Decommissioning Programme for Rampion Offshore Wind Farm

April 2018

Rampion Offshore Wind Limited

Rev.	Purpose of Issue**	Remark/Description	Init.	Date
00	Review	Initial document for review and completion	EWO	07/10/14
00	Consultation	Document issued to Consultees for review	EWO	19/01/15
01	Review	Consultation Responses incorporated	EWO	01/05/15
01	Issued	Issued to DECC for Approval	EWO	15/05/15
02	Review	Further Consultation responses from TCE, MMO & UKHO incorporated	EWW	01/09/17
03	Review	Updated to reflect Export Cable status	EWW	18/04/18

GLOSSARY

BATNEEC	Best Available technique not Entailing Excessive Cost
BMAPA	British Marine Aggregates Producers Association
BPEO	Best Practicable Environmental Option
CCTV	Closed Circuit Television
CDM Regulations	The Construction (Design and Management) Regulations 2007
DBEIS	Department of Business, Energy and Industrial Strategy (formerly DECC)
DECC	Department of Energy and Climate Change
EIA	Environmental Impact Assessment
ELO	Environment Liaison Officer
E.ON	E.ON Climate & Renewables Rampion Offshore Wind Limited
ES	Environmental Statement
FLO	Fisheries Liaison Officer
GIS	Gas insulated Switchgear
HDD	Horizontal Directional Drilling
HSSE	Health, Safety, Security and Environment
IMO	International Maritime Organisation
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
MCA	Maritime and Coastguard Agency
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MP	Monopile

MSL	Mean Sea Level
MVA	Mega Volt Ampere
NE	Natural England
O&M	Operation & Maintenance
PA	Public Address
PETP	Polyethylene Terepthalate Polyester
ROV	Remotely operated Vehicle
ROW	Rampion Offshore Wind Farm Limited
The Order	The Rampion Offshore Wind Farm Order 2014
TCE	The Crown Estate
THLS	Trinity House Lighthouse Services
TP	Transition Piece
UKHO	UK Hydrographic Office
UNCLOS	United Nations Convention of the Law of the Sea
UPS	Uninterruptible Power Supply
UXO	Unexploded Ordnance
WTG	Wind turbine generator
XLPE	Cross linked polyethylene

Contents

Executive Summary

In accordance with Section 105(02) of The Energy Act 2004, and in order to discharge requirement 8 of the Rampion Offshore Wind Farm Order 2014, Rampion Offshore Wind Limited (ROW) is required to prepare an Offshore Decommissioning Programme for the Rampion offshore wind farm. This document constitutes the preliminary Decommissioning Programme for the offshore elements of the Project and was submitted to DECC for approval in 2015 prior to the start of the construction of the wind farm .

The programme is informed and supported by the Environmental Impact Assessment carried out for the Rampion Project. The Environmental Statement was submitted as part of the Project's application for development consent under the Planning Act 2008, which was submitted to the Secretary of State in March 2013. The Environmental Statement provides detailed analysis of the baseline physical, biological and human environment. The assessment of the impact of the project on receptors and stakeholders takes into account decommissioning provisions that are consistent with those presented in this document.

In considering appropriate decommissioning provisions, ROW has sought to adhere to the following key principles:

- *No harm to people*
- *Consideration of the rights and needs of legitimate users of the sea*
- *Minimise environmental impact*
- *Promote sustainable development*
- *Adhere to the Polluter Pays Principle*
- *Maximise the reuse of materials*
- *Commercial viability*
- *Practical integrity*

1. Foreword

1.1 The Rampion Offshore Wind Farm is located in the English Channel, approximately 13km offshore and corresponding to the stretch of coast extending from approximately Worthing to Newhaven off the Sussex coast. The site forms part of Zone 6 awarded to E.ON Climate and Renewables UK (E.ON) by The Crown Estate (TCE) as part of the Round 3 Offshore programme. The project is currently under construction.

1.2 The project is owned by Rampion Offshore Wind Ltd (ROW), whose shareholders are E.ON, the Green Investment Bank and Enbridge. E.ON is supplying all of the services to construct and operate the project on behalf of ROW.

1.3 E.ON is a major investor-owned energy company - generating electricity, retailing power and gas, developing gas storage and undertaking gas and oil exploration and production. E.ON is one of the UK's leading green generators and is committed to being a leading player in the offshore wind industry. In addition to its stake in London Array, the world's largest offshore wind farm, it owns and operates four offshore wind farms in UK waters - the UK's first offshore wind farm near Blyth in Northumberland, Scroby Sands off the coast of Great Yarmouth, Robin Rigg in the Solway Firth and the Humber Gateway offshore wind farm, located off the Holderness coast. The construction of Rampion is due to be complete by the end of 2018, with an expected operational life thereafter of 24 years. After this period the wind farm is expected to enter into a phase of decommissioning.

1.4 This document presents the decommissioning programme for the offshore elements of Rampion and is being submitted for approval in accordance with the requirements under Section 105 of the Energy Act 2004 and Requirement 8 of the Rampion Offshore Wind Farm Order 2014 (the Order).

2. Introduction

2.1 In July 2014 the Secretary of State made The Rampion Offshore Wind Farm Order 2014 (the Order) granting development consent for the offshore wind farm and associated development.

2.2 In accordance with the notice issued by the Secretary of State under Section 105(2) of the Energy Act 2004 on 18 September 2014 to Rampion Offshore Wind Limited (ROW) , this Decommissioning Programme is applicable to all offshore components associated with the wind farm including the wind turbines, the offshore sub-station, the foundations, the export and array cables (including those between the installation and the mean low water mark)and the scour protection.

2.3 This programme is informed and supported by the Environmental Impact Assessment (EIA) for the project which was undertaken to support the application submitted to the Secretary of State in March 2013.

2.4 The programme assumes that full decommissioning will commence after the design life of the wind turbines (24 years), but it should be noted that the wind farm may be 're-powered' after 24 years with new wind turbines to take advantage of the available lease period with The Crown Estate (40 years), subject to the findings of a new EIA and consent application.

2.5 This Decommissioning Programme shall be reviewed in the years before decommissioning is due to commence to reflect the relevant proposal and the best practises established at that time.

2.6 Rampion is due to enter the OFTO process in 2018, and the decommissioning programme will be updated upon completion of the divestment of the transmission assets.

3. Background Information

Project Description

3.1 The Rampion Offshore Wind Farm is located in the English Channel, some 8 km south of the Sussex Coast. The location of the site is shown in Figure 1.

3.2 The wind farm will have an installed capacity of 400MW. The offshore element of the project will consist of 116 Vestas V112 3.45MW WTGs and a single twin circuit 33kV to 150kV substation and associated array and export cables. Each WTG will be mounted on a monopile with a separate transition piece attached to form the foundations.

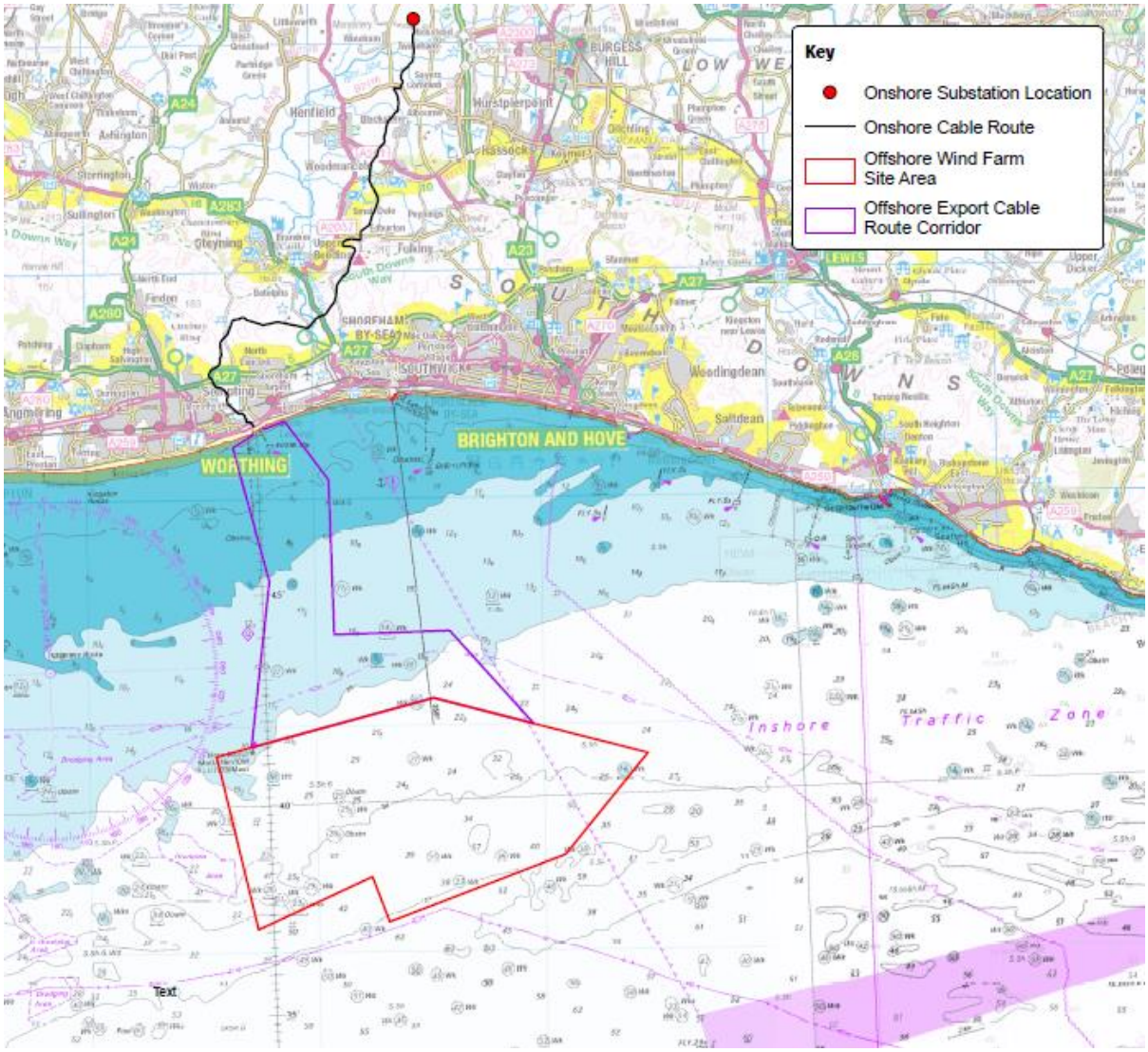

Figure 1. Location of the Rampion Offshore Wind Farm

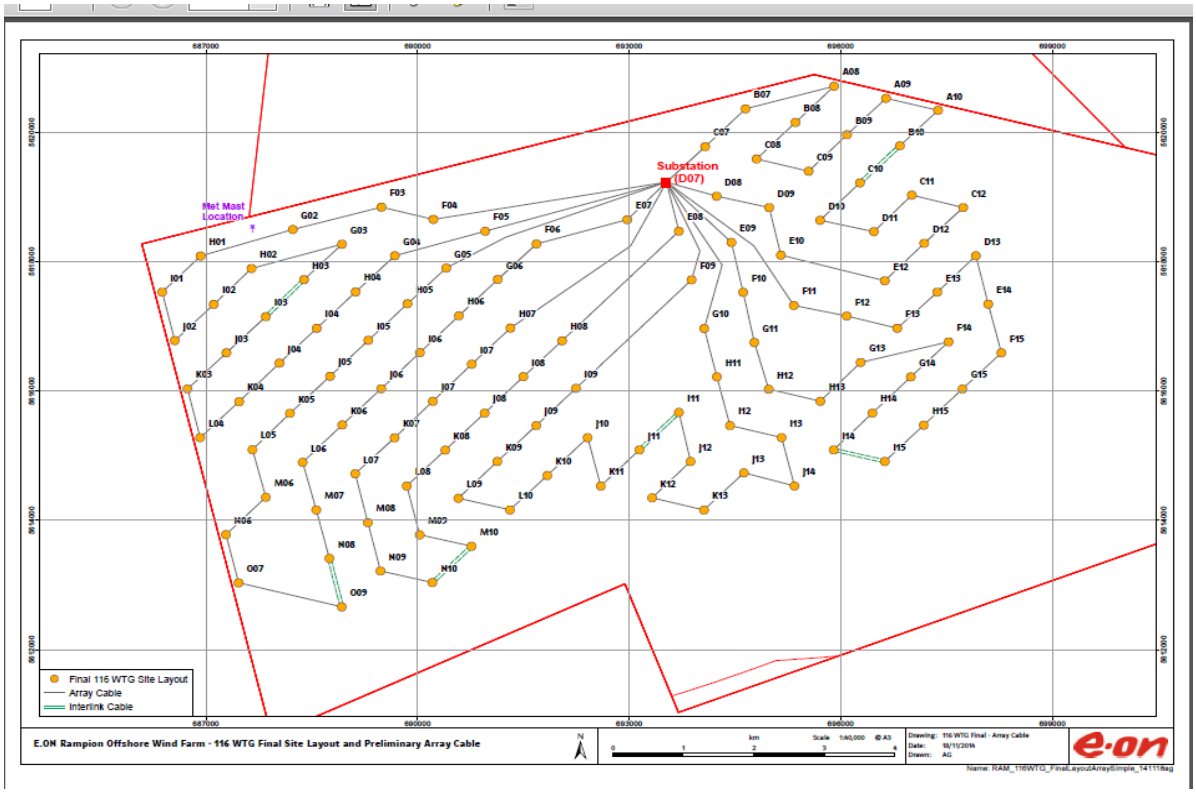

Figure 2: Offshore Array Layout

Project Programme

3.3 The bullet points below provide an overview of the current high level schedule.

- 2014 – Offshore pre-construction monitoring works began
- Q2 2015 – Onshore Construction Started
- Q2 2015 – Offshore UXO/Boulder clearance started
- Q1 2016 – Start of offshore foundations installation
- Q2 2016 – Start of cable installation
- Q1 2017- Start of turbine installation
- Q4 2018 – Full operation

Conditions and Mitigation Measures

3.4 The Rampion project has been subject to Environmental Impact Assessment (EIA) in accordance with The Planning Act (Environmental Impact Assessment) Regulations 2009.

3.5 The Application for development consent which was submitted to the Secretary of State was accompanied by an Environmental Statement (ES) which reported the findings of the EIA.

3.6 The ES reported on a range of environmental parameters and identified potential impacts related to the construction and operation of Rampion.

3.7 Where impacts could not be overcome by embedded design changes, mitigation and monitoring measures were incorporated in the ES where appropriate and agreed with statutory consultees.

3.8 Further discussions during the examination of the application by the Planning Inspectorate provided the opportunity for additional mitigation opportunities to be identified.

3.9 The Order made by the Secretary of State in 2014 encompasses a number of consents that would previously have been applied for separately and permits the developer to disapply legislation. This includes Marine Licences which would normally be sought under the Marine Coastal Access Act.

3.10 The Order includes a number of requirements and conditions which must be discharged in advance of the commencement of the construction of Rampion, by the Relevant Authority.

3.11 Since being awarded the consent the design basis for the project has been refined in accordance with the requirements and conditions within the Order and with the technical design details provided by engineering consultants and contractors.

3.12 Further site investigation and increased knowledge about the ground conditions for the site has led to a greater understanding of the nature of the site and identification of constraints to construction.

3.13 There are three principal elements to the process:

- Refinements to project design to mitigate against impacts – e.g. micrositing assessments for wind turbine foundations, array and export cable routing.
- Mitigation measures for project construction and operation – e.g. sizing and number of turbines
- Ongoing monitoring programmes to improve understanding of potential impacts – e.g. geophysical surveys/monitoring.

3.14 The majority of mitigation measures and the mechanisms for establishing monitoring programmes have been agreed in consultation with statutory bodies and have been incorporated as conditions within the Order.

3.15 The following documents supporting the construction process have been produced in accordance with the conditions within the deemed Marine Licences to ensure the delivery of embedded mitigation measures, that the environment is protected throughout construction and subsequent operation of the wind farm, and that an environmental baseline is captured and understood:

- Rampion Design plan (RAM-ERA_ECF-PLA-0032) including details of
  - the regard given to the views and distance of the turbines from the Sussex Heritage Coast and South Downs National Park;
  - the proposed layout and choice of foundations of all WTGs;
  - the regard given to other constraints such as ecological effects, safety and engineering and design parameters; and
  - the dimensions of structures.
- Rampion construction and monitoring programme (RAM-ERA-ECF-SDL-0001), including details of:
  - Proposed construction start date,
  - Timings for mobilisation of plant, delivery of materials and installation works;
  - Proposed pre-construction surveys, baseline report format and content construction monitoring and post-construction monitoring and related reporting; and
  - Indicative written construction programme for all WTGs and cables.
- Rampion Construction Method Statement (RAM-ERA-ECF-PLA-0015) including details of:
  - Drilling methods and disposal of drill arisings and material extracted during seabed preparation and foundation installation;
  - WTG and offshore substation location and installation (including protection);
  - Cable installation;
  - Contractors; vessels and vessel transit corridors;
  - Proposals to reduce the noise and vibration from installation works;
  - Protocol for routeing vessels;
  - Associated works;
  - Areas within which construction activity will take place; and
  - schedule of planned maintenance.
- Rampion Project Environmental Management and Monitoring plan (RAM-ERA-ECF-PLA-0013 – array, RAM-ERA-ECF-PL-0039- export cables) including:
  - Marine pollution contingency plan (RAM-ERA-ECF-PLA-0016);
  - Chemical risk assessment (RAM-ERA-ECF-PLA-0033);

- Waste management plan and disposal arrangements (RAM-ERA-ECF-PLA-0017);
- Appointment and responsibilities of a Fisheries Liaison Officer and an Environmental Liaison Officer; and
- Fisheries liaison plan (RAM-ERA-ECF-PLA-0025)

- Rampion Scour management and cable armouring plan (RAM-ERA-ECF-PLA-0026);
- Rampion Marine mammal mitigation protocol (RAM-ERA-ECF-PLA-0021);
- Rampion Cable specification and installation plan (RAM-ERA-ECF-PLA-0031);
- Rampion Offshore Written scheme of Archaeological Investigation (RAM-ERA-ECF-PLA-0019);
- Rampion Diver mitigation plan (RAM-ERA-ECF-PLA-0022) ; and
- Rampion Annex I habitat mitigation plan (RAM-ERA-ECF-PLA-0023).

4. Project description

Detailed Engineering and Build

4.1 Final Build Plans for each phase will be confirmed after construction (taking account of micro-siting) at which time As-Built Final Build Plans will be submitted to DBEIS, indicating the actual locations of the structures, cable routes etc. The Decommissioning Plan will then be updated to reflect the As-Built Final Build Plan.

4.2 The principal elements of the equipment supply and contracting are described in this section. Please note that this Decommissioning Programme is specific to the offshore elements of Rampion, as required by the Notice from the Secretary of State.

Wind Turbine Generators

4.3 Rampion consists of 116 Vestas 3.45MW WTGs. Elevations for the WTGs are as follows:

Turbine Size	Max hub height (above MHWS)	Max hub height (above MSL)	Max rotor diameter	Max height (above MHWS)
3.45MW	84.82m	81.84m	112m	140.82m

4.4 The main components of the WTG are:

Rotor / Hub – The V112-3.45 MW offshore turbine is equipped with a 112 meter diameter rotor consisting of three blades and the hub. The blades are controlled by a microprocessor pitch control system called Optitip. Based on the prevailing wind conditions, the blades are continuously positioned to optimise the pitch angle. The hub supports the three blades and

transfers the reaction forces to the main bearing and torque to the gearbox. The hub structure also supports blade bearings and their hydraulic pitch cylinder.

Blades – The blades are made of carbon and fibre glass and consist of two airfoil shells bonded to a supporting beam. The turbine is equipped with a pitch system for each blade and a distribution block, all located in the hub. Each pitch system is connected to the distributor block with flexible hoses. The distributor block is connected to the pipes of the hydraulic rotating transfer unit in the hub by means of three hoses (pressure line, return line and drain line). Each pitch system consists of a hydraulic pitch cylinder mounted to the hub and with the piston rod mounted to the blade via a torque arm shaft. Valves facilitating operation of the pitch cylinder are installed on a pitch block bolted directly onto the cylinder.

Gearbox – The main gear converts the low speed rotation of the rotor to high speed generator rotation. The gearbox is a four stage differential gearbox where the first three stages are planetary stages and the fourth is a helical stage.

Yaw System – The yaw system is an active system based on a robust pre-tensioned plain yaw bearing concept with PETP as friction material. The yaw gears are 2-stage planetary gears with a worm drive and with built in torque limiters.

Generator – The generator is a 3-phase asynchronous induction generator with a permanent magnet rotor which is connected to the grid through the full scale convertor. The converter consists of four converter units operating in parallel with a common controller. The convertor controls both the generator and the power quality delivered to the grid.

4.5 Three blades are attached to a nacelle housing the generator, gearbox and other operating equipment. The unit cast resin transformer will also be located in the nacelle.

4.6 Key components of the nacelle include:

- Main shaft and bearing
- Gearbox
- Generator
- Transformer

4.7 The nacelle and hub will have dimensions in the order of 17m x 5m x 8m. The total weight of the nacelle and hub area are approximately 170 tonnes.

4.8 The blades are made from carbon fibre and fibre glass and are bolted to a hub from which the pitch control is made.

4.9 The blades are 55 metres long and weigh 12.3 tonnes each.

4.10 Key components of the tower section include:

- Ladders
- Lift
- Power cable
- Control equipment
- Bolts
- 33kV Switchgear
- Tower damper
- Tower sections

4.11 Of these components the tower sections themselves make up the bulk of the approximately 178 tonne complete weight.

4.12 The location of each turbine is fixed subject to a micro-siting tolerance.

Turbine Foundations & Transition Pieces

4.13 A monopile solution has been selected for the wind turbine foundations for the Rampion project.

4.14 The monopile solution comprises driving a hollow steel pile into the seabed sub-strata, relying on the frictional properties of the seabed sediments for support.

4.15 The monopiles are between 48 and 83m in length (with around 30m to 42m embedment into the seabed), 5.0m outer diameter at pile top and 5.75m – 6.50m outer diameter at seabed and 409 to 820 tonnes in weight.

4.16 The foundations require ancillary equipment including:

- Cable entry and protection features: The cables are installed in a "J-tubeless" arrangement. Each structure has two array cables which are routed through holes in the monopile wall situated approx. 2.0m above the seabed.
- Corrosion protection: a combination of a protective paint coating and installation of sacrificial anodes on the sub-sea structure. The anodes are standard products for offshore structures and are welded onto the steel structures. The anodes typically consist of zinc and aluminium, and are connected to the structure via doubler plates to ensure the integrity of the primary structure is maintained in the unlikely failure of an anode connection. Cadmium will not be used. The number and size of anodes will be confirmed during detailed design.

4.17 Transition pieces (TP) making the connection between the WTG tower bottom flange and the top of the monopile have the general specification:

- Outer diameter of 5.0m;
- Top level approximately 20 m above LAT;
- Total length 23 m to 29 m including grout skirt
- Total weight approx 120 to 265 tonnes including appurtenances;
- Overlap between TP and monopile 11 to 17 meters grouted connection.

4.18 The structural connection between the monopile and transition piece is by means of two flanges bolted together with 142 x M50 studs/nuts. Additionally, the annulus formed in the overlap between the monopile and transition piece (the grout skirt is filled with grout, principally as a form of corrosion protection.

4.19 In addition the transition piece include the following components:

- Boat fenders;
- Access ladders;
- Cables;
- Work Platform;
- Handrail sections;
- Grating;

Offshore Substation

4.20 The offshore substation consists of a topside structure with integral cable deck supported on a jacket foundation. An indicative overall structural arrangement of the topside structure and Jacket is provided in Figure 3 below:

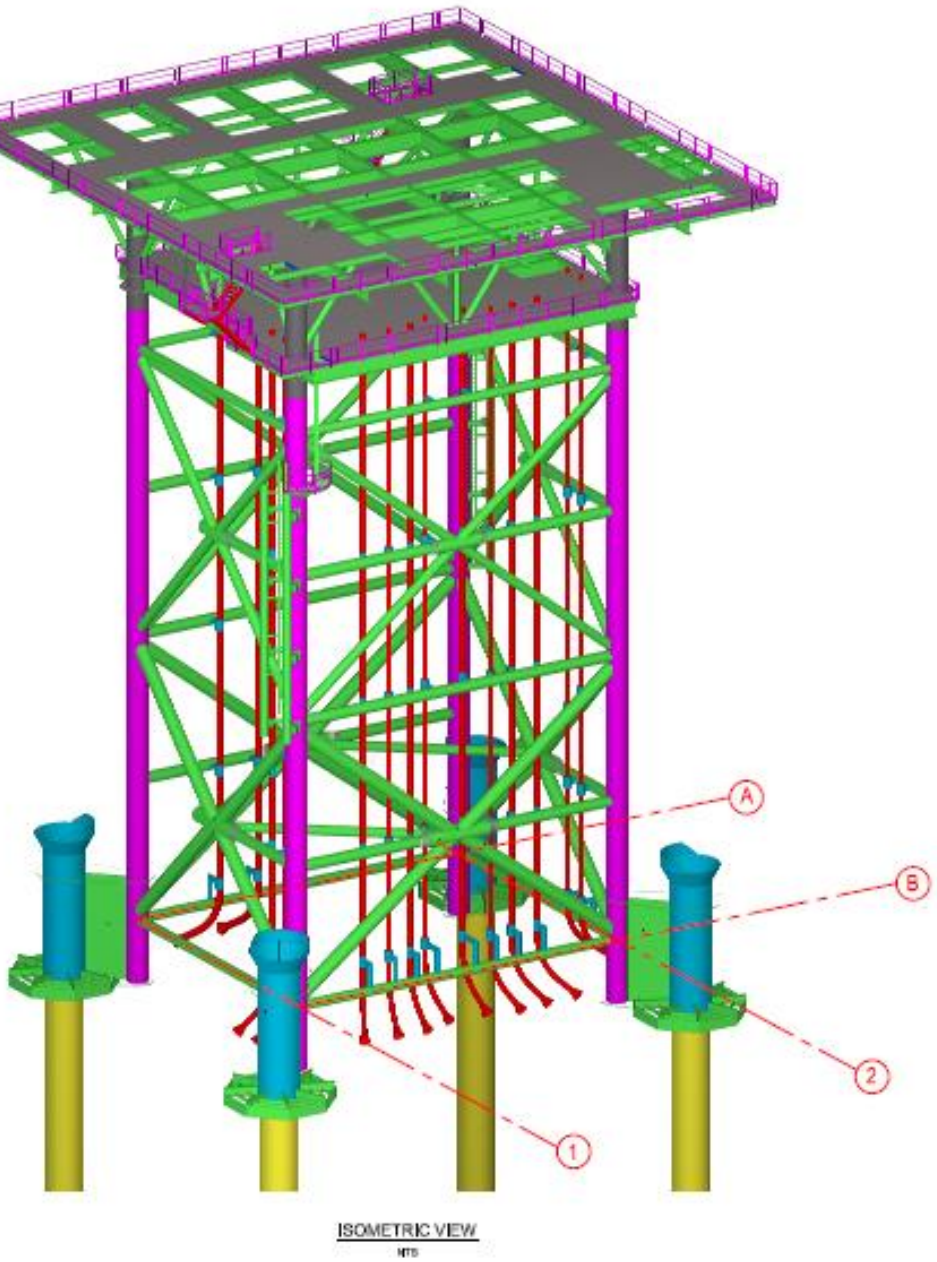

Figure 3: Indicative Overall arrangement showing the topside and Jacket

4.21 The purpose of an offshore sub-station platform is to transform the voltage of the electricity generated at the wind turbine to a higher voltage suitable for transmission of power to shore. As such it houses the electrical high and medium voltage components to enable the transformation of the 33 kV voltages produced by the wind turbines to 150kV before it is exported to the onshore grid.

4.22 The components of the offshore substation include two 180MVA transformers, 150kV Gas Insulated switchgear (GIS) and 33kV switchgear.

4.23 As well as the high and medium voltage components of the Substation, it is equipped with a low voltage system that is used to supply the substation with electrical power for the power, lighting, control system, and auxiliary circuits. Emergency power is provided by

Uninterruptible Power Supplies (UPS) which are used for fire detection, telephones, PA and CCTV systems and local area network. A diesel generator is installed on the substation capable of running for a limited number of days providing 'site load' should the connection to on-shore substation be lost.

4.24 An indicative arrangement of the equipment on the Substation topside is shown in Figure 4 below:

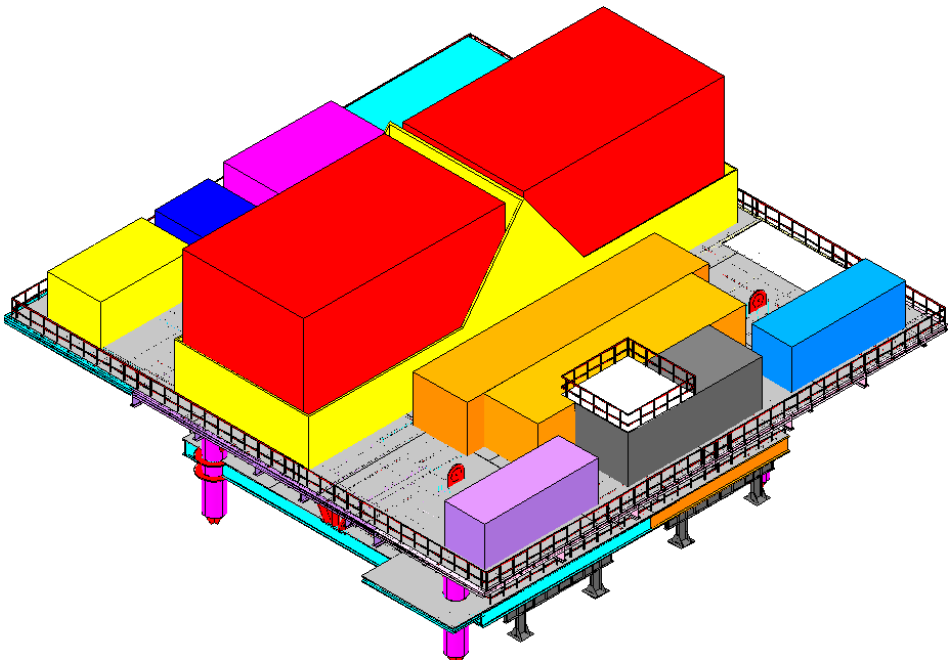

Figure 4: Topside equipment deck – indicative arrangement

4.25 The overall plan dimensions of the topside are approx. 40m x 35m with an installed weight of approximately 1200 tonnes.

4.26 The components within the sub-station offshore platforms include:

- High voltage transformers;
- High voltage GIS;
- Medium voltage switchgear;
- Control rooms;

- Back-up diesel generator and storage tank;
- J-tubes for array and export cables;
- Medium and high voltage cables;
- Helihoist area;
- Workshop & Stores; and
- Emergency accommodation

Export Cables

4.27 Sub-sea power cables are required to connect the wind farm to the onshore electricity transmission system. These cables will also comprise internal fibre optics for wind farm control purposes. The 3-core cables will consist of copper or aluminium conductors with integral insulation, core screening, and steel armour (for stiffness and impact resistance).

4.28 The export cables have the following target buried depths:

Section	Target Depth of Burial	Minimum Depth of Burial
HDD exit to 10m Chart Datum	2.0m	1.5m
10m Chart Datum to Substation	1.5m	1.0m

4.29 It is considered that the proposed burial depths for export cables are sufficient to ensure that the cables do not become exposed by the removal of overburden material.

4.30 The wind farm has 3 installed export cables, two of which are live and transmit power along the c13km long route from the offshore substation to the landfall at Brooklands Park, near Worthing, and an additional fibre optic cable to provide communications between the array and the shore.

4.31 At the date of writing, three export cables have been installed, and a fourth is due to be installed in Summer 2018, subject to the approval of the Marine Licence application submitted to the Marine Management Organisation.

4.32 The wind farm will be operated on two of the four installed cables.

4.33 At the beach the export cables pass under the beach through sealed Horizontal Directional Drilled (HDD) ducts.

Inter-Array Cables

4.34 The inter-array cables interconnect the wind turbines within the arrays to each other and to the offshore sub-station platforms. The cables are standard 3-core, aluminium conductor, XLPE insulated and armoured submarine cable, rated at 33kV.

4.35 All cables are to be buried in the seabed to a nominal depth of 1m.

4.36 The estimated total cable length, for both export and inter-array cables is approximately 202 km. Note that cables are not oil/fluid filled.

4.37 The one hundred and sixteen (116) 3.45 MW WTGs are arranged in twelve strings, with pairs of strings joined by a back-link cable. Each string connects between eight and ten turbines.

4.38 The WTGs are connected by 33kV submarine array cable sections (112 pieces), the total array cable route length (in the seabed) is approximately 152km.

Meteorological Mast

4.39 A meteorological mast (at location 50º 41' 16.702"N 000º 20' 35.850"W) was installed in April 2012 to verify wind speed assumptions and to measure environmental parameters.

4.40 In January 2014 the entire lattice tower of the Met Mast failed. This resulted in the collapse of the tower into the sea. The met mast has been made safe with the monopile, platform, boat landing, ladders, solar panels, batteries, ancillaries, marine navigation aid and foghorn all being operational. .

4.41 The foundations of the Met Mast consist of a steel monopile with a diameter of 2.5m and a length of approximately 60m, of which 20m is driven into the seabed. The monopile is made of approximately 100 tonnes of steel. There is frond mat scour protection laid on the seabed.

4.42 The Met Mast will be decommissioned in 2017, under a separate marine Licence, and therefore is not considered further within this document.

Scour protection

4.43 Scour is the term used for the localised removal of sediment from the area around the base of support structures located in moving water. When a structure is placed in a current, the flow is accelerated around the structure. If the bed is erodable (and the shear stresses are of sufficient magnitude), a scour hole forms around the structure. This phenomenon is known as local or structure-induced sediment scour.

4.44 At the Rampion site, there are 47 locations where some scouring of the upper softer clay and/or sand and gravel material may occur and scour protection measures have been installed around the structure, in the form of mattressing.

4.45 In accordance with the Deemed Marine Licence – array (condition 11(1) (e)) a Scour Protection Management and Cable Armouring Plan was submitted for the approval of the MMO prior to the installation of any scour protection. This plan details the need, type

sources, and quantity and installation methods for scour protection around the turbine foundations, and was approved by the MMO prior to the installation of the scour protection.

5. Offshore construction and installation

Monopile installation

5.1 The monopiles and TPs were loaded and sea-fastened onto the foundation installation vessel from Esbjerg Port, and transported directly to the Rampion wind farm site for installation.

5.2 Upon arrival at the first foundation installation position, the sequence of works was as follows:

1. The Foundation Installation vessel (loaded with monopiles) is positioned over reference target at pre-defined orientation. Vessel is jacked up to working height.
2. The monopile gripper (attached to the vessel hull) is deployed to the horizontal position.
3. The gripper arms are extended at their mid-stroke position and are kept opened.
4. The monopile sea-fastenings are removed and the monopile is upended from horizontal to vertical using installation vessel upending devices (main crane and deck tools).
5. The crane lifts and moves the monopile to a pre-calculated crane radius.
6. The crane slews until the centre of monopile meets the centre line of gripper arms. This operation is done manually/visually guided by instructions from staff positioned at the vessel stern.
7. The pile is lowered through the open monopile gripper. The monopile is kept out of the water until the pile positioning / orientation is verified.
8. The pile gripper arms are closed around the pile to restrain and guide it laterally.
9. Pile inclination is verified (by surveyors onboard the vessel) and adjusted by the crane if necessary to bring the pile to the 'true vertical' position.
10. The pile is lowered into seabed while it is being guided by the gripper. Self-weight of monopile penetrates seabed.
11. The main crane is unlatched from the monopile (via monopile upending and lifting tool).
12. The gripper guides and maintains the monopile vertically. The inclination of the monopile is adjusted by the gripper arms as necessary.
13. The main crane installs the driving hammer on to the monopile top. Piling operations commence initially with the soft start procedure.
14. Monopile inclination is frequently verified (by surveyors and by utilising an inclinometer onboard the hammer) before and between the hammering operations (hammer blows). The inclination of the monopile is adjusted by the gripper arms if necessary to maintain its 'true vertical' position.

15. The monopile is driven to the predetermined depth where the monopile can hold itself vertically without the assistance of the gripper. The gripper arms are opened when necessary to allow clearance for the pile hammer.
16. The monopile is driven to the target depth.
17. The hammer is recovered to the vessel deck.
18. The gripper is retracted and raised prior to the "Transition Piece" installation.

Transition piece installation

1. The Foundation Installation vessel jacks up to working height for TP installation. The main crane is rigged to lift the transition piece via pre-installed lifting lugs.
2. The transition piece is lifted and set onto the monopile. A gangway is placed between the vessel stern and the transition piece.
3. Personnel transfer onto the transition piece to check the transition piece to monopile flange alignment and to assist in making adjustments as necessary. Several temporary installation works are completed to ensure safety of personnel.
4. Hydraulic bolt tightening equipment is utilised to tighten the bolts between the TP and monopile flanges, in several tightening phases. The bolts/nuts are stored inside the transition piece prior to its installation upon the monopile.
5. The main crane is de-rigged from the transition piece and the lifting lugs are returned to the vessel.
6. The grout hose is connected to the grout inlet at the transition piece platform and the crew prepare the equipment for commencement of grouting operations.
7. Grout is pumped into the base of the annulus whilst the bolt tightening is being completed in a pre-defined sequence.
8. The grout fills the annulus and displaces the seawater via the exit/ breather near the top of the transition piece. A filter system (likely to be a geotextile material bag) is installed on the exit/breather hole
9. Other small temporary equipment will be installed on the transition piece to assist with cables installation.
10. The tools and other equipment are then removed, and a tent-like cover is installed over the transition piece, to protect the exposed flange until the wind turbine is later installed.
11. The personnel transfer onto the installation vessel and the gangway is removed.
12. The vessel jacks down and departs for the next installation.

Figure 5: Installation of Transition pieces

Wind Turbine Installation

5.3 The installation of the wind turbines for the offshore wind farm is being performed by the same jack-up vessel as used for the foundation installation.. However, the main principle of the installation process is as follows::

1. The jack-up installation vessels work both in the field and transiting parts to the construction area.
2. A batch of wind turbines divided into main parts (blades, nacelle including the hub, tower) are loaded out on to the installation vessel at the pre-assembly area at Esberg.
3. The installation vessels shuttle between the offshore construction site and pre-assembly quayside to pick up the wind turbine components. Eight sets of components for a complete wind turbine are loaded.
4. The installation vessel is equipped with sea fastenings and cranes specific selected and designed for the installation of wind turbines. The installation vessel is positioned close to a foundation, jacks up to a safe height and the installation of the wind turbine is ready to start.

5. The first step is the erection of the tower. The tower islifted from the jacked up installation vessel and lifted in position in one or two sections.
6. After the tower is mounted on the foundation, the nacelle is lifted from the jacked up installation vessel to the top of the tower. The nacelle is securely attached to the top of the tower and the turbine is ready for the final rotor assembly.
7. The rotor assembly is a single blade installation process. The principle in this is that the hub is attached to the nacelle onshore at the pre assembly site and then the blades are lifted individually lifted and attached to the hub.
8. The turbine is now installed and the installation vessel jacks down and move to a new position.

Figure 6: WTG installation

Offshore Substation installation

5.4 The installation of the offshore substation was undertaken as follows:

1. Installation vessel arrived at the site and positioned itself in the correct location for installation of jacket and pin piles.
2. The transportation barge arrived on site with the Jacket and pin piles and positioned itself alongside the installation vessel.
3. The installation vessel crane was rigged to the jacket and the structure was lowered to the seabed. The The installation vessel crane was used to upend and lift a pin pile which was then lowered through one of the jacket leg pile sleeves. The pile hammer was installed on top of the pin pile and the pile was driven to its design embedment depth .This was repeated at each leg location.
4. Jacket levelling was completed and the piles were then grouted into the pile sleeves to secure the jacket legs to the piles.
5. Subsequently, the topside module was brought to site and rigged to the vessel crane.
6. The module was lifted from the barge onto the stabbing points on the top of the jacket.
7. The barge moved away and departed from the site and was demobilised.

8. The topside module was welded to the jacket to secure it in its final position.
9. The installation vessel departed from the site and was demobilised.
10. An additional installation jack-up was brought to site, to complete the installation of the substation components.

Operations & Maintenance (O&M)

5.5 The Rampion Offshore wind farm will be treated as a long-term asset with operational procedures and expenditure plans consistent with those of a power station.

5.6 ROW, as operator of the project, will establish a self-contained operational facility at Newhaven Port for the control and management of operation and maintenance activities.

5.7 The facility will provide an operations base for monitoring and control, a maintenance team base with workshop and storage facilities and provision of routine maintenance vessels.

5.8 The facility will have the capability to cater for additional manning for non-routine maintenance. A core team of staff will be based permanently at the facility.

OFTO

5.9 The Electricity Act 1995 allows OFGEM to make regulations for competitive tenders for Offshore transmission Licences.

5.10 Under the Regulations, all offshore connections of 132KV and over require an Offshore transmission licence to be awarded through a competitive tender to an Offshore transmission Operator (OFTO).

5.11 The Generator cannot also be an OFTO, and therefore ROW will enter the tender process in 2018.

5.12 Once the transmission assets have been transferred to an OFTO, this Decommissioning programme will be reviewed to reflect the divestment of the assets.

Health, Safety, Security and Environment (HSSE)

5.13 In its management of the Rampion project, ROW is committed to uphold the highest standards as far as is reasonably practicable for HSSE.

5.14 This means that ROW is committed to:

- pursue the goal of no harm to people,
- protect the environment by maintaining a high standard of environmental care, assessing the ongoing environmental impact of its activities as an integral part of decision making,

- play a leading role in promoting best practices in the wind power industry through continuous performance appraisal and targeting ongoing improvement,
- Manage HSSE matters as any other critical business activity and promote a culture in which all persons working on the Rampion project including contractors and sub-contractors share this commitment.

5.15 The HSSE Policy is that ROW:

- has a systematic approach to HSSE management designed to ensure compliance with the law and to achieve continuous performance improvement;
- sets targets for improvement; measures, appraises and reports performance;
- requires its Contractors, vendors and suppliers to manage HSSE in line with this policy;
- ensures that HSSE is the responsibility of all managers and individuals; and
- requires everyone to stop any work, or prevent work from starting, where adequate controls of HSSE risks are found not to be in place including HSSE performance in the appraisal of all persons working on the project.

5.16 ROW aims to have an HSSE performance it can be proud of, to earn the confidence of customers, business partners and society at large, to be a good neighbour and to contribute to sustainable development.

5.17 In support of this commitment and the HSSE Policy, the Steering Committee from time to time endorses other strategic HSSE objectives, which are interpreted and clarified as necessary prior to adoption by the Rampion Project Manager and communication to Rampion staff.

5.18 To implement these policies, an HSSE Management System has been put in place to ensure that health, safety, security and environmental matters are properly addressed by the project in a way that complies with legislative requirements and is consistent with the HSE policies, procedures and targets operated by Rampion.

5.19 The Rampion project has been registered with the Health and Safety Executive under the Construction Design & Management (CDM) Regulations 2015.

6. Detail of Proposed Decommissioning Measures

Guiding Principles

6.1 In considering the proposed decommissioning programme for the Rampion project, ROW has sought solutions for each offshore element of the wind farm that adhere to the following principles:

Guiding principle	Comments
No harm to people	ROW is committed to adhering to the highest standards for health and safety throughout the lifecycle of the Rampion project. ROW seeks to promote safe practices and minimise risk in the development and implementation of decommissioning solutions.
Consideration of the rights and needs of legitimate users of the sea	ROW respects the rights and needs of other users of the seabed. Decommissioning activities will seek to minimise the impact on stakeholders and emphasis will be placed on clear, open communication.
Minimise environmental impact	The Best Practicable Environmental Option (BPEO), at the time of considering the precise decommissioning procedure, an approached will be chosen which minimises impact on the environment at an acceptable cost.
Promote sustainable development	In decommissioning the Rampion project, ROW will seek to ensure that, as far as is reasonably practicable, future generations do not suffer from a diminished environment or from a compromised ability to make use of marine resources.
Adhere to the Polluter Pays Principle	ROW's decommissioning and waste management provisions acknowledge our responsibility to incur the costs associated with our impact on the environment.
Maximise the reuse of materials	ROW is committed to maximising the reuse of waste materials and pays full regard to the 'waste hierarchy'.
Commercial Viability	In order that commercial viability is maintained, the BATNEEC (Best Available Technique not Entailing Excessive Cost) decommissioning solutions will be sought.
Practical Integrity	Solutions that are necessary to achieve one or more of the above objectives must be practicable.

Proposed Decommissioning

6.2 At the time of writing ROW is undertaking key design and development work for the project. The overriding aim is to develop a project that is safe, durable and cost-efficient throughout its lifetime. Taking a lifecycle approach to the design and development work ensures that decommissioning considerations are incorporated into decision-making and, where possible,

means that the principles identified above are being incorporated into early decision-making.

6.3 Taking into account the UK's commitments under UNCLOS; IMO standards and the work of OSPAR, ROW's starting assumption in establishing the decommissioning requirements has been complete removal of all offshore components to shore for reuse, recycling or incineration with energy recovery or disposal at a licensed site. This assumption has been assessed for all components against the key principles presented above. In some instances this option has not been considered to be appropriate and alternative options have been considered. These alternatives have also been assessed according to the above principles and the optimum solution selected.

6.4 A further prerequisite for not fully removing a component is consistency with at least one of the circumstances set out on page 57 of DECC guidance ("Decommissioning Offshore Renewable Energy Installations Under the Energy Act 2004, Guidance Notes for Industry, January 2011) as situations where such a solution may be considered. The circumstances set out in the guidance are listed below:

I *"the installation or structure will serve a new use, whether for renewable energy generation or for another purpose, such as enhancement of a living resource[1] (provided it would not be detrimental to other aims, such as conservation). In these situations, we would normally expect the decommissioning programme to set out the eventual decommissioning measures envisaged should the installation or structure finally become 'disused' and a point reached when extending its life or finding a beneficial reuse is no longer possible;*

II. entire removal would involve extreme cost. It is considered that design decisions should, as far as possible, result in installations, which are affordable to remove, but it is recognised that some elements, such as deep foundations, may nonetheless be costly to remove;

III. entire removal would involve an unacceptable risk to personnel;

IV. entire removal would involve an unacceptable risk to the marine environment;

V. the installation or structure weighs more than 4000 tonnes in air[2] (excluding any deck and superstructure) or is standing in more than 100m of water and could be left wholly or partially in place without causing unjustifiable interference with other uses of the sea."

6.5 The methods of decommissioning will be affected by site specific factors, by final design choices, and by the equipment and vessels available at the time. The measures described in this section are based on current technology and information, but it should be recognised that the methods are likely to evolve over time.

6.6 Periodic review of the Decommissioning Programme and the measures proposed within it will take place throughout the lifetime of the wind farm to accommodate new information. For example, new offshore technologies are continually being evaluated, tested and

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[1] It would not be acceptable for a decommissioning programme to propose leaving an installation in place on the grounds that it may, in the future, provide new surfaces for colonisation and the formation of an artificial reef.

[2] This weight specification is taken directly from the IMO standards and is interpreted as applying to an individual device, and not to, say, an entire wind farm.

developed. ROW expects considerable advances over the lifetime of the project with new techniques evolving as experience and knowledge in the sector grows.

6.7 In particular, it is acknowledged that lessons may be learned through the construction and operation of the project and through industry experience in decommissioning renewable energy and other offshore installations. Sufficient time must be given to researching the different available technologies for each phase of the decommissioning operation.

6.8 It may also be necessary to amend these measures in order to comply with revised best practice guidelines and future legislation.

6.9 It should be noted that although this plan provides an outline view of decommissioning activities, a detailed plan will be produced and submitted to the MMO prior to the commencement of any activities. It is likely that a new marine licence will also be required.

Wind Turbines

6.10 It is intended that the entire wind turbine structure is fully removed from site in its main constituent parts of rotor assembly, nacelle and tower before being disassembled fully onshore. This reduces offshore risk, for example in relation to spillage, and facilitates safe deconstruction onshore. In terms of the key principles, this approach has been assessed as follows:

Guiding Principle	Comments
No harm to people	Safest option, involving standard procedures and minimal work offshore.
Consideration of the rights and needs of legitimate users of the sea	Complete removal of structure best long-term solution. Appropriate notification and consultation would precede temporary works/disturbance
Minimise environmental impact	Risk of spillage slight as all pollutants are fully contained inside the nacelle and removed in single lift. All dismantling takes place onshore therefore minimizing the risk of spillage.
Promote sustainable development	Materials completely removed from site, ensures future generations do not suffer from a diminished environment or from a compromised ability to make use of marine resources.
Adhere to the Polluter Pays Principle	Entirely consistent: owner pays full cost of removal and disposal
Maximise the reuse of materials.	All deconstruction to take place onshore, maximum potential for reuse of materials.
Commercial Viability	Most commercially viable solution:, minimal works offshore, maximum re-sale/reuse value from materials, minimum residual risk

Practical Integrity	Known/tried procedures reduced risk due to minimal offshore works

6.11 The decommissioning of the superstructure (i.e. removal of turbine components including blades, nacelle, and tower) is likely to be a reversal of the installation process. Opportunities to re-use the generating equipment will be maximised.

6.12 Health and Safety will be of paramount importance during decommissioning. All work will follow the recommendations and requirements of the CDM regulations (or applicable codes and standards at the time the work starts).

6.13 The general methodology for carrying this out is as follows:

- De-energize and isolate from Grid (may be undertaken in phases)
- Mobilise suitable heavy lift vessel(s) to the wind farm location
- Cut turbine interconnecting cables adjacent to the substructures
- Remove rotor component parts
- Remove nacelle including gearbox and generator
- Remove turbine tower
- Transport all components to an onshore site at which they will be processed for reuse, recycling or disposal.

6.14 Once onshore, the structures and substructures will be reduced to sizes suitable for disposal as follows:

- Removal of all hazardous substances and fluids from the turbines (such as oil reservoirs and any hazardous materials and components). All components to be disposed of in accordance with relevant regulations
- All steel components sold for scrap to be recycled. This forms the bulk of the structures and substructures
- The turbine blades (fibreglass) will be disposed of in accordance with the relevant regulations in force at the time of decommissioning. One potential disposal method identified is to break down the fibreglass into a pulp for use as cavity insulation in buildings

Foundations & Transition Pieces

6.15 Design considerations have been made to ensure that the installations are affordable to remove. However, design codes and standards limit the ability to reduce steel thicknesses and to lighten the structures to ease future removal. The result is that the monopoles and the jacket piles are of a size that means they will not be able to be removed from the seabed

once piled to the design penetration depth of approximately 30m to 42m below seabed. Consequently it is proposed that the foundations are cut at or below seabed. In the first instance a general target of cutting one metre below seabed is proposed, though it may be necessary to vary the target depth for individual foundations subject to site specific factors such as the specific ground conditions at each turbine location.

6.16 In contrast, for complete removal it should be noted that in order to overcome vast frictional forces, considerable excavation would be needed – in some instances up to 42m depth must be foreseen. In addition, the pulling forces required would introduce considerable health and safety risks.

6.17 In order to be able to undertake the cutting procedure, the diameter of the excavation hole will increase by at least two metres for every additional metre in depth below seabed. As such, it may be considered too intrusive and damaging to consider cutting below one metre depth.

6.18 It is preferable that, following the cutting operation, the foundations and transition pieces be removed as a single structure. To keep the total maximum lift weight below 600 tonnes, it may be necessary to remove the transition piece before some of the deeper water foundations are cut at the seabed.

6.19 TCE have noted that the seabed in the vicinity of the wind farm is composed of gravely sand and there is potential for the seabed to be scoured by tidal action. Periodic reviews and post-construction surveys will enable ROW to undertake a review of the conditions and if required modelling may be required to inform the rates of sediment transport over time, and determine the appropriate level to which the piles should be cut below the seabed level at the time of decommissioning.

6.20 The following table compares and contrasts the options of complete removal of foundations with the alternative of cutting below seabed as described above:

Criterion	Complete Removal	Cutting below seabed
No harm to people	High risk to personnel associated with lifting extreme weights. Risk compounded by significant length of time needed to undertake works offshore. Diver operations would be required.	Fewer activities to be undertaken over a shorter time period offshore, minimising risk to personnel. Post decommissioning site monitoring will identify any unlikely exposure with the result that safety risk is insignificant.
Consideration of the rights and needs of legitimate users of the sea	Disadvantages to other users of the marine environment include disruption over a longer time period whilst the works are undertaken and remaining scour holes associated with excavation.	No risk presented providing cutting is to sufficient depth, site is monitored post decommissioning; any unlikely exposure identified.
Minimise environmental impact	Excavation pits over a wide area causing significant impact to marine	Considerably reduced works footprint relative to complete

	environment. Associated dumping of excessive volume of waste material also required. Disturbance would take place over long time period. Some artificial reef habitat may be lost, but long term risk of decay and pollution will be eliminated.	removal. Works would take place over reduced time period and involve less equipment. Seabed recovery time shorter than complete removal scenario. Some artificial reef habitat may be lost, but long-term risk of decay and pollution will be eliminated.
Promote sustainable development	In the long term complete removal affords maximum flexibility over use of seabed, though considerable destruction over the whole site in short-medium term	Some activities may be limited at turbine locations: e.g. extraction Providing remaining structures do not become exposed most future activities will not be affected. Seabed recovery is highly likely.
Adhere to the Polluter Pays Principle	Consistent in principle, assuming a suitable disposal solution can be found for the excavated waste material and that the seabed can be restored.	Consistent as far as is reasonably practicable – all remains to be suitably buried.
Maximise the reuse of materials.	Maximum material potentially available for reuse	Less material available for reuse relative to complete removal.
Commercial Viability	Not commercially viable – excavation and extreme lifting involves major equipment requirements over longer periods of time	Less expensive alternative to complete removal, involving minimal excavation.
Practical Integrity	Not a practical solution: Extreme risk associated with heavy lift, considerable excavation needed with associated storage or disposal of large volume of waste.	Standard procedures and equipment.

6.21 This initial analysis shows that cutting below seabed is preferable to complete removal on the grounds of safety, practical integrity and commercial viability. However, it should be noted that these are preliminary assessments, and prior to any final decision being taken on the most appropriate methods for decommissioning a full EIA is likely to be required, which will consider the impacts and any mitigations required to minimise or reduce the impacts

6.22 ROW consider that there is consistency between this proposal and the relevant circumstances set out in DECC guidance note on decommissioning of offshore renewable energy installations:

- Entire removal would involve extreme cost.
- Entire removal would involve an unacceptable risk to personnel.

6.23 It is also noted that this approach is standard practice within the oil and gas industry for similar structures.

6.24 Although ROW is committed to cutting foundations below seabed, contingency plans will be put in place to ensure appropriate actions are carried out in the case that remaining structure(s) become exposed.

6.25 On current knowledge, abrasive diamond wire cutting is likely to be the preferred method for cutting all the foundation structures at or below seabed.

6.26 The use of divers for any of the removal works will be minimised and if possible eliminated completely.

6.27 The general methodology for decommissioning of the wind turbine monopiles is likely to be as follows:

- Operate cutting procedure at or below seabed.
- Remove transition piece and upper part of monopile as a single object using suitable lifting vessel.
- Transport to onshore location for offloading/disposal.
- Remove internal equipment and disassemble onshore.

Offshore Substation

6.28 It is proposed that the oil filled transformers are sealed and removed separately and taken to shore complete, reducing the potential for offshore spillage risk and facilitating safe dismantling. Similarly, the standby diesel generator and associated diesel tanks will also be sealed and removed. Next, the topsides are cut from the jacket and removed in one piece. Finally the jacket pin piles are cut 1m below seabed and the jacket removed. The complete lift weight is expected to be in the region of 800 tonnes. The justification for described removal of the topsides is outlined below:

Criterion	Complete Removal
No harm to people	Safest option, involving standard procedures and minimal work offshore.
Consideration of the rights and needs of legitimate users of the sea	Complete removal of structure best long-term solution. Appropriate notification and consultation would precede temporary works/disturbance.
Minimise environmental impact	Risk of spillage slight as all pollutants are fully contained and removed in a few controlled lifts.

	The majority of dismantling takes place onshore
Promote sustainable development	Materials completely removed from site, ensures future generations do not suffer from a diminished environment or from a compromised ability to make use of marine resources.
Adhere to the Polluter Pays Principle	Entirely consistent: owner pays full cost of removal and disposal.
Maximise the reuse of materials.	Maximum potential for reuse of materials.
Commercial Viability	Most commercially viable solution:, minimal works offshore, maximum re-sale/reuse value from materials, minimum residual risk.
Practical Integrity	Main risk is heavy lift and this can be mitigated by use of correct procedures and capable vessels and equipment. Most practical method.

6.29 The justification for cutting foundations below seabed provided in section 6.19 above also applies to this proposal.

6.30 The decommissioning of the transformer platforms will follow similar method as described for the turbines and turbine foundations. The complete 'topside' structure will be removed in a single lift, taken by suitable vessel to an onshore facility where the equipment and structure will be dismantled and the constituent parts processed for reuse, recycling and or disposal.

Offshore Cables

6.31 At the time of writing ROW intends to follow the current industry standard practice by leaving both inter-array and export cables in-situ buried under the seabed. As such, life-cycle costs and environmental impact will be considered in the design of the inter-array and export cables.

6.32 It is proposed that cables adjacent to the substructures are cut at a point below the surface of the seabed to allow the cable to remain buried. The cut sections would be removed with minimal disruption of the seabed. It is proposed to leave the remaining cable in situ as the disruption caused by jetting and or excavating the seabed to remove the cable is regarded as being detrimental.

6.33 Whilst it is considered that cables are buried at a safe depth, contingency plans will be put in place to ensure appropriate actions are carried out if the cables do become exposed.

Criterion	Complete Removal	Leaving In-situ
No harm to people	Risk to personnel not excessive	Burial within stable clay seabed does not pose safety risks to marine users
Consideration of the rights and needs legitimate users of the sea.	Removal affords maximum flexibility over use of seabed	No risk presented from leaving buried cables in situ. Potential for extraction activities limited
Minimise environmental impact	Given the considerable length of cable and the need for jetting techniques, removal would cause considerable damage and disruption to the seabed and established communities. These impacts could be considered large relative to the environmental gains from removal.	Benign - no environmental impact associated with long term disintegration of buried cables.
Promote sustainable development	Though considerable 'troughs' would remain on the seabed in the short-medium term, complete removal affords maximum flexibility over use of seabed in the long term.	Some future activities may be limited, e.g. extraction
Adhere to the Polluter Pays Principle	Consistent, assuming suitable disposal option is found for surplus cable components	Benign, no pollution risk
Maximise the reuse of materials.	Maximum material, e.g. copper, potentially available for reuse	No reuse possible if left in situ
Commercial Viability	Expensive operation, offset to an extent by copper re-sale value	Limited cost involved with reburial of cable 'ends'
Practical Integrity	Possible to undertake. Likely to cause damage to marine environment.	N/A

6.34 In light of the proposal to leave cables buried under the seabed, the cables will be cut at a suitable point as close to the foundation as possible, with the ends buried to a proposed

depth of around 1 metre below seabed level. This will minimise the further disruption to the seabed and any established marine life in the area.

6.35 In the event of economic justification in the future, complete removal of the cables from the seabed would be considered, however this would be subject to an environmental impact assessment, and considerations of the most appropriate methodology to decommission the cables would not be made on cost basis alone.

Scour Protection

6.36 Scour Protection has been placed at 47 locations within the array, and it is currently proposed that scour material is left in-situ following decommissioning.

	Complete Removal	Leave In-situ
No harm to people	Removal is a labour intensive activity, involving divers and posing an unacceptable risk to personnel	Reduced risk for contractors. Marginal, increase in risk to marine users: some additional rock over small areas at specific locations
Consideration of the rights and needs legitimate users of the sea	Removal affords maximum flexibility over use of seabed	May limit uses of seabed. May generate positive habitat benefits.
Minimise environmental impact	Removal will cause considerable damage and disruption to the seabed and established communities. Associated equipment and vessels will generate disturbance and additional noise over wide area. These impacts could be considered large relative to the environmental gains from removal. Materials gathered would need to be dumped elsewhere.	Habitat for established communities retained, no short or long term detrimental effects on marine environment anticipated.
Promote sustainable development	Consistent in principle, assuming suitable disposal solution found	Prevents some future activities on the seabed. Total area of sterilisation is small
Adhere to the Polluter Pays Principle	Consistent in principle	Inferior option to complete removal in this regard
Maximise the reuse of materials.	Opportunities for reuse of materials gathered are limited. Materials would need to be disposed of elsewhere.	N/A
Commercial Viability	Expensive, labour intensive, high volume operation	Costs limited to ongoing monitoring

Practical Integrity	High reliance on manual work, labour intensive. Possible but not practical	N/A

6.37 In relation to the circumstances set out in the DECC guidance where non-removal may be considered acceptable, it is considered that in this instance "the installation or structure will serve a new use … through the enhancement of a living resource". At present it is considered that entire removal of scour protection would involve an unacceptable risk to personnel and cause unnecessary damage to the seabed

6.38 However, depending on the advice of Natural England, nearer the time of decommissioning a thorough assessment of removal versus leaving scour protection in situ will be undertaken.

7. Environmental Management

Waste Management

7.1 ROW is committed to maximising the reuse of waste materials and pays full regard to the 'waste hierarchy' which suggests that reuse should be considered first, followed by recycling, incineration with energy recovery and, lastly, disposal. In any event, waste management will be carried out in accordance with all relevant legislation and it would be intended that any disposal took place on land.

7.2 In following the waste hierarchy and subject to evolution of technology, change in regulations and demand for materials over the lifetime of the project, the waste management of the main project components might involve Pre-treatment Disposal / Recycle

Waste Type	Pre-Treatment	Disposal/Reuse/Recycle
Wind turbine foundations	Establish available design life at end of 24 years.	Reuse by repowering with new/superior wind turbines or other renewable generation technology(if design is suitable)
Steel from wind turbine foundations, tower and nacelle removed to shore	Break down into transportable size	Recycle
Copper/aluminium from power cables not buried below seabed and transformers	Strip cable from power cables and transformers	Recycle
Glass-fibre Reinforced Epoxy (GRE) from the blades	Break down into transportable size	Recycle
Used lubricants from wind turbine	Filter	Recycle

Non-recyclable materials and fluids		Landfill

7.3 As a part of the review process, all appropriate regulations and guidelines will be reviewed, including the Waste Framework Directive, National Planning Policy for Waste and the Waste Management Plan for England, and any other such policies and frameworks which are relevant at the time of decommissioning.

7.4 A waste management plan will be drawn up, in consultation with the Environment Agency and Local Authorities, well in advance of the commencement of decommissioning to ensure that adequate time remains for the proper provisions to be made

Lighting and Marking

7.5 In accordance with the Order the appropriate markings and lights shall be exhibited during the decommissioning of the wind farm.

7.6 In relation to aviation safety, the shape, colour and character of the lighting will be compliant with the Air Navigation Order 2009 (or as otherwise directed by the Civil Aviation Authority).

7.7 In relation to navigational safety, lights and markings will be agreed with Trinity House, in consultation with the Maritime and Coastguard Agency. In particular, Trinity House Lighthouse Service (THLS) will be consulted prior to decommissioning to specify any obstruction marking that may be required during the removal operations. In the event that any obstruction is left on site that may be considered to present a hazard to navigation, the necessary marking specified by THLS shall be displayed.

Environmental Impact Assessment

7.8 Consistent with the commitment to undertake reviews of the decommissioning provisions contained within this document, it is proposed that the Project Environment Management and Monitoring Plan shall be updated with the relevant information associated with the required monitoring works and reviewed throughout the lifetime of the project.

7.9 A final review will be undertaken towards the end of the life of the installation when the final details of the decommissioning measures are known. At this point a decision will be made as to whether any more detailed assessment is required. Key criteria that will inform this decision include:

- Identification and assessment of potential impacts on the environment, including exposure of biota to contaminants associated with the installation,
- other biological impacts arising from physical effects,
- conflicts with the conservation of species, with the protection of their habitats, or with mariculture

7.10 Surveys in and around the wind farm that could inform this process could include:

- Benthic: side scan sonar, imaging
- Marine Mammals: should decommissioning activity give rise to high noise levels, it may be appropriate to survey marine mammal activity
- Review of Nature Designations
- Identification and assessment of potential impacts relating to interference with other legitimate uses of the sea. It is possible that the nature and/or intensity of human activities taking place on/around the Rampion site such as commercial fishing may have changed over the lifetime of the project. A review will be undertaken to identify those activities with potential to be affected by decommissioning.
- Identification and assessment of potential impacts on amenities, the activities of communities and on future uses of the environment
- Identification and assessment of potential impacts on historic environment interests

7.11 If required, the final EIA will fill any 'gaps' in relation to the above. It will also describe the measures envisaged to avoid, reduce and, if possible, remedy any significant adverse effects indicated.

7.12 The use of explosives is not proposed, however should explosives be necessary during the course of decommissioning, the potential impact of these on marine life, particularly marine mammals, would be assessed. The use of explosives would require rigorous justification and a mitigation strategy would be proposed. All appropriate guidelines and regulations such as those currently available from JNCC/NE would be followed.

8. Consultations with Interested Parties

8.1 ROW regards effective and open communication and consultation as essential elements to the successful development of the Rampion project. These principles have been adopted during the development of the project and will be applied during the life of the offshore wind farm including the decommissioning phase of the project.

8.2 ROW has sought the advice and opinions of the following parties, in drafting and reviewing the decommissioning programme for the project, in accordance with Section 105 of the Energy Act 2004:

- British Marine Aggregate Producers Association (BMAPA)
- Chamber of Shipping
- Environmental Agency
- Joint Nature Conservation Committee
- Maritime and Coastguard Agency

- National Federation of Fishermen's Organisation
- Natural England
- Relevant Harbour Authority
- Royal Yacht Association
- Relevant Planning Authority
- Trinity House

8.3 Additionally, the draft Decommissioning Programme was placed on the Rampion website, and email notification sent to members of the Project Liaison Groups set up by ROW during the development stage of the Project.

8.4 Responses received during the consultation have been incorporated into this programme, where appropriate.

8.5 Following submission of the programme to DECC, further consultation with statutory bodies was undertaken by DECC and responses to further points have also been included in the document.

8.6 Appendix 1 provides details of all responses received.

8.7 In order that the impact on legitimate marine users and stakeholders is minimised, early and comprehensive consultation prior to decommissioning is required. This strategy will be finalised and undertaken as part of the final review process undertaken prior to decommissioning.

8.8 At the time of decommissioning, and in accordance with the conditions included within Schedule 13 & 14 of the Order, ROW will issue timely and efficient Notices to Mariners and other navigational warnings of the position and nature of the decommissioning activities that will be taking place. Efforts will be made to ensure that this information reaches mariners in the shipping and fishing industry as well as recreational mariners.

8.9 The UK Hydrographic Office (UKHO) will be notified as appropriate on the progress and completion of the works. It is noted that the UKHO requires at least six weeks' notice for the updating of nautical charts and publications.

8.10 It is anticipated that Safety zones will be required during decommissioning, and an application will be submitted to the MCA in advance of the commencement of works. Guard vessels may also be deployed during decommissioning.

9. Schedule and the Review Process

9.1 It is proposed that decommissioning commences 24 years after the commencement of operation of the wind farm, coinciding with the end of the design life of the turbines. There remains the possibility that the electrical infrastructure (40 year design life) will be re-

utilised and the wind-farm ‘re-powered’ with new wind turbines, however this would be treated as a new wind farm proposal, and would require EIA and new consents.

9.2 It is proposed that full decommissioning in accordance with the provisions described above, of Rampion will take 12 to 18 months to undertake. Offshore decommissioning and onshore dismantling and disposal will run in parallel. A detailed programme of the works will be provided towards the end of the life of the project.

9.3 ROW acknowledges that the most important steps in the decommissioning process is advanced planning and the selection of the best decommissioning options. As has been indicated throughout this document, it is intended that the current decommissioning provisions are rigorously reviewed and assessed over the lifetime of the project.

9.4 ROW intends to undertake internal reviews of the Decommissioning Programme throughout the life of the project and proposes that a formal review exercise is undertaken with DECC, Natural England and MMO at the following times:

- 5 years following commencement of generation;
- 10 years following commencement of generation;
- 15 years following commencement of generation
- 20 years following commencement of generation (Final Review)

9.5 The final review 20 years after commencement of generation will provide an opportunity to scrutinise the detail of the decommissioning provisions in consultation with DECC and key stakeholders, including NE, MMO, MCA & THLS ensuring the impacts of the decommissioning works have been adequately assessed and the schedule of works and the costs associated are fully understood and agreed. At this stage consideration will also be given as to whether a revised EIA, and Appropriate Assessment are deemed necessary.

9.6 The decommissioning work will require a Marine Licence under the Marine and Coastal Access Act, from the MMO. The following aspects shall be considered as part of the application:

- Description of the items to be decommissioned;
- Description of proposed decommissioning measures;
- Environmental Impact Assessment (including measures to mitigate environmental impact);
- Consultation with relevant bodies;
- Decommissioning Schedule with anticipated dates;
- Project management and verification;
- Seabed clearance;

- Restoration of site , and
- post-decommissioning monitoring, maintenance and management of the site.

Seabed Clearance

9.7 In accordance with the Polluter Pays Principle, ROW proposes to clear the seabed in accordance with the provisions made in this Decommissioning Programme and to collect and provide evidence to reflect this.

9.8 Following decommissioning, surveys will be carried out to show that the site has been cleared. These surveys will enable identification and subsequent recovery of any debris located on the sea-bed which may have arisen from activities related to the Rampion and which may pose a risk to navigation, other users of the sea or the marine environment. It is currently intended that side scan sonar will be used to identify debris, with an ROV deployed to investigate and recover any potential hazards identified.

9.9 The area to be covered will be determined prior to decommissioning. Reference will also be made to the "Archaeological No Build Areas" in order that these are not inadvertently cleared in the process of removing any debris. Analysis of the survey data will also ensure that items for removal and disposal relate only to the wind farm. The appropriate competent authority will be approached regarding the identification of other anomalies that may be of archaeological interest.

9.10 It is important that this process of collecting and presenting evidence that the site is cleared is independent. ROW propose that an independent survey company complete the surveys and that they report in parallel to both ROW and DECC.

Restoration of the Site

9.11 ROW is committed to restoring the Rampion site, as far as is reasonably practicable, to the condition that it was in prior to construction.

9.12 Consistent with the decommissioning provisions detailed above, the key restoration work will relate to:

- Ensuring that foundations cut below seabed (turbines, substation and met mast) are made safe
- Ensuring that cable ends are adequately buried

9.13 Active restoration relying on intervention with equipment is not proposed as it is considered that such works present unnecessary and unacceptable risk to personnel. Rather, it is considered that allowing the seabed to 'self-settle' is sufficient and in proportion to the limited environmental impact of the proposed decommissioning.

9.14 Should post decommissioning surveys indicate that previously buried cables have become exposed such that they pose a navigational risk, the exposed parts of cable would be cut away and removed from the sea bed.

Post-Decommissioning Monitoring, Maintenance & Management

9.15 Given that ROW is not proposing to fully remove all installations, some post decommissioning activities are proposed in order to identify and mitigate any unexpected risks to navigation or other users of the sea which may be posed by the remaining materials (for example, where cables or foundations may have become exposed due to natural sediment dynamics).

9.16 The proposed post decommissioning activities are appropriate to:

- the scale and nature of the remaining infrastructure
- the degree of risk that any remains become exposed
- the degree of risk to marine users

9.17 Whilst the Rampion site is relatively large, it is considered that the risk of exposure is extremely low, primarily due to the depth at which foundations will be cut and cables buried.

9.18 In comparison to the oil and gas industry where the likelihood of debris falling overboard over the life of the installation is relatively high, such risks are low for the Rampion project where offshore work associated with operations and maintenance is low and contained within the turbine structure.

9.19 On the basis of this low degree of risk, it is proposed that the following monitoring surveys are undertaken for elements left in situ beneath the sea-bed:

- Once at the time of completion of decommissioning
- Once the year after decommissioning
- Once after 5 years

9.20 At each proposed point in time, ROW will perform a geophysical survey including a magnetometer survey on the site where equipment was installed. As indicated in paragraph 7.67 above, ROW proposes to use an independent survey company to complete the surveys. The company will be requested to report in parallel to both ROW, MMO and DBEIS.

9.21 In the event that any of the assets left in situ become exposed, a remedial plan will be agreed with the MMO.

9.22 If after 5 years the need for further surveys is determined, the scope and frequency of the surveys will be agreed with the MMO.

9.23 In the event of protrusion or in the event that scour protection materials are left on site following decommissioning, ROW will ensure that notification is given to the Hydrographic Office so that suitable notation of a potential anchoring hazard can be marked on relevant charts and mariners informed accordingly.

9.24 Additionally a Notice to Mariners would be issued to inform sea users of any anchoring hazards and where possible these hazards will be removed from the seabed.

APPENDIX 1. CONSULTATION RESPONSES

Stakeholder	Comment	ROW Response
Maritime & Coastguard Agency		
	Clarification and confirmation is required on the mitigation measures that will be employed to minimise risks to mariners, e.g:	
	Notification to the UKHO - the UKHO needs at least six weeks advanced notification for the updating of nautical charts and publications	Details of the proposed consultation including the issue of Notices to Mariners and notification to the UKHO are included in Section 8.
	promulgation of information and warnings to mariners	
	Safety Zones - 1 500m safety zone is typically implemented during decommissioning and an application would normally be supported by MCA	noted - the text has been updated to reflect this (para 8.7)
	The use of guard vessels - the MCA would expect guard vessels to be present	noted - the text has been updated to reflect this (para 8.7)
Marine Management Organisation (MMO)		
	Schedule and Review process	
	1.1 Paragraph 7.55 (page 40) states that "It is proposed that decommissioning commences 24 years after the commencement of operation of the first turbines to be installed, coinciding with the end of the design life of the turbines."	
	Clarification is requested regarding the commencement of decommissioning. Specifically, clarification is requested regarding whether the whole site will be decommissioned at once or whether decommissioning will commence in phases in relation to the commencement of operations.	Noted - the text in paragraph 9.1 has been update to clarify the position
	Furthermore it should be noted that the action of "repowering" the wind farm would require a new consent.	Noted - the text in 9.1 has been updated to clarify the position
	1.2 Paragraph 7.59 (page 40) states that: "the final review will take place 20 years after the commencement of generation". It must be noted that decommissioning will require a marine licence under the MCAA. At the time of decommissioning the final review of the decommissioning programme will be at least 5 years old. The information provided from this review may be considered out of date at the time of	Noted - the text in paragraph 9.4 has been updated to clarify the position

	application, subject to a review of the application by the MMO.	
	1.3 The MMO would expect to see the following included as part of the application:	Noted - the text in paragraph 9.6 has been updated to clarify the position
	- Description of items to be decommissioned	
	- Description of proposed decommissioning measures	
	- Environmental Impact Assessment (including measures to mitigate environmental impact)	
	- Consultation with relevant bodies	
	- Decommissioning Schedule with anticipated dates	
	- Project management and verification	
	- sea-bed clearance	
	- restoration of site, and	
	- post-decommissioning monitoring, maintenance and management of the site.	
Response 7th July 2015	Although the plan gives an outline of decommissioning activities, a detailed methodology must be submitted to the MMO prior to the commencement of decommissioning. It should be noted that a marine licence is likely to be required	Noted – and this text is now included in para 6.9
	It is noted that surveys are 0, 1 and 5 years are proposed to assess whether cables remain buries. However the plan does not cover whether cable exposures will be remedied. In addition the MMO remains concerned about liability for the cables beyond the 5 years monitoring scheme	Text in para 9.21 – 9.22
Natural England		
	Request that closer to the time of decommissioning; Natural England is consulted again on a revised plan, which should include updated technical details relating to the decommissioning procedures for the different parts of the wind farms (and any scour protection).	Noted - the text in paragraph 9.4 has been updated to clarify the position
	We also welcome that monitoring programmes, such as those detailed in section 4.14, will be produced in accordance with the conditions stated within the DML and also note ROW's commitment to undertake further surveys to inform the EIA process and the most appropriate decommissioning methods, to address any potential nature conservation concerns. Natural England would be happy to receive a timescale of the surveys when known.	noted - ROW will provide this information once it is known, as set out in paragraph 9.5

	Natural England notes the proposal to leave cables in situ and the measures taken to ensure they do not become exposed. However, if they do become exposed we recommend a contingency plan is in place for its reburial, although we note that should they become a hazard to navigation they will be recovered, as specified in the plan. Natural England note the monitoring survey time line for elements that may be left in situ on the sea bed although would like confirmation that this section (Section 7.72) is complete in the report.	It is confirmed that this section is complete in the report.
Trinity House Lighthouse Services		
	I can confirm that Trinity House are content with the proposed removal of structures to 1m below seabed level and your acknowledgement of the need to contact Trinity House concerning risk mitigation measures during this phase of the project. Please be advised that initial contact should be made with Trinity House at least six months prior to any decommissioning works commencing.	Noted.
West Sussex County Council		
	In general terms the document struggles to provide a great level of detail owing to construction methods and detailed designs not having been established/finalised (e.g. as set out in Section 4.14). As a result the document if very much provides an outline programme of decommissioning.	
	It is recognised that it is difficult for any decommissioning plan to be specific so far in advance of decommissioning being programed. However, in order to ensure that any plan reflects changes over the life of the development, it is important that any proposed monitoring and review of the plan is clearly programmed. Whilst this is detailed to some extent within this plan (section 7.55 – 7.58), it is felt that the timetable for review should be more detailed, responsive to key milestones and on-going ecological monitoring reports, and subject to further approval after reviews. In this regard, all on-going monitoring requirements/commitments that may arise as a result of Marine Licences and Environmental Impact Assessment should be clearly set out and the timetable reflect any programme of monitoring required under other legislation. Stakeholders to be involved in all reviews should be more exhaustive than DECC to include the relevant stakeholders throughout the life of the development (in particular Natural England/English Heritage).	Noted - the text in paragraph 9.5 has been update to clarify the position

	With regard to the Waste Management Section 7.41 – 7.44 consideration shouldn't only be given to the waste hierarchy but also to the principles of the Waste Framework Directive, National Planning Policy for Waste (October 2014) and the Waste Management Plan for England (December 2013). In particular, there should be consideration of minimising the distances travelled by waste, and provision for advice being sought from the Environmental Agency and Waste Planning Authorities when creating a Waste Management Plan (who will be able to advise of the facilities in the locality.	noted - the text has been updated to reflect this
	Under Section 7, the supporting text and tables used to provide comparisons of decommissioning options (e.g. complete removal against leaving in situ) whilst a useful summary, do not provide any evidence or references to impact assessments undertaken when arriving at conclusions. In this regard table 7.18 does not give any indication of the extent of the difference in time periods discussed. In addition, whilst it is accepted economic justification is a consideration, considerable weight must also be given to environmental justifications (e.g. para 7.37 does not recognise this).	Noted - the text has been updated to clarify the position.
	Given the large number of acronyms the plan would benefit from a glossary.	noted - a glossary has now been included
South Downs National Park Authority		
	I am writing to confirm that South Downs National Park Authority has reviewed the draft document and support the methodology as detailed at this time. The SDNPA also supports regular review over the period of the installation.	noted - no further action required
Brighton & Hove City Council		
	Brighton & Hove City Council has no objection to the proposed decommissioning programme. In particular, the aim of maximising recycling and reuse of the turbine components in accordance with the waste hierarchy is welcomed.	noted - no further action required
Adur District and Worthing Borough Councils		
	No response received	
Lewes District Council		
	No response received	
British Marine Aggregate Producers		

Association		
	No response received	
UK Chamber of Shipping		
	No response received	
Environment Agency		
	No response received	
JNCC (Offshore Wind)		
	No response received	
NFFO		
	No response received	
Shoreham Port Authority		
	No response received	
Royal Yacht Association		
	No response received	
South Downs Society		
	I write on behalf of the South Downs Society, the national park society for the South Downs National Park. The national park will be adversely affected both by the visual impact of the offshore turbines and by the impact of the engineering operation required to run the energy transmission cables through the downs. These adverse effects were noted at the public hearing.	
	At this stage our attention is drawn to para 3.5 of the consultation document:	
	"3.5 The Programme assumes that full decommissioning will commence after the design life of the wind turbines (24 years), but it should be noted that the wind farm may be 're-powered' after 24 years with new wind turbines to take advantage of the available lease period with The Crown Estate (40 years)."	
	Is this prospective "repowering" permitted under the development consent order? It should be made clear whether a further consent would be required in order to "take advantage of the available lease period".	Noted – text has been updated to provide clarification
Vic Ient		
	There are many technical points with regard to decommissioning of the platforms, the cutting of pylons on the seabed and the removal or burial of cables on the seabed etc. However the key issue is the protection of marine life and shipping in the future. I would like to make 2 comments on	

	the decommissioning programme:	
	1. There is nothing in the commercial section because the report says it is commercially sensitive. However the issue is whether the company would have the financial wherewithal to remove the pylons at some future date. To ensure there is enough money available to carry out the removal I believe there should be some form of 'bond' to ensure there is the money for removal. Otherwise the company could just turn round and say they haven't got the money in 24 or 40 years' time. The bond could be built up, year by year thus avoiding the need for up-front funding, i.e., funding of the bond is made out of revenues accumulated over time.	noted - this provision is discussed with DECC
	2. The report makes no mention of the timescale (i.e., number of years) for the removal programme. I believe that measures should be put in place to ensure removal takes place swiftly and with minimum disruption to the environment on and off shore.	Paragraph 9.2 provides details of proposed decommissioning timescales.
The Crown Estate	The plan details that the wind turbine mono-piles, the met mast mono-pile and substation jacket pins are to be cut at, or 1m below, seabed level. The sea bed in the vicinity of the wind farm is composed of gravelly sand and slightly gravelly sand. There is therefore a likelihood that, over time, the seabed in the vicinity of the wind farm will be subjected to tidal action. We recommend that modelling be carried out to better understand the likely extent, and rate, of seabed sediment transport over time in order to make an informed assessment as to the appropriate level to which the monopoles should be cut below seabed level at the time of decommissioning. It is of note that the southernmost boundary of the wind farm area is understood to be adjacent to a high energy environment. In order to understand what the likelihood of there being any long term consequential impact on the seabed levels in the vicinity of this feature might be, it is suggested that the seabed modelling should also take this specific additional information into account.	Noted – the plan has been updated to take account of this in para 6.19
	Where there are offshore wind farm sites which are not covered by the statutory decommissioning regime under the 2004 Energy Act, The Crown Estate has generally sought to require, as a starting point full removal of installed equipment at the time of decommissioning (in line with the decommissioning guidance note published by DECC). It is conceivable that at the time decommissioning takes place environmental and other considerations may, on the advice of	Noted – this is a commercial discussion which will be the subject of a separate agreement with TCE.

	statutory advisors and others, lead to less than full decommissioning taking place. In any event we would wish to be satisfied that decommissioning had been undertaken in accordance with the plan approved most recently prior to decommissioning and that such compliance had been verified by means of an independent third party survey post decommissioning and 5 years thereafter. If the agreed decommissioning plan provided for less than complete removal of installed equipment we would wish to be provided with some form of indemnity or insurance provision by those responsible for the works. This would involve The Crown Estate contracting with the tenant directly or taking separate security for residuals.	

Appendix 2: Decommissioning Cost and Financial Arrangements

This information is commercially sensitive and shall be provided separately for approval by DECC