Nord Stream
The new gas supply route for Europe

Nord Stream Project

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Table of Contents

List of Abbreviations

ADCP	Acoustic Doppler Current Profiler
AIS	Automatic Identification System
AUV	Autonomous Underwater Vehicles
BACI	Before and after comparison investigation
bcm	Billion cubic metres
CAMS	Catenary Anchor Monitoring System
CTD	Conductivity, Temperature and Depth recorder
CIP	Contractor Implementation Plan
CMP	Construction Management Plan
EEZ	Exclusive economic zone
EIA	Environmental impact assessment
ES	Environmental Study
ESMS	Environmental and Social Management System
ESMP	Environmental and Social Management Plan
FRS	Fartygs Rapporterings Systemet
HB	Hoburgs bank (Natura 2000 area in Swedish EEZ)
HSE	Health, Safety and Environment
HSES MS	Health, Safety, Environment and Social Management System
IFC	International Finance Corporation
IMR	Inspection, maintenance and repair
IWS	Intervention works
KP	Kilometre point
MARPOL	Merchant Shipping (Prevention of Oil Pollution) Regulations
NAVTEX	Navigational Telex
NMB	Norra Midsjöbanken (Natura 2000 area in Swedish EEZ)
ROV	Remotely Operated Vehicle
SMA	Swedish Maritime Administration
SMS	Safety Management System
SMHI	The Swedish Meteorological and Hydrological Institute
TOL	Total organic carbon
TMS	The Tug Management System
TW	Territorial waters

Environmental Monitoring Programme Sweden

1 Introduction

Nord Stream is an offshore natural gas pipeline from Russia to Germany. The Nord Stream Pipeline will connect the large natural gas resources of Russia with the European natural gas pipeline network. At full capacity, it will provide 55 billion cubic metres (bcm) of natural gas per year to European consumers. The length of the entire two-pipeline system ('the Nord Stream Pipeline') is approximately 1,220 km. The pipeline crosses the exclusive economic zones (EEZ) of Russia, Finland, Sweden, Denmark and Germany, and territorial waters (TW) of Russia, Denmark and Germany.

The pipeline construction works are planned to commence in 2010, with the second pipeline being completed in 2012. The Nord Stream Pipeline is designed to operate for 50 years. This document provides an overview of the environmental monitoring programme for the main pipeline construction activities that are planned for the installation of the Nord Stream pipelines within the Swedish Exclusive Economic Zone (EEZ).

2 General Approach

Nord Stream's general approach to environmental monitoring is to direct monitoring at those areas of environmental sensitivity that are predicted[1] to experience potential impacts of some significance (moderate significance or more) from the Project. In the Swedish EEZ all the impacts are assessed to be minor. Consequently monitoring would not necessarily be required, however, it is considered important to direct additional effort as to validate accuracy of the impact assessment on certain fit-for-purpose activities and to deliver the main monitoring objectives for the project.

The programme presented in this document focuses on the monitoring activities that are carried out in the Swedish EEZ. The monitoring programme is finalised in consultation with relevant Swedish authorities and has been adjusted where necessary to accommodate permit conditions.

The monitoring programme has been planned and developed with the following objectives:

- To monitor that the pipeline is installed and operated in accordance with the permit conditions
- To monitor that the pipeline construction does not cause impacts not previously identified or greater impacts than predicted
- To monitor the recovery of the environment after construction
- To control and monitor that significant environmental effects will not be caused
- To verify the findings of the Environmental Study (ES)
- To provide the basis for corrective action if necessary

The environmental monitoring for Nord Stream Project comprises three major phases:

- Baseline studies (prior to construction - planning/permitting phase)
- Environmental change monitoring (during construction)
- Monitoring during operation (post-construction)

[1] The significance of impacts was determined in the Espoo Report and National Environmental Impact Assessments so called Environmental Study in Sweden.

Although these steps require different actions, they are seen as a part of a single overall approach. It is important to note that monitoring parameters vary considerably from one place to another, and have been tailored to address national requirements.

Nord Stream's overall project environmental monitoring during construction and operation will thus vary in spatial range, temporal frequency, duration and monitored parameters in accordance with the potential impacts predicted and in relation to potential receptors. According to local variations in environment and construction works, certain investigations are carried out only at selected sites (e.g. contaminants in mussels at the borders of Hoburgs bank and Norra Midsjöbanken, Swedish EEZ) or once for the entire route (e.g. Hydrographic effects: Deep water inflow in the Bornholm Proper, Danish EEZ).

In order to measure the effectiveness of monitoring and mitigation measures, relevant receptors and indicators identified within the monitoring programme should be characterised by the following:

- Low natural variability and broad applicability;
- Measurable; and
- Appropriate to the scale of impact, the impact mechanism as well as temporal and spatial dynamics.

Monitoring of potential environmental factors and related impacts considers:

- Emission intensity; and
- Sensitivity of the receptor and conservation value.

A project based concept in relation to overall oceanography follows the evaluation of potential environmental impacts by consideration of the following:

- Focus on shallow waters providing habitats for conservation objectives
- General approach on potential impact areas for waters between 80m and 30m water depth
- No biological investigations below the halocline at 80m water depth if other options are available, in view of the anoxic conditions at these depths

The objectives of environmental monitoring during the pipeline construction are classified as follows:

- *Environmental change monitoring* – to detect environmental changes that may have occurred as a result of project implementation

- *Compliance monitoring* – periodic sampling or continuous recording of specific environmental and social quality indicators for a defined purpose to ensure project compliance

- *Pro-active monitoring* – timely routine and periodic checks by observation, measurement and evaluation for a defined purpose, which includes corrective action

Key principles guiding the development and implementation of the environmental monitoring programme for the Nord Stream Project are as follows:

Consistency: It's considered desirable to the extent practicable to have a harmonised approach in terms of sampling and analysis protocols along the length of the route. For some parameters there may be prescriptive requirements at the national level, but where this is not the case a harmonised approach across national boundaries will be used. This will deliver data that are more readily comparable and allows for improved environmental management and performance. Monitoring will, where reasonable and possible, be congruent with HELCOM guidelines.

Synergy: In addition to the environmental surveys the Project undertakes engineering inspection and maintenance led surveys. These include seabed investigations to understand seabed conditions, shallow geology, presence of obstacles and cultural heritage, and the condition of pipelines and their support structures. The results of the surveys are complied in integrated survey reports. This approach is adopted to maximise the synergy between the various monitoring activities (environmental and engineering) with different initial objectives.

Reporting and Data Sharing: It's important for the Project to have access to ongoing data acquisition programmes by third parties and government institutions to be able to fully interpret the data it collects. By the same token, subject to any constraints on disclosure placed by a national authority, the Project is committed to sharing its data with relevant stakeholders and making arrangements to facilitate this process. Nord Stream is committed to reporting the environmental monitoring programme results at a national level to the relevant authorities.

Seasonal and Inter-annual Variability: It is important to consider the inherent natural variability that is typical of many of the parameters used in marine monitoring programmes to avoid incorrect conclusions about its presumed impacts. Similarly, it is important that reference sites are used to account for the spatial variability that may occur in the marine environment. Whereby, data are acquired from within the impact area (as predefined in the Environmental Study, ES) and at reference areas located sufficiently far away to ensure that they are unaffected by the Project and where natural environmental conditions are preserved.

Review and Close Out: Monitoring is not an open-ended process. It is important to regularly review monitoring results, not just from the perspective of corrective action if required, for specific impacts, but also to establish, whether there is any need for a particular element of the monitoring programme to continue, or to continue in its current form. Once a designated purpose has been served some elements of the monitoring will cease. Others may be enhanced or become more frequent in response to lessons learnt.

3 Legal Framework for Monitoring in Sweden

The Nord Stream pipelines are laid outside of Sweden's territory on the continental shelf. Swedish law is not applicable on activities, operations, installations, etc. which are ongoing or which are set up outside of Sweden's territory, unless otherwise expressly stipulated in a Swedish statutes issued in accordance with the international law. In accordance with the United Nations Convention on the Law of the Sea, Sweden has issued the Continental Shelf Act, where e.g. the permitting requirements for laying pipelines on the Swedish continental shelf act is stipulated. There is no regulation in the Continental Shelf Act and its ordinance regarding monitoring. Such requirements are regulated in the Swedish Environmental Code and adjoining legislation. This legislation is, however, not applicable outside of Sweden and there is no regulation in the Continental Shelf Act in relation to the laying of cables and pipelines that is referring to the code. Nord Stream will however base its monitoring program on the regulations pertaining to those in Sweden.

The basis for monitoring in the Environmental Code is the following:

- Persons, who pursue an activity or take a measure that is liable to cause detriment to human health or affect the environment shall continuously plan and monitor the activities in order to combat or prevent such effects. Persons, who pursue such an activity or take such a measure, shall also keep themselves informed, by carrying out investigations on their own initiative or by other means, about the impact on the environment of the activity or measure.

The regulation is specified in the Ordinance on an operator's self-monitoring, where it is stipulated that a monitoring program shall comprise the following:

- Administrative details including the division of the organizational responsibility of the questions that regulates the activity or operation in question.

- Routines for continuous control of equipment that are used for the operation and control in order to prevent impacts on human health and the environment. The control shall be documented.

- Continuously and systematically investigate and assess the risks of the activity from health and environmental aspects. The result of investigations and assessments has to be documented. Information regarding accidents, breakdowns and stoppage in activities that could lead to impacts on health or environment shall immediately be forwarded to the supervisory authority.

- The operator shall have a list of hazardous chemical products etc. that are used in the operation. The list has to contain the following data: the name of the product or organism, the extent and use of the product or organism, information regarding hazards and the classification of the product or organism related to health and environment hazards.

4 Baseline Analysis during Planning prior to Construction

The Nord Stream report 'Environmental Study on the Swedish Continental Shelf outside the Territorial Waters (ES)', presents in chapter 4 'Baseline description' the baseline conditions along the pipeline route. This addresses the following:

- Methods
- Protected areas
- Physical and chemical environment
- Biological environment
- Socio-economic environment

Environmental Study related baseline field investigations have been performed during the years 2005-2009. The upcoming environmental monitoring programme related baseline field investigations are planned to be performed during the years 2010-2011. The field investigations address the following:

- Turbidity
- Eco-toxicological effects (mussels)
- Fish
- Benthic fauna
- Hydrographic effects (DEN EEZ)

5 Environmental Management and Control during Construction

Nord Stream has developed an Environmental and Social Management System (ESMS) and an Environmental and Social Management Plan (ESMP), which are implemented during the construction phase for the Project. The ESMS is extended to cover the operations phase.

The purpose of the ESMS is as follows:

- Establish a framework for implementing mitigation and management measures and for monitoring the effectiveness of those measures,
- Provide assurance to authorities and other stakeholders that their requirements with respect to environmental and social performance will be met,
- Provide for the implementation of corrective measures where required, and
- Establish a framework for performance monitoring to enable Nord Stream to ensure that its commitments and policies with respect to environmental and social performance are being met.

The content of the ESMP is guided by the findings and recommendations of the National Environmental Impact Assessments (EIAs), Environmental Studies (ESs), the Espoo Report, EU EIA Directive requirements, lenders requirements and the requirements of the relevant authorities. Most of these requirements are featured in the permits issued in each country.

Key elements within the ESMS and ESMP (construction) include:

- Project Standards Document
- Commitments Register
- Management of Change Document
- Compliance Assurance Document
- A suite of topic specific Construction Management Plans (CMP)

The Project standards have been developed on the basis of IFC EHS Guidelines and in accordance with relevant national laws and regulations.

Minimum environmental standards have been established for the following factors:

- Emissions to the Atmosphere
- Ambient Air
- Water Quality & Discharges to Water
- Waste
- Noise Emissions
- Occupational Health and Safety and
- Other Environmental Standards.

Environmental monitoring together with a specific Environmental and Social Management Plan (ESMP) (construction) is an integral part of the overall Nord Stream Health, Safety, Environmental and Social Management System (HSES MS) consistent with ISO 14001 and OHSAS 18001. The following Table 1 describes the Health & Safety, Environmental & Social Management System in the Swedish EEZ.

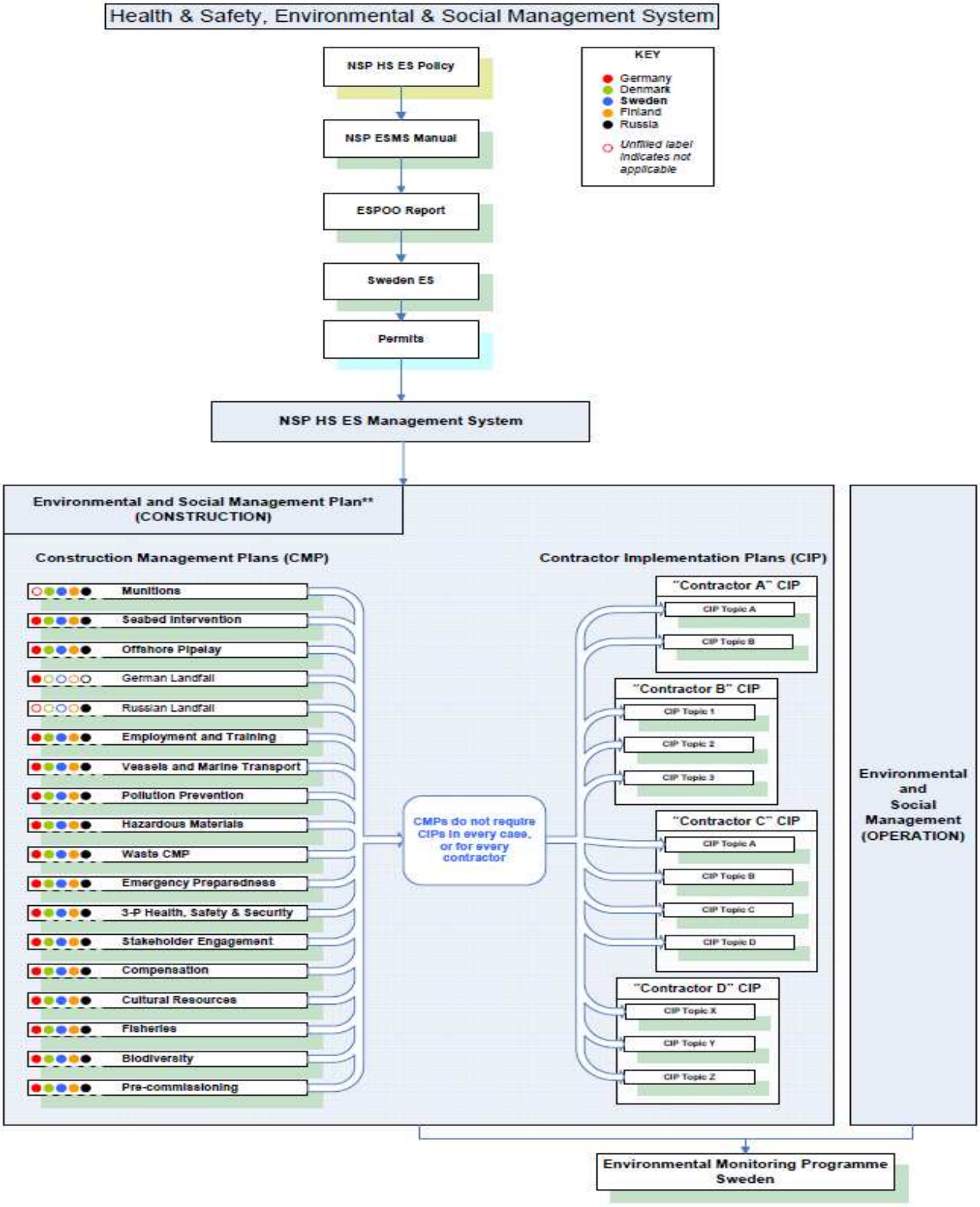

Table 1. Health and Safety, Environmental and Social Management System in the Swedish EEZ.

5.1 Project Organisation and Management Roles

Nord Stream's organisation and management roles are linked to Health, Safety, Environment and Social Management System (HSES) with intention to ensure that all aspects of the HSES management are suitable and sufficient and inform the active parties of the roles and responsibilities of the key personnel and which procedures and work instructions have primacy.

The objective is to ensure that:

- Each party involved in the activity is deemed to be in control and accountable of its own Safety Management System (SMS)
- Arrangements are arrived at through consultation and agreement with all parties involved
- All aspects required for a safe operation have been adequately addressed through the SMS
- The key project personnel are informed of their roles and responsibilities
- Communications throughout the project for routine and emergency situation is informed
- Field and vessel emergency procedures are integrated during activities.

Effective communications and coordination has been recognised during the hazard identification process as being an essential element in the reduction of inherent risks associated with the work. In order to assist with routine off/onshore communications a Nord Stream representative will be on board on the pipe lay vessels.

Prior to arrival at any work site, pipe lay vessels shall give information to local authorities, as applicable on:

- Destination
- Purpose for entering area
- Estimated time of arrival
- Estimated time of departure
- Establish contact with Emergency Response Centre
- Establish communication with onshore project

The following table 2 describes in details the Nord Stream's project HSE organisation and management roles.

Project HSE Organisation and Management Roles			
Active Party	**On/offshore**	**HSE title**	**Method / Responsibility**
Contractor		Personnel	Compliance - Quality, health, safety and environment (QHSE) Plan
Contractor		Vessels	Compliance - Quality Management Systems, Certified Safety Management System (SMS)
Contractor	On/offshore	Project HSE Coordinator	• Identifying, planning, documenting and monitoring the implementation of project HSE measures; • Promotion of HSE familiarity within the project and support areas; • Support to site/vessel HSE personnel; • Coordinate and participate in internal and external HAZID, Risk Assessment and HAZOP studies; identification and reporting of HSE deficiencies and support to hazard observation and event reports; • Assess and report on environmental monitoring data; • Conduct internal and external project HSE audits; • Participation in internal HSE audit activities as required by corporate programs, including the evaluation of sub-contractors

Contractor	Offshore	Vessel HSE Personnel	Performing and reporting inspections and surveillance as required by contract, specification, system documentation and legislation; • Provision of QHSE support to investigations regarding accidents/incidents, nonconformity or environmental incidents; • Safety induction briefings for the new arrivals at vessel/site.
Contractor	On/offshore	Project Manager	Manage, co-ordinate and plan the daily activities of all operations in accordance with the appropriate programme and procedures. Ensure that all operations are performed in accordance with legislative and company defined policies and procedures in a safe manner.
Contractor	Offshore	Vessel Master	Responsible for ensuring that all operations from the vessel are carried out in a professional and safe manner. At all times shall liaise closely with the Project Management and Onboard Representatives.
Contractor	Offshore	Logistics Coordinator	Acts as the liaison point with the Vessel Master and holds the responsibilities of coordinating and advising on support vessel movement to and from the pipe lay spread.
Contractor	Offshore	Emergency Response Coordinator	The first point of contact for the vessel in the event of any emergency. Mobilises local services and the onshore support team.
Nord Stream	Offshore	NSP Company Representative	Acts as the liaison point with the Vessel Master and the Company onshore management.
Nord Stream	Offshore	H&S Advisor	Has a monitoring role to carry-out regular audits and inspections to ensure the contractor is complying with contractual arrangements and the contractor's own operational procedures. Report directly to the Nord Stream Company Representation offshore.
Nord Stream	Offshore	Environmental Advisor	Be onboard the pipe lay vessel to ensure the correct implementation of general (MARPOL) and project specific requirements, including the environmental conditions stipulated on construction permits. Supervises the environmental monitoring operations conducted by third-party contractors and sub-contractors of the main construction contractor.
Nord Stream	Offshore	Fishing Industry Representative	Nord Stream will provide representative from the Fishing Industry the possibility to be onboard the pipe lay vessel, at relevant sectors of the lay corridor, as communications interface between construction and fishing vessels operating in the vicinity.
Nord Stream	On/offshore	Onshore Project Manager	Management responsibility for the achievement of HSE requirements for the Project Scope of Work, as stipulated in this Project HSE Plan. Shall: • Provide visible leadership, systems and resources to work safely; • Ensure that required HSE activities are properly planned and controlled; • Monitor compliance with legal and contractual HSE requirements; • Ensure HSE risks on the project are identified and discussed with all parties involved; • Ensure timely close-out of HSE concerns / HAZID actions raised during the project; • Familiarise senior offshore personnel with HSE objectives and requirements during the project mobilisation meeting; • Ensure availability of materials, tools, PPE and procedures required prior to start of activities; • Ensure changes to approved procedures are addressed as per the Management of Change procedure.
Nord Stream	On/offshore	HSE Manager	• Develop and maintain the Project HSE Plan and Environmental Protection Plan for the construction works; • Review the HSE Plans and procedures provided by the sub-subcontractors for compliance with contractual HSE requirements; • Discipline review of applicable Allseas project procedures; • Provide assistance to Assistant Project Manager to verify adherence to the HSE requirements by means of general follow-up, audits or inspections; • Provide specialist advice to the project team and vessel(s)/site(s); • Facilitate HAZID reviews; • Lead project HSE audits, as required; • Liaise with Safety Officer onboard on project related HSE issues; • Raise HSE issues at internal progress meetings; • Advise Project Manager on project safety statistics / key performance indicators.
Nord Stream	On/offshore	Discipline Specialist	• Liaise with QHSE Engineer on HSE requirements / safety studies during job preparation, as required; • Embody good practice into procedures; • Familiarise with site HSE rules, when making visits; • Participate in HSE Audits and HAZID meetings, if required

Table 2. The table defines Nord Stream's Project HSE organisation and management roles.

5.2 Project Construction Control Management Plans (CMPs)

The Project construction phase is managed through a suite of Construction Management Plans (CMPs) as follows:

- Munitions;
- Seabed Intervention;
- Offshore Pipe lay;
- Employment and Training;
- Vessels and Marine Transport;
- *Russian Landfall;*
- *German Landfall;*
- Pollution Prevention;
- Hazardous Materials;
- Waste;
- Emergency Preparedness;
- Third Party Health, Safety and Security;
- Stakeholder Engagement;
- Cultural Resources;
- Fisheries;
- Biodiversity;
- Pre-Commissioning and
- Compensation.

Each CMP provides detailed information, requirements and minimum environmental standards relating to either a specific construction activity (e.g. seabed intervention) or an environmental/social issue (e.g. waste management). In this way the topics address the environmental and social management, mitigation and monitoring actions to be undertaken by Nord Stream and have been developed as the basis for Contractors Implementation Plans (CIPs), which detail the procedures by which Nord Stream`s permit conditions and commitments are met during the construction phase. The CIP documents how the management and monitoring actions that are contractor responsibilities (as reflected within the CMPs) are implemented and controlled.

Nord Stream has developed a compliance assurance programme to ensure that the Project contractors properly implement their CIPs. The contractor's compliance with the defined procedures is monitored through offshore inspections and reporting, for example compliance assurance during:

- Vessel safety audits by a marine warranty surveyor prior to mobilisation; and
- Periodical on-site environmental and safety inspections during rock placement and pipe-laying by an environment, health and safety representative.

During construction the contractors are required to prepare routine progress and field reports and Nord Stream is maintaining regular notification and liaison with the relevant authorities throughout the works.

The following selected Construction Management Plans are applicable and of relevance in the Swedish EEZ and reflects the permit conditions and commitments made by Nord Stream in a topic based approach.

5.2.1 Munitions Clearance

This CMP describes the mitigation and monitoring measures for munitions, including those to be implemented by the Munitions Clearance Contractor to affect the environmental and social mitigation measures.

Monitoring arrangements are developed by the contractor following the monitoring protocols and includes assessments of:

- Possible mammals prior to detonation to avoid injury or death;
- Seabed crater creation: Pre- and post-detonation surveys are being undertaken at detonation sites by means of ROV visual inspection in order to determine crater size;
- Post-detonation monitoring to estimate the quantity of any dead fish and other marine vertebrates;
- Pre- and post-detonation inspection of the integrity of objects located within a 1km radius from munitions by means of ROV visual inspection; and
- Ship traffic monitoring.

Further Swedish country specific details are available in the document 'Monitoring measures for Munitions Clearance Sweden[2].

5.2.2 Seabed Intervention

Minimum monitoring requirements identified in each country are focused on the impacts of potentially greatest significance. In Swedish EEZ this is estimated to be the post-lay trenching, based on the significance of the source of impact and the sensitivity of the potential receptors.

Swedish country specific details are available in sections 7.2.1, 7.2.2 and 8.2.1.

5.2.3 Offshore Pipe lay

Offshore pipe-lay is not leading to any significant environmental or social impacts provided that the proposed mitigation measures, as stated in the Environmental Study, are appropriately implemented.
As such the monitoring requirements are focused on:

- Verification that all identified mitigation measures are appropriately implemented
- Surveys (these are to be performed by the pipe-lay contractor and are described below).

The monitoring requirements are being coordinated with those of other construction activities and in particular the monitoring requirements described in the Seabed Intervention CMP (which, for example, also includes turbidity/suspended sediment monitoring requirements).

The Offshore Pipe-Lay Contractor is undertaking the following monitoring activities:

- Verification that all identified mitigation measures are appropriately implemented
- A pre-lay survey is being performed just prior to the commencement of construction work to confirm the previous route surveys and to ensure that no new obstacles are found on the seabed

[2] Nord Stream AG, 2010, Monitoring measures for Munition Clearance Sweden, G-PE-PER-REP-000-MunCleSE-B.

- Monitoring of the touchdown point of the pipeline by remotely operated vehicle (ROV) in order to visually confirm the integrity of the pipeline on the seabed and that sensitive areas (such as munitions, cultural heritage sites etc.) have been avoided
- An as-laid survey is being performed once the pipelines have been laid on the seabed by the pipe-laying vessel to document the pipe-laying. The survey is establishing the as-laid position and condition of the pipelines and is comprising:
    - o Bathymetry and side scan sonar measurements
    - o Visual inspection by ROV.

5.2.4 Employment and Training

Subsidiary objectives in the context of employment and training include assessment of the impact of ongoing activities and ensuring that the potential for negative environmental and social impacts are minimised in project implementation. Nord Stream has documented the process by which monitoring, measurement and reporting of the impact of activities associated with the Project is undertaken to ensure compliance with regulatory requirements and operational control parameters, and to measure performance against the HSES policy, HSES objectives and target and Key Performance Indicators (KPIs).

5.2.5 Vessels and Marine Transport

Nord Stream is appointing a Company Representative for each major contract. The Company Representative is responsible for reviewing the HSE performance of the assigned contractor and ensuring that the contractor incorporates all EIA commitments and permit conditions into the contractor's method statements. All the monitoring requirements relating to marine vessels apply to the vessels operated by contractors.

Nord Stream monitors and reports on compliance with MARPOL and HELCOM standards.
Relevant standards have been developed for:

- NOx emissions from diesel engines;
- SOx emissions;
- Oily discharges;
- Sewage discharges; and
- Other discharges to sea (including ballast waters and drainage water).

Further Swedish country specific details are available in section 9.2.3.

5.2.6 Pollution Prevention

The Pollution Prevention CMP documents the actions and measures necessary to prevent, or significantly control, pollution impacts on environmental and/or human receptors. It covers environmental planning, emissions to air, water protection, wastewater streams, noise nuisance, environmental monitoring and equipment engineering requirements. The Pollution Prevention CMP details specific pollution control measures to be implemented by Nord Stream and/or Nord Stream's Contractors. The measures are derived from EIA and ES findings, as well as international standards and national legislations.

5.2.7 Hazardous Materials

Nord Stream is not operating its own hazardous materials storage facilities. Consequently, monitoring is limited to compliance monitoring of the main contractor and subcontractor's management of hazardous materials via a periodic audit programme.

Verification monitoring requires internal and external audits of hazardous materials management and implementation of the hazardous materials, including:

- Legal compliance
- Transportation
- Storage (including temporary storage ahead of final disposal), security and segregation
- Competency and training records
- Handling
- Availability, suitability and use of Personal Protective Equipment (PPE)
- Management practices, risk assessment and hazardous material inventories

5.2.8 Waste

Compliance monitoring of the main contractor and sub contractor's waste management performance is taking place through a periodic audit programme.

The contractor and sub contractor's monitoring is e.g. including.

- Waste management compliance - All waste contractors are evaluated and monitored against the Nord Stream Waste Management Policy.
- Records and reporting - Records of the quantities and types of waste generated is maintained including source, duty of care documentation, storage, transfer and disposal details. Such data shall be periodically (e.g. monthly) be reported.
- Regular monitoring of wastes disposal.
- Training for Waste management.

5.2.9 Emergency Preparedness

Nord Stream is appointing a Company Representative for each major contract. The Company Representative is responsible for reviewing the HSE performance of the assigned contractor and ensuring that the contractor incorporates all EIA & ES commitments and permit conditions into the contractor's method statements. These responsibilities of the Company Representative include ensuring contractor compliance with the emergency preparedness requirements of the Source Documents and of the Emergency Preparedness CMP. The contractor defines in its Emergency Preparedness CIP the responsible persons and their duties. This includes, in the case of offshore activities, a description on how the interface between vessel and construction crews is managed.

5.2.10 Third-party Health, Safety and Security

Nord Stream is appointing a Company Representative for each major contract. The Company Representative is responsible for reviewing the HSE performance of the assigned contractor and ensuring Third Party Health, Safety and Security. As part of the CIP for Third Party Health, Safety and Security contractors are required to specify monitoring provisions for each mitigation and management measure for which the contractor has responsibility.

5.2.11 Stakeholder Engagement

To monitor its performance Nord Stream is establishing a stakeholder database to record communications with stakeholders. Performance in communication with stakeholders and managing any grievances is reported on a quarterly basis during construction and annually during operation. This is used to identify any trends in stakeholder comments, to evaluate the effectiveness of the engagement process and to identify improvement opportunities.

5.2.12 Cultural Resources

In terms of monitoring requirements for Cultural Heritage, the pipe lay Contractor should undertake post installation monitoring in accordance with the commitments to confirm the level of impact on any cultural artifacts i.e. that the pipeline is correctly positioned and has not had any adverse effect on cultural heritage. Nord Stream ensures that the contractor incorporates all commitments and permit conditions into the contractor's method statements.

Further Swedish country specific details are available in section 9.2.1.

5.2.13 Fisheries

Overall principles governing monitoring requirements for fisheries are defined as:

- Monitoring undertaken during construction activities is sufficient to verify impact predictions.
- Monitoring undertaken post-construction is used to assess the recovery of the seabed. Construction activities that may have potentially significantly impacts on fish are primarily those associated with: pressure/sound waves generated during munitions detonation and sediment release (principally from dredging activities etc, in Swedish EEZ however only post-lay trenching - no dredging activities). Monitoring requirements specific to such activities and potential impacts are addressed in the Munitions, Seabed Intervention and Offshore Pipe-lay CMPs.

Monitoring requirements associated with fisheries impacts from construction include:

- Monitoring of interactions of fishing vessels with construction vessels and activities
- Monitoring of adherence to the construction restriction periods at sensitive fisheries locations

Further Swedish country specific details are available in section 8.2.3 and 9.2.4.

5.2.14 Biodiversity

This section describes the monitoring measures implemented in relation to activities impacting on biodiversity in order to gauge the effectiveness of the environmental and social mitigation measures. An overview of the necessary actions in the planning and implementation phases is detailed in the following chapters. Nord Stream is appointing a Company Representative for each major contract. The Company Representative is responsible for reviewing the HSE performance of the assigned contractor and ensuring that the contractor incorporates all ES commitments and permit conditions into the contractor's method statements. It is anticipated that such requirements may vary from country to country and is detailed in the Post- Permit CMP.

6 Technical Inspections

Regular inspection surveys of the pipeline system are carried out as part of the inspection, maintenance and repair (IMR) programme through the operation phase. The main goal of inspection surveys is to ensure the safe and reliable operation of the pipeline system throughout its lifetime. Basic requirements to inspections of the pipeline system are established in Offshore Standard DNV-OS-F101, which is the governing code for design, construction and operation of the Nord Stream Pipeline System.

Before the start of operation of the pipeline system an Inspection Programme is developed. It describes the main types of inspections, their requirements and frequency. All the inspection require-

ments identified during the design phase as affecting the overall pipeline integrity (safety and reliability) during operation is covered in the Inspection Programme.

Four types of inspections are foreseen:

- External offshore inspection for the main marine section of the system (deeper than approximately 15 meters)
- Internal inspection over the full pipeline length (pig-trap to pig-trap)
- Shallow water and onshore inspections surveys using geophysical surveys of the buried sections (Russia and Germany)
- External inspections of the exposed onshore sections (Russia and Germany)

External Offshore Inspection evaluates the pipeline seabed configuration and the external condition of pipelines. This inspection survey is executed from onboard of a vessel equipped with ROVs or AUVs having visual, acoustic and electro-magnetic instruments. During offshore external inspection the following is determined:

- Pipeline plan position and vertical profile
- Adjacent seabed profiles
- Presence of objects in the vicinity of the pipeline
- Condition of pipeline concrete weight coat and field joints
- Condition of the anodes (cathodic protection level)

All collected data are compared with previous surveys to allow comparison to the design and as-built condition. Historical trending is used to assess the development of such items as freespans, seabed scour, areas prone to damage, and consumption and physical loss of anodes (prediction of anode wastage).

Internal inspection is executed with internal pipeline gauges (so called pigs). Intelligent pigs that run through the entire pipeline length with the gas flow, to inspect for possible metal losses of pipeline body due to corrosion and change of local pipe geometry (dents).

Shallow water and onshore inspections surveys of the buried sections: these surveys utilize geophysical techniques to confirm the seabed bathymetry, plan position of the pipeline, the depth of burial and less frequently the cathodic protection. Historical trending of the gathered survey data is used to assess such parameters as the long term stability of the seabed and pipeline depth of burial.

External inspections of the exposed onshore sections mainly concern ground stability, condition of the pipelines and associated infrastructure and the cathodic protection.

The Inspection Programme also provides for special inspections in case of any unexpected events, which may impair the safety and reliability of the system. If the pipeline parameters are discovered to deviate critically from the design limits in any of the inspections, appropriate maintenance or repair programme is implemented.

The first inspections under the Nord Stream Inspection Programme takes place as soon as possible after putting the pipeline system into operation. These first surveys are baseline inspections. The frequency of following inspections depends on the results of baseline inspections and likewise, the starting date of each following inspection depends on the results of the previous one.

7 Environmental Monitoring during Construction

7.1 Scope and Schedule

Environmental monitoring during construction in Swedish EEZ addresses the impacts that may result from the following construction activities (for two pipelines laid successively):

- Post-lay trenching
- Rock placement (pre-lay and post-lay)
- Pipe-laying

The pipeline construction period is estimated to last for approximately 2.5 years. The construction time schedule is based on a planned start of the overall work in March 2010, for different construction related activities in Sweden, which are shown in table 3.

Timing of monitoring during construction follows the construction schedule and therefore the monitoring activities will in many cases not be a continuous process.

Before the pipeline construction can start, munitions have to be cleared from the security corridor and partially from the anchor corridor. The clearance is carried out during the period from March to May 2010 and is for the Swedish EEZ expected to last for a few weeks. Monitoring during munitions clearance in Swedish EEZ is presented in the document 'Monitoring measures for Munitions Clearance Sweden'[3].

In order to ensure the integrity and stability of the pipelines, rock placement operations have to be carried out. The pre-lay intervention works in Swedish EEZ are only planned for a few locations for each pipeline. It has been estimated that it will take a few days to place the rock at those locations. In the Swedish EEZ there are also rock berms to the east of Gotland for the hyperbaric tie-in and it has been estimated that installing these rock berms will take a couple of weeks.

[3] Nord Stream AG, 2010, Monitoring measures for Munition Clearance Sweden, G-PE-PER-REP-000-MunCleSE-B.

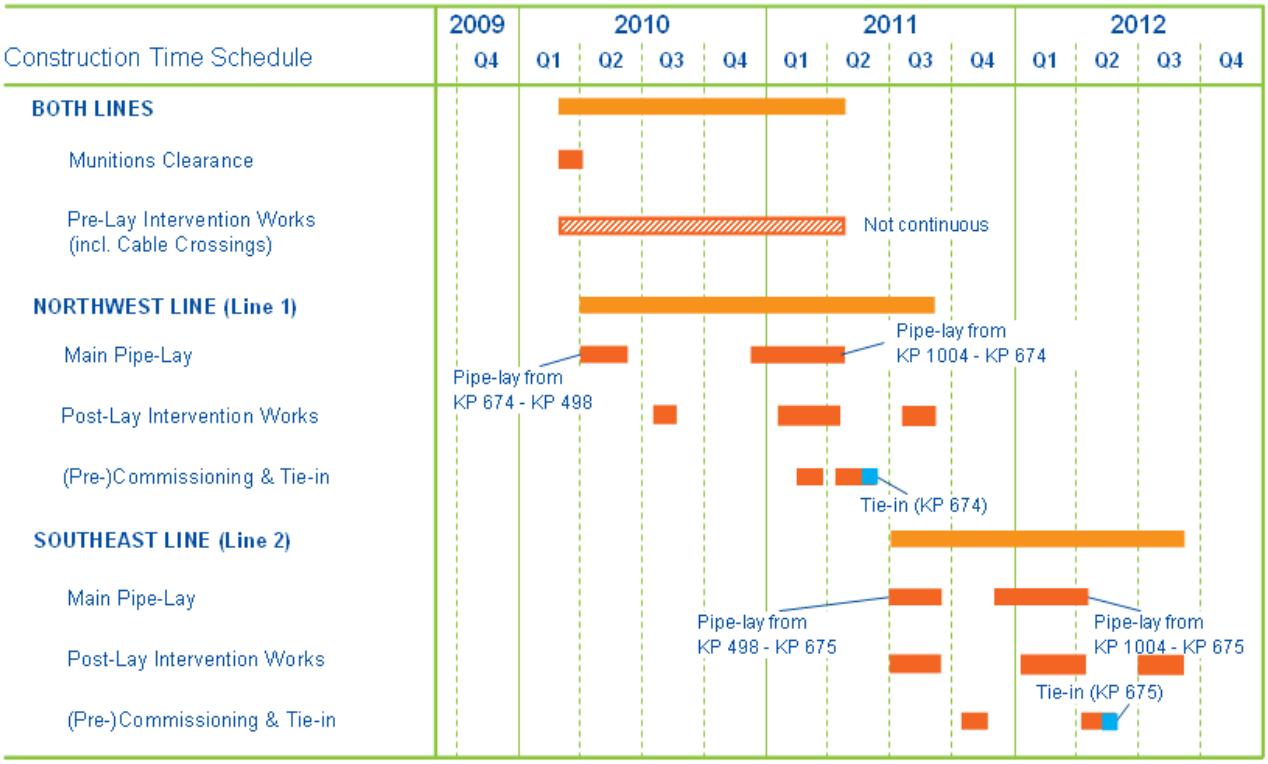

Table 3. The table presents Nord Stream's planned construction schedule in Sweden.

The laying of the first pipeline is planned to start in the Swedish EEZ in April 2010 and the vessel is starting the laying at approximately KP 674, going in a northern direction towards Finland, and is planned to reach the Finnish border at KP 498 in early June 2010. The other section within Swedish EEZ, from KP 1004 to KP 674, is planned for pipe lay from December 2010 until April 2011. The construction of the second pipeline within Swedish EEZ is planned from July to September 2011 for the section between KP 498 and KP 675, and from December 2011 until April 2012 for the section from KP 1004 to KP 675.

Post-lay trenching is planned to commence shortly after the pipeline installation to ensure the "on-bottom stability", in other words to ensure that the pipelines are stable and not able to move on the seabed. The time period, when post-lay trenching is planned to be performed in Swedish EEZ is between mid-February and mid-April 2011 for the first pipeline and between mid-February and mid-April 2012 for the second pipeline.

The following figure 1 presents the seabed intervention works planned to be carried out in Swedish EEZ. Further Swedish country specific details are available also in sections 7.2.1 and 8.2.1.

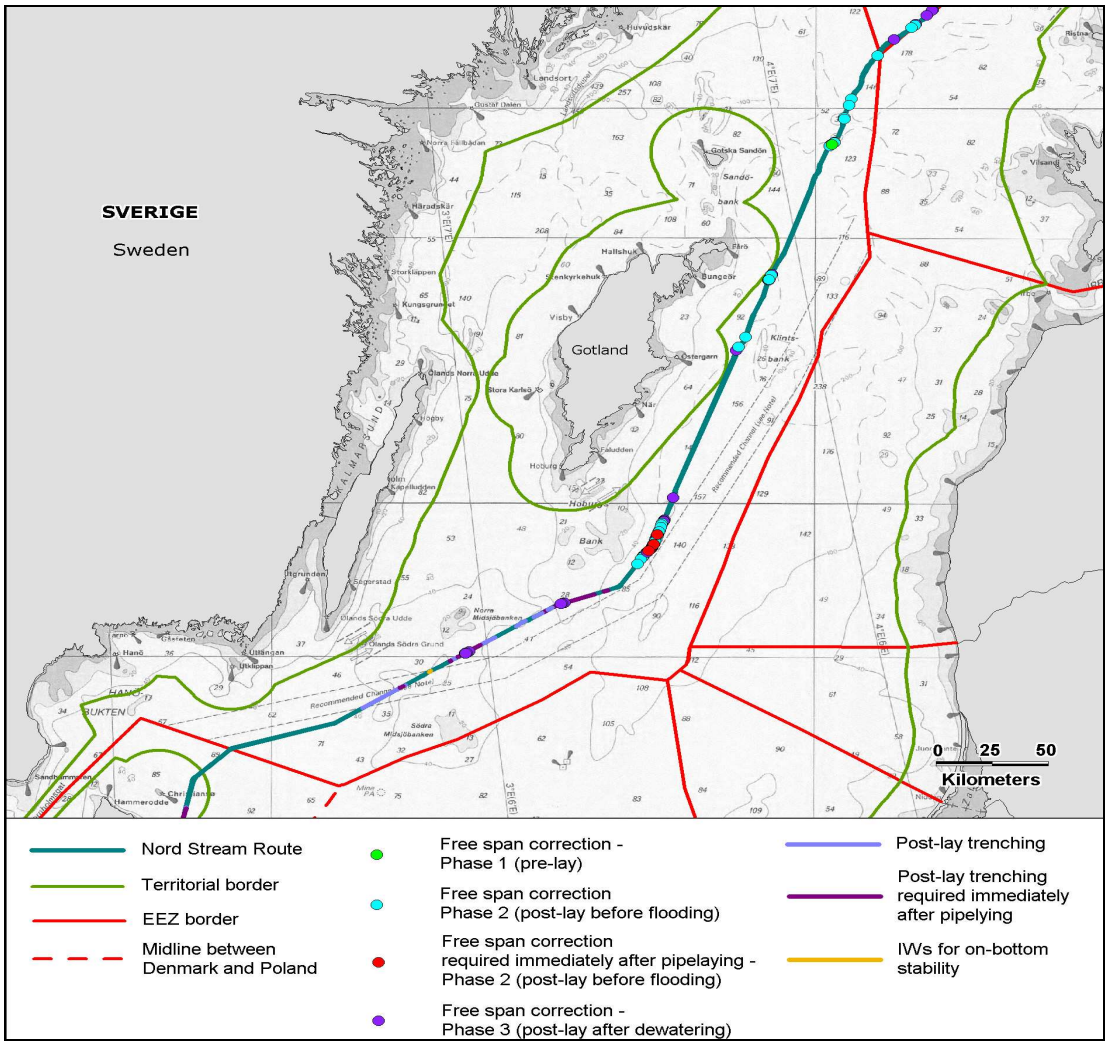

Figure 1. The map presents the seabed intervention works in the Swedish EEZ.

7.2 Monitoring Activities

The programme presented in this chapter concentrates on the environmental monitoring activities carried out during construction in the Swedish EEZ.

Based on the results of performed environmental assessments, environmental monitoring during construction in the Swedish EEZ concentrates on the following:

- Seabed morphology
- Turbidity
- Sediments
- Eco-toxicological effects (mussels)

The objective of environmental monitoring during construction is to:

- Assure compliance with the permit conditions and to address the requirements
- Confirm the assessments in the Swedish Environmental Study

The monitoring programme is mainly developed for the first pipeline and is reviewed by following an analysis and reporting of the results, and a modified programme may be implemented for the sec-

ond pipeline installation (in accordance with the permit condition of having the monitoring programme under regular review). In this context there is also opportunities to apply lessons learned from monitoring results potentially near to the monitoring site, in subsequent sections of the construction activities along the route and for the second pipeline (in compliance to the Nord Stream and Contractors HSE regulations).

7.2.1 Seabed Morphology

Prior to pipe-laying the existing seabed conditions including the seabed bathymetry and presence of obstacles on the directly affected seabed is surveyed by means of an ROV instrumented with multi-beam echo sounder or similar, sonar and video cameras. Also the condition of the pre-lay rock berms per design is controlled as a part of the pre-lay survey. After pipe laying as-laid surveys of the pipelines are performed to document their position and condition, by using the same devices.

After pipe-laying follows the post-lay rock placement and post-lay trenching. During and after the post-lay rock placement the condition of the rock berms and the pipelines is verified by means of an ROV instrumented with multi-beam echo sounder or similar, sonar and video cameras. Prior to post-lay trenching the presence of obstacles, pipe position and condition is surveyed by means of an ROV instrumented with multi-beam echo sounder or similar, sonar and video cameras. After the post-lay trenching the trench depth and the condition of the pipe is documented using the same devices.

An as-built survey is performed after the construction of the pipelines has been completed, i.e. in the Swedish EEZ after the post-lay seabed interventions. The survey documents the pipeline configuration and that the integrity of the pipeline has been maintained. The as-built survey is an external inspection conducted by means of an ROV instrumented with multi-beam echo sounder or similar, sonar and video cameras and side-scan sonar. The monitoring programme for seabed morphology is presented in Table 4.

Seabed morphology monitoring					
Project activity	**Parameter**	**Unit**	**Method**	**Location**	**Timing**
Pre-lay rock placement	Obstacles	Yes / no, location (E,N)	Instrumented ROV with multi-beam echo sounder, sonar and video cameras	All pre-lay rock placement locations	Prior to pre-lay rock placement
	Seabed bathymetry	m (depth)			
	Condition of rock berms	m^3 (volume), m (height)			Monitoring berm during placement
					After pre-lay rock placement
Pipe-laying	Obstacles	Yes / no, location (E,N)	Instrumented ROV with multi-beam echo sounder, sonar and video cameras	Full length of installation corridor	Prior to pipe-laying (pre-lay survey)
	Seabed bathymetry	m (depth)			
	Rock berm – per design	m (height)			
	Pipe position	m (E, N, depth)		Intermittent	During pipe-laying
	Pipe position	m (E, N, depth)		Full length of pipeline	After pipe-laying (as-laid survey)
	Pipe condition	intact / damage			
Post-lay rock placement	Condition of rock berm and pipe	m^3 (volume), m (height), Intact / damage,	Instrumented ROV with multi-beam echo sounder, sonar and video cameras	All post-lay rock placement locations	Monitoring berm during placement
					After post-lay rock placement
Post-lay trenching (ploughing)	Obstacles	Yes / no	Instrumented ROV with multi-beam echo sounder, sonar and video cameras	Sections where post lay trenching are required	Prior to and after trenching
	Pipe position	m (E, N, depth)			
	Pipe condition	intact / damage			
	Trench depth	m (depth)			
	Pipe condition	intact / damage			
Post- construction	Pipeline integrity, extent of rock berms and seabed conditions	Intact / damage, m^3 (volume), m (height), m (free spans length and height)	Instrumented ROV with multi-beam echo sounder, sonar and video cameras, Side scan sonar	Sections where post lay interventions have been performed	After post-lay rock placement or other intervention (as-built survey)

Table 4. The table presents the monitoring programme for seabed morphology during construction in the Swedish EEZ. (It excludes the munitions clearance and socio-economic monitoring parts and concentrates on the main construction activities in the Swedish EEZ.)

7.2.2 Turbidity, Sediments and Eco-toxicological effects

The monitoring programme for turbidity, sediments and eco-toxicological effects (mussels) is focused on the post-lay trenching construction activities and the Natura 2000 conservation areas; Hoburgs bank and Norra Midsjöbanken in the Swedish EEZ. It has been planned to assure compliance with the conditions of the given permit for the Swedish EEZ, which includes a requirement for not exceeding the concentration of suspended sediments beyond 15 mg/l at the border to the Natura-2000 areas; Hoburgs bank and Norra Midsjöbanken. To comply with this requirement, four long-term monitoring stations are equipped with data transmission ability in order to facilitate on-line transmission of current and turbidity measurements. The turbidity measurements can be further converted to mass concentration of suspended sediments based on calibration against previously extracted water samples. In that way, compliance with the permit requirement, regarding a guideline value of maximum increased sediment concentration of 15 mg/l resulting from construction works at the border of Hoburgs bank and Norra Midsjöbanken, can be assured on a real-time basis. Mitiga-

tion measures can also be implemented in case the measurements indicate a possible triggering of the concentration limit. The purpose of the long term monitoring stations is to measure the suspended sediment concentrations/turbidity at the border of the Natura 2000 areas; Norra Midsjöbanken and Hoburgs bank over a longer period that includes different current and weather situations, both before, during and after the period of post-lay trenching and thereby factor in the seasonal variables.

Nord Stream is prepared to implement mitigation and corrective measures in order to reduce turbidity levels should the threshold value be triggered. In the first instance, such corrective action includes a reduction in the post-lay trenching spread speed by 10% for a period of 200m. If the levels are still above the requirement a further 10% reduction in speed will be applied for a further 200m until suspended sediment concentrations are within the correct guideline value range. The procedure can continue until the post-lay trenching activity has stopped and until suspended sediment levels return to acceptable levels.

Increased suspended sediment concentrations from the post-lay trenching activities is monitored through four long-term monitoring stations, sediment traps and mussel cages at the boarder to the Natura 2000 areas; Norra Midsjöbanken and Hoburgs bank and with vessel born campaign monitoring along the pipeline in post-lay trenching sections in the vicinity of Natura 2000 areas (in compliance with Nord Stream and Contractors HSE regulations). The monitoring measurements factors in spatial and temporal variation of suspended sediment concentrations, current velocity and direction, conductivity, temperature, salinity and stratification of the water column in relation to seabed type (hard clay, soft clay and gravel/sand) and water conditions (oxic/anoxic, stratified/mixed) and enable a proper quantification of the overall re-suspension and dispersion resulting from the Project construction activities.

The vessel born campaign is planned to be carried out in the immediate vicinity of selected construction sites. The monitoring procedure is carried out by vessel operated automatic sensors. With the intention of calibrating and validating the results from automatic sensors, water samples are taken and analysed for turbidity profiles, mass concentration of suspended sediments, water temperature and conductivity.

The long-term monitoring is performed with Acoustic Doppler Current Profilers (ADCP). ADCP measures changes in underwater current field (current speed and direction) throughout the whole water column. The stations are also instrumented with an automatic turbidity sensor. The turbidity sensors are installed at three different levels above the seabed and it monitors the turbidity, conductivity, temperature and oxygen conditions.

Monitoring of eco-toxicological effects by measuring growth and accumulation of contaminants in benthic fauna (common mussel) is planned in the vicinity of the four long-term monitoring stations at the border to the Natura-2000 areas; Hoburgs bank and Norra Midsjöbanken. The applied monitoring method is mussel cages and the measurements also include the effects from turbidity and sedimentation. Potential changes in contaminant levels and natural variations are also assessed. To cater for natural variations the mussel references cages are located in areas characterized by similar seabed and depth conditions.

The monitoring programme for turbidity, sediments and eco-toxicological effects is summarized in Table 5 and more information is available in the document 'Monitoring programme for turbidity, sediments and eco-toxicological effects within Swedish EEZ[4].

Turbidity, sediments and eco-toxicological effects monitoring			
Project activity	**Parameter**	**Method**	**Location**
Turbidity (long term stations)	Spatial and temporal variation of suspended sediment concentrations, current velocity and direction, conductivity, temperature/salinity and stratification of the water column	ADCP with a turbidity sensor and CTD profile	4 ADCP stations, located at the borders of HB and NMB (Natura 2000 areas)
	Water samples for calibration of sensors, the mass concentration of suspended sediments, profiles of turbidity and of water temperature/conductivity	Water sampling for calibration and analysis	
Turbidity (vessel based)	Sediment plume dispersion, mass concentration of suspended solids in the vicinity of the construction spread	Vessel operated automatic sensoring	Along the post-lay trenching in the vicinity of HB and NMB (Natura 2000 areas)
Sedimentation	Qualification of the suspended sediment concentrations	Sediment traps	In the vicinity of the 4 long term turbidity stations at the borders of HB and NMB (Natura 2000 areas)
Eco-toxicological effects (common mussels)	Effects of turbidity, sedimentation and changes in contaminant levels	Mussel cages	In the vicinity of the 4 long-term turbidity stations at the borders of HB and NMB (Natura 2000 areas) and at reference sites on the banks

Table 5. Monitoring programme for turbidity, sediments and eco-toxicological effects during construction in the Swedish EEZ.

8 Environmental Monitoring during Operation

8.1 Scope and Schedule

The programme presented in this chapter concentrates on the monitoring activities carried out during operation in the Swedish EEZ.

Based on the results of performed environmental assessments, environmental monitoring during operation in the Swedish EEZ concentrates on the following:

- Seabed morphology
- Recovery of benthic fauna
- Fish and fishery
- Hydrographic Effects: Deep Water Inflow (DEN EEZ)

The objective of environmental monitoring during operation is to:

- Document the recovery of the Baltic Sea environment after construction
- Monitor that significant environmental effects are not caused during operation

Monitoring during operation is carried out until it can be assured that there are no unexpected impacts on the selected impact targets (~3years). If the outcome of monitoring is assessed to be non-significant or negligible the proposed monitoring changes are reported to the relevant authorities.

[4] Nord Stream AG, 2010, Monitoring programme for turbidity, sediments and eco-toxicological effects within Swedish EEZ, G-PE-PER-REP-100-04100000-B.

8.2 Monitoring Activities

8.2.1 Seabed Morphology

The seabed conditions surrounding the pipelines are checked at regular time intervals during external offshore inspections in the operations phase. At this time, any potential foreign objects in the vicinity of the pipelines are also detected. The inspection is carried out by means of an ROV instrumented with a multi-beam echo sounder or similar, sonar and video cameras. The aim of the inspection is to ensure the long-term pipeline integrity. The monitoring programme for seabed morphology during operation is presented in Table 6.

Seabed morphology monitoring					
Project activity	**Parameter**	**Unit**	**Method**	**Location**	**Timing**
Operation	Pipeline position, condition and adjacent seabed	Location, intact / damage, seabed profile	ROV instrumented with multi-beam echo sounder, sonar and video cameras	Entire pipeline length in the Swedish EEZ	At regular intervals for the lifespan of the pipeline

Table 6. Monitoring programme for seabed morphology during operation in the Swedish EEZ.

8.2.2 Recovery of Benthic Fauna

The monitoring programme for benthic fauna is directed at post-lay trenching, rock placement and pipe lay construction activities and in the vicinity of Natura 2000 conservation areas; Hoburgs bank and Norra Midsjöbanken in the Swedish EEZ. Monitoring is planned in order to evaluate and document the recovery of benthic fauna after construction and to confirm the assessment in the Swedish environmental study. The recovery is investigated and observed with the intention of evaluating the potential qualitative and quantitative changes in benthic 'infauna' communities and to identify the effects of the establishment of new habitats (artificial reefs) on 'epifauna' growth. If changes have occurred then the recovery of the benthic fauna and invertebrate communities is monitored. Reference sites are established in the Natura 2000 conservation areas; Hoburgs bank and Norra Midsjöbanken in order to address natural variations.

A baseline is established prior to construction and the recovery of benthic fauna is monitored once a year by using Van Veen grab sampling methods, and continuing for the first three years of operation. However, monitoring is planned to cease as soon as complete re-colonization has been proven and is reported to the authorities. The method for benthic sampling follows the guidelines in the Swedish Environmental Protection Agency's Handbook for Environmental Surveys: "Metodbeskrivning för provtagning och analys av mjukbottenlevande makroevertebrater i marin miljö" and the HELCOM guidelines for soft bottom sampling (Combine Program), where feasible. In order to assess the potential impact caused by the Nord Stream project, reference samples are taken prior to the commencement of construction works and preference in selecting the monitoring locations is given to sites with soft sediments (practicability of quantitative sampling). In addition, benthic fauna is sampled at sections, where the water depth does not exceed approximately 80 m, since long lasting anoxia prevents propagation of invertebrates in deeper waters. Based on the natural distribution of sediments and concerns voiced in relation to Natura 2000 conservation areas (Norra Midsjöbanken and Hoburgs bank), the benthos investigation transects are restricted to the area from the pipeline in the direction of the Natura 2000 sites Norra Midsjöbanken and Hoburgs bank. In addition to the sampling, fouling communities are documented by means of visual inspection during the external technical inspection (artificial reefs effect).

The monitoring programme for benthic fauna during operation is summarised in Table 7 and more information is available in the document 'Monitoring programme for benthic fauna within the Swedish EEZ'[5].

Recovery of Benthic Fauna Monitoring			
Project activity	**Parameter**	**Method**	**Location**
Benthic infauna	Evaluate potential qualitative and quantitative changes in benthic fauna communities	Van Veen grab	East of Hoburgs bank and Norra Midsjöbanken (transects from pipeline to the borders of Natura 2000 areas)
Benthic epifauna	Identify the establishment of communities on the new habitats (artificial reefs)	Visual inspections	Pipeline on seabed between Hoburgs bank and Norra Midsjöbanken
			Pipeline on seabed after rock placement in the vicinity of Hoburgs bank
			Pipeline on seabed after trenching in the vicinity of Norra Midsjöbanken

Table 7. Monitoring programme for benthic fauna during operation in the Swedish EEZ.

8.2.3 Fish and fishery

The monitoring programme for fish and fishery can be seen as a combined programme, due to the fact that the activities and results are interlinked, but is implemented with separate components. Fish monitoring is conducted with reference to post-lay trenching, rock placement and pipe lay construction activities and in the vicinity of Natura 2000 conservation areas; Hoburgs bank and Norra Midsjöbanken in the Swedish EEZ, while fishery monitoring covers the southern part of the Swedish EEZ.

The monitoring addresses possible effects on flora and fauna in the Natura 2000 areas (Hoburgs bank and Norra Midsjöbanken as being important spawning and nursery areas) for fish and due to the importance of fish both to the environment (indicator of environmental changes) and fishery from a socio-economical perspective in Swedish EEZ. The purpose of the programme is to describe and evaluate potential changes on fish communities and fish patterns (where feasible) so as to validate the impact assessment findings in the Swedish Environmental Study. Monitoring is also performed in order to respond to the concern raised by the Swedish Board of Fisheries and other stakeholders, regarding possible effects on fish and fish stocks inside the Natura 2000 areas; Hoburgs bank and Norra Midsjöbanken. The monitoring programme is in addition, designed to identify possible changes in distribution of fish and fish stocks caused by the pipelines during construction and operation. Further, if changes occur, they should be evaluated to find out if they can be attributed to the Nord Stream project or other anthropogenic changes or to natural factors.

The monitoring programme evaluates the potential impacts on demersal fish species, rather than pelagic fish as it is impractical to monitor the latter as they have a wide home range which makes it impossible to analyse the catches in relation to localised offshore infrastructure and construction influences. Demersal fishes can be investigated in deeper offshore waters by trawling and by gill nets, but should generally only be done above the halocline level in order to avoid zones of seasonal hypoxia.

[5] Nord Stream AG, 2010, Monitoring programme for Benthic Fauna within the Swedish EEZ, G-PE-PER-REP-100-04140000-B.

It's assessed that results from three years monitoring data, post establishment of the pipelines are required to obtain a statistical basis for evaluation of the fish results. Monitoring could however be terminated as soon as no impacts can be detected. For example, if the results from the monitoring programme for turbidity, sediments and eco-toxicological effects within Swedish EEZ validates that there are no effects in the vicinity of the Natura 2000 areas; Hoburgs bank and Norra Midsjöbanken, the termination is proposed to be discussed with the relevant authorities. The duration for monitoring of fishery is proposed to be five years after start of operation of the first pipeline.

The monitoring programme for fish and fishery during operation is presented in Table 8 and more information is available in the document 'Monitoring programme for the fish and fishery within Swedish EEZ'[6].

Fish and Fishery Monitoring			
Project activity	**Parameter**	**Method**	**Location**
Fish	Demersal Fish communities variations from one year to another addressing qualitative and quantitative changes	Fish station surveys by echo sounder, gill net and trawls, species sampling, visual inspection	Pipe lay direct on the seabed, in the vicinity of Norra Midsjöbanken
			Rock placement, East of Hoburgs bank
			Post-lay trenching, in the vicinity of Norra Midsjöbanken
			Natura 2000 areas, Hoburgs bank and Norra Midsjöbanken
Fishery	Demersal Fishery patterns Changes in fish species and catch variations from one year to another	Trawl patterns based on satellite track data and log books	Southern part of Swedish EEZ

Table 8. Monitoring programme for fish and fishery during operation in the Swedish EEZ.

8.2.4 Hydrographic Effects: Deep Water Inflow in the Bornholm Proper (Danish EEZ)

During the Swedish Environmental Study process and public consultation phase a concern was raised in relation to the Nord Stream Project influence on the mixing efficiency for the deepwater inflow of saline water from Kattegat into the Baltic Proper. For this reason comparisons of hydrographic measurements before and after the construction will be undertaken. Baseline field investigations before construction are done during 2010, starting in January and continuing approximately one year, and the post-construction investigations are planned for 2013. The survey aims to describe the bottom currents, interfacial friction and dissipation of inflow waters.

Monitoring is performed with an ADCP (Acoustic Doppler Current Profiler) with special emphasis on the lower part of the water column and with a CTD (Conductivity, Temperature and Depth recorder) with special emphasis on the lower 15-20m part of the water column with the first point approximately 1 m above the seabed. Hydrographic measurements (velocity, temperature, salinity) of both deep water and of intermediate water inflow is carried out at KP1035 in the Bornholm Proper in the Danish EEZ, but the results are to be reported to both the Swedish and Danish authorities.

There will also in addition be line-transect measurements of the full column velocity along the pipeline route between KP 1030 and KP 1070 during each service visit to the ADCP.

[6] Nord Stream AG, 2010, Monitoring programme for fish and fishery within Swedish EEZ, G-PE-PER-REP-100-04090000-B.

More information is available in the document 'Hydrographic effects: Deep water inflow in the Bornholm Basin'[7].

9 Socio-economic Monitoring

9.1 Scope

The programme presented in this chapter addresses monitoring activities to be carried out during construction and operation in the Swedish EEZ.

Based on the results of performed assessments, the socio-economic monitoring during construction and operation focuses on the following aspects:

- Cultural heritage
- Cable crossings
- Shipping (commercial)
- Fishery (commercial)
- Monitoring programmes (assessed impacts to national and international stations)

9.2 Monitoring Activities

9.2.1 Cultural Heritage

In order to prevent damage to cultural heritage sites during the pipe-lay (incl. anchor handling) or seabed intervention works, detailed security and anchor corridor surveys have been performed. The security and anchor corridor surveys consist of a geophysical assessment, visual inspection and an expert evaluation of findings. The Swedish Maritime Museums assessed the cultural heritage value of the objects found. Prior to construction the area of directly effected seabed is surveyed to verify the seabed conditions i.e. that there are no new objects. A controlled installation procedure, including the safety zones to be used, has been discussed with the Swedish Maritime Museums regarding the locations where archaeologically significant wreck sites should be safeguarded. The protection zone around cultural heritage sites is established to minimize the risk of impacts to these sites. In the vicinity of cultural heritage sites pipe-laying is also followed closely by ROV. For wrecks with a high cultural value a post-lay inspection will be done after the section installation.

Although detailed surveys have been carried out prior to construction work, there is always the chance of making accidental finds of cultural artifacts during construction works. If accidental finds are made, a Chance Finds Procedure in the Cultural Heritage Management Plan (CMP) is followed to avoid impacts. The procedure provides guidelines for actions to be taken, when dealing with accidental finds and provides instructions for documenting and reporting observations.

Based on the assessment, results the monitoring of impacts on cultural heritage in the Swedish EEZ focuses on the following objects:

- No wrecks were found in the security corridor, but several wrecks have been found in the anchor corridor in the Swedish EEZ. The aim of the wreck evaluations was to determine the cultural heritage value and to identify the origin of the wrecks both by age and type of vessel.

[7] Nord Stream AG, 2010, Hydrographic effects: Deep water inflow in the Bornholm Basin (Danish EEZ), G-PE-PER-REP-000-HydrogSE-B.

The procedures for wooden wrecks are slightly different from the procedures for steel/iron wrecks, but in both cases the entire vessel is surveyed including the deck and possible other items on the seabed around the wreck. This information formed the base for decisions regarding what wrecks to safe guard, the safety distances and anchor positions.

The table 9 presents the cultural heritage monitoring in Swedish EEZ.

Cultural Heritage monitoring			
Project activity	**Parameter**	**Method**	**Location**
Cultural heritage	Presence of new objects	Visual inspection via ROV	Installation corridor along the entire pipeline length
	Position and integrity of cultural heritage	Visual inspection via ROV	
	Integrity of cultural heritage	Visual inspection via ROV	Selected objects defined in the anchor corridor assessment

Table 9. Monitoring programme for cultural heritage in Swedish EEZ.

9.2.2 Cables

In order to prevent damage to cables, detailed technical solutions and agreements are negotiated with the cable owners. Crossings are constructed so that the pipelines and the cables remain a safe distance from each other. They are also constructed in such a way that avoids the cables being unduly stressed or loaded by the pipelines. At most crossings, cables on the seabed are covered/ buried, and the pipelines are elevated and supported by concrete mattresses or rock berms. In all instances, corrosion potential is taken into account and the necessary precautions are implemented.

The Nord Stream pipelines cross cables 10 times in the Swedish EEZ (5 cables per pipeline). Prior to the installation of a crossing the position of the cable is verified and after the installation an as-built survey of the crossing is performed. Both surveys are conducted by means of a visual inspection via ROV. The cable owners are notified prior to and after the crossing installation.

The pipeline is laid on the crossings using a controlled lay procedure, during which the pipe-laying is closely followed by means of an instrumented ROV. The condition of the crossing is monitored prior to the pipeline installation during the prelay survey and after installation during the as-laid survey. The figure 2 presents the cable crossings in Swedish EEZ.

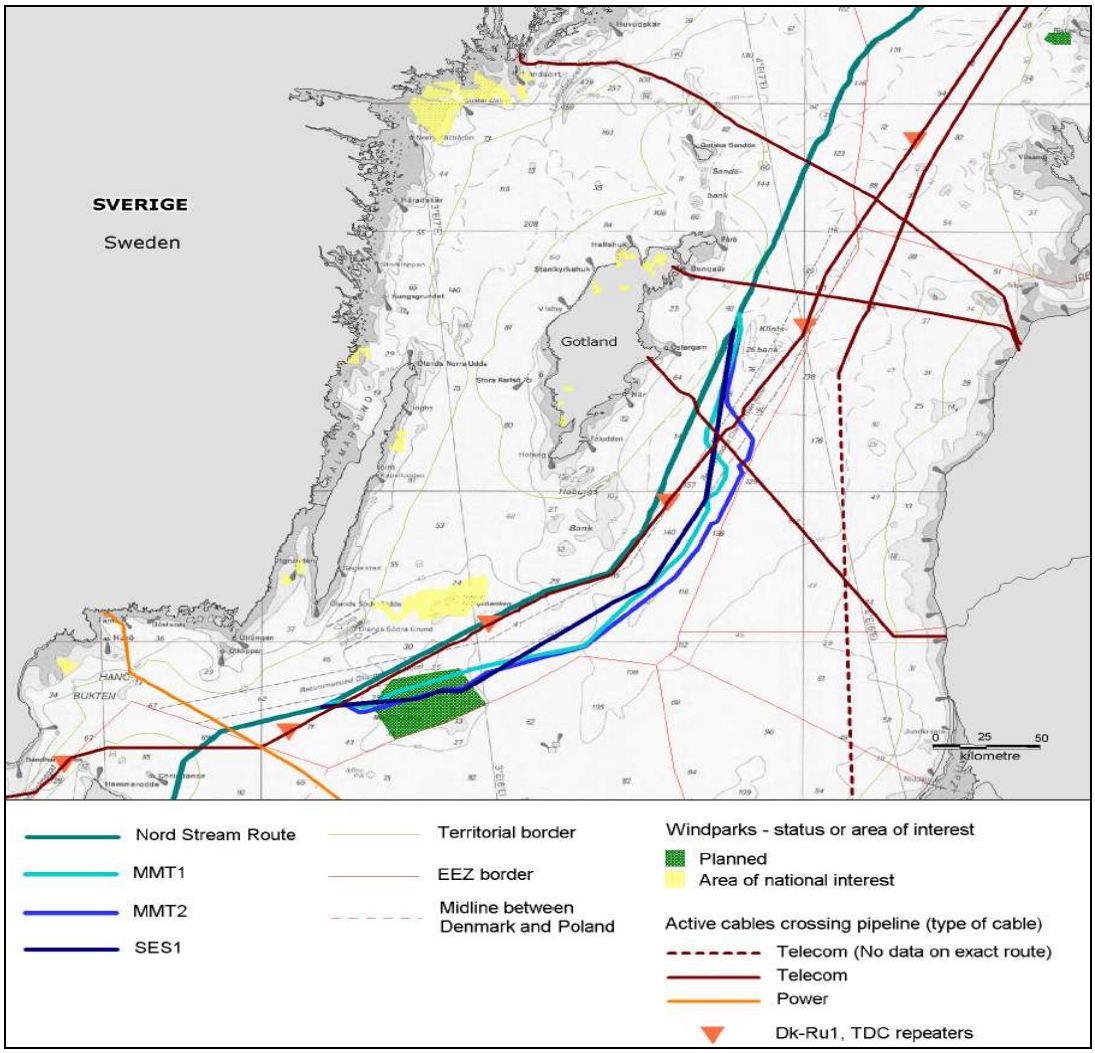

Figure 2. The map presents the cable crossings in Swedish EEZ, 3 telecom cables and 2 parallel power cables.

9.2.3 Shipping (commercial)

To reduce the frequency of potential collisions between commercial ship traffic and the vessels performing pipeline construction activities, mitigation measures are detailed in ship traffic management procedures (or plans).

The ship traffic management is applicable to the following construction activities in the Swedish EEZ:

- Pipe-laying
- Rock placement (pre-lay and post-lay)
- Post-lay trenching
- Cable crossings
- Munitions clearance
- Pre-commissioning and hyperbaric tie-in

The ship traffic management procedures are developed by the pipe-lay contractor to ensure the safety of third party shipping. The vessels use Automatic Identification System (AIS) for the identification and locating of vessels. Any unexpected vessels entering a 'closest point of approach' radius are contacted and monitored closely and if necessary the support vessels of the spread are used to alert them. In order to notify smaller vessels, fishing organizations and maritime organizations are informed prior to the commencement of construction works and updated during the performance of the construction works.

During the pipe-laying activities the movements of the vessels within the pipe-lay spread and third party shipping are monitored in accordance with a ship traffic management plan. The plan defines a safety zone of 2-3 km radius around the pipe-lay barge. Safety zones of varying sizes are established around all vessels performing underwater activities. No vessels are allowed to enter this zone without permission from the vessel's captain. The track and speed of any vessel approaching the safety zone is monitored, any vessel on course to enter the safety zone is contacted and requested to change course. In case radio contact with the vessel is not established, the pipelay spread supporting vessels are able to intervene and potentially intercept approaching vessel. During rock placement, post-lay trenching, munitions clearance, pre-commissioning and hyperbaric tie-in activities as well as survey works vessel movements are monitored.

Before and during construction the locations of the construction vessels are announced in 'Notices to Mariners' in order to increase the awareness of project generated ship traffic. Furthermore, navigational warnings via NAVTEX and VHF/MF will be issued in the affected areas so intervening vessels are aware of the locations of the lay barge, pipe carriers and intervention work vessels. When operating in the Swedish EEZ sector a daily report will be transmitted which include the vessel name, call sign, present position and planned route for the next 24 hours.

The Pipe lay Vessel, supported by Anchor Handling Tugs (re-positions the anchors to allow the movement of the pipe lay vessel), Pipe Carriers (3-4 vessels transporting single pipe joints from various onshore load-out points along the pipe route to the pipe lay vessel in order to maintain a constant supply of pipes) and a Supply Vessel (provides supplies to the pipe lay vessel approximately twice a week) are the vessels involved in the pipe lay procedure. The Tug Management System (TMS) is a computer and microwave communication system that is primarily used to position the tugs that are part of the pipe lay spread. The system is controlled by the Survey Party Chief (reporting to the Vessel Master) and provides the real time position of the tugboats. In addition to the position of the tugs, the location of the anchors and all other vessels that form the pipe lay spread are shown (in real time) on the video display units. In addition to the TMS for positioning the Anchor Handling Tugs, the pipe lay vessel has a real time Catenary Anchor Monitoring System (CAMS) to control the positions of the anchors in the water column. In line with the watch keeping procedures, onboard at the pipe lay vessel the traffic is constantly monitored visually and by radar. The pipe lay vessel transmits a safety report including position, direction and safe distance to vessels, if their course does not rule out a dangerous approach. Due to a higher traffic interaction frequency in the deep water shipping route, there is intensified monitoring for vessels. The figure 3 presents the coating yards, transhipment sites and the major shipping routes for the Project.

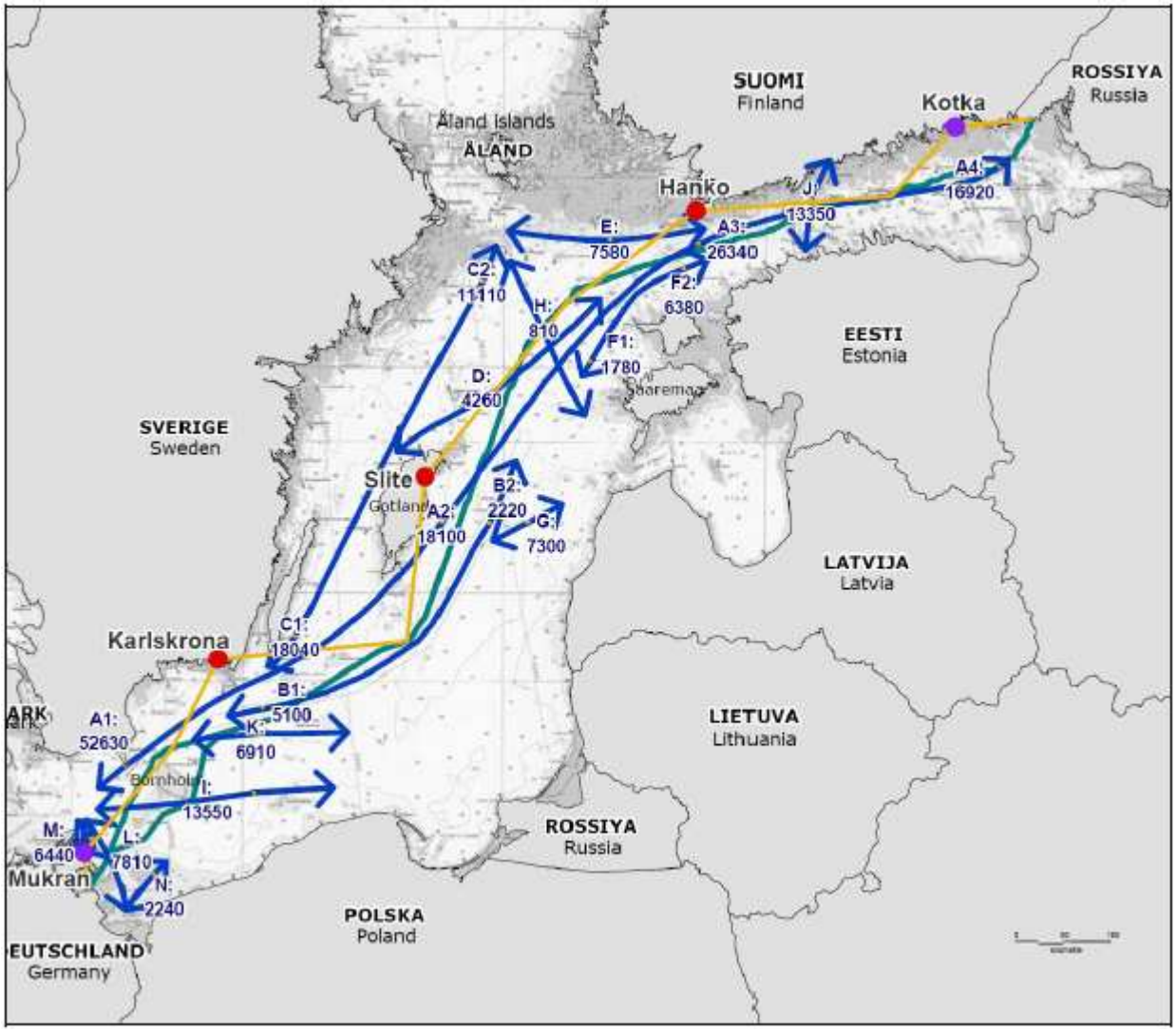

Figure 3. The map presents the coating yards (purple dots), transhipment sites (red dots) and the major shipping routes in the Baltic Sea.

9.2.4 Fishery, (commercial)

In order to minimise the risk of vessel collision, safety zones with varying radius are established around the construction sites. A negative impact of this mitigation measure is that potential fishing activities are excluded from the safety zone during the construction works. However, the effect is temporary and of short duration as the pipe-laying operation is a progressive, moving activity (approx 2.5 to 3 km per day) and the duration of other construction activities such as rock placement and trenching activities at different sites is short-term.

Prior to the commencement of construction activities Nord Stream has informed the fishing associations regarding the planned activities and safety zones of different construction works. Throughout the construction period regular information is made available, addressing construction vessels, work scopes, progress and potential safety concerns, including how to handle the interaction between fishing gear and the pipeline. Following the installation of the pipelines the as-built configuration is

provided to the fishing community. After that construction has been finalised, Nord Stream will apply to have the pipelines shown on nautical charts.

The future conditions for bottom trawling over- and in the vicinity of the pipelines have been raised as a concern by fishery communities. In addition, the Board of Fisheries has expressed a concern that fish are likely to gather around the pipelines, which makes them easier to catch. This could result in over fishing of fish stocks, which are not subject to quotas. Based on the Nord Stream commitments it has been decided to include the fishery patterns changes evaluation into the fish and fishery monitoring (further information in section 8.2.3). The objective of the fishery monitoring programme is therefore to investigate, if there is any change in the commercial fishery around the Nord Stream pipelines compared with fishing patterns before the pipelines were established. Further, if there is any change, the scale of impacts on the commercial fishery will be assessed. The trawl patterns are based on satellite track data and log books. More information is available in the document 'Monitoring programme for fish and fishery within Swedish EEZ'[8].

9.2.5 National and International Monitoring Programmes

In order to find out, if the pipe-lay affects governmental or international monitoring programs, reference station locations have been identified in relation to the pipeline route and related construction and operation activities. Monitoring station coordinates of both national and international monitoring programs have been investigated and the information concerning of location and measured parameters has been compiled. An assessment of impacts has been conducted and mitigation measures recommended.

Potential impacts on environmental monitoring stations could be caused, if:

- Monitoring activities coincide in time with construction work
- Monitoring stations are located close to areas with seabed intervention works (trenching or rock placement) and hence potentially affected by re-sedimentation of sediment that has been brought in suspension during construction
- Monitoring stations are very close to the pipelines and potentially affected by local changes in erosion/sedimentation patterns around the pipelines during pipeline operation

In the Swedish EEZ, the following types of environmental monitoring stations and measured parameters have been investigated:

- *Sediment contaminant stations:* The Geological Survey of Sweden, SGU, has stations to monitor contaminants in the sediments. Samples are taken from the upper sediments (0-10cm) to measure the concentrations of heavy metals and other environmental toxins. The monitoring stations are located in different basins to investigate the conditions in various parts of the Baltic Sea.
- *Marine biology stations:* At accumulating soft bottoms in the Baltic proper there are monitoring stations to investigate benthic macrofauna.
- *Pelagic water stations:* The measurements include physical and chemical parameters in the water column. At some of the stations content of phytoplankton and primary production is also measured. Samples and measurement are taken monthly or yearly. In the southern part of the Swedish EEZ there is a monitoring station with a fixed installation – a buoy, which measures wave height.

[8] Nord Stream AG, 2010, Monitoring programme for fish and fishery within Swedish EEZ, G-PE-PER-REP-100-04090000-B.

- *Helcom stations:* COMBINE programme with monitoring stations in the whole Baltic Sea. Various parameters are measured at different stations – physical and chemical measurements, phytoplankton and primary production, zooplankton, benthic fauna and microbiology. The stations are in most cases the same as national stations.

Figure 4 depicts the national and international monitoring station locations in the Swedish EEZ.

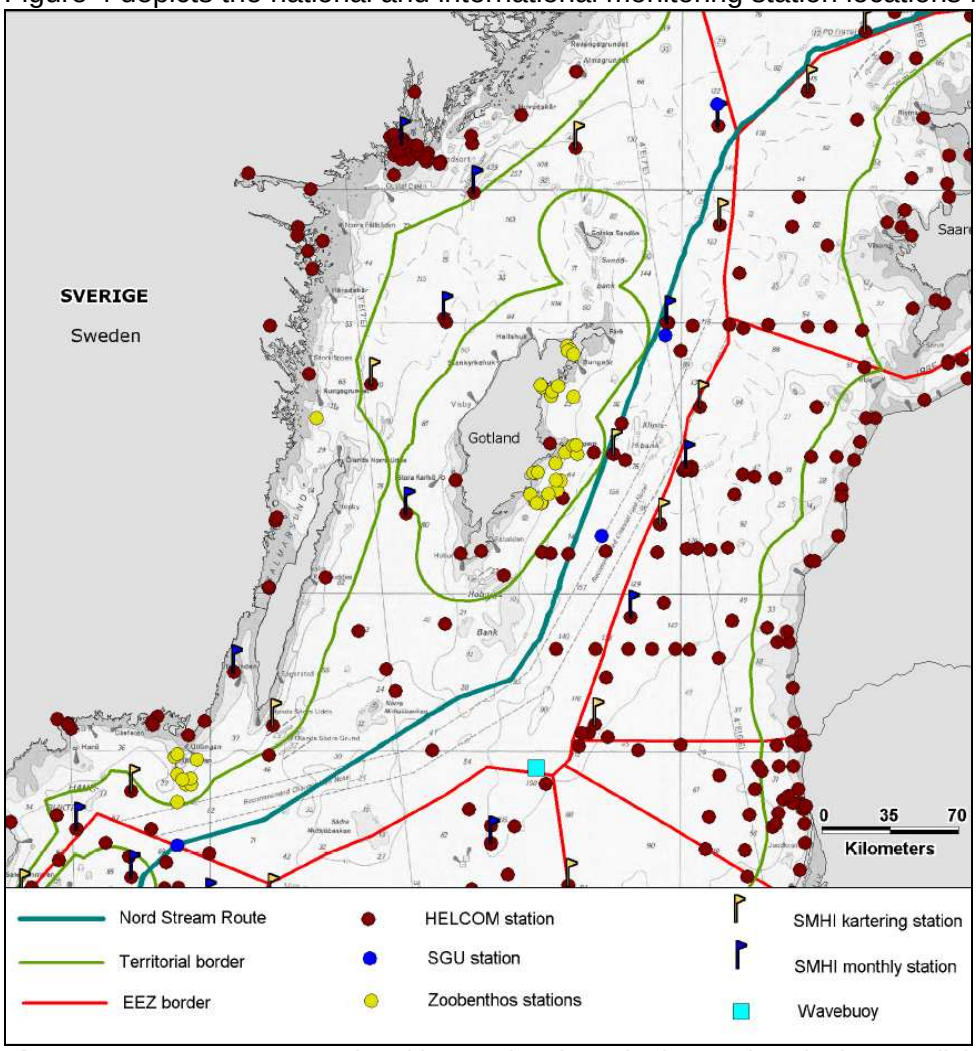

Figure 4. Governmental and international monitoring stations in the Swedish EEZ.

For a more detailed study of monitoring stations, those within 3 km from the pipeline route have been chosen and assessed in detail. Impacts from conflicts with the vessels involved in the construction work, increased sedimentation during construction and changes in sedimentation patterns during operation could be expected close to the pipeline route. Of the existing monitoring stations in the Swedish EEZ four stations are located within 3 km from the pipeline route (and one SMHI station in the Finnish EEZ). The impacts on these stations have been assessed further in Table 5. No significant impacts on monitoring stations are expected at distances more than 1.5 km from the pipeline route.

Name of station	Measured parameters	Distance to western pipeline Line 1	Distance to eastern pipeline Line 2	Assessment	Proposed mitigation
SGU contaminants **N Bornholm Basin** (SWE EEZ)	Contaminants in sediments	0.4 km	0.3 km	The station could be impacted by sediments from construction work and from change in sedimentation conditions.	SGU contacted and since monitoring could be impacted, mitigation measure is agreed. **The station will be relocated**.
SMHI kartering **BY13** (SWE EEZ)	Physical/ chemical properties in the water column	3.2 km	2.8 km	Unlikely that monitoring activities coincide with construction work and also unlikely that construction work will have an impact on monitoring vessel or samples. Monitoring will occur approx. once a year at the station.	SMHI contacted and has confirmed that monitoring will not coincide with the construction work during 2010. If the **construction schedule changes SMHI will be informed** and mitigation measures agreed.
SMHI kartering **BY27** (FIN EEZ)	Physical/ chemical properties in the water column (pelagic station)	0.8 km	1.6 km	Unlikely that monitoring activities coincide with construction work. Measures approximately once a year at the station, normally during the winter. Pipe lay in Finnish EEZ for the line 1 will not coincide with monitoring activities.	SMHI contacted and has confirmed that monitoring will not coincide with the construction work during line 1 construction. If the **construction schedule changes SMHI will be informed** and mitigation measures agreed.
Marine Research Centre at the Finnish Environment Institute **Algaline 11** (SWE EEZ)	Physical/ chemical/ biological properties in water column. Samples taking unattended (Ferry-Box) on cargo ships. Samples depths approx.5 m	0.4 km	0.3 km	Monitoring activities could coincide with construction works as the distance is short. A temporary impact due to the security zone around lay barge. But the construction works takes place at great depths and no changes in measured parameters expected.	Marine Research Centre contacted and as the monitoring is performed by using cargo ships there is no fixed monitoring time schedule. **Marine Research Centre to be informed and updated with the construction schedule.**
Marine Research Centre at the Finnish Environment Institute **HA3** (SWE EEZ)	Physical/ chemical properties in water column and zoo benthos	0.7 km	0.9 km	The station could be temporary impacted by sediments from anchor handling. The anchor handling is however assessed to have no impact on zoo benthos. Station has normally anoxic conditions with no macrozobenthos present.	Marine Research Centre contacted. **Marine Research Centre to be informed and updated with construction schedule**.

Table 5. An assessment of monitoring stations in the vicinity of the pipeline route in the Swedish EEZ.

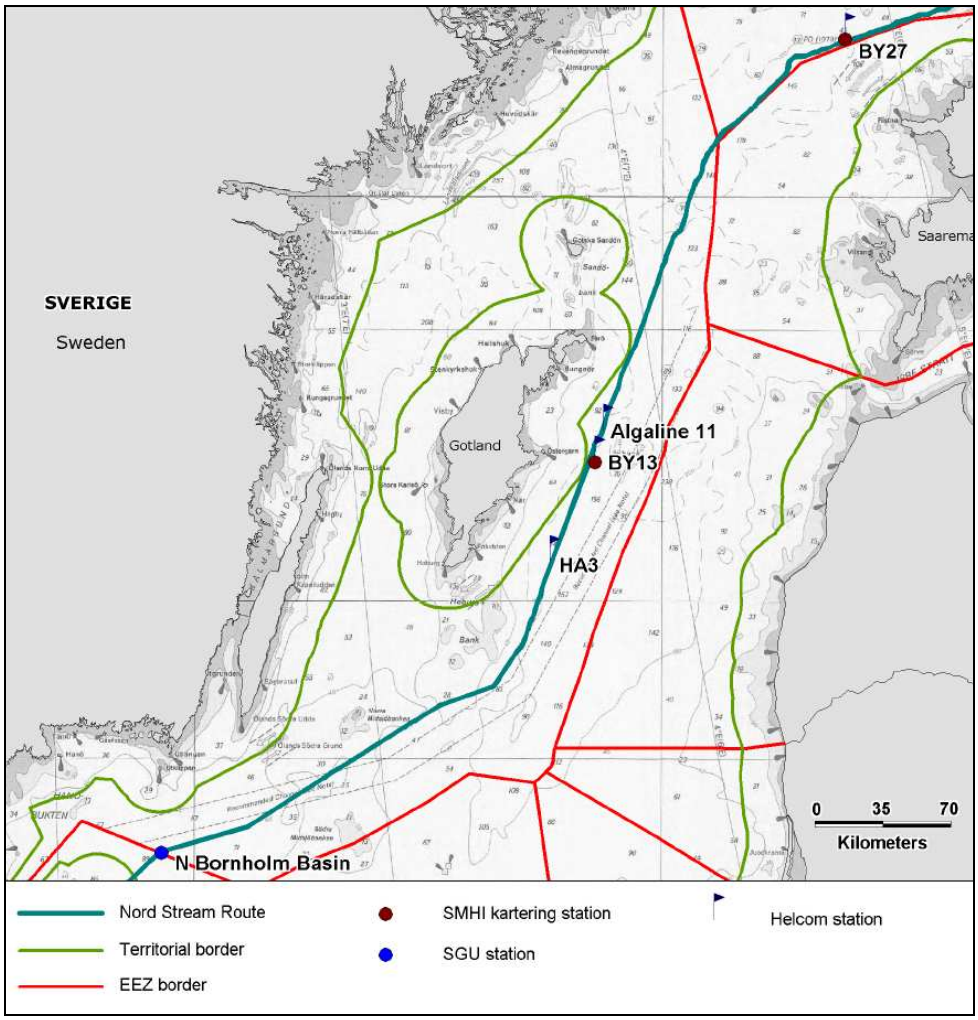

Figure 5. Assessed national and international monitoring stations in the Swedish EEZ and one Swedish monitoring station in the Finnish EEZ.

Nord Stream has assessed and introduces measures to mitigate the potential impacts to affected countries in relation to their monitoring stations and programmes in the Swedish EEZ and Swedish stations along the pipeline route. The total amount of stations within 3 km of the pipeline route is five, of which four stations are in the Swedish EEZ and one Swedish station in the Finnish EEZ. As the assessment conclusion Nord Stream will inform the stations owners (SGU, SMHI and Marine Research Centre at the Finnish Environment Institute) of the construction schedule changes (if any) in order to mitigate the potential impacts to existing monitoring stations and has also agreed to a relocation of the SGU station in the northern Bornholm Basin.

10 Reporting of Monitoring Results

Environmental Monitoring Programme results are compiled of the fit-for-purpose activities to ensure delivery for the main monitoring objectives. Some of the monitoring results are delivered to meet permit conditions, while others are set-up to confirm the findings and commitments in the Environmental Study for the Swedish EEZ.

The permit condition regarding the turbidity guideline value requires monitoring on a real time basis and an instant reporting, if the value is exceeded. Reporting of other monitoring results is not considered time critical and therefore the results are analysed and assessed to a larger extent before reporting is done. Reports of the main monitoring activities are made available to the authorities when the monitoring activity has been finished, and when the analysis and assessments have been completed.

Monitoring results are summarised in a report on a yearly basis and submitted to the relevant authorities each year during the planned monitoring period. The report will cover the monitoring results for all monitored parameters in a summarised manner. There is also opportunities to apply lessons learned from monitoring results potentially near to the monitoring site, in subsequent sections of the construction activities along the route and for the second pipeline (in compliance with the Nord Stream and Contractors HSE regulations). If for instance the outcome of monitoring is assessed to be non-significant or negligible, suggested changes to subsequent monitoring are to be reported to the relevant authorities. Unexpected events and chance finds are reported immediately, according to the specific procedure, to the relevant authorities. An overview of the monitoring programme and reporting in Swedish EEZ is available in appendix 1.

11 Revision Record

Rev.	Date	Description	Prepared	Checked	Approved		
			Nord Stream				
A	2010-01-21	Issue for Use/ Consultation	AKI/HLI	TSA/MHA	NAN		
A1	2010-02-12	Reissue for Comments	AKI/HLI	TSA	NAN		
B	2010-03-01	Reissue for Use	AKI/HLI	TSA/MHA	NAN		

Appendix 1. Overall matrix of environmental monitoring programme in the Swedish EEZ

Overall Matrix - Environmental Monitoring Programme					
Phase	**Monitoring activity**	**Project activity**	**Location**	**Scope**	**Reporting**
Construction	Construction control	All construction activities	Full length of the pipeline	16 CMPs control	KPI's including non-compliance instant reporting of the HSE hazards
Construction, Operation	Technical inspections	Inspection, maintenance and repair	Full length of the pipeline	Offshore Standard DNV-OS-F101 - Design, construction and operation	As-built, As-laid reports
Prior construction, Construction	Cultural heritage	Pipe lay	Assessed locations	Archeological assessment Anchor patterns development	Chance finds procedure (accidental finds observations reporting)
	Cables	Pre-lay works Pipe lay	Full length of the pipeline, when crossing cables	Technical solutions, Agreements, Visual inspections ROV 5 cables,10 times cable cross	As-built report
	Shipping	All construction activities	Full length of the pipeline, extra when crossing deep water shipping lane	Ship traffic management procedures	Daily and weekly reporting
	Fishing (commercial)	All construction activities	Full length of the pipeline	Safety zone As-built configuration	Regular information updates As-built report
Prior construction	Impact on existing monitoring programmes	All construction activities	Full length of the pipeline, where stations coincide with construction	National, International monitoring programmes station locations investigations and implementation of mitigation measures	Positioning investigation Mitigation agreements with affected parties Report after construction
Prior construction	Monitoring measures for munitions clearance	Munitions clearance	Assessed locations in Swedish EEZ (7 mines notified)	Seabed morphology Cultural heritage etc. Ecological mitigation and monitoring Commercial shipping	Summary report
Construction	Seabed morphology	Pre-lay rock placement	All pre-lay rock placement locations	Obstacles Seabed bathymetry Conditions of rock berms	As-built As-laid reports
		Pipe lay	Full length of the pipeline	Obstacles Seabed bathymetry Rock berm per design Pipe position & condition	
		Post-lay rock placement	All post-lay rock placement locations	Condition of rock berm and pipe	
		Post-lay trenching	All post-lay trenching locations	Obstacles Pipe position & condition Trench depth	
		After construction	Full length of the pipeline	Pipeline integrity and seabed conditions	
Construction	Turbidity	Post-lay trenching	Border areas of Hoburgs bank & Norra Midsjöbanken	Turbidity level and resuspended sediments	Instant reporting, if exceeding guideline values. Annual reporting
	Sedimentation	Post-lay trenching	Border areas of Hoburgs bank & Norra Midsjöbanken	Sedimentation (sediment traps)	Annual reporting (Proposal after line1 for line2 monitoring)

	Turbidity	Post-lay trenching	Along trenching sites (in the vicinity of the Hoburgs bank&Norra Mids-jöbanken)	Vessel born campaign for plume spread	
	Eco-toxicological effects (mussels)	Post-lay trenching	Border areas of Hoburgs bank&Norra Midsjöbanken, references at the banks	Effects of turbidity, sedimentation and changes in contaminants content	
Operation	Seabed morphology	Location intact Damage seabed profile	Full length of the pipeline	Pipeline position & condition Adjacent seabed	Report after final-ised investigation
	Benthic infauna	Post-lay trench-ing	Transects from pipeline to the borders of Natura 2000 areas (HB&NMB)	Infauna sampling for registra-tion of effects/recovery	
Operation	Benthic epi-fauna	Rock placement	East of Hoburgs bank	Survey with video inspection, for qualitative registration of epifauna ("reef effects")	Annual reporting of infauna and epi-fauna (artificial reef effects) Final report of surveys
		Post-lay trenching	In the vicinity of Norra Midsjöbanken		
		Pipe lay (direct on seabed)	Between Hoburgs bank and Norra Midsjöbanken		
	Fish	Pipe lay	In the vicinity of Norra Midsjöbanken	Demersal fish communities, changes in fish species and catch	Annual reports Final report of surveys
		Rock placement	East of Hoburgs bank		
		Post-lay trenching	In the vicinity of Norra Midsjöbanken		
		Natura 2000 areas	At Hoburgs bank and Norra Midsjöbanken		Survey reports, Annual reports Final report of surveys
Operation	Fishery	Operation of pipeline	Southern part of the Swed-ish EEZ (KP 750-1004)	Fishery patterns, changes in demersal fish species and catch	Baseline report Annual reports Final report of surveys
Operation	Hydrographic effects	Operation of pipeline	Bornholm Basin (DEN EEZ)	Mixing efficiency of the deep-water inflow of saline water and blocking effect	Annual reporting Final report of surveys
	Technical inspections	External off-shore inspections	Full length of the pipeline	Pipeline seabed configuration External conditions	
Operation		Internal inspections		Corrosion, Local pipe geome-try	Report after final-ised investigation
Operation	Operation control	*to be published at a later stage*	*to be published at a later stage*	*to be published at a later stage*	*to be published at a later stage*