exposure of the pipeline and any potential effect on the marine environment and other uses of the sea. The study should include the survey history of the pipeline with appropriate data to confirm the actual status of the pipeline including the extent and depth of burial, trenching, spanning and exposure. It should also detail levels of fishing activity in the area (BEIS, 2017).

Where rock installation has been used to protect a pipeline, it is recognised that removal of the pipeline is unlikely to be practicable and it is generally assumed that the rock installation and the pipeline will remain in place. Where this occurs, it is expected that the rock installation will remain undisturbed (BEIS, 2017).

### 3.8.2 Environmental impacts of decommissioning

In case the pipeline is left in situ, for a number of years the potential environmental impacts will be comparable to some of the impacts caused by the presence of the pipelines during the operational phase. This includes the continued presence of the pipeline on the seabed, which potentially leads to a "reef effect", and there can potentially be an impact on commercial fisheries. Also, there will be a continuation of the release of metal from the sacrificial anodes.

In addition to the above, there will be a release of mainly iron from the gradual corrosion of the steel pipelines in the marine environment. This release will be slow and is not expected to have any negative impact on the marine environment.

In case the pipeline is fully or partly removed, the potential impacts on the marine environment are expected to be comparable to the impacts of construction of the entire or parts of the offshore pipeline. In addition, there will be a large amount of materials recovered which will partly cause waste creation and will partly provide resources for recycling (e.g. the pipeline steel).

### 3.9 Mitigation measures

The chapter discusses activities that minimize impacts, as they relate to the Polish part of the undersea Baltic Pipe project. These activities were divided into four categories:

- activities to minimize significant impacts;
- Mitigation measures implemented in the project design
- Mitigation measures applied for unplanned events;
- Mitigation measures that comprise common practise or regulatory measures.
Since no significant impacts were identified during the assessment of the impact of the Polish part of the Baltic Pipe project (SMDI, 2019), mandatory minimizing measures are not required.

### 3.9.1 Mitigation measures implemented in the project design

The project design and the pipeline route selection are generally based on the consideration of reducing impact from the project on the environment. In Chapter 5, Alternatives, a thorough description of the route selection, including some of the incorporated environmental consideration, is outlined. Table 3-12 contains other important activities to minimize environmental impacts or to optimize the Polish undersea part of the Baltic Pipe project.

**Table 3-12 Examples of minimizing measures implemented at the design stage of the Polish Baltic Pipe undersea part.**

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal zone</td>
<td>Temporary storage of land relative to the performance of earthworks and restoration of the seabed to its original state (reclamation) Works related to the extension of the gas pipeline to land in the coastal zone will require temporary storage of the soil removed from the tunnelling machine (TBM) in places where the water depth exceeds 7 m (within a 1 km wide corridor), so as to minimize the potential impact relative to projects that take place in the zone of the highest intensity of sedimentation and erosion processes (up to a depth of 7 m). After the completion of earthworks (including microtunnelling), the seabed will be restored to its original state using temporarily stored material.</td>
</tr>
<tr>
<td>Hydrography and water quality</td>
<td>Microtunnelling The use of this method translates into a lesser degree of sediment spreading in the coastal zone.</td>
</tr>
<tr>
<td>Archeology and cultural heritage offshore</td>
<td>Querying of cultural heritage In order to optimize the route of the pipeline, a query was carried out regarding cultural heritage objects, in order to minimize the impact of the Project and the risk of delays in the implementation schedule.</td>
</tr>
<tr>
<td>Shipping and shipping lanes</td>
<td>Pipeline protection at crossing points with shipping routes To ensure the safety of the pipeline and vessels, the gas pipeline will be secured at junctions with main shipping routes by being buried at the bottom of the sea and/or protected with rock material. This mainly applies to route I that connects TSS &quot;Adlergrund&quot; with TSS &quot;Ławica Słupska&quot;. For the Niechorze-Pogorzelska alternative, this refers to a shipping route that runs along the Polish coast at a distance of about 20 km from the shore, due to its small depth and risk of bogging.</td>
</tr>
</tbody>
</table>

### 3.9.2 Mitigation measures for unplanned events

The occurrence of an unplanned event, such as the removal of ammunition, can cause potential impacts on fish and marine mammals at an individual level (section 7.3.1 and 7.3.2). The minimizing measures for the Polish part of the undersea pipeline suggested in this connection are presented in Table 3-13.

**Table 3-13 Suggested actions to minimize impacts in the event of ammunition removal.**

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>Plan of conventional arms removal Development of a conventional weapons disposal plan, by separately indicating a mitigation plans for marine mammals, including the specification of a specific minimizing measure application, such as the use of marine mammal observers, Passive Acoustic Monitoring (PAM),</td>
</tr>
<tr>
<td>Marine mammals</td>
<td></td>
</tr>
<tr>
<td>Receptor</td>
<td>Mitigation measures</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td>acoustic deterrents and isolation devices (bubble curtains). The plan should cover areas and species that are subject to protection.</td>
</tr>
<tr>
<td></td>
<td><strong>Acoustic barriers</strong></td>
</tr>
<tr>
<td></td>
<td>The use of acoustic barriers (ex. bubble curtains), and the use of acoustic deterrent devices in combination with the conducting of observations.</td>
</tr>
<tr>
<td></td>
<td><strong>Sonar survey</strong></td>
</tr>
<tr>
<td></td>
<td>A sonar test to identify the presence of shoals or groups of fish can determine whether the munition clearance time is appropriate, or whether the detonation should be postponed. This assessment can be helpful in protecting shoals/schools of fish that may be present in the area.</td>
</tr>
<tr>
<td></td>
<td><strong>Visual observations and PAM</strong></td>
</tr>
<tr>
<td></td>
<td>Visual monitoring carried out by marine mammal observers (MMO) from a ship (or a suitable observation platform). Visual monitoring should be limited to periods of good visibility during the day, because visibility worsens in bad weather or lighting conditions. If the presence of marine mammals is detected before the planned clearance of the unexploded ordnance, the detonation should be postponed. Visual observation before munitions clearance does not guarantee that marine mammals will not be affected by detonation, because they can stay under the surface of the water and thus remain undetected for a longer period of time. Nevertheless, visual inspection of munitions clearance can help to protect those animals that are spotted. As a good practice for the methodology of visual observation of marine mammals, it is possible to implement activities recommended by the Joint Nature Conservation Committee (JNCC, 2017). PAM is a set of hydrophones that is introduced into the water column, and the sounds detected using them are processed using specialized software to determine the presence of marine mammals. PAM will be implemented as a supplement to the visual observations done by the MMO.</td>
</tr>
<tr>
<td></td>
<td><strong>Seal scarer</strong></td>
</tr>
<tr>
<td></td>
<td>Seal scarers or seal scramers are acoustic deterrent devices, which can be used to deter seals and harbour porpoises from e.g. construction activities, fishing gear etc. The range, or the efficiency of the devices depends on the type of scarer and the set-up. Porpoises react to seal scarers more strongly than seals do (Hermannsen <em>et al</em>, 2015).</td>
</tr>
<tr>
<td></td>
<td><strong>Seasonality</strong></td>
</tr>
<tr>
<td></td>
<td>Studying the activity of marine mammals indicates the probability that porpoises will be present in the area of project implementation in Polish waters in the summer season. The results of the conducted research and the fact that the harbour porpoise is the subject of protection of the Natura 2000 area, within the boundaries of which the project will be implemented, it is recommended that any operations related to UXO removal be conducted outside the summer season.</td>
</tr>
</tbody>
</table>

### 3.9.3 Measures to minimize impacts determined by law or common practices

The Baltic Pipe project will, naturally, comply with the applicable regulation in force and with common practice industry norms, some of which also contribute to the mitigation of the environmental impacts from the project. In this regard, an environmental management plan will be developed. Measures to minimize the impact of the Polish part of the Baltic Pipe, as per the
regulations or in the commonly used practices, which are presented here Table 3-14, are preferred measures that can be part of the environmental management plan. However, it should be emphasised that the list is not exhaustive.

**Table 3-14 Examples of regulatory or common practise mitigation measures (not exhaustive).**

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Mitigation measures</th>
</tr>
</thead>
</table>
| **Commercial fisheries** | Dialogue with fishing community and drafting of joint reservoir sharing guidelines  
The purpose of this process is to work with the fishing community to avoid or minimize the impact on fishing activities. The result should be working out the principles of a common coexistence between fishermen and the gas pipeline. The scope of navigation limitation is described in Chapter 5.1.7 of the Polish EIA Report (SMDI, 2019). Details should be established with the maritime administration, which is responsible for establishing security zones and that rules that govern them. |
| **Environmental monitoring system and maritime research** | Coordination and logistics  
Spatial limitations relative to the exclusion of an area from navigation around the pipeline installation site, which makes it possible for sampling at the measuring station to take place. In this case, the impact will be removed. The scope of the navigation limitation is described in Chapter 5.1.7 of the Polish EIA Report (SMDI, 2019), while details should be agreed with the maritime administration. |
| **Shipping and shipping lanes Commercial fisheries** | Information on construction activities  
In cooperation with and by agreement of the Maritime Office in Szczecin, the developer will provide information about the planned construction periods, work scope, and area. |
| **Biodiversity (marine portion)** | International Convention on the Control and Management of Ships’ Ballast Water and Sediments (BWM)  
The objective of the BWM Convention is to prevent, reduce and, as far as possible, eliminate the transmission of these organisms and pathogens by controlling and managing ship-borne ballast water and sediment. It is assumed that all participating vessels will comply with the BWM convention and the HELCOM guidelines for alien species and ballast water management in the Baltic Sea area.  
Reduction of light pollution  
Electric lighting on ships poses a collision risk for nocturnal migrants because it attracts birds and/or bats. Reducing lighting will minimize the impact on biological resources while ensuring safe operation. |
| **Climate and air quality (marine part)** | SO\(\text{\(x\)}\) and NO\(\text{\(x\)}\) emission control areas  
The International Maritime Organization (IMO) has designated the Baltic Sea as an Emission Control Area (ECA) from 2015, in accordance with Regulation 14 of the MARPOL Convention, Annex VI meant to reduce SO\(\text{\(x\)}\) emissions (also known as SECA), and from 2021, the Baltic Sea has been included in Regulation 13 of the MARPOL Convention, Annex VI, to reduce NO\(\text{\(x\)}\) emissions (also known as NECA).  
Ships and fuel used as part of construction work will have to comply with applicable legislation, including legislation resulting from designated NECA and SECA areas. |

The information included in this chapter correspond to the information found in Chapter 3 and 13 of the Environmental Impact Report (SMDI, 2019).
4. RISK ASSESSMENT

4.1 Introduction
This chapter presents a summary of the results of the risk assessment related to the risk of environmental accidents and the risk to the population (third party risk, or societal risk).

Risk is defined as the likelihood of an accidental event combined with the consequence of the event.

For the offshore part of the Baltic Pipe project, detailed risk analyses have been carried out and documented in the Construction Risk Analysis, CRA (Ramboll, 2018e) and in the Quantitative Risk Assessment, QRA (Ramboll, 2018f) for the construction and operational phases, respectively.

In the following, a summary of the results of the risk assessment related to the risk of environmental accidents and the risk to the population (third party risk, or societal risk) is provided. With respect to working environment and the risk to personnel participating in the construction work, this is not part of this report and reference is made to the above-mentioned CRA report (Ramboll, 2018e).

The framework for controlling the risks during construction and operation is the Health, Safety and Environmental Management System of the operator GAZ-SYSTEM S.A.

4.2 Application of the ALARP principle
Design of the Baltic Pipe project has been carried out using the principle of reducing the risk to a level that is *As Low As Reasonably Practicable* (ALARP). The ALARP principle is defined here Figure 4-1. ALARP is the last step in the ocean risk assessment process.

ALARP demonstration is the final step of the risk assessment methodology to identify whether there is any reasonably practicable additional safety measure that could be implemented to reduce the risks. ALARP demonstration for the offshore part of the Baltic Pipe project is documented in Ramboll, 2018g.
Unacceptable risks found in the upper part of the chart require an unconditional limitation: the risk goes beyond legal requirements, company’s activity standards, etc. Risks in the ALARP area (admissible risks) should be limited to the lowest practically possible level (ALARP), until the costs related to further risk reduction become disproportionately high in relation to the benefits that are obtained.

4.3 Risk acceptance criteria
The risk assessment criteria (RAC) established for the Baltic Pipe offshore pipeline are in line with industry best-practice based on previous experience from large offshore pipeline projects (Ramboll, 2018).

For human safety, a RAC has been established for individual risk (IR), which is the risk of loss of life for individuals (i.e. each individual person). The criterion is different for 1st and 3rd persons.

For 1st person (a person involved in work for the project, e.g. the installation contractor), the fatal accident rate (FAR) should be <10 per 10^8 exposure hours for pipeline installation.

Third parties are defined members of the society that may be exposed to the activities of GAZ-SYSTEM S.A. (ex. people living in areas there are close to landfall, ship passengers, etc.) Societal risk (or group risk) is the risk of loss of life for a population (i.e. a number of different individuals and groups of people). Risk acceptance criteria were only defined in relation to third parties. They were described according to the F-N curve found in the Figure below (Figure 4-2). Risk levels below the tolerance criterion are in the ALARP region and shall be evaluated according to the ALARP principle (see Section 4.2), (Ramboll, 2018).

Figure 4-1 ALARP triangle
The most critical 10 km section along the pipeline is evaluated against the tolerance criteria, including risks from all relevant accidental scenarios.

4.4 Hazard identification

HAZID workshops were held on June 20 and 21, 2018 in Copenhagen, Denmark, to identify problems and threats that could affect the design and layout of the Baltic Pipe undersea pipeline. They were the starting point of the risk management process during the design of the offshore pipeline.

The conclusion from the HAZID study is that the main challenges related to the Baltic Pipe offshore pipeline include the following (Ramboll, 2018d):

- The pipeline will be routed through areas with a high density of ship traffic, making the QRA an important tool to ensure that appropriate protection is installed along the relevant lengths of the pipeline.
- The pipeline will cross a number of cables and most importantly the Nord Stream pipeline(s). This requires a well-developed crossing design, in which the crossing location, height of crossing structure and avoidance of electromagnetic corrosion are taken into account.
- The pipeline will cross close to a military submarine exercise area. The risk related to this shall be handled carefully.
- The pipeline will pass through several Natura 2000 sites (this includes one in the Swedish EEZ and two in Polish waters). The planned EIA must focus on a number of key concerns and is expected to further clarify any complications related to pipeline installation through these areas.
- Most of the hazards in the installation phase are related to asset risks, especially project delays.
- The planning of the installation phase as well as clearly defined requirements for all contractors in the installation phase are critical to reducing risks from a variety of hazards.
- Seabed intervention work as well as potential unexploded ordnance/chemical warfare agent (UXO/CWA) objects along the pipeline route.
- Man-access to the tunnel which will require focus in the execution phase of the project. The hazards related to the tunnel are: operation in a confined space under compressed air, retrieval of TBM, heavy/blind lifting on the work site. The latter two risks are level III human safety risks.

Figure 4-2 Risk acceptance criterion for third person societal risk (Ramboll, 2018e).

The most critical 10 km section along the pipeline is evaluated against the tolerance criteria, including risks from all relevant accidental scenarios.
All outlined risks were specified in the HAZID register. The register also includes information regarding the 15 main activities/assumed risk mitigation measures, and a series of side actions. An important stage in the risk management process is the verification of results and the "closure" (approval) of the designated activities, along with the assessment of the level of risk that remains after the activities are performed (residual risk assessment). It shows that the efforts that were undertaken have eliminated, prevented, controlled and mitigated hazards, and confirmed the risk reduction as per the ALARP, in line with the principle set out in point 4.2.

4.5 Ship traffic
The intensity of ship traffic in the area of the pipeline was analysed using historical data from the Automatic Identification System (AIS) from 2016. It should be noted that only ships with a gross tonnage (GT) over 300 GT are required to have an AIS system. To account for the increased maritime activity in the future, ship traffic is estimated for the year 2032 which is 10 years after operation start.

The majority of the ship traffic in the area follows the various shipping lanes (see Figure 4-3). The main directions of ship traffic are east-west from the inner Baltic Sea and towards Fehmarn Belt, north-south from southern Scania (Trelleborg/Ystad) to Swinoujscie, and north-southwest from southern Scania (Trelleborg/Ystad) to Fehmarn Belt (Rostock/Lübeck). In order to increase shipping safety, the movement of ships between Bornholm and Sweden is regulated using the Bornholmsgat traffic separation system (TSS). Its task is to delimit ship traffic in the south-westerly direction from the north-east direction.

As seen in Figure (Figure 4-3), seven different critical zones have been identified along the pipeline. All the critical zones are located in the major traffic lanes, where the release frequency is high. Red dots indicate the kilometre point interval (KPI) where the release frequency is critically high and yellow dots indicate KPIs included to extend the critical zone to a fitting length.
The yearly ship traffic across the pipeline route is shown in Figure 4-4. To account for the increased maritime activity in the future, ship traffic is estimated for the year 2032 which is 10 years after operation start.

Figure 4-4 Expected annual ship crossings along the Baltic Pipe route in 2032 (Ramboll, 2018f).
4.6 Hazards and risks during the construction phase

4.6.1 Methodology

During construction of the offshore Baltic Pipe pipeline, there will be an increase in ship traffic in the project area due to the presence of the work vessels. The main contribution to the increase is the pipe-lay and seabed interventions work vessels travelling along the pipeline, as well as the pipe carrier vessels supplying the pipe-lay from one or more shore bases. The shore base(s) to be used during the construction phase have not yet been selected. In order to be able to carry out a risk analysis regarding the pipe carrier vessel, the calculations have been made assuming that Ronne (Bornholm) is used as shore base for storage of the pipe sections. Both the pipe-lay vessel, the seabed interventions vessels and the pipe carrier vessels cross existing ship traffic lanes (see Figure 4-3), which increases the risk for ship-to-ship collisions resulting in loss of life or substantial oil releases.

As part of the Baltic Pipe CRA (Ramboll, 2018e), it was concluded that mitigation measures will be recommended for pipelay and rock lay vessels, in order to prevent potential collisions with ambient traffic. Mitigation measures include the use of notices to nearby mariners, safety zones and AIS communication technology. These mitigation measures have been included in the following results.

4.6.2 Risk related to oil spills

The risk of larger oil spills during the construction phase relates to the risk of third-party vessels colliding with one of the work vessels participating in the construction works. In addition to this, there is a risk of a minor oil spill from e.g. bunkering operations. The main risks of oil spill relate to third party collision with the lay barge, and, to a minor extent, third-party collision with other construction vessels. In particular, these risks are linked to the critical zones where the pipeline crosses shipping lanes (see Figure 4-3, Figure 4-4 and Table 4-2).

The frequencies of oil spills of various sizes have been calculated for the various parts of the pipeline route (see Table 4-1). Spills from bunker operations, which can have a size of 0-200 tonnes of bunker oil, appear in a separate row. The spills in the remaining rows have been calculated for lay barges and seabed interventions vessels after implementation of mitigation measures, and for the pipe carried without mitigation measures. The methods and assumptions for the calculations are documented in Ramboll, 2018e.

Table 4-1 Frequencies of oil spills of various size during the construction period. Bunker spill, which is in the range 0-200 t, is in a separate row.

<table>
<thead>
<tr>
<th>Oil spill size [tonnes]</th>
<th>Danish</th>
<th>Swedish</th>
<th>Polish</th>
<th>Disputed area</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 (bunker)</td>
<td>7.12×10^{-5}</td>
<td>8.56×10^{-5}</td>
<td>1.47×10^{-4}</td>
<td>1.34×10^{-5}</td>
<td>1.72×10^{-4}</td>
</tr>
<tr>
<td>500</td>
<td>1.67×10^{-5}</td>
<td>1.89×10^{-5}</td>
<td>2.26×10^{-7}</td>
<td>3.53×10^{-6}</td>
<td>3.93×10^{-5}</td>
</tr>
<tr>
<td>1,000</td>
<td>7.70×10^{-6}</td>
<td>8.80×10^{-6}</td>
<td>9.73×10^{-8}</td>
<td>1.57×10^{-6}</td>
<td>1.82×10^{-5}</td>
</tr>
<tr>
<td>10,000</td>
<td>4.82×10^{-6}</td>
<td>5.39×10^{-6}</td>
<td>6.59×10^{-8}</td>
<td>1.01×10^{-6}</td>
<td>1.13×10^{-5}</td>
</tr>
<tr>
<td>50,000</td>
<td>1.06×10^{-6}</td>
<td>1.32×10^{-6}</td>
<td>8.79×10^{-9}</td>
<td>1.98×10^{-7}</td>
<td>2.58×10^{-6}</td>
</tr>
<tr>
<td>100,000</td>
<td>1.26×10^{-7}</td>
<td>1.59×10^{-7}</td>
<td>5.41×10^{-11}</td>
<td>1.64×10^{-8}</td>
<td>3.02×10^{-7}</td>
</tr>
<tr>
<td>&gt;100,000</td>
<td>2.52×10^{-8}</td>
<td>3.18×10^{-8}</td>
<td>1.08×10^{-11}</td>
<td>3.28×10^{-9}</td>
<td>6.03×10^{-8}</td>
</tr>
<tr>
<td>Total</td>
<td>1.02×10^{-3}</td>
<td>1.20×10^{-4}</td>
<td>1.87×10^{-6}</td>
<td>1.97×10^{-5}</td>
<td>2.43×10^{-4}</td>
</tr>
</tbody>
</table>

As expected, the frequencies of small spills from bunker operations are higher than the frequency of larger spills as a consequence of a potential collision between a third-party vessel (oil tanker) and a work vessel. The frequency of oil spills caused by vessel collision is highest in Danish and Swedish waters, which coincides with the areas where the ship crossing traffic is highest, as outlined in Figure 4-4.
Risk acceptance criteria are usually related to human safety and not to the risk of oil spills. Also, because larger oil spills are fortunately relatively rare, it is difficult to find statistics to compare with for establishing whether the calculated spill frequencies are acceptable. Figure 4-5 shows FN-curves for annual spill frequencies of oil and chemicals, respectively, for an average offshore installation on the UK continental shelf during the period 2005-2010. This figure is not directly comparable with the conditions related to construction of a pipeline in the Baltic Sea, but it does, however, give an indication of what is considered acceptable in other industries with very high safety requirements and in a comparable environment.

Figure 4-5 shows that no oil spills larger than 200-300 tonnes occurred in the area/period serving as the basis for the figure. The annual frequency of a spill in the range of 10-100 tonnes is on the order of magnitude of $10^{-2}$ to $10^{-3}$ for an average offshore installation on the UK continental shelf during the period 2005-2010. When comparing with the calculated frequencies for the construction period for the Baltic Pipe (Table 4-1), these are on the order of magnitude of $10^{-4}$-$10^{-5}$ spills, i.e. the likelihood of an oil spill as a consequence of the construction of the Baltic Pipe is on the order of magnitude of $10^{-2}$-$10^{-3}$ of the yearly likelihood of an oil spill from an offshore oil and gas installation on the British continental shelf. It is expected that this proportion is also the same for larger oil spills than the spills covered by the statistics shown in Figure 4-5.

**Figure 4-5** FN-curve for accidental releases of oil and chemicals, respectively, normalised to an average offshore installation (drilling or producing platform) on the UK continental shelf. The data are based on statistics for all UK offshore installations for the period 2005-2010 (after Energy Institute, 2012).

The above shows that the frequencies of possible oil spills as a consequence of the project are low, relative to e.g. oil and gas exploration and production, which have an inherent risk of oil spills. This is due to the fact that the project does not introduce oil to the area, except for bunker oil on the vessels. The risk of a large oil leak as a result of the project’s impact is related only to the possible interaction (collisions) between work vessels and third party tankers. The risk of oil leakage caused by the Baltic Pipe project is comparable to the risk posed by a number of other activities in the Baltic Sea area, such as commercial fishing, shipping, etc.

### 4.6.3 Risk to human safety (third parties)

The risk to third party personnel has been calculated, using the same ship traffic data as used for the oil spill frequency calculations. The method and assumptions are documented in Ramboll, 2018e.
Societal risks (towards third parties) are evaluated by means of the FN curve. It presents the number of fatalities (N) against the annual frequency (F) of incidents with fatalities ≥N. The FN curve is presented for pipeline construction phase in the Danish, Swedish and Polish waters in Figure 4-6. The risk in the disputed area is included both in the risk curve for the Danish area and in the risk curve for the Polish area.

Figure 4-6 FN-curve illustrating societal risk (third party) for the construction phase. The frequencies have been calculated after mitigation measures have been implemented for the pipe-lay vessel and for the pipe carrier and rock installation vessel without mitigation measures (Ramboll, 2018e).

When comparing with the risk acceptance criteria (Section 4.3) the risk to third party is well below the acceptance criteria, i.e. in the ALARP zone, where risks need to be reduced to a level as low as reasonably practicable.

4.6.4 Environmental consequences of oil spills during construction

Due to the low probability of oil spills of the consequence of the Baltic Pipe construction works (see Section 4.6.2), no modelling of the dispersion of oil has been conducted for this project. Below is a short qualitative overview of the potential consequences of a possible oil spill.

Oil spilled to the marine environment will rapidly spread out and move on the sea surface with wind and currents while undergoing a number of chemical and physical changes (weathering). Some of these processes, such as natural dispersion of the oil into the water, lead to the removal of the oil from the sea surface, and facilitates its natural breakdown in the marine environment. Others, particularly the formation of water-in-oil emulsions, cause the oil to become more persistent, and remain at sea or on the shoreline for prolonged periods of time (ITOPF, 2014a).

Oil may impact an environment by one or more of the following mechanisms (ITOPF, 2014b):

- Physical smothering, with an impact on physiological functions;
- Chemical toxicity, giving rise to lethal or sub-lethal effects or causing impairment of cellular functions;
- Ecological changes, primarily the loss of key organisms from a community and the takeover of habitats by opportunistic species;
- Indirect effects, such as the loss of habitat or shelter and the consequent elimination of ecologically important species.
More specifically, if oil spill is introduced to the Baltic Sea, direct impacts can occur on seabirds and marine mammals by smothering of feathers and skin and ingestion of oil adhered to the food source (HELCOM, 2018). An oil spill is a serious threat to all links in the trophic chain in the marine environment - from plankton to seabirds. Polycyclic aromatic hydrocarbons (PAHs) can cause carcinogens and mutagens to develop on invertebrates and vertebrates, causing the death of organisms. PAHs can accumulate in fatty tissue and be introduced via plankton to higher trophic level organisms.

As the risk of oil spill from the Baltic Pipe project is low, the risk and detailed impact assessments will not be dealt with further.

4.7 Risk related to possible munitions finds
The pipeline route extends through areas where there is a risk of encountering both conventional and chemical munitions. Potential munitions objects will as far as possible be avoided, by designing the route based on the findings from the geophysical surveys. There is, however, a risk that e.g. buried munitions objects might be encountered during the detailed magnetometer survey carried out prior to pipe-lay.

An overall UXO hazard location plan is shown in Figure 4-7. In addition to the conventional munitions, there is additionally a risk of encountering chemical munitions for the part of the pipeline Southwest for Bornholm.
4.7.1 Risk of unplanned conventional munitions encounter

It is difficult to quantify the risks caused by the presence of munitions, due to the limited experience with infrastructure projects in the area.

With regards to military explosives, the risks to personnel, marine life and assets arises from the possible detonation of the munition objects. The risk can be divided into the risk of having to clear identified munitions objects and the risk of accidental detonation of munitions.

The risk of having to clear munitions is mitigated by, as far as possible, re-routing the pipeline to avoid munition objects visible at the seabed. Following a dedicated munitions survey, using magnetometers to identify also possible munitions buried in the seabed, additional munitions objects may be identified. In some case re-routing is not feasible at this stage (e.g. if re-routing would require an additional munitions survey covering the changed route), detonation triggered by a donor charge might be required. This will be carried out by a qualified contractor under very strict safety procedures. The risk to personnel is therefore considered negligible.
The main issue in the case of munitions clearance is the possible impacts on marine mammals and fish caused by the underwater noise (see Sections 7.3.1 Fish and 7.3.2 Marine mammals).

In the event that UXO needs to be removed during the construction process and has not been identified during the pre-completion studies carried out (unplanned event), the Investor will apply feasible measures to minimise the risk of impacts on fish and marine mammals (e.g. observations, deterrence). In this case, detonation can be carried out at any time of the year.

The likelihood of accidental detonation of munitions is much smaller than the likelihood of having to clear munitions objects. The consequences of such would be largest in the near-shore areas, where back-hoe dredging takes place, i.e. personnel could in theory be exposed in case of an accidental detonation. Further offshore, a possible detonation could only cause damage to the pipeline or equipment during the construction phase, i.e. when the pipeline is not gas-filled.

Based on the fact that detailed geophysical surveys and a dedicated munitions survey have been carried out, and the experiences from other projects in the Baltic Sea, the risk related to possible accidental detonation of munitions is considered negligible.

4.7.2 Risk of unplanned chemical munitions encounter
The pipeline route extends through a chemical munitions risk area, in which fishing vessels are required to have first aid gas equipment on board. The pipeline route does not, however, cross the designated chemical munitions dumping site, which is situated to the northeast of Bornholm. Moreover, it does not extend through areas in which sea dumped chemical warfare materials have been encountered during the period 1961-2012 (see Figure 4-7).

Therefore, it is very unlikely that any chemical munitions objects will be encountered during the construction of the Baltic Pipe. The vessels participating in the construction work in the risk area southwest of Bornholm will be required to have first aid gas equipment onboard, and to have procedures in place for dealing with possible encounters. Exposure to e.g. lumps of mustard gas could take place in the case of contamination of the trenching plough, anchors or other equipment in contact with the seabed.

4.8 Environmental hazards and risks during the operational phase

4.8.1 Methodology and hazards considered
During the operational phase, the hazards and risks relate to possible leaks of gas in the case of damage to the integrity of the pipeline system. A QRA has been performed in compliance with DNV, 2010 and DNV GL, 2017. The assessment is documented in Ramboll, 2018f. The applied methodology is shown in Figure 4-8.
The hazard identification (HAZID) study conducted during the detailed design phase for the Baltic Pipe project identified the following main hazards during the operational phase of the pipeline system (Ramboll, 2018d):

- Interaction from anchors (emergency anchoring and unintentionally dragged anchors);
- Sinking ships;
- Ship groundings;
- Dropped objects.

Other risks were identified during the HAZID workshop i.e. risks related to unexploded ordnances (UXO), internal corrosion, material defects, earthquakes and slugging. These risks will either be very unlikely to occur or be handled through proper operational planning and management. Therefore, these risks were rated as negligible and were therefore not considered further (Ramboll, 2018d). The remaining hazards are described below.

**Dropped and dragged anchors**

Incidents where dropped anchors have hooked and damaged or ruptured subsea cables have occurred numerous times in the Baltic Sea. It is believed that dropped and dragged anchors represents one of the main hazards to the Baltic Pipe (Ramboll, 2018d).

**Sinking ships**

There are also examples of ships sinking following a collision in the area. An example of this is the Chinese bulk carrier Fu Shan Hai, which sunk following a collision with the container vessel Gdynia in 2003. The risk for collisions is inherently increased in highly trafficked shipping lanes such as
those crossed by the Baltic Pipe and that there is a possibility that a sinking ship could hit and severely damage the pipeline (Ramboll, 2018d).

**Ship groundings**
The draught of ships entering and exiting the Baltic Sea is limited by the water depth below the Great Belt Bridge, which is 19 m going into the Baltic Sea. Thus, a grounding ship with a direct impact on the pipeline is only considered possible at water depths of less than 19 m. This is the case near the landfalls and at Rønne Banke. As the grounding frequency at Rønne Banke is expected to be extremely low, and the significance of groundings at the nearshore areas are expected to be very low, the hazard for grounding ships is disregarded and has not been further quantified (Ramboll, 2018d).

**Dropped objects**
Objects dropped from passing ships has been considered as a hazard to the pipeline integrity. However, this hazard has been qualitatively evaluated to not represent a significant factor in the overall risk picture, and is thus not quantified (Ramboll, 2018d).

### 4.8.2 Gas release

**Gas release frequencies**
The ship traffic scenario which has made the basis for the QRA includes the input and cases outlined in Figure 4-9.

![Ship traffic data](image1)

**Figure 4-9 Methodology for ship traffic frequency assessment (Ramboll, 2018f).**

Figure 4-10 shows the release frequencies calculated for the individual KPI along the pipeline route, using the above methodology. The figure is based on the expected number of ships of various size classes crossing the pipeline in 2032 (see Figure 4-3). The highest number of crossings are found at KPI 129 (in Swedish waters) and 137 (in Danish waters), with approximately 5,200 and 4,700 crossings respectively. These maxima and the remaining local peaks correspond clearly to the various main traffic lanes crossed by the pipeline.
Critical zones, which are parts of the pipeline (of at least 10 km each) where the release frequency is higher than the acceptance criteria of $10^{-5}$ incidents per year, have been defined. The identified critical areas are found in Table 4-2. The table also shows the dimensions of additional protection in the form of rock cover placed on top of the pipe, and the release frequencies with this additional protection in place. The release frequencies are, with this protection, in all cases below one incident per year.

**Figure 4-10** Overall yearly release type frequencies for individual KPI's of the pipeline, after adding protection to reach the $10^{-5}$ acceptance criterion for each KPI, distributed on causes of leaks.

**Table 4-2** Description of critical zones along the BP pipeline route, release frequencies without protection, the protection applied, and the release frequencies without protection (Ramboll, 2018f). The crossings are in Danish waters (DK), Swedish waters (S) and the Disputed Area (DA).

<table>
<thead>
<tr>
<th>Critical zone</th>
<th>Description</th>
<th>Initial KPI</th>
<th>Final KPI</th>
<th>Unprotected release frequency [year⁻¹]</th>
<th>Protection thickness [m]</th>
<th>Protection length [km]</th>
<th>Protected release frequency [year⁻¹]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (DK)</td>
<td>Øresund traffic</td>
<td>30</td>
<td>39</td>
<td>$5.28 \times 10^{-4}$</td>
<td>0.9</td>
<td>6</td>
<td>$1.65 \times 10^{-5}$</td>
</tr>
<tr>
<td>2 (S)</td>
<td>Trelleborg-Lübeck</td>
<td>46</td>
<td>56</td>
<td>$1.21 \times 10^{-3}$</td>
<td>0.9</td>
<td>7</td>
<td>$1.56 \times 10^{-5}$</td>
</tr>
<tr>
<td>3 (S)</td>
<td>Trelleborg-Swinoujscie</td>
<td>72</td>
<td>81</td>
<td>$6.35 \times 10^{-4}$</td>
<td>0.9</td>
<td>8</td>
<td>$8.57 \times 10^{-6}$</td>
</tr>
<tr>
<td>4 (S)</td>
<td>Ystad-Swinoujscie</td>
<td>110</td>
<td>122</td>
<td>$5.18 \times 10^{-4}$</td>
<td>0.8-1-1</td>
<td>6</td>
<td>$2.65 \times 10^{-5}$</td>
</tr>
<tr>
<td>5 (S/DK)</td>
<td>Baltic Traffic (Bornholm N)</td>
<td>125</td>
<td>142</td>
<td>$2.97 \times 10^{-3}$</td>
<td>1.0-1-1</td>
<td>13</td>
<td>$7.16 \times 10^{-5}$</td>
</tr>
<tr>
<td>6 (DK)</td>
<td>Baltic Traffic</td>
<td>172</td>
<td>181</td>
<td>$1.27 \times 10^{-4}$</td>
<td>0.6-0.9</td>
<td>3</td>
<td>$7.58 \times 10^{-5}$</td>
</tr>
</tbody>
</table>
Critical zones 1 and 6 are situated in Danish waters, whereas the critical zone 5 is situated partly in Swedish and partly in Danish waters; it includes the Bornholmsgat TTS, as outlined in Section 4.5.

**Release types**

The distribution of leak sizes is given for generic failures and for ship traffic related releases in Table 4-3, together with the corresponding release rate. The shown release rates for small, medium and large releases are calculated as the initial mass flow rate, while the rupture flow rate is calculated as the weighted mean mass flow of the initial 20 minutes of the release.

<table>
<thead>
<tr>
<th>Leak size</th>
<th>Ship Traffic Release</th>
<th>Generic Release</th>
<th>Release rate [kg/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Distribution</td>
<td>Distribution</td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>0%</td>
<td>74%</td>
<td>7.9</td>
</tr>
<tr>
<td>Medium</td>
<td>0%</td>
<td>16%</td>
<td>49.2</td>
</tr>
<tr>
<td>High</td>
<td>50%</td>
<td>2%</td>
<td>125.8</td>
</tr>
<tr>
<td>Rupture</td>
<td>50%</td>
<td>8%</td>
<td>3613</td>
</tr>
</tbody>
</table>

Small, medium and large releases exhibit a relatively constant mass flow throughout the first hour as the released mass is small compared to the mass available, while the flow rate of a rupture decreases exponentially.

As illustrated in Figure 4-11, the gas from a ruptured subsea pipeline will disperse into the surrounding water column in a cone-like shape while heading towards the sea surface. This underwater dispersion can be divided into three flow zones; Zone of Flow Establishment (ZOFE), Zone of Established Flow (ZOEF) and Zone of Surface Flow (ZOF).
In most cases, a gas leak will not be ignited, but will instead escape to the atmosphere and contribute to the global pool of greenhouse gases (GHG). Methane (CH$_4$), which is the main constituent of natural gas, is a strong GHG, which has a global warming potential (GWP) of approximately 28 times relative to CO$_2$ (IPCC, 2014).

Calculations of the dispersion of released gas in the atmosphere using computational fluid dynamic (CFD) simulations have been carried out as part of the QRA. These calculations have been used for quantification of the likelihood of an explosion, which subsequently has been used in the analysis of risk to human safety (Ramboll, 2018f).

**Consequence assessment**

The release of gas from a subsea gas pipeline can result in a gas cloud close to the sea surface. If the gas cloud reaches a critical air-to-gas ratio, an explosion may occur due to an ignition source (e.g. a passing ship) and cause a fatal accident. Therefore, it is important to clarify the dispersion and consequence of such a gas leakage.

In order to evaluate the plume distribution of the dispersed gas into the atmosphere, the extent of the leakage needs to be specified. The size of the leakage relates to the size of the inflicted hole. For the Baltic Pipe project, Four different hole sizes are considered and presented in (Table 4-4).

**Table 4-4 Hole size and size interval of gas releases.**

<table>
<thead>
<tr>
<th>Leak size</th>
<th>Size interval [mm]</th>
<th>Applied size [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>&lt; 20</td>
<td>20</td>
</tr>
<tr>
<td>Medium</td>
<td>20 – 80</td>
<td>50</td>
</tr>
<tr>
<td>High</td>
<td>&gt; 80</td>
<td>80</td>
</tr>
<tr>
<td>Rupture</td>
<td>Rupture</td>
<td>914</td>
</tr>
</tbody>
</table>

Approximations of the gas mass flows have been calculated using PHAST (Process Hazard Analysis Software, by DNV GL), version 8.11. In order to adjust the PHAST calculations to the underwater situation, the pressure inside the pipeline has been reduced to compensate for the water pressure.

**Figure 4-11 Gas release from a ruptured subsea pipeline (Ramboll, 2018c).**
The calculations assume a release depth of 40 m, which corresponds to a water pressure of roughly 4 barg (Ramboll, 2018f).

4.8.3 Risk to human safety (third parties)
The risk to human safety is assessed both in terms of individual risk (3rd party) and societal risk (3rd party).

Individual risk presents the summarized frequency per year for fatality of the person expected to be most exposed to risk based on the total failure frequency of the pipeline system and the consequences following a release of gas from the pipeline.

Societal risk represents the summarized frequencies per year for fatal accidents and the expected number of fatalities for these accidents based on the total failure frequency of the pipeline system and the consequences following a release of gas from the pipeline (Ramboll, 2018d).

The individual risk (third party) was evaluated for the most exposed individual crossing the 10 most critical KPI’s of the pipeline. Evaluation was performed with respect to ship traffic and generic failure related accidents. Individual Risk (third party) was found to be $4.28 \times 10^{-6}$ incidents per year prior to protection and $1.07 \times 10^{-6}$ incidents per year post protection. The individual risk (third party) is thus considered acceptable below the acceptance criteria of $10^{-5}$ per year both prior to and post protection (Ramboll, 2018f).

The societal risk was evaluated using a FN curve. The FN curve, prior to and post protection, is shown in Figure 4-12. It is clearly seen that the societal risk (third party) is lowered to a level acceptable when subject to the ALARP principle, when the above-mentioned protective measures are introduced.

![ FN curve illustrating societal risk (third party) for unprotected and protected pipeline (Ramboll, 2018f).](image)

4.8.4 Environmental consequences of gas leaks during operation
A potential gas leak will cause vertical mixing of the water column above the rupture, as shown in Figure 4-11. A large rupture will harm marine life (e.g. marine mammals, fish and birds) in the plume, which can have a diameter expanding to up to approximately 40 m at the water surface in
the case of a full rupture (Ramboll, 2018f). The vertical mixing of the water column will potentially impact salinity, water temperature and oxygen conditions above the rupture. The seawater temperature may also be impacted by the cooling caused by the pressure drop induced gas expansion. The above potential impacts will be local and short term only.

The solubility of natural gas in seawater is low, and almost all the leaked gas will end up in the atmosphere. If the gas is ignited, the explosion will have an impact on marine life in the impacted area. If the gas is not ignited, it will mix with the atmospheric air and contribute to the global pool of GHG. The pipeline has a total length of approx. 274 km and an inner diameter of 0.8728 m, i.e. the total volume of the pipeline is approximately 163,755 m$^3$. The maximum density of the gas in the pipeline under operational conditions will be approximately 85.6 kg/m$^3$ (Ramboll, 2018m). Conservatively assuming that this maximum density prevails in the entire pipeline system, the pipeline can contain up to approximately 14,000 tonnes of natural gas. Assuming that all of it is methane, and that the GWP is as outlined in point 0, this amount is equivalent to approximately 392,000 tonnes of CO$_2$. For comparison, this corresponds to 2.7% of the yearly CO$_2$ emissions from all vessels in the Baltic Sea in 2016.

4.9 Seismic activity
The Baltic Sea is situated on the Eurasian continental plate, providing relatively stable geological conditions. The area is nearly devoid of earthquake activity in global terms (Mäntyniemi, 2004). However, seismic activity in the form of small-scale earthquakes occurs occasionally. This activity is mainly the result of stress release in the lithosphere caused by uplift following deglaciation at the end of the latest ice age.

Seismic activity is defined as the types, frequency and size of earthquakes that happen over a period of time in a certain area. The southern Baltic Sea and the adjacent areas of Germany, Poland, the Baltic states and the Kaliningrad enclave are characterized by very low seismicity. Three earthquakes, in Germany and in Kaliningrad, measured to be in the range of 3.1-4.7 Mw (moment magnitude scale – corresponds to the Richter scale for medium-sized earthquakes), are the largest measured in the region in historical times (Grünthal et al., 2008). This is in line with the conclusion that the largest earthquakes in the Eastern European Platform do not exceed Mw = 5.0-5.5, and that the East Baltic region is classified a territory of low or very low seismic activity (Pačėsa & Šliaupa, 2011). This also conforms with measurements of seismic activity in Denmark, which has similar magnitudes as in the Fennoscandian Shield and the East European Platform. Earthquakes in the region are generally not associated with fault zones such as e.g. the deep fault zone called the Tornquist zone, which is a 30-50 km wide zone of extensive faulting developed in late Cretaceous/early Tertiary time and extending from Poland through Bornholm and further west-northwest. There are no signs of geologically recent faulting or recent crustal deformation in the area, which corroborates the characterization of Denmark and its neighbouring areas as having a small earthquake potential (Voss et al., 2017).

The above is in line with investigations carried out for the Nord Stream pipelines. During the planning of the Nord Stream pipelines, a probabilistic seismic hazard analysis was prepared for the entire route and region. It was concluded that seismicity in the region, and hence along the route, is very low to low, also compared with other regions in Europe. The same was concluded for the risk of seismic hazard. Submarine landslides have not been reported in the Baltic Sea in recent geological time (Ramboll / Nord Stream 2 AG, 2017).

Earthquakes might be a hazard to submarine pipelines due to 1) direct impact on the pipeline from the seismic activity (this is particularly the case in areas where the pipeline is buried and crosses an active fault zone), and 2) impact from e.g. submarine landslides triggered by seismic activity (this is particularly the case at the slopes of continental shelves). With respect to the direct impact, methods and criteria to be used for ensuring that pipelines are designed to withstand the foreseeable seismic activity are outlined in NORSOK, 2007 and ISO 19901-2, 2017.
The Baltic Sea area is, however, an area where the level of seismic activity is so low that no special precautions need to be taken for ensuring the integrity of the pipeline. This is due to the tectonic stability of the region and the fact that the pipeline does not cross any active faults. The foreseeable magnitudes of any future earthquakes will not pose a direct risk to the pipeline system. With respect to possible indirect impacts, earthquakes can trigger landslides e.g. at the continental slopes. Such conditions do not exist along the pipeline route in the Baltic Sea, and as stated above, no submarine landslides have been reported from the area in the present geological setting.

Therefore, in the Baltic Sea it is not considered necessary to carry out specific analysis with respect to possible earthquakes in relation to submarine pipelines.

4.10 Extreme weather
A met-ocean study has been carried out in order to establish the operational and extreme weather conditions along the Baltic Pipe route. The study included simulation of waves, currents and water levels at the 55 positions along the Baltic Pipe route alternatives shown in Figure 4-13 (Ramboll, 2018o). A Weibull analysis has been carried out for 12 wave directional sectors and for each month at each of the 55 points along the proposed pipeline routes. The points have been chosen to ensure that the conditions along the entire pipeline route are well-represented. A so-called peak-over-threshold analysis has been carried out to derive the extreme significant wave heights, current velocities and water levels for the return periods 1, 5, 10, 50 and 100 years for all points along the pipeline.

The results of the met-ocean study have been used as input to the design of the pipeline system. This is e.g. the case with respect to forecasting of the coastal morphology at the Polish (Ramboll, 2018p) and Danish (Ramboll, 2018q) landfalls, respectively. These forecasts have been prepared to ensure that the coastal morphological development at the landfalls does not cause exposure of the pipeline where it is buried in the seabed. In general, the met-ocean study has been used as the basis for the design of the pipeline system, e.g. when implementing the detailed design of the seabed interventions works to be carried out (Ramboll, 2018r). In this way, the hazards related to extreme weather conditions have been mitigated in the pipeline design.

![Figure 4-13 Location of points used in the met-ocean data analysis (Ramboll, 2018).](image)
4.11 Sabotage and terrorist attack

Pipelines are vulnerable to sabotage / terrorist attacks using explosives or other physical means. Oil and gas pipelines have globally been favoured targets of terrorists, militant groups, and organized crime (Parfomak, 2016). The majority of the attacks on pipelines have historically taken place in less stable regions of the world, e.g. in Columbia, former Soviet states, India, Nigeria, Mexico and the Middle East; no attacks appear to have taken place in Europe. The vast majority of the attacks have taken place on land. One attack has however been reported on an underwater pipeline operated by Shell in the Nigerian Delta in 2016, resulting in an oil spill and disruption of the production for some weeks (Laessing, 2016).

Pipelines are vulnerable, as they are ‘soft’ targets difficult to defend, and relatively easy to hit. Although energy supply chains in Europe have so far not been targeted, the threat of hydrocarbon supply disruptions is real, and the risks are growing (EU, 2009). With respect to the Baltic Pipe, the pipeline will lay exposed at the seabed at large distances offshore; at the landfalls, the pipeline will be buried in the ground, but not deeper than it would be possible to access it relatively easily. Therefore, it is technically possible to damage the pipeline using e.g. explosives attached to the pipeline surface. But there is no apparent reason that the Baltic Pipe should attract specific attention from terrorists with a political agenda. The pipeline is rather uncontroversial, both with respect to the countries involved and the environmental impacts of the operation of the pipeline system. With respect to sabotage and terrorist attack, the following can therefore be concluded in connection with possible physical damage to the Baltic Pipe offshore part:

- Norway, Denmark and Poland are not high profile political targets compared to many other countries operating oil and gas pipelines.
- The territory through which the pipeline extends (Denmark, Sweden, Poland) is well-managed and with well-functioning national intelligence agencies alert on possible plans to carry out terrorist attacks.
- The pipeline system would not cause attention from extreme environmentalists; more environmentally-damaging fossil fuels such as coal, shale oil and similar would be more relevant targets. Furthermore, where natural gas substitutes coal, it can even have a positive environmental impact.
- It is more complicated to carry out a subsurface attack than to damage the pipeline onshore; this is illustrated by the fact that apparently only one subsurface sabotage action targeting a subsea hydrocarbon pipeline has taken place, compared to the numerous onshore attacks registered.

Disruption of the computer systems controlling the operation of the Baltic Pipe system is a more likely threat to the operation of the system. The energy sector has incurred more cybersecurity incidents than any other sector over the past several years, and the yearly number of attacks is increasing. Among the more commonly utilized operational control systems employed in the energy sector are the Supervisory Control and Data Acquisition (SCADA) systems. SCADA systems are software-based control systems that can collect real-time data such as line pressure from sensors located throughout the pipeline network, which can be monitored from the control room. SCADA-related problems were identified to be part of, if not the proximate cause of recent pipeline accidents (Dancy & Dancy, 2017). This risk is mitigated by ensuring that the SCADA system, and the control system of the Baltic Pipe operation in general, is robust and continuously updated to the highest standards.

4.12 Possible explosions in neighbouring industrial or military objects and resulting from transport

The route of the Baltic Pipe system does not expose the pipeline to possible explosions from neighbouring industrial or military objects and resulting from land transport. The possible risk arises from the ship traffic that will cross the pipeline, as outlined earlier in this chapter.
4.13 Emergency response

4.13.1 General
An emergency response (ER) setup will be developed by GAZ-SYSTEM before construction and operation, respectively, takes place. The ER setup will be tailored according to the activities which are planned to take place and the risks associated with these activities, as outlined above. The framework for the ER setup is the Health, Safety and Environment (HSE) management system of GAZ-SYSTEM, which has been developed in accordance with the standards OHSAS 18001 / ISO 45001: Occupational Health and Safety Management Systems, and ISO 14001: Environmental Management Systems.

4.13.2 Emergency Response during the construction phase
A Project Health Safety and Environment Plan (GAZ-SYSTEM, 2019a) has been prepared and is further developed as the project progresses. The plan is applicable to all work carried out as part of the Baltic Pipe Offshore Pipeline Project, whether work is carried out in the Project or at the Contractor’s offices, construction sites or on marine construction and associated vessels.

Complementary to the above plan is a Contractor HSEQ Requirements Specification (GAZ-SYSTEM, 2019b) and the Contractors’ HSE Management Plans, which they will develop prior to commencement of any worksite activities. The ER Plans and Procedures for all construction sites and vessels will be detailed within the Contractors’ HSE Management Plans. Prior to mobilization of rigs and vessels, the necessary combined operations bridging documents will be developed between the relevant parties.

GAZ-SYSTEM will forward information about the ER setup, including the setup for handling possible oil spills, to the DEA on a yearly basis during the construction period.

4.13.3 Emergency Response during the operations phase
GAZ-SYSTEM will, in cooperation with Energinet, establish an ER set-up for the operations phase. GAZ-SYSTEM will own and operate the offshore interconnector between Denmark and Poland and will therefore be responsible for the ER setup for this part of the system. Details about the ER set-up for the operations phase will be developed at a later stage, and it will be part of the application for permit to operate the pipeline system.

4.14 Conclusion
The main risks of accidental events, both in the construction and in the operational phase, relate to the fact that the pipeline route crosses several shipping lanes. This means that there is a risk that third party vessels collide with one of the construction vessels, which may cause harm to humans and/or spills of oil to the sea. This also means that there is a risk of interference between the vessel traffic and the pipeline during the operational phase, e.g. from anchors or sinking ships.

The likelihood of an oil spill during the construction phase has been shown to be low, and comparable with other maritime activities in the Baltic Sea not involving the transport of production of oil. Comparing the likelihood of oil spills during the period of constructing the Baltic Pipe system with the likelihood of oil spills from offshore installations in the North Sea confirms this conclusion. With respect to possible gas leaks, the environmental impacts of such will be local and short-term.

In case of a large rupture, the methane escaped to the atmosphere will contribute to the global pool of GHG. In such an unlikely major event, the possible impact on human lives will, however, be the main concern.

Munitions objects are, as far as reasonably practicable, avoided by re-routing. If re-routing is not possible, there is a risk that munitions clearance will need to take place. In such a situation, mitigation measures will be implemented.
Mitigation measures have been included in the design of the pipeline system, so that the risk to human safety (third party) is below the risk acceptance criteria, and measures are implemented to ensure that the risks are further reduced to a level as low as reasonably practicable (ALARP). This is the case for both the construction and operational phases.

The information included in this chapter corresponds to the information found in Chapter 4 of the Polish Environmental Impact Report (SMDI, 2019).
5. ALTERNATIVES

Both EU\(^{29}\) legislation and the provisions of the Espoo Convention (Article 5) require the developer to assess reasonable alternatives, including the no-action (or zero) alternative.

Within the Baltic Pipe project alternatives refer mainly to alternative routes, both offshore and onshore. Except for the zero alternative, there is no technical alternative to a pipeline. This chapter presents the main alternative routes through the Baltic Sea which have been assessed during the planning phase, and the major constraints for each route are listed.

5.1 The zero alternative
The no-action (or zero) alternative means not implementing the project at all, i.e. all activities connected with project would not take place. Consequently, there would be no environmental or social impact (negative or positive) from the project itself.

The zero alternative represents therefore the baseline environmental conditions, which will be described in-depth in the EIA, as will the impacts of implementing the project.

5.2 Considered route alternatives
The proposed pipeline route from Denmark to Poland that crosses the Polish EEZ and runs through the territorial waters of Poland is the main subject of this environmental impact assessment, as part of the transboundary context described in Chapter 1. Introduction. This proposed route has been selected based on analysis and evaluation of different route alternatives (Figure 5-1).

Figure 5-1 Route alternatives through German EEZ and Swedish EEZ along with Polish and Danish landfalls (Ramboll, 2018h). The abbreviations are explained in the text.

The approximate length of possible route alternatives is presented here Table 5-1.

Table 5-1 Estimated lengths of the various route alternatives.

<table>
<thead>
<tr>
<th>Area</th>
<th>Route Section</th>
<th>Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danish landfalls</td>
<td>Faxe North (Faxe N);</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Faxe South (Faxe S).</td>
<td>14</td>
</tr>
<tr>
<td>Offshore routes</td>
<td>Swedish bypass route</td>
<td>213</td>
</tr>
<tr>
<td></td>
<td>Swedish base case route (SE);</td>
<td>193</td>
</tr>
<tr>
<td></td>
<td>Swedish alternative route (SEA);</td>
<td>211</td>
</tr>
<tr>
<td></td>
<td>German base case route (GE);</td>
<td>192</td>
</tr>
<tr>
<td></td>
<td>German alternative route (GEA).</td>
<td>194</td>
</tr>
<tr>
<td>Polish landfalls</td>
<td>Niechorze-Pogorzelaica</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>Rogowo</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Gaski</td>
<td>74</td>
</tr>
</tbody>
</table>

It should be remembered that the presented parameters of the Project are based on the current project work and are the current assumptions as of the moment of writing the Report. Some of them may still undergo minor modifications which do not have a significant impact on the occurrence and scale of impacts, e.g. resulting from the results of geotechnical surveys, munitions occurrence analyses or other conditions which cannot be predicted at the present stage. During the construction phase it may be necessary to change the route due to unexpected encounters of military explosives or dumped chemical weapons. However, the pipeline route will not extend beyond the corridor surveyed.
5.2.1 Landfall and offshore alternatives

The following were variants that were considered as part of the Baltic Pipe project (Figure 5-1):

- Landfall routes in Denmark:
  - Faxe North (Faxe N);
  - Faxe South (Faxe S).
- Offshore routes:
  - Swedish bypass route (preferred alternative);
  - Swedish base case route (SE);
  - Swedish alternative route (SEA);
  - German base case route (GE);
  - German alternative route (GEA).
- Landfall routes in Poland:
  - Niechorze-Pogorzelica,
  - Rogowo,
  - Gaski.

Methodology for route selection

Various route alternatives have been studied during preceding feasibility and concept studies and during the initial phase of the present project phase. The optimisation of route alternatives has been complex, as the southern Baltic Sea has many restricted areas, shipping lanes, existing installations, and service lines. The development of the preferred route is the result of an iterative process, in which the comments of authorities and stakeholders were considered. Moreover, the various alternatives were analysed in detail, with regards to the following queries:

- Standard industry criteria for offshore pipeline design;
- Possibility of obtaining construction permit;
- Environmental concerns;
- Compatibility with the project time schedule;
- Cost.

The two landfall route alternatives and the four offshore route alternatives presented to the authorities and stakeholders were all selected with due regard to industry standard for safety of the public and personnel, protection of the environment, and the probability of damage to the pipeline or other facilities. Factors taken into consideration included the following, taken from the DNVGL guidance on pipeline design (DNV GL, 2017):

- Environment: Archaeological sites, exposure to environmental loads, areas of natural conservation interest such as oyster beds and coral reefs, marine parks, turbidity flows.
- Seabed characteristics: Uneven seabed, unstable seabed, seabed geotechnical properties (hard spots, soft sediment, and sediment transport), subsidence, seismic activity.
- Facilities: Offshore installations, subsea structures and well heads, existing pipelines and cables, obstructions, coastal protection works.
- Third-party activities: Ship traffic, fishing activity, dumping areas for waste, ammunition, etc., mining activities, military exercise areas.
- Shore crossing: Local constraints, third-party requirements, environmentally sensitive areas, vicinity to people, limited construction period.

Due to the iterative nature of the route selection process, the final decision on the preferred route deviates slightly from the route presented during the first public hearing to the Danish EIA, in order to satisfy the wishes and requirements of the relevant authorities.
5.2.2 Landfall routes

Both landfall routes in Denmark (i.e. Faxe N and Faxe S) were designed to avoid the raw material extraction sites and the Natura 2000 site ("Havet og Kysten mellem Præstø Fjord og Grønsund") in Faxe Bugt (Figure 5-2).

![Figure 5-2 Danish landfall location alternatives.](image)

The shore crossing at the Faxe N landfall route is located west of the village of Lund (Figure 5-2). As the pipeline would be located only about 500 m from the village, some impact from construction activities could be expected. The pipeline is then routed northwest around the Natura 2000 site “Skovene ved Vemmeltofte”. South of the Natura 2000 site, the pipeline is extended to the compressor station. As can be seen in (Figure 5-2), this section from the landfall to the compressor station is considerably longer than the Faxe S landfall route.

At the Faxe S landfall, the shore crossing is located about 3 km south of Faxe Ladeplads. This landfall is associated with some biological and geological concerns due to the presence of the protected bird species sand martin, which nests in the cliff at the landfall site, and the cliff itself, which is registered as of geological interest. These concerns can, however, be mitigated by using tunnelling instead of an open trench (see Chapter 3, Project description). As there are only few dwellings in the area and no impact is expected on the preserved archaeological site “Skansen ved Strandegård” (about 300 m from the landfall routing), the only socio-economic concern associated with the landfall Faxe S is related to farming activities. Therefore, Faxe S is the preferred landfall site. This is prompted by the following considerations: the pipeline route from the point of shoreline intersection to the gas compressor station is shorter, and there are fewer residential buildings that can potentially be affected by the negative impact of the project, while problems related to biological impacts in the landfall area of Faxe S can be minimized by mitigation measures.
5.2.3 Offshore route alternatives

Two main offshore routes were considered; a Swedish base case route (SE) and a German base case route (GE). Besides these main alternatives, every route has a set of alternative routes (indicated using dotted lines in the Figure 5-3). These are the alternative Swedish route (SEA) and the German alternative route (GEA). Each of these proposed offshore alternatives are described in turn in the following sections. Some of the most influential receptors in the process of considering route alternatives have been military areas and Natura 2000 sites; these are presented in Figure 5-3 and Figure 5-4, respectively.

![Figure 5-3 Military areas.](imageURL)
Figure 5-4 Natura 2000 sites.

**German offshore routes**

The German base case route and alternative routes follow the same 70 km alignment within Danish waters from the landfall site to the German EEZ (Figure 5-1). Within the German EEZ, the two route options follow largely the same course, but they diverge close to the Swedish and Danish EEZ borders, which results in reduced impacts on one receptor and increased impacts on another. Specifically, the German alternative is routed further northwest so as to cross a major shipping lane at a more perpendicular angle, which will lead to a lower impact on maritime traffic. However, the German alternative route crosses into the NATO submarine exercise area, Bravo 2, which is avoided by the German base case route.

After the two German route options merge again, the remainder of the route crosses other major shipping routes as close to perpendicularly as possible, and no other submarine exercise areas are crossed. However, other types of military practice areas are crossed by the German route, including a research area and a firing danger area.

In addition to maritime traffic and military practice areas, several other socio-economic and biological considerations taken into account in the development of the German route have included offshore infrastructure, extraction sites, commercial fishery and protected areas.

With respect to infrastructure, the German route has been designed to avoid existing and planned wind farms, including those currently under construction. However, the route does cross 25 cables and the Nord Stream Pipeline (NSP) is crossed at the shallow depth of 21.7 m. Crossing of NSP in such shallow waters would be technically difficult, due to the risk of grounding of ships above the rock installation required for the pipeline crossing.
Impacts on other socio-economic receptors has also been minimised, as the route avoids raw material extraction sites and trenching of the pipeline in the areas with the highest commercial fishery catches will reduce the risk of snagging of fishing gear on the pipeline.

The route does not pass through any Special Areas of Conservation (SAC). Although routing through Special Protection Areas (SPAs) has been minimised to the extent possible, the route does inter the SPA Pommersche Bucht. However, no biological impacts which cannot be mitigated have been identified during the evaluation of the German route options.

Through dialogue with the German Defence Forces during the scoping process, it became evident that the presence of a pipeline would be incompatible with the military activities ongoing in the NATO submarine exercise areas and the firing danger area Pommersche Bucht (BSH, 2019). Therefore, the German offshore routes were assessed not to be feasible (Ramboll, 2018h).

**Swedish offshore routes**

From the landfall site, the Swedish base case route and the Swedish alternative route follow the same alignment, which runs between the raw materials extraction sites in Faxe Bugt, north of the Krieger’s Flak wind farm and into the Swedish EEZ. Before re-entering the Danish EEZ to the southwest of Bornholm, the route options split into two main alternatives: the base case route, which follows a more south-westerly path within the Danish EEZ before crossing the disputed area and entering Polish waters; and the alternative route, which enters Danish territorial waters southwest of Bornholm prior to crossing the disputed area further east of the base case route. The most significant difference between the two main Swedish route options is that the Swedish alternative route avoids crossing the Natura 2000 site “Adler Grund og Rønne Banke”, which is crossed by the Swedish base case route.

Both route options cross the major international, bi-directional shipping lanes running along the border between the Swedish and Danish EEZs. The Swedish base case route crosses the TSS Bornholmsgat, the most heavily trafficked shipping lane in the Baltic Sea, at a more perpendicular angle than the Swedish alternative.

With respect to military practice areas, near the Danish EEZ border, the route crosses the northern edge of the Bravo 4 submarine exercise area and from here, the Swedish alternative route splits from the Swedish base case route. Both routes pass inside the submarine exercise area Bravo 5, and the Swedish base case route, having re-entered Danish waters, subsequently crosses the corner of the military firing danger area Ruegen (sector C). The section of the Swedish alternative which runs along the coast of Bornholm is routed southwest of the firing danger area Raghammer Odde.

Concerning offshore infrastructure, the both Swedish routes have been designed to avoid existing and planned wind farms, including those currently under construction. Both route options cross 13 cables, considerably fewer than the German route options, as well as the NSP pipelines. The NSP pipelines are crossed at a water depth of 45.7 m, which is much deeper than for the German route and represents a safer option with respect to the risk of ship grounding.

Both alternatives of the Swedish route bypass the currently exploited raw material extraction areas. Potential future areas of raw material extraction were also bypassed, where possible. Both routes cross a mine belt from World War II as well as the British minefield, Pollack, near the coast of Bornholm. The alternative crosses through the centre of the minefield, whereas the base case route crosses only the extended minefield area. This poses a risk of encountering CWA and UXO. However, local re-routing can be implemented if UXO or CWA are identified along the route.

Biological considerations were also important in the route design process, and protected areas were avoided where possible. The Swedish route option crosses into the Swedish EEZ within the Natura
2000 site “Sydvästskånes Utsjøvatten”, but the route avoids the designated habitat type reef. The route options split close to the Danish EEZ border, and after entering Danish waters, the Swedish base case route crosses the Natura 2000 site “Adler Grund og Rønne Banke”, where crossing the designated habitat type reef cannot be avoided. The Swedish alternative route is designed to avoid crossing this Natura 2000 site i.a., as the reef most likely will be destructed due to construction or presence of pipeline.

Summary
On the basis of the above considerations and dialogue with the authorities, military practice areas and Natura 2000 sites were regarded as the most important topics in the selection of the preferred route. The German Defence Forces were contacted regarding the crossing of the submarine exercise areas Bravo 4 and Bravo 5. While re-routing of the German routes was not feasible, bypassing these exercise areas by re-routing to the north was possible for the Swedish alternative. This led to the development of the Swedish bypass route, a variation of the Swedish alternative, which runs 550 m north of the Bravo areas. On this basis, the Swedish alternative route, with the bypass variant, is selected as the preferred offshore route, as it avoids military areas and the Natura 2000 site “Adler Grund og Rønne Banke” in Danish waters.

5.2.4 Polish landfall routes
Three landfall routes were assessed in Poland as part of the route selection process: Niechorze, Rogowo and Gaski. Due to a negative opinion from the National Polish Defence, the Gaski variant was considered no longer feasible and was deselected. Niechorze-Pogorzela was chosen as the preferred landfall in Poland due to technical issues, primarily of geological character, and Rogowo will be assessed as an alternative as part of the permitting process in Poland.

In the Niechorze-Pogorzela variant, the landfall of the gas pipeline is planned in Pogorzela near Niechorze. The first dry weld in the Niechorze-Pogorzela variant is located 200 m inland, counting from the coastline. The landfall of the gas pipeline is located in the area of wide beach and dunes. The section of the route on land and coastal shallow waters crosses Natura 2000 protected areas. The route has been optimised so that it does not cross the strip of grey dunes, which are a priority habitat within the Natura 2000 area). A trenchless landfall construction method was chosen to minimise the potential impact. Based on the analysis of seabed dynamics data, it was decided that the tunnel in this alternative should be at least 600 m long. The landing and construction site is covered with crowberry forest. As a result of the project implementation, a fragment of the natural habitat fragment 2180 - Mixed forests and forests on coastal dunes with an area of approx. 1.4 ha during construction and approx. 0.3 ha at the exploitation stage - will be periodically destroyed and lost.

In the Rogowo variant, the landfall of the gas pipeline is planned between Mrzežyno and Rogowo. The first dry weld in the Rogowo variant is 350 m deep inland, counting from the coastline. The landfall of the gas pipeline is located in an area with wide beaches and dunes, as well as forest areas. The dune belt and forests belong to the Natura 2000 protected areas, as well as the coastal area. The trenchless construction of the landfall section of the gas pipeline has been chosen to minimise the impact on protected natural habitats. Based on the analysis of seabed dynamics data, it has been determined that the tunnel in this variant should be at least 1200 m long.

The information included in this chapter corresponds to the information found in Chapter 3.2 and Chapter 6 of the Polish Environmental Impact Report (SMDI, 2019).
6. METHODOLOGY FOR TRANSBOUNDARY IMPACT ASSESSMENT

Overall the methodology applied for the transboundary impact assessment is equal to the one applied in the national EIA. However, this report focuses geographically on the marine border zones between the PoOs. The project encompasses three border zones, of which two are between Denmark and Sweden and one between Denmark and Poland. The impact assessment addresses the potential environmental and social impact of all parts of the project life cycle – construction, operation and decommissioning – on the relevant environmental and social receptors.

The assessment covers the direct and indirect, cumulative and transboundary, permanent and temporary, and positive and negative impacts of the project, and considers the objectives defined at the EU (e.g., Marine Strategy Framework Directive and the Water Framework Directive) and national levels.

Impacts will be evaluated based on their nature and scale and in relation to the receptor (social and environmental). The impact assessment will distinguish between the sensitivity of the receptor and the magnitude of the impact to predict the significance of the impact.

The methodology to be used for assessment of impacts includes the following criteria for categorising environmental and social impacts:

- Sensitivity of the receptor;
- Nature, type and reversibility of impacts
- Intensity, scale and duration of the impact; and
- Overall significance of the impact.

The impact assessment methodology serves to provide the means of characterising identified impacts and their overall severity.

6.1 General methodology

6.1.1 Basis of assessment

Assessments must always be based on a detailed description of the environment to which the potential impact relates (starting situation). The presentation of the initial situation depends on various factors, such as the nature of the project’s impact and receptor properties. They will be determined individually for each receptor. In some cases, it is sufficient to use external data from scientific literature as well as unpublished materials and data, including data from public institutions and monitoring results. In other cases, additional tests are necessary.

The following table provides an overview of the elements of the marine environment, which constitute interaction receptors, and which could potentially be generated by the Baltic Pipe project, as well as the scope of specific research carried out as part of the project. Extensive literature research was carried out for all such environmental elements that were identified this way.

Table 6-1 An overview of targeted research in marine areas under the Baltic Pipe project.

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Exit research</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical-chemical environment</strong></td>
<td></td>
</tr>
<tr>
<td>Seabed morphology and bathymetry</td>
<td>Multi-beam sonar survey, side sonar</td>
</tr>
<tr>
<td>Hydrography and water quality</td>
<td>Sampling to determine water quality along the pipeline route, including CTD profiles</td>
</tr>
<tr>
<td>Geology and surface sediments</td>
<td>Surface seismic-acoustic profiles, sampling of the seabed with a cone-shaped probe, magnetic testing</td>
</tr>
<tr>
<td>Receptor</td>
<td>Exit research</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Climate and air</td>
<td>-</td>
</tr>
<tr>
<td>Underwater noise</td>
<td>-</td>
</tr>
<tr>
<td><strong>Biological Environment</strong></td>
<td></td>
</tr>
<tr>
<td>Plankton</td>
<td>Sampling to determine water quality along the pipeline route (including chlorophyll a)</td>
</tr>
<tr>
<td>Benthic habitats, flora and fauna</td>
<td>Phytobenthos mapping and macrozoobenthos sampling along the pipelines route</td>
</tr>
<tr>
<td>Fish</td>
<td>Studying of ichthyoplankton, pelagic and demersal fish, including hydroacoustic surveys</td>
</tr>
<tr>
<td>Marine mammals</td>
<td>Air tests, shore observations, C-POD tests</td>
</tr>
<tr>
<td>Birds, including migratory</td>
<td>Air examinations, research from ships</td>
</tr>
<tr>
<td>Migrating bats</td>
<td>Acoustic monitoring of bat activity during migration periods. The tests were carried out from observation stations and transects</td>
</tr>
<tr>
<td>Annex IV species</td>
<td>See marine mammals</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>See other biological environment receptors</td>
</tr>
<tr>
<td>Natura 2000 offshore</td>
<td>-</td>
</tr>
<tr>
<td>Marine Strategy Framework Directive (entire marine area, environmental status according to 11 descriptors)</td>
<td>See other biological environment receptors</td>
</tr>
<tr>
<td>Water Framework Directive (ecological status 1 NM zone, chemical status 12 NM zone)</td>
<td>See other and physio-chemical and biological environment receptors</td>
</tr>
<tr>
<td><strong>Socio-economic environment</strong></td>
<td></td>
</tr>
<tr>
<td>Shipping and shipping lanes</td>
<td>-</td>
</tr>
<tr>
<td>Commercial fisheries</td>
<td>-</td>
</tr>
<tr>
<td>Archaeology (cultural heritage)</td>
<td>-</td>
</tr>
<tr>
<td>Cables, pipelines and windfarms</td>
<td>-</td>
</tr>
<tr>
<td>Raw material extraction sites</td>
<td>-</td>
</tr>
<tr>
<td>Military practice areas</td>
<td>-</td>
</tr>
<tr>
<td>Environmental monitoring stations and research areas</td>
<td>-</td>
</tr>
<tr>
<td>Tourism and recreational areas</td>
<td>-</td>
</tr>
<tr>
<td>Conventional and chemical munitions sites</td>
<td>Magnetic testing</td>
</tr>
</tbody>
</table>

### 6.1.2 Combined impacts of project-related activities

This Espoo report focuses on activities carried out on the territory of Poland, including territorial waters, EEZ and disputed territory, which may potentially have negative effects on the territories of vulnerable parties - Sweden, Germany and Denmark. It is estimated that the implementation and exploitation of the land part of the pipeline does not involve any transboundary impacts, due to the local nature and extent of the project’s impact.

The relevant elements of the marine environment that may be potentially exposed to impacts are presented in Table 6-2.
Table 6-2 Environmental receptors relevant to the EIA the Baltic Pipe project (offshore part within the Baltic Sea).

<table>
<thead>
<tr>
<th>Physical–chemical environment</th>
<th>Biological Environment</th>
<th>Socioeconomic environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bathymetry</td>
<td>• Plankton</td>
<td>• Shipping and shipping lanes</td>
</tr>
<tr>
<td>• Hydrography and water quality</td>
<td>• Benthic habitats, flora and fauna</td>
<td>• Commercial fisheries</td>
</tr>
<tr>
<td>• Surface sediments and contaminants</td>
<td>• Fish</td>
<td>• Archaeology (cultural heritage)</td>
</tr>
<tr>
<td>• Climate and air</td>
<td>• Marine mammals</td>
<td>• People</td>
</tr>
<tr>
<td>• Underwater noise</td>
<td>• Seabirds</td>
<td>• Tourism and recreational areas</td>
</tr>
<tr>
<td></td>
<td>• Migratory birds</td>
<td>• Cables, pipelines and windfarms</td>
</tr>
<tr>
<td></td>
<td>• Migrating bats</td>
<td>• Raw material extraction sites</td>
</tr>
<tr>
<td></td>
<td>• Annex IV species</td>
<td>• Military practice areas</td>
</tr>
<tr>
<td></td>
<td>• Biodiversity</td>
<td>• Conventional and chemical munitions sites</td>
</tr>
<tr>
<td></td>
<td>• Protected areas/Natura 2000</td>
<td>• Environmental monitoring stations and research areas</td>
</tr>
</tbody>
</table>

Table 6-3 presents an overview over the potential project impacts together with the receptors that may be affected. The assessment in Chapter 7 addresses all these potential conflicts listed in Table 6-3.

Table 6-3 Characteristics of potential transboundary impacts.

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Impact characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>When carrying out seabed interventions work during construction (Section 3.4.2), the seabed will be impacted.</td>
</tr>
<tr>
<td></td>
<td>Trenching (Section 3.4.2, offshore construction): Total pipeline length in the Baltic Sea: 274 km; trench length will be 63.5, 25 and 45 km in DK, SE and PL respectively; trench width: 10-30 m, depending on water depth and sediment type. Spoil heaps from the trenched sediment will be placed along the trench.</td>
</tr>
<tr>
<td></td>
<td>Rock /concrete mattress installation: Rock and concrete mattress installation are means of protecting the pipeline and will be used when crossing existing marine infrastructure (pipelines, telecom and power cables) and potentially also in shipping lanes. The rocks will be placed at the seabed using a dynamic positioning fall pipe vessel equipped with a flexible fall pipe, which will ensure that the rocks are placed correctly. Concrete mattresses will be deployed by crane from a vessel. The physical disturbance of the seabed during construction will be limited to the specific area where rock installations will take place (expected to be at 14, 10 and 3 locations in DK, SE and PL respectively).</td>
</tr>
<tr>
<td></td>
<td>Impacts from construction vessels: The DP vessel area of influence on the seabed will correspond: Corresponding to the width of the applied ship, approximately 40 m. The anchors and anchor chains area of influence on the seabed will be approximately: Approximately 1,500 m around the pipeline.</td>
</tr>
<tr>
<td></td>
<td>The impact will hence be localised around the intervention works.</td>
</tr>
<tr>
<td>Physical disturbance of the seabed</td>
<td>Sediment spill primarily originates from the seabed, where the seabed interventions take place. Sediments are dispersed in the water column and transported with the currents before they re-settle to the seabed. The</td>
</tr>
<tr>
<td>Potential impact</td>
<td>Impact characteristics</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Sediment spill has been modelled (SMDI, 2019) and the model results show that the increase in SSC will be very limited and that the duration of SSC exceeding 10 mg/l in the close border areas will be less than 1 hour (Figure 6-1).</td>
<td></td>
</tr>
<tr>
<td>Contaminants and nutrients (release of contaminants and nutrients associated with the sediment)</td>
<td>The sediments that are spilled and dispersed in the seawater may potentially include heavy metals and organic contaminants. This is particularly the case for fine-grained sediments and particulate organic matter (POM). A proportion of the particle-associated contaminants may be released to the water column as a result of the shift in the chemical environment when the particles are suspended in the water. The majority of the contaminants are, however, expected to continue being associated with the particles and will therefore settle back to the seabed. Analyses performed in the Danish EIA (SMDI, 2019), conclude that the water quality only can be affected very locally and temporarily by an increase in the concentrations of contaminants and nutrients caused by the construction works.</td>
</tr>
<tr>
<td>Sedimentation</td>
<td>Following dispersion in the water column, the spilled sediments will gradually settle to the seabed at a rate depending on the characteristics of the sediments, the hydrographic conditions, and the water depth. Sediment modelling for the dispersing sediment layer (in g/m³) was performed. The results show a very limited impact (Figure 6-2).</td>
</tr>
<tr>
<td>Underwater noise</td>
<td>The Baltic Pipe construction activities will cause emissions of underwater noise of varying frequencies and intensities, which may impact marine mammals and fish. The underwater noise generated from the vast majority of the construction activities is not distinguishable from the ambient noise levels in the Baltic Sea, which is characterized by large volumes of ship traffic and therefore a relatively high background underwater noise level. Hence, only noise from munitions clearance is included in the underwater noise propagation modelling and the following impact assessment on marine life. Based on the route design strategy, munitions clearance is treated as an unplanned event and is dealt with as such in the assessments (see Sections 7.3.1 and 7.3.2).</td>
</tr>
<tr>
<td>Physical disturbance above water during construction (e.g. from presence of vessels, noise and light)</td>
<td>Physical disturbance above water mainly relates to the presence and activity of construction vessels, including supply vessels with pipe and food supply potentially affecting marine animals and interfering with human activities (e.g. shipping, commercial fisheries).</td>
</tr>
<tr>
<td>Shipping restriction zones (around construction vessels)</td>
<td>During construction, safety zones will be established around the construction vessels to ensure navigational safety. Experience from other pipeline construction projects suggests that a construction exclusion zone will be established around the pipe-lay vessel, with a radius of 1,500 m centred around the pipe-lay vessel. Likewise, safety zones with a radius of 500 m will be defined around other vessels carrying out surveys, seabed intervention works, etc. However, supply vessels are not expected to impose safety zones. The extent of the safety zones will be agreed with the applicable national maritime authorities.</td>
</tr>
</tbody>
</table>

\[30\] Further characteristics of the different noise sources are given in section 9.5.1. of SMDI, 2019
### Potential impact

<table>
<thead>
<tr>
<th><strong>Potential impact</strong></th>
<th><strong>Impact characteristics</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions to air (emissions of air pollutants and greenhouse gasses (GHGs))</td>
<td>The combustion of fossil fuels by the vessels used during construction of the Baltic Pipe project will result in the emission of several components. Based on experience from other comparable projects, the following are considered to be the four main air emissions: CO₂ (Carbon dioxide), NOₓ (nitrogen oxides), SOₓ (sulphur oxides) and PM (particulate matter). Furthermore, production of the materials used for the project will generate emissions. These air emissions can potentially have an impact on climate, air quality and human health. Calculations of atmospheric emissions from the Baltic Pipe project are discussed in section 7.2.1.</td>
</tr>
<tr>
<td>Discharge to sea</td>
<td>Discharges to sea will occur as part of the pre-commissioning activities. Potential impacts will be restricted to nearshore areas and will not be dealt with no further in this Espoo report.</td>
</tr>
<tr>
<td>Airborne noise</td>
<td>Impacts from airborne noise will be restricted to the onshore part and is hence not dealt with in the Espoo report. Impact from airborne noise from vessels is dealt with under &quot;Disturbance above water&quot;</td>
</tr>
<tr>
<td>Non-indigenous species</td>
<td>All vessels participating in the Baltic Pipe project will be requested to comply with the BWM Convention and the HELCOM Guide to alien species and ballast water management in the Baltic Sea (HELCOM, 2014). Therefore, the risk of introducing NIS by Baltic Pipe project activities is considered to be very low. As rocks are supplied from onshore sources, the risk of introducing non-indigenous species from this source is negligible.</td>
</tr>
</tbody>
</table>

### Operational phase

<table>
<thead>
<tr>
<th><strong>Operational phase</strong></th>
<th><strong>Impact characteristics</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of the pipeline</td>
<td>The presence of the pipeline may change the seabed conditions and hydrodynamics, resulting in temporary disturbance or permanent loss of habitats for benthic flora and fauna; another potential impact is the introduction of a new substrate i.e. an artificial reef. The pipeline length in Polish waters is 81 km (for the Niechorze-Pogorzelica alternative, including the pipeline portion found in the conflict zone), of which a large proportion is laid directly on the seabed and not trenched or supported by rock installations. Rock installations placed at numerous locations create new substrate at the seabed.</td>
</tr>
<tr>
<td>Physical disturbance above water during operation (e.g. from maintenance vessels, noise and light)</td>
<td>The physical disturbance above water during operation is mainly related to the presence and activity of survey and maintenance vessels. The physical disturbance is of the same nature as during the construction period, but with a much lower frequency. The expected frequency of surveys and maintenance is once per year.</td>
</tr>
<tr>
<td>Shipping restriction zones (around maintenance vessels)</td>
<td>For the vessels carrying out survey and maintenance, exclusion zones will be defined around vessels carrying out the work, corresponding to the safety zone for “other” vessels during operation (500 m radius around the vessels). The establishment of safety zones results in all ship traffic being requested to avoid these exclusive zones, thus potentially having an impact on both commercial and leisure shipping as well as fishery. The frequency of the survey and maintenance activities are, however, low, i.e. approximately once per year.</td>
</tr>
</tbody>
</table>
Potential impact | Impact characteristics
--- | ---
Safety zones (around the pipeline) | Under the administrative order on protection of submarine cables and submarine pipelines, cable or pipeline fields are given a 500 m wide restriction zone along and on each side of the infrastructure. Ships may not, without urgent necessity, anchor in the cable and pipeline fields established for such infrastructure (e.g. pipelines for the transport of hydrocarbons, etc.), which cover the associated restriction zones. In the restriction zones, suction dredging, fishing for stones as well as any use of tools or other gear that is dragged on the seabed is prohibited.
Heat from pipeline | For the situation with gas flow from Poland to Denmark, the temperature along the pipeline will be very close to the temperature of the surrounding seawater and seabed surface sediments (SMDI, 2019).
Contaminants from anodes | Sacrificial anodes mainly consisting of aluminium will be used as a back-up corrosion protection system in case of damage to the coating of the pipeline. Beyond the immediate vicinity of the anode (i.e. <5 m), the concentrations of metal ions within the water column because of anode degradation during the operational phase will generally be indistinguishable from background concentrations.

Figure 6-1 Simulation of the time the sediment concentration is increased to at least 10 mg/l (suspended sediment) due to trenching (using post-lay ploughing).
Figure 6-2 Simulation of spilled sediment deposits (sedimentation) at the seabed one week after finalisation of trenching (using post-lay ploughing).

6.1.3 Sensitivity of receptor/environmental elements

The overall significance of the impacts is evaluated based on the evaluation of the single impact variables, as described above, and on the sensitivity of the resource/receptors affected.

It is imperative to place some form of value on the sensitivity (low, medium or high) of a resource/receptor that could potentially be affected by project activities. Such a value may be regarded as subjective to some extent.

However, expert judgement and stakeholder consultation ensure a reasonable degree of consensus on the intrinsic value of a resource/receptor. The allocation of a value to a resource/receptor allows for the assessment of a resource’s/receptor’s sensitivity to change (impact). Various criteria are used to determine value/sensitivity, including, among others, resistance to change, adaptability, rarity, diversity, value to other resources/receptors, naturalness, fragility and whether a resource/receptor is actually present during a project activity. These determining criteria are elaborated upon in Table 6-4.
Table 6-4 Criteria used to evaluate the sensitivity of a resource/receptor.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low:</td>
<td>A receptor that is not important to the functions/services of the wider ecosystem or that is important but resistant to change (in the context of project activities) and will naturally and rapidly revert to pre-impact status once activities cease.</td>
</tr>
<tr>
<td>Medium:</td>
<td>An environmental receptor/element that is important to the functions/services of the wider ecosystem. It may not be resistant to change, but it can be actively restored to pre-impact status or will revert naturally over time.</td>
</tr>
<tr>
<td>High:</td>
<td>A receptor that is critical to ecosystem functions/services, not resistant to change and cannot be restored to pre-impact status.</td>
</tr>
</tbody>
</table>

6.1.4 Nature, type and reversibility of impacts

Impacts are initially described and classified according to their nature (either negative or positive), their type and their degree of reversibility. Type refers to whether an impact is direct, indirect, secondary or cumulative. The degree of reversibility refers to the capacity of the impacted environmental or social component/resource to return to its pre-impact state.

Nature, type and reversibility of impacts are presented in Table 6-5.

Table 6-5 Classification of impacts: Nature, type and reversibility of impacts

<table>
<thead>
<tr>
<th>Nature of impact</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>An impact that is considered to represent an adverse change from the baseline (current condition) or to introduce a new, undesirable factor.</td>
</tr>
<tr>
<td>Positive</td>
<td>An impact that is considered to represent an improvement to the baseline or to introduce a new, desirable factor.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of impact</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>An impact that results from a direct interaction between a planned project activity and the receiving environment.</td>
</tr>
<tr>
<td>Indirect</td>
<td>An impact that results from other activities that are assessed to happen as a consequence of the project.</td>
</tr>
<tr>
<td>Secondary</td>
<td>An impact that arises following direct or indirect impacts as a result of subsequent interactions within the environment.</td>
</tr>
<tr>
<td>Additive</td>
<td>Combined impacts of project-related activities.</td>
</tr>
<tr>
<td>Cumulative</td>
<td>An impact that may occur in combination with other plans or projects that are currently under consideration, or any existing or proposed projects and plans.</td>
</tr>
<tr>
<td>Transboundary</td>
<td>An impact that occurs across borders.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree of reversibility</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reversible</td>
<td>An impact on receptors that ceases to be evident, either immediately or following an acceptable period of time, after termination of a project activity.</td>
</tr>
</tbody>
</table>
| Irreversible            | An impact on receptors that is evident following termination of a project activity and that remains for an extended period of time. An impact that cannot be reversed by the...
implementation of mitigation measures.

### 6.1.5 Intensity, scale and duration of impacts

The predicted *impact magnitude* is defined and assessed in terms of a number of variables, primarily the intensity, scale and duration of an impact. Ascribing values to the variables is, for the most part, objective. However, awarding a value to certain variables may be subjective in that the extent, and even direction, of change often is difficult to define.

An explanation of the classifications and values applied in the EIA is presented in Table 6-6.

#### Table 6-6 Classification of impacts in terms of intensity, scale and duration.

<table>
<thead>
<tr>
<th>Impact intensity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No impact:</td>
<td>No impacts on the structure or function of the receptor within the affected area.</td>
</tr>
<tr>
<td>Minor impact:</td>
<td>Minor impacts on the structure or function of the receptor within the affected area, but basic structure and function remain unaffected.</td>
</tr>
<tr>
<td>Medium impact:</td>
<td>There will be partial impacts on the structure or function inside the affected area. Structure/function of the receptor will be partially lost.</td>
</tr>
<tr>
<td>Large impact:</td>
<td>The structures and functions of the receptor are altered completely. Structure/function loss is apparent inside the affected area.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Geographical extent of impacts (scale)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Local impacts:</td>
<td>Impacts are restricted to the project area (1 km on each side of route)</td>
</tr>
<tr>
<td>Regional impacts:</td>
<td>There will be impacts outside the immediate vicinity of the project area (local impacts).</td>
</tr>
<tr>
<td>National impacts:</td>
<td>Impacts will be restricted to the national sector.</td>
</tr>
<tr>
<td>Transboundary impacts:</td>
<td>Impacts will be experienced outside of the Danish/Swedish/Polish territory. Impacts can also be across a national border within the Parties of Origin.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration of impacts</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary:</td>
<td>Impacts during and immediately after the project activity; however, the impacts stop shortly after the activity is stopped.</td>
</tr>
<tr>
<td>Short term:</td>
<td>Impacts throughout the project activity and up to one year after.</td>
</tr>
<tr>
<td>Medium term:</td>
<td>Impacts that continue over an extended period, between one and ten years after the project activity has ended.</td>
</tr>
<tr>
<td>Long term:</td>
<td>Impacts that continue over an extended period, more than ten years after the project activity has ended.</td>
</tr>
</tbody>
</table>
6.1.6 Overall significance of impacts

The severity of the impact is then defined by comparing the impact magnitude of the project and the sensitivity of the environmental receptors. It is classified according to a scale which ranges from “negligible” to “major”, defined as presented in Table 6-7, where the distinction between a significant/not significant impact is also specified.

Table 6-7 Criteria for evaluation of the significance of an impact (a combination of impact magnitude and sensitivity).

<table>
<thead>
<tr>
<th>Significance</th>
<th>Severity of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not significant</td>
<td>Negligible: There will be no or negligible impact on the environment.</td>
</tr>
<tr>
<td></td>
<td>Minor: Minor adverse changes that might be noticeable but fall within the range of normal variation. Impacts are short-term and natural recovery takes place in the short term.</td>
</tr>
<tr>
<td></td>
<td>Moderate: Moderate adverse changes in an ecosystem. Changes may exceed the range of natural variation. Potential for natural recovery in the medium-term is good. However, it is recognised that a low level of impact may remain. Impact may or may not be significant depending on the impact type. Mitigation measures may be applied to reduce the impact.</td>
</tr>
</tbody>
</table>

Significant

<table>
<thead>
<tr>
<th>Significance</th>
<th>Severity of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major: The structure or function in the area will be changed, and the impact will also have impact outside the project area. Mitigation measures will be considered to reduce the impact.</td>
<td></td>
</tr>
</tbody>
</table>

Positive impacts are shown with a “+” in the comprehensive tables for the potential impacts.

6.2 Natura 2000 assessments

In accordance with Articles 6(3) and (4) of the Habitats Directive, it is required to perform an assessment of whether a project may result in significant impacts on Natura 2000 sites. For the Baltic Pipe project, the assessments of potentially affected Natura 2000 sites are documented in the respective national EIA reports of Denmark, Sweden and Poland.

The methodology for Natura 2000 assessments is a four-step process comprising:

- Screening;
- Appropriate assessment;
- Assessment of alternative solutions; and
- Assessment where no alternative solutions exist and where adverse impacts remain.

The initial step of the assessment is a Natura 2000 screening, which identifies the potential impacts of a project on a Natura 2000 site(s), either alone or in combination with other projects or plans and considers whether these impacts are likely to be significant. In the case that the screening reveals that significant impact on the designation basis of the Natura 2000 site can be ruled out with certainty, no further assessment steps are required. In the case that impact is likely to be significant, an appropriate assessment must be conducted. In the latter case, the assessment also includes transboundary impacts, so that all aspects of potential impacts on the site are covered.

Section 7.3.4of the Espoo report summarizes the results from the Natura 2000 assessments and emphasizes the transboundary impacts where relevant.
6.3 **Annex IV assessments**

Article 12 of the Habitats Directive aims at the establishment and implementation of a strict protection regime for animal species listed in Annex IV(a) of the Habitats Directive within the whole territory of Member States.

In accordance with the Directive, the following is prohibited for strictly protected species:

- All forms of deliberate capture and keeping and deliberate killing;
- Deliberate damage to or destruction of breeding or resting sites;
- Deliberate disturbance of wild fauna particularly during the period of breeding, rearing and hibernation, in so far as disturbance would be significant in relation to the objectives of this Convention;
- capturing their wild eggs, or keeping their eggs, even when they are empty;
- the possession and internal trade of those animals, regardless of whether they are alive or dead, including stuffed animals and easily recognizable animal products or products derived therefrom, should this contribute to the effectiveness of the provisions of this Article.

The assessments of the ecological functionality of present Annex IV species will be included as a part of the national EIAs and will be summarised in the Espoo report (Section 7.3.3).

The information included in this chapter corresponds to the information, especially with regards to specific transboundary assessments, to the information found in Chapter 8 of the Polish Environmental Impact Report (SMDI, 2019).
7. TRANSBOUNDARY IMPACT ASSESSMENT

7.1 Screening of potential transboundary impact

This chapter of the Espoo report covers activities carried out on the maritime territory of Poland (territorial waters, EEZ and the disputed area) that may cause potential negative impacts in Denmark, Sweden and Germany (Affected parties). Previously, it was assessed that the construction and operation of installations on land would not cause transboundary impacts due to the local nature and range of impacts. Thus, only the offshore activities within the Baltic Sea are subject to the Espoo procedure and considered in this report. Figure 7-1 shows the project area.

Figure 7-1 Project area for the Baltic Pipe project.

A detailed assessment of all significant potential impacts on the marine receptors has been made and documented in the EIA report prepared in accordance with Polish legal requirements (SMDI, 2019).

Based on the results of this detailed impact assessment included in the EIA report, the Espoo report presents verification of the same impacts in relation to their potential transboundary impacts. Due to the small spatial extent of the majority of project-related impacts, in many cases the possibility of significant transboundary impacts may be ruled out. For this reason, these impacts are not subject to detailed analysis in this chapter. The analyses focused on impacts where significant transboundary impact cannot be excluded.

Table 7-1 presents the results of the initial assessment (screening) and indicates the impacts that were assessed in detail later in this chapter.
Table 7-1 Screening of potential transboundary impacts.

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Potential impact</th>
<th>Transboundary evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical and chemical environment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seabed morphology and bathymetry</td>
<td>• Physical disturbance of the seabed • Sedimentation • Presence of the pipeline</td>
<td>The impacts are assessed to be not significant and occurring only locally. Transboundary impact can be excluded.</td>
</tr>
<tr>
<td>Hydrography and water quality</td>
<td>• Suspended sediment (SSC) • Contaminants and nutrients • Water/wastewater discharge to the sea • Release of contaminants from anodes • Presence of the pipeline • Heat from pipeline</td>
<td>All potential impacts are assessed to be minor or negligible. Transboundary impact can be excluded.</td>
</tr>
<tr>
<td>Geology and surface sediments</td>
<td>• Physical disturbance of the seabed • Contaminants and nutrients • Sedimentation • Presence of the pipeline • Release of contaminants from anodes</td>
<td>The impacts are assessed to be not significant and occurring only locally. Transboundary impact can be excluded.</td>
</tr>
<tr>
<td>Climate and air quality</td>
<td>• Emissions to air</td>
<td>Transboundary impacts due to emissions cannot be excluded (see section 7.2.1 below).</td>
</tr>
<tr>
<td>Underwater noise</td>
<td>• Underwater noise from construction activities • Underwater noise from unplanned events</td>
<td>The impact from construction noise is assessed to be negligible. Transboundary impact can be excluded. Impacts due to unplanned events have been assessed in relation to environmental elements such as fish and marine mammals (see below).</td>
</tr>
<tr>
<td><strong>Biological environment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plankton</td>
<td>• Suspended sediment (SSC) • Contaminants and nutrients</td>
<td>The impact is assessed to be not significant and occurring only locally. Transboundary impact can be excluded.</td>
</tr>
<tr>
<td>Benthic habitats, flora and fauna</td>
<td>• Physical disturbance of the seabed • Suspended sediment (SSC) • Sedimentation • Presence of the pipeline</td>
<td>Impacts are small or insignificant and insignificant. Transboundary impact can be excluded.</td>
</tr>
<tr>
<td>Fish</td>
<td>• Physical disturbance of the seabed • Suspended sediments (SCC) • Sedimentation • Underwater noise</td>
<td>Transboundary impacts related to underwater noise cannot be excluded (see section 7.3.1 below).</td>
</tr>
<tr>
<td>Marine mammals</td>
<td>• Suspended sediment (SSC) • Impacts/physical disturbances on water • Underwater noise (construction activities, unplanned events)</td>
<td>Transboundary impacts related to underwater noise cannot be excluded (see section 7.3.2 below).</td>
</tr>
<tr>
<td>Sea and migratory birds</td>
<td>• Impacts/physical disturbances on water</td>
<td>The impact is assessed to be negligible. Transboundary impact can be excluded.</td>
</tr>
<tr>
<td>Migrating bats</td>
<td>• Physical disturbance above water (collision with construction vessels)</td>
<td>The impact is assessed to be negligible. Transboundary impact can be excluded.</td>
</tr>
</tbody>
</table>
Although there is no potential transboundary impact on shipping and navigation routes related to the construction or operation of the planned pipeline in Polish territorial waters, EEZ and the disputed area, the impact assessment on this environmental element has been presented for comparative purposes with the other parts of the Baltic Pipe project.

| Annex IV species | • Deliberate killing  
• Deliberate disturbance | Transboundary impact from underwater noise cannot be excluded (see Section 7.3.3 below). |
|------------------|----------------------|--------------------------------------------------|
| Biodiversity     | • Physical disturbance of sediment  
• Suspended sediment  
• Sedimentation  
• Underwater noise (construction activities, unplanned events)  
• Physical disturbances on water  
• Presence of the pipeline  
• Non-indigenous species | All potential impacts are assessed to be minor or negligible. Transboundary impact can be excluded. |
| Natura 2000 offshore | • Suspended sediment concentrations (SSC)  
• Sedimentation  
• Underwater noise  
• Physical disturbances on water  
• Presence of the pipeline | Transboundary impacts related to noise generated by unplanned events (ammunition removal) cannot be excluded (see section 7.3.4 below). |
| Marine Strategy Framework Directive (entire marine area, environmental status according to 11 descriptors) | • Physical disturbance of the seabed  
• Suspended sediment  
• Contaminants and nutrients  
• Underwater noise  
• Non-indigenous species  
• Presence of the pipeline | In the context of the Polish basin, the impact on 11 indicators was assessed as minor or insignificant. Significant transboundary impact can be excluded. |
| Water Framework Directive (ecological status in zone 1 NM, chemical state in zone 12 NM) | • Suspended sediment  
• Contaminants and nutrients  
• Release of contaminants from anodes | Impacts on the ecological or chemical status are assessed to be minor or negligible. Significant transboundary impact can be excluded. |

### Socio-economic environment

| Shipping and shipping lanes | • Shipping restriction zones  
• Pipeline security zones (in the vicinity of the pipeline) | The protection zones and the presence of the pipeline in Polish waters may affect international shipping lanes. 31 |
|-----------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Commercial fisheries       | • Shipping restriction zones  
• Safety zones (along the pipeline)  
• Presence of the pipeline  
• Presence of vessels | Pipeline protection zones in Polish waters may affect Danish, Swedish and German fisheries (see section 7.4.2 below). |
| Archaeology (cultural heritage) | • Physical disturbance of the seabed | In the event of unexpected archaeological discoveries, actions will be taken in accordance with the applicable Polish law during construction. Transboundary impacts can be excluded. |
| Cables, pipelines and windfarms | • Physical disturbance of the seabed  
• Presence of the pipeline | The risk of damage of internationally important cables and pipelines is minimized by the methodology applied to establish the crossings. Transboundary impact is thus avoided. The pipeline does not significantly restrict future development of marine infrastructure. |
| Raw material extraction sites | • Shipping restriction zones  
• Safety zones (along the pipeline) | The pipeline route does not intersect existing or planned extraction sites. It may, however, run through areas of sand deposits, which requires confirmation in the course of |

31Although there is no potential transboundary impact on shipping and navigation routes related to the construction or operation of the planned pipeline in Polish territorial waters, EEZ and the disputed area, the impact assessment on this environmental element has been presented for comparative purposes with the other parts of the Baltic Pipe project.
The EIA Report (SMDI, 2019) also assessed cumulative impacts and concluded that the cumulative impacts of existing and planned projects and planned activities related to the implementation of the Baltic Pipe project are unlikely to affect the marine environment. Significant transboundary impact can be excluded.

### 7.2 Physical and chemical environment

This chapter describes the baseline conditions of potential receptors (see Table 7-1) and provides an assessment of the potential transboundary impact on the physiochemical environment.

#### 7.2.1 Climate and air

The construction of the Baltic Pipe gas pipeline involves the emission of greenhouse gases and pollutants into the atmosphere that arise during the operation of machinery and the production of materials. Greenhouse gas emissions have a transboundary impact contributing to global climate change, whereas air pollutants can have a local and/or regional impact. Both factors influence the environment and the living conditions for flora and fauna as well as humans.

In this section, the contribution of the Baltic Pipe to these emissions is assessed. However, this assessment applies only to emissions generated during construction and operation/maintenance and does not take into account the greenhouse gas emissions resulting from the combustion of natural gas transmitted through the pipeline.

During construction and operation of the Baltic Pipe project, there will be a need for vessels undertaking surveys, carrying out construction works, transporting materials etc. The combustion of fossil fuel from the operation of vessels will result in the emission of several substances. Based on experience from other comparable projects, the following are considered as the four main air emissions: CO₂ (carbon dioxide), NOₓ (nitrogen oxides), SOₓ (sulphur oxides) and PM (particulate matter).

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23Although there is no potential transboundary impact on shipping and navigation routes related to the construction or operation of the planned pipeline in Polish territorial waters, EEZ and the disputed area, the impact assessment on this environmental element has been presented for comparative purposes with the other parts of the Baltic Pipe project.
In addition, production of all components of the Baltic Pipe is associated with emissions to air, in particular CO₂ from steel, concrete, aluminium and coating production.

**Legal requirements**
The legal requirements for the Baltic Pipe project including requirements for greenhouse gas (CO₂) emissions and air quality are described below.

**Greenhouse gas emissions (CO₂)**
Poland has ratified the UN Kyoto Protocol on the reduction of greenhouse gas emissions and has committed itself to reduce CO₂ emissions by 6% by 2012 (relative to the 1988 level). In addition, Poland as an EU Member State participates in the EU emissions trading system, which obliges Member States to reduce emissions from industrial sectors covered by the system to 21% by 2020 compared to 2005 emissions (14% for Poland, after taking into account additional mechanisms provided for in the EU ETS) and 43% in 2030. In so-called non-ETS sectors 33Poland has an individual goal of reducing CO₂ emissions by 7% in 2030 (compared to 2005), but it can increase emissions by 14% by 2020.

**Air quality**
International Maritime Organization (IMO) operating under the UN has designated the Baltic Sea as an Emission Control Area (ECA) in accordance with Regulation 14 of Annex VI to the MARPOL Convention to reduce SOX emissions (area also referred to as SECA (Sulphur Oxide Emission Control Area). This means that the sulphur limit for fuel oil used in SECAs from 1 January 2015 is 0.1%. The regulation has led to a significant reduction of SO₂ emissions in the Baltic Sea since it has come into effect (Johansson & Jalkanen, 2016).

In addition, from 2021, the Baltic Sea will be considered as an Emission Control Area (ECA) in accordance with Regulation 13 of Annex VI to the MARPOL Convention to reduce NOX emissions (area also referred to as NECA). This means that all vessels built after 2021 are required to reduce NOₓ emissions by 80% compared to the present emission level. It is expected that before this regulation will bring full effects, a long period will be needed to renew the fleet.

The EU has adopted a directive on air quality 34introducing limit values for air pollutants, 35which also apply as permitted emission levels in Poland (they were introduced by the Regulation of the Minister for the Environment of 24 August 2012 on the levels of certain substances in the air36). The limit values and critical levels apply over differing periods of time because the observed impacts associated with the various pollutants occur over different exposure times.

Limit values and critical levels of pollutants mentioned in the introduction are presented in Table 7-2

<table>
<thead>
<tr>
<th>Polluting components</th>
<th>Averaging period</th>
<th>Limit values [µg/m³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO₂</td>
<td>1 hour</td>
<td>200, not to be exceeded more than 18 times per calendar year</td>
</tr>
<tr>
<td>NO₂</td>
<td>Calendar year</td>
<td>40</td>
</tr>
</tbody>
</table>

33Non-ETS sectors are not a part of the EU emissions trading system (ETS). The non-ETS sectors include e.g. transportation, agriculture and heating.


35Limit values are in the Air Quality Directive defined as: “(...) a level fixed on the basis of scientific knowledge, with the aim of avoiding, preventing or reducing harmful effects on human health and/or the environment as a whole, to be attained within a given period and not to be exceeded once attained”.

36Regulation of the Minister of the Environment of August 24, 2012 on the levels of certain substances in the air (Rozporządzenie Ministra Środowiska z dnia 24 sierpnia 2012 r. w sprawie poziomów niektórych substancji w powietrzu)(Journal of Laws item 1031).
SO\(_2\) 1 hour 350, not to be exceeded more than 24 times per calendar year

SO\(_2\) 24 hours 125, not to be exceeded more than 3 times per calendar year

PM\(_{2.5}\) Calendar year 25 (20)*

PM\(_{10}\) 24 hours 50, not to be exceeded more than 35 times per calendar year

PM\(_{10}\) Calendar year 40

* Data in brackets are limit values in force since 2020.

Baseline

Current CO\(_2\) emissions and emissions of air pollutants related to the marine section of the pipeline mainly originate from ships operating in the Baltic Sea. Table 7-3 presents a summary of emissions from ships operating in the Baltic Sea in 2016 and for comparison, the total emissions in Poland in 2016.

Table 7-3 Total emissions from all vessels in the Baltic Sea in 2016 (Johansson and Jalkanen, 2017) and total emissions in Poland in 2016 (KOBIZE, 2018 and KOBIZE, 2018b).

<table>
<thead>
<tr>
<th>Polluting components</th>
<th>Emissions from vessels in the Baltic Sea [tonnes]</th>
<th>Total emissions in Poland [tonnes]</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO(_2)</td>
<td>14,700,000</td>
<td>395,823,720*</td>
</tr>
<tr>
<td>NO(_x)</td>
<td>318,000</td>
<td>726,431,200</td>
</tr>
<tr>
<td>SO(_x)</td>
<td>10,000</td>
<td>-</td>
</tr>
<tr>
<td>SO(_2)</td>
<td>-</td>
<td>581,520,300</td>
</tr>
<tr>
<td>PM(_{2.5})</td>
<td>9,000</td>
<td>145,506,900</td>
</tr>
<tr>
<td>PM(_{10})</td>
<td>-</td>
<td>259,165,300</td>
</tr>
<tr>
<td>PM (TSP)</td>
<td>-</td>
<td>352,306,100</td>
</tr>
</tbody>
</table>

* CO\(_2\) emissions without LULUCF according to the UNFCCC methodology.

The CO\(_2\) emissions from vessels from the Baltic Sea correspond to 4,792,000 tonnes of fuel (Johansson & Jalkanen, 2017).

Emissions from the Baltic Sea from operations in the Baltic Sea mix in a complex way with emissions originating from land-based activities, and concentrations of pollutants in the air depend on many factors, such as seasons and atmospheric conditions.

Impact assessment and transboundary impacts

The only potential impact of the project on climate and air quality are emissions to the atmosphere, which will occur during both construction and operation.

Table 7-4 Potential impact on climate and air quality, operations offshore.

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions to air</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Emissions to air

Most of the emissions related to the construction of the pipeline's marine section are emissions resulting from the combustion of fossil fuels by vessels used in the Baltic Sea to lay the pipeline. At the operational stage, emissions are generated during the combustion of fossil fuels by research vessels and vessels carrying out maintenance work.

Emissions to the atmosphere related to the pipeline's seawater include both CO\(_2\) emissions affecting the climate and pollutants that affect air quality.

CO\(_2\) emissions
Table 7-5 presents CO2 emissions resulting from the construction and operation of the maritime section of the project and the materials generated during production. For operation, the results are shown per year on average during estimated operation time (50 years). CO2 emissions from material production cover the two main materials – steel and concrete, used for the pipes and tunnel elements.

Table 7-5 CO2 emissions from the construction and operation of the pipeline’s offshore section (averaged over its entire life span of 50 years).

<table>
<thead>
<tr>
<th>Activity</th>
<th>CO2 emissions [tonnes]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation phase offshore</td>
<td>46,111</td>
</tr>
<tr>
<td>Material production (steel and concrete)</td>
<td>68,694</td>
</tr>
<tr>
<td>The implementation phase, in total</td>
<td>116,795</td>
</tr>
<tr>
<td>Operation (yearly average)</td>
<td>20</td>
</tr>
</tbody>
</table>

The sensitivity of the climate as an element of the environment was considered high due to the potential overall impact on ecosystems. CO2 emissions have a negative, secondary, transboundary and irreversible impact on the climate.

CO2 emissions from the pipeline's operation were considered negligible as annual emissions account for less than 0.003 ‰ of total emissions from ships in the Baltic Sea, which is even lower with respect to the total annual CO2 emissions generated in Poland. On the other hand, estimated CO2 emissions from construction phase are significantly higher than those from operation and corresponded to approximately 0.03% of total annual CO2 emissions in Poland and approximately 0.8% of CO2 emissions from ships in the Baltic Sea in 2016. Because the impact is short-term, it is considered small and therefore insignificant.

Table 7-6 Significance of impact on climate offshore.

<table>
<thead>
<tr>
<th>Emissions to air (CO2 emissions, construction)</th>
<th>Sensitivity</th>
<th>Intensity</th>
<th>Scale</th>
<th>Duration</th>
<th>Severity of impact</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions to the atmosphere (CO2 emissions, operation)</td>
<td>High</td>
<td>Medium</td>
<td>Transboundary</td>
<td>Short-term</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

CO2 emissions generated by the marine part of the Baltic Pipe project in Poland were assessed jointly in the EIA Report (SMDI, 2019), Chapter 9.4 Climate and air quality.

Polluting components

Table 7-7 presents emissions of pollutants generated during the construction and operation of the offshore section of the pipeline.

Table 7-7 Pollutants generated during construction and operation offshore.

<table>
<thead>
<tr>
<th>Emissions to the atmosphere [in tonnes] *</th>
<th>NOx</th>
<th>SO2</th>
<th>PM (TSP)</th>
<th>PM10</th>
<th>PM2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation phase (offshore)</td>
<td>1,247</td>
<td>29</td>
<td>54</td>
<td>53</td>
<td>53</td>
</tr>
<tr>
<td>Operation (annual average values)</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* values do not include emissions from the disputed area

In the estimates, it has not been taken into account that the Baltic Sea has been designated as a NECA area, implying that all vessels built after 2021 are required to reduce NOX emissions by 80% compared to the present emission level. This means that the NOX emission level associated with
the project may potentially be lower than the one analysed, especially during the operation time. The ships and fuel used as part of the construction activities for the Baltic Pipe project will be required to comply with to legislation in force, and this will include the legislation as a result of the designated NECA and SECA areas.

The sensitivity of the offshore air quality is assessed as low, as the background level is low and there are good spreading conditions. The above calculated air emissions cover all construction activities offshore and will therefore be emitted in very low amounts along the pipeline route during the construction period. The intensity is assessed as minor during construction and with no impact during operation. The impact is mainly local, but sometimes it may also have a regional scope. The severity of the impact is assessed as minor during construction and negligible during operation. Significant transboundary impact can be excluded.

**Table 7-8 Significance of impact on air quality offshore.**

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Severity of impact</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions to air (polluting components, construction)</td>
<td>Low</td>
<td>Minor</td>
<td>Local to regional</td>
</tr>
<tr>
<td>Emissions to air (polluting components, operation)</td>
<td>Low</td>
<td>No impact</td>
<td>Local to regional</td>
</tr>
</tbody>
</table>

**Conclusion on transboundary impact**

Potential impacts on the climate and air quality from the construction and operation of the proposed pipeline in Polish waters are summarised in Table 7-9.

**Table 7-9 Overall impact significance for climate and air quality.**

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Severity of impact</th>
<th>Significance</th>
<th>Transboundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions to air (CO₂ emissions, construction)</td>
<td>Minor</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>Emissions to air (CO₂ emissions, operation)</td>
<td>Negligible</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>Emissions to air (polluting components, construction)</td>
<td>Minor</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>Emissions to air (polluting components, operation)</td>
<td>Negligible</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Both in the national and transboundary context, the impact of emissions generated during the project on human health can be excluded.

**7.3 Biological environment**

This chapter describes the baseline conditions of potentially endangered environmental elements (see Table 7-1) and presents an assessment of potential transboundary impacts on the biological environment.
7.3.1 Fish Baseline

The fish community in the Baltic Sea is greatly influenced by the hydrological uniqueness of the sea. The sea is semi-enclosed and surrounded by a large drainage basin. The Baltic Sea ecosystem is characterised by lower biological diversity of fauna and flora compared to other sea waters with normal salinity (33-37 PSU) (Ojaveer et al., 2017). The water is too fresh for most marine species and too salty for most freshwater species. Approximately 100 fish species (excluding those in the Kattegat) are adapted to the Baltic Sea ecosystems (Ojaveer et al., 2017). Almost all these species can be found in the southwestern part of the Baltic Sea.

About 105 species of fish and lamprey live in the Bornholm Basin. Among the 105 species recorded in the Bornholm Basin, we distinguish 20 orders (HELCOM, 2012), with predominant perciformes (22.9%), cypriniformes (18.1%) and gadiformes (10.5%) (HELCOM, 2012). The perciformes order, meaning "perch-like", includes freshwater species such as perch (Perca fluviatilis), pikeperch (Sander lucioperca) and ruffe (Gymnocephalus cernua), which naturally prefer less saline waters i.e. mostly the coastal areas, but also marine species such as greater sandeel (Hyperoplus lanceolatus), mackerel (Scomber scombrus) and the invasive round goby (Neogobius melanostomus). The gadiformes order includes the most commercially important species in the Baltic Sea, i.e. cod (Gadus morhua), but in general, most of the registered fish of this order are noted as temporally occurring with no reproduction, e.g. haddock (Melanogrammus aeglefinus), pollack (Pollachius pollachius) and hake (Merluccius merluccius). Lastly, there are the ray-finned fishes i.e. cypriniformes, which include bream (Abramis brama), roach (Rutilus rutilus) and the silver bream (Blicca bjöerkna).

According to the HELCOM checklist for Baltic fish and lamprey species, 37% of species regularly breed in the Bornholm Basin (HELCOM, 2012). Among them are species such as herring (Clupea harengus), sprat (Sprattus sprattus), cod, flounder (Platichthys flesus) and plaice (Pleuronectes platesssa). These species are important to the marine trophic chain and commercial fisheries in the Baltic Sea.

Fish play an important role in the Baltic Sea, as they are an essential link between planktonic production and higher trophic level predators. Forage fish are planktivorous pelagic species that transform the major part of zooplankton production into food available at higher trophic levels (Engelhard et al., 2013). Breeding success, condition and reproductive capacity of predators are linked to fish as a food source for marine birds, mammals and fish predators. Decreasing the number of planktivorous fish can lead to a change in the food pyramid, especially in the “wasp-waist” ecosystem, such as the Baltic Sea, where only a few species of plankton-eating fish are found at the intermediate trophic level. Alterations in abundance or distribution of these species can have large implications for higher trophic levels. During the last 30 years, such changes have occurred with restructuring of the ecosystem, as the biomass of sprat has increased significantly because of the drop in its main predator, the cod (Eero et al., 2012, Casini et al., 2014).

The HELCOM Red List of Baltic Sea species in danger of becoming extinct is a threat assessment that includes fish species. The list follows the red list criteria of the International Union for Conservation of Nature (IUCN). In the Bornholm Basin, eel is the only regularly occurring fish that was listed as critically endangered in the HELCOM Red List of the Baltic Sea species (HELCOM, 2012). Historically, there has been a decline in the population over the last three decades, and only 1-5% of the former population arrives in Europe today. In the Baltic Sea, the eel fishery consists of fishing for yellow eel (growing phase) and silver eel (migrating phase).

Aside from the eel, there are other species in the area surrounding the Baltic Pipe pipeline that are listed on the HELCOM and IUCN Red Lists. As the majority of these species are temporally occurring or listed with an IUCN status of Vulnerable, they are judged as being of relatively low importance and will not be dealt with further.
Commercially important species

Commercial fishing is carried out in large parts of the Baltic Sea by all countries in the region. The fisheries target both marine and freshwater species, but approximately 95% of the total fish catch in terms of biomass consists of cod, sprat and herring (ICES, 2017). The catches are used for both human consumption and industrial use. The Baltic Sea fisheries also target demersal species, such as plaice and flounder, along with migratory species, such as trout and salmon. The following section includes a stock definition for the commercially important species e.g. cod, sprat, herring, plaice and flounder. Commercial fisheries as a receptor is dealt with in section 7.4.2.

Cod

Cod is a demersal species found throughout the Baltic Sea. Since 2003, cod stocks in the Baltic Sea have been divided into two separate populations, i.e. West Baltic and Eastern Baltic cod. These shoals/populations have been highlighted because there is evidence to suggest phenotypic and genetic differences between these two populations. Studies suggest that the cod exhibit natal homing for spawning i.e. they spawn in the same place almost every year, and a difference of approximately 4 months in the timing of peak spawning season between the two stocks may add to the separation between the stocks. Recently the number of Western Baltic cod has increased, and the latest research shows that the majority of cod in the ICES subdivision (SD) 24 belongs genetically to the eastern Baltic population (ICES, 2015).

Figure 7-2 presents cod spawning and nursery areas in the south-western Baltic Sea.

The reproductive cycle for the Western Baltic cod starts late October and spawning begins approximately four months after (see Table 7-10). The spawning period is from the end of February to the beginning of June, and the main spawning season is from March to April (ICES, 2015). Male cod tend to stay longer in the spawning area and reach maturity earlier than females. Salinity > 15 PSU is a requirement for fertilization to occur, and greater than 20 PSU ensures the buoyancy of the eggs (ICES, 2015). Spawning of the eastern stock differs, as it is confined to deeper areas where salinities are sufficiently high to allow egg fertilisation and buoyancy i.e. 12-14 PSU. Historically, the eastern Baltic cod has had a spawning period that extended from March to September, but from 2000-2010, spawning continued until as late as October/November (Köster et al., 2016).
Figure 7-2 Areas of spawning and feeding grounds for cod fry in the south-western part of the Baltic Sea. The fishing ban area and closed areas for fishing are also indicated on the map.

**Sprat**
Sprat is a pelagic species. They are widely distributed in the open sea areas of the Baltic Sea, but high concentrations of young-of-the-year are found in coastal areas (see Figure 7-3). The latter occurs in the autumn and first quarter of the year. Some years juvenile herring tend to stay in the same areas as sprat, and shoals occur often in both open sea and coastal areas (ICES, 2008).

Sprat in the Baltic Sea are near the northern limit of the species' geographic distribution. Therefore, lower temperatures are detrimental to their production and survival in the Baltic Sea, and laboratory experiments have shown that cold water prevents the hatching of sprat eggs (ICES, 2008). In the Baltic Sea, the water temperature has increased over the last years. The effects of warm temperature on sprat biology has resulted in higher egg and larval survival, faster growth rates in larvae and adults, higher food supplies for larvae and adults, and increased and/or earlier egg production (faster gonadal development due to higher temperature and food supply) (ICES, 2008, Voss et al., 2012). Historically, the peak spawning time for sprat in the Baltic Sea occurred in May (see Table 7-10). However, due to inter-annual variability in temperatures, the timing of reproduction has changed. Spawning occurs from January to July (Muus & Nielsen, 1998). During the summer, the sprat spawning activity decreases, and they begin to migrate out of the deep basin towards shallow feeding grounds.
Herring

Herring is a pelagic species that is distributed throughout the Baltic Sea. In the Baltic Sea there are two different herring populations, which are distinguished on the basis of the spawning period, i.e. the spring spawning population and the autumn spawning population. Herrings spawning in spring in the southern Baltic are migratory, they travel to water areas of higher salinity in the open sea or even to areas outside the Baltic Sea where they spend their winter. Then, in the period from March to May, they go to spawning grounds on the southern coast of the Baltic Sea (see Table 7-10). The Central-Baltic population consists mainly of the herring stock spawning in spring, which reach Polish waters in June and mix with the population spawning on the southern shores of the Baltic Sea. This population leaves the waters of the southern Baltic Sea from October to November, travelling towards the northern waters for wintering, and then in spring migrates to Swedish and Latvian spawning grounds. Spawning and nursery areas of the herring are usually found close to the shore and are particularly sensitive to anthropogenic influences, such as the extraction of raw materials, e.g. sand and gravel (Figure 7-4). Spring spawning occurs at the coast with a temporal gradient from south to north. When spawning is completed, the spawning individuals migrate to the deep basins to feed. The main spawning grounds in the southern part of the Baltic Sea are the areas around Rügen and the Gulf of Gdansk, and several smaller spawning areas are located along the coast of Poland (Zaucha and Matczak 2011, Parmanne et al. 1994).
Figure 7-4 Herring spawning areas and migration patterns in the southwestern part of the Baltic Sea. The map also presents no fishing zones and surface concentration of herring biomass [t ∙ NM\(^{-2}\)] (project area, January 2018).

**Plaice**
Plaice is an important species in European waters that has been exploited for centuries. Plaice is a demersal species. The distribution of plaice in the Baltic Sea is dependent on salinity and the stock extends from the Gulf of Gdansk to the Gotland area, but is also found sporadically farther north. Plaice spawning grounds are found in the Bornholm Basin, and nursery areas are located in shallow waters up to 10 m deep (ICES, 2014). Juveniles are located in shallow coastal waters and in estuaries. As plaice grow older, they move into deeper water. The abundance of plaice in the southern Baltic Sea is influenced by the migration of plaice from Kattegat.

In the period from February to March in the Bornholm Basin and other basins (see Table 7-10) plaice spawning takes place, and the eggs are pelagic (ICES, 2014). Spawning does not take place in brackish water if salinity is lower than one third of the average sea salinity because the spawn falls to the bottom (Muus and Nielsen, 1998). Spawning of marine fish with pelagic eggs in the Baltic Sea is restricted to the deep basins due to low salinity of surface water.

**Flounder**
Flounder is the most widely distributed flatfish species in the Baltic Sea. There are two species of flounder in the Baltic Sea, the European flounder and the Baltic flounder (Platichthys solemdali), which appear to be nearly identical (Momigliano et al., 2018). The two species can be distinguished by two methods, either genetically or by studying their eggs and sperm. The Baltic flounder lays sinking eggs on the seafloor in coastal areas, whereas the European flounder spawn buoyant eggs in deep areas. The Baltic flounder is more common in the Gulf of Finland, but it sometimes spawns in the Slupsk Rig in Polish waters. European flounder occurs mainly in the central and southern part of the Baltic Sea. Hence the European flounder is present in the Arkona and Bornholm Basins.
Water resources that allow the reproduction of European flounder populations depend on such parameters as salinity exceeding 12 PSU and oxygen concentration above 2 ml O2/l. Reproduction is therefore dependent on hydrological conditions in spawning grounds, i.e. in the Bornholm Basin (ICES, 2014). Spawning takes place in the period from March to June (see Table 7-10), and nursery areas are found in shallow offshore waters. The eggs of the European flounder are buoyant, unlike the sinking eggs of the Baltic flounder. Juveniles migrate to nearshore waters in the autumn.

Table 7-10 spawning period for commercially important species, e.g. cod, sprat, herring, plaice and flounder in the southern Baltic.

<table>
<thead>
<tr>
<th>Species</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI.</th>
<th>VII</th>
<th>VIII</th>
<th>IX</th>
<th>X</th>
<th>XI</th>
<th>XII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cod</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sprat</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Herring</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Plaice</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flounder</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Impact assessment and transboundary impact
With regards to the construction and operation of the Baltic Pipe pipeline, the potential impacts that it presents Table 7-11 are deemed to be significant for assessing the impact on fish along the pipelines' route.

Table 7-11 Potential impacts on fish.

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical disturbance of the seabed</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Suspended sediment</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Sedimentation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Underwater noise</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Physical disturbance of the seabed
During the construction phase many operations may cause physical disturbances in the seabed morphology. Seabed interventions and pipe-lay works comprise trenching, rock installation, and operations of DP-vessels and anchoring operations, which may cause disturbance and change to the benthic habitats. This impact can potentially disturb spawning and nursery areas.

The sensitivity of fish to physical disturbance of the seabed varies depending on biological circumstances, i.e. the life stage at which the fish is in (egg, larval, fry, juvenile and adult) and whether the fish is spawning (Kjelland et al., 2015). Also, the duration and impact magnitude of the physical disturbance is relevant in regard to the sensitivity. Pelagic eggs (e.g. cod eggs), which usually concentrate in the halocline due to low salinity, is less susceptible to physical disturbance of the seabed, and demersal eggs (e.g. herring eggs) are sensitive to anthropogenic influences, such as mining raw materials (Janßen and Schwarz, 2015; Sundby and Kristiansen, 2015). Although seabed disturbances will occur, they will be temporary and mature fish will soon return to the area. Disturbances affecting the spawning period and the eggs will therefore be limited in time. Therefore, sensitivity to physical disturbances was assessed as low.

In the area of the project implementation, no bottom spawning grounds have been detected, which would be affected by physical disturbances in the seabed. This also applies to herring spawning in the autumn, whose spawning grounds are limited to areas with steep coastal slopes or areas with intense vertical mixing of water layers and the herring spawning in the demersal zone (i.e. populations that spawn in the spring), as well as flounder that is known to spawn in many coastal areas of the Baltic Sea (Sundby and Kristiansen, 2015, Momigliano et al., 2018) outside the potential transboundary impact.

Due to seabed disturbances, fish may initially exhibit avoidance behaviours (Kjelland et al., 2015). However, due to the fact that the areas close to the pipeline are homogeneous, this impact will not
affect the spatial availability of the habitat (i.e. local impact) and will be reversible. After the completion of the work, the fish will return to the area, therefore the duration of the impact is assessed as short term, although the nature of the impact is limited. Therefore, impact on fish habitats as a result of construction works is assessed as an impact of negligible severity.

In summary, the physical disturbance of the seabed is assessed to have no significant impact on fish (Table 7-12). The scale is local, and transboundary impact can be excluded.

### Table 7-12 Significance of impact on fish from physical disturbances of seabed during the pipeline construction.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical disturbance</td>
<td>Intensity</td>
<td>Scale</td>
<td>Duration</td>
</tr>
<tr>
<td>of the seabed</td>
<td>Low</td>
<td>Minor</td>
<td>Local</td>
</tr>
</tbody>
</table>

### Suspended sediments

The seabed intervention related to the construction works will cause resuspension of sediments to the water column, which may impact fish communities by provoking avoidance, clogging of gills, reduction in feeding ability due to reduced visibility and reduced viability of pelagic fish eggs.

The pipeline sections for which trenching is envisaged are shown in Figure 3-15.

Because an increase in SSC in the water column is a regular feature of the sea (e.g. during stormy events), the vulnerability of fish to resuspended sediment depends entirely on the magnitude, composition and duration of the impact. Demersal fish are, generally, better adapted to elevated SSC and are less sensitive than pelagic species. Pelagic fish eggs are especially sensitive to high SSC, which can lead to egg abrasion. Therefore, the sensitivity depends on the species and can be assessed as high.

Avoidance behaviour of fish can potentially be observed among individuals that are within range of the construction site due to the increase of SSC. However, this impact is assessed as short-term because it will take time before the fish resettles the area. The expected avoidance behaviour will also reduce the potential impact of clogging of fish gills. The quantitative knowledge about avoidance thresholds to sediment suspension is limited, but one study found that 3 mg/l resulted in avoidance behaviour in both cod and herring (Westerberg, Rönnbäck & Frimansson, 1996). Also, what is the case for cod will probably also apply to plaice and flounder, which have a similar spawning area and area of distribution for their eggs and larvae (Westerberg, Rönnbäck & Frimansson, 1996).

The sediment may adhere to pelagic fish eggs of such species as cod or sprat, causing it to sink to a depth in which oxygen deficiency prevails. For cod eggs, a critical sediment concentration of 5 mg/l was observed, and the larvae in the yolk sac show an increased death rate at a sediment concentration of 10 mg/l (Westerberg et al., 1996). As Figure 7-2 presents, the planned Baltic Pipe pipeline route does not cross cod spawning grounds in the Baltic Sea under the Polish jurisdiction. Nevertheless, it should be noted that spawning of cod takes place in the water column above the halocline, and the increase of SSC mainly takes place in the bottom waters. Therefore, even if near the project area there were any areas of importance for cod spawning, there would be no impact on fish eggs or fry. Turbulent mixing is suppressed by the halocline, meaning that sediment does not diffuse across the layer (Lee & Lam, 2004). In addition, the threshold concentration (5 mg/l) will be exceeded as a result of trenching work only during a few hours mainly in coastal areas, see Figure 7-5.
In summary, the impact on fish and fish egg from sediment spill is assessed to have a high sensitivity, as the impact of elevated SSC is species-specific. However, the intensity is minor, as the dispersion caused by sediment spill will be close to natural conditions. The scale was rated as regional, i.e. in most cases, threshold values will be exceeded within a few kilometres of the construction site. The duration of the exceedances of threshold concentrations is on average less than a day.

Small amounts of sediment may spread across the border from Poland to Denmark south of Bornholm, where trenching works are also planned on both sides of the border and the disputed area (see Figure 7-5). However, the severity of the impact is minor, and the impact will be insignificant. Significant transboundary impact can be excluded.

**Table 7-13 Significance of suspended sediment impact on fish.**

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspended sediments</td>
<td>High</td>
<td>Minor</td>
<td>Regional</td>
</tr>
</tbody>
</table>

**Sedimentation**

Suspended sediment made available due to construction will re-deposit on the seabed. This sedimentation may potentially affect fish populations by smothering larvae and eggs. There is no expected impact on pelagic fish from sedimentation.

Similarly to the potential impact of suspended sediments, the magnitude of the impact is closely related to the quantity, time and space scale of the re-sedimentation.
Demersal fish eggs and larvae may become critically covered by sediment (smothering) close to heavy intervention work (trenching areas) (Kjelland et al., 2015). Fish eggs and larvae of species spawning in the demersal zone, such as herring and Baltic flounder, may be covered with sediments as a result of the process. Sedimentation can also influence the availability of food sources for fish by burying benthic fauna (Hutchison et al., 2016). Despite these potential impacts, sensitivity is assessed as medium, because with time the environment will naturally return to its original state.

In addition, there will be no significant impact of sedimentation on fish eggs in coastal waters and open sea waters, as there are no significant bottom spawning areas at the pipelines' route. All potential impacts will occur near the pipeline. The modelling results showed that a relatively intensive sedimentation would occur in the temporary storage area and in a small area near the TBM exit point. The sediment thickness in the temporary storage area will be approximately 10-20 mm, and in the area near the TBM exit point approximately 1 mm. However, as stated above, there are no important spawning grounds for demersal species in this relatively small area.

In conclusion, the magnitude of sedimentation impact on larvae and eggs of demersal fish was rated low due to limited duration, local scale and reversibility, see Table 7-14. Therefore, it is assessed that there will be no significant impact on fish from sedimentation. Accordingly, transboundary impact can be excluded.

**Table 7-14 Significance of sedimentation impact on fish in the case of resuspended sediment during pipeline construction.**

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedimentation</td>
<td>Medium</td>
<td>Minor</td>
<td>Local</td>
</tr>
</tbody>
</table>

**Underwater noise**

Anthropogenic underwater noise is potentially a threat to fish, and it has been recognized as an impact that may have significant implications (Slabbeekorn et al., 2010). Fish are exposed to moderate but widespread low-frequency noise, produced by various coastal activities, yet there is little insight into the nature and extent of the impact of sounds on fish (Slabbeekorn et al., 2010). Underwater noise may impair the ability of fish to use biologically relevant sound for e.g. acoustic communication, predator avoidance, prey detection and usage of the soundscape (Slabbeekorn et al., 2010). Generally, no research is available in this area, and the majority of available studies have been carried out on captive fish (Graham and Cooke, 2008, Cell et al., 2016). However, there are indications that fish which are exposed to white noise or simulated boat noise have increased stress hormone (i.e. cortisol) levels (Cell et al., 2016). Other studies have shown the acceleration of heart rate and motor activity under the influence of noise (Graham and Cooke, 2008). It is not possible to extrapolate these findings to free-living fish that can leave the area. However, research suggests that noise may have a potential impact on fish. Such impacts will also be species-specific, as each species has a different hearing ability and dependency on sound (Slabbeekorn et al., 2010).

Fish have two sensory systems for detection of water motion, i.e. the inner ear and the lateral line system (Ladich & Schulz-Mirbach, 2016). Generally, fish hear best within 30 – 1,000 Hz, but there are species that can detect sounds up to 3,000 – 5,000 Hz, whereas other species are sensitive to infrasound or ultrasound (Slabbeekorn et al., 2010; Ladich & Schulz-Mirbach, 2016). An example of such a species is the European eel, which can detect and avoid infrasounds (<20 Hz) produced by predators.

The impact of underwater noise on fish can vary significantly, depending on the duration and the received level of the noise (see Table 7-15). Fish are known to respond differently to underwater noise (experimental), which suggests that the reactions are likely dependent on variables such as location, temperature, physiological state, age, body size and shoal/school size (Peng et al., 2015).
Table 7-15 Potential impacts of underwater noise on fish.

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Description of potential impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>Several studies have reported mortality of fish exposed to blasts or other types of high-level sounds (Yelverton et al., 1975; Popper &amp; Hastings, 2009). Blast injuries can occur if munitions clearance takes place, whereas rock installation is incapable of producing noise with this type of impact. International guidance values regarding mortality from noise are described in 7.3.1.</td>
</tr>
<tr>
<td>Physical injury</td>
<td>High-level acoustic exposures like blasts can cause physical damage. There are no investigations that have determined whether blasts that do not kill fish have had any impact on physiology (e.g. metabolic rate, stress). This type of impact can only occur in the area of close vicinity to the noise source (Peng, Zhao and Liu, 2015). International guide values for noise injuries are given in Table 7-16.</td>
</tr>
<tr>
<td>Permanent threshold shift (PTS)</td>
<td>Permanent threshold shift can be caused by elevated noise resulting in auditory tissue damage. The hearing threshold does not recover after exposure (Andersson et al., 2016). PTS values for cod and herring are given in Table 7-16.</td>
</tr>
<tr>
<td>Temporary threshold shift (TTS)</td>
<td>Temporary elevation of the hearing threshold due to noise exposure. Hearing will recover with time, dependent on exposure, repetition rate, sound pressure level (SPL), frequency and health of the fish (Andersson et al., 2016). TTS can potentially occur at greater distances. International guide values for TTS are given in Table 7-16, which also contains values for cod and herring.</td>
</tr>
<tr>
<td>Masking of other sounds</td>
<td>Noise above the ambient level could cause masking, interfering with the ability of fish to hear communication signals or other important sounds (Slabbekoorn et al., 2010). No threshold values for masking of sounds are available in literature.</td>
</tr>
<tr>
<td>Behavioural response</td>
<td>Noise not resulting in PTS and TTS can cause avoidance, flight behaviour, fright response and altered swimming behaviour (Slabbekoorn et al., 2010; Andersson et al., 2016). International orientation values for behavioural responses are given in Table 7-16, including values for cod and herring.</td>
</tr>
</tbody>
</table>

Table 7-16 International guidance values (IGV) for fish and Cod/Herring (CH) (Andersson et al., 2016).

<table>
<thead>
<tr>
<th>Guidance values for fish including cod/herring</th>
<th>Response</th>
<th>Sound Pressure Level (SPL=dB re 1 μPa/SEL=dB re 1 μPa^2s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGV</td>
<td>Fatal injury</td>
<td>207 dB re 1 μPa^2s (SEL)</td>
</tr>
<tr>
<td>IGV</td>
<td>Injury with recovery</td>
<td>203 dB re 1 μPa^2s (SEL)</td>
</tr>
<tr>
<td>IGV</td>
<td>TTS</td>
<td>186 dB re 1 μPa^2s (SEL)</td>
</tr>
<tr>
<td>Cod/Herring</td>
<td>PTS/TTS</td>
<td>205 dB re 1 μPa (SPL)</td>
</tr>
<tr>
<td>Cod/Herring</td>
<td>Mild behavioural response</td>
<td>75 – 125 dB re 1 μPa (SPL)</td>
</tr>
<tr>
<td>Cod/Herring</td>
<td>Strong behavioural response</td>
<td>125 – 165 dB re 1 μPa (SPL)</td>
</tr>
<tr>
<td>Cod/Herring</td>
<td>Strong escape response</td>
<td>165 dB re 1 μPa (SPL)</td>
</tr>
</tbody>
</table>

Construction activities
Construction activities, such as rock installations, trenching, pipe-lay, anchor handling and ship traffic are characterized as sources of continuous noise. The underwater noise generated from the construction activities is not distinguishable from the ambient noise levels, as the background levels
in the Baltic Sea, where there are already large volumes of ship traffic, are relatively high. As a matter of fact, background noise levels of 127 dB re 1 μPa (SPL), which are measured around shipping lanes in the Baltic Sea (Tougaard, 2017), exceed the threshold level for which the IGV assign strong behavioural response (Table 7-16). In addition, near the pipeline and ships involved in construction activities there will be behavioural reactions to underwater noise generated by construction works, such as rock and ship traffic. The duration will be immediate and will cease after the activity has ended. It is not likely that there will be significant impacts on fish.

**Unplanned events – munitions clearance**

In connection with the risk assessments (Chapter 4), it has been identified that munitions clearance of UXO may pose a risk during the construction phase. Based on the route design strategy, munitions clearance is handled as an *unplanned event*.

Impulsive noise emissions are relevant in relation to potential munitions clearance. The individual threshold values are presented in Table 7-16. Distances of potential impact of munition clearance on fish are presented in Table 7-17.

**Table 7-17 Modelled distances of the potential impact of munition clearance on fish.**

<table>
<thead>
<tr>
<th>Distance [km]</th>
<th>Niechorze-Pogorzelica</th>
<th>Rogowo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charge size</td>
<td>150 kg TNT(^1)</td>
<td>950 kg TNT(^2)</td>
</tr>
<tr>
<td>Period</td>
<td>Summer/Winter</td>
<td>Summer/Winter</td>
</tr>
<tr>
<td>max/avg</td>
<td>Max</td>
<td>Avg</td>
</tr>
<tr>
<td>Mortality</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Injury</td>
<td>0.8</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**Comments:**
For the area of the Polish sea crossed by the gas pipeline there is no reliable data on the value of loads. For this reason, for the purposes of modelling, the following has been assumed:
1) Adopted average charge;
2) Maximum load of German and English bombs used during World War II.

While the munition clearance will be unavoidable, the most pessimistic scenario predicts that fish mortality may occur at a maximum distance of 0.8 km in the Niechorze-Pogorzelica alternative and 0.7 km in the Rogowo alternative (Table 7-18). The most pessimistic scenario foresees fish injuries at a distance of 0.8 km from the location of the project in the Niechorze-Pogorzelica alternative and the maximum distance of 0.7 km in the Rogowo alternative.

It is likely that it will be lethal for shoals or schools of fish that are present within the mentioned distances, when munitions clearances occur. Sensitivity to the impact at the *individual* level is high due to the lethal effect and irreversibility, and the intensity of impact on the regional scale is high. Lastly, the duration of the impact is assessed to be immediate.

On a population level, the severity of the impact is minor. Munition clearance will only present a lethal or injury risk for a very small proportion of larger populations. This means that the structure and function of the populations will remain unaffected.

Regarding behavioural response, fish are known to respond differently to tested noise, which suggests that the reactions are likely dependent on variables such as location, temperature, physiological state, age, body size and shoal/school size. Most likely there will be a limited reaction to munition clearance, and the scale of impact, which is also dependent on the species, will vary from local to regional.
### Table 7-18 Significance of underwater noise impact on fish (unplanned event - munitions clearance) before mitigation measures.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underwater noise (unplanned event - munitions clearance)</td>
<td>High</td>
<td>Large</td>
<td>Local/regional</td>
</tr>
</tbody>
</table>

#### Mitigation measures

A sonar survey should be carried out to determine the presence of schools or fish stocks in the area and to assess whether the munition clearance period is appropriate or whether it should be postponed. This assessment can be helpful in protecting shoals/schools of fish that may be present in the area.

#### Conclusion on mitigation measures

The mitigation measure described above will reduce the severity of the impact because the munition clearance will affect a smaller number of individuals. Nevertheless, the severity of the impact is assessed as low, since it is possible that there will be some variation in relation to a given fish population, but it will be close to negligible compared to the situation without the use of mitigation measures.

### Table 7-19 Significance of underwater noise impact on fish (unplanned event - munition clearance) after applying mitigation measures.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underwater noise (unplanned event - munitions clearance)</td>
<td>High</td>
<td>Large</td>
<td>Local/regional</td>
</tr>
</tbody>
</table>

#### Conclusion on transboundary impact

According to the map of munitions hazard areas (Figure 4-7) near the border between Poland and Denmark, and in the disputed area, there are no areas with the risk of finding munitions, and the probability of detecting munitions is very low.

The above assessment shows that the underwater noise generated by munition clearance for the project route alternatives Niechorze-Pogorzelica and Rogowo may cause mortality of fish at the maximum distance of 0.8 km from the source of explosion and damage to fish within a radius of 0.8 km from the source of the explosion. In the case munitions clearance takes place right at the border, the impact would be transboundary. The assessment of this transboundary impact is similar to the national assessment, i.e. it is judged that only a very small proportion of a larger population can be affected, and thus the impact is not significant.

### Table 7-20 Overall significance of impact on fish.

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Impact severity</th>
<th>Significance</th>
<th>Transboundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical disturbance of the seabed</td>
<td>Negligible</td>
<td>Not significant</td>
<td>No</td>
</tr>
<tr>
<td>Suspended sediment</td>
<td>Minor</td>
<td>Not significant</td>
<td>No</td>
</tr>
<tr>
<td>Sedimentation</td>
<td>Minor</td>
<td>Not significant</td>
<td>No</td>
</tr>
<tr>
<td>Underwater noise (Unplanned event)</td>
<td>Minor</td>
<td>Not significant</td>
<td>No</td>
</tr>
</tbody>
</table>
7.3.2 Marine mammals

Baseline

The baseline description on marine mammals is based on literature as well as targeted marine mammal surveys including visual observations from shore, aerial surveys from plane and acoustic monitoring with C-PODs along the planned route and the considered alternatives (SMDI, 2019).

Four species of marine mammals are resident in the Polish part of the Baltic Sea; Grey seal (*Halichoerus grypus*), harbour seal (*Phoca vitulina*), ringed seal (*Pusa hispida*) and harbour porpoise (*Phocoena phocoena*). The ringed seal occurs irregularly in Polish waters and has not been recorded in the area of potential impacts of the project (SMDI, 2019), therefore it will not be discussed further in this document. In addition, other marine mammals sporadically occur on the Baltic Sea, including dolphin (e.g. *Stenella coeruleoalba*), orca (*Orcinus orca*), white whale (*Delphinapterus leucas*), but these species appear rarely and are not included in this assessment.

Harbour seal

The harbour seal is rare in Polish waters, and the Vistula estuary (Wisła Przekop) is the only place where this species has been observed in recent years. The Baltic Sea population was estimated in 2016 to comprise 1,700 individuals (Hansen, 2018).

The Baltic Sea population can be divided into two subpopulations, referred to as the Kalmarsund and the southern Baltic subpopulation. There is evidence that the harbour seal found in Polish waters belongs to a subpopulation whose resting place is in Falsterbo, Saltholm and Bøgestrømmen. This subpopulation is somewhat isolated from the harbour seal inhabiting the Kattegat and the Skagerrak, and the borderline is in the Gedser region (Olsen et al. 2014).

Survey campaigns have been performed as observations from shore and as aerial surveys. During the research campaigns conducted from the air in Polish waters, seals were not observed.

Harbour seals do not usually move too far from their colonies in search of food (less than 30 km, Dietz et al., 2015), although they have also been observed at greater distances. Food sources consist mainly of a large variety of fish species, but also squid and crustaceans. The vision of seals is adapted to function equally well under and above water. Seals have whiskers, which have an equally high importance for food search as well as for perception (Denhardt et al., 1998). In addition, hearing is well-adapted to aquatic life.

Seals are generally not considered sensitive to disturbance (Blackwell et al., 2004), except during breeding and moulting. In these periods, the species are sensitive to physical disturbance, especially from disturbance on land near colonies (Galatius, 2017). The harbour seal mates in May/June, and young are born in August/September (Hansen, 2018). So these are the periods in which this species is the most vulnerable. In addition, pups are sensitive to disturbances near the colony in June/July because they need resting places where they suckle the mother's milk.

The harbour seal is listed in Annex II and V of the Habitats Directive. This species has not been included as a designated object of protection of the Polish Natura 2000 Ostoja area on the Pomeranian Bay PLH990002, which is located near the pipelines' route. On the basis of the HELCOM red list, the South Baltic subpopulation is considered the least endangered.
Colonies of grey and harbour seals and the regular occurrence zone of the grey seal and harbour seal (Hansen, 2018, Dietz et al., 2015, Teilmann et al., 2017). The grey seal is present in the entire project area, which is marked in blue.

Grey seal
The grey seal is found in the whole of the Baltic Sea. It is estimated that the total population size in the Baltic Sea is 40,000 individuals. In the Polish part of the Baltic Sea, grey seals are found along the entire coast. In recent years, several hundred cases of live or dead animals found or observed in various places along the Polish coast have been registered. The only place where grey seals can be observed for most part of the year is the area near the mouth of the Vistula (Przekop). The Mewia Łacha nature reserve located in this area is a resting place for 90 individuals (SMIOUG, 2018). However, in Polish waters there are no colonies understood as a place of rest, moulting, mating and breeding. Colonies are permanent places of seal residence, remaining in one location for many years. Grey seal colonies closest to the project site are found on Saltholm in the Øresund Straits, the Rødsand Sandbank in the south of the Danish island of Lolland and the Falsterbo peninsula in Sweden (Figure 7-6).

Survey campaigns have been performed as observations from shore and as aerial surveys. During the two research campaigns conducted from the air in Polish waters, no grey seals were observed. No grey seals were observed from the shore.

Grey seals travel far between resting spots and foraging sites (up to 380 km have been registered, Dietz et al., 2015). Grey seals feed on a wide variety of fish species. In the Baltic Sea, the main food source is herring, but sprat and Atlantic cod are also important food sources. Diving occurs at all water depths within the project area. Studies of the sense of sight and hearing of grey seals have not been conducted, but it is generally assumed that these senses function similarly to harbour seals.

Grey seals breed at undisturbed haul-out sites in February and March.
Seals are generally not considered sensitive to disturbance (Blackwell et al., 2004), except during breeding and moulting. In these periods, the species are sensitive to physical disturbance, especially from disturbance on land near colonies (Galatius, A., 2017). As there are no grey seal haul-out sites near the planned pipeline route, grey seal is not considered sensitive to construction activities.

The grey seal is included in Annex II and V of the Habitats Directive. The species is not included in Polish Natura 2000 sites along the pipeline route. In the HELCOM Red List, it is considered of least concern, while at the national level in Poland it is considered to be endangered (Głowaciński, 2001). In addition, the grey seal is included in Annex II to the Bonn Convention.

Harbour porpoise

Harbour porpoise is the only cetacean species that lives in the Baltic Sea. Two populations of harbour porpoise can be found in the Baltic Sea; the Baltic Sea (or Baltic Proper) population and the Belt Sea population. The Baltic Sea population is an endangered population (only 500 individuals). The Belt Sea population size was estimated at approximately 18,500 individuals in 2012 (Sveegaard et al., 2013) and during the SAMBAH study, more than 20,000 individuals were estimated (SAMBAH, 2016). These two populations are clearly separated in the summer, and the limit of their occurrence runs from north to south along the east coast of Bornholm. In winter, both populations are more dispersed, but the SAMBAH results suggest that harbour porpoises from the southwestern Baltic Sea usually migrate to Danish territorial waters (Sveegaard et al, 2015). In the summer (May-October), there may be specimens from the population of the Belt Sea in the project area, but it is estimated that there will be a small number of individuals (see Figure 7-7).

In winter (from October to April) increased harbour porpoise activity is expected along the Polish coast, which indicates the importance of this region as a wintering area for this species. However, this increased activity is mainly observed in the central and eastern part of the Polish coast, and in the western part of the Polish Baltic Sea coast the harbour porpoise appears only sporadically. Harbour porpoise distribution can be seen in 7.3.2. Density in the project area is generally low, much lower than in other parts of the project area, i.e. in Danish or Swedish waters.

During the research campaigns conducted in 2018, 1 harbour porpoise was observed in Polish waters along on the part of the pipeline common to both alternatives - August 2018, aerial observation.

In addition, acoustic monitoring was applied throughout the area using 10 C-POD detectors, of which 4 C-POD detectors were used in the Polish part of the project area. The results of the spring and summer tests confirmed that in the spring the harbour porpoise is very rare in the Polish part of the project area.

In July, in the common area of both route alternatives, 26 days of positive harbour porpoise detection were recorded. Similar activity was recorded in the area north-west of the Rogowo alternative in August (25 DPD). Also in the region of Niechorze-Pogorzelica alternative in August there was a greater activity of harbour porpoise - 15 DPD, and along Rogowo alternative - 20 DPD. In September, greater activity was recorded in the area of the preferred option (16 DPD) than in the area of the alternative route (5 DPD). During the winter, the activity of harbour porpoises in

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Bonn convention: Convention on the Conservation of Migratory Species of Wild Animals (CMS): The Convention provides a global platform for the conservation and sustainable use of migratory animals and their habitats. It brings together the States through which migratory animals pass (called the Range States) and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range. Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Migratory species that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention.
the area of the Project implementation was negligible. About 10 days of positive detection were recorded in spring on each station, in both alternatives considered and in the common part.

The concentration of the harbour porpoise is higher in the summer, which is particularly evident in the northern part of the project area common to both alternatives - Niechorze-Pogorzelica and Rogowo. In general, in Polish waters in the area of the project, the harbour porpoise density is very low throughout the year Figure 7-7 (SAMBAH, 2016). Referring the results of observations to the results of the SAMBAH program, it should be stated that the active individuals in the area of the implementation of the Polish part of the Project are individuals of the Belt Sea population.

![Figure 7-7](image.png)

Figure 7-7 Harbour porpoise subpopulations and distribution for the periods November – April and May – October (SAMBAH, 2016). The population separation border marks the western boundary of the Baltic Sea population occurrence during the summer period.

The main food source for harbour porpoise is various fish species, especially cod, herring, and sprat (Börjesson & Berggren, 2003), but the species is an opportunistic feeder, adapting its feeding conditions towards available prey. The depth of the dive does not generally exceed 50 m, which means that the harbour porpoises dive at all depths in the project area.

Harbour porpoises use echolocation for foraging and navigation and are hence able to navigate and search for prey in complete darkness. Hearing capabilities are a key feature of the species, although harbour porpoises also have good vision underwater.

Harbour porpoise breed from mid-June to late August in the Baltic Sea, where calving takes place in May-June and mating in July-August (SAMBAH, 2016). Females give birth to a single calf and the calf is dependent on its mother for the following year. There are no specific breeding areas identified in the Baltic Sea, but areas around the Midsjö Banks in Sweden are considered important (outside project area (SAMBAH, 2016)). It is assumed that the harbour porpoise is especially sensitive during the breeding period, but the calves are considered vulnerable during the lactation period, which lasts 8-11 months.

The species are strictly protected under Annex IV of the Habitats Directive (EU Directive on the Conservation of Natural Habitats and Wild Flora and Fauna - 92/43/EEC). Furthermore, it is included on the Bonn Convention Appendix II. According to the HELCOM Red List, the population of the Baltic Sea is considered critically endangered and the population of the Belt Sea is vulnerable.

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38Bonn convention: Convention on the Conservation of Migratory Species of Wild Animals (CMS): The Convention provides a global platform for the conservation and sustainable use of migratory animals and their habitats. It brings together the States through which
Impact assessment and transboundary impact

In connection with the construction and operation of the Baltic Pipe, three potential impacts have been identified and are presented in Table 7-21. These impacts are assessed in more detail below.

Table 7-21 Potential impacts on marine mammals.

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspended sediment</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Physical disturbance above water</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Underwater noise (construction activities, unplanned events)</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Suspended sediment

Impact on marine mammals due to the increased concentration of suspended sediments that arises as a result of construction works may cause vision problems and behavioural reactions, such as the avoidance of suspended sediment plumes. However, the modelling results show that the increase in the suspended sediment concentration related to the construction will occur only locally around the construction site and will have a short term duration. All three species of marine mammals show low sensitivity to increased suspended sediments concentrations. Thus, the impact on the Polish area of the project was assessed as negligible.

Suspension plumes from the Polish project area will not have a negative impact on Danish, Swedish or German waters. Transboundary impact on marine mammals from increased SSC can therefore be excluded.

Table 7-22 Significance of suspended sediment impact on marine mammals.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspended sediment</td>
<td>Low</td>
<td>Minor</td>
<td>Local</td>
</tr>
</tbody>
</table>

Physical disturbance above water

Physical disturbances as a result of operations related to conducting construction works above water may potentially disturb seals (but not porpoises); however, seals are not generally considered a species sensitive to disturbances (Blackwell et al., 2004). During periods of breeding and moulting, seals are sensitive to physical disturbance on land near colonies (Galatius, 2017). Since there are no known seal colonies in Polish waters and construction works will not be carried out close to known colonies in the waters of the affected parties, the impact on reproduction and moulting is unlikely.

Physical disturbances from the Polish project area will not have a negative impact on Danish, Swedish or German waters. Transboundary impact on marine mammals from physical disturbance can therefore be excluded.

Table 7-23 Significance of the impact of physical disturbances above water on marine mammals.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical disturbance above water</td>
<td>Low</td>
<td>Minor</td>
<td>Local</td>
</tr>
</tbody>
</table>

Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Migratory species that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention.
**Underwater noise**

Potential impacts on marine mammals from underwater noise range from physical injury to behavioural responses (Figure 7-8), characteristics of which are presented in Table 7-24.

![Figure 7-8 Zones of influence at various distances from an underwater noise source (WODA, 2013).](image)

For marine mammals, the auditory system is the most sensitive organ and the risk of damage on is higher than in the case of impacts on other organs. Following exposure to loud noise levels, threshold shifts are often observed. Shifting the hearing threshold is a limitation of hearing sensitivity, which can be permanent or temporary, depending on the level and time of exposure. In terms of the degree of severity, the impacts vary, ranging from blast injury to TTS (Sveegaard et al., 2017).

**Table 7-24 Potential impacts of noise on marine mammals (Yelverton et al., 1973, Southall et al., 2007, Sveegaard et al., 2017).**

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Description of potential impact</th>
</tr>
</thead>
</table>
| Physical injury (blast injury)         | Tissue damage due to the shock wave. Measurements for threshold values have been performed on mammals with ear drums (Yelverton et al., 1973). As the harbour porpoise has no functional ear drum, this measured threshold value does not apply. Risk of tissue damage is measured as the acoustic impulse (Pa·s)  
280 Pa²·s: No mortality, but moderately severe blast injuries (including ear drum rupture) are frequently observed. Animals are capable of recovery.  
140 Pa²·s: High risk of minor injuries caused by a shock wave, including the rupture of the eardrum.  
70 Pa²·s: Low risk of blast injuries. No ear drum rupture.  
35 Pa²·s: Safe level.  
Physical injury can be from insignificant bleeding to death of the affected species. Minor injuries will heal quickly and long-term effects are not expected. More severe injuries can reduce viability and hinder the ability of reproduction. |
| Permanent threshold shift – PTS        | Permanent hearing loss. Damage to the sensory organ. Hearing threshold does not recover after exposure. Because in most species the ability to hear is essential, hearing impairment causes a reduction in vitality, which can even lead to death. The impact severity is dependent on the level of PTS, in which high PTS levels are more severe than small PTS (viability is not reduced significantly). |
### Potential impact

<table>
<thead>
<tr>
<th>Description of potential impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold values for harbour porpoise and seals can be seen in Table 7-27.</td>
</tr>
</tbody>
</table>

### Temporary threshold shift – TTS

- Temporary hearing loss. Depending on the level of exposure, the ability to hear returns within minutes or hours. As the impact is relatively short-term, the viability of the marine mammals is not at high risk.

- Threshold values for harbour porpoise and seals can be seen in Table 7-27.

### Avoidance behaviour

- Underwater noise, which does not induce TTS or PTS, may still impact marine mammals by altering behaviour, which again can have implications for the long-term survival and reproductive success of the individuals.

- Avoidance behaviour ranges from panic and flight to disturbance (Skjellerup et al., 2015). Panic behaviour can cause severe impact, from being accidentally caught by fishing devices to stranding on shallow water, which in turn can result in death of an individual. Flight and disturbance behaviour can reduce foraging or nursing time, which again can reduce the fitness of the species.

- No threshold values for construction activities or explosions have been determined in the literature.

### Masking of other sounds

- Masking is the situation in which project generated noise hinders the detection and identification of other sounds. Masking is relevant in connection with continuous noise (thus, not munitions clearance) and must coincide in time and approximately be within the same frequency band. The impact of masking on marine mammals has not been assessed in the scientific literature.

- No threshold values for construction activities have been determined in the literature.

### Behavioural response

- Behavioural responses to noise (other than avoidance behaviour) can include e.g. altered swimming patterns. Behavioural responses are difficult to predict and therefore to assess.

- No threshold values for construction activities have been determined in the literature.

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The sensitivity of marine mammals to underwater noise depends on the type of noise (e.g. level, frequency, single events from explosions vs. continuous noise such as rock installations), the threshold values, the vulnerability over the season (Table 7-25) and the species. Seals are generally considered a species less susceptible to disturbances due to underwater noise than porpoises (Blackwell et al., 2004).

Table 7-25 Vulnerable periods (marked in grey) for marine mammals in the southern Baltic Sea in connection with population size and key periods (breeding, moulting and lactation as specified in the baseline sections).

<table>
<thead>
<tr>
<th>Species/group</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harbour porpoise – Belt Sea population</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harbour porpoise – Baltic Sea population</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harbour seal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grey seal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1Adults are sensitive during the breeding period (June-August). Calves are sensitive 8-11 months after birth.

2Very vulnerable population.

3Very low abundance (if any present) in the project area (SAMBAH, 2016).
When defining the sensitivity to an activity, type of the activity and the seasonality have been taken into consideration.

**Construction activities**

Construction activities, such as rock placement, trenching, pipe laying, anchor handling and ship traffic are classified as works generating continuous noise. The underwater noise generated from the construction activities is not distinguishable from the ambient noise levels, as the background levels in the Baltic Sea, where there are already large volumes of ship traffic, are relatively high. In addition, near the pipeline and ships involved in construction work there will be behavioural reactions to underwater noise generated by construction works, such as rock and ship traffic. The duration will be immediate and will cease after the activity has ended.

It is not likely that there will be significant impacts on marine mammals.

Underwater noise associated with construction on the Polish project area will not have a negative impact on Danish, Swedish or German waters. Transboundary effects on marine mammals from construction-related underwater noise can therefore be excluded.

**Table 7-26 The significance of the impact of underwater noise generated by rock works on marine mammals.**

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underwater noise - construction activities</td>
<td>High</td>
<td>Minor</td>
<td>Local</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Immediate</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

**Unplanned events**

In connection with the risk assessments (Chapter 4), it has been identified that munitions clearance may pose a risk during the construction phase. In connection with the route planning strategy, which aims to bypass munitions as much as possible, munition clearance is treated as an unplanned event.

As stated in Chapter 4, the pipeline route in Polish waters passes through an area where there is a small risk of encountering munitions, which is mainly related to the crossing of earlier shipping routes with munitions depots. In general, the risk of encountering UXOs in the Polish part of the project area is low.

Underwater noise from munitions clearance will potentially generate an impact on marine mammals. The literature includes a set of threshold values for TTS and PTS (Table 7-24) which is presented in Table 7-27

**Table 7-27 Threshold values for munitions clearance for marine mammals (Southall et al., 2007; Sveegaard et al., 2017).**

<table>
<thead>
<tr>
<th>Species/group</th>
<th>Munitions clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PTS</td>
</tr>
<tr>
<td>Harbour porpoise</td>
<td>179 dB SEL</td>
</tr>
<tr>
<td>Seal</td>
<td>179 dB SEL</td>
</tr>
</tbody>
</table>

To assess the potential impact from munition clearance, noise propagation models have been applied calculating the expected range, in which impact on marine mammals in the form of PTS/TTS can occur. Details on the modelling methodology, the munitions types considered and the results for the propagation of underwater noise during munition clearance are provided in the EIA report (Chapter 5 in Ramboll, 2018a). Propagation models depict the winter and summer periods as well as two types of munition in Niechorze and Rogowo. Models for the winter season are represented in Figure 7-9 Figure 7-10 PTS contours correspond to physical and irreversible injuries in marine mammals, whereas TTS contours correspond to the TTS area and avoidance behaviours.
Figure 7-9 TTS and PTS for winter scenario for a 150 kg TNT.
Figure 7-10 TTS and PTS for winter scenario for a 950 kg TNT.

Table 7-28 Distances for the potential impact of munition clearance on marine mammals.

<table>
<thead>
<tr>
<th>Distance [km]</th>
<th>150 kg TNT&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>950 kg TNT&lt;sup&gt;(2)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Period</strong></td>
<td><strong>Summer</strong></td>
<td><strong>Winter</strong></td>
</tr>
<tr>
<td>Niechorze-Pogorzelica</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum/average</td>
<td>Max</td>
<td>Avg</td>
</tr>
<tr>
<td>PTS</td>
<td>3.7</td>
<td>3.1</td>
</tr>
<tr>
<td>TTS</td>
<td>12.6</td>
<td>10.2</td>
</tr>
<tr>
<td>Rogowo;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum/average</td>
<td>Max</td>
<td>Avg</td>
</tr>
<tr>
<td>PTS</td>
<td>4.9</td>
<td>3.7</td>
</tr>
<tr>
<td>TTS</td>
<td>13.9</td>
<td>10.9</td>
</tr>
</tbody>
</table>

**Comments:**
For the area of the Polish sea crossed by the gas pipeline there is no reliable data on the value of loads. For this reason, for the purposes of modelling, the following has been assumed:
1) Adopted average charge;
2) Maximum load of German and English bombs used during World War II.

To assess the impact on marine mammals, it is important to assess the impact both on an individual basis and on a population level. Impacts can also differ between species and populations. The impacts are assessed below for physical injury/PTS and TTS/avoidance behaviour for harbour porpoises and seals. The assessment was made without mitigation measures (which is a hypothetical scenario, because some or all mitigation measures should be introduced) and with mitigation measures. Assessments without mitigation measures are made without taking into account the season when construction activities are conducted.
Physical injury and PTS

Harbour porpoise

The sensitivity of individual harbour porpoises of both populations to injury and PTS is high, as the impact is permanent and will most likely cause lowered fitness and potentially death as a consequence.

If the munitions cannot be avoided in the case of the Niechorze-Pogorzelica and Rogowo alternatives, in the most pessimistic scenario the risk of PTS will occur at a maximum distance of 6 km from Niechorze and 6 km from Rogowo (Table 7-28). This means that if harbour porpoises are present in this area, the risk of injury and permanent hearing damage is likely to occur. Impact magnitude at the individual level is high because the intensity of impact is large and the duration is long term. The impact severity is major.

On a population level, the impact is different. In the case of the population of the Belt Sea, the impact is unlikely to be significant, because due to the high degree of dispersion in Polish waters, the impact will affect only a few individuals, or none at all, of a large population. Therefore, the impact on the structure and viability of the population will be minor. The impact severity is assessed to be minor. The opposite is the case for the Baltic Sea (Baltic Proper) population. If individuals from this very small and endangered population (< 500 individuals) are severely impacted, the impact magnitude on the population will also be high, as the viability of the population will be influenced. By applying the preventive approach (excluding the fact that species density is low), the severity of impact is assessed as significant.

If the munition clearance takes place near the Polish-Danish or Polish-German border, a transboundary impact of the same severity (major) may occur in Danish or German waters. Due to the distance of the Baltic Pipe pipeline route from the Swedish border (> 50 km) there will be no transboundary impact on harbour porpoises leading to the PTS.

Seal

The sensitivity of individual seals to injury and PTS is high, as the impact is permanent and will most likely cause lowered fitness and potentially death as a consequence, similarly to harbour porpoise.

The range of impact is the same as in the case of the harbour porpoise (Table 7-28), see section above.

At the individual level, the risk of injuries and PTS exists within a radius of 5.3 km in winter for the grey seal in the case of Niechorze and 5.6 km for the grey seal in the case of Rogowo (the harbour seal does not occur in this region, Figure 7-6). The magnitude of impact at the individual level is high because the intensity of impact is large, and the duration is long term. The impact severity is assessed as major.

On a population level, the impact is not likely to be as severe, as only a few individuals out of a large population are likely to be impacted, and hence the impact severity on the structure of the populations will be minor.

If the munition clearance takes place near the Polish-Danish or Polish-German border, a transboundary impact of the same severity (minor) may occur in Danish or German waters. Due to the distance of the Baltic Pipe pipeline route from the Swedish border (> 50 km), there will be no transboundary impact on the seals leading to the PTS.
TTS and avoidance behaviour
The sensitivity to TTS and avoidance behaviour is low for both harbour porpoise (both populations) and seals, as the impact will cease immediately (i.e. within minutes to hours) after the blast.

If the munition clearance along Niechorze or Rogowo turns out to be unavoidable, in the most pessimistic scenario, the risk of TTS and avoidance behaviour will occur within a maximum radius of 18.7 km from both places (Table 7-28). It is expected that marine mammals will be able to hear explosions at a very large distance (beyond the TTS zone) and are expected to react strongly within the TTS zone. Although the response will be strong and will lead to strong behavioural responses and the risk of TTS, the impact magnitude is assessed as minor because the sense of hearing and response patterns will return to normal after the effects have stopped. The impact severity will hence be minor and not significant for all the analysed species.

If the munitions clearance takes place near the Polish-Danish or Polish-German border, a transboundary impact of the same severity (minor) may occur in Danish or German waters.

Table 7-29 Significance of impacts in the Polish zone and transboundary impacts on marine mammals as a result of underwater noise created during munitions clearance (unplanned event) - before applying mitigation measures. PTS: Blast injury/PTS; TTS: TTS and avoidance behaviour.

<table>
<thead>
<tr>
<th>Underwater noise - Munitions clearance</th>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltic Sea Harbour porpoise</td>
<td>PTS</td>
<td>High</td>
<td>Large</td>
<td>Regional</td>
</tr>
<tr>
<td></td>
<td>TTS</td>
<td>Low</td>
<td>Large</td>
<td>Regional</td>
</tr>
<tr>
<td>Belt Sea Herbal porpoise</td>
<td>PTS</td>
<td>High</td>
<td>Large</td>
<td>Regional</td>
</tr>
<tr>
<td></td>
<td>TTS</td>
<td>Low</td>
<td>Large</td>
<td>Regional</td>
</tr>
<tr>
<td>Seal</td>
<td>PTS</td>
<td>High</td>
<td>Large</td>
<td>Regional</td>
</tr>
<tr>
<td></td>
<td>TTS</td>
<td>Low</td>
<td>Large</td>
<td>Regional</td>
</tr>
</tbody>
</table>

Mitigation measures
To reduce the impact from blast injury and PTS on individuals and at the population level for the two populations of harbour porpoises and the two species of seal, mitigation measures will be applied. Visual monitoring by a marine mammal observer and seal scarers are often used measures to limit the impact of underwater noise. In addition, the selection of the period in which munitions will be removed may limit the potential impact on the endangered harbour porpoise population in the Baltic Sea.

Overall, it is suggested that a UXO specific marine mammal mitigation plan that will be implemented, including mitigation measures such as marine mammal observations (MMO), passive acoustic monitoring (PAM), acoustic deterrents. The plan will contain appropriate mitigation
measures to be applied during munitions clearance. The plan must correspond to the specific characteristics of the area and species.

**Visual observations and PAM**

Visual monitoring by MMOs will be undertaken from the source vessel (on a suitable viewing platform). Visual monitoring should be restricted to periods of good visibility during daylight hours, as visibility decreases during poor weather or lighting conditions. If marine mammals are present prior to planned munitions clearance, the detonation should be postponed. Visual observations prior to munitions clearance do not guarantee that marine mammals are not affected, as marine mammals may stay below the surface and hence remain undetected for long periods. However, a visual survey prior to clearance can help to protect animals which are sighted. The guidelines set out by the JNCC committee should be used as a guide to the appropriate visual observation methodology (JNCC, 2017). PAM devices are hydrophones dipped in a water column or towed behind a vessel. The sounds detected by these devices are processed using specialised software. PAM monitoring can be used as a complement to visual observations carried out by MMO.

**Seal scarer**

Seal scarers or seal scramers are acoustic deterrent devices, which can be used to deter seals and harbour porpoises from e.g. construction activities, fishing gear etc. The range, or the efficiency of the devices depends on the type of scarer and the set-up. Harbour porpoises react more strongly to seal scarers than seals (Hermannsen et al, 2015).

A review done by Centre for Environment and Energy for the Danish Energy Agency has summarised the deterrence range from several studies of scarers and has found that for harbour porpoises the most efficient seal scarer (Lofitech) has a range of 350-7,500 m. According to the review, all animals were deterred within 350 m, most animals at a range of 1,000-2,000 m, and the maximum reaction range was 7,500 m (Hermannsen et al, 2015).

The application of seal scarers can reduce the risk of severe blast injury (non-recoverable injury, Table 7-21) to a negligible level, as no animals (harbour porpoises and seals) will be close to the detonation site.

For harbour porpoises, the PTS zone will also be reduced, as seal scarers are efficient to a distance of 1-2 km. In the case of small detonations (150 kg TNT), the impact will be low, and the severity is negligible, because most porpoises are likely to be deterred from the PTS zone.

In the case of large detonations (950 kg TNT), the PTS zone will not be removed, because seal scarers may not deter all porpoises in this area. Due to the fact that the sound pressure level decreases exponentially from where munitions are located and the severity of the PTS decreases (Table 7-24), it is estimated that the PTS will be limited to minor or moderately serious injuries. These are injuries that animals can survive (Table 7-24). In both versions of the project in Polish waters - Niechorze-Pogorzelica and Rogowo - the density of the porpoise is very low, but seal scarers can further reduce the risk of serious threats.

Since the most serious cases of PTS are limited to minor or moderately serious injuries, the impact on porpoises at the individual level for both populations is assessed as medium and severity as moderate. However, this is not a significant impact because individuals can survive.

The severity of the impact at the population level for the population of the Belt Sea is assessed as low, because the probability of PTS impact is very low due to the low density of this population in Polish waters. Therefore, the impact is assessed as insignificant.
The severity of impact at the population level for the Baltic Sea population is also assessed as minor and insignificant because the probability of PTS impact is very low due to the low density of this population in the project area - this density is lower than in the population of the Belt Sea.

Seals may not be deterred due to their curious behaviour, but seals may seek to the surface due to the noise from seal scarers. When the seal's head is above the water, the animal is not exposed to hearing damage. The risk of blast injury and PTS is hence reduced. The impact magnitude is therefore assessed as medium and the severity as moderate for seals on an individual level. The impact severity on a population level is still assessed as minor.

Acoustic devices are hence the most effective to reduce the risk of PTS, as TTS goes beyond the efficiency of seal scarers. The assessment conclusions for TTS therefore remain unchanged.

**Seasonality**
In contrast to the other PoO’s waters, studies on the activity of marine mammals indicate the probability of occurrence of harbour porpoise in the area of the project in Polish waters in the summer season, with no detection of any individuals in the winter season. Taking into account the results of research that was carried out and the fact that the harbour porpoise is the subject of protection of the Natura 2000 area within the boundaries of which the project will be implemented, it is recommended that possible operations related to the munition clearance are conducted outside the summer season.

**Conclusion on mitigation measures**
A combination of the three proposed mitigation measures will significantly reduce the impact on harbour porpoises and seals. The most effective will be the protection of the endangered population of the Baltic Sea, which can be avoided if munitions are removed only during the summer (from May to October).

The severity of impact on individuals as a result of a blast can be reduced to a negligible level, the severity of PTS at the individual level can be limited to moderate and at the population level to a small one. The severity of TTS impact and behavioural responses can be limited to a small degree (Table 7-30).

**Table 7-30 Significance of impact on marine mammals from underwater noise from munitions clearance (unplanned event) - after mitigation. PTS: Blast injury/PTS; TTS: TTS and avoidance behaviour.**

<table>
<thead>
<tr>
<th>Underwater noise - Munitions clearance</th>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harbour porpoise - Baltic Sea</td>
<td>PTS: High</td>
<td>Minor</td>
<td>Regional</td>
<td>Long-term</td>
</tr>
<tr>
<td></td>
<td>TTS: Low</td>
<td>Minor</td>
<td>Regional</td>
<td>Immediate</td>
</tr>
<tr>
<td></td>
<td>PTS: High</td>
<td>Medium</td>
<td>Regional</td>
<td>Long-term</td>
</tr>
<tr>
<td></td>
<td>TTS: Low</td>
<td>Large</td>
<td>Regional</td>
<td>Immediate</td>
</tr>
<tr>
<td>Seal</td>
<td>PTS: High</td>
<td>Medium</td>
<td>Regional</td>
<td>Long-term</td>
</tr>
<tr>
<td></td>
<td>TTS: Low</td>
<td>Large</td>
<td>Regional</td>
<td>Immediate</td>
</tr>
</tbody>
</table>

* In summer, there will be an insignificant number of these individuals in this area, therefore the severity of the impact is assessed as insignificant.

**Conclusion on transboundary impact**
On the basis of a map showing the areas covered by the threat of munitions (Figure 4-7), it can be seen that the probability of finding munitions at the Polish/Danish border is very low. The area
of the Baltic Pipe project closest to the German border is also characterised by a very low probability of detecting munitions.

It follows from the assessment above, that underwater noise from munitions clearance without application of mitigation measures can lead to blast injury or PTS for very few individuals of harbour porpoises. These activities may have a significant impact on the Baltic Sea population (Baltic proper), which is present in the project area only in the winter season. The severity of the impact without the use of mitigation measures would be significant. The transboundary impact would have the same weight if the munitions clearance took place close to national borders.

A similar assessment was also made for the harbour seal and grey seal, which can be injured during munitions clearance. However, the significance of the impact at the population level is assessed as low, since there are no resting places or other sensitive areas near the pipeline’s route (there are no known resting places in Poland), and the probability of the occurrence of seals far from the shore is low. The same also applies to transboundary impacts in Denmark, i.e. the transboundary impact in the case of seals is insignificant.

No significant transboundary impact is expected due to underwater noise in German waters on harbour porpoises or seals due to the distance from German waters and the low density of harbour porpoises and seals in these waters.

By applying the three above-mentioned mitigation measures, transboundary impacts on marine mammals are reduced in the following ways:

- restricting munitions clearance to the summer season ensures that impact on the endangered Baltic Sea population is negligible;
- using seal scarers, visual observations and PAM devices before munition clearance will significantly reduce the likelihood of injuries caused by blast or PTS and the severity of other PTS for harbour porpoises and seals.

It can be concluded that the severity of transboundary impact on individuals as a result of a blast can be reduced to a negligible level, severity as a result of PTS at an individual level to moderate, at the population level to a small, and severity of TTS impact and behavioural reactions to minor.

Table 7.31 Overall national Danish and transboundary impact significance on marine mammals after implemented mitigation measures. Impacts are determined for populations taken into account in the planned events.

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Impact severity</th>
<th>Significance</th>
<th>Transboundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspended sediment</td>
<td>Negligible</td>
<td>Not significant</td>
<td>No</td>
</tr>
<tr>
<td>Physical disturbance above water</td>
<td>Negligible</td>
<td>Not significant</td>
<td>No</td>
</tr>
<tr>
<td>Underwater noise - construction activities</td>
<td>Negligible</td>
<td>Not significant</td>
<td>No</td>
</tr>
<tr>
<td>Underwater noise - unplanned event</td>
<td>Minor</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### 7.3.3 Annex IV species

In this section, the baseline for Annex IV species in the area is described and the impact from the project is assessed. The impacts described below can be important in a transboundary context when project activities are carried out near the border with Denmark or Germany.

**Baseline**

The harbour porpoise (*P. phocoena*) is the only species in Annex IV that occurs in the Polish waters of the Baltic Sea. Information on this small marine mammal, its distribution and biological characteristics can be found in section 7.3.2.
For the species included in Annex IV, an impact assessment will be carried out consisting in the deliberate killing and preservation of the ecological functions of breeding and resting areas. The areas of reproduction and rest are described below.

As presented in Figure 7-7 in section 7.3.2, in the Polish part of the Baltic Sea the probability of detecting harbour porpoises is generally very small (SAMBAH, 2016). No specific areas of harbour porpoise reproduction are known in the project area. Harbour porpoises are continuously swimming and have no specific resting sites. There are two harbour porpoise populations in the western Baltic Sea: the population of the Belt Sea, whose probability of occurrence in the project area in Polish waters is the highest in August, and the population of the Baltic Sea, whose individuals may appear on Polish waters in the project area during winter (from November until April). The highest probability of occurrence of these populations is in February (SAMBAH, 2016).

Impact assessment and transboundary impact
The methodology for the impact assessment for Annex IV species is described in Section 6.3. In accordance with the Habitats Directive, the following is prohibited for strictly protected species (emphasis added):

- all forms of deliberate capture or killing of specimens of these species in the wild;
- deliberate disturbance of these species, particularly during the period of breeding, rearing, hibernation and migration;
- deliberate destruction or taking of eggs from the wild;
- deterioration or destruction of breeding sites or resting places;
- the keeping, transport and sale or exchange, and offering for sale or exchange, of specimens taken from the wild, except for those taken legally before this Directive is implemented.

Planned project activities will not cause intentional or deliberate capture or killing of harbour porpoises. Hence, an assessment is not relevant for the planned project activities.

Intentional disturbance of the species of wild fauna mentioned above may be problematic in relation to construction activities, because these actions may contribute to disturbing the animals. The remaining prohibited actions listed above are not a concern for this project.

A key issue in the assessments for Annex IV species is the ecological functionality of breeding and resting areas. Ecological functionality means the ability of the population to reach or sustain a viable population size, with the potential to reach or maintain favourable conservation status within the entire range of the species, hence the maintenance of the breeding and resting areas. Thus, Article 12(1)(d) of the Habitats Directive ensures that such sites and areas are not damaged or destroyed by human activities.

Potential impacts on harbour porpoise have been identified in the section on marine mammals (section 7.3.2 of this report), while only negligible and insignificant impacts have been identified for activities planned under the project. In addition, there are no specific breeding areas identified in the Baltic Sea, although areas around the Midjö Banks in Sweden are considered important (SAMBAH, 2016). The Midjö Bank in Sweden is outside of the project area (the distance from pipeline is more than 120 km). Therefore, it is unlikely that there will be a significant impact on two porpoise populations and a lowering of conservation status. All impacts are local, and transboundary impact on harbour porpoise can be excluded.
Unplanned events – munitions clearance
Underwater noise due to an unplanned event, which may be munitions clearance, is described in section 7.3.2, and it has been found that impacts on harbour porpoise may occur.

Deliberate killing
On the basis of the assessment of munition clearance taking into account visual observations, PAM and seal scarers as mitigating measures, it was found that at the individual level the impact on harbour porpoises will be moderate. Due to the limited risk of blast injuries and serious PTS, the impact on harbour porpoises was assessed as insignificant, both at the individual level and population level, and the project itself will not involve deliberate killing of porpoises.

Deliberate disturbance and impact on ecological functionality
Munitions clearance will be temporary, and since key areas of porpoise breeding are outside the potential impact zone (the maximum distance from the source of underwater noise on which TTS can occur, the animals are 18.7 km for the alternatives Niechorze-Pogorzelica and Rogowo, Figure 7-6 and section 7.3.2) and there will be no significant impact at the population level, it is unlikely that there will be a significant impact on populations of porpoises. Therefore, there will be no negative impact on the conservation status of the species.

Conclusion on transboundary impact
The described project impacts were assessed in relation to the prohibited acts indicated in Article 12 (1) (a) - (d) of the Habitats Directive (Table 7-1). It is concluded that project activities will neither lead to the deliberate killing of harbour porpoises nor will they cause significant disturbance or destroy breeding or resting areas important to this species. Therefore, these activities will not have a negative impact on the behaviour of the ecological functions of the population and on the current and future conservation status. Transboundary impact on harbour porpoise can be excluded.

7.3.4 Natura 2000
The alignment of the Baltic Pipe either crosses or passes nearby Natura 2000 sites in the Baltic Sea. In accordance with the prescribed methodology (see section 6.2), a screening has been conducted to identify those Natura 2000 sites, for which a significant impact cannot be excluded with certainty and for which an appropriate assessment needed to be prepared. As presented in Figure 7-11, the Natura 2000 areas through which the pipeline route will run are only areas in Poland and Sweden. For these areas, proper assessments were carried out as part of national EIA procedures. The results of the initial assessment (diagnosis) are summarized in Table 7-32.
Figure 7-11 Natura 2000 sites along the planned Baltic Pipe route. EU Natura 2000 codes are presented on the map.

Table 7-32 Summary of screening results for Natura 2000 areas (SMDI, 2019). The screening includes transboundary impacts on Natura 2000 sites in Sweden, Denmark and Germany.

<table>
<thead>
<tr>
<th>Natura 2000 site (national #)</th>
<th>Potential impact</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ostoja on the Pomeranian Bay</td>
<td>Construction: - Suspended sediments / sedimentation - Underwater noise Operation: - None</td>
<td>None of the considered alternatives of the project is to be implemented in or near protected habitats. Taking into account the limited duration and spatial extent of the occurrence of increased suspended sediment concentration, the dispersion of sediment during construction is not likely to have a significant impact on Natura 2000 sites. Impact on harbour porpoises is not likely due to the very low density of harbour porpoises in the area of the project within the Natura 2000 area, the relatively limited size of the planned construction site, low risk of munitions detection and the introduction of planned mitigation measures.</td>
</tr>
<tr>
<td>Natura 2000 site (national #)</td>
<td>Potential impact</td>
<td>Conclusion</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------</td>
<td>------------</td>
</tr>
</tbody>
</table>
| **Pomeranian Bay SPA No. PLB990003** | Construction:  
- Suspended sediments / sedimentation  
- Physical disturbance above water  
- Risk of collision  
Operation:  
- Physical disturbance above water | Details of relevant assessments are provided in chapter 9.18 of the Polish EIA report (SMDI 2019). Due to the relatively limited size of the planned construction site, birds will be able to easily find alternative feeding places. In addition, the construction period will be short in every location along the pipeline route. Therefore, it is unlikely that there will be a significant impact on bird species. It is estimated that the risk of collision with birds will be low and will not affect wintering or migrating populations. The basis of this assessment is the fact that the anchoring barge and other vessels at any time during construction will occupy a relatively small area compared to the total area occupied by species of birds wintering and migrating on the Polish area of the Baltic Pipe pipeline route. In addition, data collected during monitoring during the construction of other projects confirmed that few birds collided with construction ships. The severity of the impact is negligible and the risk of collision is assessed as insignificant. Details of relevant assessments are provided in chapter 9.18 of the Polish EIA report (SMDI 2019). |
| **"Stevns Rev" #206 (H206 - SAC DK00VA305)** | Construction:  
- Suspended sediments / sedimentation  
Operation:  
- None | Due to the distance between the site of possible dispersion of sediments as a result of construction works and Stevns Rev, the likelihood of significant impact on Natura 2000 areas can be ruled out. The potential impact of the Baltic Pipe project, alone or in combination with other plans and projects, will not have a significant impact on the Natura 2000 area. |
| **Havet og kysten mellem Præstø Fjord og Grønsund No. 168 (H147 - SAC DK006X233 F84 - SPA)** | Construction:  
- Suspended sediments / sedimentation  
Operation:  
- None | Due to the distance between the site of possible dispersion of sediments as a result of construction works and Stevns Rev, the likelihood of significant impact on Natura 2000 areas can be ruled out. |
<table>
<thead>
<tr>
<th>Natura 2000 site (national #)</th>
<th>Potential impact</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK006X089 F89 - SPA</td>
<td></td>
<td>The potential impact of the Baltic Pipe project, alone or in combination with other plans and projects, will not have a significant impact on the Natura 2000 area.</td>
</tr>
<tr>
<td>Adler Grund og Rønne Banke nr 261</td>
<td></td>
<td>Due to the distance between the place of possible dispersion of sediments as a result of construction works and Adler Grund og Rønne Banke, the likelihood of significant impact on Natura 2000 areas can be ruled out. The potential impact of the Baltic Pipe project, alone or in combination with other plans and projects, will not have a significant impact on the Natura 2000 area.</td>
</tr>
<tr>
<td>Bakkebrædt og Bakkegrund no. 212</td>
<td></td>
<td>Due to the distance between the place of possible dispersion of sediments as a result of construction works and Bakkebrædt og Bakkegrund, it is possible to exclude the probability of significant impact on Natura 2000 sites. The potential impact of the Baltic Pipe project, alone or in combination with other plans and projects, will not have a significant impact on the Natura 2000 area.</td>
</tr>
<tr>
<td>Sydvästskånes utsjövatten</td>
<td></td>
<td>Due to the distance between the place of possible dispersion of sediments as a result of construction works and Bakkebrædt og Bakkegrund, it is possible to exclude the probability of significant impact on Natura 2000 sites. The potential impact of the Baltic Pipe project, alone or in combination with other plans and projects, will not have a significant impact on the Natura 2000 area.</td>
</tr>
<tr>
<td>Pommersche Bucht mit Oderbank</td>
<td></td>
<td>The distance between this Natura 2000 area and the area of the project implementation on Polish waters is over 8 km. Due to the limited duration and scale of the increased suspended sediment concentration, it can be ruled out that the dispersion of sediments generated during the construction</td>
</tr>
<tr>
<td>Natura 2000 site (national #)</td>
<td>Potential impact</td>
<td>Conclusion</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------------</td>
<td>------------</td>
</tr>
</tbody>
</table>
| Pommersche Bucht SPA No. DE1552401 | **Construction:**  
- Suspended sediments / sedimentation  
- Physical disturbance above water  
**Operation:**  
- None | will significantly affect the Natura 2000 site.  
As construction works will be carried out more than 8 km from the boundaries of this Natura 2000 site, disturbances related to this activity and underwater noise are unlikely to have a significant impact.  
The Polish section of the pipeline route near this Natura 2000 site does not run through danger zones related to the presence of munitions (UXO) or chemical weapons (CWA). Therefore, munition clearance is not expected.  
The potential transboundary impact of the Baltic Pipe project, alone or in combination with other plans and projects, is unlikely to have a significant impact on the Natura 2000 area.  
The distance between this Natura 2000 area and the area of the project implementation on Polish waters is over 8 km. Due to the limited duration and scale of the increased concentration of suspended sediments, it can be ruled out that the dispersion of sediments generated during construction will significantly affect the Natura 2000 site.  
As construction works will be carried out more than 8 km from the boundaries of this Natura 2000 site, disturbances related to this activity and underwater noise are unlikely to have a significant impact.  
The potential transboundary impact of the Baltic Pipe project, alone or in combination with other plans and projects, is unlikely to have a significant impact on the Natura 2000 area. |
Regarding the potential transboundary impact on Danish, Swedish or German Natura 2000 sites as a result of activities carried out in Polish waters, only the German areas Pommersche Bucht mit Oderbank SCI DE1652-301 and Pommersche Bucht SPA DE1552401 are close to the possible range of impacts associated with work carried out in Polish waters. However, no trenching works will be carried out in the vicinity of the German EEZ in Polish waters (see Figure 3-15), and the distance to the German Natura 2000 sites from the place along the pipeline route in which the trenching works are planned is large enough to prevent a significant transboundary impact (<10 km). The dispersion of sediments as a result of pipe-laying activities will be negligible, and significant impacts as a result of dispersion of suspended sediments are unlikely.

Underwater noise from construction activities can potentially impact marine mammals. As the noise generated by construction works will have the same level as the current background noise in the project area (or a lower level), the impact of underwater noise as a result of construction works is unlikely to be significant. It is therefore concluded that no transboundary impact will occur on Natura 2000 sites.

Since there will be no significant impact on Polish Natura 2000 sites or significant transboundary impact on neighbouring Natura 2000 sites, the cohesion of Natura 2000 sites will not be affected.

7.4 Socio-economic environment

This chapter describes the baseline conditions of potential receptors of the impact (see Table 7-1) and presents an assessment of the potential transboundary impact on the socio-economic environment.

7.4.1 Shipping and shipping lanes

The implementation of the Baltic Pipe project in Polish territorial waters, EEZ and the disputed area is not related to the potential transboundary impact on shipping and shipping routes both during the pipeline's implementation and operation, but an assessment of the impact on this receptor has been presented for the purpose’s comparisons with other parts of the Baltic Pipe project.

The Baltic Sea constitutes one of the most intensely trafficked seas in the world and accounts for approximately 15% of the world’s cargo transportation. Ship traffic from the North Sea enters the Baltic Sea either via the Kadet Channel, located between Denmark and Germany, or through the Sound between Denmark and Sweden. Maritime transport is considered an industry of high economic importance and is of key importance to the economy at both national and international levels.

Baseline

Between Denmark and Poland it is not possible to design a pipeline route that avoids all shipping lanes. However, the planned route has been designed to minimise the route length over which there are a high number of ship passages. Figure 7-12 shows the traffic density in the south-western part of the Baltic Sea based on data from the Automatic Identification System (AIS) in 2016.
As shown in the figure above (Figure 7-12), most vessel traffic in the south-western part of the Baltic Sea takes place along designated routes that are compatible with traffic separation schemes (TSS).

The only significant route in Polish waters due to its intensity and international connection that crosses the route is route no. 7 (according to Figure 7-12). This shipping lane is used by ships sailing to and from Gdynia and Gdańsk, Kaliningrad in Russia and Klaipeda in Lithuania, and passes through the TSS Adlergrund. This route connects to shipping lane 5 within the German EEZ, south-west of the TSS and north of Rügen. Route 7 is mainly used by merchant ships (62%). At the junction of Route 7, 6342 ship crossings were recorded in 2016. However, shipping lane 7 is much smaller compared to other shipping lanes in the Baltic Sea with a traffic volume of 25,000 or more crossings per year. The crossing of the offshore gas pipeline with route 7 will take place at depths of approx. 46 - 54 m, while in 2016 no vessels with a depth exceeding 19 m of draught were recorded on route 1.

Other shipping lanes with which the planned pipeline will cross are of local significance, with ship movements between 70 and 150 crossings per year and a maximum draft of 11 m.

Impact assessment and transboundary impact
The assessment carried out in this transboundary context extends the meaning of the term "transboundary impact" in such a way that all significant impacts threatening the safety and ease of navigation in the Baltic Sea are considered as international impacts, even if the effects of these impacts cannot be assigned to one country.
The Baltic Pipe pipeline project may interfere with navigation in Polish waters at the construction and operation stages. Table 7-33 presents potential impacts.

Table 7-33 Potential impacts on shipping and shipping lanes.

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship traffic restriction zones</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Safety Zone</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

The following sources of impacts have been screened out:

- **physical disturbance above water (construction):** Increased vessel traffic as a result of operating vessels involved in the project, which do not require restricted navigation zones, may be omitted, as these vessels will sail at normal speed and comply with the same navigation regulations as commercial vessels, so their impact will be negligible;

- **presence of the pipeline on the seabed (operation):** The pipeline intersects with shipping lane 7 at a water depth above 45 m. On the entire route the pipeline will be buried in the seabed in water areas less than 20 m deep so that it does not constitute an obstacle in shallow waters. As a consequence, the conditions regarding the draught of ships will not be changed along the entire Baltic Pipe in Polish waters. Potential impacts from the presence of the pipeline can therefore be excluded, as no restrictions to ship movements are expected.

- **safety zone (operation)** The impact of a permanent safety zone in the 500 m belt on both sides of the pipeline can be omitted, since anchoring is already prohibited along shipping lanes.

**Ship traffic restriction zones**

*Construction phase*

The establishment of temporary zones for the restriction of navigation around vessels laying pipes and restricted navigation areas around other vessels with limited manoeuvrability (e.g. ploughs and ships making rock installations) may have an impact during the construction of the planned pipeline. It is anticipated that the zone of navigation restrictions around the anchoring barge will have a radius of 1,000-1,500 m, and the safety zone around the DP pipe-laying vessel of around 1,000 m. For all other vessels with limited manoeuvrability, a navigation restriction zone will be established with a radius of 500 m. Ships not associated with the project will not be allowed to enter these zones, which will require their routes to be adjusted to designated navigation restriction zones during construction works. The water around the intersection of shipping lanes with the planned pipeline is of sufficient depth, which is necessary for vessels using shipping to avoid grounding. It is also expected that other ships will be able to safely bypass vessels that carry out construction work. Therefore, the sensitivity is assessed to be low.

In cooperation with the contractor and the Director of the Maritime Office in Szczecin, the developer will announce the planned periods of construction work.

The impact of the establishment of shipping zones will be local, limited in time and not intense, since no lasting changes will take place. This characteristic, combined with the low sensitivity of the impact, makes the impact assessed as having minor severity and generally insignificant.

*Operation*

During the operational phase, planned inspections and maintenance activities will be carried out along the pipeline with a low frequency (e.g. 1-2 times a year during the first years and once every 5 years thereafter). Also, for ships carrying out inspections, a safety zone will be established, which other vessels will not be able to enter. Ships carrying out inspections/maintenance work are smaller and move faster than ships laying pipes, and therefore only require a 500 m safety radius. The impact of this safety zone will be local, limited in time and its intensity will be minor. Due to the minor intensity, the impact is assessed as a negligible, and as a result, completely insignificant (Table 7-34).
Table 7-34 Significance of impact on shipping and shipping routes as a result of safety zones during construction and operation.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipping restriction zones (construction)</td>
<td>Low</td>
<td>Minor</td>
<td>Local</td>
</tr>
<tr>
<td>Safety zones (operation)</td>
<td>Low</td>
<td>Minor</td>
<td>Local</td>
</tr>
</tbody>
</table>

Conclusion on transboundary impact

Potential impacts on shipping and shipping routes in connection with the construction and operation of the proposed pipeline in Polish waters are summarized in Table 7-35 Overall disturbance of internationally important shipping lanes will be short term and spatially restricted, and significant impact can be excluded.

Table 7-35 Overall significance of the impact on shipping and shipping lanes.

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Impact severity</th>
<th>Significance</th>
<th>Transboundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipping restriction zones (construction)</td>
<td>Minor</td>
<td>Not significant</td>
<td>No</td>
</tr>
<tr>
<td>Safety zone (operation)</td>
<td>Negligible</td>
<td>Not significant</td>
<td>No</td>
</tr>
</tbody>
</table>

7.4.2 Commercial fisheries

Baseline

Commercial fishing is carried out in large parts of the Baltic Sea by all countries in the region. The fisheries target both marine and freshwater species, but approximately 95% of the total fish catch in terms of biomass consists of cod, sprat and herring (ICES, 2017). For a detailed biological description of the important commercial fish species, please consult Section 7.3.1. The composition of the catch is to some extent determined by the salinity, as there is a change in the distribution from marine species to freshwater species from south to north in the Baltic Sea (Leppäranta & Myrberg, 2009). The catches are used for both human consumption and industrial use. The Baltic Sea fisheries also target demersal species, such as plaice and flounder, along with migratory species, such as trout and salmon. Species of freshwater origin that are commercially exploited in the Baltic Sea include pike, pikeperch, perch and whitefish. In addition, eels are also caught in the Baltic Sea, whereby the catching of eels with a total length of 12 cm or more are prohibited in EU waters, including in the Baltic Sea, during a three-month protection period, which each Member State defines individually between 1 September 2018 and 31 January 2019. Poland has determined that this period will run from November 1 to January 31.

The greatest spatial resolution of available fishery data for the Baltic Sea is provided in ICES rectangles (~ 30 x 30 NM). The rectangles are used for the gridding of data to make simplified analysis and visualization.

In the Baltic Sea region, fishing vessels are required to keep a logbook. The logbook contains fishing information on quoted fish species (date, gear used, ICES rectangle and landings in kg).

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39The Regulation of the Minister of Agriculture and Rural Development of 6 July 2015 on the dimensions and protective periods of marine organisms caught in recreational activities and detailed methods and conditions of recreational fishing (Rozporządzenie Ministra Rolnictwa i Rozwoju Wsi z dnia 6 lipca 2015 r. w sprawie wymiarów i okresów ochronnych organizmów morskich poławianych przy wykonywaniu rekreacyjnego oraz szczegółowego sposobu i warunków wykonywania rybolowstwa rekreacyjnego). Consolidated text of 2018, item 24 as amended; and the Regulation of the Minister of Maritime Economy and Inland Navigation of 16 September 2016 on the dimensions and protective periods of marine organisms and detailed conditions for commercial fishing (Rozporządzenie Ministra Gospodarki Morskiej i Żeglugi Śródlądowej z dnia 16 września 2016 r. w sprawie wymiarów i okresów ochronnych organizmów morskich oraz szczegółowych warunków wykonywania rybolowstwa komercyjnego), Journal of Laws of 2016, item 1494, as amended.
These data are used to provide an overview of the spatial distribution of the catches on a species level and the amount that is landed. The fisheries that are distributed along the Baltic Pipe are found within the ICES SDs 24 and 25. The SDs contain 13 and 17 ICES rectangles, respectively. It is relevant to the project to analyse catch data for ICES rectangles that are located along the Baltic Pipe route and adjacent to those, i.e. 36G4, 37G2, 37G3, 37G4, 37G5, 38G2, 38G3, 38G4, 38G5, 39G2, 39G3, 39G4 and 39G5, see Figure 7-13.

Figure 7-13 ICES rectangles in subdivisions 24 and 25 including the Arkona Basin and the Bornholm Basin respectively.

Data from the Vessel Monitoring System (VMS) for catches using machinery in contact with the bottom and pelagic trawls are collected from the HELCOM centre. The VMS data have greater spatial resolution than the ICES rectangles and describe the fishing effort, i.e. hours per c-square (grid 0.05 x 0.05 degrees).

Fishing techniques
Commercial fishers use a variety of fishing techniques, which are adapted to the characteristics of the species they target. The characteristics of the target species largely determine the technological solutions affecting the efficiency of fishing, e.g. in the case of catches aimed at pelagic fish, the detection of fish stocks by means of fishing echosounders is more important than the fishing process itself. For demersal species that have a less heterogeneous distribution, detection is less important, as catchability is mainly driven by the area swept (Eigaard et al., 2014).

Pelagic trawl and seine
Pelagic trawl and seine fisheries target a mixture of herring and sprat. The catches vary with season and area, and are used for consumption, fishmeal, and oil production. Trawlers using mesh sizes smaller than 32 mm fish for industrial purposes, whereas meshes above 32 mm are mostly used to fish for human consumption. Sprats are mainly fished using pelagic single- and double-trawl sets.
Fishing for sprat is carried out year-round, with the main fishing season in the first half of the year. There are currently three types of fleets: small cutters (17-24 m length) with an engine power of up to 300 h.p., medium-size cutters (25-27 m length) with an engine power of up to 570 h.p., and large vessels (>40 m length) with an engine power of 1050 h.p (ICES, 2013).

Demersal trawl and seine
Demersal trawls and, to a lesser degree, seines, are the most common gear types in the southwestern part of the Baltic Sea. These mobile contact tools are mainly used for cod fishing. Flatfish is often caught as bycatch when fishing for cod, but in certain periods and areas, demersal trawlers may target flatfish. Bottom trawls for small size catches are used sporadically for catching herring and sprat.

Gillnet
Gillnets are used to catch fish in a wide range of habitats. They are generally considered a shallow-water gear. However, bottom sets can be used at depths exceeding 50 m (Hubert et al., 2012). They are widely used in offshore fisheries targeting cod, flatfish, and herring. In coastal fisheries, gillnets are set to catch a mix of marine and freshwater species, i.e. cod, flatfish, herring, whitefish, pikeperch, perch, and pike. Drift nets have been prohibited since 2008, and the European Union has limited the length of tools depending on the vessel size and the immersion time.

Other gear types
In the commercial fishing industry, the following tools are also used that provide relatively small catches in terms of weight:

- longlines are used to target cod, salmon and sea trout. After the prohibition of drift nets in 2008, longlines have become an important tool in offshore salmon fishery.
- there is a wide range of traps used for trap net fisheries, where the type of trap net used depends on the targeted species, e.g. herring, salmon, whitefish, and eel.
- generally, fyke nets and trap nets are set in shallow water not much deeper than the height of the first frame or hoop. However, they can be set in water greater than 10 m deep (Hubert et al., 2012).

Polish fishing fleet
According to the data available at the end of 2017, the Polish fishing fleet consists of 834 vessels, of which 336 operate in the West Pomeranian region. The fishing fleet operating from ports near the Polish part of the Baltic Pipe project, i.e. Kolobrzeg, Dziwnów, Rewal, Niechorze-Pogorzelica, Mrzeżyno and Dźwirzyno amounts to an average of 92 ships a year. Figure 7-14 shows the breakdown of these fleets based on the length of the ship.
Figure 7-14 A breakdown of fishing vessels registered in ports near the project area based on length.

Figure 7-15 presents the intensity of use of the area along the Baltic Pipe route and in its vicinity by fishing vessels based on VMS data (includes vessels over 12 m). Each line represents the route of one vessel on a given day that shows the route of vessels on their way to fishing areas. It can be seen that the project area is crossed by ships on the way to fishing areas in the Pomeranian Bay and Bornholm.
Figure 7-15 Routes of fishing vessels in the project area and in neighbouring areas (CMR, VMS data).

Polish fishing logbooks and statistics
In 2010-2015, ICES rectangles 36G4, 37G4, 37G5, 38G4, 38G5 and 39G5 were fished and 45 different species were registered. The summed catch for the period was 237,272 tonnes with a mean annual catch of 39,545.33 tonnes. Catches of commercially important species, i.e. cod, herring, flounder, plaice and sprat, in the period under discussion amounted to 208,826.7 tonnes, representing about 88% of the total catch in weight terms with a sales value of EUR 79.6 million.

Figure 7-16 presents the importance of fisheries and the relative approach by countries that fish in ICES rectangles adjacent to the Baltic Pipe, based on the average value of catches (€) in 2010-2015 for cod, flounder, herring, plaice and sprat. A species important for the Polish fishing fleet in the region was the sand eel, whose catch in terms of weight in this period accounted for 4.8% of total catches.
Significance of fisheries and relative coverage by countries that fish in ICES rectangles adjacent to the Baltic Pipe, based on the average catch value (€) for 2010-2015 for cod, flounder, herring, plaice and sprat. Data were collected from national fishery authorities for fisheries that operate in subdivision 24 and 25. Finnish data are not included due to data protection, but the summed catch for the period comprises less than <1% when compared to Danish landings.

In terms of catch in terms of weight, seven of the nine most important species are marine species, i.e. cod, sprat, herring, sprat, flounder, cod, sandeel and plaice. Due to the presence of the Szczecin Lagoon (located in rectangle 36G4) and close to the estuary of the Oder, the total catch contains a relatively large number of freshwater fish. The European perch (*Perca fluviatilis*) and pike-perch (*Sander lucioperca*) belong to the nine most important species in terms of weight.

Table 7-36 Total catch weight of the Polish fishing fleet (in tonnes) in ICES rectangles 36G4, 37G4, 37G5, 38G4, 38G5 and 39G5 in the period from 2010 to 2015.

<table>
<thead>
<tr>
<th>Species</th>
<th>Scientific name</th>
<th>Quantity (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herring</td>
<td><em>Clupea harengus</em></td>
<td>72,004.0</td>
</tr>
<tr>
<td>Sprat</td>
<td><em>Sprattus sprattus</em></td>
<td>69,714.7</td>
</tr>
<tr>
<td>Flounder</td>
<td><em>Platichthys flesus</em></td>
<td>43,301.9</td>
</tr>
<tr>
<td>Cod</td>
<td><em>Gadus morhua</em></td>
<td>23,502.2</td>
</tr>
<tr>
<td>Sandeels sp.</td>
<td><em>Ammodytes sp.</em></td>
<td>11,341.9</td>
</tr>
<tr>
<td>European perch</td>
<td><em>Perca fluviatilis</em></td>
<td>4,823.0</td>
</tr>
<tr>
<td>Pike-perch</td>
<td><em>Sander lucioperca</em></td>
<td>956.6</td>
</tr>
<tr>
<td>European plaice</td>
<td><em>Pleuronectes platessa</em></td>
<td>303.9</td>
</tr>
</tbody>
</table>
The sum of catches of the Polish fishing fleet (Figure 7-17 and Table 7-37) indicates that certain areas have more economic significance. The highest catch in terms of weight was recorded in ICES rectangles 38G5, 37G5 and 39G5 located in the area extending from the Polish coast to the areas west of Bornholm. Catches in these three rectangles account for 79% of all catches of the Polish fleet in ICES rectangles adjacent to the Baltic Pipe in Polish waters. The following is a summary of the average annual catch value and the commercial value for the period 2010-2015 (Table 7-37).

**Table 7-37 Average annual catches (in tonnes) and the value of Polish catches (in € 1,000) in the period 2010-2015 in ICES rectangles located in the vicinity of the Baltic Pipe in subdivisions 24 and 25.**

<table>
<thead>
<tr>
<th>ICES Rectangle</th>
<th>Catch in tonnes</th>
<th>Value in € 1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>36G4</td>
<td>2,509.3</td>
<td>198.7</td>
</tr>
<tr>
<td>37G4</td>
<td>2,214.5</td>
<td>666.3</td>
</tr>
<tr>
<td>37G5</td>
<td>8,724.3</td>
<td>3,221.8</td>
</tr>
<tr>
<td>38G4</td>
<td>3,320.1</td>
<td>1,312.0</td>
</tr>
<tr>
<td>38G5</td>
<td>15,692.8</td>
<td>6,334.2</td>
</tr>
<tr>
<td>39G5</td>
<td>6,814.0</td>
<td>1,838.7</td>
</tr>
</tbody>
</table>

* The average annual catch value is calculated solely on the basis of catches of herring, sprat, cod, flounder and plaice.

There is a strict correlation between the average annual catch (in tonnes) and the value (€), because rectangles 38G5, 37G5 and 39G5 are the most important for both parameters. There is a discrepancy between the average annual catch and the value for the 36G4 and 37G4 rectangles. For these two rectangles, an important part of the annual catch is freshwater fish, for which catch data is missing.
Figure 7-18 Fishing effort in terms of estimated hours per c-square for mobile contacting gear in 2013 based on VMS/logbook data processed by the ICES Working Group on Spatial Fisheries Data (WGSFD) (HELCOM, 2015). The rectangles and codes (ICES rectangles) are used for the gridding of data to make for simplified analysis and visualization.

Figure 7-18 shows the fishing effort for mobile contacting gears in 2013 for HELCOM members, excluding Russia, in the Arkona and Bornholm Basins. Despite the lack of sufficient data for 38G2, 39G2, 38G4 and 37G4, we see a clear trend that reflects the data in Figure 7-16. As the pipeline will be located on the seabed, it is important to assess the fishing effort for mobile contacting gears such as demersal trawls. Especially the Niechorze alternative presents the limited importance of fishing with the use of mobile contact tools. Because Figure 7-18 presents the fishing effort of countries other than Poland, it is advisable to make an assessment based on the intensity in comparison with the information it contains Table 7-37 in order to get a full picture of fisheries in the region.
Figure 7-19 Fishing effort in terms of estimated hours per c-square for midwater trawl gear in 2013 based on VMS/logbook data processed by the ICES Working Group on Spatial Fisheries Data (WGSFD) (HELCOM, 2015). The rectangles and codes (ICES rectangles) are used for the gridding of data to make for simplified analysis and visualization.

Figure 7-19 shows the fishing effort for midwater trawl gears in 2013 for HELCOM members, excluding Russia, in the Arkona and Bornholm Basins. For many of the c-squares in the Figure (Figure 7-19) no data has been reported. The lack of data is most likely connected with the overall low biomass of sprat and herring in the area that are normally caught by pelagic trawling vessels. Pelagic trawl effort was less intense than bottom-contacting gears. The year 2013 is assessed to be a representative year for both fishing techniques in the period, as there are little to no changes in the fishing effort pattern in the period 2010 to 2013 where data are available from HELCOM.

**Impact assessment and transboundary impact**

The Baltic Pipe project may cause disturbance in Polish commercial fishing both at the construction and operation stages. The potential impact on commercial fishing is presented in Table 7-38.

**Table 7-38 Potential impacts on commercial fisheries.**

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship traffic restriction zones</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Safety zone (along the pipeline)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Presence of the pipeline</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Physical disturbance above water</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Ship traffic restriction zones**

Traffic restriction zones will be established around construction vessels. The restriction zones around vessels laying pipes and the ships accompanying them will have a radius of 1,000-1,500 m, depending on the application of the DPS (Dynamic positioning system), anchors and anchor chains. Restricted zones will be moved along with vessels continuously moving at a speed of 3-4
km per day in waters with a depth exceeding 20 m, i.e. where fishing is the most intense. Therefore, the impact of shipping restriction zones on commercial fisheries will be regional/transboundary and temporary.

As shown in Table 7-37, some of the ICES rectangles have a higher average annual economic value. The socio-economic impact that may occur as a result of physical disturbances over water will have a diverse impact on individual fishermen and will depend on the techniques used, e.g. types of fishing gear, target species clusters, sizes, etc. In general, fishing enterprises fish in several ICES rectangles, so it is unlikely that a temporary restriction zone for fishing will restrict fishing activities. However, it can alter the catch per unit effort (CPUE) for a short period of time.

In cooperation with the contractor and the Director of the Maritime Office, the developer will announce the planned periods of construction works. In addition, compensation will be a measure to limit the economic impact on fisheries in areas that will be temporarily closed due to restricted navigation zones.

Table 7-39 Significance of the impact of ship traffic restriction zones on commercial fishing.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship traffic restriction zones</td>
<td>Medium</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Safety zone
The area of the safety zone is determined by the Polish maritime authorities, and the maximum size of each zone cannot exceed 500 m. Because the final radius of the zone is not known, a 500 m radius was used to calculate the safety zones that will be laid around the pipeline after the start of operation, in spite of the fact that so far the safety zones established for pipelines have been much smaller. This can have a potential impact on the total fishable area for commercial fisheries and alter the fisheries pattern in the area. For safety reasons, the entire pipeline will be buried in the seabed in areas with a depth of less than 20 m, which will also affect the final radius of the safety zone. In the case of fishermen using bottom trawling, impact due to the safety zone is very unlikely, because it will take less than 1% of the total catchment area in Polish waters in ICES rectangles along the Baltic Pipe route and in rectangles adjacent to these rectangles, see Table 7-40.

Table 7-40 Percentage (%) of the fishing area occupied by the safety zone at pipeline sections without trenching, for individual ICES rectangles.

<table>
<thead>
<tr>
<th>ICES Rectangle</th>
<th>Safety Zone [km²]</th>
<th>ICES area [km²]</th>
<th>Uptake in % of fishable area</th>
</tr>
</thead>
<tbody>
<tr>
<td>37G4</td>
<td>10.12</td>
<td>3,539.98</td>
<td>0.27</td>
</tr>
<tr>
<td>37G5 (Niechorze-Pogorzelica)</td>
<td>19.22</td>
<td>3,539.98</td>
<td>0.52</td>
</tr>
<tr>
<td>37G5 (Rogowo)</td>
<td>0 (100% trenching work)</td>
<td>3,539.98</td>
<td>0</td>
</tr>
</tbody>
</table>

Therefore, the effect on CPUE and availability of fishable area is assessed as minor.

The intensity of the impact is minor. The range of impact of the safety zone will be local and transboundary as it will affect domestic and foreign fisheries within a radius of 200 m from the pipeline. The duration of the safety zone is assessed to be long-term. The significance of the impact is assessed as low and the impact insignificant.
Table 7-41 Significance of the impact of safety zones on commercial fishing.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Zone (along the pipeline)</td>
<td>Medium</td>
<td>Minor</td>
<td>Local / Transboundary</td>
</tr>
</tbody>
</table>

**Presence of the pipeline**

The impact on commercial fisheries may occur on sections where the pipeline will be placed directly on the seabed and on sections with rock installations, see section 3.4.2, Figure 3-15. The presence of the pipeline may affect catches using bottom trawling, as they may catch onto the pipeline. However, hooking is a seldom occurring accidental situation where the trawl equipment becomes stuck under the pipeline created by a span.

In the zone of the pipeline, the seabed is relatively flat, but in sections where free spaces under the pipeline (so-called free spans) can occur and there are areas of intensive fishing, fencing securing trawls will be used, i.e. rock material placed in open spaces. Demersal trawlers are advised to avoid fishing across the pipeline. It is unlikely that the presence of the pipeline will limit fishing activities because bottom trawlers can move their fishing effort quite freely, but the location of bottom fishing will need to be modified. Pelagic trawlers will not be affected by the presence of the pipeline, as the towed net maintains a natural distance to the seabed. In addition, the pipeline will take up less than 1% of the total catchment area in Polish waters in ICES rectangles along the Baltic Pipe route and in neighbouring rectangles, which will have little impact on the CPUE and the availability of the fishing area, see Table 7-40.

The impact intensity will, therefore, be minor and local/transboundary, because it affects national and foreign fisheries. However, this will be a long-term impact, and its severity is assessed as minor, and hence the significance of the impact as insignificant.

Table 7-42 Significance of impact on commercial fisheries from the presence of the pipeline.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of the pipeline</td>
<td>Low</td>
<td>Minor</td>
<td>Local / Transboundary</td>
</tr>
</tbody>
</table>

**Physical disturbance above water – presence of vessels**

The presence of vessels in the construction and operation phase will be a limitation to which domestic and foreign fishing fleets are already adapted due to the intensive traffic in the Baltic Sea under normal conditions. Therefore, the sensitivity of commercial fisheries is assessed to be low.

Vessels used in both the construction and operation phases may inadvertently cut fishing gear lines, such as longlines or gillnets, which are used in shallow waters. Abandoned, lost or otherwise discarded fishing gear is an increasing problem as it can have an impact on the environment and lead to economic losses for fishermen. Despite this potential impact, relatively few fishermen use this type of tool, and the pipeline’s laying period in shallow water will be short. The impact is therefore assessed to be of minor intensity. As the vessels will move continuously, the scale is local, and the duration is immediate. In combination with low sensitivity, the severity of the impact is assessed as insignificant and minor.
Table 7-43 Significance of the impact on commercial fishing as a result of the presence of vessels during construction and operation.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
<th>Impact severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of vessels</td>
<td>Low</td>
<td>Minor</td>
<td>Local / Transboundary</td>
</tr>
</tbody>
</table>

**Conclusion on transboundary impact**

All Baltic coastal states except Russia are members of the EU, with their fisheries activities being regulated by the EU Common Fisheries Policy. In 2006, the EU and Russia agreed to a bilateral framework fisheries agreement. The Baltic Pipe project, due to safety zones, navigation restriction zones and the presence of the pipeline on the seabed, will affect the fishing area available to Baltic Sea countries. However, after completion of the construction, the pipeline will occupy less than 1% of the total fishing area in Polish waters in ICES rectangles along the Baltic Pipe route transboundary and in rectangles adjacent to these rectangles (see Table 7-40), therefore the transboundary impact (socio-economic) will not be significant.

In general, the sensitivity of fisheries to potential impacts is assessed as minor, the intensity of impacts as minor, and their scale as local/regional. In terms of duration, the establishment of shipping zones and the presence of ships (i.e. physical disturbances over water) are characterised by a limited duration, while the presence of a pipeline and a safety zone along the pipeline is of a long-term nature. The severity of each impact is negligible or minor, and no impact has been assessed as significant, see Table 7-44.

Table 7-44 Overall impact significance on commercial fisheries.

<table>
<thead>
<tr>
<th>Impact severity</th>
<th>Significance</th>
<th>Transboundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship traffic restriction zones</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Safety zones around the pipeline</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Presence of the pipeline</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Physical disturbance above water</td>
<td>Negligible</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

**7.4.3 Military practice areas**

The implementation of the Baltic Pipe project in Polish territorial waters, EEZ and the disputed area is not related to the risk of potential transboundary impact on military sites during both the implementation and operation of the pipeline; however, the assessment of the impact on this receptor has been presented for comparative purposes with other parts of the Baltic Pipe project.

The Baltic Sea is a strategic area where there are many types of military exercise areas. These military practice areas are an important receptor, which should be assessed because of the role they play in national security and international manoeuvres. The military practice areas concerned in relation to the Baltic Pipe project are mostly used by NATO and are as such of international importance. In this section, the term "transboundary impact" is therefore extended in the way that it covers any impact on international military exercise areas even though it occurs locally in one of the countries.

**Baseline**

In Polish territorial waters and the EEZ along and near the planned route, in both locations there are no military exercise areas (see Figure 7-20) or temporary exercise areas. Both locations - Niechorze-Pogorzelica and Rogowo - received a positive opinion from the Ministry of National Defence during the procedure of issuing permits for laying and maintaining an offshore pipeline.
The nearest military exercise area in the Danish waters is "EK D 396 Hullebaek" to the south of Bornholm, where the firing danger area "EK D 395 Raghammer Odde" is located. The distance from these areas to the nearest point of the project area in Polish waters is about 11.4 km. In German waters, the closest military exercise area is ED-D 47 Sector C.

**Impact assessment**

The construction of the Baltic Pipe pipeline on Polish waters will not interfere with everyday activities carried out on military exercise areas in Danish, German and Swedish waters. No impacts are anticipated during the operational phase.

**Conclusion on transboundary impact**

There is no risk of affecting military exercise areas as a result of the construction or operation of the planned pipeline in Polish waters.

**7.5 Cumulative impacts**

Cumulative environmental impacts can be defined as effects on the environment, which are caused by the combined results of activities from the present project activity in combination with other ongoing or planned projects.

In the environmental impact assessments (EIA) developed for Poland, Sweden and Denmark, projects have been identified whose impacts can potentially accumulate with the impacts of the Baltic Pipe project in order to assess them in terms of:

- the timeframe of the project (both the life cycle and the potential impacts);
- locations in the same geographical area as the Baltic Pipe;
• similarities in the type of impacts to the impacts of the Baltic Pipe project and impacts on the same receptors as the Baltic Pipe.

In Table 7-45 projects were presented that were included in the assessment of cumulative impacts of the Polish part of the Baltic Pipe project. The table below presents the results of the initial assessment of a number of previously selected projects. For this purpose, all projects within a 100 km radius, which results from the potential range of impact related to the propagation of underwater noise, were taken into account. The number of such projects is limited. In addition to the remaining parts of the pipeline, only offshore wind farm projects have the potential to cumulate impacts with the planned pipeline in the area of Polish jurisdiction.

Table 7-45 Offshore projects covered by the assessment of cumulative impacts of the Polish part of the Baltic Pipe project.

<table>
<thead>
<tr>
<th>Project</th>
<th>Location</th>
<th>Shortest distance to pipeline</th>
<th>Timeframe of project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore wind farms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind farm projects provided for in the draft of the Maritime Water Management Plan</td>
<td>The Oder Bank in the Pomeranian Bay</td>
<td>500 m</td>
<td>2028-30 the earliest project start dates</td>
</tr>
<tr>
<td>Wind farm projects in Germany:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Arcadis Ost,</td>
<td>North-east of the island of Rügen</td>
<td>a) 70 km</td>
<td>The exact dates are unknown, the estimated delivery time is 2021-2025</td>
</tr>
<tr>
<td>b) Baltic Eagle</td>
<td></td>
<td>b) 60 km</td>
<td></td>
</tr>
<tr>
<td>c) Wikinger Sud</td>
<td></td>
<td>c) 45 km</td>
<td></td>
</tr>
<tr>
<td>Pipelines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nord Stream</td>
<td>South of Bornholm</td>
<td>Place of intersection pipelines approx. 3.4 km from the border of the Polish EEZ</td>
<td>Existing</td>
</tr>
<tr>
<td>Nord Stream 2</td>
<td>Two alternatives, west of Bornholm and southeast of Bornholm</td>
<td>Place of intersection pipelines approx. 1.5 km from the border of the Polish EEZ</td>
<td>Under construction</td>
</tr>
</tbody>
</table>

The development of offshore wind farms on the north bank of the Oder Bank, provided for in the draft plan for marine areas, will take place no earlier than in 2028-30 (FNEZ, 2018), i.e. work related to the preparation and implementation of these investments that could significantly increase the scale of impact on the considered receptors (especially in the field of noise from the process of pile-driving wind farm foundations and the impact on birds) will not be cumulative with the impacts of the Polish part of the Baltic Pipe project. The only impacts that may accumulate are those related to the presence of infrastructure and changes in the morphology of the seabed after the completion of projects. However, all of these impacts have a local range, and thus do not generate the risk of transboundary cumulative impacts both in relation to Denmark and Germany.

In the case of offshore wind farm projects in Germany, the only type of impact that could be the source of cumulative impacts is the impact associated with the generation of underwater noise. All other types of impacts do not have spatial extent, which would cause the accumulation of impacts. In this context, another type of impacts, after the underwater noise, with the largest spatial extent
are those related to the disturbance of bottom sediments. For wind farm projects, the expected range of this type of impact is up to 40 km (SMDI, 2019, Chapter 5).

The construction of offshore wind farms is an important source of underwater noise, especially caused by pile-driving the foundations for towers, which can potentially lead to accumulation with impacts arising during the implementation of the Baltic Pipe project. In the present analyses of the possibility of cumulative impacts, only the impacts related to munition clearance are of significant importance. Modelling of the impact of underwater noise for munition clearance operations shows that the spatial range of TTS for marine mammals in Polish waters does not exceed 19 km, and at the same time the probability of finding munitions in Polish waters on the planned pipeline is low. For these reasons, the possibility of a significant negative impact of a transboundary nature can be ruled out. In addition, munition clearance is not a continuous process, and thus the time coordination of the operation of removing found munitions and pile driving periods allows the possibility of any cumulative effects to be avoided.

In the case of the Nord Stream and Nord Stream 2 pipelines, due to the existence of the first one, and in the case of Nord Stream 2 taking into account the assumed schedule of project implementation and the commencement of the Nord Stream 2 pipeline, there will be no cumulative impacts during the construction phase. The operation phase of the Baltic Pipe pipeline does not cause any significant impacts, in particular transboundary impacts. Thus, it can be ruled out that, even in the event of potential accumulation of impacts, it would have the character of significant transboundary impacts.

### 7.5.1 Conclusion

Overall, cumulative impacts from existing and planned projects and the planned project activities for the Baltic Pipe project are not likely to be significant for the marine environment. The main reason for this is the local and short-term nature of Baltic Pipe impacts, i.e. overlapping of impacts with other projects can only occur at short distance.

From a transboundary perspective, the distances between activities carried out as part of the Baltic Pipe project in Polish territorial waters and activities in ongoing projects in Denmark, Sweden or Germany are much greater, hence the occurrence of cumulative impacts can be ruled out.

The information contained in this chapter corresponds to the information contained in Chapters 9 and 11 of the EIA Report (SMDI, 2019).
8. IMPACT ON CLIMATE

This chapter discusses the expected emissions of greenhouse gases (GHG) related to the operation of the Baltic Pipe. Once the pipeline is operational, most of the GHG emissions related to the project will originate from the use of gas that is transported by the pipeline. The calculated GHG emissions are analysed in the context of the current and future energy market of Poland and related to the EU climate targets and Paris Treaty.

8.1 Calculation of GHG emissions

The Baltic Pipe is supposed to transport a yearly amount of 10 billion m$^3$ natural gas to Poland. Its combustion will result in the release of 21.2 million tons of CO$_2$ equivalent per year including minor contributions of nitrous oxide (N$_2$O) and non-combusted methane (CH$_4$). During the planned 50 years' lifetime of the pipeline this sums up to approximately 1.06 billion tons of CO$_2$ (see Table 8-1).

Table 8-1 GHG emission during operation of the Baltic Pipe and emission factors used for calculation (IPCC, 2006), approximate numbers.

<table>
<thead>
<tr>
<th></th>
<th>CO$_2$</th>
<th>CH$_4$</th>
<th>N$_2$O</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission factor (EF) [kg GHG/TJ]</td>
<td>56,100</td>
<td>1</td>
<td>0.1</td>
<td>-</td>
</tr>
<tr>
<td>Emissions (per year) [Mt GHG]</td>
<td>21.2</td>
<td>0.01 (CO$_2$ eq.)</td>
<td>0.01 (CO$_2$ eq.)</td>
<td>21.2 (CO$_2$ eq.)</td>
</tr>
<tr>
<td>Emissions (50 years) [Mt GHG]</td>
<td>1,061</td>
<td>0.53 (CO$_2$ eq.)</td>
<td>0.50 (CO$_2$ eq.)</td>
<td>1,062 (CO$_2$ eq.)*</td>
</tr>
</tbody>
</table>

*Tentative maximum numbers if using full capacity of the pipeline during entire lifetime

In 2016, the total GHG emissions in Poland amounted to 398 megatons CO$_2$ (see Table 8-2). Emissions due to natural gas deliveries through the Baltic Pipe would therefore be equal to 5.4% of total national emissions in 2016. However, it should be noted that not all gas delivered through the Baltic Pipe will be delivered to Poland. The Baltic Pipe will also establish a north-south corridor for European natural gas, which then can be distributed from Poland to other countries in eastern Europe. However, since Poland’s demand is rather large and growing, in this scenario it is assumed that the Polish energy sector absorbs the entire capacity of the Baltic Pipe. Actual data in the future may lead to a different conclusion.

Table 8-2 Total main GHG emission in Poland as of 2016 (KObiZE, 2018)

<table>
<thead>
<tr>
<th></th>
<th>CO$_2$</th>
<th>CH$_4$</th>
<th>N$_2$O</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total GHG emissions in 2016 [Mt]</td>
<td>322</td>
<td>46 (CO$_2$ eq.)</td>
<td>20 (CO$_2$ eq.)</td>
<td>398 (CO$_2$ eq.)</td>
</tr>
</tbody>
</table>

8.2 Polish energy market

The total primary energy supply (TPES) in Poland is based mainly on fossil fuels. First place belongs to hard coal and lignite, which cover 51 % of the demand. Crude oil also has a significant share of 25 %, while natural gas and renewables comprise 14 and 9 % respectively (see Figure 8-1). In Poland 88 % of electricity is generated from coal, most of it being domestic hard coal and lignite.
The demand for natural gas currently amounts to 17 billion m³ per year (year 2018). However, since Poland has experienced continuous economic growth within the last three decades the demand for natural gas and energy in general has been increasing accordingly. It is estimated that the demand for natural gas will be above 20 billion m³ in the year 2030 (Mościcka-Dendys, 2018).

At the time being Poland can cover about 25 % of the natural gas by domestic production. Poland is therefore depending strongly upon gas import, traditionally covered by Russia. However, in 2016 a liquid natural gas (LNG) terminal was opened in Świnoujście, which has increased imports of LNG, mostly from the USA, and partly from Qatar. Further extension of LNG capacity is planned for the future. As of 2018 Russian gas comprises 74 % of natural gas imports (see Figure 8Figure 8-22). Contracts for gas delivery from Russia expire in 2022. According to Poland’s gas diversification plans, the contracts shall not be extended, and the import of natural gas shall be covered by Norwegian gas (Baltic Pipe) and LNG from 2022 on.
8.3 Polish Energy Policy in the light of EU climate and energy framework and Paris Agreement

The EU's nationally determined contribution (NDC) under the Paris Agreement is to reduce greenhouse gas emissions by at least 40% by 2030 compared to 1990, under its wider 2030 climate and energy framework. All key legislation for implementing this target has been adopted by the end of 2018. The 2030 climate and energy framework sets three key targets for the year 2030:

- At least 40% cuts in greenhouse gas emissions (from 1990 levels);
- At least 27% renewable energy share;
- At least 27% improvement in energy efficiency.

The framework was adopted by EU leaders in October 2014. It builds on the 2020 climate and energy package. It is also in line with the long-term perspective set out in the Roadmap for moving to a competitive low carbon economy in 2050, the Energy Roadmap 2050 and the Transport White Paper.

In 2018, Poland’s Ministry of Energy prepared an updated energy policy paper, which currently is in public hearing as draft (Energy Policy of Poland until 2040, EPP2040 (Polityka energetyczna Polski do roku 2040, EPP2040)). The policy defines the strategy and the targets for the country up to 2040. In the context of the EU 2030 climate and energy framework, EPP2040 formulates the following targets for 2030:

- Reduction of coal share in the generation of electricity to 60% in 2030,
- Increase of Renewable Energy Sources (RES) in gross final energy consumption to 21% in 2030,
- Introduction of nuclear energy by 2033,
- Improvement in energy-efficiency by 23% by 2030 (comparing to 2007),
- Reducing CO2 emissions by 30% by 2030 (comparing to 1990).

EPP2040 elaborates on eight strategy directions addressing different thematic complexes of the energy market (Ministry of Energy, 2018). Within these directions natural gas plays an important role, in particular for the following policy elements and targets:

- Diversification of the gas market (i.e. creating alternatives for Russian gas delivery)
- Restructuring/ extending of power capacity utilizing nuclear power and RES (wind and photovoltaic). Establishing gas-fired units and energy storage technologies as a backup for RES.
- Development of gas transmission system and penetration
- Technical development of district heating and modernization of household energy consumption
- Increasing energy efficiency

In order to make the targets of the EPP2040 feasible, a continuous and safe natural gas supply is required. One alternative to the Baltic Pipe would be to increase the LNG capacity beyond existing plans, which would mean the construction of further LNG terminals and associated infrastructure.

8.4 Impact on climate

Gas delivered through the Baltic Pipe is planned to replace Russian natural gas deliveries one by one right from the commencement of its operation in 2022. Thus, no incremental GHG emissions are created in the Polish energy production.

In addition, the use of natural gas bears the potential of GHG emission reductions, either directly by replacing coal or oil, or indirectly by enabling establishment of RES and energy efficient technologies, e.g. creating backup for large scale offshore wind power as stipulated in the EPP20140. Besides it should be noted that the Baltic Pipe allows the transport of other types of gases e.g. biogas.
As per today, it is speculative to quantify the amount of GHG saved by the Baltic Pipe, since the speed and direction of development in the Polish energy market cannot be foreseen. A scenario presented by Energinet (Energinet, 2018) shows that the utilization of 10% of the Baltic Pipe capacity (1 billion m³) for the substitution of coal or oil would result in a reduction of 1.2 – 2.2 megatons of annual CO₂ emissions depending on the exact use of the gas. The potential, however, is significantly higher.

The information included in this chapter corresponds to the information found in Chapter 6.1, 7.10.2 and 9.8.2 of the Polish Environmental Impact Report (SMDI, 2019).
9. ENVIRONMENTAL MONITORING

9.1 Environmental monitoring in Poland

European legislation in the field of environmental impact assessments sets out the basic rules for monitoring environmental impacts, as related to the implementation and operation of assessed projects, indicating the obligation to monitor those impacts that have a significant negative impact on the environment. These rules correspond to the requirements laid down by the Espoo Convention, Article 9, part. c, which indicates that, in connection with an environmental impact assessment, an environmental program may be prepared, if such monitoring is relevant to the project. The national legal basis for presenting the monitoring proposal is art. 66 clause 1 item 16 of the Act regarding the disclosure of environmental information and environmental protection, public involvement in environmental protection, and environmental impact assessments.

The monitoring program is aimed at verifying whether the project’s impacts were properly identified and assessed and ensuring that the mitigation measures implemented are functioning as planned. In addition, the monitoring programme can be used to monitor the change to a receptor impacted to some degree by the project.

In the following paragraphs, a proposal for a monitoring programme is presented. The detailed planning and execution of the programme will be established in consultation with the competent authorities. During this dialogue with the authorities, monitoring locations, procedures, and periods will be decided.

This chapter presents a proposal for a monitoring program and a list of the receptors to be monitored, based on:

- assessment of the project’s impact on particular receptors (see Chapter 5, Chapter 9 of the Polish EIA Report (SMDI, 2019);
- experience from similar projects, taking into account project specificity, technical assumptions, and location (in relation to the marine environment, as well as the specificity of the Baltic Sea);
- possible remedial/mitigation measures and control of their effectiveness;
- guidelines and guides for conducting the monitoring of specific environmental components.

The impact assessment, including the modelling results of sediment spill, show that the project will generate only limited impacts on the marine environment.

It is therefore suggested to include offshore monitoring of:

- Sediment dispersion;
- effectiveness of mitigation measures and remedies in cases of detonation of conventional weapons relative to marine mammals;
- restoring the seabed to its original state.

The monitoring set up will be suitable to capture transboundary impacts of sediment spill and underwater noise, if such impact occurs.

9.1.1 Construction phase

Sediment dispersion

The purpose of the monitoring will be to investigate the concentration and extent of the disturbed sediment spread as a result of offshore pipe-lay works (during the construction period). The main objective of such monitoring will be verification and confirmation that concentrations of released compounds, as a result of sediment disturbance, will not be exceeded in comparison to the obtained model results, and thus will not differ from the results of the project’s impact assessment (in particular regarding water status and biodiversity).
Validation of the modelling inputs will in turn support the conclusions of the assessment of impacts on water quality and other receptors.

**Unplanned events – effect of mitigation measures in the event of munitions clearance**
The purpose of monitoring will be to confirm the effectiveness of the implemented measures to ensure effective protection of marine mammals against impacts from offshore noise that is created during the clearance of unexploded ordnance.

Monitoring of marine mammals should be implemented by the use of visual observers and passive acoustic monitoring to ensure that seals and harbour porpoises are properly scared out of the zone of physical injury. In this way, the adequate protection of animals against significant impacts can be ensured.

**9.1.2 Operation**

**Restoring the seabed to its original state**
The purpose of the monitoring will be to confirm that the measures taken to restore the seabed to the original condition in the project impact area have been designed and implemented correctly and effectively and guarantee unchanged conditions for sedimentation and erosion of the coastal zone, while maintaining the functionality of this zone, as defined by maritime administration authorities for shore safety.

**9.1.3 Justification for monitoring programme**
Experience from Nord Stream, which is currently the only operational pipeline system in the Baltic Sea, and where an extensive monitoring programme has been completed, has shown that no significant or measurable impacts were observed on fish along the pipeline; benthic fauna; water quality; hydrography; or socio-economic receptors, such as commercial fisheries and marine archaeology (Ramboll O&G/Nord Stream AG, 2011a,b, 2012, 2013, 2014 and 2015). It should be emphasized that Nord Stream consists of two pipelines with a larger pipe diameter than the analysed project. The potential for impact on the seabed is therefore significantly lower for the Baltic Pipe.

The information included in this chapter corresponds to the information found in Chapter 14 of the Environmental Impact Assessment Report (SMDI, 2019).
10. GAPS AND UNCERTAINTIES

According to the EIA legislation, an EIA report must contain a description of the most important gaps and uncertainties in the data and methods applied for calculating and assessing the environmental impact of the project.

In the following, the gaps and uncertainties are described for the project in general and for the specific models and calculation methods applied. Overall, it is considered that none of the listed gaps and uncertainties will lead to significant changes in the environmental assessments of the Baltic Pipe project for the Polish part of the Baltic Sea. The assessment is considered sufficiently conservative, in particular because experiences from the Nord Stream project have shown that no significant or measurable impacts on the marine environment were observed.

10.1 General uncertainties
There are general uncertainties related to the project design and the baseline data.

10.1.1 Design of the Baltic Pipe project
The Baltic Pipe project in this report has been defined in technical, technological, and logistic terms, however, at the time of submitting of the report, the project's detailed documentation is not complete. For this reason, at subsequent stages of design work, corrections or changes in the technical documentation of the design and organization of construction activities may occur and may also include construction technologies used. Additionally, further technical studies may be implemented when a more detailed project design becomes available. Therefore, information presented in the EIA about pipeline length, trenching length and location are based on the current design and may be subject to minor changes. Furthermore, all numbers presented in the EIA about e.g. use of materials, rock volumes and emissions from the project are approximate estimates based on the current knowledge at the time of the EIA. In the EIA report, on this basis, and where there are uncertainties regarding the final project design and methods, a worst-case approach has been applied. This means that the conclusions of the EIA report are sufficiently robust to contain project adjustments in the upcoming detailed design phase.

10.1.2 Baseline data
The baseline has been prepared using desktop studies of scientific literature, technical reports of available data covering the project area (from e.g. authorities), together with field surveys, where results add new information and/or can confirm already existing information. The baseline data are considered sufficient as a basis for the description of the baseline in the EIA and Espoo report and a valid basis for the assessments.

10.2 Uncertainties of models and calculations
Modelling and calculations have been undertaken for sediment dispersion, underwater noise, airborne noise, air quality and emissions.

10.2.1 Sediment dispersion
The sediment dispersion model is based on a theoretical calculation model supplied with physical input parameters. These input parameters are current fields, spills originating from the proposed construction methods and physical properties of the spilled material.

Current fields are based on “historical” situations (hindcast) of characteristic hydrographic conditions as they most likely could be under a future construction phase. Actual conditions can be different during the construction of the Baltic Pipe project. The given model results are considered as a realistic extent of the impact, but a specific impact cannot be determined.

As input for the sediment dispersion model, spill percentages from the different types of offshore construction activities applied for the project are defined. The applied spill percentages are based
on empirical data and literature studies. However, the actual spill percentage will depend on the equipment used for the task, in combination with the type of seabed.

Physical properties of the sediment main correlates with settling velocity, which again is a matter of grainsize distribution. The samples collected from boreholes were not analysed when the modelling was initiated, and consequently, specific grain size distributions along the route were not available. However, assumptions on the type of seabed material were based on dedicated surveys along the route. This information was transformed into a grain size distribution based on experience. The assessed grain size distributions were biased towards fine sediments which is considered conservative.

10.2.2 Underwater noise
The underwater noise propagation model is based on a theoretical calculation model supplied with physical input parameters such as salinity and temperature data, seabed conditions and bathymetry. If the physical measures are correct, the theoretical results are considered credible, which is the case for the current project. Measurements of underwater noise from munitions clearance, however, may result in varying noise levels due to other physical measures not included in the calculation model, e.g. waves at the surface, partial detonation and/or the munition being embedded in the seabed.

10.2.3 Airborne noise
The noise calculations for airborne noise are associated with some uncertainty. Both the calculation model itself, but also the assumptions about individual noise sources and construction descriptions, are subject to uncertainty. The uncertainty regarding the determination of noise in the construction phase was estimated on the present basis to be ± 5-7 dB. However, it should be emphasized that the assumptions used in this study are generally conservative, i.e. considered worst-case.

10.2.4 Air quality modelling
The modelling of pollutant spread in the air was carried out using the "OPERAT FB" program for Windows v.6.4.4/2012 (extended version) made by "PROEKO" (author Ryszard Samoć), and is consistent with the reference calculation methodology set out in Annex 3 to the Administrative Order made by the Minister of the Environment on January 26, 2010 regarding reference values for certain substances found in the air (Journal of Laws 2010, No. 16, item 87). The model is based on meteorological data from the meteorological station in Kolobrzeg as this station guarantees that the data are representative for the pipeline's proposed landfalls. However, the station is located away from the gas pipeline landfall areas found in the Report, i.e. about 17 km east of the Rogowo site and about 27 km east of the Niechorze-Pogorzela location, which means that the real conditions for the spread of pollutants may potentially be different. However, taking into account the adopted conservative boundary conditions, the modelling results are considered sufficient and reliable enough to assess the impact of the Project. The information included in this chapter corresponds to the information found in Chapter 15 of the Environmental Impact Assessment Report (SMDI, 2019).

11. CONCLUSION

Construction and operation of the Baltic Pipe natural gas pipeline in the Baltic Sea is unavoidably associated with impacts on the marine environment. Each impact is characterized by its intensity, range and duration, and the resulting environmental effect depends strongly on the sensitivity of the receptor towards the impact. Based on the results of the Polish environmental impact assessment (EIA report), the Espoo report analyses how far activities in the Polish waters have an impact on receptors in the neighbouring countries, such as: Denmark, Sweden, and Germany. In the following, the main conclusions are summarized for each country.
11.1 Transboundary impacts: Poland - Denmark

Like Poland, Denmark is a party of origin and an affected party in the Espoo process. Due to the nature and intensity of effects, the only place on the Baltic Pipe route where transboundary impacts may occur due to activities that fall under Polish jurisdiction are the Danish waters south of Bornholm. Project impacts that can potentially have a long range include sediment dispersion and underwater noise. It can be concluded from the assessment that significant impacts from activities in Polish waters across the borders to Denmark will not occur.

Due to the fact that the noise generated during pipeline construction is not greater than the noise generated during current use of the land where the project is planned, the analysis of underwater noise generated during munitions clearance becomes a key element of project impact assessment. As a result, the environmental elements/receptors of potential project impacts are fish and mammal populations, i.e. grey seals, porpoises, and harbour seals. Nevertheless, due to the density of the mammals in the waters that are subject to impacts, the likelihood of the most vulnerable receptors being impacted is very low. In addition, the area around the border between Denmark and Poland is not located within an area of registered munitions finds. Therefore, the probability that munitions will be discovered during the pre-construction survey is considered very low. All of these circumstances, as well as the implementation of mitigation measures allow for the conclusion that there will be no significant transboundary impact.

In the Danish waters neighbouring the Baltic Pipe project under Polish jurisdiction, there are no Natura 2000 areas, and the closest Natura 2000 area is outside the range of impact generated by construction activities and operation phase activities related to Baltic Pipe.

The restriction zone around the pipeline for commercial fishery in Polish waters will also affect Danish fishing activities. As specified in section 7.4.2, restrictions will be imposed on only a very small fraction of the available fishing grounds, and thus, the impact on the Danish commercial fishery is assessed to be not significant.

It is concluded that there are no significant transboundary impacts from Poland on Denmark.

11.2 Transboundary impacts: Poland - Sweden

There is no Polish-Swedish border along the Baltic Pipeline route. The shortest distance between a stretch of the Baltic Pipeline section located in Polish waters and the Swedish EEZ is about 54 km. Project impacts that can potentially have a long range include sediment dispersion and underwater noise. None of these effects are have the scale, duration or intensity to have an impact on Swedish waters.

The restriction zone around the pipeline for commercial fishery in Polish waters will also affect Swedish fishing activities. As specified in section 7.4.2, restrictions will be imposed on only a very small fraction of the available fishing grounds, and thus, the impact on the Swedish commercial fishery is assessed to be not significant.

It is concluded that there are no significant transboundary impacts from Poland on Sweden.

11.3 Transboundary impacts: Poland - Germany

There is no Polish-German border along the Baltic Pipeline route. The shortest distance between a stretch of the Baltic Pipeline section located in Polish waters and the German EEZ is about 8.5 km. Project impacts that can potentially have a long range include sediment dispersion and underwater noise. Sediment dispersion modelling indicates that due to the distance and limited duration of the impact, it is unlikely that sediment dispersion during construction will have a significant impact on German waters.
The noise generated as a result of munitions clearance could be a potential source of noise for the porpoise, the grey seal and the harbour seal, and for the fish that are found in the Baltic Sea. The assessment results indicate that due to the distance from German waters, impacts on fish populations is unlikely. The population of marine mammals in German waters is located within the range of a potential impact from munitions clearance on waters under Polish jurisdiction. Nevertheless, the likelihood of a potential impact is very low, due to the low density of porpoises and seals in German waters, and a low likelihood of performing munitions clearance activities, given that the planned project route in Polish waters next to the German EEZ is not in a registered munitions find area. Application of mitigation measures allows for the conclusion that there will be no transboundary impact.

Two Natura 2000 areas in the German EEZ located closest to the Baltic Pipe project are the Pommersche Bucht Special Protection Area for birds and Pommersche Bucht mit Oderbank SCI area. The distance between these Natura 2000 areas and the closest Baltic Pipeline point is about 8.5 km. Due to the reasons described above related to impacts on fish and marine mammal populations, the possibility of significant transboundary impacts has been excluded.

The restriction zone around the pipeline for commercial fishery in Polish waters will also affect German fishing activities. As specified in section 7.4.2, restrictions will be imposed on only a very small fraction of the available fishing grounds, and thus, the impact on the German commercial fishery is assessed to be not significant.

It is concluded that there are no transboundary impacts from Poland on Germany.

11.4 Baltic Pipe entire route throughout the Baltic Sea

In section 7.15 it has been stated that cumulative impacts due to other plans and projects in the Baltic Sea region can be ruled out. In principle, given the size of the Baltic Pipe project, cumulative impacts can also arise within the project itself when all impacts from all three countries overlap.

The potential for such cumulative impact depends on:

• the timeframe of the construction in the different sections of the project;
• whether the impact type in one section is similar to the impacts in the remaining sections, and whether these impacts of can affect the same receptors.

Analysing the envisaged timeframe for the construction works (see Chapter 3) it is revealed that only landfall construction in the nearshore areas in Denmark and Poland will occur simultaneously. Both activities cause small scale disturbance of nearshore habitats. However, the nearshore habitats are different in Poland and Denmark, and none of the potential impacts will be of a transboundary character. Cumulative impacts on the same receptors can be excluded.

Offshore construction is planned as a continuous process starting from the nearshore section in either Denmark or Poland terminating at the other nearshore section.

Significant impacts on receptors from short-term potential impacts such as sediment dispersion, underwater noise, presence of vessels etc. have not been identified in Poland, and are hence they are not expected to occur in Denmark and Sweden as the impact intensity will be of same character. As impacts will not occur simultaneously, the impact is not likely to be cumulative.

Long-term or permanent impacts, such as seabed intervention work and the presence of the pipeline can have a local impact on receptors. These impacts have been assessed by the Polish EIA as insignificant. Considering the entire route of the pipeline, the absolute magnitude of the impact
is scaled up. However, as the reference area is equally scaled up, the significance is not changed, and cumulative impacts on the environment from the project as a whole can be excluded.
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