Hornsea Project Two Offshore Wind Farm

Safety Zone Application

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Abbreviations

AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
BEIS	Department for Business, Energy, and Industrial Strategy
COLREGs	International Regulations for Preventing Collisions at Sea
Fl	Flashing
HLV	Heavy Lift Vessel
HTV	Heavy Transport Vessel
IALA	International Association of Lighthouse Authorities
IMO	International Maritime Organization
km	Kilometre
LAT	Lowest Astronomical Tide
LMP	Lighting and Marking Plan
m	Metre
MCA	Maritime and Coastguard Agency
MP	Monopile
MW	Megawatt
nm	Nautical Mile
NRA	Navigation Risk Assessment
NUC	Not Under Command
OSS	Offshore Substation
PLGR	Pre-lay Grapnel Run
RAM	Restricted in Ability to Manoeuvre
RCS	Reactive Compensation Substation
SGRE	Siemens Gamesa Renewable Energy
SOLAS	Safety of Life at Sea
SOV	Service Operations Vessel
SPS	Significant Peripheral Structure
TH	Trinity House
TP	Transition Piece
UKHO	United Kingdom Hydrographic Office
VHF	Very High Frequency
WTG	Wind Turbine Generator
WTW	Walk to Work
Y	Yellow

1. Introduction

1.1 Background

Hornsea Project Two is the second project to be developed within the former Hornsea Zone. The Development Consent Order was granted on the 16 August 2016 and came into effect in September 2016. Following consent, Hornsea Project Two received a Contract for Difference from the Department for Business, Energy and Industrial Strategy (BEIS) on the 11th of September 2017 for 1,386 Megawatts (MW).

1.2 Scope of the Safety Zone Application

This document represents the primary supporting document to Ørsted's application for safety zones to be implemented for Hornsea Project Two. The application will be submitted to BEIS as required under their safety zone guidance (BEIS, 2011), which is based upon the relevant legislation in place for safety zone applications (see Section 1.3).

The purpose of the proposed safety zones is to manage potential interactions between vessels and the offshore wind farm construction and maintenance activities, with a view to minimising the risk of an incident which may threaten primarily life or the environment, but also Ørsted assets.

It is noted that safety zones are also applied for around the Reactive Compensation Stations (RCS) associated with Hornsea Project Two (see Section 2 for further details).

1.2.1 Construction Phase

During the construction phase, the following safety zones are applied for:

- "Rolling" 500 metre (m) safety zone established around each wind farm structure, and / or their foundations, whilst construction work is being performed, as indicated by the presence of construction vessels; and
- Pre-Commissioning 50m safety zones established around any wind farm structure which is either partially completed or constructed but not yet commissioned where a construction vessel is not present.

Further details as to what will trigger these safety zones are provided in Section 9.

1.2.2 Operation and Maintenance Phase – Major Maintenance

During any periods of major maintenance (see Section 5) within the operation and maintenance phase, the following safety zones are applied for:

- 500m safety zones around all "major maintenance" being undertaken around a wind farm structure, as denoted by the presence of a major maintenance vessel.

For reference, the definition of "major maintenance" given within the Electricity Regulations 2007 (which details regulations associated with application procedures and control of access related to safety zones) is as follows:

"*works relating to any renewable energy installation which has become operational, requiring the attachment to, or anchoring next to, such an installation of a self-elevating platform, jack-up barge, crane barge or other maintenance vessel*."

Further details as to what will trigger these safety zones are provided in Section 9.

1.2.3 Operation and Maintenance Phase –Normal Operations

No permanent safety zones are applied for during normal operations (i.e., activities not classed under the definition of major maintenance given in Section 1.2.2).

1.2.4 Decommissioning Phase

Safety zones for the decommissioning phase of the Project will be applied for prior to such operations taking place once associated requirements are known.

1.3 Legislation Compliance

This document has been drafted in compliance with the following legislation and guidance to ensure all necessary information required is included within this safety zone application:

- Section 95 and Schedule 16 of the Energy Act 2004;
- Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007; and
- Guidance Notes: Applying for Safety Zones around Offshore Renewable Energy Installations (BEIS, 2011).

2. Project Overview

2.1 Layout

Hornsea Project Two will be located in the Southern North Sea, approximately 57 nautical miles (nm) east of the Holderness coastline, as shown in Figure 2.1.

In summary, the project design consists of:

- Up to 165 WTGs, with a generating capacity of up to 8.4 MW;
- WTGs constructed on monopile (MP) foundations;
- One Offshore Substation Platforms (OSS) to collect the generated electricity for transmission to shore;
- A network of 165 inter-array cables with combined length of up to 374 kilometres (km) to connect strings of WTGs together and connect WTGs to the OSS;
- Three export cables (max length 423km) to transmit the electricity from the Offshore Substation (OSS) to landfall at Horseshoe Point, Lincolnshire; and
- One RCS within the offshore cable corridor.

The final layout of WTGs and OSS across the site is shown in Figure 2.2. This includes 12 spare locations which may be required in the event that a preferred location proves unsuitable.

The layout has been agreed in principal with Maritime and Coastguard Agency (MCA) and Trinity House (TH), and the associated coordinates of each structure and spare locations are provided in Appendix A. It should be noted that micrositing of up to 50m may be required for certain structures, and as such the as-built positions may differ from the coordinates shown in Appendix A.

Minimum spacing between WTGs is approximately 810m, and average spacing between adjacent structures is approximately 1.2km.

2.2 Project Schedule

Offshore construction activities are scheduled to commence in 2020 with completion and final commissioning expected by 2022. The provisional construction schedule for components of the wind farm is summarised in Table 2.1. It should be noted that the schedule below is based on a number of assumptions (e.g. weather, delivery and installation programs, etc.) and therefore the stated dates are subject to change.

Table 2.1 Indicative Project Schedule

Milestone	Date
Export Cable Installation (offshore)	Q2 2020 – Q4 2021
Inter-Array Cables	Q2 2020 – Q4 2021
Scour Protection	Q4 2020 – Q1 2021
Foundation Installation	Q4 2020 – Q4 2021
Substructures (Jackets)	Q3 2020
Substructures (Topsides)	Q2 2021
WTGs	Q2 2021 – Q1 2022

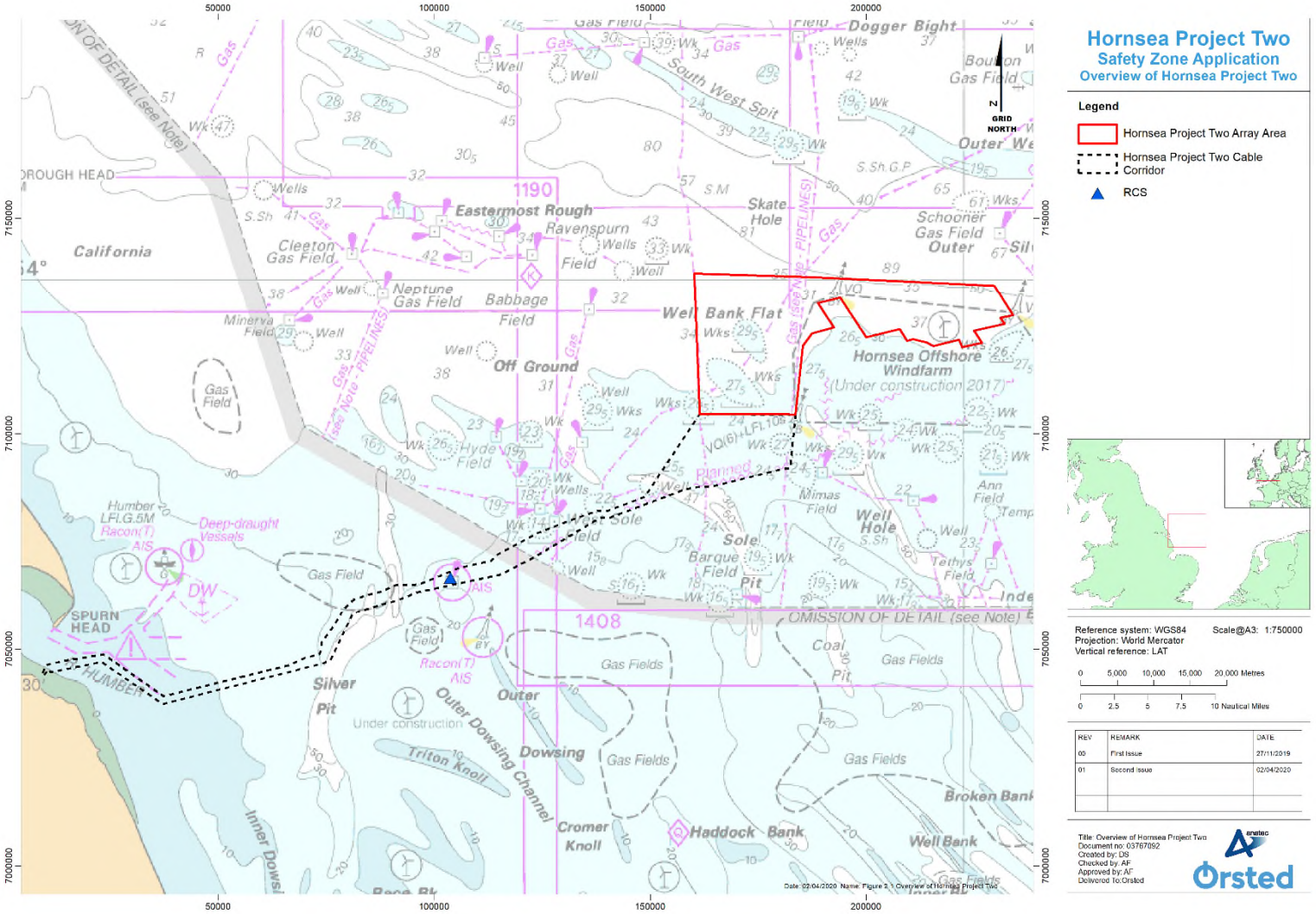

Figure 2.1 Overview of Hornsea Project Two

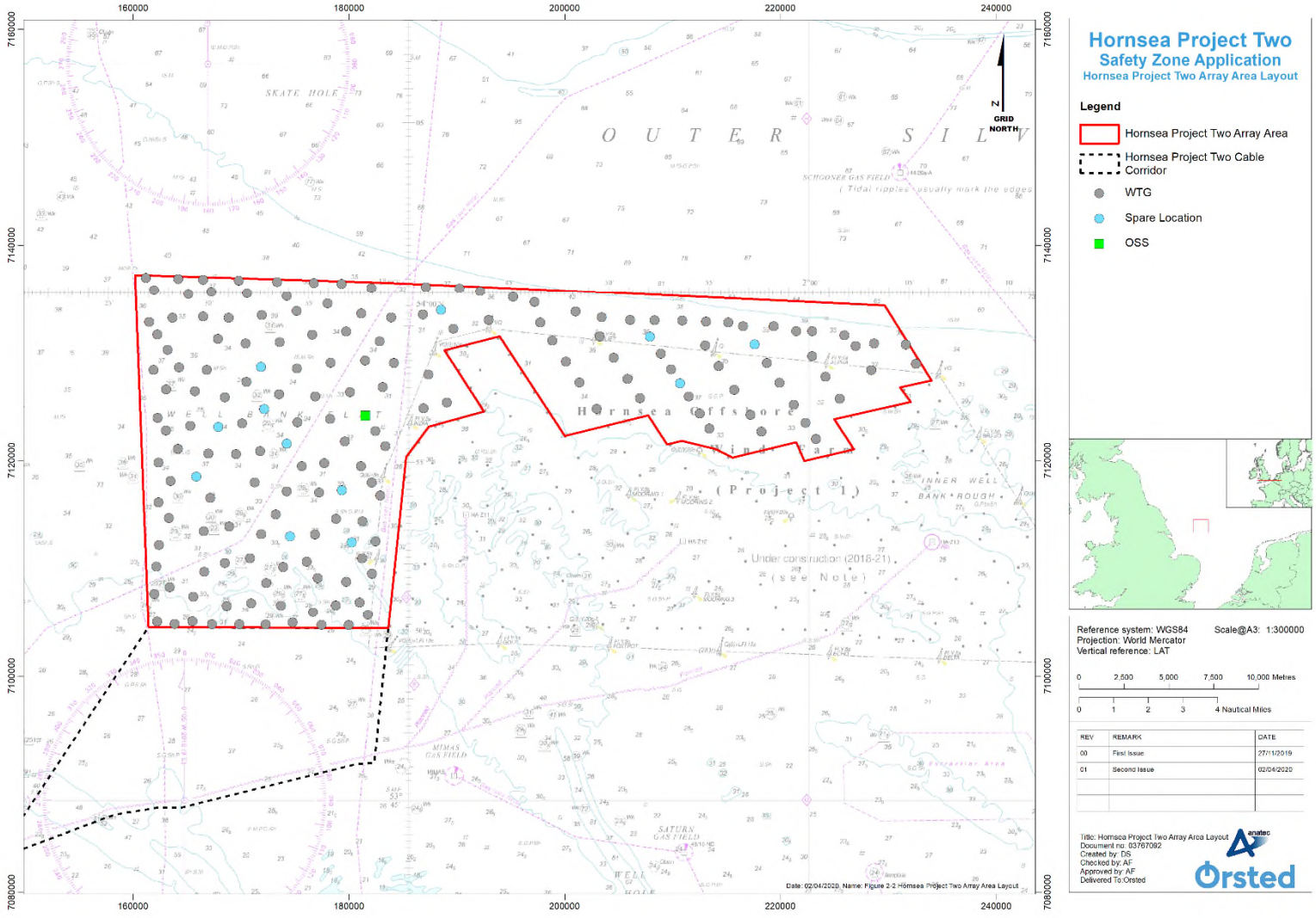

Figure 2.2 Hornsea Project Two Array Area Layout

3. Project Components

3.1 Foundations

The WTGs (see Section 3.2) are to be installed via Transition Piece (TP) onto MP foundations, of diameter ranging between 8.3 and 9.5 m.

A schematic of the TP and MP assembly is provided in Figure 3.1.

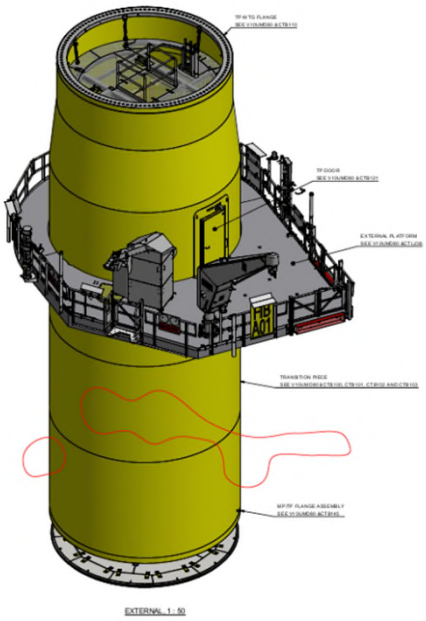

Figure 3.1 Indicative TP and Monopile Assembly

Both the OSS and RCS will be installed on jacket foundations, fixed with eight and four piles respectively.

3.2 Wind Turbine Generators

Ørsted are utilising 8.0 MW WTGs rated to 8.4 MW supplied by Siemens Gamesa Renewable Energy (SGRE), with each installed via TP onto MP foundations as per Section 3.1.

Key parameters of the WTGs are detailed in Table 3.1.

Table 3.1 WTG Parameters

Parameter	Value
Manufacturer	SGRE
Capacity	8 MW rated to 8.4 MW
Rotor Diameter	167 m
Blade Length	81.0 m
Hub Height (Lowest Astronomical Tide (LAT))	120.5 m

Parameter	Value
Maximum Tip Height (LAT)	204.4 m
Interface Height (Foundation to TP) above LAT	25.4 m
Blade Clearance (Mean High Water Springs)	34.1 m

3.3 Offshore Substation

As detailed in section 2.1, the Hornsea Project Two layout includes one OSS. As per Section 3.1, the OSS will be installed on a jacket foundation fixed via eight piles. The jacket structure will also comprise the boat landings, intermediate platforms (cellar deck) and ladder.

Key parameters of the OSS are detailed in Table 3.2.

Table 3.2 OSS Topside Parameters

Parameter	Value
Length	70m
Width	60m
Max Height above LAT	60m

3.4 Reactive Compensation Substation

As detailed in Section 2.1, Hornsea Project Two will utilise a single RCS built within the Hornsea Project Two Export Cable Corridor. As per Section 3.1, the RCS will be installed on a jacket foundation fixed via four piles. The jacket structure will also comprise the boat landings, intermediate platforms (cellar deck) and ladder.

Key parameters of the RCS are detailed in Table 3.2.

Table 3.3 RCS Topside Parameters

Parameter	Value
Length	36m
Width	22m
Max Height above LAT	34m

3.5 Cables

The OSS will connect to the onshore grid via three offshore export cables making landfall at Horseshoe Point, Lincolnshire at the mouth of the River Humber. Final cable routes are still being assessed, however they will be contained within the Hornsea Project Two cable corridor shown in Figure 2.1.

It is anticipated that the combined length of the Hornsea Project Two export cables will not exceed 450 km. The WTGs and the OSS will be connected via a network of inter-array cables, which will not exceed 500 km in length.

4. Construction Overview

4.1 Scour Protection

It is anticipated that of the 165 WTGs, a total of 89 locations will require scour protection. The scour installation at these locations will be undertaken by a fall pipe vessel and is anticipated to occur between Q3 2020 and Q1 2021. The RCS will also require scour protection, which will be installed in 2020 prior to installation of the jacket.

4.2 Wind Turbine Generators

Installation of the WTG foundations will be undertaken by a Heavy Lift Vessel (HLV), with associated works anticipated to commence in Q3 2020, starting with scour protection, and be completed by Q4 2021.

Installation of the WTGs onto the foundations is expected to commence in Q3 2021 and be completed by Q1 2022. Each vessel cycle will be capable of carrying and fitting four WTGs, with a total of five lifts being required for each WTG as follows:

- 1 x tower;
- 1 x nacelle; and
- 3 x blade.

It is anticipated that eight WTGs could be installed per week, assuming optimal conditions.

4.3 Offshore Substation

The OSS foundation and jacket will be transported to site via Heavy Transport Vessel (HTV), prior to installation by a Heavy Lift Crane Vessel. Once fixed via piles, the topsides will be installed on the jacket structure although this will be several months after the installation of the jacket structure.

It is anticipated that a jack up will also be required during the commissioning phase.

4.4 Reactive Compensation Substation

Installation of the RCS components will be as for the OSS (see Section 4.3), noting that unlike the OSS, it will be installed upon scour protection (see Section 4.1).

4.5 Cables

Following pre-lay surveys, boulder clearance and seabed preparation (sandwave clearance), a pre lay grapnel run (PLGR) will be undertaken over the cable routes. Export cables will be laid either through simultaneously lay and burial or post-lay backfilling using ploughs. Array cables will be installed using trenching or jetting tools. Where target burial depths are not able to be met or at cable crossings, external rock or other cable protection may be utilised.

5. Operations and Maintenance

The definition of “major maintenance” given within the Electricity Regulations 2007 (which details regulations associated with application procedures and control of access related to safety zones) is as follows:

“*works relating to any renewable energy installation which has become operational, requiring the attachment to, or anchoring next to, such an installation of a self-elevating platform, jack-up barge, crane barge or other maintenance vessel*.”

Under this definition, vessel types that will trigger a major maintenance safety zone include:

- Service Operations Vessels (SOVs) with a Walk to Work (WTW) system;
- Jack-ups;
- Floating barges; and
- Heavy lift vessels.

Full details of major maintenance activities that will occur as part of the operation of Hornsea Project Two are unable to be confirmed at the time of writing based on the information available. However, it is intended that an SOV will remain on site during operations and engage in maintenance operations including the transfer and pick up of personnel to / from the structures via the WTW system. Further details of the SOV are provided in Section 6. Larger vessels may also be required where a need arises for significant maintenance operations unable to be handled by the SOV.

Throughout major maintenance details of the work being carried out shall be promulgated through local Notice to Mariners and radio warnings as designated by the United Kingdom Hydrographic Office (UKHO).

6. Service Operations Vessels

It is intended that SOVs will be utilised during the operational phase of Hornsea Project Two for maintenance purposes. The operations undertaken by the SOV are considered as being particularly sensitive as assessment has shown potential risks to personnel and infrastructure, most notably when the WTW system is in use.

Given the personnel on board and the vulnerable nature of the WTW system, 500m around SOVs when attached to a structure are included within those safety zones applied for within this application. As per Section 5, an SOV falls under the definition of “Major Maintenance” given in the Electricity Regulations 2007 (given that it attaches to the structure) and is hence eligible for the corresponding 500m safety zones afforded to such operations. A detailed justification is provided in Section 10.

6.1 Indicative Parameters

It is currently anticipated that the *Wind of Hope* will be used during the operational phase of Hornsea Project Two. Relevant parameters of this vessel are provided in Table 6.1, noting that the values given are likely to be indicative should an alternate SOV be utilised.

Table 6.1 Indicative SOV Parameters

Parameter	Value
Length (m)	83
Beam (m)	19.4
Draught (m)	5
Dead Weight Tonnage	1,625
Accommodation	Up to 90 personnel

6.2 Walk to Work

The SOV(s) will utilise a WTW system to transfer personnel to the WTGs. The WTW system employed by the SOV anticipated to be used during the operational phase of Hornsea Project Two (see Section 6.1) utilises a motion compensated gangway with a range of up to approximately 19m, as illustrated in Figure 6.1 which provides an indicative portrayal of the system in use.

Figure 6.1 Indicative WtW Illustration (courtesy of Cemre Shipyard)

Safety zones will only be active around a structure while the SOV is attached to that structure. In the event of an emergency (e.g., a potential collision incident), the SOV has procedures in place to evacuate the WTW system, and subsequently disconnect. However, given that this may lead to personnel being left on a structure (and therefore vulnerable in an emergency situation), risk assessment has identified the need for these safety zones around structures to which the SOVs are attached to ensure the potential for an emergency situation and unplanned evacuation is minimised.

6.3 Crane Capacity

The SOVs will be fitted with cranes, noting that lifting operations will be undertaken to transfer stores / equipment onto the structures associated with Hornsea Project Two. For the purposes of providing an indication as to crane capacity of the SOVs, the *Wind of Hope* (see Section 6.1), is currently planned to be fitted with the following:

- 1 x Active Heave Compensated Offshore Crane (three tonnes);
- 1 x offshore crane; and
- 1 x provision crane.

7. Lighting and Marking

This section summarises the lighting and marking of the Project which has been drafted in consultation with Trinity House (TH) and the MCA via the Lighting and Marking Plan (LMP) (Document No: 00253854). Aviation lighting (including Search and Rescue lighting) is not considered pertinent to this safety zone application and has therefore not been included, however full details are available within the LMP.

7.1 Construction Phase

7.1.1 Lighting

During construction, all fixed structures, including partially constructed structures such as WTG foundations, will be mounted and marked with a Flashing (Fl) Yellow (Y) 2.5 second (s) light (FL. Y. 2.5s) visible through 360 degrees with a 2 nm range.

These lights should meet International Association of Lighthouse Authorities (IALA) Availability Category 2 (not less than 99.0%) and will remain in place until the operational lighting has been commissioned, and has been accepted as such by TH.

7.1.2 Buoyage

All required construction phase buoyage will be established at least eight weeks prior to the commencement of construction works and will remain in place until the operational marking requirements have been inspected and passed by TH. The Hornsea Two Array Area will be marked via 13 buoys during the construction phase.

- 3 x north cardinals;
- 2 x west cardinals;
- 2 x south cardinals; and
- 6 x special marks.

Further, the Hornsea Two RCS will be marked with three buoys during construction:

- 1 x north cardinal;
- 1 x east cardinal; and
- 1 x west cardinal.

7.2 Operational Phase

7.2.1 Lighting

During the operational phase, in line with requirements under IALA O-139 (IALA, 2013), certain peripheral structures will be marked as Significant Peripheral Structures (SPS). Each SPS will be fitted with three marine lights (spaced at 120° degree intervals) satisfying the following criteria:

- 5nm light Fl Y 5s, 360° visibility, flashing in synchronicity, IALA category 2 (> 99.0% availability).

7.2.2 Sound Signals

Each SPS (see Section 7.2.1) will also be fitted with sound signals, which will activate whenever visibility is less than 2nm. When activated, the signals will sound a blast lasting 2s every 30s. They will meet IALA category 3 availability requirements (> 97.0%).

7.2.3 Buoyage

In agreement with TH, no buoyage will be utilised during the operational phase.

8. Marine Traffic Survey Data

8.1 Introduction

In line with BEIS guidance (2011) this safety zone application includes assessment of up to date marine traffic survey data collected during 2019. The primary source of this data was the *Esvagt Castor*, which was performing a traffic monitoring survey for Hornsea Project One during part of January 2019 and June 2019. To ensure coverage was as comprehensive as practical, the data has been supplemented with additional Automatic Identification System (AIS) data recorded from both shore-based and offshore receivers (where available).

Periods to monitor were chosen such that downtime was minimal, and to account for potential seasonal variations and are as follows:

- 14 days winter 2019 (AIS only): 5th to 18th January 2019; and
- 14 days summer 2019 (AIS only): 1st to 14th June 2019.

A number of vessels associated with the wind farm industry, generally involved with the construction of Hornsea Project One, were considered to represent temporary traffic and, thus were excluded from the main analysis. For reference, wind farm vessels are presented in Section 8.3.10, as it should be noted that operational and maintenance wind farm traffic will be present at Hornsea Project One following commissioning (albeit likely at lower levels than during construction).

AIS and radar collected as part of the Hornsea Project Two Navigational Risk Assessment (NRA) (Anatec, 2015) process has also been considered on a secondary basis, in particular to identify any changes in traffic patterns or behaviours arising since the original assessment. This data was collected in 2012 and totalled 42 days, with periods set as follows:

- AIS and Radar data 7th October to 24th November 2012 (28 days winter)
- AIS and Radar data 1st to 19th June 2012 (14 days summer)

It should be considered when viewing this analysis that the 2012 NRA survey data was collected prior to commencement of construction of Hornsea Project One. As shown in Section 8.3, vessel patterns and routeing reflected within the 2019 data have differed since the time of the NRA, and the construction of Hornsea Project One is likely to be a primary contributing factor to this (noting it is adjacent to Hornsea Project Two).

8.2 2012 Navigational Risk Assessment Data

A marine traffic survey was undertaken by Anatec in 2012 for the purpose of informing the NRA. This survey comprised of both AIS and radar data collected by the *Southern Star* and the *Normand Mermaid* during bird, marine mammal, geophysical survey and geotechnical work within the Hornsea Project Two Array Area. The data collected comprised of a 14 day summer period in June 2012 and a 28 day winter period during October and November 2012. The data collected during these two survey periods is presented in Figure 8.4, colour coded by vessel type.

An average of 34 unique vessels per day was recorded during the summer survey period and an average of 35 unique vessels per day for the winter survey period. The main vessel types recorded within the study area were commercial vessels, with cargo vessels accounting for 59% of the total and tankers a further 16%. Commercial vessels were also the most commonly recorded within the Hornsea Project Two Array Area itself, with cargo vessels accounting for 51% and tankers a total of 24%.

8.3 2019 Marine Traffic Survey Data

A plot of the vessel tracks recorded during the 2019 summer and winter survey periods is presented in Figure 8.5, colour coded by vessel type. A number of vessel types (i.e., Military, Dredger/Subsea Operations, and High-Speed Crafts) have been assigned to the 'other' category in given that they accounted for less than 1% of the overall total vessels detected during the two 2019 survey periods.

At the time of writing, Hornsea Project One is still marked via construction buoyage. As can be seen in Figure 8.5, the significant majority of traffic is avoiding the buoyed construction area.

8.3.1 Vessel Type

The distribution of vessel types recorded within the study area is presented in Figure 8.1. For the purposes of this figure, less common vessel types (i.e., Military, Dredger/Subsea Operations, High Speed Crafts) have been grouped into the "Other" category given they each contributed less than 1% of the total.

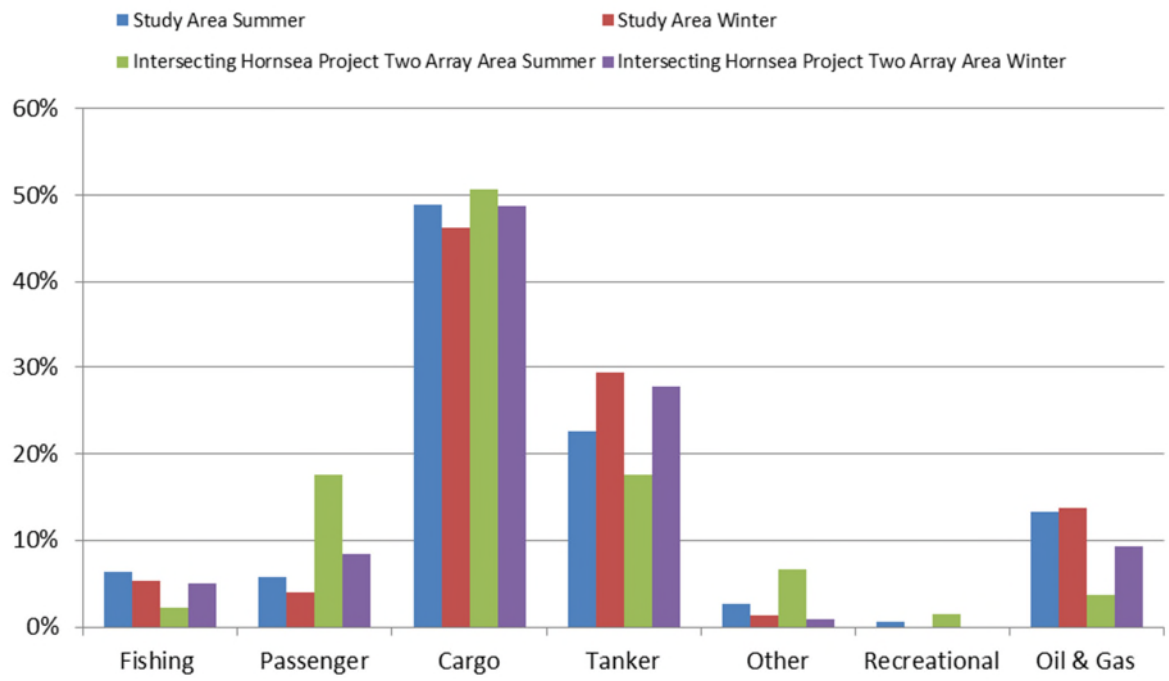

Figure 8.1 Vessel Type Distributions

The main vessel types within the study area were cargo vessels (46% in winter and 49% in summer) followed by tankers (29% in winter and 23% in summer). Notable levels of oil and gas vessel activity were also observed (13% in both winter and summer).

The main vessel types intersecting the Hornsea Project Two Array Area were cargo vessels (49% in winter and 51% in summer) followed by tankers (28% in winter and 18% in summer). Notable levels of passenger vessel traffic was also recorded intersecting the Hornsea Project Two Array Area during summer (18%) which can mostly be attributed to the *Princess Seaways* and *King Seaways* commercial ferries, which run the DFDS operated Newcastle (UK) / Ijmuiden (Netherlands) route.

The vessel type distributions during the 2019 surveys were broadly similar to that observed within the NRA.

8.3.2 Vessel Count

The number of unique vessels recorded during the winter and summer survey periods are presented in Figure 8.2 and Figure 8.3 respectively.

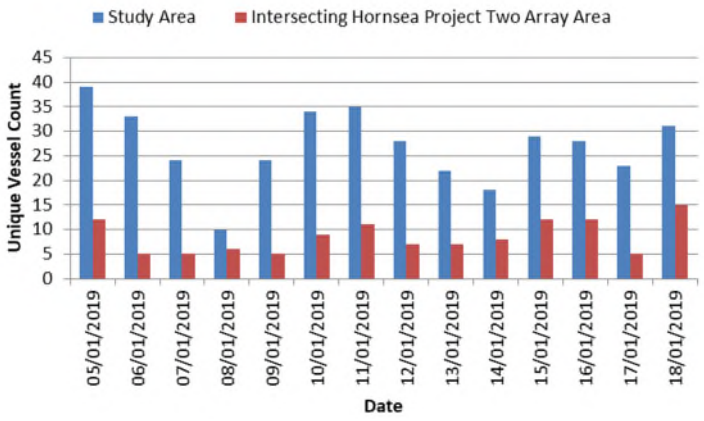

Figure 8.2 Daily Counts – January 2019

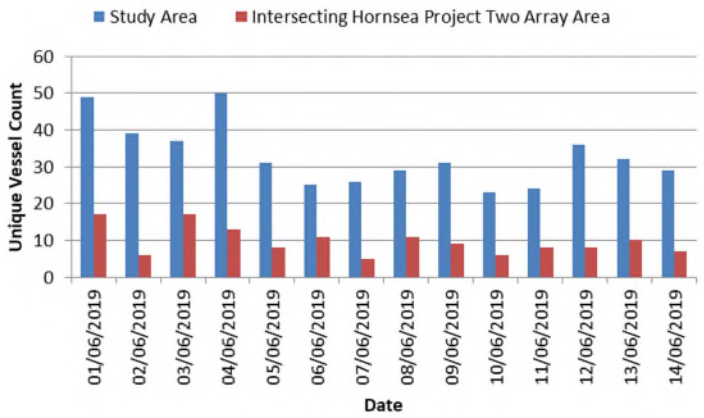

Figure 8.3 Daily Counts – June 2019

An average of 32 unique vessels per day were recorded within the study area during the summer survey period. This represents an increase over that of winter, when 27 vessels per day were recorded. There were average of 9 and 10 unique vessels per day intersecting the Hornsea Project Two Array Area for the summer and winter survey periods respectively.

These average numbers of vessels are broadly comparable to the averages detected during the 2012 survey, noting an overall general decrease in traffic as indicated in Table 8.1. This may be due to changes in vessel routeing in the area, noting the construction of Hornsea One began after the NRA surveys in 2012.

Table 8.1 Vessel Count Summary

Period	Summer 2019	Summer 2012	Winter 2019	Winter 2012
Study Area	32	35	27	35
Hornsea Two Array Area	10	12	9	12

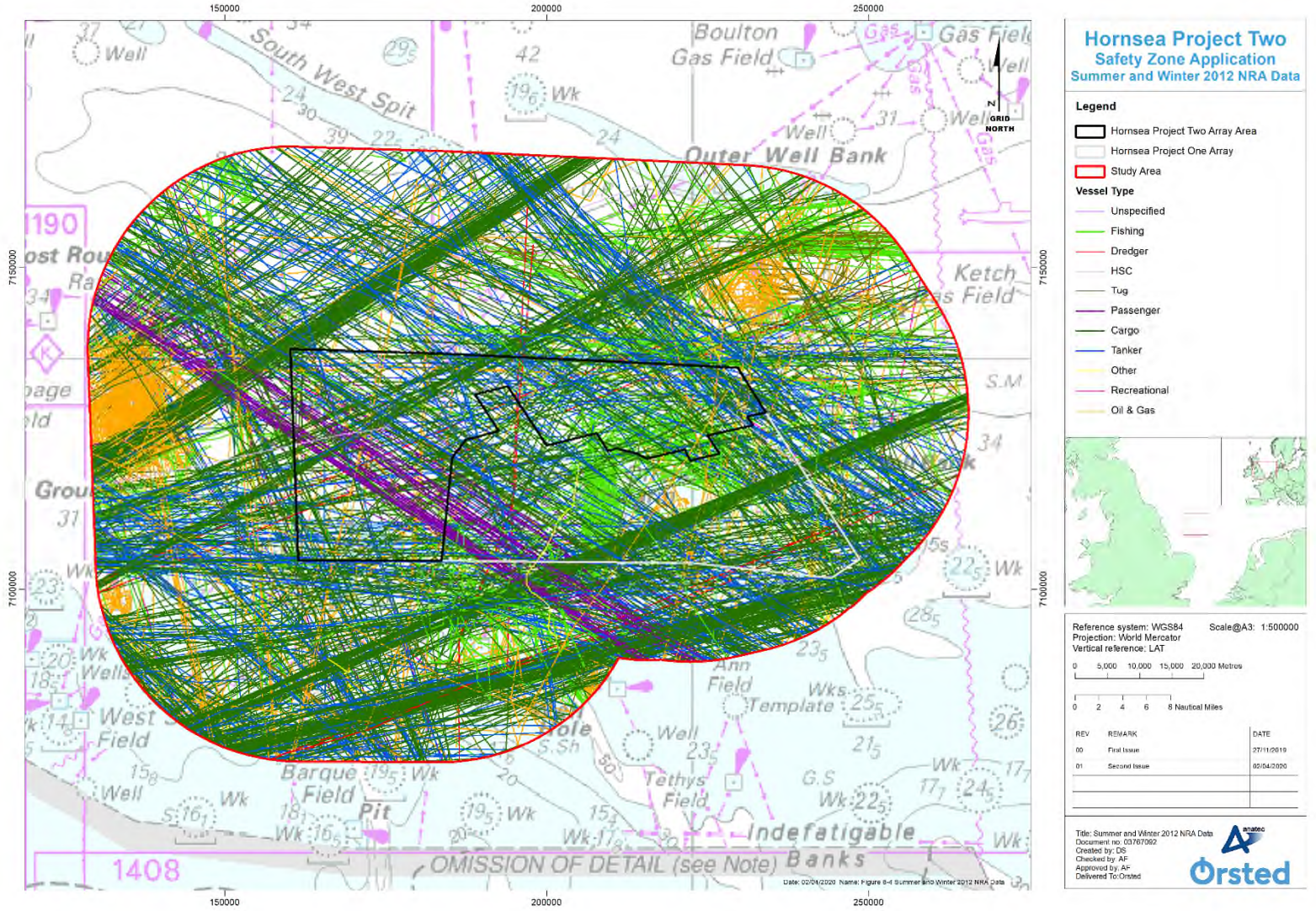

Figure 8.4 Summer and Winter 2012 NRA Data

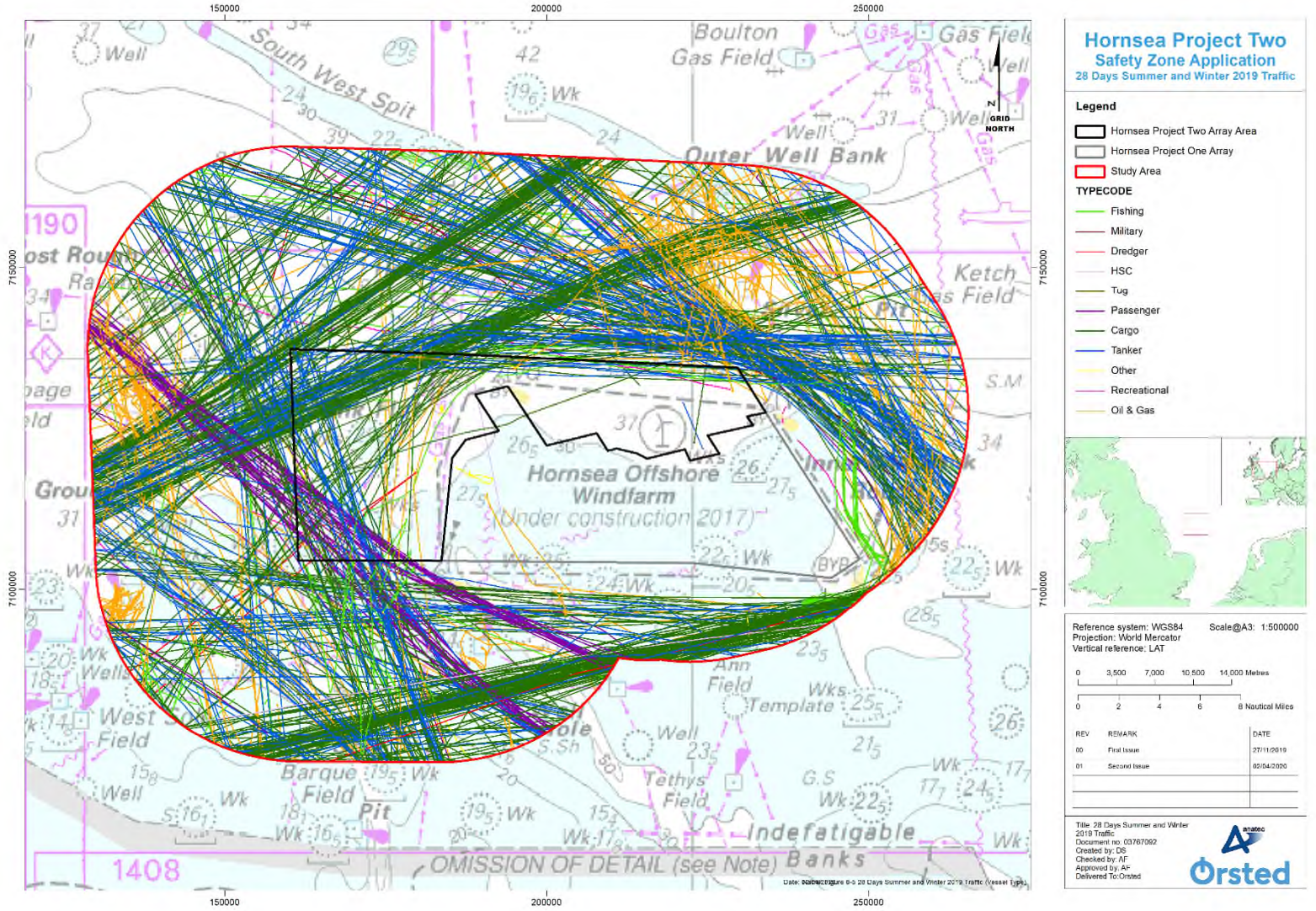

Figure 8.5 28 Days Summer and Winter 2019 Traffic (Vessel Type)

8.3.3 Cargo Vessels

Figure 8.6 presents the tracks of cargo vessels recorded within the study area during the 2019 surveys.

During the 2019 surveys, there was on average 15 unique cargo vessels per day transiting the study area and an average of two unique cargo vessels intersecting the Hornsea Project Two Array Area. This represents a decrease from the levels recorded within the 2012 survey when 18 unique cargo vessels were recorded per day within the study area and four unique cargo vessels were recorded per day intersecting the Hornsea Project Two Array Area. This may be due to changes in vessel routeing following the construction of Hornsea Project One.

8.3.4 Tankers

Figure 8.7 presents the tracks of tankers recorded within the study area during the 2019 surveys.

During the 2019 surveys, there was an average of seven unique tankers per day transiting within the study area and an average of two unique tankers intersecting the Hornsea Project Two Array Area. This is considered comparable to the 2012 survey when six unique tanker vessels were recorded per day within the study area and two unique tankers were recorded per day intersecting the Hornsea Project Two Array Area.

8.3.5 Passenger Vessels

The tracks of passenger vessels recorded within the study area during the 2019 surveys are shown in Figure 8.8.

During the 2019 surveys, there was on average two unique passenger vessels per day transiting within the study area and an average of one unique passenger vessel intersecting the Hornsea Project Two Array Area. The *Princess Seaways* and *King Seaways* operated by DFDS on the route between Newcastle (UK) and Ijmuiden (Netherlands) accounted for the majority (> 90%) of the passenger vessel transits in the study area during the 2019 survey periods. This route has shifted further south compared to the 2012 survey data to account for the presence of Hornsea Project One.

8.3.6 Oil & Gas Vessels

Figure 8.9 presents the tracks of oil & gas vessels recorded within the study area during the 2019 surveys.

During the 2019 surveys, there was on average three unique oil & gas vessels per day recorded within the study area and an average of one oil & gas vessel every two days intersecting the Hornsea Project Two Array Area. This is comparable to the 2012 survey when four to five unique oil & gas vessels were detected per day and one unique oil & gas vessel per day intersecting the Hornsea Project Two Array Area. During both the 2019 and the 2012 surveys the tracks were observed to be concentrated in similar areas, in particular at the Schooner Gas Field north of the Hornsea Project Two Array Area.

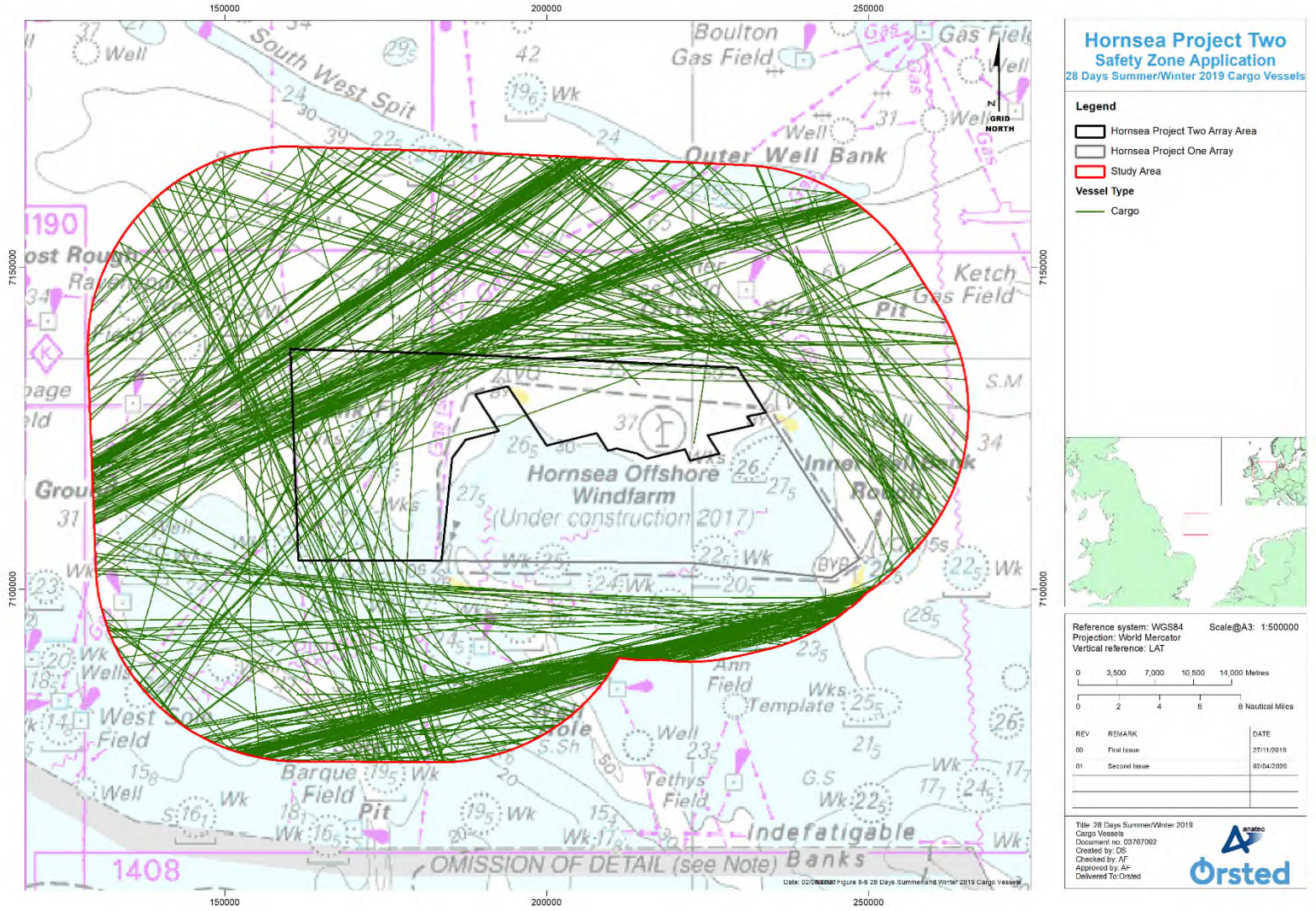

Figure 8.6 28 Days Summer/Winter 2019 Cargo Vessels within the Study Area.

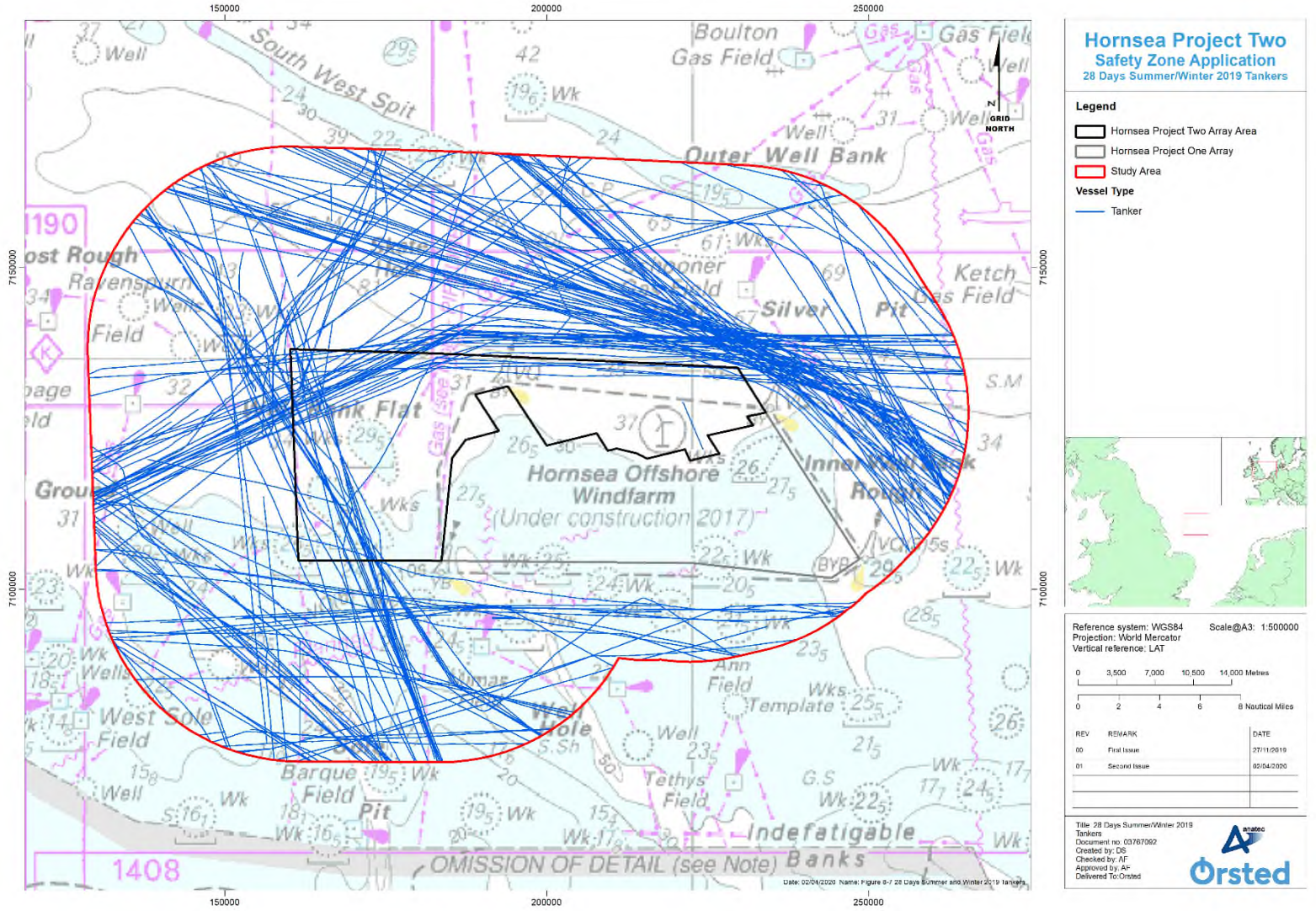

Figure 8.7 28 Days Summer/Winter 2019 Tankers within the Study Area.

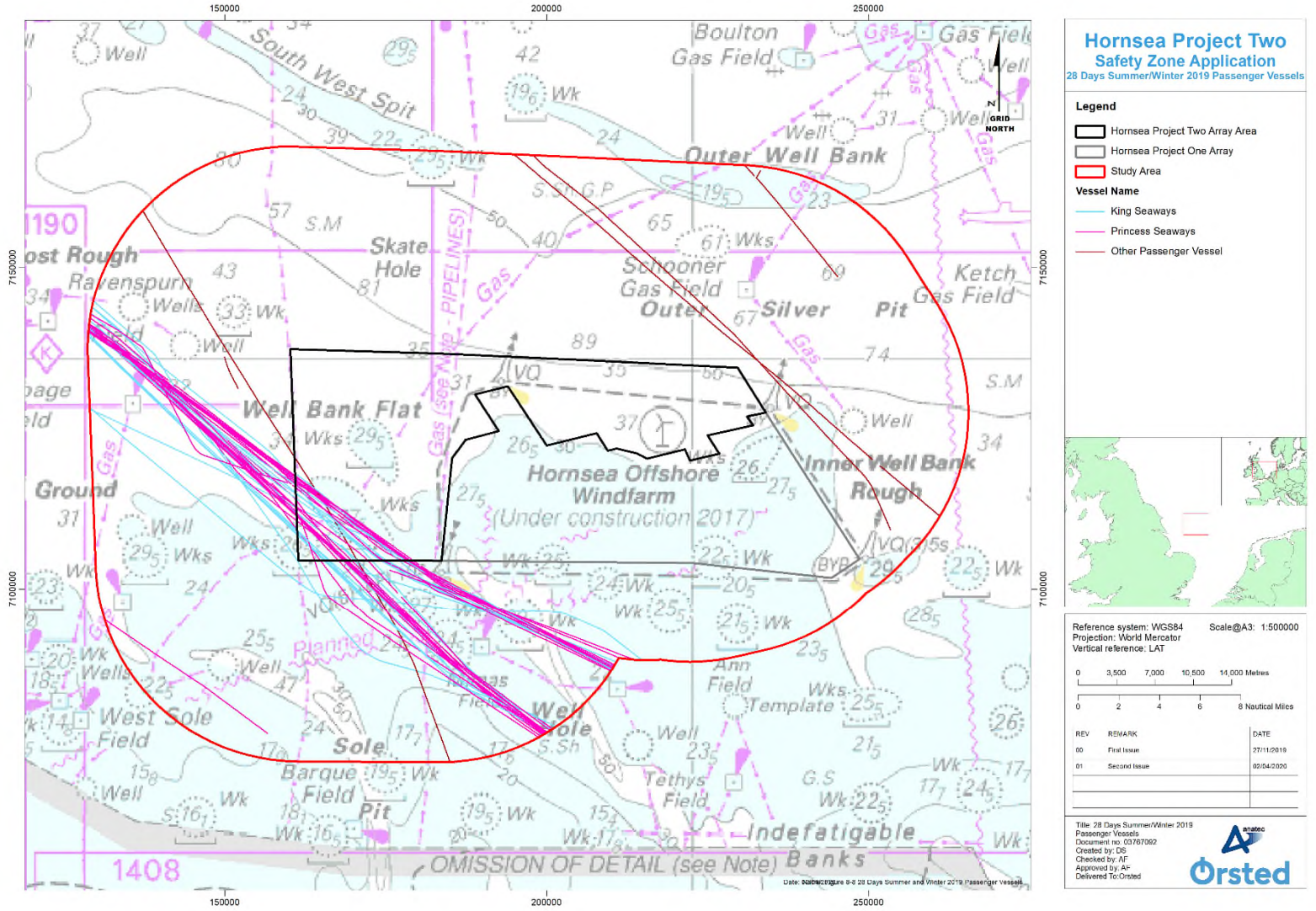

Figure 8.8 28 Days Summer/Winter 2019 Passenger Vessels within the Study Area.

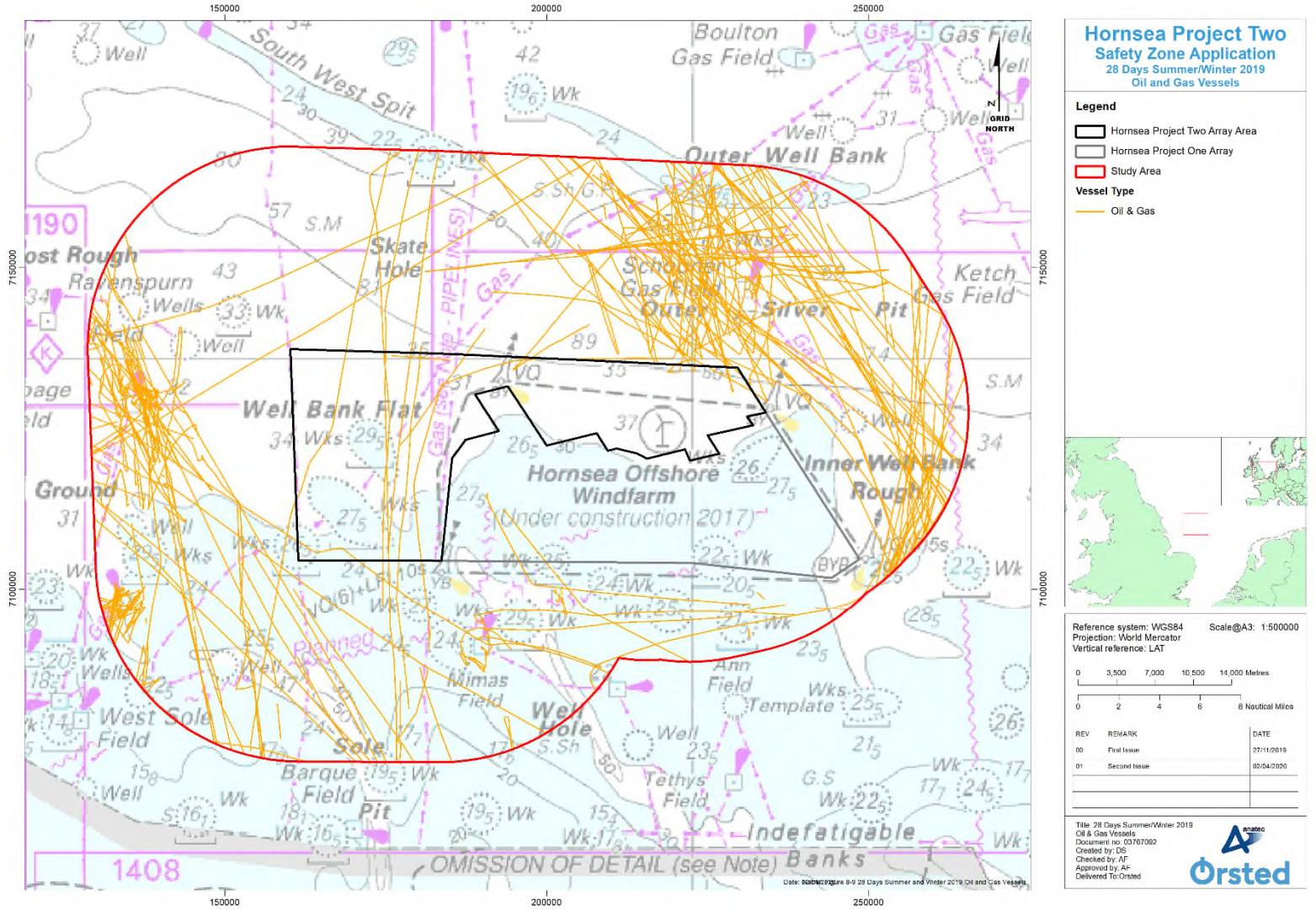

Figure 8.9 28 Days Summer/Winter 2019 Oil & Gas Vessels within the Study Area.

8.3.7 Anchored Vessels

Based on the information transmitted via AIS and an assessment of vessels exhibiting potential anchoring behaviours, the only anchoring activity in the area occurred from wind farm support vessels within the Hornsea Project One Array Area.

It is noted that limited levels of anchoring from non-wind farm vessels was recorded within the NRA data, both within and near the Hornsea Project Two Array Area. It is considered likely that the presence of the buoyed construction area around Hornsea Project One has dissuaded any third-party vessels from anchoring in the area.

8.3.8 Fishing Vessel Activity

Figure 8.10 presents the tracks of fishing vessels recorded within the study area during the 2019 surveys.

During the 2019 surveys, there was an average of three unique fishing vessels per day transiting within the study area and an average of a fishing vessel every three days intersecting the Hornsea Project Two Array Area. Fishing vessels accounted for a total of 7% of traffic during summer, and 5% during winter.

These levels are comparable to the 2012 surveys when an average of three unique fishing vessels per day were recorded in the study area and an average of one every two days were detected in the Hornsea Project Two Array Area.

It is noted that while the general volume of fishing vessels remains broadly similar between the 2012 and 2019 data sets, based on a high-level assessment of vessel behaviour more active fishing (i.e., gear deployed) was observed in the 2012 NRA data than within the 2019 data. Fishing can vary on a seasonal and annual basis, however it is noted that the construction of Hornsea One may have had an effect on fishing levels in the area. It should also be considered that fishing vessels of less than 15m (i.e., those not required to broadcast via AIS) may be underrepresented.

8.3.9 Recreational Vessel Activity

Figure 8.11 presents the tracks of recreational vessels recorded within the study area during the 2019 surveys.

All recreational traffic during the 2019 surveys was recorded during summer. This is likely due to the distance that Hornsea Project Two Array Area is located from the shore, noting that winter conditions are generally unfavourable for recreational traffic.

It should be considered that recreational vessels are not required to broadcast via AIS, and as such activity may be underrepresented.

8.3.10 Wind Farm Support Vessels

Figure 8.12 presents the tracks of wind farm support vessels, recorded within the study area during the 2019 surveys. As per Section 8.1 these vessels have not been included in the preceding analysis, however are included for reference.

During the 2019 surveys, there was on average 12 unique wind farm support vessels per day transiting / working within the study area and an average of five unique wind farm support vessels per day intersecting the Hornsea Project Two Array Area. The significant majority of these were wind farm support vessels associated with Hornsea Project One. Based on the data broadcast via AIS, these vessels were in majority transiting to the site from Grimsby.

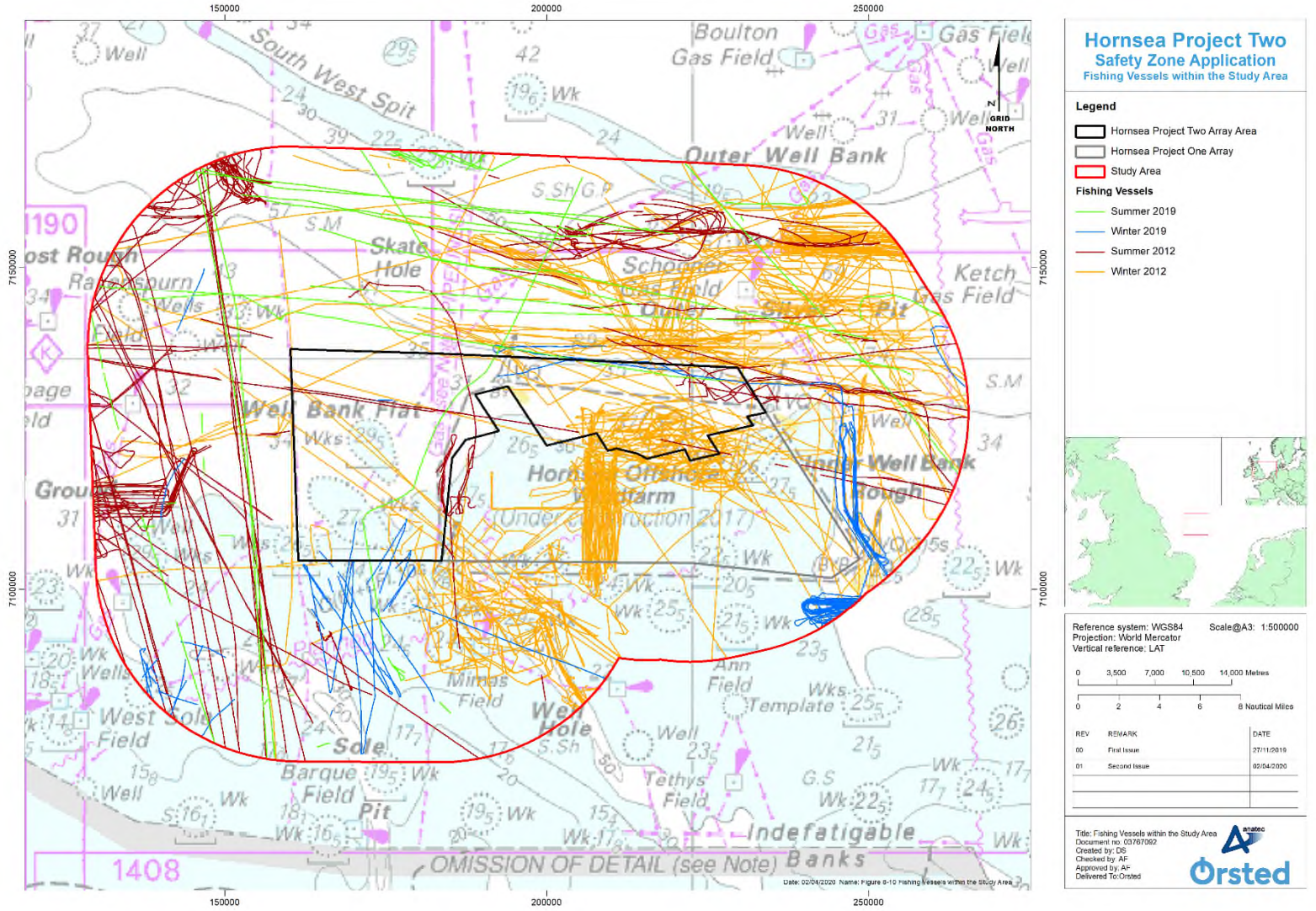

Figure 8.10 Fishing Vessels within the Study Area (2012 and 2019)

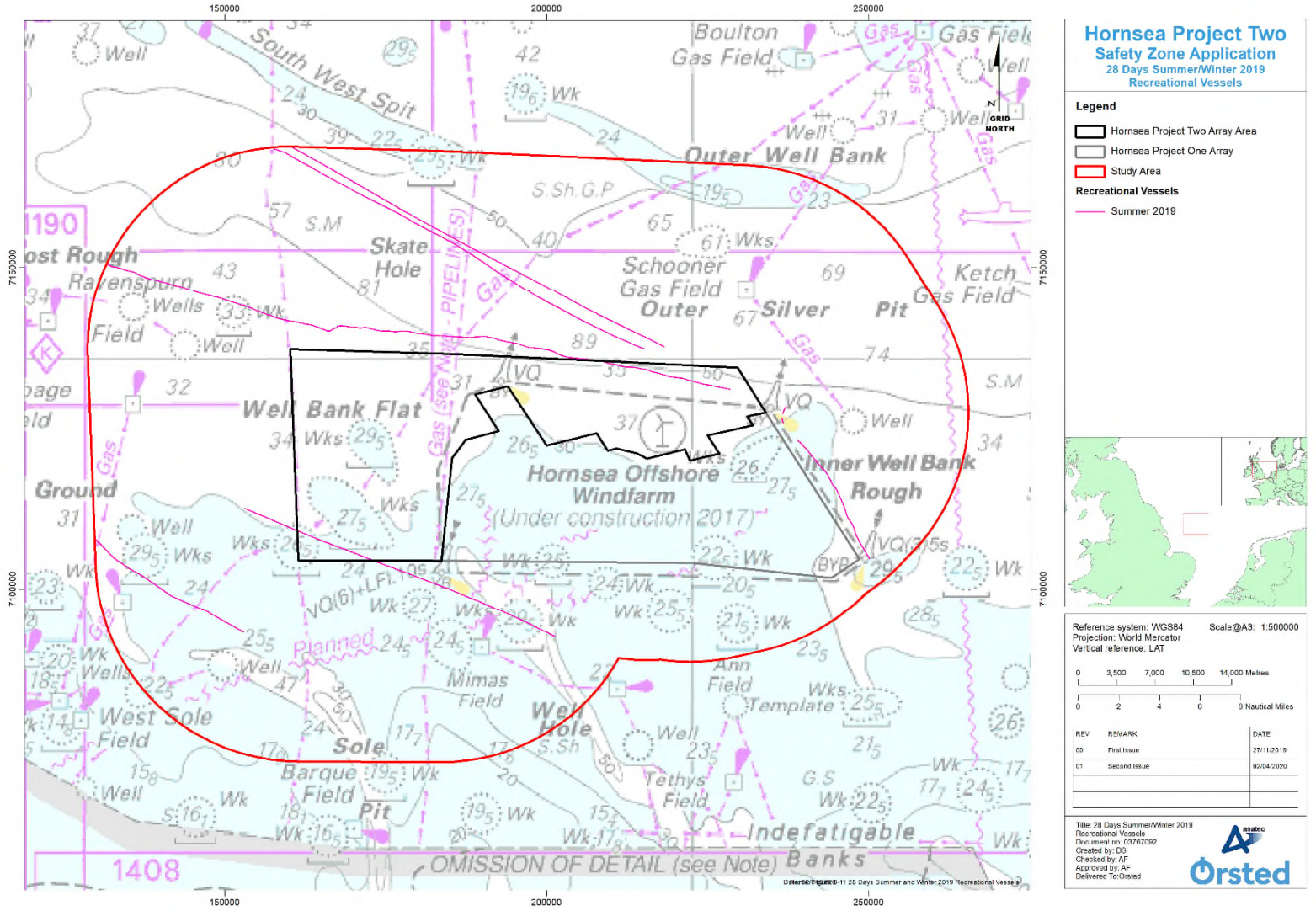

Figure 8.11 28 Days Summer/Winter 2019 Recreational Vessels within the Study Area.

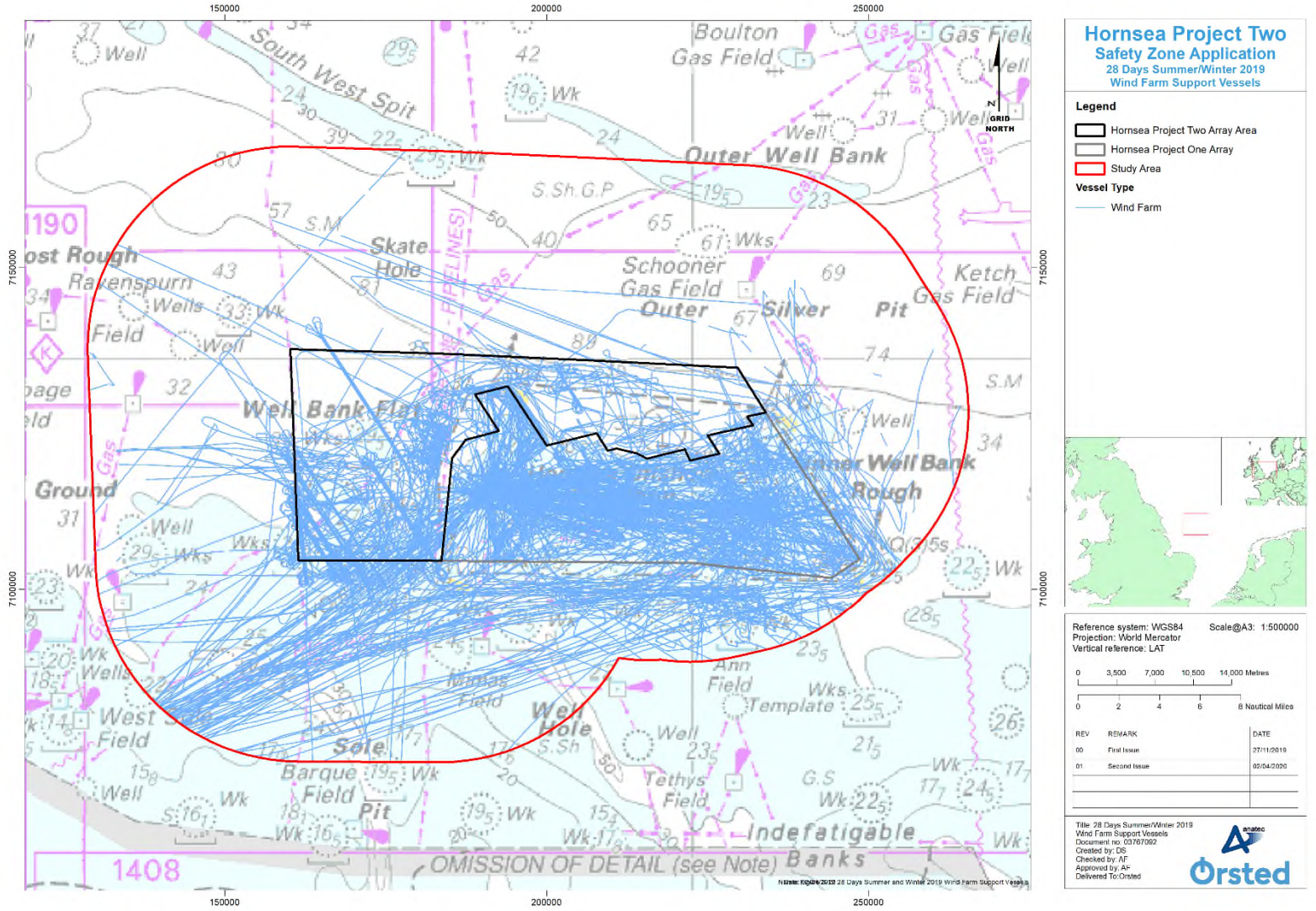

Figure 8.12 28 Days Summer/Winter 2019 Wind Farm Support Vessels within the Study Area.

9. Safety Zone Overview

9.1 Safety Zone Triggers

For the purpose of clarity, this section provides an indication as to what activities are considered as triggering a safety zone during the construction and operational phase of the Project. The list of activities presented represents those activities identified to date, and as such is not considered as being exhaustive. The activities listed have been identified on the basis that they satisfy the following criteria:

- Risk assessment has identified that safety zones are a necessary mitigation measure to bring risks (as per Section 10) to within As Low as Reasonably Practicable (ALARP) parameters; and
- The activities are considered as being allowed safety zones under the relevant guidance and legislation as listed in Section 1.3.

The identified activities are listed below:

- Any construction or major maintenance operation involving a vessel Restricted in Ability to Manoeuvre (RAM) stationed at a structure (within 500m);
- Any construction or major maintenance operation involving any kind of attachment to a structure (e.g., WTW, temporary power cabling, transfer of stores); and
- Any construction or major maintenance operation involving a vessel that is required by the nature of the operation to be anchored to the seabed next to structure (e.g., heavy lift operations).

For SOVs these activities are further defined as:

- Any construction or maintenance operation involving the WTW system (noting that this requires attachment to the structure); and
- Any lifting operation at a structure which requires the SOV to be stationed at the structure (including both attachment to the structure, or being anchored next to the structure).

9.2 Relevant Structures

The safety zones listed above are applied for around the WTGs, the OSS, Additionally, the major maintenance safety zones are also applied for around the RCS.

It is noted that permanent safety zones during the operational phase are not applied for around any structure.

10. Justifications for Safety Zones

The use of safety zones was identified as a necessary embedded mitigation measure within the NRA (Anatec, 2015). This section summarises the need for the safety zones, based on the findings of the NRA, the marine traffic analysis undertaken for this application as per Section 10 and experience of other similar operational or construction projects.

10.1 Reduction in Collision Risk

Throughout the construction of Hornsea Project Two, various vessels will be within the buoyed construction area carrying out the installation of the required infrastructure including the WTGs, foundations, OSS, RCS, and cables. Given the size of the components and the nature of the required associated works, the vessels on site will include those that are RAM or those engaged in sensitive operations while attached to a structure (e.g., SOVs), with the potential for multiple such vessels to be on site simultaneously.

Vessel numbers during operation are anticipated to be significantly less than during construction. However, during periods of major maintenance there may be a requirement for RAM vessels. There is also the potential that an SOV with a WTW system will be used as part of maintenance operations (noting that SOVs are covered under the definition of major maintenance as per Section 5 when the WTW system is utilised).

As per Sections 8.3.3 (cargo), 8.3.4 (tanker), and 8.3.5 (passenger), commercial vessel routes currently transit through the site. Notably, this traffic includes the DFDS operated commercial passenger ferry route between Newcastle and Ijmuiden. Based on typical activity observed at other wind farms, it is likely that once the site is marked as a buoyed construction area (see Section 7.1.2), commercial vessels will deviate around the site, noting that details of the Project and the buoyage will be promulgated in advance of construction. However, it should be considered that, particularly early on during construction before passing vessels have fully adapted to the site, commercial vessels may still choose to enter the buoyed construction area, especially into areas where works are not ongoing or have yet to commence. The 500m rolling construction safety zones would make it clear to any such vessels areas where sensitive operations are being undertaken (i.e., those involving a RAM vessel), and as such which areas should be avoided to reduce collision risk to within ALARP parameters.

Smaller vessels (e.g., fishing and recreational vessels) may also choose to avoid the buoyed construction area. However, given the typical size of such vessels, and the nature of their activity, they may be more likely to enter into the site than larger commercial vessels, and may also feel more comfortable passing close to sensitive operations. The 500m rolling construction safety zones are therefore necessary to make it clear to any such vessels the areas where such operations are being undertaken (i.e., those involving a RAM vessel), and as such which areas should be avoided to reduce collision risk to ALARP. Both fishing vessels and recreational vessels were recorded within the site in the marine traffic assessment (see Sections 8.3.8 and 8.3.9 respectively), albeit at low levels.

During operation, it is considered likely that commercial vessels deviations would be firmly established, and as such associated traffic would already be avoiding the structures. Based on experience at other operational wind farm projects, such vessels (i.e., large commercial vessels) will continue to utilise the deviated routes even after the construction buoys have been removed. However, smaller vessels may choose to enter into the site. It is therefore necessary to protect any major maintenance activities via the proposed 500m safety zones to ensure collision risk to the maintenance vessels is ALARP.

10.2 Reduction in Allision Risk

The installation of structures within the site will create an allision risk to passing traffic, particularly during the construction phase when third party vessels may still be unfamiliar with Hornsea Project Two. It should also be considered that during construction, partial structures will be present, and operational lighting and marking may not yet have been commissioned.

As noted in Section 10.1, based on experience at other wind farms, it is likely that the majority of commercial vessels will avoid the site altogether once it is marked as a buoyed construction area. However, it should be considered that such vessels may still transit through, particularly during the early stages of construction during areas where no or limited works are ongoing. Smaller vessels (e.g., fishing and recreation) may choose to avoid the site during construction, however given their size and manoeuvrability, they may be more comfortable navigating through than commercial vessels.

Therefore, the implementation of 50m safety zones around any pre-commissioned (including partial) structures would make it clear to passing vessels that the installations represent an allision risk and should be avoided and will reinforce the need for all vessels to passage plan to take account of the wind farm. The lack of ongoing construction activity (in the form of construction vessel presence) at such structures may result in third party vessels passing closer than they would to structures where RAM vessels were present, and the 50m safety zones are therefore considered a necessary mitigation to ensure safe passing distances are maintained until the operational phase mitigations are implemented.

As per Section 12, any safety zones would be monitored and policed by a designated vessel. The formal approval of the safety zones would provide said vessel with the legislative framework to warn passing third party vessels that entry into active safety zones is prohibited. It should also be considered that details of the safety zones will be promulgated in advance to relevant marine users, and this will increase general awareness of the Project, which will further reduce allision risk.

Without the implementation of these safety zones the allision risk to passing traffic cannot be mitigated satisfactorily and the risk would not fall within ALARP parameters.

10.3 Protecting Project Personnel

Throughout the construction phase and during periods of major maintenance of Hornsea Project Two there will be a significant increase in the total number of persons within the immediate sea area (i.e., crew members and wind farm technicians). This includes personnel on RAM vessels which are at particular risk of collision as per Section 10.1, or any vessel engaged in a sensitive operation (e.g., an SOV utilising a WTW system), and also technicians stationed on the structures themselves, which are at risk of allision as per Section 10.2.

The transfer of crew to structures via the WTW system from an SOV (as per Section 6) is considered as posing particular risk to personnel in the event of an emergency situation, given the sensitive nature of the associated operations. While personnel are in the process of transferring, or stationed on the WTGs themselves having successfully transferred, they are at risk should a potential allision or collision scenario occur. During any such sensitive operation where the SOV is attached to a structure during either the construction or operational phase, it is necessary to make clear to passing traffic the area which should be avoided to ensure the risks to personnel are ALARP.

The implementation of mandatory 500m safety zones provides an alert to vessels transiting within the area that a sensitive operation is underway and allows them to passage plan to maintain a safe passing distance for any activity and thus ensures the safety of the crew and personnel (to within ALARP parameters). During the construction phase, in the event that personnel are left on a structure without construction vessel

presence, the 50m safety zones would allow for additional allision protection (noting that 500m safety zones are not supported by stakeholders unless a vessel is present).

10.4 Prevention of Dangerous Behaviour

Experience at other wind farms has indicated that third party vessels can pass sensitive operations at distances which are of concern to the construction or maintenance vessels engaged in those operations (including SOVs). During such operations, the Project vessels will be fully compliant with the International Regulations for Preventing Collisions at Sea (COLREGS) (International Maritime Organization (IMO), 1972), including watch keeping requirements.

Experience shows that COLREGS does not fully provide the required level of mitigation to ensure that the safety of sensitive operations is not impacted by passing vessels. Although COLREGS provides responsibilities for vessels at sea, a clear demarcation of areas to be avoided for the safety of the project vessel, personnel, and third-party vessels and crew due to the risks of the operations occurring is required. By promulgating safety zones both in advance and at the time of operation, vessels can effectively passage plan to ensure they stay clear of any sensitive or dangerous operations, as identified by risk assessment. A 500m safety zone radius is well known as a safe passing distance in the offshore wind industry, and prevents the ambiguity often presented in the wording of COLREGS. For example, Rule 18 states that:

A vessel engaged in fishing when underway shall, so far as possible, keep out of the way of:

i. a vessel not under command (NUC);
ii. a vessel restricted in her ability to manoeuvre (RAM).

“So far as is possible” is not defined, which often leads to confusion. The intention of safety zones is not to over-regulate or prosecute the third-party mariner, but to ensure that those mariners are aware that entering those safety zones could lead to dangerous occurrences.

10.5 Assistance in Passage Planning

As per the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974), all vessels are required to passage plan before proceeding to sea, taking all known and relevant factors into consideration. The implementation of safety zones will make it clear to all vessels the areas which should be avoided within the site while constructing or once operational (where maintenance is underway), which as noted above will allow for effective passage planning and remove any ambiguity as to what warrants a safe passing distance.

10.6 Reduction in Fishing Gear Snagging

As per Section 8.3.8, fishing vessels do currently transit through the Hornsea Project Two Array Area, and vessels within the study area do engage in active fishing (i.e., gear is deployed).

Therefore, it should be considered that the anchor spread of construction / maintenance vessels, any partially completed structures, and inter-array cables in proximity to structures all pose a snagging risk to deployed fishing gear. The implementation of 500m safety zones around active structures where construction or major maintenance works were ongoing and 50m safety zones around pre-commissioned structures will therefore reduce the likelihood of an associated snagging incident.

Further, as the presence of safety zones shall be broadcast to the fishing community, in addition to more general information surrounding the construction / maintenance works, the likelihood of a fishing vessel being made aware of the ongoing works increases, thus reducing the overall potential for interaction and thus snagging risk.

10.7 Reduction in Interaction with Anchor Spread

During construction, it may be necessary for certain vessels to utilise an anchor spread, with the potential for similar activity to also be required during periods of major maintenance. These subsea anchors and lines / chains create an interaction risk with vessel anchors and fishing gear. This could lead to severe consequences for the construction / maintenance and / or the passing vessel, with the potential for injury or loss of life.

The implementation of mandatory 500m safety zones provides a buffer from passing traffic and thus reduces the likelihood of an anchor spread interaction. As per Section 12, the safety zones would be monitored and policed by a designated on-site vessel. The formal approval of the safety zones would provide said vessel with the legislative framework to warn passing vessels that entry into active safety zones is prohibited, ensuring the risk to and from sensitive operations requiring anchor spreads is minimised.

It should be noted that anchor spreads may exceed the 500m radius of the safety zones, however the sections posing most under keel risk to passing vessels will be within the 500m confines. Other forms of mitigation (e.g., marker buoys) may be utilised to alert passing vessels to the full extent of any anchor spreads.

10.8 Accounting for Inexperienced Mariners

As summarised in Section 8.3.9, recreational vessels were recorded intersecting (or passing in close proximity to) the Hornsea Project Two Array Area. Typically, recreational vessels do not carry as high a standard of navigational equipment as commercial vessels, as there is no requirement for them to do so. Furthermore, the crew of recreational vessels may not be as experienced, and may have few formal qualifications.

Therefore, there is a need to mitigate against the lack of experience and reduced navigational equipment on board recreational vessels. Implementation of mandatory safety zones in conjunction with other embedded mitigation measures (e.g., guard vessel used where identified as necessary, construction site marking and charting, monitoring and policing of safety zones) is required. It is noted that inexperienced mariners may not be able to effectively assess their distance from / to a safety zone. The guard vessel (or designated monitoring vessel as per Section 12) would in those circumstances use standard marine procedures to advise them of their approach.

As previously detailed, if a vessel were to infringe a safety zone, thus becoming at risk of an allision / collision, the designated monitoring vessel would initiate the monitoring and policing procedure, as detailed in Section 12. Any infringements to these safety zones shall be noted by the onsite vessel (s) and efforts made to contact the vessel using standard marine procedures, alerting it to the safety zone infringement. Furthermore, the designated monitoring vessel shall be contactable (via Very High Frequency (VHF)) and be able to provide information to recreational vessels navigating in proximity to the Hornsea Project Two Array Area.

Therefore, the implementation of safety zones in tandem with a suite of other mitigation measures shall bring the risk to inexperienced mariners to within ALARP parameters.

10.9 Accounting for Unforeseen Risk

Throughout the construction phase and during periods of major maintenance of the Project, there is the potential for a number of events to occur which may result in previously unforeseen risk, for example:

- Fire / Explosion on board construction / maintenance vessel;

- Machinery failure (including steering) on board construction / maintenance vessel;
- Cargo (e.g. wind turbine components) shifting on board construction / maintenance vessel;
- Structural failure of wind farm component;
- Dropped object;
- Accidental interaction with unexploded ordnance / wreck; or
- Accident associated with adverse weather.

If any of these incidents were to occur during the construction phase or during periods of major maintenance at Hornsea Project Two, there is potential for loss of life and serious environmental damage. It is therefore important to sterilise the immediate working area of existing marine traffic. The presence of these safety zones allows third party traffic to passage plan and pass at a safe distance, and therefore reduces the risk of a third-party vessel becoming involved in any of the aforementioned unforeseen risk scenarios. This greatly reduces the overall severity of consequence to third party users of any potential incident.

Once again, safety zones will be implemented in tandem with a suite of other mitigation measures (e.g. dedicated onsite vessel(s), construction site marking and charting, monitoring and policing of safety zones) thus bringing the risk to within ALARP parameters.

11. Impact of Safety Zones

11.1 Commercial Vessel Routeing (including Commercial Ferries)

As can be seen in Section 8.3, cargo, tanker, and passenger vessel routes currently intersect the site based on the data studied. Notably, this includes the DFDS operated Newcastle to Ijmuiden passenger ferry route.

Based on experience at other existing wind farms, once the construction buoyage is placed, the significant majority of commercial vessels will deviate to avoid the buoyed construction area altogether. Any commercial vessels that did enter the area would likely still avoid areas were structures were being constructed or constructing. By the operational phase, commercial vessel deviations would be established.

On this basis, there is not considered to be any significant impact from the safety zones (above that of the structures themselves) to commercial vessels during either the construction or operational phases.

11.2 Fishing Vessels

As per Section 8.3.8, fishing vessels were recorded mostly transiting through the study area with no active fishing occurring within the Hornsea Project Two Array Area in contrast to the activity detected in the 2012 surveys. Notably, fishing vessels are avoiding Hornsea Project One completely even though not all the safety zones will be active at any one time therefore allowing access to part of the site.

However, it should be considered that the 2019 data studied was AIS only, and as such any non-AIS vessels may be underrepresented. Anecdotal evidence suggests that limited numbers of fishing vessels do fish within the Hornsea Project Two Array Area.

Regardless, given vessels would be free to utilise areas of the Hornsea Project Two Array Area where construction work was not ongoing, no significant impact is anticipated.

11.3 Recreational Vessels

As per Section 8.3.9, recreational vessels were only detected during the summer survey period, and in low numbers, this is probably a result of the distance that Hornsea Project Two is from shore. Most of these vessels based on their tracks would be intersecting the Hornsea Project Two Array Area or the cable corridor. Based on experience at other wind farms recreational vessels would either avoid the buoyed construction area entirely or transit through a section of the site where 500m safety zones, hence construction, is not currently occurring.

11.4 Anchored Vessels

It is considered unlikely that a vessel would deliberately choose to anchor within the site once construction was underway or operational (except in an emergency). Regardless, based on the marine traffic data studied, anchoring activity within and in proximity to the site is limited (see Section 8.3.7), and any impact from safety zones is therefore likely to be minimal.

12. Monitoring and Policing

12.1 Monitoring

Safety zones are most effectively monitored via the use of a guard vessel, or other mobile onsite vessel not deemed critical to construction or operational activities. However, as such a vessel may not always be available (e.g., during periods of adverse weather), Ørsted intend to undertake a tiered approach to the monitoring of safety zones. This will ensure that the safety zones can remain as active mitigation measures even when a dedicated monitoring vessel is unavailable. The approach is as follows:

- Where a guard vessel, or other mobile vessel is on-site and able to be assigned dedicated monitoring duties, the safety zones will be monitored and policed by this vessel;
- Where no such vessel is available, a vessel associated with the relevant construction or maintenance operation will undertake monitoring (i.e., a crew member on board will be assigned monitoring / policing duties);
- Where no vessel is present, and where coverage allows, monitoring will be undertaken via AIS.

Where a vessel is monitoring the safety zone, Radar, AIS, VHF communications and visual observations shall be utilised to make early contact with any third-party vessels in the area approaching the site to alert them to the presence of any currently active (or soon to be active) safety zones. A vessel observed to enter into a safety zone (or pass in close proximity) will be contacted by the monitoring vessel (using standard marine procedures), and informed that they have or are close to infringing the safety zone. The vessel will be instructed to increase their minimum passing distance from the safety zone and to avoid or refrain from entering them in the future.

Where no monitoring vessel is available, AIS coverage will be monitored where practical to identify any vessels approaching or infringing the active safety zones. Where feasible, contact will be made with the associated vessels at the earliest opportunity, and details of any incidents will be logged, with the AIS evidence retained for submission to BEIS where appropriate (see Section 12.2).

It is noted that direct navigational advice will not be given to any vessel. Standard marine terminology will be used to warn the vessel that action to avoid the safety zone would be required.

12.2 Policing

The details of any vessels which consistently ignore the warnings issued by the designated monitoring vessel (see Section 12.1) with regards to safety zones, and / or are considered to be causing a potential danger to vessels and / or assets within the area will be noted and reported to the BEIS as the licensing authority. This will include any supporting evidence collected (e.g., AIS recording, witness statements). Where infringements occur when no monitoring vessel was available, reports may still be made to BEIS where the associated activity was considered dangerous based on the AIS evidence, or where the infringement was made by a vessel which has previously infringed a safety zone.

BEIS will then decide what action, in consultation with other stakeholders, is required. Prosecutions are only likely to be sought where infringements are deliberate and malicious, causing damage, nuisance or endangering lives. In particular, prosecution would not be sought in the event of a third-party vessel entering into a safety zone to fulfil obligations under SOLAS (IMO, 1974) to render assistance to persons in danger.

12.3 Existing Experience

It is noted that due to the development of other existing wind farms in the southern North Sea area (e.g., London Array, Race Bank, Thanet, Dudgeon), the majority of regular operators (including local recreational sailors) shall be familiar with the implementation and operation of construction / major maintenance safety zones, and the associated procedures around how they are monitored and policed.

13. Summary

This document has presented a safety case demonstrating the need for safety zones to be implemented at Hornsea Project Two during the construction phase, and also during periods of major maintenance in the operational phase.

The followings safety zones are considered necessary, based on the findings of the NRA (Anatec, 2015) and this safety case:

- "Rolling" 500m safety zone established around each wind farm structure, and / or their foundations, whilst construction work is being performed, as indicated by the presence of construction vessels;
- Pre-Commissioning 50m safety zones established around any wind farm structure which is either partially completed, or constructed but not yet commissioned where a construction vessel is not present; and
- 500m safety zones around all "major maintenance" being undertaken around a wind farm structure, as denoted by the presence of a major maintenance vessel (where "major maintenance" is as per the definition given in the Electricity Regulations 2007).

The safety zones are considered necessary on the basis that they will:

- Reduce the potential for collision risk;
- Reduce the potential for allision;
- Reduce the likelihood of passing traffic interacting with the anchor spread of construction / maintenance vessels;
- Protect persons engaged in the construction / maintenance process;
- Ensure personnel engaged in sensitive SOV operations involving WTW systems are protected when transferring, or stationed on the structure following transfer;
- Prevent behaviour considered as being dangerous;
- Assist third party vessels in passage planning;
- Reduce the likelihood of fishing vessel snagging risk;
- Provide an additional level of mitigation to account for inexperienced mariners; and
- Provide an additional level of mitigation to account for unforeseen risks.

The implementation of mandatory construction / major maintenance safety zones, in conjunction with other mitigation measures listed throughout this safety case shall ensure that the risks to both passing traffic and construction / maintenance vessels are within ALARP parameters. They will also ensure risks to project personnel are minimised.

Marine traffic assessment of up to date (2019) data identified no changes to the data assessed previously that would affect the findings of the NRA that safety zones are a necessary mitigation in order that risks are ALARP. Further, the marine assessment is deemed as showing that the extent of the safety zones is balanced effectively with the level of traffic, noting that no significant impacts to shipping and navigation users arising from the safety zones have been identified either within this safety case or within the NRA.

The mandatory safety zones shall primarily be monitored for infringements by third party vessels by a guard vessel (used where identified as necessary), or other nominated vessel. Where such a vessel was unavailable, AIS would be used where feasible for monitoring purposes. The primary response will be to warn passing traffic of the ongoing works and any active safety zones, and to alert infringing vessels to an infringement by VHF radio. Records of all infringements shall be kept, and, if necessary, evidence passed to BEIS (as the licensing authority) and the MCA for follow-up action if they deemed it appropriate.

14. References

Anatec (2015). Hornsea Project Two Navigation Risk Assessment. Aberdeen: Anatec.

BEIS (2011). Guidance Notes: Applying for Safety Zones around Offshore Renewable Energy Installations. London: BEIS.

IALA (2013). O-139 the Marking of Man-Made Offshore Structures. Edition 2. Saint Germaine en Laye, France: IALA.

IMO (1972). International Regulations for Preventing Collisions at Sea. IMO: London.

IMO (1974). International Convention for the Safety of Life at Sea (SOLAS). IMO: London.

Appendix A Structure Coordinates

ID	Type	Longitude	Latitude
HB-A33	WTG	001° 37' 57.803" E	53° 50' 29.267" N
HB-A34	WTG	001° 37' 0.843" E	53° 50' 10.395" N
HB-A35	WTG	001° 35' 38.747" E	53° 50' 10.673" N
HB-A36	WTG	001° 34' 11.908" E	53° 50' 15.204" N
HB-A37	WTG	001° 32' 51.273" E	53° 50' 11.189" N
HB-A38	WTG	001° 31' 32.462" E	53° 50' 11.410" N
HB-A39	WTG	001° 30' 10.367" E	53° 50' 11.625" N
HB-A40	WTG	001° 29' 12.627" E	53° 50' 17.137" N
HB-A41	WTG	001° 28' 18.540" E	53° 50' 11.892" N
HB-A42	WTG	001° 27' 26.514" E	53° 50' 16.601" N
HB-B33	WTG	001° 37' 33.421" E	53° 50' 51.251" N
HB-B34	WTG	001° 36' 21.448" E	53° 50' 45.899" N
HB-B35	WTG	001° 35' 13.361" E	53° 50' 33.537" N
HB-B36	WTG	001° 33' 37.899" E	53° 50' 45.810" N
HB-B37	WTG	001° 32' 8.155" E	53° 50' 49.964" N
HB-B38	WTG	001° 30' 55.137" E	53° 50' 44.954" N
HB-B39	WTG	001° 29' 14.878" E	53° 51' 1.451" N
HB-B40	WTG	001° 28' 4.042" E	53° 51' 18.685" N
HB-B41	WTG	001° 27' 17.753" E	53° 51' 6.422" N
HB-C31	WTG	001° 38' 10.651" E	53° 51' 42.659" N
HB-C33	WTG	001° 36' 52.795" E	53° 51' 27.863" N
HB-C34	WTG	001° 35' 27.289" E	53° 51' 34.674" N
HB-C35	WTG	001° 33' 43.982" E	53° 51' 53.971" N
HB-C36	WTG	001° 32' 53.096" E	53° 51' 26.106" N
HB-C37	WTG	001° 30' 48.833" E	53° 52' 1.232" N
HB-C38	WTG	001° 29' 47.174" E	53° 51' 45.985" N
HB-C40	WTG	001° 27' 23.556" E	53° 51' 54.988" N
HB-D31	WTG	001° 37' 40.702" E	53° 52' 9.651" N
HB-D34	WTG	001° 34' 54.942" E	53° 52' 3.787" N
HB-D36	WTG	001° 32' 4.396" E	53° 52' 9.877" N
HB-E30	WTG	001° 38' 20.662" E	53° 52' 39.669" N
HB-E33	WTG	001° 35' 19.727" E	53° 52' 51.654" N
HB-E35	WTG	001° 32' 38.771" E	53° 52' 52.589" N

ID	Type	Longitude	Latitude
HB-E37	WTG	001° 29' 45.853" E	53° 52' 57.758" N
HB-E39	WTG	001° 27' 32.070" E	53° 52' 33.661" N
HB-F30	WTG	001° 37' 41.387" E	53° 53' 15.052" N
HB-F31	WTG	001° 36' 22.988" E	53° 53' 19.636" N
HB-F34	WTG	001° 33' 21.917" E	53° 53' 27.435" N
HB-F36	WTG	001° 31' 1.994" E	53° 53' 5.918" N
HB-F38	WTG	001° 28' 1.461" E	53° 53' 20.796" N
HB-G28	WTG	001° 38' 34.923" E	53° 54' 0.819" N
HB-G31	WTG	001° 35' 31.457" E	53° 54' 5.997" N
HB-G33	WTG	001° 33' 54.545" E	53° 54' 8.245" N
HB-G36	WTG	001° 30' 5.868" E	53° 53' 56.278" N
HB-G38	WTG	001° 27' 30.432" E	53° 53' 48.597" N
HB-H28	WTG	001° 38' 9.721" E	53° 54' 23.516" N
HB-H31	WTG	001° 34' 39.577" E	53° 54' 52.637" N
HB-H34	WTG	001° 32' 18.640" E	53° 54' 24.268" N
HB-H37	WTG	001° 28' 6.627" E	53° 54' 26.710" N
HB-J28	WTG	001° 37' 37.361" E	53° 54' 52.648" N
HB-J30	WTG	001° 35' 47.178" E	53° 54' 57.829" N
HB-J33	WTG	001° 32' 35.286" E	53° 55' 19.426" N
HB-J34	WTG	001° 31' 23.153" E	53° 55' 14.062" N
HB-J35	WTG	001° 29' 59.914" E	53° 55' 15.151" N
HB-J36	WTG	001° 28' 28.926" E	53° 55' 23.164" N
HB-J37	WTG	001° 27' 30.502" E	53° 54' 59.063" N
HB-K27	WTG	001° 38' 50.251" E	53° 55' 27.940" N
HB-K28	WTG	001° 36' 48.685" E	53° 55' 36.441" N
HB-K35	WTG	001° 29' 5.460" E	53° 56' 3.943" N
HB-K36	WTG	001° 27' 52.347" E	53° 55' 55.917" N
HB-L07	WTG	002° 0' 21.280" E	53° 55' 40.546" N
HB-L10	WTG	001° 57' 37.133" E	53° 55' 53.863" N
HB-L13	WTG	001° 55' 1.715" E	53° 55' 59.170" N
HB-L27	WTG	001° 38' 20.383" E	53° 55' 54.825" N
HB-L28	WTG	001° 36' 4.446" E	53° 56' 16.216" N
HB-L30	WTG	001° 34' 26.565" E	53° 56' 10.266" N
HB-L33	WTG	001° 31' 40.776" E	53° 56' 8.331" N
HB-L36	WTG	001° 27' 27.891" E	53° 56' 17.804" N

ID	Type	Longitude	Latitude
HB-M07	WTG	001° 59' 49.863" E	53° 56' 9.138" N
HB-M10	WTG	001° 57' 4.659" E	53° 56' 23.373" N
HB-M13	WTG	001° 54' 32.437" E	53° 56' 25.740" N
HB-M16	WTG	001° 51' 33.463" E	53° 56' 52.708" N
HB-M18	WTG	001° 49' 24.078" E	53° 56' 33.844" N
HB-M23	WTG	001° 41' 54.110" E	53° 56' 45.382" N
HB-M24	WTG	001° 40' 45.087" E	53° 56' 34.765" N
HB-M25	WTG	001° 38' 42.641" E	53° 57' 12.129" N
HB-M27	WTG	001° 37' 4.161" E	53° 57' 3.385" N
HB-M28	WTG	001° 35' 20.538" E	53° 56' 55.668" N
HB-M30	WTG	001° 33' 31.792" E	53° 56' 59.436" N
HB-M31	WTG	001° 31' 53.992" E	53° 57' 21.261" N
HB-M33	WTG	001° 30' 49.387" E	53° 56' 54.400" N
HB-M34	WTG	001° 29' 19.481" E	53° 57' 4.898" N
HB-M35	WTG	001° 27' 53.518" E	53° 57' 8.344" N
HB-N05	WTG	002° 1' 32.490" E	53° 56' 51.750" N
HB-N07	WTG	001° 59' 14.561" E	53° 56' 41.251" N
HB-N10	WTG	001° 56' 16.295" E	53° 57' 7.296" N
HB-N13	WTG	001° 53' 59.500" E	53° 56' 55.616" N
HB-N16	WTG	001° 50' 55.702" E	53° 57' 26.901" N
HB-N18	WTG	001° 48' 32.413" E	53° 57' 20.576" N
HB-N23	WTG	001° 40' 59.560" E	53° 57' 34.528" N
HB-N24	WTG	001° 39' 16.120" E	53° 57' 54.759" N
HB-N27	WTG	001° 36' 6.352" E	53° 57' 55.331" N
HB-N28	WTG	001° 34' 25.111" E	53° 57' 45.434" N
HB-N33	WTG	001° 29' 55.131" E	53° 57' 43.002" N
HB-N34	WTG	001° 28' 32.070" E	53° 57' 47.334" N
HB-N35	WTG	001° 27' 15.262" E	53° 57' 42.563" N
HB-P03	WTG	002° 3' 6.811" E	53° 57' 42.076" N
HB-P05	WTG	002° 0' 49.891" E	53° 57' 30.521" N
HB-P07	WTG	001° 58' 32.017" E	53° 57' 19.928" N
HB-P10	WTG	001° 55' 29.472" E	53° 57' 49.790" N
HB-P13	WTG	001° 53' 6.314" E	53° 57' 43.830" N
HB-P16	WTG	001° 50' 14.360" E	53° 58' 4.314" N
HB-P18	WTG	001° 47' 51.495" E	53° 57' 57.562" N

ID	Type	Longitude	Latitude
HB-P25	WTG	001° 37' 50.092" E	53° 57' 59.387" N
HB-P27	WTG	001° 35' 11.445" E	53° 58' 44.630" N
HB-P29	WTG	001° 33' 33.711" E	53° 58' 31.547" N
HB-P30	WTG	001° 31' 51.850" E	53° 58' 29.054" N
HB-P31	WTG	001° 30' 29.022" E	53° 58' 37.386" N
HB-P34	WTG	001° 27' 57.601" E	53° 58' 18.169" N
HB-Q01	WTG	002° 5' 20.701" E	53° 57' 53.332" N
HB-Q05	WTG	002° 0' 9.688" E	53° 58' 7.088" N
HB-Q07	WTG	001° 57' 53.615" E	53° 57' 54.820" N
HB-Q10	WTG	001° 54' 49.397" E	53° 58' 26.136" N
HB-Q13	WTG	001° 52' 35.892" E	53° 58' 11.391" N
HB-Q16	WTG	001° 49' 32.907" E	53° 58' 41.805" N
HB-Q18	WTG	001° 47' 10.514" E	53° 58' 34.582" N
HB-Q21	WTG	001° 42' 14.523" E	53° 58' 55.276" N
HB-Q25	WTG	001° 38' 33.154" E	53° 58' 33.401" N
HB-Q26	WTG	001° 36' 53.090" E	53° 58' 50.609" N
HB-Q30	WTG	001° 31' 0.795" E	53° 59' 14.784" N
HB-Q31	WTG	001° 29' 44.445" E	53° 59' 17.286" N
HB-Q33	WTG	001° 28' 12.642" E	53° 59' 14.705" N
HB-Q34	WTG	001° 27' 27.198" E	53° 58' 45.352" N
HB-R01	WTG	002° 4' 50.024" E	53° 58' 27.533" N
HB-R02	WTG	002° 3' 15.459" E	53° 58' 29.302" N
HB-R03	WTG	002° 2' 19.655" E	53° 58' 25.013" N
HB-R18	WTG	001° 46' 34.829" E	53° 59' 6.800" N
HB-R20	WTG	001° 44' 0.294" E	53° 59' 10.873" N
HB-R22	WTG	001° 40' 43.025" E	53° 59' 20.604" N
HB-R23	WTG	001° 39' 7.380" E	53° 59' 15.372" N
HB-R25	WTG	001° 37' 38.428" E	53° 59' 22.585" N
HB-R27	WTG	001° 34' 24.063" E	53° 59' 27.139" N
HB-R29	WTG	001° 32' 39.857" E	53° 59' 19.825" N
HB-R34	WTG	001° 27' 2.582" E	53° 59' 7.353" N
HB-S03	WTG	002° 1' 46.269" E	53° 58' 43.573" N
HB-S04	WTG	002° 0' 9.203" E	53° 58' 51.171" N
HB-S05	WTG	001° 59' 21.550" E	53° 58' 50.845" N
HB-S06	WTG	001° 58' 14.051" E	53° 58' 59.837" N

ID	Type	Longitude	Latitude
HB-S07	WTG	001° 56' 42.226" E	53° 58' 59.629" N
HB-S08	WTG	001° 55' 58.117" E	53° 59' 6.335" N
HB-S09	WTG	001° 54' 51.178" E	53° 59' 8.020" N
HB-S11	WTG	001° 53' 39.952" E	53° 59' 9.800" N
HB-S12	WTG	001° 52' 17.088" E	53° 59' 10.565" N
HB-S14	WTG	001° 51' 4.059" E	53° 59' 10.904" N
HB-S15	WTG	001° 49' 38.882" E	53° 59' 15.968" N
HB-S16	WTG	001° 48' 20.833" E	53° 59' 26.034" N
HB-S26	WTG	001° 35' 57.551" E	53° 59' 40.475" N
HB-S27	WTG	001° 33' 54.442" E	53° 59' 53.699" N
HB-S29	WTG	001° 31' 56.093" E	53° 59' 59.028" N
HB-S30	WTG	001° 30' 8.840" E	54° 0' 1.286" N
HB-S31	WTG	001° 28' 59.550" E	53° 59' 57.443" N
HB-S33	WTG	001° 27' 17.254" E	54° 0' 4.207" N
HB-T17	WTG	001° 46' 17.658" E	53° 59' 42.758" N
HB-T18	WTG	001° 45' 13.419" E	53° 59' 51.873" N
HB-T20	WTG	001° 43' 34.937" E	54° 0' 2.073" N
HB-T21	WTG	001° 42' 32.665" E	54° 0' 7.485" N
HB-T22	WTG	001° 40' 52.140" E	54° 0' 10.121" N
HB-T23	WTG	001° 38' 8.886" E	54° 0' 7.942" N
HB-T25	WTG	001° 36' 39.150" E	54° 0' 15.815" N
HB-T26	WTG	001° 35' 16.475" E	54° 0' 17.330" N
HB-T27	WTG	001° 33' 25.843" E	54° 0' 19.331" N
HB-T29	WTG	001° 31' 31.133" E	54° 0' 21.377" N
HB-T30	WTG	001° 29' 44.281" E	54° 0' 23.254" N
HB-T31	WTG	001° 28' 29.220" E	54° 0' 24.558" N
HB-T33	WTG	001° 26' 52.613" E	54° 0' 26.216" N
HB-S22	Spare	001° 41' 37.039" E	53° 59' 29.029" N
HB-S13	Spare	001° 52' 2.813" E	53° 58' 41.344" N
HB-R07	Spare	001° 57' 17.363" E	53° 58' 27.739" N
HB-N30	Spare	001° 32' 37.604" E	53° 57' 48.042" N
HB-P13	Spare	001° 53' 33.824" E	53° 57' 18.896" N
HB-L31	Spare	001° 32' 47.350" E	53° 56' 33.410" N
HB-K34	Spare	001° 30' 29.635" E	53° 56' 2.051" N
HB-J31	Spare	001° 33' 55.217" E	53° 55' 32.491" N

ID	Type	Longitude	Latitude
HB-H36	Spare	001° 29' 23.374" E	53° 54' 34.380" N
HB-H30	Spare	001° 36' 40.205" E	53° 54' 10.130" N
HB-E34	Spare	001° 34' 5.070" E	53° 52' 48.648" N
HB-E31	Spare	001° 37' 9.548" E	53° 52' 37.715" N
HB-Z11 (OSS)	OSS	001° 37' 50.474" E	53° 56' 21.869" N
HB-Z01 (RCS)	RCS	0º 55’ 56.151” E	53º 38’ 0.138” N