0	30/07/18	IFU – Issued For Use	JOA	ECB & RIB	FIH
A	19/07/2018	IFR – Issued For Review	JOA	ECB & RIB	FIH
Revision	**Issue Date**	**Reason for Issue / Change**	**Author**	**Reviewer**	**Approver**

HVDC Cable Infrastructure:
UK Marine Post Installation Survey Plan

Document Originator	**Project Name: NorthConnect**	**Total Pages**
NorthConnect KS	**NCT Document Number**	
Originator Logo	**NCOFF-NCT-X-TA-0002**	**7**
	Co-financed by the European Union Connecting Europe Facility	

REVISION RECORD

Rev. No.	Date	Section(s)	Page(s)	Change
A	19.07.2018	All	All	First draft issued.
0	30.07.2018	All	All	Review comments addressed.

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1. ABBREVIATIONS

The following acronyms are used in this document:

HVDC	High Voltage Direct Current
CMS	Construction Method Statement
IRM	Inspection Repair and Maintenance
JV	Joint Venture
TBI	Time-Based Inspection
CBM	Condition-Based Maintenance
MAG	Magnetic Data Acquisition
MBES	Multi-beam Echo Sounder
ROV	Remote Operated Vehicle
SBP	Sub-bottom Profiler
SSS	Side Scan Sonar
USBL	Ultra-Short Base Line (a subsurface positioning system)
UXO	Unexploded Ordnance

2. INTRODUCTION

2.1 Purpose of Document

This document outlines the requirements for the post installation Inspection, Repair and Maintenance (IRM) of the NorthConnect Interconnector marine High Voltage Direct Current (HVDC) cables, and associated seabed infrastructure within the UK Exclusive Economic Zone. It provides details of the following aspects of the NorthConnect IRM Requirements:

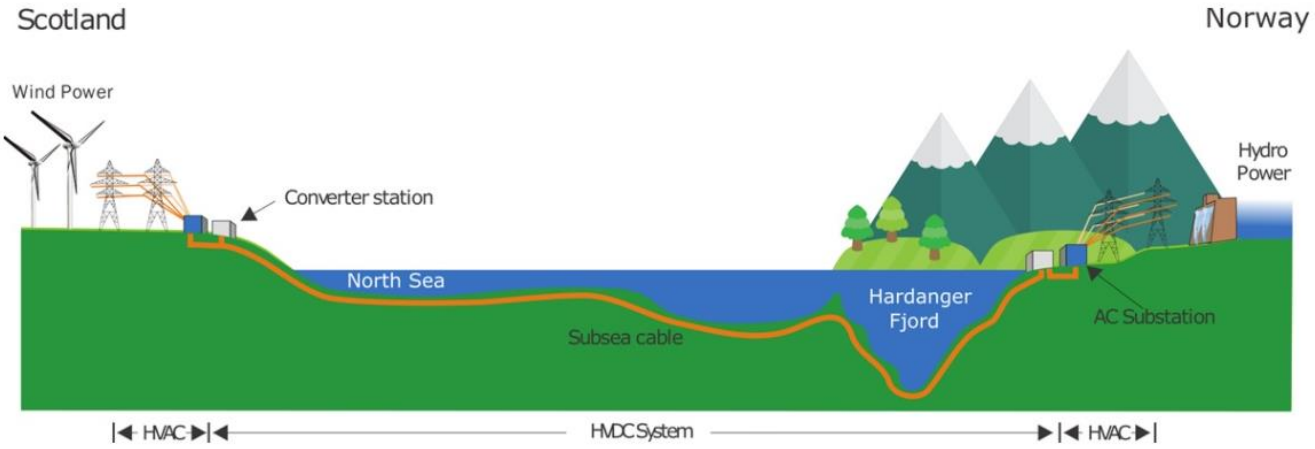
- Time based inspection activities;
- Types of survey and equipment to be utilised; and
- Condition based maintenance activities, including proposed mitigation if spans or movement or other dangers to legitimate users of the sea are identified.

The document does not include detail of the immediate post lay survey operations, since these are considered to be part of the installation works and, as such, are covered in the Construction Method Statement (CMS) NCGEN-NCT-X-RA-0002 (NorthConnect, 2018).

2.2 Project Description

NorthConnect is a project set up to develop, consent, build and operate an HVDC electrical interconnector between Peterhead in Scotland and Simadalen in Norway. The 665km long, 1400MW interconnector will provide an electricity transmission link allowing the two nations to exchange power and increase use of renewable energy. The intention is for the HVDC interconnector to be operational by 2023.

NorthConnect is a Joint Venture (JV) project company owned by four community and state-owned partners from Norway and Sweden: Agder Energi AS, E-CO Energi AS, Lyse Produksjon AS, and Vattenfall AB. The partnership was established on 1st February 2011.



3. TIME-BASED INSPECTION ACTIVITIES

3.1 Survey and Inspection Schedule

NorthConnect are committed to ensuring the marine cable system is frequently inspected to ensure that they are adequately protected and that associated infrastructure does not pose a risk to other legitimate users of the sea. In order to facilitate this, the following Time-Based Inspection (TBI) regime will be implemented:

- Two years after the completion of the installation period, NorthConnect will conduct a survey of the entire marine cable route; then
- Following the initial 2-year survey, the entire marine cable route will be surveyed at least every 5 years for the duration of the project lifetime.

Findings from all cable route inspection surveys will be documented and compared with as-built survey documentation, together with information from the previous post installation surveys where available. NorthConnect will identify areas where more frequent inspection is required, henceforth referred to as critical areas, based on discrepancies between the most recent survey and data from the as-built survey data or previous routines inspections. Critical areas are likely to include regions of mobile sediments or increased scour.

NorthConnect will ensure that any critical areas identified are surveyed more frequently. However, the actual frequency of these inspections will be dependent on the nature of the seabed feature or other discrepancy, and specifically according to the perceived risk to the cable system or other legitimate users of the sea.

3.2 Survey and Inspection Scope

As a minimum the TBI surveys will specifically include the following aspects of the marine cable system:

- Cable burial depth and protection level;
- Condition of Horizontal Direction Drill exit points at the UK landfall;
- Condition of offshore joint locations;
- Condition of existing infrastructure crossings;
- Identification or potential risks to other users of the sea, such as snagging risks; and
- Identification of potential risks to the cable system including:
    - Free spans;
    - Mobile sediments;
    - Dropped objects and debris; and
    - Evidence of increased anchoring or fishing activity.

3.3 Survey and Inspection Spread

The TBI surveys will be conducted using the following survey platforms:

- Offshore survey vessel with dynamic positioning system; and
- Remotely Operated Vehicle (ROV):
    - The ROV will be equipped with a high definition photographic and video system, utilised for conducting visual inspection of the cable system and associated infrastructure; and
    - The ROV will all be used as a platform for various other sensors as detailed below.

The following survey sensors may be utilised during the TBI surveys, depending on the specific inspection requirements:

- Multibeam Echo Sounder (MBES) for the provision of bathymetric information and 3D images of external cable protection:
    - MBES will be hull mounted, towed close to the seabed, or deployed on a ROV;
- Side Scan Sonar (SSS) for provision of high resolution acoustic images of the seabed and cable protection, including identification of free-spans:
    - SSS will be towed close to the seabed or deployed on an ROV;
- Sub-Bottom Profiler (SBP) to acquire acoustic seabed profiles, and inform cable burial depth assessment:
    - SSS will be towed close to the seabed or deployed on an ROV;
- Magnetometer (MAG) data acquisition for identification of ferrous objects including potential UXO or dropped objects:
    - MAG will be towed close to the seabed or deployed on an ROV;
- Cable/Pipeline tracking systems in order to assess depth of lowering of the cable system or other seabed infrastructure:
    - Cable/Pipeline tracker will be deployed on an ROV
- Ultra-Short Baseline (USBL) underwater positioning system, used to determine the 3-dimensional position of ROVs and other towed devices.

Whilst it is anticipated that the TBI survey operations will only utilise geophysical techniques, there is the potential that geotechnical sampling may be required, depending on the findings of the TBI surveys to inform remedial works. If required, geotechnical sampling may include:

- Vibro Coring;
- Gravity Coring;
- Piston Coring; and
- Cone Penetration Testing.

4. CONDITION BASED MAINENANCE ACTIVITIES

Dependant on the findings of the TBI survey operations, NorthConnect will plan and execute any necessary Condition Based Maintenance (CBM) or interventions in order to ensure the cable system remains operational and does not pose a threat to other legitimate users of thee sea. CBM activities may include, but are not limited to:

- Maintaining designed cable protection levels through re-burial, or remedial rock placement;
- Maintaining rock berms at subsea asset crossings;
- Removing potential snagging risks;
- Rectification of free-spans;
- Remediation of threats to the cable system associated with mobile sediments; and
- Removal of other threats to the cable system, including:
    - Boulders;
    - UXO;
    - Dropped objects and debris; and
    - Lost fishing gear.

NorthConnect will ensure a pool of suitable vessels are available for CBM activities.

5. ADMINISTRATIVE REQUIREMENTS

5.1 Licences and Permits

NorthConnect will ensure all necessary licences and permits are in place prior to conducting TBI and CBM operations. For example, European Protected Species licences may be required for geophysical survey operations or UXO removal.

5.2 Stakeholder Liaison

Prior to conducting TBI or CBM operations, NorthConnect will ensure that all necessary steps are taken to inform stakeholder and other legitimate users of the sea of the planned operations. This will be done in accordance with the provisions of NorthConnect HVDC Cable Infrastructure UK Communications Strategy NCGEN-NCT-X-FA-0001 (NorthConnect, 2018).

6. REFERENCES

NorthConnect, 2018. HVDC Cable Infrastructure: Construction Method Statement. NCGEN-NCT-X-RA-0002.
NorthConnect, 2018. HVDC Cable Infrastructure: UK Communication Strategy. NCGEN-NCT-X-FA-0001.