Abandoned Anchors Freshwater West

Jan De Nul

Valid for
#GL22_DC Cable Marine

Greenlink Interconnector Project

Client Project Ref: 70044124

Index of Revisions

Rev	Date	Description
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Document title:

ABANDONED ANCHORS FRESHWATER WEST

Project:

GREENLINK INTERCONNECTOR PROJECT

SUB-CONTRACT FOR OFFSHORE HVDC INSTALLATION AND BURIAL

Cable Contractor: SUMITOMO ELECTRIC

Sub-Contractor: Jan De Nul Luxembourg sa

JDN document no.:	JDN.6746.SEI.TN.90.98.01
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01	12/09/2024	Amended			
00	04/08/2023	Issued for Information	DEMS	VEEM	SLO
Rev.	Date	Purpose of submission	Prepared	Checked	Approved
			Sub-Contractor		

Revision change details

Revision	Location	Brief description of change
00	Entire document	First issue
01	Entire Document	Amended

Table 1-1: Revision change details

Contents

List of figures

List of tables

Purpose of the Document

The purpose of the document is to provide details regarding the abandonment of 2 3Te Deltaflipper anchors at the Freshwater West landfall.

2 ABBREVIATIONS AND DEFINITIONS

Abbreviation	Definition
HDD	Horizontal direction drilling
DSV	Dive Support Vessel
PO	Pompei
RHIB	Rigid-hull inflatable boat
HDPE	High-density polyethylene

Table 1-2: Abbreviations

Term	Definition
Cable Contractor	Sumitomo Electric Industries Ltd.
Client	Greenlink Interconnector Ltd.
Sub-Contractor	Jan De Nul Luxembourg S.A.
Project	Greenlink Interconnector Project

Table 1-3: Table of project definitions

1 INTRODUCTION

During the installation campaign of the HDPE ducts at the Freshwater west landfall, DSV Pompei was deployed to assist with both diving works and the push/pull operations. To accommodate this, the vessel was moored on a 4 point mooring, which can be seen in Figure 1-1.

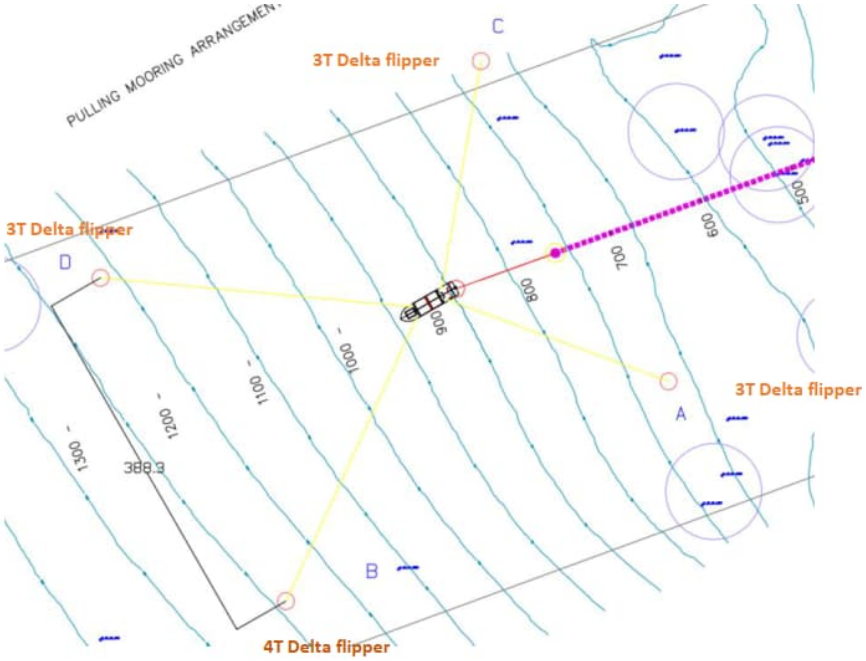

Figure 1-1: 4 point mooring pattern for HDPE push/pull operations

As can be seen in the above layout, both aft anchors were 3T Delta Flippers. The rigging arrangement is shown Figure 1-2. The steel pennant wire consists of a 30 m 36 mm soft loop steel wire to which a 22 mm chain is connected and guided through the pennant buoy. The forerunner arrangement consists of a 50m 32mm and a 25 m 24 mm steel wire connected to an orange A7 buoy.

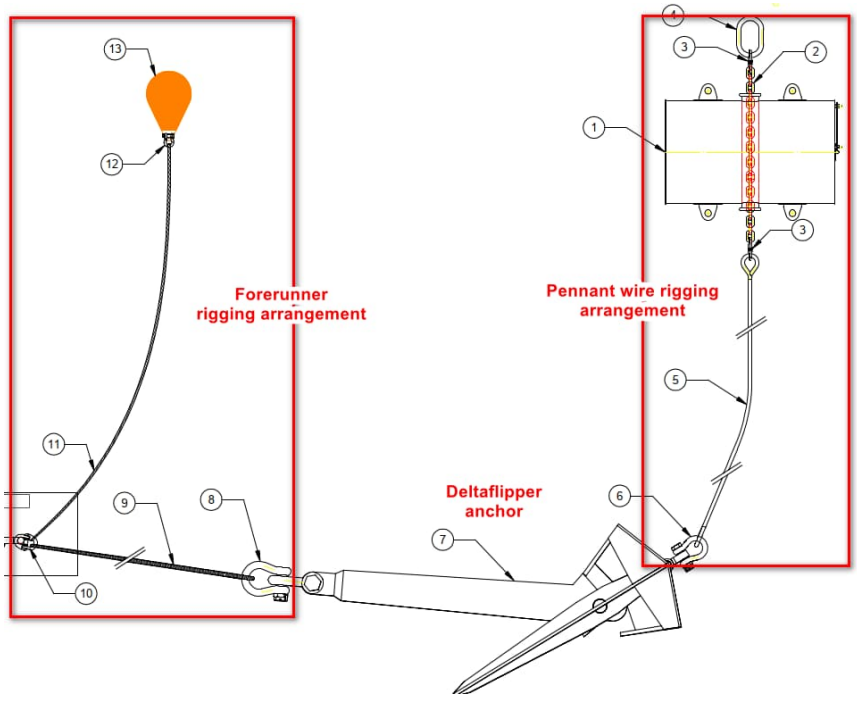

Figure 1-2: anchor rigging arrangement

Due to winter work, the available weather windows were limited. As an optimization both anchors A and C were pre-deployed by means of the anchor handling vessel Willendeavour (WE). Anchors B and D were deployed by the Pompei, after which the Willendeavour would assist with connecting the pre-deployed anchors A and C to the mooring wires.

However due to adverse weather conditions, the buoys parted from the two anchors and whilst numerous attempts were made to locate and recover the anchors as described in section 4 of Annex A these were unsuccessful with the anchors being completely buried beyond a practical depth that can be detected, let alone recovered.

The Navigational Risk assessment in Annex A demonstrates that these anchors are not a risk to Navigation and as such no further efforts to either locate or recover these will be made.

2 ANCHOR ASSEMBLY AND LOCATIONS

The anchor rigging configuration is shown in Figure 1-2. The anchors were deployed at coordinates listed in Table 2-1: Anchor drop locations Table 2-1 . These locations, together with the bellmouth locations are visualized in Figure 2-1.

Easting	Northing	Latitude	Longitude
356667.96	5725253.32	51;39;35.881N	005;04;20.245W
356534.24	5725539.65	51;39;45.021N	005;04;27.623W
*WGS84 UTM30N and WGS84 Lat/Lon			

Table 2-1: Anchor drop locations

The bellmouths, as installed during HDD installation, are located at below coordinates.

Easting	Northing	Latitude	Longitude
356470.03	5725357.04	51;39;39.055N	005;04;30.693W
356479.81	5725344.71	51;39;38.665N	005;04;30.166W
*WGS84 UTM30N and WGS84 Lat/Lon			

Table 2-2: Anchor drop point locations

The distance between anchor C, A and the bellmouths is approximately 204 and 317m. The parallel distance between anchor C and the northern HDD route is approximately 200. The distance between anchor A and the southern HDD route is approximately 250m.

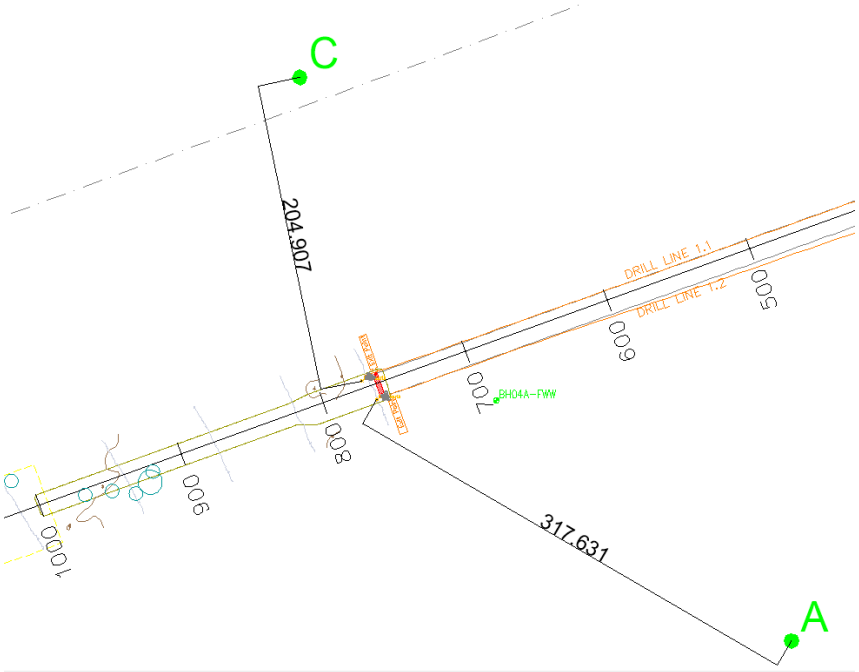

Figure 2-1: Anchor drop positions and bellmouth locations

ANNEX A. Navigational Risk Assessment

Document title:

NAVIGATIONAL RISK ASSESSMENT

FRESHWATER WEST

Project:

GREENLINK INTERCONNECTOR PROJECT

SUB-CONTRACT FOR OFFSHORE HVDC INSTALLATION AND BURIAL

Cable Contractor: SUMITOMO ELECTRIC

Sub-Contractor: DJN Jan De Nul Luxembourg sa

JDN document no.:	JDN.6746.SEI.NAV.21.98.03
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Rev.	Date	Purpose of submission	Prepared	Checked	Approved
			Sub-Contractor		

Document distribution and access

This document was prepared by Jan De Nul for the Greenlink Interconnector Project.

On a Project level, the Jan De Nul Project management team reviewed the document while project management will ensure implementation in the field.

This is a controlled document, stored on the Jan De Nul project server, the online Jan De Nul platform (Meso) and the Project specific platform Sharefile. As such, the document is accessible to all members of the Project management team and, if applicable, other interested parties.

Revision change details

Revision	Location	Brief description of change
00	Entire document	Issued for information

Table 1: Revision change details

Contents

List of figures

List of tables

Greenlink Interconnector Project

Greenlink Interconnector Ltd. (GIL) is proposing to develop an electricity interconnector between the South-east of Ireland, from Great Island, County Wexford to South-west Wales, at Pembroke, Pembrokeshire. The topology for the Interconnector is a High Voltage Direct Current (HVDC), Voltage Source Converter (VSC) symmetrical monopole, i.e. the DC link requires two high voltage cables, one positive and one negative.

The HVDC Cable System shall consist of two HVDC power cables and a fibre optic cable and associated accessories.

The HVDC Cable System shall consist of the following route sections:

- An onshore DC cable route in the UK running from the HVDC converter station located at Pembroke to the sea / land transition at Freshwater West Beach with a circuit length of approximately 5.6 km.
- An offshore cable system running between the transition joint located in the field adjacent to Freshwater West Beach in the UK to the transition joint located in the field adjacent to Baginbun Beach in Ireland with a circuit length of 159 km.
- An onshore DC cable route in Ireland running from the transition joint in the field adjacent to at Baginbun Beach to the HVDC converter station located near to Great Island Sub-station (220kV) with a circuit length of 22.5 km.

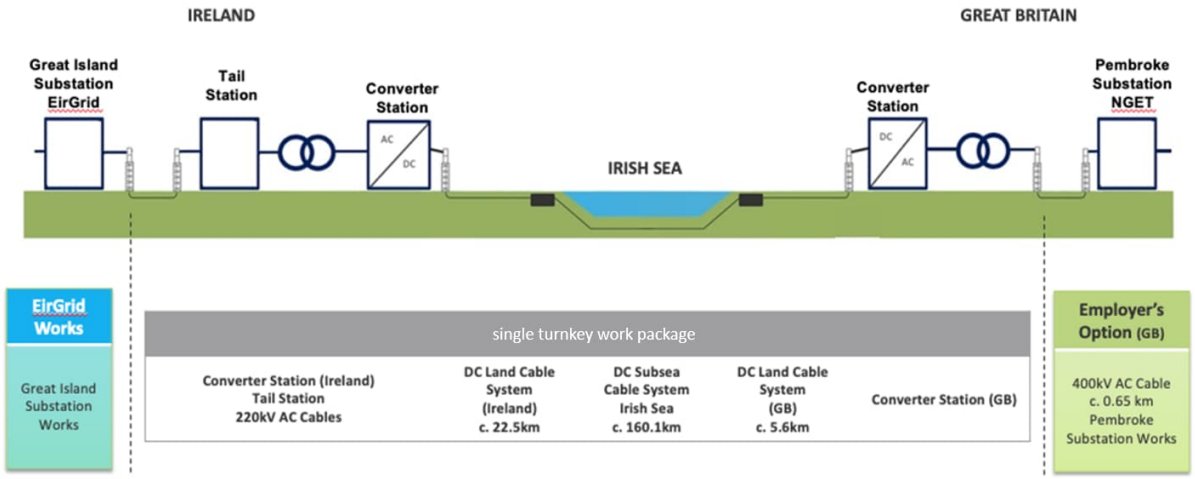

Figure 1 Project Overview

1 REFERENCES

1.1 CODES, STANDARDS AND GUIDELINES

Document Title	Document Number
(1) Marine operations, Design and Fabrication	DNV-OS-H102
(2) Marine operations and marine warranty	DNV-ST-N001
(3) UK Maritime and Coastguard Agency	MGN 371
(4) International Regulations for Prevention of Collisions at Sea	
(5) Signals of Distress (Ships) Rules 2012	S.I. No.170 of 2012

Table 2: Codes, standards and guidelines

1.2 SUB-CONTRACTOR DOCUMENTS

Document Title	Document Number
(6) Project Health and Safety Manual	JDN.6746.SEI.PSM.21.99.01 / P–021001_EC_24000.A011#GL22&AQB070
(7) Project Quality Plan	JDN.6746.SEI.PQM.02.99.01 / P-021001_EC_22000.A011#GL22&AQA011

Table 3: Sub-Contractor documents

1.3 PROJECT SPECIFIC DOCUMENTS

Document Title	Document Number

Table 4: Project specific documents

1.4 CABLE CONTRACTOR DOCUMENTS

Document Title	Document Number
(8) Part 3, Schedule 1 – Cable Contractor's Requirements	70044124-PRO-ITN-3.3.0

Table 5: Cable Contractor documents

2 ABBREVIATIONS AND DEFINITIONS

Abbreviation	Definition
AHV	Anchor Handling Vessel
AIS	Automatic identification systems
CD	Chart Datum
COLREGS	International Regulations for Preventing Collisions at Sea
CT	Constant Tension
DC	Direct Current
DP	Dynamic Positioning
FLO	Fisheries Liaison Officer
GIL	Greenlink Interconnector Ltd.
HDD	Horizontal Directional Drilling
HDPE	High Density Polyethylene
HVDC	High Voltage Direct Current
KP	Kilometer Point (distance)
kV	Kilo Volt
LAT	Lowest Astronomical Tide
MSG	Made Smart Group
MSL	Mean Sea Level
OOW	Officer on Watch
OSV	Offshore Support Vessel
PLGR	Pre Lay Grapnel Run (dragging a grapnel assembly along the future cable route for debris removal)
PO	M/V Pompeï
RPL	Route Position List
SEI	Sumitomo Electric Industries Ltd.
SI	Superintendent
SIMOPS	Simultaneous Operations
VSC	Voltage Source Converter

Table 6: Abbreviations

Term	Definition
Cable Contractor	Sumitomo Electric Industries Ltd. (SEI)
Client	Greenlink Interconnector Ltd
Sub-Contractor	Jan De Nul Luxembourg S.A. (JDN)
Project	Greenlink Interconnector Project

Table 7: Table of project definitions

3 PURPOSE OF THIS DOCUMENT

JDN performed a shipping and navigation assessment of the as-left conditions of the site where the asset (HDPE pipe with a steel bellmouth and temporary auxiliary equipment) has been installed. The below figure shows an overview of the site location.

Figure 2 - Overview of the landfall site area. The onshore cable corridor of Greenlink Interconnector is indicated in red.

The HDD exit point will be positioned approximately 750m offshore from the high water line at -4.0 m depth (LAT) from Freshwater West, Wales, United Kingdom.

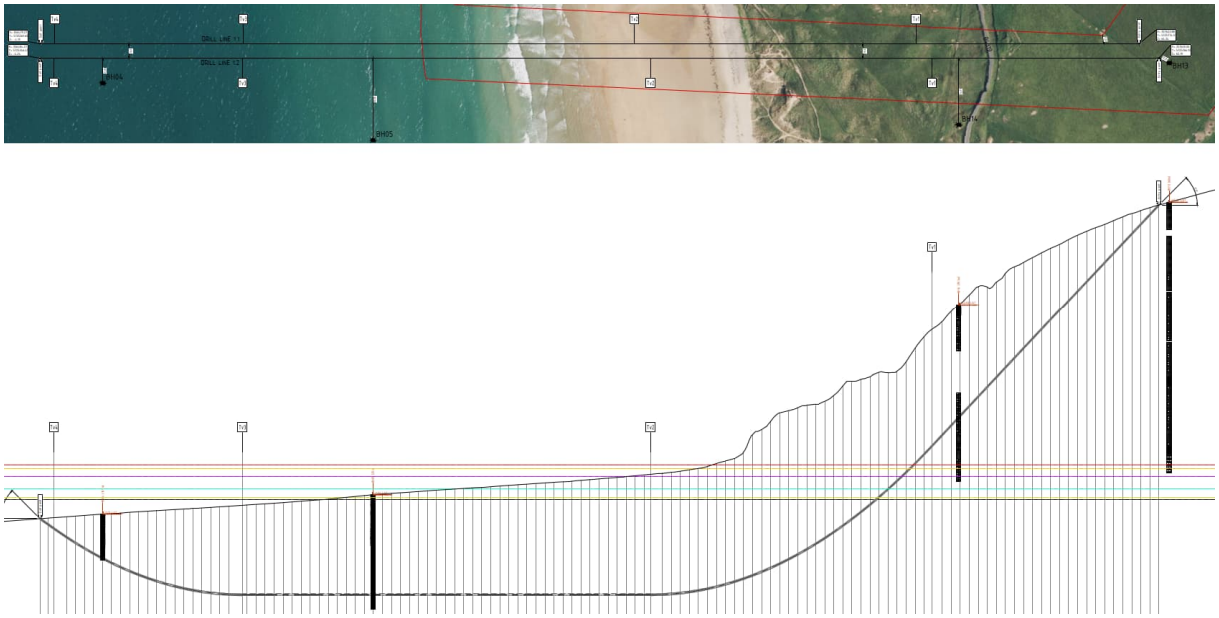

Figure 3 - detailed location of asset trajectory to be installed underneath the beach.

4 INSTALLED ASSETS

A steel bellmouth structure (yellow) was installed at the end of the HDPE pipe (red). The offshore end of the HDPE pipe was temporarily stabilised with rock bags. In April 2024, the rock bags were removed and the entire bellmouth and pipe structure was buried below seabed (deeper than 4.2m below LAT) using controlled flow excavation method. Below figures show depths and dimensions.

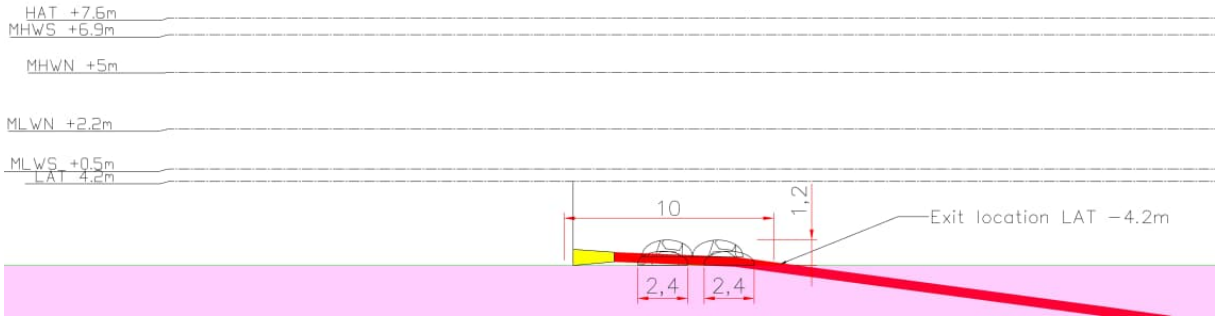

Figure 4 – profile view of the installed asset. Note the rock bags have been removed and the pipe (red) with bellmouth (yellow) has been lowered below seabed in April 2024.

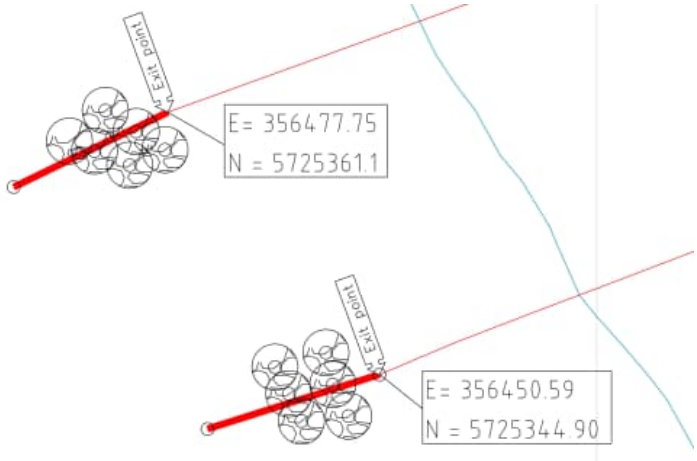

Figure 5 - top view of the installed asset. Note the rock bags have been removed and the pipe (red) with bellmouth (yellow) has been lowered below seabed in April 2024.

At the sea-side of the HDPE pipe a bellmouth has been installed. Material specifications are as follows:

- Design life time: 40 years
- Material specifications: Steel S235 (minimum)
- Flare angle: Between 7 -3 degrees
- Maximum OD: 600 mm
- Flare length: 450 – 570 mm

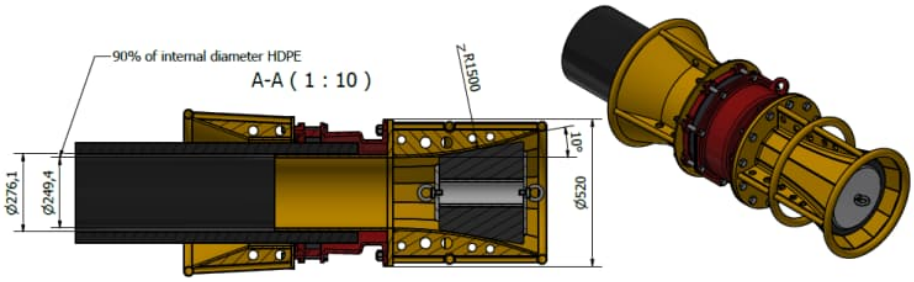

Figure 6 – Bellmouth

During the operations, two anchors of 3.0 metric tonnes were pre-deployed for the diving support vessel. The diving support vessel would anchor in the nearshore area to allow shutting down the engines and undertaking diving operations. A sketch of the anchor with its steel wire installation rigging is shown on below figure. During the deployment of the anchors, a pre-tension was applied with a multicat to ensure the anchor would start digging itself in to generate the required soil resistance.

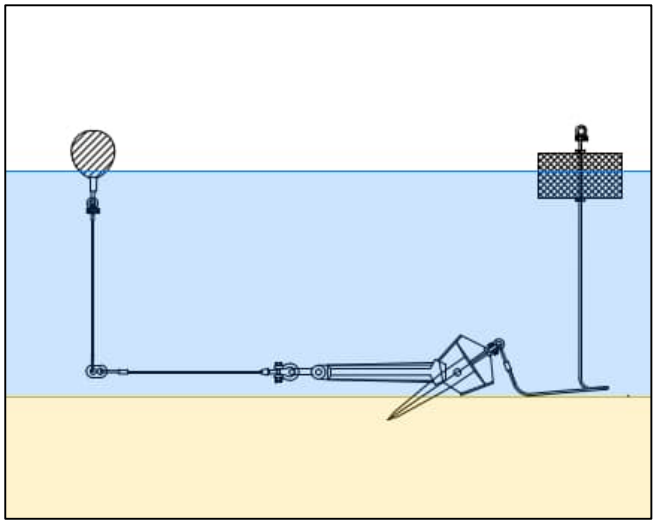

Figure 7: cross section of the pre-deployed anchor with steel wire rigging.

Due to adverse weather conditions, the buoys have parted from the two anchors. Several attempts were undertaken to excavate and retrieve the anchors. However, due to the applied pretension, the anchors had shifted position and had become buried, making all attempts futile. An overview of the timelines is presented below:

- In December 2022, two anchors were pre-installed nearshore Wales with a multicat. Each anchor had an inflatable Norwegian buoy and a yellow steel can buoy.
- During the winter storms, the buoys were subject to high wave action as they were close to the breaker zone (at low tide). One by one the buoys failed (without suitable weather window in between to try and recover the anchors and replace/reinforce the buoys).
- When all 2 x 2 buoys had parted, several salvage attempts were undertaken for the anchors:
    - in January 2023, a diving campaign was organised from a workboat using airlift tools for the divers to excavate around the deployment location.
    - in May 2023, another diving campaign was organised from a workboat using now also a magnetometer to detect the anchor or its steel wires.
    - On several occasions in September-October 2023 and April 2024, multibeam echosounder surveys were conducted as part of the Greenlink interconnector cable installation works. The deployment area of the anchors was also covered in these surveys to see if any changes on seabed level could have uncovered the anchors.
    - in May 2024, a final attempt was made using the controlled flow excavation tool, which is used for burial of the cable nearshore. The tool ejects a powerful jet of water at the soil to fluidise and excavate an open trench which then naturally backfills. As part of the wet testing of the tool prior to actually burying the cable, the tool was used on the deployment location of the anchors. The area was then surveyed by a multibeam echosounder to check anomalies on the bathymetry in the open trench.

From all the above, it is clear that the anchors have become completely buried following their installation in December 2023, beyond a practical depth that can be detected, let alone recovered.

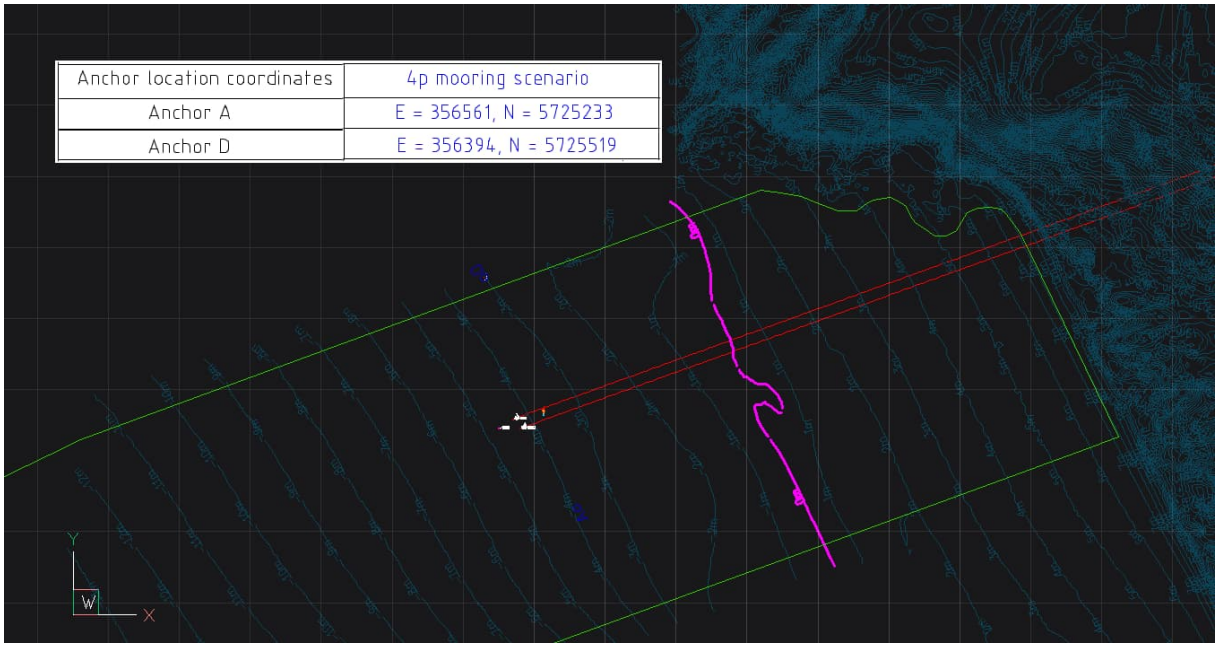

Figure 8: as-left situation of the seabed in front of Freshwater West. Green is the installation corridor, left for scale (width 500 m). Red is the two HDD trajectories, passing underneath the beach with the exit points offshore central in the figure with white letters. Pink is the 0m LAT contour. The two anchors A and D are left in position but buried. The cables and HDPE ducts with the steel bellmouth structure are also buried.

5 MARINE TRAFFIC ANALYSIS

During the execution of the project, all ship movements in the area were monitored by the guard vessels and installation vessels on site. The figure below shows the access channels of Milford Haven near the Freshwater West nearshore Wales.

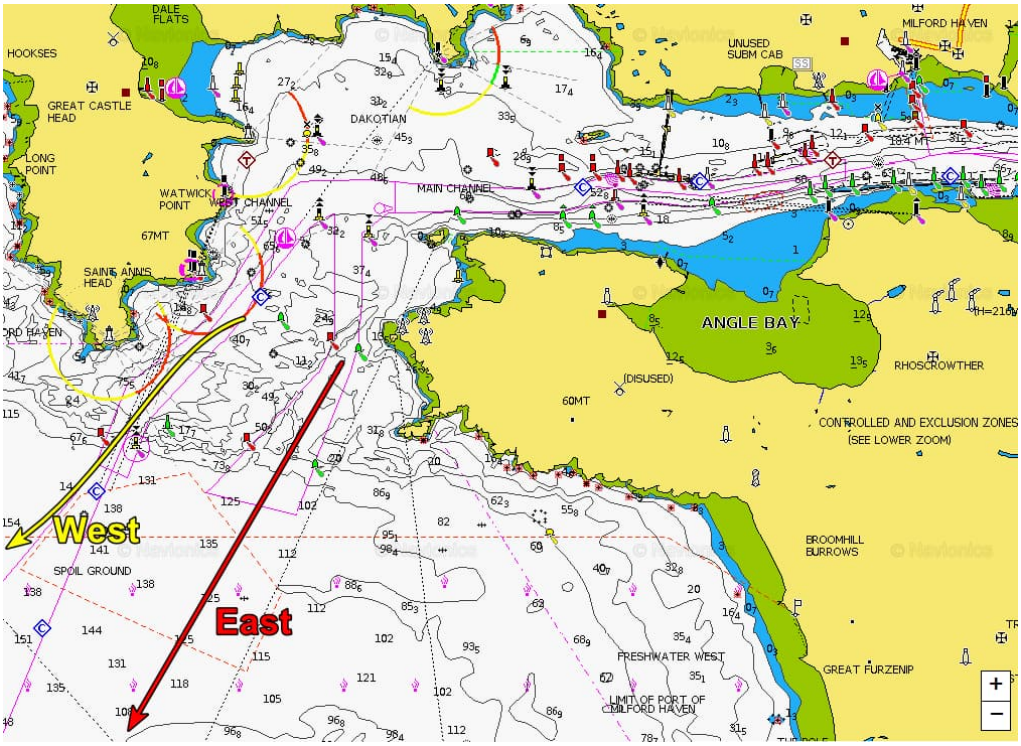

Figure 9 – Traffic channels and navigational chart to mark usual vessel traffic in area (copyright Navionics/Garmin)

The last year's traffic in the project area shows exclusively pleasure fishing craft from Milford Haven and Pembroke or Neyland Marina coming to this nearshore shallow area outside the access channels, in front of Freshwater West.

Figure 10 – Neyland Marina (copyright Allatsea.co.uk)

6 NAVIGATIONAL HAZARDS

Upon review of the information and admiralty charts for the area, no significant navigational hazards are identified in the vicinity of the project area.

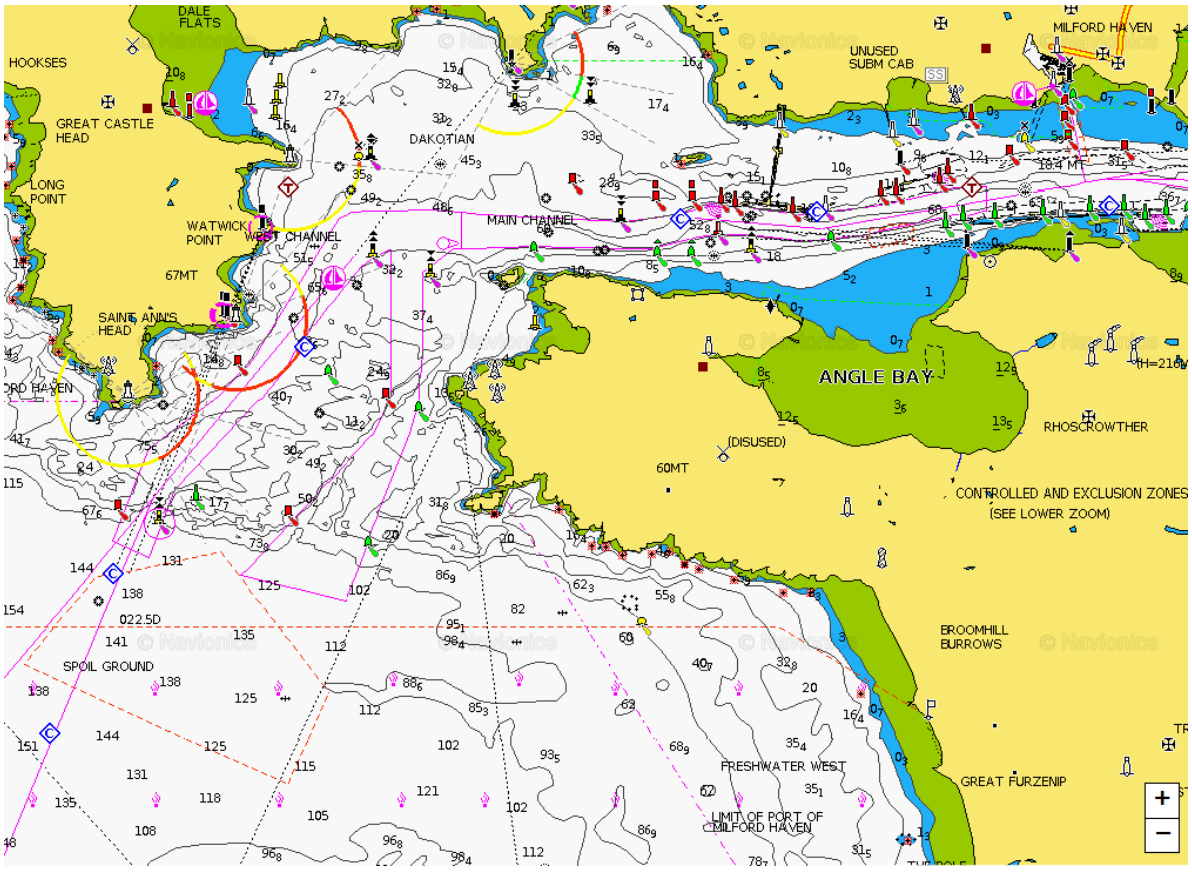

Figure 11 – Project area extract admiralty chart (copyright Navionics/Garmin)

7 RISK ASSESSMENT

7.1 METHOD

The assessment was carried out in accordance with the UK Department of Trade and Industry methodology for offshore wind farms and taking into account guidance MGN 371 by the UK Maritime and Coastguard Agency.

Using all the information gathered from investigations, consultations and the collection of navigation data, a hazard identification exercise has been performed.

This process was carried out by project personnel with input from consultees and a panel of experts for the project. The below list of hazards was used to document all the hazards that are likely to exist in relation to navigation during the construction and as left situation of the temporary marine structure. The hazard list was used to further investigate navigation risks identified and to quantify their likelihood and consequence. Where possible hazards have been identified, this exercise has also been used to identify potential mitigation/control measures to be considered.

Items required to support the risk assessment such as the navigation marking were investigated further to provide a better understanding of the issues and potential constraints to risk control measures available.

All identified risks were deemed acceptable once the necessary control measures were put in place.

7.2 RISKS

There were a number of risks which were identified as tolerable but these will need to be monitored once construction commences and the site is in operation.

This included:

- The risk of static or trawling fishing vessels to making contact with the installed asset
- The risk of a vessel under control making contact with installation vessels or installed buoys
- The risk of a vessel not under command or drifting making contact with installation vessels or installed buoys

7.3 CONTROL MEASURES

To limit the impact of risk some important general risk prevention, mitigation and emergency control measures were identified during the risk assessment process and the project execution. An example of the more general risk control measures included:

- Adequate marking of the site: Navigation buoy with light and marker installed next to the site to increase navigation safety. It was discussed in 2023 with Trinity House and the MCA during the project execution if the navigational marker buoy could be omitted as it proved difficult to deploy and maintain in the breaker zone of the beach. This was agreed as anyhow the navigational risk was minimal for the rock bags which were left in place at the time.
- Promulgation of information and warning through notices to mariners and other appropriate media to heighten mariner awareness of site. A Notice to Mariners and guard vessels were instated during the project execution, when the rock bags were still in place and the cables were not buried yet.

- Marking of the site on navigation charts in order to inform vessels of the site and give them opportunity to plan alternative route. This was not applicable as it only concerned a temporary situation and was covered under Notice to Mariners.

7.4 RISK ASSESSMENT OF UNMARKED ANCHORS

With the project execution completed, the risk assessment for the current situation is revised.

In April 2024, the seabed has been left and restored due to natural sedimentation to the original state, without any local reduction of water depth remaining that could obstruct vessels. The power cables, HDPE pipe and bellmouth structure have all been buried below seabed, as was always foreseen. The rock bags have been recovered to shore. Only the anchors remain in their buried state, due to the pre-tension applied during deployment, beyond detection and recovery.

With regards to a risk of snagging on the installed buried anchors, only recreational and 'pot' fishing takes place in the nearshore area so the seabed is not disturbed to the burial depth of the anchors.