HORIZON NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

8.27 Water Framework Directive Information to Support Article 4(7) Derogation

PINS Reference Number: EN010007

Application Reference Number: 8.27

25 March 2019

Revision 3.0
Examination Deadline 8

Regulation Number: 5(2)(q)

Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Horizon Internal DCRM Number: WN0902-JAC-PAC-REP-00065

[This page is intentionally blank]

Contents

Appendices

List of Tables

List of Figures

This page is intentionally blank

Executive Summary

The Water Framework Directive (WFD) Compliance Assessment (Application Reference Number 8.26) concluded that the Wylfa Newydd Project may not comply with the environmental objectives of the WFD. This report therefore provides the information required to support a derogation under Article 4(7) of the WFD.

The WFD Compliance Assessment concluded that there is a risk of deterioration of WFD status in two water bodies as a result of the Wylfa Newydd project; details are provided in table 1.

Table 1: Classification and quality elements at risk of deterioration

Water body	Classification/quality element at risk	Current element classification
The Skerries	Hydromorphology: Morphological conditions	High
Ynys Môn Secondary	Saline intrusion (component of both chemical and quantitative status)	Good
	Groundwater-Dependent Terrestrial Ecosystem (GWDTE) (quantitative status only)	Good

For a derogation to be granted, the criteria in Article 4(7) must be satisfied. Article 4(7) states that "Member States will not be in breach of this Directive when:

- failure to achieve good groundwater status, good ecological status or, where relevant, good ecological potential or to prevent deterioration in the status of a body of surface water or groundwater is the result of new modifications to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater, or
- failure to prevent deterioration from high status to good status of a body of surface water is the result of new sustainable human development activities

  - and all the following conditions are met:

  (a) all practicable steps are taken to mitigate the adverse impact on the status of the body of water;

  (b) the reasons for those modifications or alterations are specifically set out and explained in the River Basin Management Plan required under Article 13 and the objectives are reviewed every six years;

  (c) the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and

(d) the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option."

Information is provided in relation to each of these tests for the relevant classification and quality elements in both water bodies.

For test (a) mitigation for the effects relating to saline intrusion and effects on Groundwater-Dependent Terrestrial Ecosystem (GWDTE) in the Ynys Môn Secondary Ground water body is outlined, which mainly focuses on mitigation relating to design and construction. For The Skerries water body, mitigation for the effects on hydromorphology (in particular the loss of intertidal habitat) is presented. Each mitigation measure is considered with respect to technical feasibility and disproportionate cost.

For test (b) this report outlines how Horizon will work with Natural Resources Wales to include the water body modifications when the Western Wales River Basin Management Plan is updated.

To address test (c) the case for overriding public interest for the Wylfa Newydd Project is presented with links made with national policy and legislation.

Test (d) considers the alternative solutions and locations of the relevant elements of the Wylfa Newydd Project. This includes consideration of different designs and alternative means of achieving the same outcome. For both The Skerries and Ynys Môn Secondary water bodies the relevant design-related options are investigated to determine whether there was a significantly better environmental option.

The requirements of Article 4(8) and Article 4(9) are also considered.

1 Introduction

1.1 Background

1.1.1 Horizon Nuclear Power Wylfa Limited (Horizon) is applying to the Secretary of State for a Development Consent Order (DCO) under the Planning Act 2008, to construct, operate and maintain a new nuclear power station on land west of Cemaes on Anglesey.

1.1.2 Development of the Wylfa Newydd Project requires a number of applications to be made under different legislation to different regulators. In addition to an application for development consent, applications will also be made for a Marine Licence and Environmental Permits.

1.1.3 To support these applications an assessment has been carried out to consider the effects of the Wylfa Newydd Project in respect of compliance with WFD which is implemented in Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (the 2017 Regulations). The applications are also supported by assessments carried out in accordance with the Town and Country Planning (Environment Impact Assessment) Regulations 2017 and the Conservation (of Habitats and Species Regulations (2010). The Enabling Works, which are the subject of Town and Country Planning Act 1990 (as amended) applications, are supported by separate WFD Compliance Assessments.

1.1.4 A WFD Compliance Assessment (Application Reference Number: 8.26) for the Wylfa Newydd Project was produced to inform Natural Resources Wales (NRW) and the Secretary of State in relation to their duties to have regard to the River Basin Management Plan (Western Wales) (RBMP) and any supplementary plans (Regulation 33 of the 2017 Regulations). The Compliance Assessment determined that there are aspects of the Wylfa Newydd Project that may not comply with the environmental objectives of the WFD and therefore require further consideration. The purpose of this report is to the WFD Compliance Assessment (Application Reference Number: 8.26) in order to provide the decision makers with the necessary information in relation to derogation under Article 4(7) of the WFD. This report should be read in conjunction with the WFD Compliance Assessment (Application Reference Number: 8.26).

1.2 Water Framework Directive terminology

1.2.1 Table 1-1 provides a definition of key terms associated with the WFD that are used throughout this report.

Table 1-1 Water Framework Directive terminology

Term	Abbreviation	Explanation
General		
Artificial Water Body	AWB	A water body that has been artificially created, such as a canal.
Compliance	-	Adherence to the requirements of legislation, in this case the WFD.
Chemical status	-	A measure of the overall chemical quality of the water body (surface water or groundwater). Reported as either a 'pass' or 'fail' and assessed from compliance with environmental standards for chemicals that are priority substances and/or priority hazardous substances. The status is determined by the worst-scoring chemical.
Ecological Potential	-	Those surface waters identified as Heavily Modified Water Bodies or Artificial Water Bodies must achieve Good Ecological Potential. Good Ecological Potential is a recognition that changes to morphology could make Good Ecological Status very difficult to meet.
Ecological Status	-	This is an expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters, classified in accordance with Annex V of the WFD.
Groundwater-dependent terrestrial ecosystem	GWDTE	A terrestrial ecosystem that is directly dependent on the water level in or flow of water from a groundwater body (that is, in or from the saturated zone).
Heavily Modified Water Body	HMWB	A water body not considered to be able to achieve 'natural reference conditions' as a result of its physical modification to support a defined use. The WFD recognises the important uses of HMWBs (e.g. from past engineering works).
Mitigation measure (specific to WFD)	-	A specific activity assigned to a WFD water body catchment or specific HMWB to help to address any modifications or pressures on the quality elements preventing the achievement of Good Status or Potential. The mitigation measures are assessed as being 'in place' or 'not in place' and contribute towards the achievement of Good Potential.
Non-reportable water bodies		Catchments and associated water features that are too small to be a formal WFD water body. Examples are reens, ditches, streams or brackish lagoons. It is likely that these stretches of water are not monitored by Natural Resources Wales (NRW) and their status is not reported. NRW has confirmed that these water bodies must be

Term	Abbreviation	Explanation
		considered as part of the WFD Compliance Assessment.
River Basin District	-	The area of land and sea, made up of one or more adjacent river basins together with their associated groundwaters and coastal waters.
River Basin Management Plan	RBMP	The preparation of an RBMP is required under the WFD for each River Basin District. The RBMP should outline the current status of all water bodies and identify measures for achieving the protection, improvement and sustainable use of water within a river's catchment area.
Water body	-	A discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water (estuary) or a stretch of coastal water. Groundwater bodies are defined as distinct volumes of groundwater within an aquifer or aquifers.
Status/potential classes		
High Ecological Status	-	WFD term used for natural surface water bodies denoting only very minor or no deviation from undisturbed 'natural reference conditions' in a water body, for hydromorphological, physico-chemical and biological quality elements.
Good Ecological Status	GES	Good Ecological Status is a WFD term denoting a slight deviation from 'natural reference conditions' in a surface water body or the hydromorphological, physico-chemical and biological conditions associated with little or no human pressure.
Good Ecological Potential	GEP	Those surface waters identified as HMWBs must achieve Good Ecological Potential. Good Ecological Potential is a recognition that changes to morphology could make Good Ecological Status very difficult to meet.
Poor Ecological Status/Potential	-	Poor Ecological Status/Potential is not described by the WFD. In terms of this document Poor Ecological Status/Potential denotes a relatively significant deviation (major alteration) from the 'reference condition' in a surface water body, for hydromorphological, physico-chemical and biological quality elements.
Good chemical status	-	Good chemical status is achieved in a surface or groundwater body in which concentrations of pollutants do not exceed the environmental quality standards established in Annex IX and under Article 16(7) for surface waters and table 2.3.2 of Annex V for groundwater.

Term	Abbreviation	Explanation
Good quantitative status	-	Quantitative status is an expression of the degree to which a body of groundwater is affected by direct and indirect abstractions. Good quantitative status is achieved in a groundwater body when: the level of groundwater in the groundwater body is such that the available groundwater resource is not exceeded by the long-term annual average rate of abstraction; the groundwater is not subject to anthropogenic alterations that could result in: a) failure to achieve environmental objectives for associated surface waters; b) any significant diminution in the status of such waters; c) any significant damage to terrestrial ecosystems which depend directly on the groundwater body; and there are no alterations in flow direction that could result in a sustained anthropogenically induced saline intrusion.
Groundwater Status	-	The status of a body of groundwater, determined by the poorer of its quantitative status and its chemical status.
Quality and classification elements		
Biological quality element	-	Ecological receptors that form the biology in both coastal and fluvial waters; for example, fish, aquatic flora and phytoplankton.
Hydromorphological quality element	-	Parameters that define the hydrology and geomorphology of both coastal and fluvial waters. Examples for coastal water bodies include the structure of the intertidal zone and wave exposure; and, for fluvial water bodies include the riparian zone, structure of the bed and banks and lateral and longitudinal connectivity.
Physico-chemical quality element	-	Parameters that support the assessment of the water quality in surface waters; for example, transparency, thermal conditions, salinity, pH, nutrient conditions and specific pollutants.
Groundwater classification elements	-	The four component parameters that comprise groundwater quantitative status - saline intrusion, surface water, GWDTE and water balance; and the five component parameters that comprise groundwater chemical status - saline intrusion, surface water, GWDTE, drinking water protected areas and general quality assessment.

Term	Abbreviation	Explanation
Nature of effects		
Temporary	-	An effect is defined as temporary if it persists for only a short period of time without the need for further restoration measures. A 'short period of time' is not defined in the Directive but can be taken to be the frequencies mentioned for the monitoring programmes (Annex V 1.3.4 and 2.2.3).
Non-temporary	-	A non-temporary effect is one from which recovery is expected, but recovery may or may not occur within the duration of one RBMP cycle (six years).
Permanent	-	A permanent effect is one from which recovery is not possible.

1.3 Compliance with the Water Framework Directive

1.3.1 The primary aim of the WFD, as set out in Article 1, is to establish a framework for the protection of inland surface waters, transitional waters, coastal water and groundwaters. This framework will prevent further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystem (Article 1(a)). Article 4(1)(a)(i) and Article 4.1(b)(i) of the WFD requires Member States to implement the necessary measures to prevent deterioration of the status (surface waters) and take the measures necessary to prevent or limit the input of pollutants into groundwater and to prevent deterioration of the status of all bodies of groundwater.

1.3.2 The WFD Compliance Assessment (Application Reference Number: 8.26) identified that the Wylfa Newydd Project may be at risk of non-compliance with one or more of the environmental objectives of the WFD as set out in Article 4(1) of the Directive. Quality elements in two water bodies, The Skerries and Ynys Môn Secondary, were identified as being at risk of deterioration and the reasons for this are discussed in section 3.

1.3.3 Following this conclusion, a decision was made to consider the relevant aspects of the Wylfa Newydd Project potentially resulting in non compliance against the requirements of Article 4(7).

1.4 Requirements of Article 4(7)

1.4.1 Article 4(7) of the WFD makes provision for a situation where the environmental objectives in Article 4(1) cannot be met, thereby allowing derogation from its requirements. For a derogation to be granted, the criteria in Article 4(7) must be satisfied. Article 4(7) states that "Member States will not be in breach of this Directive when:

- failure to achieve good groundwater status, good ecological status or, where relevant, good ecological potential or to prevent deterioration in

the status of a body of surface water or groundwater is the result of new modifications to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater, or

- failure to prevent deterioration from high status to good status of a body of surface water is the result of new sustainable human development activities and all the following conditions (tests) are met:

  (a) all practicable steps are taken to mitigate the adverse impact on the status of the body of water;

  (b) the reasons for those modifications or alterations are specifically set out and explained in the RBMP required under Article 13 and the objectives are reviewed every six years;

  (c) the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and

  (d) the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option."

1.4.2 Under Article 4(7) exemptions can be applied for "new modifications" or *"*new sustainable human development activities*".* The Wylfa Newydd Project qualifies under both these criteria; this is discussed further in section 4.2.

1.5 Consultation in relation to Article 4(7)

1.5.1 A WFD working group was set up which included representatives from Horizon, NRW and the Isle of Anglesey County Council (IACC). Regular working group meetings were held between December 2016 and December 2017. A full list of consultation undertaken to date is provided in the WFD Compliance Assessment (Application Reference Number: 8.26). The consultation specific to Article 4(7) derogation is summarised in table 1-2.

Table 1-2 Stakeholder consultation relating to Article 4(7) of the WFD for the Wylfa Newydd Project

Date	Stakeholder	Title	Description
23 February 2017	NRW	WFD working group meeting 1	Discussion of comments on the first Horizon technical memo on Article 4(7) (setting out the need for Horizon to consider Article 4(7)).
22 August 2017	NRW IACC	WFD working group meeting 6	Teleconference to discuss the second Horizon memo on Article 4(7) titled 'Development of a case under Article 4(7) of the WFD for the Wylfa Newydd Power Station'.
12 October 2017	NRW	WFD working group meeting 7	Further discussion of the content of the Article 4(7) report.
2 November 2017	NRW	WFD working group meeting 8	Presentation of Horizon's approach to the '*Information to Support Article 4(7) Derogation'* report.
19 December 2017	NRW	WFD working group meeting 9	Discussion of comments on the first draft of the Article 4(7) report

1.6 Report aims and objectives

1.6.1 The aim of this report is to provide regulators with sufficient information to inform tests in line with the requirements of Article 4(7) for the Ynys Môn Secondary and The Skerries water bodies. The specific objectives of this report are to:

- summarise the results of the WFD Compliance Assessment (Application Reference Number: 8.26) and identify the water bodies and the component classification and quality elements at risk of not meeting the WFD objectives as set out in Article 4(1);
- explain the approach to the provision of information relating to derogation for the Wylfa Newydd Project; and
- present the information required in respect of each condition test of Article 4(7).

1.6.2 This is a factual report and is not intended to conclude whether a case for derogation has been made. The responsibility for determining the derogation case lies with the competent authority (NRW).

1.7 Report structure

1.7.1 The report structure is outlined in table 1-3.

Table 1-3 Report structure

Section	Title	Description
1	Introduction	Introduces the Wylfa Newydd Project, sets out relevant WFD terminology and details consultation.
2	Project description	Provides an overview of the Wylfa Newydd Project and key activities forming the Power Station and Associated Development.
3	Summary of the Water Framework Directive Compliance Assessment	Summarises the results of the WFD Compliance Assessment (Application Reference Number: 8.26) and identifies the water bodies and component classification and quality elements at risk.
4	Approach to derogation for the Wylfa Newydd Project	Explains the approach taken to presenting the information relating to derogation for the Wylfa Newydd Project.
5	Information to support Article 4(7) derogation criteria assessment for the Ynys Môn Secondary water body	Presents the information to inform tests for the Ynys Môn Secondary water body.
6	Information to support Article 4(7) derogation criteria assessment for The Skerries water body	Presents the information to inform tests for The Skerries water body.
7	Articles 4(8) and 4(9)	Provides the information in relation to Articles 4(8) and 4(9).
8	Summary	Outlines the conclusions of this report.

2 Project description

2.1 The Wylfa Newydd Project

2.1.1 Horizon is proposing to construct and operate the Wylfa Newydd Project, which comprises the Wylfa Newydd DCO Project, the Licensable Marine Activities and the Enabling Works. Each of these elements is described further below. The Wylfa Newydd DCO Project will be consented under a DCO and the Licensable Marine Activities will be consented under a Marine Licence. There is some overlap between the two; the Marine Works (see below) will be consented under both the DCO and the Marine Licence.

Wylfa Newydd DCO Project

2.1.2 The Wylfa Newydd DCO Project comprises those parts of the Wylfa Newydd Project which are to be consented by a DCO, namely:

The Nationally Significant Infrastructure Project (NSIP)

- Power Station: the proposed new nuclear power station at Wylfa, including two UK Advanced Boiling Water Reactors, the Cooling Water System, supporting facilities, buildings, plant and structures, radioactive waste and spent fuel storage buildings and the Grid Connection.
- other on-site development: including landscape works and planting, drainage, surface water management systems, public access works including temporary and permanent closures and diversions of public rights of way, new Power Station Access Road and internal site roads, car parking, construction works and activities including construction compounds and temporary parking areas, laydown areas, working areas and temporary works and structures, temporary construction viewing area, diversion of utilities, perimeter and construction fencing, and electricity connections;
- Marine Works comprising.
  - Permanent Marine Works: the Cooling Water System, the Marine Off-loading Facility, breakwater structures, shore protection works, surface water drainage outfalls, waste water effluent outfall (and associated drainage of surface water and waste water effluent to the sea), fish recovery and return system, fish deterrent system, navigation aids and Dredging;
  - Temporary Marine Works: temporary cofferdams, a temporary access ramp, temporary navigation aids, temporary outfalls and a temporary barge berth;
- Off-site Power Station Facilities: comprising the Alternative Emergency Control Centre (AECC), Environmental Survey Laboratory (ESL) and a Mobile Emergency Equipment Garage (MEEG);

Associated Development

- the Site Campus within the Wylfa Newydd Development Area;
- temporary Park and Ride facility at Dalar Hir for construction workers (Park and Ride);
- temporary Logistics Centre at Parc Cybi (Logistics Centre);
- the A5025 Off-line Highway Improvements;
- Wetland habitat creation and enhancement works as compensation for any potential impacts on the Tre'r Gof Site of Special Scientific Interest (SSSI) at the following sites:
  - Tŷ Du;
  - Cors Gwawr;
  - Cae Canol-dydd

2.1.3 The following terms are used when describing the geographical areas related to the Wylfa Newydd DCO Project and the Licensable Marine Activities:

- Power Station Site – the indicative areas of land and sea within which the majority of the permanent Power Station, Marine Works and other on-site development would be situated; and
- Wylfa Newydd Development Area – the indicative areas of land and sea including the Power Station Site and the surrounding areas that would be used for the construction and operation of the Power Station, the Marine Works, the Site Campus and other on-site development (WNDA Development).

Licensable Marine Activities

2.1.4 The Licensable Marine Activities comprise the Marine Works and the disposal of material from Dredging at the Disposal Site.

Enabling Works

2.1.5 The Enabling Works comprise the Site Preparation and Clearance Proposals (SPC Proposals) and the A5025 On-line Highway Improvements.

2.1.6 Horizon has submitted applications for planning permission for the Enabling Works under the Town and Country Planning Act 1990 to the IACC.

2.1.7 In order to maintain flexibility in the consenting process for the Wylfa Newydd DCO Project, the SPC Proposals have also been included in the DCO application. The A5025 On-line Highway Improvements are not part of the DCO application.

3 Summary of the Water Framework Directive Compliance Assessment

3.1 Overview

3.1.1 A Compliance Assessment was carried out to consider the effects of the Wylfa Newydd Project in respect of the WFD (Application Reference Number: 8.26). The report considered all project activities in relation to the objectives set out in Article 4(1). The WFD water bodies on Anglesey are shown in figure 3-1 and outlined in table 3-1.

Table 3-1 Summary of WFD water bodies screened into the Compliance Assessment (Application Reference Number: 8.26)

Water body type	WFD water body Name	WFD water body number
Coastal	The Skerries	GB611010390000
	Anglesey North	GB641010620000
	Cemlyn Lagoon	GB610100083000
	Caernarfon Bay North	GB621010380000
Transitional (included for all quality elements)	Alaw	GB521010207600
Transitional (included only for fish)	Cefni	GB521010207500
Fluvial (included for all quality elements)	Alaw - downstream Llyn Alaw	GB110102058981
	Tan R'Allt	GB110102059100
	Afon Cleifiog	GB110102058930
	Afon Crigyll	GB110102058970
Fluvial (included only for fish)	Wygyr	GB110102059170
	Goch Amlwch	GB110102059230
	Goch Dulas	GB110102059000
	Lligwy	GB110102059070
	Ddrydwy	GB110102058860
	Ffraw	GB110102058680
	Cefni – Ceint to Cefni reservoir	GB110103058770
	Cefni – Cefni reservoir east	GB110102058780
	Cefni – Cefni reservoir west	GB110103058790

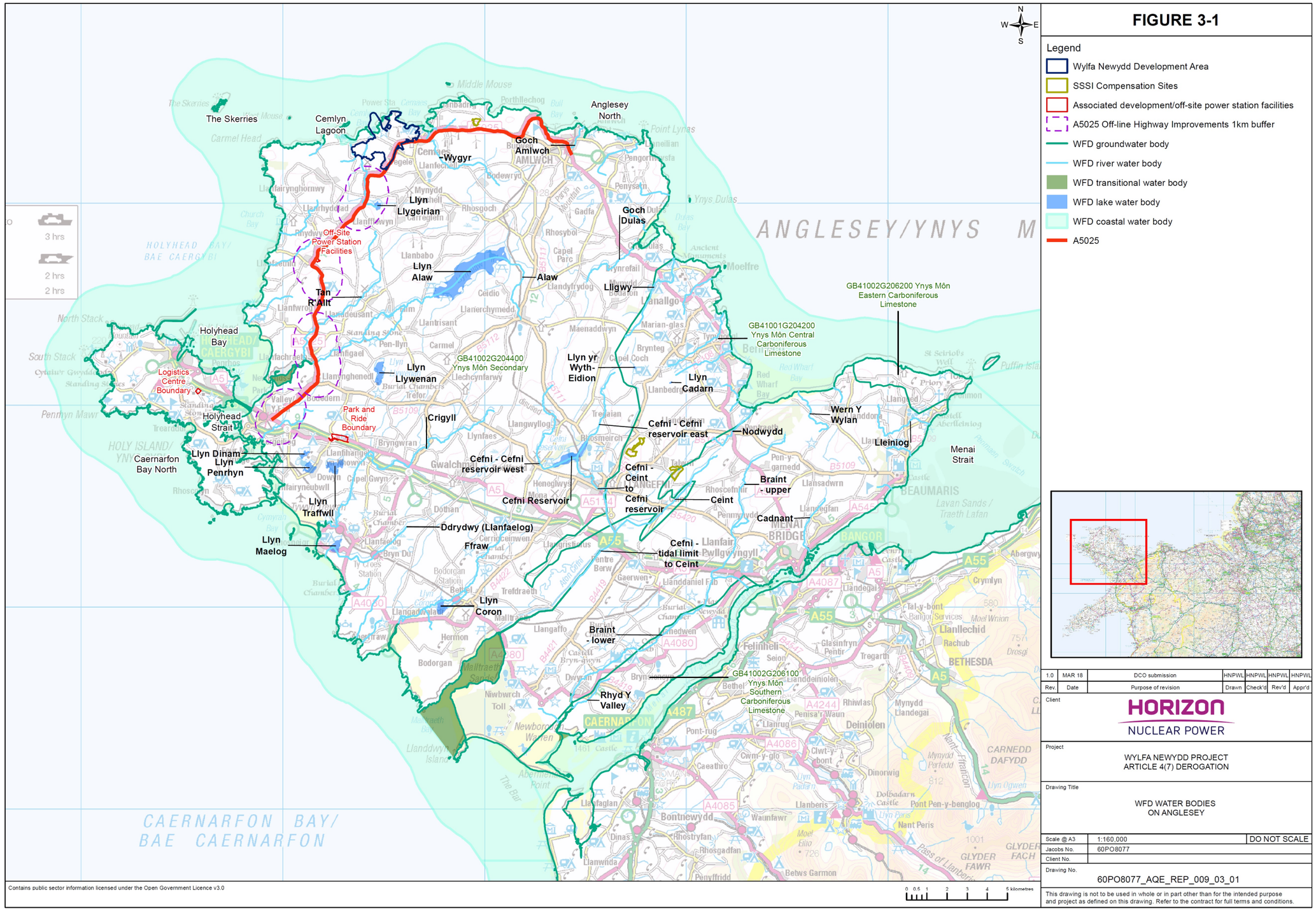
Water body type	WFD water body Name	WFD water body number
	Ceint	GB110102058940
Groundwater	Ynys Môn Secondary	GB41002G204400
	Ynys Môn Central Carboniferous Limestone	GB41001G204200

3.1.2 The assessment identified that there were quality elements in two water bodies at risk of deterioration; this would also result in deterioration at a water body level (see table 3-2). Further details on the risks to these water bodies are outlined in sections 3.2 and 3.4. Following this conclusion, it was required that the Wylfa Newydd Project would need to have due regard to the WFD and therefore consider the requirements of Article 4(7).

Table 3-2 Classification and quality elements at risk of deterioration

Water body	Classification/quality element at risk	Current element classification
The Skerries	Hydromorphology: Morphological conditions	High
Ynys Môn Secondary	Saline intrusion (component of both chemical and quantitative status)	Good
	Groundwater-Dependent Terrestrial Ecosystem (GWDTE) (quantitative status only)	Good

Figure 3-1 Figure 3-1 WFD Water bodies on Anglesey



[This page is intentionally blank]

3.2 The Bund Case

3.2.1 In its judgement on the Bund case [RD1], the Court of Justice of the European Union (CJEU) clarified the way in which compliance with the Directive's key environmental objectives should be interpreted in the assessment of new developments and scheme proposals. The clarifications were:

- *"deterioration of the status"* of the relevant body of surface water includes a fall by one class of any element of the "quality elements" within the meaning of Annex V of the WFD even if the fall does not result in a fall of the classification of the body of surface water as a whole;
- consent for development must not be granted by an appropriate authority, unless a derogation is granted, where the project may cause a deterioration in the status of a body of surface water or where it jeopardises the attainment of good surface water status or of good ecological potential and good surface water chemical status by the date laid down in the directive; and
- if the quality element is already in the lowest class, any deterioration of that element represents deterioration of status within the meaning of Article 4(1)(a)(i).

3.2.2 The judgement states that where there may be a risk of deterioration (i.e. where the status of any quality element could be jeopardised) that consent may not be granted.

3.2.3 Although the ruling was specific to surface water bodies NRW has stated that the ruling would also apply to the classification elements which comprise the status of groundwater bodies [RD2].

3.3 Ynys Môn Secondary groundwater body

3.3.1 The WFD Compliance Assessment (Application Reference Number: 8.26) identified potential deterioration of the Ynys Môn Secondary groundwater body (GB41002G20440) status caused by quantitative pressure.

3.3.2 The published data state that the Ynys Môn Secondary groundwater body is currently achieving poor status overall, as the current chemical status is poor due to failure of the chemical dependent surface water body status test [RD3]. The reason for failure is due to diffuse local discharges of metals from abandoned mines. As there is no known technical solution to resolving this problem a less stringent objective (less than good) has been set. There are no measures identified in the Western Wales RBMP for the Ynys Môn Secondary groundwater body.

Saline intrusion

3.3.3 Activities which could potentially cause deterioration in the status of saline intrusion are:

- dewatering to -13.5m Above Ordnance Datum (AOD) associated with the deep excavation and construction of the Cooling Water System;
- dewatering associated with the deep excavation to -18mAOD and construction of the reactor building.

3.3.4 The potential adverse impacts of dewatering are a local reversal of groundwater flow along a very small length of coast at Porth-y-pistyll, during the construction period (see figure 3-3).

3.3.5 As a consequence, there could be a very small volume of sea water drawn into the aquifer (6.5m^3/d). This is compared to the groundwater model results which show that for the most likely modelled scenario, an estimated 175m^3/day of groundwater would be abstracted from the excavations (45m^3/day from the seaward excavation and 130m^3/day from the inland excavation), with typically a further 750m^3/day of direct rainfall being abstracted (see appendix D8-7, Surface water and groundwater modelling results, Application Reference Number: 6.4.32).

3.3.6 The model predicts that seawater might flow into the bedrock aquifer where it meets the coast at Porth-y-pistyll (see appendix D8-7, Application Reference Number: 6.4.32). Much of the seawater, when the excavation is at -18mAOD, will enter the seaward end of the excavation. In addition, any locally significant saline inflows would end up in the excavation, rather than in the bedrock surrounding it, being pumped out as part of the dewatering management.

3.3.7 The key considerations relating to the potential for saline intrusion which in turn determine the potential for deterioration of the water body are:

- Groundwater contours in superficial deposits and bedrock in the baseline condition flow in a NW direction towards the coast. There are no saline water inflow risks associated with the baseline. Monitoring of water quality in four ground investigation boreholes close to Porth-y-pistyll (BH518R, BH822, BH850, BH852) has not identified saline water (appendix D8-3, Application Reference Number: 6.4.28). BH850 and BH852 are both within 50m of the coast, with screened sections down to -12 and -8mOD respectively (i.e. well below sea level) and with depths to groundwater of up to 6mAOD.
- The Ghyben Harzberg relationship gives the theoretical fresh water/saline water interface at a depth below sea level as 40 times the height of fresh water above sea level. The lack of salinity in the monitoring data above suggests that the fresh water/saline water interface is steep with a very limited and deep saline wedge. This is as expected from the recognised low permeability of the bedrock at these depths of >40m below OD. These suggest that it is highly unlikely there would be any significant saline water upcoming during dewatering.

3.3.8 The duration of the land-based excavation phase of construction could last several years with active groundwater dewatering lasting for approximately two to three years.

3.3.9 The location of the reversal of flow and therefore saline intrusion at the start of construction is likely to be within Porth-y-pistyll due to the presence of the semi-dry cofferdam, but once the cofferdam is removed the location of inflow may be closer to the coastline (figure 3-2 and figure 3-3). It is noted that the model, as depicted in figure 3-3, shows dewatering of one large excavation (see appendix D8-7, Application Reference Number 6.4.32).

3.3.10 The effects of the cooling water outfall tunnel construction dewatering on the water levels and flow direction in the aquifer are considered to be local with no reversal of flow and therefore no saline intrusion risk.

3.3.11 The extent of the saline intrusion effect would be small in comparison to the area of the groundwater body and the groundwater body would recover without further intervention, following completion of land-based excavation.

3.3.12 During operation of the Power Station, inland groundwater heads will remain above sea level and flows will always be towards the coast so there will be no saline intrusion.

3.3.13 The prediction of saline intrusion is derived from groundwater modelling and is a worst case. This is because the model does not take into account any mitigating factors, in particular:

- the model is state steady and assumes permanent dewatering whereas the dewatering will be non-permanent and saline intrusion will not occur until late in the construction and will be reversed, and
- the model for the construction phase did not take into account that the excavation walls will be shotcreted which will limit groundwater ingress and will therefore overestimate inflow of groundwater to the excavation.

The dewatering is not permanent and saline intrusion would recover. The duration of recovery is uncertain and therefore it is not possible to define an end date beyond which the dewatering works would no longer impact the water body. However, in the worst case it may take longer than one RBMP cycle (six years) to fully recover and therefore the predicted saline intrusion effect has been classified as non-temporary. The WFD Compliance Assessment (Application Reference Number: 8.26) therefore concluded that the Wylfa Newydd Project could jeopardise the status of the Ynys Môn Secondary groundwater body as a result of saline intrusion.

Figure 3-2 Extent of excavations during construction (phase 4) (see appendix D8-7, Application Reference Number: 6.4.32)

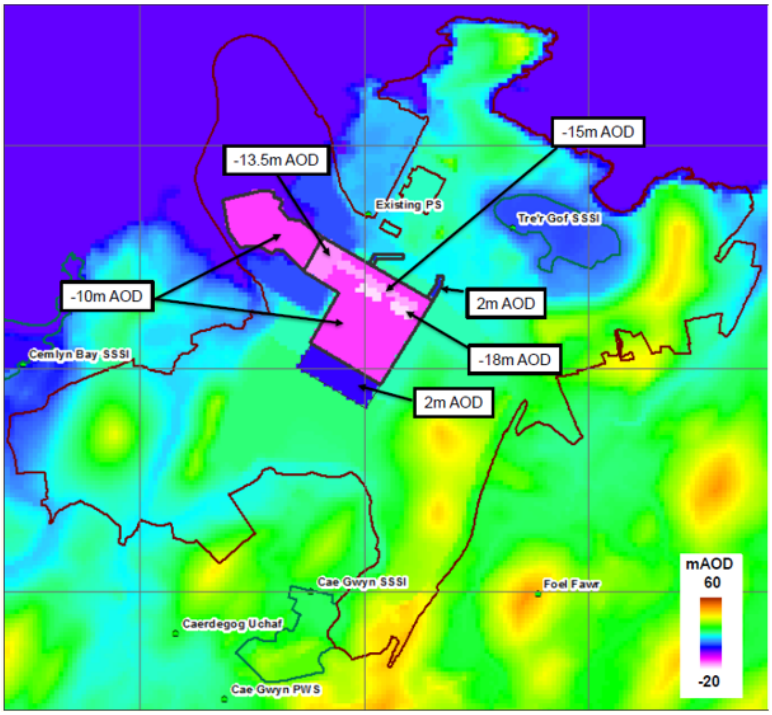
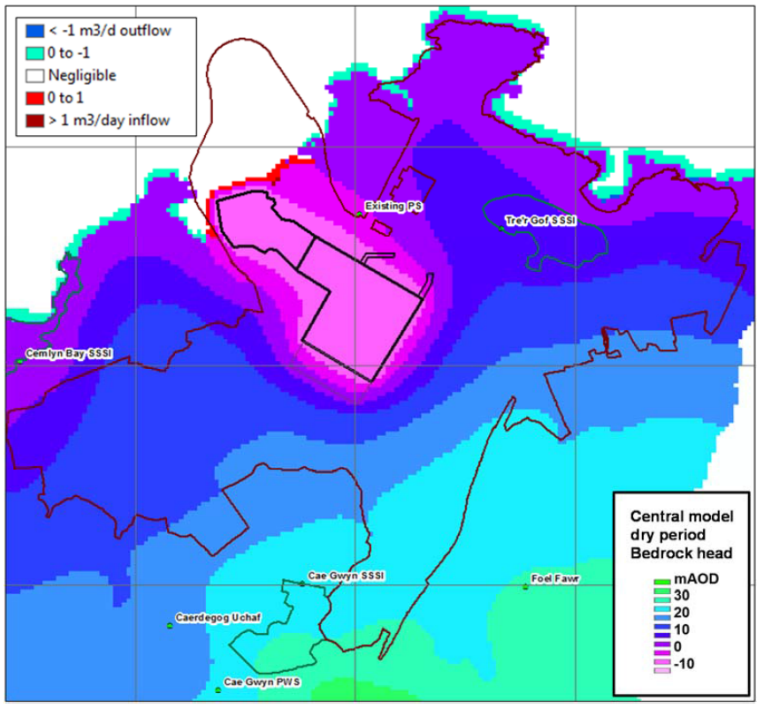


Figure 3-3 Simulated General Head Boundary flow map during construction (see appendix D8-7, Application Reference Number: 6.4.32)



Tre'r Gof Site of Special Scientific Interest (SSSI)

3.3.14 Tre'r Gof SSSI is a GWDTE. The activities which could potentially cause deterioration to Tre'r Gof SSSI are:

- Power Station Site construction:
  - bulk earthworks including platform creation, drumlin removal and creation of landscape Mound A, and to a lesser degree Mound B, with steeper slopes than currently present;
  - drainage systems; and
  - dewatering of excavations (figure 3-4).
- Site Campus construction and operation:
  - drainage into Tre'r Gof drains and changes to rainwater infiltration to ground.
- Power Station operation:
  - drainage system; and
  - altered landscape (Mound A and B).

3.3.15 The effects on Tre'r Gof SSSI which relate to these activities are only relevant to the DCO application.

3.3.16 These activities could result in the following effects on the groundwater regime at Tre'r Gof SSSI:

- greater runoff rate from the higher, steeper and temporarily un-vegetated catchment compared to that generated from the current less steep and vegetated slope surface;
- different hydraulic characteristics of the soils and rock used for the new landforms;
- changed drainage which may alter the existing interaction between surface water and groundwater in the vicinity of Tre'r Gof SSSI;
- reduced groundwater recharge due to the presence of the Site Campus and the potential for the ground to become compacted during construction works;
- altered groundwater levels, flow, seepage and spring flow in both superficial and bedrock; and
- changes in groundwater base flow to surface water ditches inflowing into Tre'r Gof SSSI.

3.3.17 Dewatering during construction on the Power Station Site may affect the groundwater flow with reference to Tre'r Gof SSSI.

3.3.18 The altered groundwater regime combined with the re-routing and change in residence time of groundwater could also have effects on the mineral (especially calcium and bicarbonate) groundwater quality. Due to the predominance of vegetation communities in Tre'r Gof SSSI that are highly sensitive to groundwater levels and chemistry, a change in species

composition may occur if the potential changes in the levels and chemistry of shallow groundwater occurred. Such changes to notable vegetation communities could compromise the conservation status of Tre'r Gof SSSI.

3.3.19 The duration of the potential deterioration is summarised below.

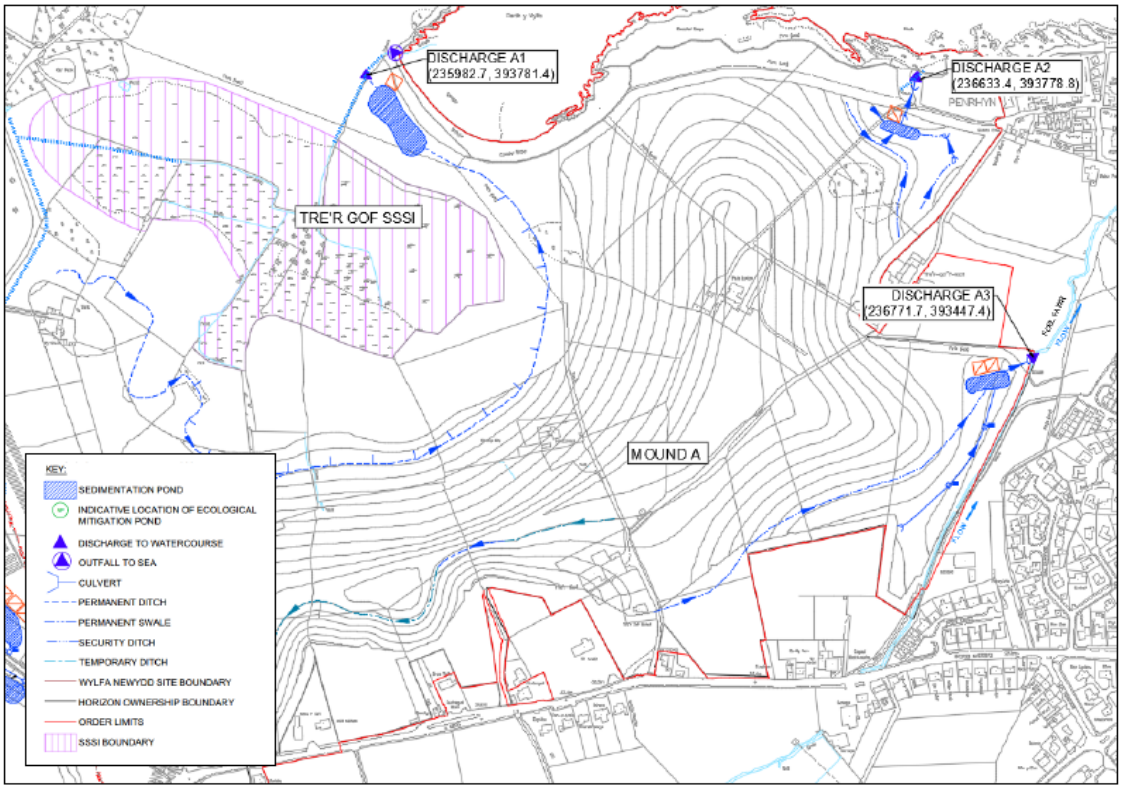
- Hydrological changes due to landscaping would occur relatively early in the construction period and settle down into a new altered status when mounds are revegetated during operation.
- It is possible that there would be long-term permanent changes in habitats within Tre'r Gof SSSI.

3.3.20 The Wylfa Newydd Project would result in a high degree of uncertainty around the predicted future state of Tre'r Gof SSSI because:

- its function is only partly understood due to the natural complexity of the hydrology and hydrochemistry; and
- due to the substantial change in landform and drainage that is proposed within the Tre'r Gof catchment.

3.3.21 The WFD Compliance Assessment (Application Reference Number: 8.26) concluded that in relation to the GWDTE quantitative test, the potential damage to Tre'r Gof SSSI could cause deterioration in the status of the Ynys Môn Secondary groundwater body.

Figure 3-4 Indicative layout of Mound A and drainage around Tre'r Gof SSSI



3.4 The Skerries water body

Hydromorphology

3.4.1 The morphological conditions quality element in The Skerries water body is currently achieving high status. The normative definition of high status is given in Annex V:1.2 as *"There are no, or only very minor, anthropogenic alterations to the values of the physico-chemical and hydromorphological quality elements for the surface water body type from those normally associated with that type under undisturbed conditions."*

3.4.2 The activities which could potentially cause deterioration to the hydromorphological status of The Skerries water body are:

- construction and commissioning of concrete batching plant and associated surface water drainage;
- construction of the Cooling Water System, breakwaters and Marine Off-loading Facility (MOLF) including dewatering;
- semi-dry and wet marine excavation including construction and removal of cofferdam, piling and dewatering; and
- excavation and construction of Cooling Water intake and outfall, including tunnelling.

3.4.3 The effects on the morphological conditions quality element which relate to these activities are relevant to the DCO application and the Marine Licence application.

3.4.4 The main effect on the morphological conditions is from the loss of the coastal bed (subtidal area) and intertidal zone under the footprint of the Marine Works.

3.4.5 The Shoreline Structures Assessment [SUP-RD1] paper describes the methodology used in the assessment of risk posed to transitional and coastal waters by the presence of shoreline reinforcements and other structures. In the absence of monitoring data all available knowledge needs to be used in classifying waterbodies.

3.4.6 The activities under assessment include flood and coastal defence and port and harbour operations. Such activities involve the modification of transitional and coastal shorelines through the construction of reinforcements and breakwaters and infrastructure such as wharves, docks, jetties and piers to support maritime industries (source pressure). Modification of shorelines results in the alteration of sediment transport and hydrodynamics (exposure pressure). The impact of these activities is the direct loss or change of intertidal and subtidal habitats with the consequent loss of benthic communities (receptor), which are often a vital resource for higher trophic levels such as fish and birds (receptors).

3.4.7 This risk assessment method gives equal importance to both the absolute length of shoreline structures and the proportion of shoreline occupied by shoreline structures to give a more rounded ranking of water bodies at risk of failing to meet good ecological status.

3.4.8 The shoreline structures assessment for The Skerries water body assigned a reporting category of ‘2a’. This is a low risk score which takes into consideration both the presence and influence of structures on the morphology of the water body [RD4]. Although there are structures within the water body (e.g. the Cooling Water intake of the Existing Power Station), these are small and therefore exert very limited hydromorphological pressure on the water body. These structures were present at the time of the High status classification and are therefore considered part of the baseline.

3.4.9 The footprint of the Marine Works within The Skerries water body would be 31.1ha which includes all permanent and temporary structures as well as the excavated and dredged area. Given the duration that temporary structures are in place and the requirement for maintenance dredging, the footprint was assessed as being permanent.

3.4.10 Of the 31.1ha footprint in The Skerries water body, 7.6ha would be lost in the intertidal zone equating to 3.62% of the total intertidal area (210ha) within the water body. The remaining 23.5ha would represent coastal bed equating to 0.24% of the total subtidal area (9,560ha) in The Skerries water body.

3.4.11 In this instance, compliance with the objectives of the WFD was informed by the interpretation of case law, namely the ‘Bund case’ (see section 3.2).

3.4.12 The judgement states that where there may be a risk of deterioration (i.e. where the status of any quality element could be jeopardised) that consent may not be granted. It is not possible to definitively conclude that the new modifications would only result in very minor anthropogenic change to hydromorphological supporting element and would therefore constitute within-class rather than between-class deterioration. Considering the wording of the judgement it is concluded that there is a risk that the morphological conditions quality element could deteriorate from high to good status. With respect to benthic invertebrates, when all predicted cumulative loss are considered, it is still possible to conclude that the Wylfa Newydd Project will not led to the loss of sensitive species and is therefore compatible with the normative definition.

Marine Benthic Invertebrates

3.4.13 A revised WFD Compliance Assessment (PINS Reference REP6-024) and Information to support a derogation under Article 4(7) (PINS Reference REP6-025) were submitted at Deadline 6 (19th February 2019) to feed into the examination of the Wylfa Newydd DCO Project. These reports also collated materials that had been prepared to inform discussions with NRW through the Statement of Common Ground process and the determination process for the Marine Licence and environmental permit applications. Draft materials were shared with NRW in advance of their formal submission. NRW therefore also made a submission for Deadline 5 (12th February 2019) (PINS Reference REP5-081), meaning NRW was able to confirm that in its opinion, it advises that the benthic invertebrates element in the Skerries Coastal water body should be considered for derogation under Article 4(7) in addition to the hydromorphology on the basis that the hydromorpholgy is a supporting element to the biology, and that benthic invertebrates are the primary receptor to changes in the hydromorphology.

3.4.14 Horizon retains its position that, when referencing the normative definition for the ecological status in coastal waters (Table 1.2.4 of Annex V of the Water Framework Directive), it can be concluded that the benthic invertebrate fauna will remain at high status with the construction and operation of the Wylfa Newydd Project. Horizon respects the position of NRW, both as an advisor in the DCO examination and as the competent authority for the marine licence. Therefore, and without prejudice, Horizon has prepared materials in respect of benthic invertebrate fauna to support an Article 4(7) derogation.

3.4.15 Written Representation (WR-1-138) and Horizon's Response to Natural Resources Wales' Deadline 5 Submission (REP6-027) expand upon the baseline description of marine benthic invertebrates within the Skerries waterbody provided in Chapter 13 of the Environmental Statement.

3.4.16 The approach taken to assessing marine habitat loss under the footprint of the Marine Works in the DCO application was extremely precautionary. The areal extent of impacts included 6.7ha of subtidal habitats of conservation importance which falls within and adjacent to the dredge area. Effects in this area will, in reality, be temporary in nature with recovery highly likely to occur. The area adjacent to the dredging footprint to the north (and characterised by muddy sands) may not be impacted at all.

3.4.17 Additional hydrodynamic modelling work which has been carried out specifically to inform the detailed design of the Marine Works has shown that hydrodynamic conditions within the harbour will remain dynamic much like present conditions. Therefore, whilst Horizon agrees with NRW that the exact same communities are unlikely to recolonise the impacted area, similar communities would be expected. Critically, these would restore ecosystem function and processes which are characteristic of broad biotope complexes. Considering the area gained from the proposed mitigation and restoration plan, as well as the potential recovery of a further 6.7ha, the net loss of intertidal and subtidal habitats of conservation importance would be significantly reduced from 20.0ha to 6.1ha.

3.4.18 The subtidal and intertidal habitats that would be affected cumulatively by the Project are considered common at a regional scale and therefore any loss would not result in wider effects on the structure and function of benthic habitats.

4 Approach to derogation for the Wylfa Newydd Project

4.1 Guidance

4.1.1 The key guidance documents used to inform this report are:

- NRW, 2018. Derogation Determination for Water Framework Directive Article 4(7). Reference number: OGN077 [RD5].
- European Commission, 2009. *Common Implementation Strategy for the Water Framework Directive (2000/60/EC).* Technical Report – 2009 – 027. Guidance document No. 20. Guidance document on exemptions to the environmental objectives [RD6].
- European Commission, 2017. *Common Implementation Strategy for the Water Framework Directive (2000/60/EC).* Guidance document No.36. Exemptions to the Environmental Objectives according to Article 4(7). Revision 4. [RD7].
- Dworak, T., Kampa, E. and Berglund, M. 2016. *Exemptions under Article 4(7) of the Water Framework Directive: Common Implementation Strategy Workshop*. 13-14 December 2016, Brussels [RD8].
- The Planning Inspectorate. 2017. *The Water Framework Directive. Advice note eighteen, version 1*. Issued June 2017 [RD9].
- NRW, 2017. Guidance for assessing activities and projects for compliance with the Water Framework Directive. Ref: OGN 072 [RD10].
- NRW, 2017. Water Framework Directive: deterioration in water body status. Ref: OGN 073 [RD11].

4.2 Article 4(7) condition tests and definitions

4.2.1 This report provides information in relation to derogations under Article 4(7) without prejudice as to whether there is a legal requirement to do so for a derogation in all instances.

4.2.2 The exemptions under Article 4.7 of the WFD can be applied to (1) new modifications to the physical characteristics of water bodies and (2) new sustainable human development activities. To benefit from an exemption, all of the following conditions must be met:

- all practicable steps are taken to mitigate the adverse impact (Test (a));
- the reasons for modifications are set out in the River Basin Management Plan and reviewed every 6 years (Test (b));
- the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in the WFD are outweighed by the benefits of the new modifications or alterations to human health, to the

maintenance of human safety or to sustainable development (Test (c)); and

- the objectives of the WFD cannot, for reasons of technical feasibility or disproportionate cost be achieved by other means which are a significantly better environmental option (Test (d)).

4.2.3 The approach taken to addressing each test and an explanation of the terms and how these have been interpreted is outlined below. Sections 5 and 6 consider these tests for the Ynys Mon Secondary and Skerries water bodies respectively.

New modifications and new sustainable human development activities

4.2.4 Under Article 4(7) exemptions can be applied for "new modifications" or *"*new sustainable human development activities*"*. These terms are defined in the European Commission Common Implementation Strategy for the Water Framework Directive [RD6]. New modifications are changes to the physical (i.e. hydromorphological) characteristics of a water body. The effects on and risk of deterioration to a classification and/or quality element may be either a direct or indirect result of the new modification. Provision is also made for alterations in the level of groundwater which may result from new groundwater abstractions or modifications to surface waters which can lead to alterations to the level of groundwater [RD7].

4.2.5 The second limb of Article 4(7) relates to a failure as a result of deterioration from high status to good status which is a result of *"*new sustainable human development activities*"*. The latest Common Implementation Strategy guidance suggests that this would only be applied in relation to an input of pollutants, and that the first limb would be used where physical modifications are the aspect requiring derogation, including for water bodies at high status [RD7]. Deterioration for groundwater bodies is not covered under "new sustainable human development activities*"* [RD7]. The application of Article 4(7) is still evolving and therefore information has been provided in relation to *"*new sustainable human development activities*"* as it may become relevant in the future.

4.2.6 The definition of what constitutes *"*new sustainable human development activities*"* is framed by the relevant decision making process and will be dependent on time, scale, involved stakeholders and information available [RD6].

4.2.7 Sustainable development is also considered within the Well-being of Future Generations (Wales) Act 2015 which states that *"sustainable development means the process of improving the economic, social, environmental and cultural well-being of Wales by taking action, in accordance with the sustainable development principle, aimed at achieving the well-being goals."*.

4.2.8 The Wylfa Newydd Project meets both the criteria for a new modification and a new sustainable human development activity. The changes to physical characteristics of the Ynys Môn Secondary groundwater body include the

deep excavations (physical modification of the aquifer itself), non-permanent dewatering of Unit 1 and Unit 2 and from the creation of landscape mounds and installation of the drainage system (resulting in changes to groundwater recharge).

4.2.9 Changes to the physical characteristics of The Skerries water body would result from the construction of the Cooling Water System, breakwaters and MOLF. Physical changes are described in chapter D13 (the marine environment) (Application Reference Number: 6.4.13) of the Environmental Statement. Changes include the loss of intertidal and subtidal habitats under the foot print of structures and modification of marine habitats resulting from changes to scour.

4.2.10 The Wylfa Newydd Project also meets the criteria for being a new sustainable human development activity and this is evidenced by the relevant National Policy Statements. Nuclear power is one of the key elements of the Government's strategy for moving towards a sustainable low carbon electricity sector [RD12]. The Sustainable Development Commission set out the potential long-term contribution of nuclear power to the target for reductions of emissions of carbon dioxide [RD13]. This is discussed further under test (c).

(a) all practicable steps are taken to mitigate the adverse impacts on the water body concerned

4.2.11 The European Commission advises that the wording "all practicable steps" is analogous with the term "practicable" used in other legislation. It suggests mitigation measures should be technically feasible; do not lead to disproportionate costs; and are compatible with the new modification or sustainable human development activity [RD6].

4.2.12 Mitigation relevant to Article 4(7) is only that which aims to minimise or even cancel the adverse impact on the status of the body of water to which the derogation applies [RD5]. The European Commission's guidance on WFD exemptions states that any measures can be considered as mitigation under the WFD as long as the benefits are experienced in the water body to which the Article 4(7) assessment is being applied [RD7].

4.2.13 The information provided in relation to test (a), has considered all mitigation measures relevant to each classification and/or quality element at risk in the two water bodies. It has taken account of the whole lifecycle of the Wylfa Newydd Project (design, construction and operation), where this is relevant to the effect on the quality element. Maintenance activities are included within operation. The guidance requires that the means of securing the proposed mitigation measures is outlined [RD9]; [RD5].

4.2.14 Relevant mitigation measures have been identified throughout the project (Mitigation Route Map, Application reference Number 8.14). The Mitigation Route Map provides an audit trail of the controls and mitigation measures within the ES and other assessment documents, setting out how they have been, or will be secured. Much of the embedded mitigation has come from the iterative process of Environmental Impact Assessment (EIA), WFD

assessment and options appraisal and has been incorporated to overcome or reduce potentially significant adverse environmental effects. The consideration of mitigation included proposed monitoring where this links to the success of the implementation of mitigation measures.

4.2.15 Potential mitigation measures have been identified through the ES process, drawn from best practice guidance, experience of successful mitigation on similar schemes, existing industry knowledge, through consultation processes and current novel and innovative mechanisms of avoiding, reducing or offsetting impacts. .

4.2.16 Mitigation measures would be secured through a number of 'control documents' which are an integral component of Horizon's DCO strategy and will be certified as part of the DCO.

4.2.17 The control documents include the following:

- Construction Method Statement (Appendix D1-1, Application Reference Number: 6.4.17): The CMS sets out the construction methodologies, works, and types of machinery required for works on the Power Station Site.
- Phasing Plans (Application Reference Number: 8.29): The Phasing Plans identify when key mitigation (such as the Site Campus and Park and Ride facility) will be constructed.
- Design and Access Statement (DAS) (Volume 1, project wide, Application Reference Number: 8.2.1), (Volume 2, power station site, Application Reference Number: 8.2.2), (Volume 3, associated developments and offsite facilities, Application Reference Number: 8.2.3): The DAS sets out the "design principles" that will guide how Horizon will construct the authorised development, and illustrative design concepts which demonstrate how the Wylfa Newydd Project could be brought forward in accordance with those principles.
- The Wylfa Newydd Code of Construction Practice (CoCP) (Application Reference Number: 8.6) and sub-CoCPs (Application Reference Number: 8.7, 8.8, 8.9, 8.10, 8.11, and 8.12). The Wylfa Newydd CoCP, together with location-specific sub-CoCPs, sets out how construction activities will be managed and controlled.
- Mitigation commitments identified in the Environmental Statement as well as other assessment processes undertaken (e.g. the WFD Compliance Assessment).
- The Wylfa Newydd Code of Operational Practice (Application Reference Number: 8.13): Similar to the CoCPs, the Wylfa Newydd CoOP sets out the controls that will apply during the operation of the Project (e.g. operating hours).

4.2.18 Where an adaptive management approach is implemented in relation to any aspect of the Wylfa Newydd DCO Project of relevance to Article. 4(7), then

this is set out in detail within the relevant sub-CoCP dealing specifically with adaptive management.

4.2.19 Other measures that are proposed in EIA assessments will be secured through other mechanisms, such as planning obligations.

4.2.20 A revised Mitigation Route Map will also be submitted at Deadline 9 (10 April 2019). This document will update all of the mitigation (embedded, good practice and additional) identified through the relevant assessment processes and through the examnation process. Specific mitigation measures are set out in chapters 5 and 6 (Ynys Môn Secondary and The Skerries respectively).

(b) the reasons for modifications or alterations are specifically set out and explained in the RBMP

4.2.21 Test (b) requires that where modifications or alterations to a water body require derogation, that the reasons for those modifications and alterations are specifically set out and explained in the RBMP and that the objectives are reviewed every six years.

4.2.22 The requirement to report the derogation within the WFD RBMP has been addressed including consideration of the timing of reporting and the need for sufficient consultation as set out in the European Commission Common Implementation Strategy for the WFD [RD6].

(c) overriding public interest and/or weighing benefits

4.2.23 There are two approaches that can be followed for test (c) of Article 4(7); these are:

- c1: overriding public interest;
- c2: that the benefits of the project to human health, human safety or sustainable development outweigh the benefits of achieving the WFD objectives.

4.2.24 For c1 “overriding” means overriding the WFD objectives as stated in Article 4(1). This is explained by NRW as *“the interest furthered by the new activity has to be more important than an EU level public interest in improving water bodies status”* [RD5].

4.2.25 A range of ‘public interests’ exist, both at an EU level and for individual member states, including energy security, job security and environmental protection. However, it is necessary to demonstrate that there is a ‘public interest’ and an ‘overriding public interest’. The European Commission’s guidance on exemptions [RD6] sets out the basis for distinguishing between the two, which in turn draws upon guidance produced for the Habitats Directive [RD14]. The guidance concludes that it is reasonable to consider that the reasons of overriding public interest refer to situations where plans or projects envisaged prove indispensable within the framework of:

- actions or policies aiming to protect fundamental value for citizens’ lives (health, safety, environment);

- fundamental policies for the state and the society;
- carrying out activities of an economic or social nature, fulfilling specific obligations of public services [RD6].

4.2.26 It has been indicated that the application of the exemption under Article 4(7) should be seen in the context of the implementation of other EU or international policies and funding mechanisms [RD8]. New modifications or new sustainable human development activities, potentially causing deterioration, are frequently linked with the fulfilment of the objectives of other policies, including energy.

4.2.27 The first part of the test, c1, has been used to determine compliance with this derogation condition for the Wylfa Newydd DCO Project. Evidence has been provided which describes the role of new nuclear power to the UK's energy security, its contribution to meeting future demands and how it aids the transition to a low carbon economy.

4.2.28 For the Wylfa Newydd Project the key policies in relation to overriding public interest are the *Overarching National Policy Statement for Energy EN-1 (NPS-EN1)* [RD12], the *National Policy Statement for Nuclear Power Generation EN-6 (NPS EN-6)* [RD15] and UK Government's Strategic Siting Assessment (SSA) process [RD16]. The policies were explicitly developed for Nationally Significant Infrastructure Projects (NSIPs) in the UK and were subject to public consultation prior to their adoption. The approach taken draws on these NPSs and other relevant policies and legislation.

4.2.29 Welsh legislation and policy are also considered in test c1, including the *Well-being of Future Generations (Wales) Act 2015* [RD8] and Energy Wales: a low carbon transition (2016) [SUP-RD2].

4.2.30 Horizon has commissioned Oxera to examine the available evidence pertaining to the urgent need for new nuclear power, over and above that considered in NPS EN-1 and EN-6. This analysis ('the Oxera analysis') presents the needs case for new nuclear power and contains evidence relevant when considering overriding public interest. It is provided in full at appendix G of the Planning Statement.

4.2.31 Materials are provided solely to inform limb 1 of test c. This is consistent with the approach that will be adopted by NRW, which will use limb 1 of test c as the basis for its consideration of any derogation under Article 4(7) of the WFD [SUP-RD3]. As stated in its response to the Written Representation, Horizon agrees with NRW that a compelling case in respect of limb 1 of test c is sufficient to meet test c.

(d) the benefits of the project cannot be achieved by other means, which are a significantly better environmental option

4.2.32 The scope of "other means" has two possible dimensions; the alternative strategic options to the Wylfa Newydd Project, and secondly, design-related alternative options.

4.2.33 A summary of the strategic case for the Wylfa Newydd Project and how all reasonable alternatives were considered, is provided in Volume 6 chapter A4 (strategic alternatives) (Application Reference Number: 6.1.4) of the Environmental Statement. This outlines the alternative solutions and alternative locations for the Power Station, and relevant Associated Developments. Additional information is presented in paragraphs 5.5.1 to 5.5.23)

4.2.34 To address test (d) fully, the design-related alternatives are also considered; this could involve the following:

- different scales;
- different designs;
- alternative operating schemes; and
- alternative locations [RD5]; RD6].

4.2.35 This includes consideration of how the design is achieved, for example using different construction methods or an alternative means of achieving the required results. The guidance states that alternatives should be "comparable, realistic and viable" [RD5].

4.2.36 An option may be a significantly better environmental option if:

- the benefit it delivers is at least equivalent to the benefit that would be delivered by the proposal;
- its environmental cost is significantly less than the environmental cost of the proposal; and
- it is economically viable and hence a realistic option.

4.2.37 Design alternatives are set out in relation to the quality elements at risk in section 5.5 (Ynys Môn Secondary) and section 6.5 (The Skerries). This identified whether any of the alternative options would have delivered a significantly better environmental option and included consideration of technical feasibility and disproportionate cost.

4.2.38 The definitions of 'technically feasible' and 'disproportionate cost' are outlined below. These are also relevant to test (a).

Key terms relevant to test (a) and test (d)

4.2.39 The terms 'technically feasible' and 'disproportionate cost' are specifically mentioned in the wording of Article 4(7) test (d) but in line with guidance [RD5]; RD6] are also relevant to test (a) in relation to mitigation measures. Definitions of these terms, drawing from the relevant guidance, are provided below. The term 'uncertainty' is also defined and criteria for assigning different levels of uncertainty are provided.

Technically feasible

4.2.40 Both NRW [RD5] and European Commission guidance [RD6], state that technical infeasibility is justified if:

- no technical solution is available;
- it takes longer to fix the problem than there is time available; and
- there is no information on the cause of the problem; hence a solution cannot be identified.

4.2.41 It is noted that issues of costs and benefits will need to be considered alongside technical feasibility [RD5]. If there could be a substantial benefit from an improvement, then this may justify a higher degree of effort to find a technically feasible option [RD5].

Disproportionate cost

4.2.42 The European Commission refers to the use of 'disproportionality' in Articles 4(4) and 4(5) as being a "political judgement informed by economic information" [RD6]. When determining that an option or measure is disproportionately costly the guidance suggests that the following points are taken into account:

- the assessment of costs and benefits will have to include qualitative costs and benefits as well as quantitative;
- the margin by which costs exceed benefits should be appreciable and have a high level of confidence; and
- disproportionate cost should also take into consideration the ability of those incurring the cost of the measures, to pay.

4.2.43 NRW guidance explains that disproportionate cost means more than a negligible amount as assessed against either total cost or turnover to the project developer [RD5]. It is also stated that "From the logic of the WFD it becomes clear that an assessment of disproportionate cost only makes sense after a combination of the most cost-effective solutions has been identified." The guidance places emphasis on implementing all measures that can be taken without involving disproportionate costs to reach the best status possible.

4.2.44 In relation to mitigation measures consideration should be given to whether the costs of the mitigation clearly outweigh the benefits, including benefits that are related to meeting WFD objectives but also wider social, economic and landscape benefits.

4.2.45 Only where mitigation measures have been deemed technically feasible and likely to have no significant environment degradation over the chosen option, would alternatives have been costed. For each option, cost engineers would identify the cost of undertaking the work for each construction element and ongoing cost considerations (including operational maintenance and decommissioning).

4.2.46 Ultimately, in screening potential mitigation measures, all those discounted were rejected on the basis of technical feasibility, their likely ineffectiveness or wider environmental effects (e.g. further increased noise). Where mitigation has been accepted, it is acknowledged that measures are not disproportionately costly.

Uncertainty

4.2.47 In some cases, there is an element of uncertainty associated with some mitigation measures in test (a), which may play an important role in determining whether the mitigation measure is suitable for inclusion. Whilst it may be technically feasible to incorporate a particular measure, the likelihood of a benefit being realised may be uncertain if there is either a lack of evidence of successful implementation elsewhere or a lack of underpinning scientific understanding. This uncertainty may also have implications for the disproportionate cost aspect, as if there is little evidence that a measure will effectively mitigate an effect, then the cost versus benefit case is weakened.

4.2.48 Levels of uncertainty are assigned using professional judgement based on the following criteria:

- Low: there is some uncertainty related to either the measure's feasibility or the benefit it would result in; however, the measure is likely to be effective.
- Medium: there is a moderate level of uncertainty related to either the measure's feasibility or the benefit it would result in, possibly related to limited scientific evidence of its effectiveness.
- High: there is no evidence of the measure's feasibility or the benefit it would result in, and no scientific evidence of its effectiveness.

4.3 Article 4(8)

4.3.1 When considering Article 4(7), it is also necessary to consider Article 4(8), "*exemptions for one water body must not permanently exclude or compromise achievement of the environmental objectives in other water bodies.*" In addition, it is necessary to consider if the derogation is *"consistent with the implementation of other Community environmental legislation".* Information relating to Article 4(8) is provided in section 7.1.

4.4 Article 4(9)

4.4.1 When considering Article 4(7), it is also necessary to consider Article 4(9), "*at least the same level of protection must be achieved as provided for by existing Community law.*" Information relating to Article 4(9) is presented in section 7.2.

5 Information to support Article 4(7) derogation criteria assessment for the Ynys Môn Secondary groundwater body

5.1 Introduction

5.1.1 This section of the report provides the information in relation to derogation for the Ynys Môn Secondary groundwater body and is split into the information relevant to each test of Article 4(7) from (a) to (d).

5.2 Test (a)

5.2.1 A summary description of all mitigation that was considered in relation to saline intrusion for the Ynys Môn Secondary groundwater body is presented in table 5-1. A description of all mitigation that was considered in relation to GWDTE for the Ynys Môn Secondary groundwater body is presented in table 5-2.

5.2.2 Further evidence on the rationale for securing and rejecting the mitigation measures listed in Tables 5.1 and 5.2 is presented in Appendix 1.

Table 5-1 Summary of mitigation measures considered in relation to saline intrusion for the Ynys Môn Secondary groundwater body. Full table presented in Appendix 1.

Ref	Design	Construction	Operation	Mitigation measure	Description	Is the mitigation measure technically feasible?	Level of uncertainty associated with the mitigation measure	Would the mitigation measure be disproportionately costly?	Potential impacts of the mitigation measure	Mitigation measure included?
YM1.1	✓			Placement of a semi-dry cofferdam in Porth-y-pistyll at the same time as deep excavations	Construction of the marine cofferdam and excavation in the dry behind the cofferdam means that the flow reversal occurs offshore at the start of the excavations.	Yes	Low	No	None	Construction Method Statement
YM1.2		✓		Appropriate monitoring will be undertaken to determine if there is significant saline intrusion into the aquifer.	The monitoring will include continuous water level monitoring at selected groundwater monitoring boreholes with monthly or quarterly water level dips at other locations and quarterly water quality sampling (for major ions) at selected locations. Monitoring of sump water quality (for major ions) would also be undertaken on a monthly or quarterly basis. Where practicable existing boreholes will be used, although it is recognised that many of these will be lost during the construction works and some replacements may be required.	Yes	Low	No.	None	Main Power Station Site sub-CoCP
YM1.3	✓	✓		Additional mitigation triggered by monitoring.	If a significant effect is identified additional mitigation may be required. Options would include: (1) grouting major inflow fractures, (2) alter pumping regime. Aim is to prevent further saline inflow.	Yes	Low	No. Implementing will help maintain the excavation in a dry state and reduce the period of dewatering.	Potential for water within the excavation to become alkaline which may then require treatment prior to discharge.	Main Power Station Site sub-CoCP
YM1.4	✓			Artificial ground freezing.	Pipes with refrigerant are run through the subsurface to freeze the ground to prevent any groundwater flow into the excavation.	The hardness of the rock requires blasting to be used initially to excavate, and it would be very difficult to insert the pipework.	High	There are no meaningful environmental benefits from emplacing technically challenging groundwater inflow prevention measures.	None	No
YM1.5	✓			Vertical grout curtains.	This technique involves a row of vertically drilled holes filled with grout under pressure. The holes are drilled at intervals in such a way that they create a curtain.	The hardness of the rock requires drilling or blasting, and it would be very difficult to insert physical barriers.	Moderate	There are no meaningful environmental benefits from emplacing technically challenging groundwater inflow prevention measures.	Groundwater contamination by grout	No

Ref	Design	Construction	Operation	Mitigation measure	Description	Is the mitigation measure technically feasible?	Level of uncertainty associated with the mitigation measure	Would the mitigation measure be disproportionately costly?	Potential impacts of the mitigation measure	Mitigation measure included?
YM1.6	✓			Low permeability cut-off walls using piling.	Installation of a vertical bored pile wall around the excavation to prevent ingress of water.	The hardness of the rock would require pile installation by boring.		There are no meaningful environmental benefits from emplacing technically challenging groundwater inflow prevention measures.	Installation would result in additional effects on receptors from increased noise.	No

Table 5-2 Summary of mitigation measures considered in relation to Tre'r Gof SSSI for the Ynys Môn Secondary groundwater body. Full table presented in Appendix 1

Ref	Design	Construction	Operation	Mitigation measure	Description	Is the mitigation measure technically feasible?	Level of uncertainty associated with the mitigation measure	Would the mitigation measure be disproportionately costly?	Potential impacts of the mitigation measure	Mitigation measure included?
YM 2.1	✓	✓		Establish buffer strips between the western and northern toe of Mound A and Tre'r Gof SSSI prior to the commencement of earthworks and maintain thereafter.	Some of the groundwater supplying Tre'r Gof SSSI emerges as springs and seeps on the edge of the basin. They are thought to be recharged by infiltration and flow within a zone 50m to 150m to the south and east of Tre'r Gof SSSI. The buffer strip in conjunction with the other mitigation aims to maintain these key groundwater discharges by encouraging residence time and infiltration to the aquifer. The buffer zone would also allow overland flow to Tre'r Gof SSSI to continue as at present. No construction works will take place within the boundary of the Tre'r Gof SSSI. Suitably demarcated buffer zones will be established. • For the north and west of the Tre'r Gof SSSI adjacent to the site Campus, the buffer zone will be 20m; • To the south of the Tre'r Gof SSSI, the buffer zone will be established at 50m; • For the more sensitive eastern end of the Tre'r Gof SSSI, the buffer zone will be established at 100m.	Yes	Medium	As it currently stands this measure is incorporated into the scheme and the cost is not disproportionate.	None	Main Power Station Site sub-CoCP
YM2.2	✓	✓	✓	Landscape mounding has been designed to avoid changes in catchment boundaries as far as practical.	Some catchment boundary changes do result from the mounding. The overall contributing catchment area remains close to the baseline situation with <10% change in catchment area.	Yes, but it is not possible to keep mounds wholly outside of Tre'r Gof SSSI Catchment as this would mean that there would not be any landscape mounds or noise barriers.	Low, with respect to area. There will be medium to high uncertainty related to the new runoff recharge characteristics of the new landscape mounding.	The landscape mounds are a sustainable local reuse of excavation material. Any transport of materials further afield would be less sustainable and more expensive and could be disproportionately costly.	None	Landscape Habitat Management Strategy
YM2.3	✓	✓	✓	Use of a permeable inert crushed rock drainage blanket below Mound A to the south and east of Tre'r Gof SSSI, and use of overflow pipes in drainage system.	Permeable drainage blanket to allow the shallow groundwater and surface water runoff flowing from the south and east of Mound A to flow under the mound into the SSSI as it currently does. The use of inert rock will seek to ensure that the shallow groundwater chemistry does not change appreciably from the baseline conditions.	Technically the blanket is easy to place, but it needs to be constructed to avoid instability of overlying materials.	Medium to High There is significant uncertainty as to its effectiveness in replicating the quality and quantity of water sources that feed	No	No	Landscape Habitat Management Strategy

Ref	Design	Construction	Operation	Mitigation measure	Description	Is the mitigation measure technically feasible?	Level of uncertainty associated with the mitigation measure	Would the mitigation measure be disproportionately costly?	Potential impacts of the mitigation measure	Mitigation measure included?
						The overflow pipes and weirs are technically feasible.	Tre'r Gof SSSI. It is not possible to accurately predict the changes in the quality of shallow groundwater chemistry or to have certainty in the resulting groundwater levels and discharges.			
YM2.4		✓		Timing of mounding.	Complete all associated earthworks on north and west side of mounding A and B (facing Tre'r Gof SSSI) during dry weather conditions, preferably within the drier months (Apr - Sep), of the first earthworks season. Objective is to slow down runoff to mimic natural runoff characteristics and avoid excess sedimentation via natural processes to remove sediment. Would also manage rainwater close to where it falls.	Yes, but will require rigorous planning and is subject to weather patterns once commenced.	Low to medium – weather and climate dependent.	No	This may slightly increase the time that the face is exposed, with effects on visual receptors for a limited period of time.	Yes
YM2.5	✓	✓	✓	Drainage - The drainage system has been designed to maintain surface water balance within existing drainage catchments as far as is practicable.	This will maintain surface water elements of flow into and out of Tre'r Gof SSSI and ensure no flooding as a result of the development.	Maintaining an overall balance is technically feasible but there is uncertainty as to replication of individual components of flow, which is where the deterioration potential lies.	Medium	Not disproportionately costly regarding overall surface water balance.	None	Wylfa Newydd CoCP
YM2.6	✓	✓	✓	Drainage - Drainage of the landscaped areas has been designed to incorporate as much flexibility as possible so that changes can be made to drainage water treatment and to the volume of water being	In addition to the drainage blanket, the drainage design for the Tre'r Gof SSSI will include the use of overflow pipes at 50m intervals in the drainage ditch to the north and west of Mound A such that during times of higher rainfall, water will flow to the ground adjacent to the drain, allowing overland flow to the SSSI to be maintained. Monitoring and	Yes	High	No, although this would require regular long term attention during operation incurring monitoring and maintenance costs which could be expensive.	None	Landscape Habitat Management Strategy

Ref	Design	Construction	Operation	Mitigation measure	Description	Is the mitigation measure technically feasible?	Level of uncertainty associated with the mitigation measure	Would the mitigation measure be disproportionately costly?	Potential impacts of the mitigation measure	Mitigation measure included?
				released at various discharge points during the construction period.	control weirs in the overflow pipes will be used to control the flow to the SSSI.					
YM2.7	✓	✓	✓	The drainage design strategy will seek to be implemented to reduce potential effects on receiving water bodies and ecological receptors, most notably the Tre'r Gof SSSI.	Where practicable, a treatment train of Sustainable Drainage System (SuDS) methods will be utilised for discharges including site drainage, surface water runoff from exposed topsoil during construction and later from the newly formed landscape mounds and from dewatering discharges. Sediment settlement ponds will be used in conjunction with other measures including silt traps, silt curtains, silt fences and vegetated channels to manage flows and meet water quality thresholds as per the findings of the Wylfa Newydd DCO Project Water Framework Directive Compliance Assessment.	Yes, but will require regular and detailed long-term attention, development and engineering modifications in the early years of operation.	Medium	No	None	Main Power Station Site sub CoCP, Wylfa Newydd CoCP
YM2.8		✓		Drainage - A SuDS treatment train will be placed for drainage operation of the Site Campus and will include attenuation of discharge to surface water and groundwater recharge.	After each phase of site campus construction, surface water drainage from the completed elements of the Site Campus will either run into the ground around the site, or into surface water channels to the east of the site. Drainage design for operation of the Site Campus, will include attenuation of discharge to surface water (e.g. geocellular attenuation tank), and recharge of storm water runoff (e.g. via infiltration trenches, reno mattress, swales), in order to reduce potential hydrological effects on the SSSI arising from surface water flows.	Yes	Low	No	Small temporary alteration to Tre'r Gof water availability, but small when compared to the potential permanent changes due to mounding in Tre'r Gof Catchment.	Design and Access Statement Volume 3 – Associated Developments and Off-Site Power Station Facilities
YM2.9		✓	✓	Monitoring and active management of the drainage system to mitigate the effects of construction activities on surface water flow and quality at the Tre'r Gof SSSI.	Monitoring will continue up to the start of construction in order to improve the robustness of the baseline data. These data will be used during detailed design to refine the drainage system to reduce potential effects. Active management of the drainage system to include monitoring of every discharge point will determine if there is a significant departure from baseline conditions. Will include monitoring upstream and downstream of all outfall points to determine if the outfall is having an effect on water quality and to allow	Yes. Depending on the findings, additional mitigation may be required as agreed with the regulator. Options could include: (1) implementing dosing using polyelectrolytes, (2) installation of additional	Low, related to the monitoring. Associated mitigations have medium uncertainty.	No	None	Main Power Station Site sub CoCP

Ref	Design	Construction	Operation	Mitigation measure	Description	Is the mitigation measure technically feasible?	Level of uncertainty associated with the mitigation measure	Would the mitigation measure be disproportionately costly?	Potential impacts of the mitigation measure	Mitigation measure included?
					treatment to be adjusted. Frequency will be a mix of continuous, daily, weekly or monthly. Will continue into operation.	treatment capacity, (3) greater manual intervention/ management of the system, (4) new drainage channels, (5) new pumping systems, (6) automated treatment and/or pumping systems.				
YM2.10		✓	✓	Tre'r Gof SSSI compensation package.	Horizon is committed to delivering a compensation package, in order to offset a potential adverse effect on Tre'r Gof SSSI, which will create new areas of rich-fen habitat and enhance areas of existing rich-fen habitat at three sites on Anglesey. Habitat creation and management schemes for each site will be developed, in line with the principles set out in the LHMS. All three sites are in the Ynys Mon Secondary groundwater body, although one also overlaps with the contiguous Ynys mon Central Carboniferous Limestone groundwater body.	Yes The availability of land for purchase is also a constraint which would determine the feasibility of habitat creation.	Low to medium	This would be dependent on the sites selected and the works required.	The objective of these works would be to provide a net positive outcome.	Landscape and Habitat Management Strategy
YM2.11		✓		Pollution prevention measures.	Horizon will employ protective measures to control the risk of pollution to groundwater, which will, in particular, be consistent with the Environmental Permitting (England and Wales) Regulations 2016 In addition, Horizon will avoid using materials that could result in direct or indirect discharge of hazardous substances or non-hazardous pollutants to groundwater.	Yes	Low	No	None	Main Power Station Site sub CoCP
YM2.12		✓		Prevention of contaminated runoff.	Horizon will address the handling of material from excavations being a potential source of contamination and will ensure measures are put in place to prevent contaminated runoff reaching open ground. Materials that could result in direct or indirect discharge of hazardous substances or non-hazardous pollutants to groundwater will be avoided.	Yes	Low	No	None	Main Power Station Site sub CoCP

Ref	Design	Construction	Operation	Mitigation measure	Description	Is the mitigation measure technically feasible?	Level of uncertainty associated with the mitigation measure	Would the mitigation measure be disproportionately costly?	Potential impacts of the mitigation measure	Mitigation measure included?
YM2.13				Dewatering (main excavation) – Appropriate monitoring will be undertaken to determine if there is an effect on Tre'r Gof SSSI from dewatering and mounding activities	Continuous water level monitoring at selected groundwater monitoring boreholes with monthly or quarterly water level dips at others and quarterly water quality monitoring	Yes	Low	No	None	Main Power Station Site sub CoCP
YM2.14				Dewatering – Additional mitigation options	If groundwater monitoring identifies an effect on the qualifying groundwater dependent terrestrial ecosystems (GWDTE) at Tre'r Gof, additional mitigation options could include: Controlling water loss from the site via the underground culvert at VN5 during critical periods, to avoid the drying and oxidation of the peat body. Construction methodologies to reduce groundwater ingress to the Cooling water tunnels, e.g. by grouting major inflow fractures. Recharging groundwater, particularly in areas potentially affected by dewatering during the construction period.	Yes	Low	No	None	Main Power Station Site sub CoCP, Landscape and Habitat Management Strategy
YM2.15				Water level management of Tre'r Gof	Water level management of Tre'r Gof will be overseen by a hydrological clerk of works	Yes	Low	No	None	Main Power Station Site sub-CoCP
YM2.16				Lining of CW tunnels during excavation	CW tunnels will be lined during operation to prevent the egress of groundwater. Lining will be undertaken using cement grouting.	Yes	Low	No	None	Construction Management Strategy
YM2.17				Tre'r Gof SSSI Hydroecological Monitoring and Mitigation Scheme	The Scheme will be agreed with IACC and in consultation with NRW. The Scheme will integrate monitoring of flow, flooding, water levels and water quality of surface and groundwater. Mitigation measures will be implemented where monitoring identifies an effect on the SSSI. The mitigation applied will be adaptive depending upon the nature of the impact and may include but not be restricted to artificial recharge, control over groundwater ingress to dewatering excavations, and outfall culvert and drainage design, processes and management.	Yes.	Low	No	None	Main Power Station Site sub-CoCP, Landscape and Habitat Management Strategy

Ref	Design	Construction	Operation	Mitigation measure	Description	Is the mitigation measure technically feasible?	Level of uncertainty associated with the mitigation measure	Would the mitigation measure be disproportionately costly?	Potential impacts of the mitigation measure	Mitigation measure included?
					The scheme will continue during operation for a period of at least five years following completion of the landform					

5.2.3 A number of mitigation measures listed in Table 5-1 were rejected. These relate specifically to the prevention of saline intrusion.

YM1.4 Artificial ground freezing

5.2.4 Artificial ground freezing is a mature mitigation measure by which pipework is inserted into the ground and coolants pumped through the system. Over time this lowers the temperature of surround groundwater, resulting in a frozen barrier between excavations (in this instance) and the free flowing groundwater.

5.2.5 Used across Europe, ground freezing is acknowledged a suitable method for preventing groundwater incursion, however cost and scaleability often restrict the use of this method to smaller complex scenarios. To support mitigation measures associated with the Ynys Mon Secondary Groundwater body there is uncertainty over the applicability on site.

5.2.6 The generally hard substratum chosen to support the nuclear reactors will make drilling of refrigerant piping exceptionally difficult, result in delays to the programme and likely cause additional drilling noise and disturbance ahead of the basement excavations themselves. The hard bedrock, with its low moisture content is also likely to significant reduce the certainty of an impermeable curtain forming, which then may allow intrusion to continue.

5.2.7 Given these issues artificial ground freezing was identified as being technical feasible, but with low certainty, and of no determinable environment benefit when the pre-application drilling is taken into consideration

YM1.5 Grout curtain

5.2.8 Similarly to the artificial ground freezing grout curtains require a series of drilled holes to be made into the substratum around the excavation through which grout is injected under pressure. The grout disperses to fill interstitial spaces and forms a barrier to groundwater intrusion.

5.2.9 A proven method, used widely in Europe since the 1970s, the use of grout curtains is identified as technically infeasible at Wylfa due to the need to scale up to deep excavation. The method is principally used to depths of 10-12 and therefore will be unable to meet the requirements of the Wylfa Newydd Project. Additionally, drilling injection shafts through hard bedrock would give rise to project delays and additional noise disturbance, whilst the injection of chemicals into the groundwater has the potential to lead to wider aquifer contamination.

5.2.10 Therefore, grout curtains are considered to be technically infeasible (high certainty). Given this finding, environmental benefit and costs have not been assessed.

YM1.6 Low permeability cut off walls

5.2.11 Low permeability cut off walls require the insertion on interlocking sheet piling to be inserted into the ground surrounding the excavation to prevent water ingress.

5.2.12 This method is widely used on construction projects, however has a maximum working depth to approximately 15m and is unlikely to be scaleable to the deep excavations required for the Wylfa Newydd Project. As with previous methods the hard substratum is reported to be a significant barrier to successful implementation, with sheet piling needing to be driven through bedrock. This will result in a significant noise source and delay to programme to enact.

5.2.13 The permeability of the finished wall would depend on the ability to interlock sheets together, which will be affected by the ground conditions encountered. As such low permeability walls are considered technically infeasible (high certainty) and have not been assessed for environmental or cost benefits.

5.3 Test (b)

5.3.1 Test (b) is a reporting obligation and does not mean that Member States must wait until the publication of the RBMP before allowing a new physical modification or new sustainable development activity to proceed [RD6]. The guidance given is that "*If a modification or alteration goes ahead in the middle of a river basin planning cycle, the reason for that modification or alteration must be set out in the subsequent (update of the) RBMPs*" [RD6].

5.3.2 The river basin management process incorporates adaptive management principles and the need to deal with physical modifications in an environmentally sensitive manner is acknowledged in the Western Wales RBMP [RD17]. This provides a framework for the necessary reporting. Should the Wylfa Newydd Project be constructed, Horizon would work with NRW to include the water body modifications when the Western Wales RBMP is updated. The information provided in both the WFD Compliance Assessment (Application Reference Number: 8.26) and this report can be used to inform this process.

5.3.3 As part of the guidance on test (b) the European Commission states that "*for modifications and alterations within the scope of the Environmental Impact Assessment Directive, Member States must ensure that the public concerned is given the opportunity to express an opinion before the project is initiated*" [RD6].

5.3.4 It is noted that even if the timing of a project is such that consultation on the RBMP will not provide an opportunity for stakeholders to comment, Article 14 requires Member States to actively involve all interested parties in the implementation of the Directive [RD6]. The guidance goes on to state that the feedback provided in such consultations can help Member States to reach a judgement on whether the exemption conditions have been met and will reduce the likelihood of challenges from interested parties [RD6].

5.3.5 Horizon has undertaken an extensive public consultation process, the feedback from which has been important in developing and refining the Wylfa Newydd Project. There have been three main stages of public consultation, as set out below, in addition to further informal consultation including a project update consultation in January 2016 and on specific elements of the Wylfa Newydd Project in May 2016 and December 2017:

- Stage One Pre-Application Consultation: September - December 2014;
- Stage Two Pre-Application Consultation: August - October 2016; and
- Stage Three Pre-Application Consultation: May - June 2017.

5.3.6 Consultation on the WFD has taken place with the Planning Inspectorate, NRW and the IACC, including monthly 'working group' meetings since February 2017. A Preliminary WFD Compliance Assessment was sent to NRW for comment in November 2016 and meetings were held to discuss the feedback and future work. In July 2017 a draft WFD Compliance Assessment was sent to NRW and IACC for comment and feedback was received and discussed at the following working group meeting. Subsequently, further feedback was sought from the Planning Inspectorate and NRW on a draft DCO application in August 2017 which included the WFD Compliance Assessment (Application Reference Number: 8.26) for the Wylfa Newydd Project.

5.4 Test (c)

5.4.1 As noted in Section 4.2, the European Commission's guidance on exemptions [RD7] sets out the basis for distinguishing between public interests and overriding public interests. The guidance concludes that it is reasonable to consider that the reasons of overriding public interest refer to situations where plans or projects envisaged prove indispensable within the framework of:

- actions or policies aiming to protect fundamental value for citizens' lives (health, safety, environment);
- fundamental policies for the state and the society; and
- carrying out activities of an economic or social nature, fulfilling specific obligations of public services [RD7].

5.4.2 This section sets out evidence to inform a case of overriding public interest for the Wylfa Newydd DCO Project. This evidence is structured to describe:

- the public need for energy;
- the public need for nuclear energy; and
- the suitability of the Wylfa Newydd DCO Project.

The need for new energy generation capacity

5.4.3 NPS EN-1 states that energy underpins almost every aspect of our way of life. It enables us to heat and light our homes; to produce and transport food; to travel to work, around the country and the world. Our businesses and jobs rely on the use of energy. Energy is essential for the critical services we rely on – from hospitals to traffic lights and cash machines. It is difficult to overestimate the extent to which our quality of life is dependent on adequate energy supplies (para 3.2.1) [RD12].

5.4.4 NPS EN-1 [RD12] makes clear that the Government's key objectives in energy policy are to ensure energy security for the UK and to decarbonise energy capacity in order to meet the UK's 2050 climate change targets. It explicitly

identifies the urgent need for new (and particularly low carbon) electricity NSIPs in the UK within the next 10-15 years, i.e. 2011 – 2025 (paras 3.3.1 to 3.3.5). It outlines the challenges facing the UK's energy security in light of the Government's carbon reduction objectives and notes that the UK not only needs a secure, diverse and reliable supply of electricity, but needs it in the context of reducing greenhouse gas emissions by at least 80% by 2050 (under the Climate Change Act 2008) (paras 3.3.14, 3.3.15).

5.4.5 The Programme for Government 2011 to 2016 sets out the Welsh Government's ambition to create a sustainable, low carbon economy for Wales. Energy Wales: a low carbon transition [SUP-RD2] emphasises the need to decarbonisation of our energy systems, citing the EU's objective of reducing greenhouse gas emissions by 80-95% by 2050 compared to 1990, with a consequent impact on increasing low carbon electricity generation. It states an expectation for energy systems to meet environmental standards and provide energy security and resilience. Finally, it states an expectation that energy systems will deliver, through energy markets, affordability and a credible framework for long term investment.

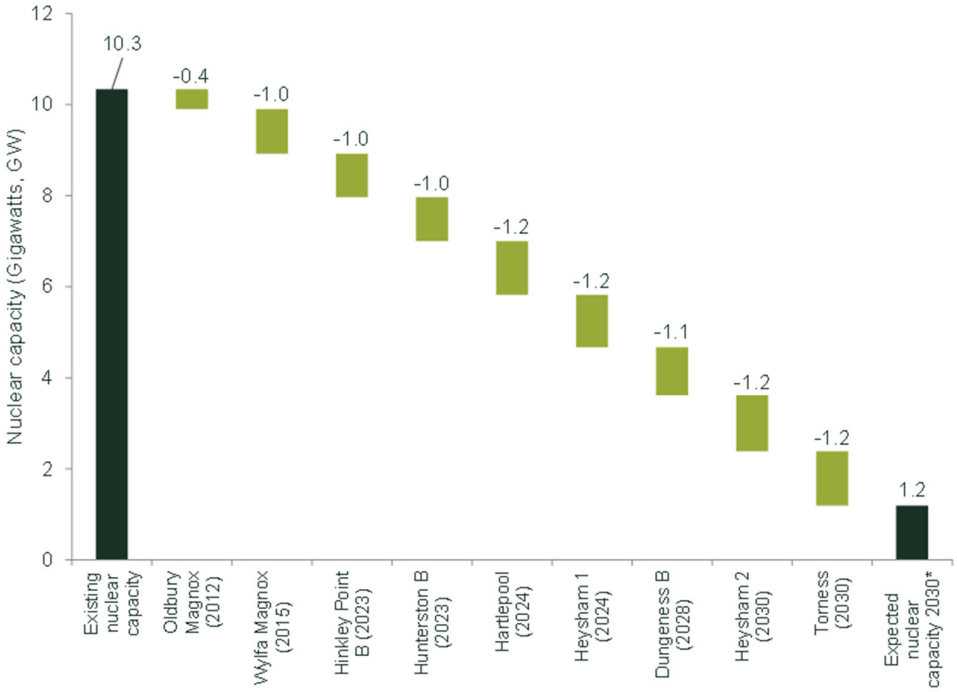
5.4.6 The following sub-sections consider the need for new energy generation capacity in the context of (i) a loss of existing generating capacity, (ii) predicted increase in the demand for electricity, and, (iii) the combination of increasing demand but decreasing supply (termed the generation shortfall).

Loss of existing generating capacity

5.4.7 A combination of aging power stations and environmental regulation means that by 2020, at least 22GW of existing generating capacity will need to be replaced. This expected decrease in generation capacity is particularly acute for coal and nuclear plants [RD12]. 8.4GW of coal capacity closed between 2010 and 2015 in response to the EU's Large Combustion Plants Directive. There are further plans to close all unabated coal fired power stations by 2025 [RD18].

5.4.8 Two nuclear power plants have been decommissioned since NPS EN-1 was published (Oldbury in 2012 and Wylfa in 2015). In addition, 88% of residual nuclear power capacity is planned to be decommissioned by 2030 [RD19], as illustrated in figure 5-1.

Figure 5-1 The loss of existing nuclear generation capacity



5.4.9 In essence, almost 90% of current coal and nuclear capacity, which together contribute almost 50% of the UKs current power needs, is expected to close by 2035.

5.4.10 Under the Climate Change Act 2008, the UK is committed to reducing its greenhouse gas emissions by at least 80% by 2050 relative to 1990 levels. It is therefore necessary that the UK reduces its use of fossil fuels, particularly in the four largest sectors for emissions: transport, industry, heating for buildings and electricity generation [RD20]. Switching away from fossil fuels in these sectors is anticipated to be achieved partly through electrification, such as increased use of electric vehicles.

5.4.11 To ensure that electrification does reduce overall emissions, new electricity has to be generated from low-carbon sources. The increase in the supply of low-carbon electricity is identified as an 'essential prerequisite' to meeting the UK's emissions targets (para 3.3.13) [RD12].

5.4.12 The government's consultation on the siting criteria and process for a new NPS for nuclear power between 2026 and 2035 [RD21] states 'the need for the UK to continue in transitioning to a low carbon electricity market is underlined by the 2015 United Nations Framework Convention on Climate Change Paris Agreement.

Predicted increase in the demand for electricity

5.4.13 Even with major improvements in energy efficiency, the demand for electricity is expected to grow as a result of electrification. EN-1 states demand for electricity is likely to increase, as significant sectors of energy demand (such as industry, heating and transport) switch from being powered by fossil fuels

to using electricity. As a result of this electrification of demand, total electricity consumption could double by 2050 (para 3.3.14) [RD12].

5.4.14 In December 2016, the Government published a consultation on the siting criteria and process for a new NPS for nuclear power between 2026 and 2035 [RD21]. The consultation document notes that since EN-1 [RD12], more recent Updated Energy and Emissions Projections 2016 have been produced which state that by 2035 overall demand for energy will have increased by approximately 20% relative to 2017 levels [RD22].

5.4.15 The National Audit Office (NAO) adopts these estimates in 'Nuclear Power in the UK', noting a predicted 20% increase in demand for electricity over the next two decades because of demographic changes, economic growth and the electrification of heat and transport (para 8) [RD23]. In particular, the NAO states that demand for generation capacity is expected to increase by a further 31GW by 2035 [RD23].

5.4.16 National Grid's projections demonstrate that a rapid uptake of electric vehicles alone could increase peak demand by approximately 15GW by 2035 [RD24]. In total National Grid estimates that by 2050, peak demand will have risen by up to 40% relative to 2016 [RD24].

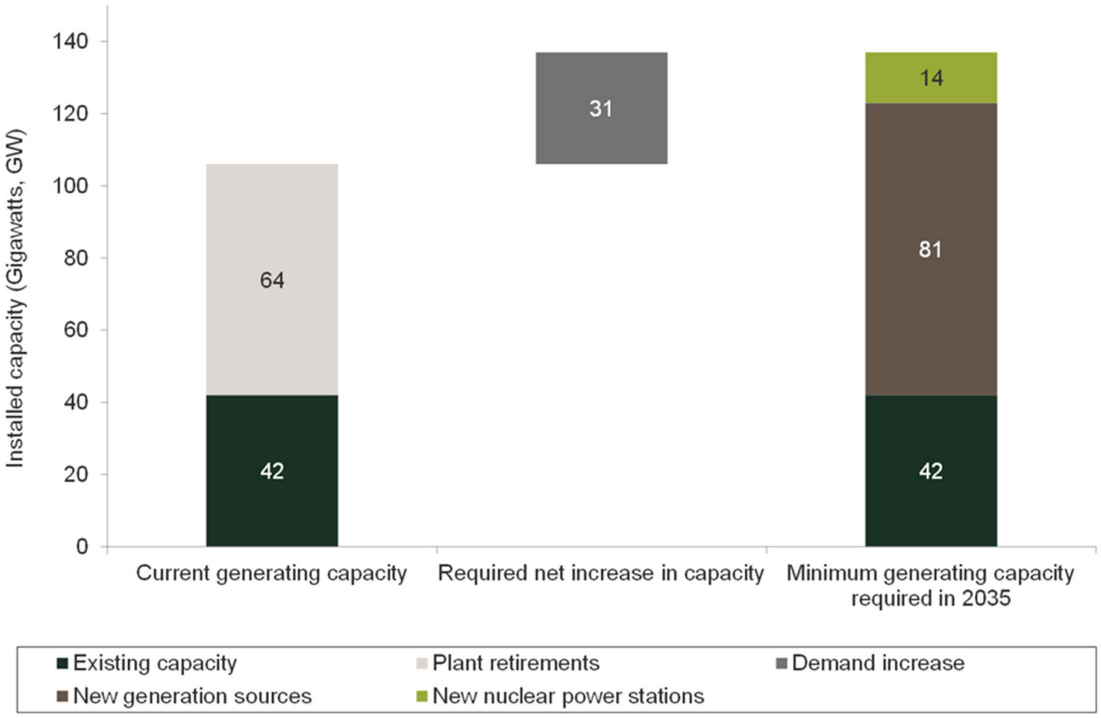
Increasing demand but decreasing supply: the generation shortfall

5.4.17 In combination, the expected loss of existing generation capacity and predicted increase in demand will result in a shortage of capacity in the coming decades unless substantial new low-carbon capacity is developed.

5.4.18 As outlined in EN-1, reflecting the requirement to maintain security of supply while also meeting greenhouse gas emission commitments, the UK will require an additional 59GW of new build electricity capacity by 2025 relative to the 2011 baseline, which translates to at least 113GW of total electricity generating capacity (para3.3.22) [RD12].

5.4.19 When looking to 2035, the NAO has specifically analysed the expected generation capacity shortfall arising from increased demand in the context of shrinking supply [RD23]. NAO estimates are illustrated in figure 5-2, showing that at least 31GW of additional capacity is required by 2035 relative to existing supply. As 64GW of existing capacity is expected to close, the overall requirement for new low-carbon energy is 95GW by 2035 (against an overall estimated requirement of 137GW).

Figure 5-2 National Audit Office on the UKs energy challenge until 2035



5.4.20 The greater reliance on renewable, but intermittent generating technologies (e.g. wind and photovoltaics) in the future means that total generating capacity may need to be even greater to ensure that peak demand can always be met [RD23]. NPS EN-1 states that if there was a very strong electrification of energy demand and a high level of dependence on intermittent electricity generation, then the capacity of electricity generation could need to triple (para 3.3.14) [RD12].

Summary

5.4.21 The significant reductions in existing capacity and predicted increases in demand relative to existing capacity will give rise to a shortage in generation capacity unless substantial new low-carbon generation is developed.

5.4.22 In addition to the need for capacity resulting from the expected shortfall in electricity generation capacity, a future increased reliance on renewable, but intermittent, generating technologies such as wind and photovoltaics means that total generating capacity may need to be even greater, to ensure that peak demand can always be met.

5.4.23 In the context of the UK's requirement for energy, the Wylfa Newydd DCO Project will generate 2.7GW of low carbon energy for decades once operational. This is enough energy to power 5,000,000 homes.

The need for new nuclear generation capacity

5.4.24 NPS EN-6 [RD15] is the NPS for nuclear power generation. It sits under the umbrella of NPS EN-1 [RD12] and, in combination, these existing NPSs establish the principle that there is a need for new nuclear power, and that this need is urgent. The urgency of bringing forward new nuclear power projects is driven by the drive to decarbonise the UK's electricity supply and to increase energy security.

5.4.25 The following sub-sections consider the need for new nuclear generation capacity in the context of (i) a need for low-carbon electricity generation, and, (ii) a lack of proven alternatives predicted increase in the demand for electricity.

Low-carbon electricity generation

5.4.26 The ministerial statement on Energy Infrastructure (Written Statement December 2017) [RD25] refers directly to the overarching NPS for Energy (EN-1) [RD12]. The statement notes that NPS EN-1 "made it clear that nuclear power is a low-carbon, proven technology which can play an important role increasing the resilience and diversity of the UK's energy system. With a number of the existing coal and nuclear fleet due to close by 2030, new nuclear power generation remains key to meeting our 2050 obligations". It states that the assessment of need for nuclear energy generation carried out to support NPS EN-1 [RD12] remains valuable and continues to be relevant.

5.4.27 The ministerial statement [RD25] acknowledges that EN-6 [RD15] only directly relates to development which forms part of a project able to demonstrate expected deployment by the end of 2025. However, it states that the Government continues to give its strong in principle support to project proposals at those sites listed.

5.4.28 The ministerial statement [RD25] states that "Government is confident that both NPS EN-1 [RD12] and NPS EN-6 [RD15] incorporate information, assessments and statements which will continue to be important and relevant for projects which will deploy after 2025 including statements concerning the need for nuclear power – as well as environmental and other assessments that continue to be relevant for those projects". In respect of matters where there is no material change in circumstances it is likely that significant weight would be given to the policy in NPS EN-1 [RD12] and NPS EN-6 [RD15].

5.4.29 In terms of the scale of need that the government believes necessary, NPS EN-1 states that of the 59GW of new electricity required by 2025, relative to the 2011 baseline, 18GW is to come from new non-renewable sources, and specifically nuclear (para 3.3.22) [RD12]. With respect to this balance, the government has previously stated that it would like a significant proportion of this balance [capacity requirement] to be filled by new low carbon generation. The government believes that, in principle, new nuclear power should be free to contribute as much as possible towards meeting the need for around 18GW of new non-renewable capacity by 2025 (para 3.3.22) [RD12].

5.4.30 Beyond the NPSs, one of the key policies in the Clean Growth Strategy [RD18] is to deliver new nuclear power through Hinkley Point C and progress discussions with developers to secure competitive price for future projects in the nuclear pipeline.

5.4.31 In its 'Future Energy Scenarios' report, National Grid presents four very different scenarios for the future of the UKs energy system to meet emissions targets. It states that new nuclear build is required in all scenarios and a gap is predicted between old plants being decommissioned and new nuclear stations beginning to generate (p59) [RD24].

5.4.32 National Grid analysis implies that the need for new nuclear generation is especially acute if the 2050 emissions targets are to be met. Its 'Two Degrees' scenario is the only scenario where the 2050 emissions targets are met. This assumes 14.5GW of new nuclear power generation by 2035 [RD24]. Hinkley Point C will provide 3.2GW of capacity and all existing nuclear generation is expected to close by 2035 [RD26]. A significant amount of new nuclear is therefore urgently required to meet the 2050 emissions targets.

5.4.33 The carbon emissions of nuclear power compare favourably with other generating technologies. Data presented by the Intergovernmental Panel on Climate Change (IPCC) [RD27] are presented in Table 5-3. These figures show that nuclear and wind have comparable lifecycle emissions (11-12gCO2eq/kWh). Notably, the median emissions of nuclear are at least twice as low as those of hydropower or solar and nuclear generation has significantly lower emissions than, for example, biomass, gas or coal.

Table 5-3 Lifecycle emissions of different generating technologies

Technologies	Lifecycle emissions (median gCO2eq
Wind onshore	11
Nuclear	12
Wind offshore	12
Hydropower	24
Concentrated solar power	27
Geothermal	38
Solar PV - rooftop	41
Solar PV – utility	48
Biomass - dedicated	230
Gas – combined cycle	490
Biomass – cofiring	740
Coal – pulverised coal	820

Source: Working Group III Technical Support Unit (2014), 'Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change', p.1335. [RD27]

Lack of proven alternatives

5.4.34 Even for technologies that have equivalently low-carbon emissions to nuclear, it is unclear how these alternatives could meet future energy needs. Industry research by Bloomberg concluded that weather conditions in the UK are such that solar could perhaps account for only 8% of the UKs generation by 2040 [RD28]. While Bloomberg [RD28] concludes that wind speeds in the UK appear 'favourable', the proportion of electricity demand that needs to be met by generation sources *other* than wind and solar by 2040 is still forecast to be as high as 50%.

5.4.35 Bloomberg predicts that even in 2040 there are entire weeks and months where non-wind/non-solar generation meets 80% and 72% of demand respectively (p4) [RD28]. The implication of this is that 70GW of dispatchable resources (generation, storage, flexible demand, interconnectors) are needed in 2040 to meet peak demand during periods of low wind and solar generation (p4) [RD28].

5.4.36 The NAO [RD23] also recognises this issue and states that with respect to nuclear power that it is a 'firm source of electricity that can be relied upon to deliver during periods of high demand, in contrast to wind and solar power which are intermittent' (para 2.7). NAO concludes that the intermittency and unreliability of renewables pose issues in terms of their adequacy and efficacy in bridging the capacity shortfall, even in the long-term.

5.4.37 In addition to industry and government concerns referred to above, academic research indicates that there is no significant evidence to support the notion of an electricity system that is 100% reliant on renewables. Heard et al [RD29] conducted a review of 24 studies, concluding that there is a near total lack of historical evidence for the technical feasibility of 100% renewable electricity systems operating at regional or larger scales. The only developed nation today with electricity from 100% renewable sources is Iceland, thanks to a unique endowment of shallow geothermal aquifers, abundant hydropower and a population of only 0.3 million people [RD29].

5.4.38 The review concluded that the assessments of studies proposing 100% renewable electricity systems reveals that in all cases and across the aggregated evidence, the case for feasibility is inadequate for the formation of responsible policy directed at responding to climate change [RD29].

5.4.39 One method of addressing the intermittency issue may be through storage. However, it is unclear whether electricity storage represents a viable option for overcoming these issues. Bloomberg notes that batteries and flexible demand technologies are not currently able to shift energy across weeks or months due to their economics and characteristics. Demand cannot be deferred for weeks, and the sheer scale (and cost) of batteries needed for seasonal storage would be prohibitive (p78) [RD28]

5.4.40 On this basis the government recognises that there are technical and commercial barriers to deploying other technologies that produce the same annual generation as that of nuclear power [RD25]. In order for large-scale solar and onshore wind to produce the same amount of electricity provided by

[Hinkley Point C], there would be significant upgrades to the grid required as well as increased costs to keep the system in balance [RD30].

5.4.41 National Grid's 'Two Degree' scenario assumes that 74GW of low-carbon generation will be available from 2025, including carbon capture and storage, hydropower, wind, solar and other renewables [RD24] (but excluding nuclear and interconnectors to allow comparison with other quoted figures). However, HM Treasury [RD31] concludes that only 48GW of low-carbon generation will be available by these dates, implying a 26GW gap in the required low-carbon capacity. Currently planned interconnector projects may account for 12GW of this shortfall, but even if all of these operate on time, a 14GW capacity gap remains. This equates to approximately five Wylfa Newydd DCO Projects. BEIS's Energy and Emissions Projections assume that two to three new nuclear reactors will be commissioned between 2028 and 2032 in addition to the Hinkley Point C plant (which is currently expected to commence operation in 2025).

Summary

5.4.42 The ministerial statement on Energy Infrastructure (Written Statement December 2017) [RD10] makes it clear that the assessment of need for nuclear power, and that this need is urgent, presented in NPS EN-1 and EN-6 remains valuable and relevant.

5.4.43 The urgency is driven by the need to shift to low-carbon electricity generation in the coming decades if the UK is to meet emissions targets and a lack of proven alternatives that can be deployed within these timescales.

The suitability of the Wylfa Newydd DCO Project

5.4.44 Energy Wales: a low carbon transition [SUP-RD2] provides unambiguous support for the Wylfa Newydd Power Station. It states that "The Welsh Government supports the development of a nuclear power station on Anglesey. This development also offers significant long-term economic benefits to Anglesey and North Wales in general. The development of the Horizon nuclear new build (Wylfa B) [Wylfa Newydd DCO Project] is a vital component of not just the Anglesey Energy Island programme but of our wider energy future in providing a constant energy source to complement the intermittency of renewable sources. There are undoubtedly risks associated with nuclear power, but the risks posed by climate change are now so serious that we cannot dispense with a proven low-carbon technology".

5.4.45 The strategic case for the Wylfa Newydd DCO Project was assessed by the UK Government. The site at Wylfa was included within NPS EN-6 [RD15] as a potentially suitable location for new nuclear power, having satisfied the Strategic Siting Assessment process [RD16].

5.4.46 The ministerial statement on Energy Infrastructure (Written Statement December 2017) [RD25] acknowledges that EN-6 [RD15] only directly relates to development which forms part of a project able to demonstrate expected deployment by the end of 2025. However, it states that the Government

continues to give its strong in principle support to project proposals at those sites listed, including Wylfa.

5.4.47 The government's consultation on the siting criteria and process for a new NPS for nuclear power between 2026 and 2035 [RD21] states that "sites listed in EN-6 on which a nuclear power station is anticipated to deploy after 2025 will continue to be considered appropriate sites and retain strong Government support during the designation of the new NPS". It states that subject to the outcome of the consultation and provided sites meet the final criteria, Government proposes to carry forward the sites listed in EN-6 into the new NPS. The ministerial statement is consistent with the consultation, stating that "for projects yet to apply for development consent and due to deploy beyond 2025, the Government continues to give its strong in principle support to project proposals at those sites currently listed in EN-6".

5.4.48 The energy NPSs took the relevant national planning policy into account at the time of publication, including Planning Policy Wales [RD32], although newer Welsh policies may also be relevant.

5.4.49 The benefits of the project for energy policy are clear. However, when considering the project, it is important to set out the wider benefits arising from the Wylfa Newydd DCO Project. These include: economic benefits and job creation; infrastructure improvements: and, tourism.

5.4.50 Additionally, the Wylfa Newydd DCO Project will deliver a package of planning obligations to be secure through a legal agreement under Section 106 of the TCPA, which are required to mitigate the impacts of the Project, but many of which will provide a longer-term legacy to Anglesey and the wider North Wales region. These include: education; jobs and skills; health and well-being; housing fund; Welsh language and culture; biodiversity and environmental; and, recreation.

5.4.51 These direct and additional benefits are summarised in the following sub-sections.

Economic benefits and job creation

5.4.52 The significant level of investment to be made by the Wylfa Newydd DCO Project would benefit the economies of both Anglesey and north Wales; this investment filters through the economy via payment to employees, contracts with local businesses and investment in infrastructure [SUP-RD2]. SUP-RD2 makes specific reference to the Anglesey Energy Island programme, stating that the Welsh Government will prioritise its efforts and focus most strongly on the energy projects that offer the greatest benefits to Wales. This document goes further, stating that the designation of the Anglesey Energy Island Enterprise Zone will further support the realisation of wider economic benefit to the region through the overarching Enterprise Island framework.

5.4.53 It is expected that at peak construction, up to 9,000 workers would be required for the Wylfa Newydd Project. Approximately 2,000 home-based workers would be employed during the peak period of construction from the Daily Construction Commuting Zone (DCCZ), which would deliver major beneficial

changes to employment in the construction sector in the DCCZ. An estimated 1,260 of these home-based workers are expected from Anglesey, ensuring beneficial effects on the labour market on Anglesey itself are delivered during the construction period.

5.4.54 The construction stage would have a beneficial effect on the local economy in Wales. It is estimated that 60% of the £10+ billion Wylfa Newydd Project value during the construction phase would be spent in the UK. It is not yet clear precisely how much of the value would be spent locally within north Wales. Adopting a benchmark of between 2% and 4% (as explained at chapter 1 in volume C of the ES) this would equate to an investment of between £200 million and £400 million within north Wales over the construction period.

5.4.55 An investment of between £200 million and £400 million represents the provision or safeguarding of between 1,200 and 3,500 job years over the investment period, equivalent to 120 to 350 Full Time Equivalent jobs.

5.4.56 During operation of the Power Station Site it is estimated that a workforce of 850 will be required. This represents a significant contribution to local employment opportunities and to the long-term population stability on Anglesey. Given the magnitude of change in local employment, the long-term nature of the positions, and the potential to reduce outward migration trends, alongside the importance of the local labour market, this would represent a major beneficial effect on the labour market on Anglesey.

5.4.57 During planned periods of Power Station outage for maintenance, the additional outage workforce would comprise up to 1,000 additional staff.

5.4.58 The total value of the operating expenditure over the lifetime of the Power Station is equivalent to £1.8 billion in present value terms, equivalent to around £30 million per year. This estimate excludes staff costs, fuel, business rates, other financial contributions, National Grid fees or other trading costs.

5.4.59 The annual average direct, indirect and induced increase in income is estimated at around £20 million on Anglesey from staff costs at the Power Station. This is equivalent to an increase of 2.1% over baseline levels. This would represent a beneficial effect on the local economy on Anglesey.

Infrastructure improvements

5.4.60 In addition to the delivery of the nuclear power station, which has significant benefits in providing long term, sustainable infrastructure for the benefit of the UK as a whole, the Project results in local infrastructure benefits through the delivery of the A5025 On-line and Off-line Highways Improvements.

5.4.61 Motorised and public transport users would experience significant decreases in traffic flow on the existing A5025 at various stages of the project.

5.4.62 The improvements will deliver benefits in specific locations. The A5025 Off-line Highways Improvements will, for example reduce existing traffic levels within Llanfachraeth by more than 60%. The highway improvements would also reduce traffic noise and air pollution in the communities of Valley, Llanfachraeth, Llanfaethlu and Llanrhuddlad (at Cefn Coch)

5.4.63 In addition, the development of the logistics centre at Parc Cybi is delivering an employment use which could be available in the long term, subject to achieving the necessary local consents. This also has the benefit of potentially kick-starting investment in this allocated employment area.

Tourism

5.4.64 During peak construction it is estimated that the additional revenue to tourism providers will be just over £12 million per year (of which the majority - £10.5 million – would be realised on Anglesey). This additional expenditure represents the provision or safeguarding of up to 571 jobs in that year. Using the employment multiplier of 1.3 for the accommodation sector, it is estimated that a further 146 jobs could be created in the wider economy. This is set out in detail in the socio-economic analysis at chapter 1 in volume C of the ES (Application Reference Number: 6.3.1).

5.4.65 In recognition that the construction of Wylfa Newydd itself may become a visitor attraction in its own right, Horizon will operate a temporary construction viewing area. This is expected to be able to operate from an appropriate point in the construction programme (having regard to safety and security considerations).

5.4.66 In acknowledgement of the importance of the tourism sector to the economy of Anglesey, Horizon will establish a tourism fund, which would be available to support Brand Anglesey during the construction project and to address adverse effects if identified through monitoring.

Education

5.4.67 The Wylfa Newydd Project will create real opportunities for young people in the communities local to the development sites.

5.4.68 The Jobs and Skills Strategy APP-411] identifies Horizon's existing programme of engagement with schools, the Primary Outreach Programme, Work Insight Week and work with key partners to deliver Science, Technology, Engineering and Mathematics initiatives.

5.4.69 Horizon will establish and maintain the Wylfa Newydd Employment and Skill Service, secured through the DCO s.106 agreement, to maximise local opportunities for local people.

5.4.70 Horizon will fund early action related to existing skills shortages through modern apprenticeships and graduate apprenticeships.

5.4.71 Horizon will implement a monitoring scheme accompanied by a fund to provide new capacity if demonstrated that the Wylfa Newydd Project creates a shortage in certain primary schools as a result of workers who bring children with them.

5.4.72 Horizon will also fund the employment of two or more peripatetic teachers to support current immersion education capacity across primary and secondary schools in Anglesey and, if monitoring indicates a need to do so, in Gwynedd.

5.4.73 The Welsh Government has stated that it will "develop our workforce by working with local and national partners such as Bangor University and Coleg Menai through their new Construction and Energy centres to promote and support the development of the full range of skills required to ensure that we take the maximum advantage of research and development, energy production, operation and maintenance opportunities – this includes facilitating the transfer of skills from the existing nuclear power station and the Trawsfynydd site to contribute to job security [SUP-RD2].

Jobs and skills

5.4.74 The Jobs and Skills Strategy [APP-411] will seek to maximise the recruitment of locally-based workers and will seek to increase the number of home-based workers above the 2,000 estimate in order to minimise the effects caused by the arrival of construction workers. This will also seek to maximise the economic benefits for local residents that will result from the jobs created as a result of the Wylfa Newydd Project. The Jobs and Skills Strategy will be backed by a flexible Skills Fund that can be used to deliver any aspect of the strategy.

5.4.75 Horizon will, through an online Supply Chain Portal, also engage with the local supply chain and maximise opportunities for local people.

5.4.76 Horizon will work with local stakeholders and training providers to ensure training aligns better with likely demand for services. One of the key mechanisms for doing this will be the Wylfa Newydd Employment and Skills Service.

5.4.77 Horizon is also currently working with local colleges and the CITB to understand the nature of local training provision and where gaps are identified the partners will work with funders and other providers to ensure capacity is sufficient, drawing on the Skills Fund as required.

5.4.78 Around a third of the operational workforce will be required to be skilled to a technical level. Horizon's apprentice programme is therefore a key part of the Jobs and Skills Strategy, making the apprenticeship route an important entry point to a career at Wylfa Newydd Power Station. Twenty-two apprentices were started with local provider Grŵp Llandrillo Menai in 2017 and 2018, and the apprentice programme will expand in a number of areas. Horizon will work with Grŵp Llandrillo Menai and industry skills bodies to ensure that the apprentice provision is constantly adapted and improved to meet the requirements of the Wylfa project.

5.4.79 Horizon will also make provision for emergency services for the construction workforce, including a financial contribution to the emergency services. Horizon will also support IACC and Betsi Cadwaladr University Health Board to develop their own workforce strategy.

Health and Well-being

5.4.80 When operational, the Power Station would help to bring a stable supply of low-carbon electricity to Wales and the UK. This has direct and indirect effects on health and well-being. For example, electricity enables people to heat and light their homes and to cook food. A stable power supply helps health and social care services to operate, jobs and economic activity to continue, and technology to function. Low-carbon energy generation can also help to reduce climate change and its many adverse effects on physical and mental health and well-being.

5.4.81 Horizon will provide appropriate occupational health and hygiene services for the construction and operational workforce, through on-site provision and financial contributions, to ensure that the local community health and welfare services and resources used by local residents are not adversely affected by the Wylfa Newydd Project.

5.4.82 The significant employment during both construction and operation will deliver health and well-being benefits, as working improves mental and physical health. The Project would benefit working people, their dependants and the wider economy. This investment is also an opportunity to improve the health and well-being of people living on Anglesey and in the wider north Wales area, for example by reducing levels of deprivation.

Housing Fund

5.4.83 Horizon will provide housing funds through the draft DCO s.106 agreement which will be flexible and could be used to:

- incentivise provision of new housing, especially affordable housing;
- augment IACC's existing empty homes programme and bring vacant properties back into use;
- encourage provision of more latent accommodation;
- fund measures to improve the function of the housing market – though helping people downsize or support rent deposits for example; and
- fund IACC officer time to deal with any increase in homelessness.

Welsh language and culture

5.4.84 Horizon is already contributing to the vitality of the Welsh language and culture by supporting a series of local events and initiatives and also by means of incorporating the Welsh language as an important aspect of working life, education and community services.

5.4.85 The significant employment opportunities offered during the construction phase is expected to reduce out-migration of young people resulting in a beneficial effect on Welsh language and culture. Around half of the local construction workforce speaks Welsh. Significant numbers of Welsh speakers are therefore expected to gain employment through the Wylfa Newydd DCO Project during construction.

5.4.86 The permanent, high-quality job opportunities offered during operation would also have a beneficial effect on Welsh language and culture as 85% of the operational workforce would be local people.

5.4.87 Additional spend in the local economy, representing a beneficial effect for local businesses in north Wales, would have a beneficial effect on businesses owned by Welsh speakers or providing services through the medium of Welsh.

5.4.88 Safeguarding the provision of local services, through increased demand during construction and operation, contributes towards sustainable communities, where Welsh language and culture forms part of the social fabric of communities.

Biodiversity and environmental

5.4.89 The overarching aim of the Landscape and Habitat Management Strategy (Application Reference Number: 8.16) is to deliver a net biodiversity benefit by restoring, creating, enhancing and providing for the ongoing management of habitats within the WNDA.

5.4.90 The proposals for the Off-site Power Station facilities will deliver a long term benefit through reducing flood risk on the site by the introduction of a swale.

5.4.91 A major beneficial effect would be the remediation of contaminated land across the WDNA, which would benefit those using or accessing the site in future.

Recreation

5.4.92 There will be an increase in the recreational amenity of new footpaths compared to baseline conditions as a result of the provision of routes suitable for wheelchair users, picnic areas, interpretation boards and a nature trail.

Summary

5.4.93 The strategic case for a new nuclear power station at Wylfa was assessed by the UK Government. The site at Wylfa was included within NPS EN-6 [RD6] as a potentially suitable location for new nuclear power, having satisfied the Strategic Siting Assessment process [RD16]. The ministerial statement on Energy Infrastructure (Written Statement December 2017) [RD25] states that the Government continues to give its strong in principle support to project proposals at those sites listed.

5.4.94 The Wylfa Newydd Project will deliver important benefits to the UK as a whole, including providing a vital role in the provision of safe and secure low-carbon electricity supplies for which there is a nationally recognised and urgent need.

5.5 Test (d)

Alternative options

Alternatives to nuclear and large-scale electricity generation

5.5.1 Within the Overarching National Policy Statement for Energy EN-1 (NPS EN-1) [RD12] the UK Government has considered the alternatives to the need for new large-scale electricity generation infrastructure (including nuclear power), including reducing overall demand, more intelligent use and additional interconnection of electricity systems. NPS EN-1 concludes that, although all of the above measures should and will be actively pursued, their effect on decreasing the need for new large-scale energy infrastructure will be limited, particularly given the likely increase in demand for electricity for domestic and industrial heating and transport.

5.5.2 NPS EN-1 states in paragraph 3.3.4 that: "There are benefits of having a diverse mix of all types of power generation. It means we are not dependent on any one type of generation or one source of fuel or power and so helps to ensure security of supply. In addition, as set out briefly below, the different types of electricity generation have different characteristics which can complement each other:

- fossil fuel generation can be brought on line quickly when there is high demand and shut down when demand is low, thus complementing generation from nuclear and the intermittent generation from renewables. However, until such time as fossil fuel generation can effectively operate with Carbon Capture and Storage, such power stations will not be low carbon;
- renewables offer a low carbon and proven (for example, onshore and offshore wind) fuel source, but many renewable technologies provide intermittent generation; and
- nuclear power is a proven technology that is able to provide continuous low carbon generation, which will help to reduce the UK's dependence on imports of fossil fuels. Whilst capable of responding to peaks and troughs in demand or supply, it is not as cost efficient to use nuclear power stations in this way when compared to fossil fuel generation." [RD12]

5.5.3 In October 2017, the Department for Business, Energy & Industrial Strategy's (BEIS) Clean Growth Strategy [SUP-RD4] confirmed the Government's continued support for growing low carbon sources of electricity, specifically including a continued commitment to nuclear energy.

5.5.4 NPS EN-1 states in paragraphs 3.5.1 and 3.5.2 that: "For the UK to meet its energy and climate change objectives, the Government believes that there is an urgent need for new electricity generation plant, including new nuclear power. Nuclear power generation is a low carbon, proven technology, which is anticipated to play an increasingly important role as we move to diversify and decarbonise our sources of electricity" [RD12, paragraph 3.5.1].

5.5.5 “It is Government policy that new nuclear power should be able to contribute as much as possible to the UK’s need for new capacity” [RD12, paragraph 3.5.2]

5.5.6 NPS EN-1 states in paragraph 3.1.3 that: “The IPC [now Planning Inspectorate and the Secretary of State] should… assess all applications for development consent for the types of infrastructure covered by the energy NPSs on the basis that the Government has demonstrated that there is a need for those types of infrastructure and that the scale and urgency of that need is as described for each of them in this Part”. [RD12].

5.5.7 The UK Government’s continued support for new nuclear power generation is set out in the Ministerial Statement which states that "new nuclear power stations have an important role to play", "nuclear is vital to our energy mix", and that the UK Government "believes that it is important that there is a strong pipeline of new nuclear power to contribute to the UK's future energy system".

5.5.8 The Ministerial Statement is clear that "Government is confident that both EN-1 and EN-6 incorporate information, assessments and statements which will continue to be important and relevant for projects which will deploy after 2025, including statements concerning the need for nuclear power – as well as environmental and other assessments that continue to be relevant for those projects."

5.5.9 The UK Government also reaffirmed its commitment to nuclear power in the Government Response: Consultation on the Siting Criteria and Process for a New National Policy Statement for Nuclear Power with Single Reactor Capacity Over 1 Gigawatt Beyond 2025 (July 2018), which provides that the "Government continues to believe that nuclear has an important role to play in the UK's energy future as we transition to the low-carbon economy".

5.5.10 The policies presented in NPS EN-1 are relevant to inform the first consideration of strategic alternatives to the Wylfa Newydd Project, when considering alternatives to nuclear and large-scale electricity generation.

5.5.11 Alternative technologies are available that have equivalently low-carbon emissions to nuclear (e.g. wind and solar), however it is unclear how these alternatives could meet future energy needs. As noted in paragraph 5.4.35, up to 70GW of dispatchable resources (generation, storage, flexible demand, interconnectors) are needed in 2040 to meet peak demand during periods of low wind and solar generation (p4) [RD28].

5.5.12 As noted in paragraph 5.4.36, NAO [RD23] concludes that the intermittency and unreliability of renewables pose issues in termns of their adequacy and efficacy in bridging the capacity shortfall, even in the long-term.

5.5.13 It is unclear whether electricity storage represents a viable option for overcoming these issues. Bloomberg notes that batteries and flexible demand technologies are not currently able to shift energy across weeks or months due to their economics and characteristics. Demand cannot be deferred for weeks, and the sheer scale (and cost) of batteries needed for seasonal storage would be prohibitive (p78) [RD28]

5.5.14 The government recognises that there are technical and commercial barriers to deploying other technologies that produce the same annual generation as that of nuclear power [RD25]. In order for large-scale solar and onshore wind to produce the same amount of electricity provided by [Hinkley Point C], there would be significant upgrades to the grid required as well as increased costs to keep the system in balance [RD30].

5.5.15 National Grid's 'Two Degree' scenario assumes that 74GW of low-carbon generation will be available from 2025, including carbon capture and storage, hydropower, wind, solar and other renewables [RD24] (but excluding nuclear and interconnectors to allow comparison with other quoted figures). However, HM Treasury [RD31] concludes that only 48GW of low-carbon generation will be available by these dates, implying a 26GW gap in the required low-carbon capacity. Currently planned interconnector projects may account for 12GW of this shortfall, but even if all of these operate on time, a 14GW capacity gap remains.

5.5.16 In the absence of proven equivalently low-carbon alternatives, BEIS's Energy and Emissions Projections assume that two to three new nuclear reactors will be commissioned between 2028 and 2032 in addition to the Hinkley Point C plant (which is currently expected to commence operation in 2025). The ministerial statement on Energy Infrastructure (Written Statement December 2017) [RD10] makes it clear that the assessment of need for nuclear power, and that this need is urgent, presented in NPS EN-1 and EN-6 remains valuable and relevant.

Strategic alternative to the Wylfa Newydd Development Area site location

5.5.17 A summary of the strategic case for the Wylfa Newydd Project and how all reasonable alternatives were considered is given below. Further information is presented in Volume D2 (alternatives and design evolution) (Application Reference Number: 6.4.2). This presents the alternative solutions and locations considered for the relevant project elements of WNDA Development.

5.5.18 NPS EN-6 [RD15] (specifically covering nuclear power generation) states the view of the UK Government that the Wylfa NPS Site is potentially suitable for the deployment of a new nuclear power station. A Government site selection assessment [RD16] recommended the Wylfa NPS site on Anglesey as it has adequate space for the development of a new nuclear power station, an existing National Grid connection and hard rock foundations. It is sufficiently high above sea level to avoid serious flood risk and has good access to seawater for cooling purposes. The nuclear heritage of the Existing Power Station on Anglesey and Trawsfynydd in nearby Snowdonia has given rise to a strong skills and knowledge base necessary for the construction and operation of a new nuclear power station on Anglesey.

5.5.19 Energy Wales: a low carbon transition [SUP-RD2] provides unambiguous support for the Wylfa Newydd Power Station. It states that "The Welsh Government supports the development of a nuclear power station on Anglesey. This development also offers significant long-term economic

benefits to Anglesey and North Wales in general. The development of the Horizon nuclear new build (Wylfa B) [Wylfa Newydd DCO Project] is a vital component of not just the Anglesey Energy Island programme but of our wider energy future in providing a constant energy source to complement the intermittency of renewable sources. There are undoubtedly risks associated with nuclear power, but the risks posed by climate change are now so serious that we cannot dispense with a proven low-carbon technology".

5.5.20 As the SSA considered alternative sites for new nuclear power stations and led to NPS EN-6 identifying the Wylfa NPS site, this fulfils the requirement in relation to consideration of strategic alternatives as part of test (d).

5.5.21 It was determined that its proximity to Tre'r Gof SSSI, a site of national importance should not prevent the site from being considered potentially suitable but identified Tre'r Gof SSSI as an area which would require further consideration.

5.5.22 The siting and layout of the main plant was selected on the basis of the following considerations:

- It creates a compact development envelope, thereby limiting landscape and visual impacts, and positions the Units within the Wylfa NPS site.
- The area in the largest uninterrupted and constrained space close to the Existing Power Station – the nearest constraints are Cestyll Garden and Anglesey AONB to the west.
- A large part of the area in the lowest lying land within the Wylfa NPS site. This is important for setting the Power Station development platform levels, which need to be optimised relative to sea level to minimise cooling water pumping costs (subject to flood level constraints arising from pluvial, fluvial or tsunami scenarios and excavation costs).
- The area is on the south side of the Existing Power Station to Cemaes and is partially screened from Cemaes but the existing topography, the Existing Power Station and its associated landscaping mounds.
- It avoids utilising land within the Tre'r Gof SSSI and Wylfa Head, thereby limiting adverse effects on the sensitive ecological receptors, and the pre-existing Dame Sylvia Crowe landscaping mounds (which screen the Existing Power Station).
- It provides access to cooling water directly from the Irish Sea, for intake and discharge.
- It reduces interference with the access route to the Existing Power Station, which assists in enabling Horizon's proposals to coordinate with the planned decommissioning of the Existing Power Station.
- It maintains the potential for National Grid to continue using the existing 400kV overhead transmission lines and substations.
- The orientation optimises the grid connection and circulating water connections between the intake, condenser and outfall.

5.5.23 In terms of alternatives, Horizon considered locating the main plant to the south-east or east of the Existing Power Station. These options were ruled out because they would:

- be closer to, or encroach on, the Tre'r Gof SSSI, which could result in adverse impacts on its hydrological regime and/or ecology;
- be closer to the villages of Cemaes and Tregele, which could result in adverse noise and vibration and landscape and visual impacts for residents;
- be further away from the existing National Grid substation;
- requires rerouting of the existing 400kV overhead transmission lines;
- be further away from the source of cooling water; and be further away from pre-existing cooling water infrastructure (associated with the Existing Power Station).

Design-related alternative options

5.5.24 Only alternatives that meet or deliver the Project need and objectives are considered further. That is, would the alternative deliver against the urgent need for new nuclear power in order to help meet the requirement for 59GW of new build electricity capacity by 2025?

5.5.25 The design-related alternatives relevant to effects on saline intrusion and the Tre'r Gof SSSI in the Ynys Môn Secondary groundwater body are outlined in table 5-4. Figure 5-3 to figure 5-6 provide information on key locations and the landform and landscape setting to support the description of options outlined in table 5-4.

5.5.26 The series of design based alternatives were considered in tandem with the design process, the EIA and consultation processes, construction method evolution and, temporary infrastructure requirements. These are documented in:

- Site Selection Reports - Volume 2 – Wylfa Newydd Development Area. (Application Reference Number: 8.24.2).
- Design and Access Statement – Volume 2 – Power Station Site. (Application Reference Number: 8.2.2).
- Phasing Strategy (Application Reference Number: 8.29).
- Volume D2 - Alternatives and design evolution (Application Reference Number: 6.4.2).
- Environmental Statement chapters including surface water and groundwater (Application Reference Number: 6.4.8) and terrestrial and freshwater ecology (Application Reference Number 6.4.9).
- Environmental Statement appendix D8-7 (Application Reference Number: 6.4.32).

5.5.27 The alternatives identified and addressed in table 5-4 which relate to the potential deterioration of the Ynys Môn Secondary groundwater body with respect to saline intrusion from dewatering of deep excavations are:

- Location, depth and sequencing of excavations for Unit 1 and Unit 2. This is on the condition that all design related alternatives would be within the Wylfa Newydd Development Area in accordance with NPS EN-6 [RD15].
- Location and depth of the Cooling Water intake. A series of locations for the Cooling Water intake were subject to option appraisals and design assessments [RD34, RD35, RD38].

5.5.28 In relation to the dewatering method of excavations for Unit 1 and Unit 2 a number of options were considered to reduce the amount of groundwater entering the excavation. These options, including artificial ground freezing, vertical grout curtains and low permeability cut-off walls have been considered under test (a) as mitigation measures (see table 5-1). The options relating to the duration and method of achieving long-term dewatering of the deep excavation are considered within table 5-4.

5.5.29 Horizon also considered locating the main plant including Unit 1 and Unit 2 to the east of the Existing Power Station. This option was ruled out because it would be closer to, or encroach on, the Tre'r Gof SSSI. This is clearly a poorer environmental option and was therefore not considered further.

5.5.30 The alternatives identified and addressed in table 5-4 which relate to the potential deterioration of the Ynys Môn Secondary groundwater body with respect to significant damage to the GWDTE of Tre'r Gof SSSI are:

- Location of landscape mounds, in particular Mound A. The overall landform and landscape design has developed in consultation with drainage, geotechnical and earthworks designers and with the IACC and other relevant stakeholders (Application Reference Number 8.16).
- The landform design is the result of a combination of many influencing factors. It represents a balanced solution which provides a landscape setting which reflects the special landscape context, provides effective screening and the successful integration of a large-scale development and removes the need to export or import material during development.
- It has been largely driven by the needs of the brief, an analysis of the site and its wider context and relevant national, regional and local policies. In summary these are to:
  - Provide an appropriate landscape setting for a major development whilst accommodating both constructional and operational needs;
  - Remove the need for removal of excavated material off site, aiming for a cut and fill balance on excavated material;
  - Minimise impacts on designated sites, which includes Tre'r Gof SSSI, Cae Gwyn SSSI and Cemlyn Lagoon SSSI and SAC, Isle of

Anglesey AONB, the North Anglesey Special Landscape area (SLA) and Cestyll Gardens, a registered historic garden;

- Reflect the nature of the local landscape/seascape which is characterised by drumlin landforms;
- Reflect typical local patterns of vegetation;
- Return the land to agricultural use and enhance the biodiversity, amenity and cultural value where possible;
- Minimise noise and visual impacts;
- Aim to achieve 1 in 6 to 1 in 8 slope gradients to facilitate future grazing;
- Reflect relevant national, regional and local planning policy; and
- Reflect the sites physical constraints, (i.e. site boundary, service easements, security requirements).

- The landform design responds to all of the above with a particular focus on following the characteristics of the local landscape and providing effective noise and visual screening. The scale of the earthworks is such that the design will require a major reconfiguration of the existing landscape to accommodate the platform levels for the new buildings and infrastructure.
- The heights and gradients have followed those in the immediate surrounding landscape, where the local drumlin forms (elongated oval-shaped hills) generally range between 30-42m AOD. Slope gradients are not uniform but the existing ones typically range between 1 in 7 and 1 in 22 within the WNDA, with the majority falling between 1 in 8 and 1 in 12. These factors along with the north to north east aligned and broadly oval shaped existing mound profiles, have significantly influenced the landform design to ensure that the final scheme looks and feels at home in its surroundings and is appropriate to the requirements of the local landscape designations which the site falls within or adjacent to.
- There will be five new mounds designed to replicate the local drumlin landscape in accordance with the landscape design philosophy and framework. In respect of the Article 4(7) the discussion focuses on Mound A as this is located within the Tre'r Gof Catchment, although not within the SSSI. Mound B is also considered as it would drain into Tre'r Gof SSSI. The parameters applied to Mounds C, D and E are intended to satisfy all design criteria but, in doing so, influence the size of Mounds A and B..
- To determine the location of the mounds, potentially available land was considered where the existing landform could best be replicated, environmental assets protected as far as possible, and which provided effective screening.

- The construction of Mounds A and B in the Tre'r Gof Catchment and change to the catchment boundaries, dimensions and steepness resulting in changes to flows was also considered.
- Landscape mounding construction phasing and timing was developed in response to consultation.

5.5.31 Design of Mound A and B, adjacent to Tre'r Gof SSSI, has evolved in tandem with the design process, architectural approach, site levels, temporary infrastructure requirements, construction method evolution, and the Environmental Impact Assessment and consultation process (Application Reference Number 8.16).

5.5.32 Key changes to the landscape and landform design to account for change to site layout and to respond to stakeholders and the public include:

- development of landscape mounding to protect views from Tregele, Cemaes, Cemlyn, the Wales Coast Path, the Isle of Anglesey AONB and Cestyll Gardens, amongst others;
- modifications to the height and gradients of mounds during project optimisation to improve the design and take account of comments from consultees;
- the early completion of Mound A to reduce disruption to the local community;
- the design of the slopes of Mound A facing Cemaes have been modified such that they would be more reflective of the existing conditions; and
- mounding would be seeded, then landscaped at the earliest practical opportunity in order to mitigate ongoing views of construction, stabilise newly created slopes, control surface water runoff and integrate the mounding into the surrounding landscape.

In locating the Site Campus adjacent to mounding surrounding Tre'r Gof SSSI it was considered that there was no significantly better environmental option that could be constructed within the constraints of the Wylfa Newydd Project. The temporary Site Campus development occupies a small proportion of the Tre'r Gof catchment, in comparison to the permanent mounding, which occupies a significant proportion of the catchment. The presence of mounds A and B are therefore considered to drive non compliance of the GWDTE and as such specific design alternatives to Site Campus are not considered further.

[This page is intentionally blank]

Table 5-4 Consideration of design alternatives relevant to the Ynys Môn Secondary groundwater body

Element of the design	Options considered	Technically feasible	Disproportionate cost	Environmental impacts	Decision and justification
Location, depth and sequencing of excavations for Unit 1 and Unit 2	Location Within the constraints of NPS-EN6, Horizon considered locating the deep excavation areas to the south-east or east of the Existing Power Station. These locations would still fall within the Wylfa NPS Site boundary.	A direct and efficient connection between the grid connection and circulating water connections between the intake, condenser and outfall elements, particularly the turbine buildings, reactor buildings and heat exchanger building is an essential safety and functional consideration of the design. The Power Station development platform also needed to be optimised relative to sea level and flood levels as the areas considered (as well as that chosen) comprise the lowest lying land within the Wylfa NPS Site. The alternative sites do not optimise these factors.	The alternative locations for the deep excavation areas could give rise to additional costs which could undermine the economic case for development as a result of: • additional long term Cooling Water pumping costs due to being further away from the source of Cooling Water and from pre-existing Cooling Water infrastructure; and • costs associated with re-routing of the existing 400 kilovolt overhead transmission lines as locations are further from the existing National-Grid substation.	There would be significant environmental impacts compared to the selected site as the alternative sites are closer to or encroach on Tre'r Gof SSSI, and are closer to the villages of Cemaes and Tregele.	The deep excavation is located within the Wylfa Newydd Development Area on the south side of the Existing Power Station. The excavation is partially screened from Cemaes by the existing topography and avoids utilising land within the Tre'r Gof SSSI and Wylfa Head (figure 5-5). The selected location for the Power Station also provides access to Cooling Water directly from the Irish Sea, for intake and discharge. The excavation reduces interference with the access route to the Existing Power Station, which assists Horizon's proposals to coordinate with the planned decommissioning of the Existing Power Station and maintain potential for National Grid to continue using the existing 400kV overhead transmission lines and substation. An excavation base of -18mAOD was selected so that final platform levels remain outside of the extreme flood events. The locations and depths deliver significantly better environmental and cost and safety benefits over locations south east and south west
	Depth (The depth of excavation and therefore extent of dewatering is a function of the platform levels for the Unit 1 and Unit 2 to allow sufficient basement and pads etc. Basement depth is further driven by the design of the cooling water intake under gravity)	The alternative proposed building platform levels were optimised in terms of health and safety. construction methodologies, and environmental implications. They underwent a series of revisions following consultations and technical and design reviews. The critical factors were that minimum site levels (ground elevation) for the buildings / facilities be selected above the height of extreme flood event levels and that the cooling water intake tunnels could operate obtain adequate volume of water under gravity at low velocity to minimise fish entrainment.	The increase in platform and consequent excavation depth from -14m to – 18mAOD increased the overall quantity of material to be excavated during site levelling and grading. However, there were no disproportionate costs in relation to benefit in this respect.	In addition to flood considerations, the design requirement looked to maximise platform levels to reduce the extent of excavation and the need to move significant amounts of excavated material during construction to reduce the environmental effects associated with movement and management of materials.	
	Sequencing The preferred option is for both units to be constructed together within a single excavation. The semi-dry cofferdam in Porth-y-pistyll would be in place for part of the excavation works. The alternative was to undertake excavation in a staged approach with the main part of Unit 2	Although the alternative is technically feasible it was not technically preferred. Given the scale of the engineering and construction operations it is preferable to carry out construction of the units together within a single excavation.	The alternative construction option where excavation is phased would significantly extend the build timescale of the project and the date when the commissioning of reactors can commence and would therefore be more expensive.	There are environmental benefits to reducing the length of time that excavation would be open.	

Element of the design	Options considered	Technically feasible	Disproportionate cost	Environmental impacts	Decision and justification
	excavations (involving blasting) being completed before construction of Unit 1 can commence.				
Duration of dewatering of the deep excavation.	Duration and method of achieving long-term dewatering of the deep excavation throughout operation. Options considered were continuation of pumping during Power Station operation or sealing of basements and cessation of pumping once construction has been completed.	It was determined that it is technically feasible to only dewater during construction and that long term dewatering during operation could be avoided with the use of passive drainage at 6mAOD.	No	Reduced energy requirements of only dewatering during the construction phase compared to during both construction and operation.	Dewatering would be restricted to the construction period after it was identified that a design was possible which allowed operational passive drainage and no dewatering. This solution reduced the environmental impacts and costs.
Location and depth of the Cooling Water intake. Note the location of the Cooling Water System is also considered in The Skerries water body in relation to the effects on morphological conditions (see table 6-2). The key aspects of this design element for the Ynys Môn Secondary water body are the general location (onshore/offshore) and depth. Options for the cooling water intake also influence the depth of the basements	Location Onshore Cooling Water intake (preferred) and offshore Cooling Water intake options.	Technically feasible although offshore locations would involve: • design and construction of long marine tunnels; • technically more involved requirement to install and maintain the intake structures; and • increased health and safety risks.	Selection of an offshore option would involve significantly increased construction cost and programme due to excavation of Cooling Water tunnels offshore and the increased distance from the Cooling Water intake.	Selection of an offshore option would widen the impacts of the Cooling Water intake compared to an onshore intake including: • increased seabed footprint; • increased volume of material excavated underwater; • potential requirement for underwater blasting; • increased habitat loss from seaward infrastructure; • requirement to biocide extensive offshore sections of the system, resulting in decreased survival of entrapped fish and other marine species; and • less opportunity to control intake velocities to limit the entrapment of fish and other marine species. Modelling identified that the chosen location and associated local dewatering would not contribute to saline intrusion.	An onshore Cooling Water intake was selected, located on the Porth-y-pistyll foreshore as the preferred location. It was deemed that the chosen onshore location would provide a number of advantages over offshore options, including: • no or limited marine tunnels; • no requirement to install and maintain offshore intake structures; • reduced seabed footprint; • limited seaward construction activities; • reduced construction cost and programme, • reduced requirement to biocide extensive offshore sections of the system; • reduced health and safety risks; and • no contribution to saline intrusion. Therefore, an offshore Cooling Water intake is not considered to be a better environmental option.
Landscape mounds In respect of the Article 4(7) derogation the entry focuses on	Location Extend mounding into adjacent catchments and change catchment	Mounding drumlins are part of the core design concept based on restoring the surrounding landscape to agricultural use, reflecting the existing open, rolling, drumlin	Given the core design principles, and the need to maintain the mound locations within the Wylfa Newydd Development Area, there were no major disproportionate	Extending the mound into adjacent catchments to Tre'r Gof SSSI would not follow the guiding landscape design concept.	The chosen location of Mound A is the result of a combination of many influencing factors and represents a balanced solution.

Element of the design	Options considered	Technically feasible	Disproportionate cost	Environmental impacts	Decision and justification
Mound A and to a lesser degree Mound B as these are located within the Tre'r Gof Catchment. Other mounds are not considered.	boundaries (see figure 5-4, figure 5-5 and figure 5-6).	landscape (elongated oval-shaped hills) of the surrounding area to embed the permanent site into its context and create a framework within the main site islands. They also allow sustainable local reuse of excavated materials within the Wylfa Newydd Development Area. Mound A is part of a series of five main drumlins, ranging in height from 25m to 42mAOD, with gradients of approximately 1:8 to 1:10. The drumlin landforms are predominantly orientated to the northeast. A sixth drumlin landform up to 40mAOD, Dame Sylvia Crowe's mound, was a feature created for the Existing Power Station (figure 5-3). The heights and gradients follow the dimensions of regional drumlins with a north/northeast alignment within 2km of the Wylfa Newydd Development Area. As such most available locations in the area were technically feasible for mounding.	costs associated with the alternative locations although if insufficient locations were found such that there would be a negative earthworks balance, there would be extensive landfill disposal costs. The selected location for Mound A may incur costs due to the requirement for very detailed drainage mitigations to support Tre'r Gof SSSI, but is not considered to be disproportionately costly given that this is a better environmental option (see explanation in adjacent column).	The alternative sites did not maximise the opportunity for mounding within the Wylfa Newydd Development Area to deliver coordinated environmental mitigation and enhancement measures to the Power Station Site in relation to: • avoiding sensitive environmental features; • maximising visual screening; • delivering effective noise screening; and • replicating the existing landscape. The chosen location of Mound A was largely determined, controlled and affirmed through consultation to: • avoid encroaching on Tre'r Gof SSSI with buffer zones to allow surface water flow into the SSSI to be managed appropriately; • achieve visual and noise screening of the Power Station from Tregele and Cemaes; • screen low-level buildings and soften views of the Power Station from the east; and • reflect the existing contours/slope profiles as far as possible on the SSSI-facing slopes.	It maximises utilisation of available land taking into account the required buffer zones around Tre'r Gof SSSI, to provide a landscape setting which reflects the special landscape context. A natural gradient would be applied to the outward-facing slopes of the landscape mound to reflect the existing drumlins and to soften views of the development. It provides a high quality setting for operation of the Power Station. Once complete it provides effective screening of construction noise sources located around the Power Station Site for properties at the western edge of Cemaes. The proposed mound location would use natural resources efficiently by retaining excavated material on-site. The design proposal avoids the creation of overbearing mound forms adjacent to Cemaes, with heights and profiles more reflective of the existing conditions. Measures incorporated into the Mound A landform design include: • the creation of buffer zones from the edge of Tre'r Gof SSSI boundary to allow surface water flow in to the SSSI to be managed appropriately; and • reflecting the existing contours/slope profiles as far as possible on the SSSI-facing slopes and the existing characteristics of land cover, soil quality and vegetation as far as possible.
	Construction phasing and timing A number of construction mound phasing alternatives were considered with regard to the landscape.	There were few significant technical feasibility barriers to the phasing alternatives other than the need to protect Tre'r Gof SSSI in terms of water management.	There are no disproportionate costs associated with the various mound options.	Early completion of the slopes facing the Cemaes are considered essential in order to reduce disruption to the local community. The slopes facing Tre'r Gof SSSI would also be prioritised.	The preferred option is for early completion of Mound A particularly the slopes facing Cemaes and Tre'r Gof SSSI.

[This page is intentionally blank]

Figure 5-3 Location of Dame Sylvia Crowe's mound

Figure 5-4 Surface water catchment areas and watercourses

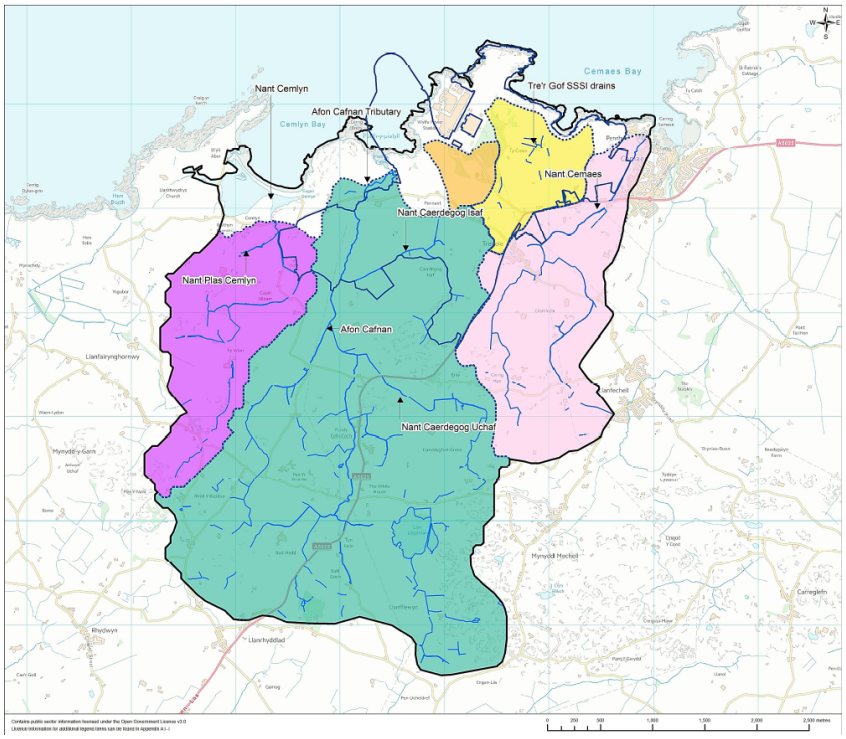
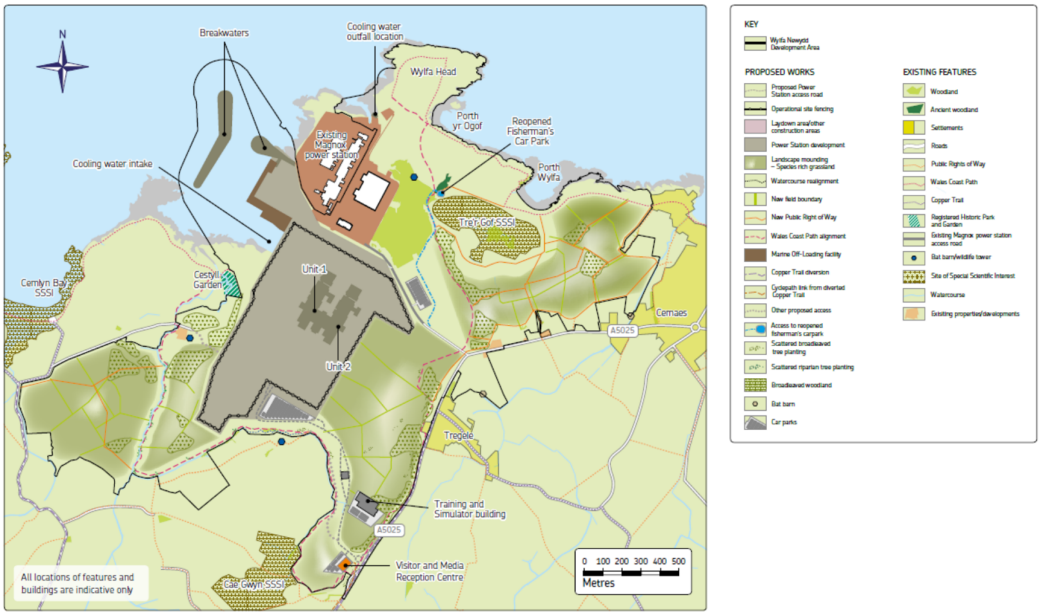


Figure 5-5 Illustrative view of landform looking north towards Wylfa Head

Figure 5-6 Landscape setting - Pre-Application Consultation Stage Three



6 Information to support Article 4(7) derogation criteria assessment for The Skerries water body

6.1 Introduction

6.1.1 This section of the report provides the information in relation to derogation for The Skerries water body and is split into the information relevant to each test of Article 4(7) from (a) to (d).

6.2 Test (a)

6.2.1 A description of all of the mitigation measures that were considered in relation to the effects on hydromorphology and marine benthic invertebrates for The Skerries water body, is presented in table 6-1.

6.2.2 The full rationale for the acceptance or rejection of mitigation is presented in Appendix 1.

6.2.3 The reduction in quality of the marine benthic invertebrate quality element is considered intrinsically linked to the pathways of effect described by the hydromorphology. Therefore, the mitigation listed is appropriate for both hydromorphological and marine benthic quality elements.

[This page is intentionally blank]

Table 6-1 Mitigation measures considered in relation to hydromorphology and marine benthic invertebrates for The Skerries water body. Full table is presented in Appendix 1. Mitigation measures related to both hydromorphology and marine benthic invertebrates unless otherwise stated.

Ref	Design	Construction	Operation	Mitigation measure	Description	Is the mitigation measure technically feasible?	Level of uncertainty associated with the mitigation measure	Would the mitigation measure be disproportionately costly?	Potential impacts of the mitigation measure	Mitigation measure included?
S1	✓			The footprint of the breakwaters, Cooling Water Intake and Outfall structures, temporary causeway, including associated dredging activities will be designed to be as small as practicable (whilst meeting operational requirements).	The aim is to ensure that the structures are sufficiently large to perform the required role, but no larger than necessary.	Yes	Low	No	None. The measure would avoid impacts to marine habitats.	Design and Access Statement - Volume 2 - Power Station Site
S2	✓			Dredging of soft sediments in Porth-y-pistyll will be restricted to the area identified in the dredging plan and the duration will be shortened as far as practicable, in order to minimise the release of suspended solids and sediment bound contaminants.	This mitigation would ensure only the targeted areas of intertidal habitat that would be lost.	Yes	Low	No	None. The measure would avoid impacts to marine habitats.	Design and Access Statement - Volume 2 - Power Station Site
S3		✓		Provision of marine ecological enhancement measures in suitable locations unconstrained by engineering design and functionality. 80 precast vertical rockpools will be installed at various heights on the MOLF wall (initial installations will be immediately following construction of the MOLF, with final installations occurring at the end of Main Construction); • 10 precast rockpools will be installed in armour rock on the western breakwater; • areas of armour rock (including the harbour side of the western breakwater, and any rock revetment) will be seeded with natural rock won from the site, where practicable (alternatively, imported material akin to natural rock will be used); • ecological enhancement of 16m3 precast concrete units on the breakwaters, to include textured surfaces; • retaining surface roughness within	To enhance the development of biodiversity and biomass on artificial structures and to create new additional intertidal habitat on the permanent marine structures. The purpose of marine ecological enhancement measures would be to increase surface and structural heterogeneity, encouraging the colonisation of native marine species and the establishment of diverse and productive intertidal and subtidal habitats within the	Yes, although it is noted that there are only certain locations where this measure can be implemented due to technical (engineering) constraints related to the integrity of structures.	Low. There is some uncertainty about the degree to which ecological enhancements will result in an increase in colonisation and productivity of marine flora and fauna.	No. This would be determined by the extent of ecological enhancements required but some enhancements can be incorporated at relatively low cost.	Non-native species could potentially colonise ecological enhancement units. However, with consideration of the design and placement of units this would not lead to an increase in either the likelihood of establishment of non-native species that are not currently present in the area, or an increase in the abundance and/or distribution of non-native species that are currently present.	Marine Works sub-CoCP

Ref	Design	Construction	Operation	Mitigation measure	Description	Is the mitigation measure technically feasible?	Level of uncertainty associated with the mitigation measure	Would the mitigation measure be disproportionately costly?	Potential impacts of the mitigation measure	Mitigation measure included?
				the dredged area to promote recolonisation; • seeding or transplanting of marine kelp of subtidal areas; • a monitoring programme to assess the effectiveness of the enhancement measures against a suite of clearly defined ecological objectives; and • provision of relevant monitoring data to local schools and universities to promote ecological enhancement of the marine environment.	footprint of the Marine Works.					
S4		✓		Implementation of a monitoring programme for the marine ecological enhancement measures and permanent structures. The aim will be to determine the success of habitat enhancement by monitoring. the colonisation of new structures, this will allow adaptive management.	To monitor the success of the marine ecological enhancement measures against a set of ecological objectives agreed with the IACC in consultation with NRW. This information will be used to inform the decision to implement further ecological enhancement if necessary, with the dual purpose of facilitating academic research and the development of an evidence base demonstrating the commercial application of ecological enhancement as mitigation for effects to benthic habitats and species.	Yes	Low	No	None	Marine Works sub-CoCP Wylfa Newydd CoCP

Ref	Design	Construction	Operation	Mitigation measure	Description	Is the mitigation measure technically feasible?	Level of uncertainty associated with the mitigation measure	Would the mitigation measure be disproportionately costly?	Potential impacts of the mitigation measure	Mitigation measure included?
S5		✓		Removal of hard engineering structures or modification of existing structures. Hydromorphology only.	Removal of other structures in The Skerries water body could reduce the net loss of the intertidal zone.	No. There are no known existing structures within The Skerries water body.	N/A	N/A as no structures identified.	N/A	No
S6		✓		Indirect/offsite mitigation (offsetting measures).	Creation of new intertidal habitat to replace the habitat lost in a different location but still within The Skerries water body.	Yes. It is technically feasible to create new rocky intertidal habitat. However, it is not considered feasible to create new sedimentary habitats within The Skerries water body. The habitats that would be lost are predominantly muddy/sandy sediment which would be very difficult to create in a sustainable manner along the existing naturally rocky coastline.	Low. Experience in the UK of rocky habitat creation has demonstrated its feasibility.	This would depend on the extent and location of habitat creation.	Creation of littoral rock habitat (e.g. an artificial rocky reef) would result in further losses of natural intertidal or subtidal habitat. This could result in additional pressure on hydromorphological quality elements within the water body which could lead to deterioration in status.	No, due to the potential impacts of the measure which could lead to further deterioration.
S7		✓		Replace hard shoreline protection with soft engineering. Hydromorphology only.	In the areas where hard shoreline protection is proposed, seek an alternative softer approach.	No. Soft engineering options (e.g. salt marsh or dunes) would not provide the required protection.	N/A	N/A	N/A	No

[This page is intentionally blank]

6.2.4 A number of mitigation measures listed in Table 5-2 were rejected. These relate specifically to the hydromorphological condition of the Skerries.

S5 Removal of hard engineering structures

6.2.5 This mitigation measure is considered technically infeasible as there are very limited opportunities to remove other hard infrastructure within the Skerries waterbody. Infrastructure associated with the Magnox site remains operational. Environmental and cost benefits have therefore not been assessed.

S6 Indirect/offshore mitigation (offsetting)

6.2.6 The creation of intertidal habitat to replace that lost from the development is technically feasible and there is a high certainty, given the experience in the UK of habitat creation. The creation of intertidal habitat is not considered scaleable to the project need, Littoral rock habitats can be created within the waterbody, however this would be at the expense, and further loss, of either natural intertidal or subtidal habitats. Intertidal soft sediments represent the majority of habitat lost from the marine construction activities, however, there are limited opportunities to recreate this habitat type within the Skerries waterbody given the generally exposed shorelines around the north and western coastline of Anglesey. As a result no significant environmental benefit is anticipated from indirect/offshore mitigation (offsetting) within the Skerries waterbody and therefore no assessment of cost is made.

S7 Replace hard shoreline protection with soft engineering

6.2.7 The potential to replace hard shoreline protection with soft engineering approaches is considered technically infeasible at a project scale. Shoreline protection materials, associated with design elements, are required to meet safety and security standards that would not be met through the use of soft engineering options. Alternatives to the proposed structures, beyond ecological enhancements secured through S3, do not meet the required levels of protection for a coastal power station site. Environment and cost benefits have not be presented for this mitigation measure, which is not considered technically feasible.

6.3 Test (b)

6.3.1 The steps that would be taken to meet test (b) are outlined in section 5.2.3 and are relevant to both The Skerries and the Ynys Môn Secondary groundwater bodies.

6.4 Test (c)

6.4.1 The case for Overriding Public Interest is presented in section 5.4.

6.5 Test (d)

Alternative options

6.5.1 A summary of the strategic case for the Wylfa Newydd Project and how all reasonable alternatives were considered is provided in section 5.5 and Appendix A. This presents the alternative solutions and locations considered for the Wylfa Newydd Development Area.

Design-related alternative options

6.5.2 The design-related alternatives relevant to effects on morphological and marine benthic invertebrate conditions for The Skerries water body are outlined in table 6-2. The full rationale for rejection or acceptance of alternatives is presented in Appendix 2.

6.5.3 One of the key decisions which informed the development of alternative options involved consideration of alternative means for transporting materials. The Wylfa Newydd Project has significant requirements in terms of the transportation of Abnormal Indivisible Loads (AIL) and bulk materials. The *Site Development. Heavy Route and MOLF Strategic Study* report [RD33] summarises the design options review that was undertaken to identify the preferred method for transportation of AIL and bulk material covering various land (road, rail) and/or sea transport options.

6.5.4 Section 5.13 of NPS EN-1 sets out the traffic and transport policies that should be considered when developing a DCO application and states that *"Water-borne or rail transport is preferred over road transport at all stages of the project, where cost-effective"* [RD12]. The Department of Transport also operates a policy to encourage the transportation of AIL away from roads and rail and towards marine solutions. Considering this policy together with technical feasibility, costs and environmental impacts, it was determined that delivery of AIL and bulk material to the Wylfa Newydd Development Area via a MOLF was the preferred option. Of the transportation alternatives examined, none were considered to represent a significantly better environmental option.

6.5.5 Several option reviews were undertaken to identify the preferred locations for key structures including the Cooling Water intake and associated structures (e.g. breakwaters), Cooling Water outfall, MOLF, each capturing evolution of the Project design [RD34, RD35]. A total of fifteen locations for the Cooling Water intake were identified over the course of the reviews; all of which were considered to be technically feasible and of proportionate cost (see figure 6-1 and table 6-2).

6.5.6 A separate study was carried out to consider suitable locations for a MOLF which identified four sites within the Wylfa Newydd Development Area [RD36] (figure 6-1). The sites to the east of Wylfa Head were discounted due to operational issues and the potential effects on terrestrial features, leaving the two options within Porth-y-pistyll (see figure 6-1 and table 6-2).

6.5.7 The preferred options for the Cooling Water intake and MOLF were considered in relation to a number of criteria including cost, safety, sustainability, constructability, operability and environmental impacts. Taking into account the outcomes of the separate studies for the Cooling Water intake and MOLF it was felt that there would be significant benefits of co-locating infrastructure to reduce the environmental impacts and footprint of the works [RD37].

6.5.8 There would be two breakwaters extending out into Porth-y-pistyll that would provide protection and create acceptable wave conditions for operation of the Cooling Water System; referred to as the western breakwater and the eastern breakwater (see figure 6-2). The breakwaters would also provide sheltered conditions for vessels accessing and berthing at the MOLF. Various design alternatives for the breakwaters have been considered including the optimum length and orientation of breakwaters and the need for breakwaters to attach to land. The design was informed by environmental assessment including the following considerations.

- The footprint on the seabed: a reduction in the size of the breakwater from 500m to 400m was investigated to ensure that the breakwater could still perform its primary function of protecting the Cooling Water intake whilst reducing its footprint.
- The form of the breakwater: wave climate studies have been carried out to assess the effects of wave refraction from the breakwater on the nearby Esgair Gemlyn.
- Effects on water quality: the western breakwater was designed with a gap between the southern tip and the land to maintain appropriate hydrodynamic flows and allow mixing within Porth-y-pistyll.
- Position of the western breakwater: this was carefully considered to ensure migratory fish species such as European eel and sea trout are not prevented from entering and leaving freshwater habitat in the Afon Cafnan.

[This page is intentionally blank]

Figure 6-1 Alternative options for the Cooling Water intake and outfall and the Marine Off-Loading Facility

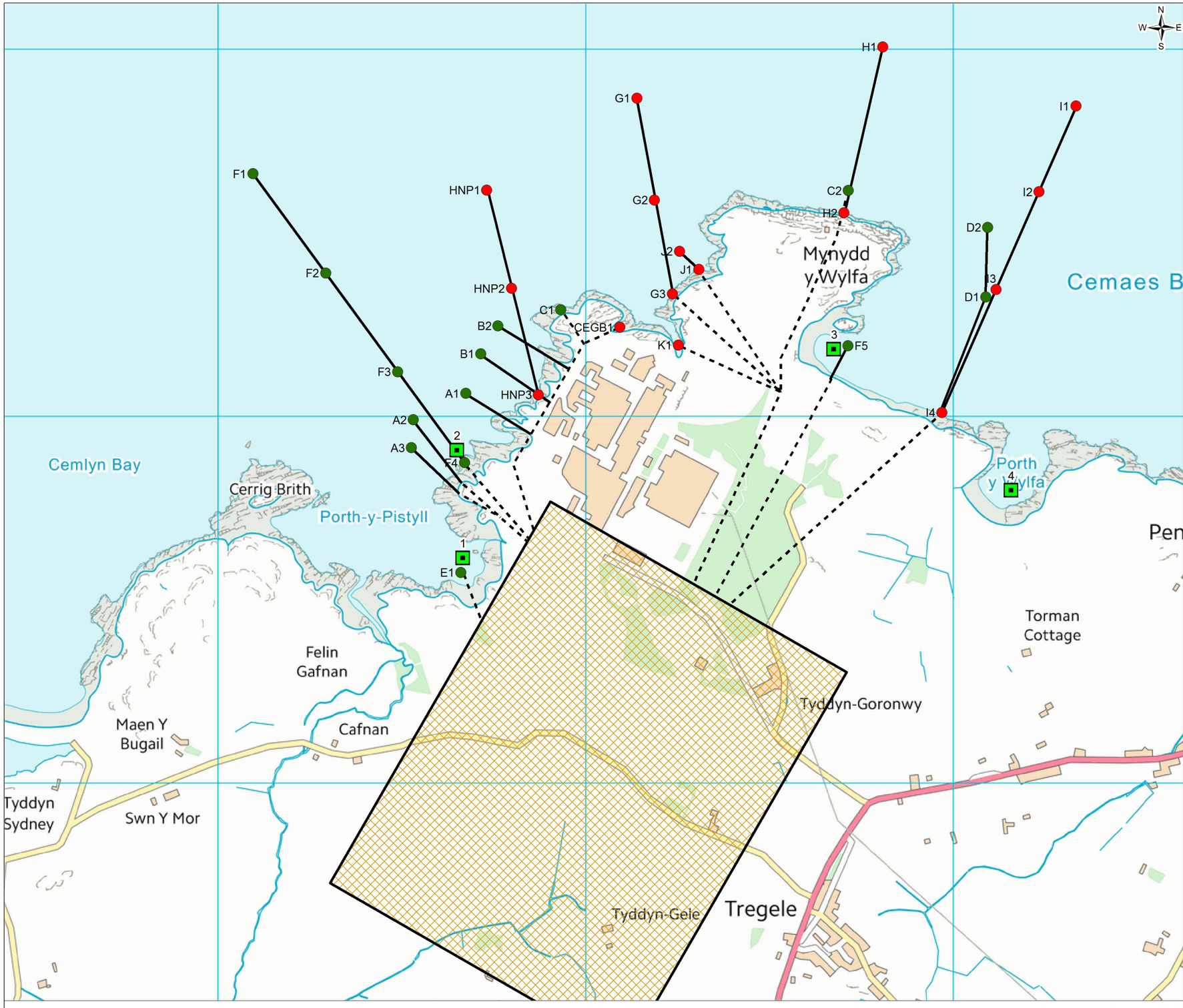


FIGURE 6-1

Legend

- Power Station (approximate location)
- Marine Off-Loading Facility options
- Cooling Water intake options
- Cooling Water outfall options

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1.0	MAR 18	DCO submission	HNPWL	HNPWL	HNPWL	HNPWL

Client: HORIZON NUCLEAR POWER

Project: WYLFA NEWYDD PROJECT
ARTICLE 4(7) DEROGATION

Drawing Title: ALTERNATIVE OPTIONS FOR THE COOLING WATER INTAKE AND OUTFALL AND THE MARINE OFF-LOADING FACILITY

Scale @ A3	1:10,000	DO NOT SCALE
Jacobs No.	60PO8077	
Client No.		

Drawing No.: 60PO8077_DCO_D_APP_08_07_06_01

Figure 6-2 Indicative layout for the construction of marine facilities

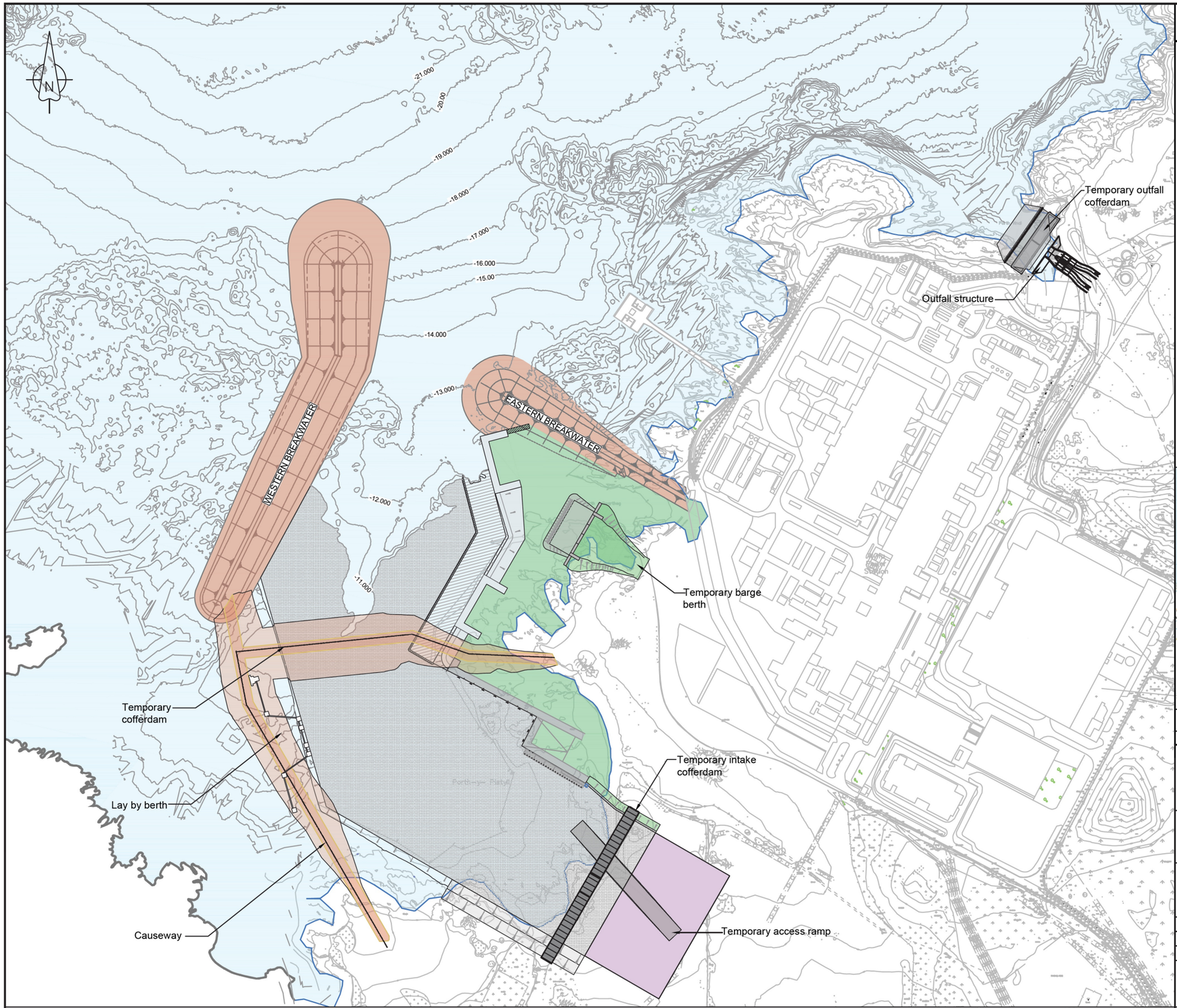
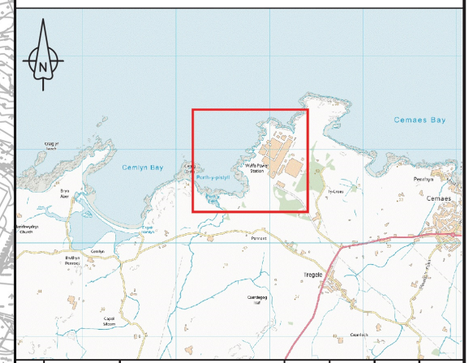


FIGURE 6-2

LEGEND

- Seawater
- Reclaimed ground
- Breakwater
- Intake area
- Dredged area to -10m AOD
- MOLF dredged to -11.9m AOD
- Slope between the dredged area and the natural seabed
- Mean high water

NOTE:
This figure is intended for illustrative purposes only; the locations, sizes and layouts of the facilities and construction areas shown are approximate. Design evolution is ongoing and certain elements shown, such as the temporary cofferdam, will be subject to change. For further details, refer to Chapter D1 of the Environmental Statement.



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1.0	MAR 18	DCO submission	HNPWL	HNPWL	HNPWL	HNPWL

Client: HORIZON NUCLEAR POWER

Project: WYLFA NEWYDD PROJECT
ARTICLE 4(7) DEGROGATION

Drawing title: INDICATIVE LAYOUT FOR THE CONSTRUCTION OF MARINE FACILITIES

Scale @ A3	AS SHOWN	DO NOT SCALE
Jacobs No.	60PO8077	
Client No.	-	

Drawing No.: 60PO8077_AQE_REP_009_06_02

Table 6-2 Consideration of design alternatives relevant to The Skerries water body (the preferred options are shown in highlighted cells). Full table is presented in Appendix 2

Element of the design/construction	Options considered	Technical feasibility	Disproportionate cost	Environmental impacts	Decision and justification
Delivery of AILs Several land (road) and/or sea transport options were examined in an options review [RD33] (see paragraphs 6.5.3 to 6.5.4 above)	Delivery by sea to the port of Holyhead and transhipment to the Wylfa Newydd Development Area by road (option 1).	Technically feasible although barge length would be limited and upgrades to the berths and load capacity may be required as well as remedial works to roads and culverts. There is also limited space nearby to locate a fabrication facility or for temporary land storage of AILs.	Costs would include shipment, port charges, possible upgrades to port and remedial road works but these are not considered disproportionate.	Delivery by sea could impact marine water quality, flora, fauna, birds and habitat integrity. Transport by road could potentially impact air quality and terrestrial flora, fauna and birds via deterioration in air quality and noise disturbance.	Direct delivery of AILs to the Wylfa Newydd Development Area via a MOLF (option 3) is a technically and financially feasible option which has considerable environmental and social benefits compared with option 1, requiring transhipment by road. There was some uncertainty regarding option 2 and the feasibility of direct transhipment of AIL using the Anglesey Aluminium Jetty to berth delivery vessels. Overall, option 2 was not considered to be a significantly better environmental option than option 3. Given the Government's preference for delivery by sea and the wider environmental impacts caused by road transport (e.g. congestion, deterioration in air quality, noise disturbance and increased carbon footprint), 'delivery by sea to the Wylfa Newydd Development Area using a MOLF' (option 3) is the preferred option.
	Delivery by sea to the port of Holyhead and transhipment to the Wylfa Newydd Development Area by sea using a MOLF (option 2).	Technically feasible although barge length at Holyhead would be limited and upgrades to the berths and load capacity may be required. There is also limited space nearby to locate a fabrication facility or for temporary land storage of AILs. Direct vessel to vessel transhipment at the port of Holyhead using the Anglesey Aluminium Jetty to berth delivery vessels would be practical providing the jetty is not required for increased cruise ship traffic in the future.	Costs would include shipment, port charges, possible upgrades to port and provision of the MOLF structure and new haul road at the Wylfa Newydd Development Area. The cost is not considered disproportionate.	Delivery by sea could impact marine water quality, flora, fauna, birds and habitat integrity. Transport by sea is the Government's preferred method of transport with direct delivery of AILs to the site offering the widest environmental, social, and landscape benefits.	
	Delivery by sea to the Wylfa Newydd Development Area using a MOLF (option 3).	Technically feasible taking into consideration operational availability and layout, construction and protection requirements of the MOLF and associated structures.	Costs would include provision of the MOLF (and associated structures) and new haul road at the Wylfa Newydd Development Area. The cost is not considered disproportionate.	Delivery by sea could impact marine water quality, flora, fauna, birds and habitat integrity. Transport by sea is the Government's preferred method of transport with direct delivery of AILs to the site offering the widest environmental, social, and landscape benefits.	
Delivery of bulk materials Several land (road and rail) and/or sea transport options were examined in an options review [RD33] (see paragraphs 6.5.3 to 6.5.4 above).	Delivery by rail and transhipment to the Wylfa Newydd Development Area by road (option 1).	Technically feasible although new railhead and transhipment facilities would be required depending on the chosen station (e.g. Rhosgoch, Gaerwen and Valley). In the case of Rhosgoch, the Amlwch branch line would need to be reinstated. At Rhosgoch and Gaerwen, there is the option to transport bulk materials from the railway station to the Wylfa Newydd Development Area via a conveyor belt as well as via road.	Costs vary depending on the chosen railway station and the extent of necessary upgrades. Rhosgoch was considered the most expensive with a capital cost of £37 million whilst Anglesey Aluminium was considered the least expensive with a predicted capital cost of around £430,000. The costs of all railway stations examined were not considered to be disproportionate.	Rail delivery to Holyhead and Anglesey Aluminium could impact air quality. Rail delivery to Rhosgoch, Gaerwen and Valley could impact geology and soils, land quality, surface water quality, ground water quality, sediment quality, Areas of Outstanding Natural Beauty (AONB) and terrestrial flora, fauna, birds and habitat integrity. RSPB nature reserves could also be impacted if bulk materials were transported from Rhosgoch and	Delivery of bulk materials to the Wylfa Newydd Development Area via provision of a MOLF (option 4) is a technically feasible option which has lower and more localised environmental impacts than those options which require the transport of bulk materials by road and/or rail (options 1, 2 and 5). Option 3 was not considered to be technically feasible. Given the Government's preference for delivery by sea and the wider environmental, social and

Element of the design/construction	Options considered	Technical feasibility	Disproportionate cost	Environmental impacts	Decision and justification
				Gaerwen railway stations to the Wylfa Newydd Development Area by road.	landscape impacts caused by road and rail transport, 'delivery by sea to the Wylfa Newydd Development Area using a MOLF' (option 4) is the preferred option.
	Delivery by sea to the port of Holyhead and transhipment to the Wylfa Newydd Development Area by road (option 2).	Technically feasible with the Anglesey Aluminium jetty used as an import berth; materials transferred by existing conveyors to the Anglesey Aluminium Plant for storage and loading onto trucks going to the Wylfa Newydd Development Area. The jetty is only suitable for the delivery of bulk sand, aggregate and cement. Steel imports would need to be delivered by either road or rail.	Costs would include reconfiguration of the handling equipment and conveyors at Anglesey Aluminium and additional costs associated with the road transport of steel products from Holyhead to the Wylfa Newydd Development Area. These costs are not considered to be disproportionate.	Delivery by sea could potentially impact marine water quality, flora, fauna, birds and habitat integrity. Transport by road could potentially impact air quality and terrestrial flora, fauna and birds via deterioration in air quality and noise disturbance.	
	Delivery by sea to the port of Holyhead and transhipment to the Wylfa Newydd Development Area via sea using an on-site MOLF (option 3).	Not considered to be technically feasible option owing to the lack of space available for stockpiling materials at the port of Holyhead.	Not considered further.	Not considered further.	
	Delivery by sea to the Wylfa Newydd Development Area using a MOLF (option 4).	Technically feasible although consideration would need to be given to the deeper draft of bulk vessels.	When considered for bulk materials alone the costs of providing a MOLF were deemed to be disproportionate to the cargo volumes required. However, when considered in combination with the large number of deliveries of AILs the cost was proportionate.	Delivery by sea and construction of the MOLF could impact marine water quality, marine sediment quality, flora, fauna, birds and habitat integrity. Construction of the MOLF could impact air quality and noise disturbance. Terrestrial receptors could also be impacted including the North Anglesey Heritage Coast, RSPB reserves, terrestrial flora, fauna and birds.	
	Delivery by road from mainland UK (option 5).	Technically feasible however practically difficult to source sufficient truck capacity and schedule deliveries.	Costs would include trucks, fuel and tolls but these are not considered disproportionate.	Delivery by road would impact air quality and would result in noise disturbance.	
Location of the MOLF for delivery of AILs and bulk materials Four sites were identified and examined within a series of option reviews [RD33]; [RD34]; [RD35]; [RD36]	Site 1 (Porth-y-pistyll).	Technically feasible to construct a MOLF. Offers the best direct access to the Power Station Site but would require significant protection works and dredging owing to the exposed nature of the site and the shallow depths offshore hindering navigation.	When considered for bulk materials alone the costs of providing a MOLF were deemed to be disproportionate to the cargo volumes required. However, when considered in combination with the large number of deliveries of AILs the cost was proportionate.	Construction of the MOLF in Porth-y-pistyll could potentially impact marine water quality, marine sediment quality, flora, fauna, birds and habitat integrity. Terrestrial receptors could also be impacted including flora, fauna, birds and habitat integrity.	Locating the MOLF at site 2 (north of Porth-y-pistyll) is a technically and financially feasible option which has considerably lower environmental impacts with respect to terrestrial receptors, compared with site 3 (Porth-y-Ogof) and site 4 (Porth Wylfa). In the options appraisal in 2012 [RD34] site 2 was considered to be too exposed, however with the decision to co-locate the intake and
	Site 2 (north of Porth-y-pistyll).	Technically feasible to construct a MOLF. Located close to the site so haul road requirements would be	When considered for bulk materials alone the costs of providing a MOLF were deemed to be disproportionate	Construction of the MOLF just north of Porth-y-pistyll could potentially impact marine water quality, marine	

Element of the design/construction	Options considered	Technical feasibility	Disproportionate cost	Environmental impacts	Decision and justification
		minimal but developing an access route to the water's edge would be difficult due to high cliffs. Significant protection works would also be required owing to the exposure of this location.	to the cargo volumes required. However, when considered in combination with the large number of deliveries of AILs the cost was proportionate.	sediment quality, flora, fauna, birds and habitat integrity. Terrestrial receptors could also be impacted including flora, fauna, birds, habitat integrity.	MOLF site 2 became a viable option. Locating the MOLF at site 1 (Porth-y-pistyll) does not represent a significantly better environmental option as the environmental impacts would be approximately the same. Environmental impacts to marine receptors would be reduced by the co-location of the MOLF and Cooling Water intake within a single bay (Porth-y-pistyll), with protection works (e.g. breakwaters) affording both structures protection from wave surges. Site 2 is the preferred option.
	Site 3 (Porth-y-Ogof).	Technically feasible to construct a MOLF. Represents the most sheltered location. No protection works would be required and owing to the seabed profile, dredging requirements would be minimal. This location is some distance from the Power Station Site so significant amounts of earthworks would be required to construct a haul road.	Costs are not considered to be disproportionate to the cargo volumes required.	Construction of the MOLF in Porth-y-Ogof would significantly impact terrestrial flora, fauna (e.g. reptiles and bats), birds, habitat integrity (e.g. chough nests and SSSI qualifying grassland), an AONB, the Anglesey Coastal Path and ecologically designated sites (e.g. Tre'r Gof SSSI). Marine receptors could also be impacted including marine water quality, flora, fauna, birds and habitat integrity.	
	Site 4 (Porth Wylfa).	Not considered technically feasible to construct a MOLF which could accommodate delivery of both AIL and bulk material. Owing to the small size of the inlet, a combined facility could only be constructed offshore, requiring significant protection works and dredging. This location is furthest from the Power Station Site and significant earthworks would be required to construct a haul road.	To construct a MOLF for AIL and bulk material delivery, costs are considered disproportionate to the cargo volumes required.	Construction of the MOLF in Porth Wylfa would significantly impact terrestrial flora, fauna (e.g. reptiles and bats), birds, habitat integrity (e.g. chough nests and SSSI qualifying grassland) and designated sites (e.g. Tre'r Gof SSSI). Marine receptors could also be impacted including marine water quality, flora, fauna, birds and habitat integrity.	
Configuration of MOLF within Porth-y-pistyll Four designs were identified and examined within a series of options reviews [RD33]; [RD34]; [RD35]; [RD36]	Ro-Ro MOLF (for delivery of AIL) and bulk materials MOLF located some 150m apart on either side of intake structure (option 1). Both breakwaters would be connected to the land.	Technically feasible option representing a compact harbour area and footprint although substantial dredging volumes would be required.	Not disproportionately costly.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity.	Option 3 represents a technically and financially feasible option which has considerably lower environmental impacts compared with the other options examined. Option 5 is not considered to be technically feasible. Options 1, 2 and 4 do not represent a significantly better environmental option given the key and additional environmental impacts identified. Whilst it is recognised that option 3 would have several impacts on marine ecological receptors, these impacts are not considered to be greater than options 1, 2 or 4 and
	Ro-Ro MOLF (for delivery of AIL) and bulk materials MOLF located some 200m apart on either side of intake structure (option 2). Both breakwaters isolated from land.	Technically feasible option representing a medium-sized open harbour arrangement.	Not disproportionately costly.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. This option has the largest dredging and blasting extent resulting in loss of intertidal and subtidal habitats. Also being larger in extent, this could impact landscape and visual receptors.	

Element of the design/construction	Options considered	Technical feasibility	Disproportionate cost	Environmental impacts	Decision and justification
	Ro-Ro MOLF and bulk materials MOLF located next to each other to the north of the intake structure. (option 3). Gap between the land and the western breakwater only.	Technically feasible option representing a medium-sized open harbour arrangement with both breakwaters isolated from land.	Not disproportionately costly.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity.	mitigation measures have been proposed to reduce effects. Option 3 is the preferred option.
	Ro-Ro MOLF and bulk materials MOLF (two berths) located next to each other to the north of the intake structure (option 4).	Technically feasible option representing a large closed harbour arrangement with smaller dredging volumes, larger harbour entrance, larger MOLF footprint (with land reclamation) and longer intake structure to accommodate an additional Cooling Water unit. Both breakwaters would be connected to land.	Not disproportionately costly.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. This option has the largest construction footprint resulting in loss of intertidal, subtidal and terrestrial habitats.	
	Floating bulk MOLF structure (two berths) (option 5).	Not considered technically feasible to construct two inline berths. It was also not feasible to build and operate the two berths at separate locations within the harbour given the position of the breakwaters (same as option 3).	n/a	n/a	
Location and design of the Cooling Water intake Fifteen locations were identified and examined within a series of option reviews [RD34]; [RD35]; [RD38].	Offshore (300m-1,200m) in Porth-y-pistyll (locations A1-A3, B1-B2 and F1-F3) (option 1).	Technically feasible option which would include a horizontal conduit; a vertical shaft for installation of pre-constructed intake structure; and an additional tunnel to connect to onshore pumphouse.	Not disproportionately costly although costs were anticipated to be greater for an offshore intake depending on the construction methodology (i.e. cut-and-cover versus tunnelling).	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. Vertical shafts would result in a pressure differential which could impact the survivability of organisms impinged in the Cooling Water intake. Locations F1 and F2: longer conduits could impact the survivability of organisms entrained in the Cooling Water intake.	Offshore intake options at D1, D2 and F5 (option 5) were ruled out due to extent of habitat loss as a result of the cut and cover technique required for these options. F1 and F2 were also ruled out on an environmental basis as the longer tunnels would have a considerable effect on entrained organisms due to longer residence times. An onshore intake located at E1 in Porth-y-Pistyll (option 2) is a technically and financially feasible option which has lower impacts on terrestrial receptors compared to other locations (e.g. option 4). A nearshore intake (option 3 (at location C1)) or an offshore intake (options 1, 3, 4 and 5) are not considered to represent a significantly better environmental
	Onshore in Porth-y-pistyll, requiring breakwaters for protection (E1) (option 2).	Technically feasible option which would include an onshore intake structure; an open channel or culvert to the Cooling Water pumphouse; and two breakwater structures.	Not disproportionately costly although the requirement for breakwater structures adds cost.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. European eel could be vulnerable to impingement in the Cooling Water intake. Presence of breakwaters could impact landscape and visual receptors (Wales Coast Path).	

Element of the design/construction	Options considered	Technical feasibility	Disproportionate cost	Environmental impacts	Decision and justification
	Nearshore and offshore in Porth-y-pistyll, requiring breakwaters for protection (C1 and F4, respectively) (option 3).	Technically feasible option which would require a horizontal conduit constructed; a vertical shaft for installation of pre-constructed intake structure; an additional tunnel to connect to onshore pumphouse; and two breakwater structures.	Not disproportionately costly although the requirement for breakwater structures and tunnels or cut-and-cover adds cost.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. C1 could potentially impact a Regional Important Geological Site (RIGS). Presence of breakwaters could impact landscape and visual receptors (Wales Coast Path). Vertical shafts would result in a pressure differential which could impact the survivability of organisms impinged in the Cooling Water intake.	option given the key and additional environmental impacts identified. Whilst it is recognised that an onshore intake located at E1 would have several impacts on marine ecological receptors (e.g. habitat loss on the foreshore), these impacts are not considered to be greater than option 2 and mitigation measures have been proposed to reduce effects. An onshore intake at E1 in Porth-y-pistyll is the preferred option.
	Offshore (100m) of Wylfa Head (C2) (option 4).	Technically feasible option which would also include a horizontal conduit; a vertical shaft for installation of pre-constructed intake structure; and an additional tunnel to connect to onshore pumphouse.	Not disproportionately costly although costs were anticipated to be greater for an offshore intake depending on the construction methodology (i.e. cut-and-cover versus tunnelling).	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. C2 could potentially impact a RIGS.	
	Offshore (100m-500m) in Cemaes Bay (D1-D2, F5) (option 5).	Technically feasible option which would include a horizontal conduit; a Cooling Water intake structure; and an additional tunnel to connect to onshore pumphouse.	Not disproportionately costly although costs were anticipated to be greater for an offshore intake depending on the construction methodology (i.e. cut-and-cover versus tunnelling).	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. Large area of marine habitat loss. Locations D1 and D2: could impact surface water receptors (cut through Tre'r Gof catchment). Habitat in Tre'r Gof SSSI as well as areas of reptile habitat and chough foraging habitat would be impacted. Potential for impingement of flatfish and sea trout found in Cemaes Bay.	
Location of the Cooling Water outfall Sixteen locations were identified and examined in a series of option reviews [RD34]; [RD35]; [RD38].	Offshore north of Porth-y-pistyll (HNP1, HNP2), Porth Wnal (J2, G1 and G2), Wylfa Head (H1), Cemaes Bay (I1, I2 and I3) (option 1).	Technically feasible. This option would include a capped radial flow or direct port outfall constructed in precast concrete, and a horizontal conduit.	Not disproportionately costly although costs were anticipated to be greater for offshore outfall options.	All locations could potentially impact marine and terrestrial flora, fauna, birds and habitat integrity. Locations HNP1, HNP2, J2, G1, G2, H1, I1, I2 and I3: entrained organisms would be subject to a pressure differential and exposed to biocides for a longer period depending on length of conduit. Locations I3 and I4: heat and biocide retention within Cemaes Bay from Cooling Water discharge with possible impacts on benthic habitats and fish (notably sea trout).	An onshore outfall at K1 at Porth Wnal is a technically and financially feasible option which has fewer impacts on marine receptors compared to several other locations examined (e.g. I3 and I4). An offshore Cooling Water outfall at locations J2 or G2, or an onshore Cooling Water outfall at locations HNP3, CEGB1, G3, J1, H2, I3 or I4 are not considered to represent significantly better environmental option given the environmental impacts identified.

Element of the design/construction	Options considered	Technical feasibility	Disproportionate cost	Environmental impacts	Decision and justification
				Locations I1-2 and J2: Potentially impact archaeology and cultural heritage receptors (RIGS).	Whilst it is recognised that an onshore outfall located at K1 would have several impacts on marine ecological receptors, the quality of benthic habitats in Porth Wnal is low (silted habitats) and these impacts are not considered to be greater than other options. An onshore outfall at K1 in Porth Wnal is the preferred option.
	Onshore north of Porth-y-pistyll (HNP3), Porth Wnal (CEGB1 and K1, G3 and J1), Wylfa Head (H2), Cemaes Bay (I4) (option 2).	Technically feasible. This option would include an open channel or closed conduit that carries Cooling Water across the foreshore to the point of discharge.	Not disproportionately costly.	All locations could potentially impact marine and terrestrial flora, fauna, birds and habitat integrity. Locations HNP3, K1, G3, J1, H2 and I4: could impact public access and recreation in Cemaes Bay (I4 only).	

7 Articles 4(8) and 4(9)

7.1 Article 4(8)

7.1.1 Article 4(8) states that *"a Member State shall ensure that the application does not permanently exclude or compromise the achievement of the objectives of this Directive in other bodies of water within the same river basin district and is consistent with the implementation of other Community environmental legislation*."

Would the application exclude or compromise the achievement of the objectives of this Directive in other bodies of water within the same river basin district?

7.1.2 The WFD Compliance Assessment (Application Reference Number: 8.26) considered the achievement of environmental objectives in water bodies beyond the Zone of Influence. The exemptions identified in relation to Article 4(7) are for the Ynys Môn Secondary groundwater body and The Skerries water body. It is considered that with the exception of these two water bodies the Wylfa Newydd Project would not compromise the achievement of the environmental objectives in any other water body within or beyond the Western Wales River Basin District. The conclusion of this assessment is presented in the WFD Compliance Assessment (Application Reference Number: 8.26). It is therefore concluded that the requirements of Article 4(8) have been met.

Is the application consistent with the implementation of other Community environmental legislation?

7.1.3 The Community environmental legislation relevant to the Wylfa Newydd Project includes the following:

- Bathing Water Directive (2006/7/EC);
- Habitats Directive (92/43/EEC);
- Birds Directive (2009/147/EC); and
- Drinking Water Directive (98/83/EC).

7.1.4 The Nitrates Directive (91/676/EEC), Urban Waste Water Directive (91/271/EEC) and Shellfish Waters Directive (2006/113/EEC) are not relevant to the Wylfa Newydd Project as there are no protected areas within or near the Zone of Influence.

7.1.5 Compliance with other Community environmental legislation was considered as part of the WFD Compliance Assessment (Application Reference Number: 8.26) and it was concluded that the Wylfa Newydd Project would meet the conditions of Article 4(8).

7.1.6 Following submission of the Development Consent Order application, clarification has been sought with respect to the interaction of the WFD Compliance Assessment and two other pieces of community environmental legislation. These are summarised in the following paragraphs.

7.1.7 With respect to the Habitats Directive and Cemlyn Bay Special Area of Conservation (SAC) and Cemlyn Lagoon water body, the assessment of the potential effects from the Wylfa Newydd Project has been focused on the requirements of the SAC and reported via the shadow Habitats Regulations Assessment (APP-050 and APP-051). This concludes that the Wylfa Newydd Project will not cause an adverse effect on the site's integrity. Information has therefore not been collated to inform a derogation under Article 4(7) of the WFD.

7.1.8 With respect to the Bathing Water Directive and Cemaes Bathing water, at a meeting with NRW's Permitting team on 1 October 2018, it was agreed that further modelling would be undertaken using a different modelling approach to expand on the existing bacteria modelling to support the current conclusions contained in the Environmental Statement. The modelling examines the effect of using advection dispersion modelling rather than particle tracking (the existing modelling presented in the DCO application) and has been submitted at Deadline 5 (12th February 2019).

7.1.9 Horizon has prepared revised figures and recalculated the areal extent of change in suspended sediment concentrations above a 10% background (0.61mg/L total suspended solids loading). These data are provided in Appendix A to Horizon's response to Written Representation – Natural Resources Wales (REP3-035). The updated cumulative modelling reflecting the modified land drainage design and dredging operations shows that the increased suspended solids quickly disperse within the marine environment and reach levels that would be detectible above background within 47.7ha.

7.1.10 Based upon the conclusions of the revised bacteria modelling and estimates of the areal extent of suspended sediment concentrations, the Wylfa Newydd Project is compliant with the Bathing Water Directive.

7.2 Article 4(9)

7.2.1 Article 4(9) states that *"Steps must be taken to ensure that the application of the new provisions, including the application of paragraphs 3, 4, 5, 6 and 7, guarantees at least the same level of protection as the existing Community legislation."*

7.2.2 NPS-EN1 [RD12], NPS-EN6 [RD15] and UK Government's Strategic Siting Assessment (SSA) process [RD16] were explicitly developed for NSIPs in the UK and were subject to public consultation prior to their adoption. The strategic case for the Wylfa Newydd DCO Project was assessed by the UK Government, with the site at Wylfa included within NPS EN-6 [RD15] as a potentially suitable location for new nuclear power, having satisfied the SSA process [RD16]. It can be concluded that the process adopted by the UK

government satisfies the requirements of Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (the SEA Directive).

7.2.3 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Infrastructure Regulations 2017), set out the procedures that must be followed so that the consideration of applications for NSIPs fully reflect the requirements of the Environmental Impact Assessment Directive (2011/92/EU) (EIA Directive) and the subsequent amendments in the Environmental Impact Assessment Directive (2014/52/EU) on the assessment of the effects of certain public and private projects on the environment.

7.2.4 The EIA Infrastructure Regulations 2017 came into force on 16 May 2017. However, the EIA Infrastructure Regulations 2009 continue to apply to any application for development consent where the Secretary of State has been requested to adopt a Scoping Opinion (as defined in the 2009 Regulations) prior to this date. The Wylfa Newydd Project Scoping Opinion was requested prior to 16 May 2017 and the Wylfa Newydd Project is therefore subject to the EIA Infrastructure Regulations 2009. Nevertheless, the EIA has taken account of the additional provisions of the EIA Infrastructure Regulations 2017. It can therefore be concluded that the Development Consent Order application and its subsequent examination satisfies the requirements of the EIA Directive.

7.2.5 The Environmental Statement included detailed assessment of project compliance with relevant European legislation. In general terms, it can therefore be concluded that the Development Consent Order application and its subsequent examination satisfies the requirements of these legislation. Much of this assessment work relates to aspects of the Wylfa Newydd Project for which there is no mechanism for the activities requiring derogation under Article 4(7) of the WFD. With respect to Community environmental legislation that is more directly relevant to the activities requiring derogation under Article 4(7) of the WFD, project compliance has been considered with reference to Article 4(8) of the WFD (see Section 7.1). Specific assessment have been completed, informed by modelling, primary data collection and detailed analyses. These findings of these assessments, and their inter-relationship with the WFD, are summarised in Section 7.1. […]

7.2.6 Based on the acceptance of NPS EN-6 and Siting Study, the findings of assessments completed by Horizon and the scrutiny afforded of the application through the DCO process, it is concluded that the Wylfa Newydd Project satisfies the requirements of Article 4(9).

8 Summary

8.1.1 This report provides the information required to inform the application of a derogation under Article 4(7) of the WFD. This has been provided as the Wylfa Newydd Project may cause deterioration in quality elements in the Ynys Môn Secondary and The Skerries water bodies.

8.1.2 The information provided in this report provides evidence that for the current design of the Wylfa Newydd Project the conditions of Article 4(7) can be met sufficiently. It is recognised that the competent authority (Natural Resources Wales and the Planning Inspectorate on behalf of the Secretary of State) is responsible for case making with regards to the derogations for the two water bodies.

9 References

Table 9-1 Schedule of references

ID	Reference
RD1	Bund für Umwelt und Naturshutz Deutschland eV v Bundesrepublik Deutschland [2015] EUECJ C-461/13
RD2	Natural Resources Wales (NRW). 2017. Application of the Weser Judgment. Statement provided by email on 23 May 2017.
RD3	Natural Resources Wales (NRW). 2017. Wales Water Body Objectives and Measures Update 2015. [Accessed: 7 August 2017] Available online from: http://waterwatchwales.naturalresourceswales.gov.uk/en/.
RD4	Environment Agency. 2006. Risk Assessment of Shoreline Structures in Transitional and Coastal Waters, 2006.
RD5	Natural Resources Wales (NRW). 2018. Derogation Determination for Water Framework Directive Article 4(7). Reference number: OGN077. Supplied in February 2019.
RD6	European Commission. 2009. Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Technical Report – 2009 – 027. Guidance document No. 20. Guidance document on exemptions to the environmental objectives.
RD7	European Commission. 2017. Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance document No.36. Exemptions to the Environmental Objectives according to Article 4(7). [Accessed 15 January 2018] Available online from: https://circabc.europa.eu/sd/a/e0352ec3-9f3b-4d91-bdbb-939185be3e89/CIS_Guidance_Article_4_7_FINAL.PDF
RD8	Dworak, T., Kampa, E. and Berglund, M. 2016. Exemptions under Article 4(7) of the Water Framework Directive: Common Implementation Strategy Workshop. 13-14 December 2016, Brussels. [Accessed: 26 October 2017] Available online from: https://circabc.europa.eu/sd/a/d453b9ae-e001-461c-80cc-a056d308295e/Key%20Issue%20Paper%204.7%20-%20Final.pdf.
RD9	The Planning Inspectorate. 2017. The Water Framework Directive. Advice note eighteen, version 1. Issued June 2017. [Accessed 26 October 2017] Available online from: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/06/advice_note_18.pdf.
RD10	NRW. 2017. Guidance for assessing activities and projects for compliance with the Water Framework Directive. Ref: OGN 072.
RD11	NRW. 2017. Water Framework Directive: deterioration in water body status. Ref: OGN 073.
RD12	Department of Energy and Climate Change. 2011a. Overarching National Policy Statement for Energy (EN-1). London: The Stationery Office.
RD13	Sustainable Development Commission. 2006. The role of nuclear power in a low carbon economy Paper 2: Reducing CO2 emissions -nuclear and the alternatives [Accessed 14 September 2017] Available online from: http://www.sd-

ID	Reference
	commission.org.uk/publications/downloads/Nuclear-paper2-reducingCO2emissions.pdf.
RD14	European Commission (2000). Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive (92/43/EEC): Assessment of plans and projects significantly affecting Natura 2000 sites. [Accessed 14 September 2017] Available online from: http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf.
RD15	Department of Energy and Climate Change. 2011b. National Policy Statement for Nuclear Power Generation (EN-6). London: The Stationery Office.
RD16	Department of Energy and Climate Change. 2009. Towards a Nuclear National Policy Statement: Government response to consultations on the Strategic Siting Assessment process and siting criteria for new nuclear power stations in the UK; and to the study on the potential environmental and sustainability effects of applying the criteria.
RD17	Natural Resources Wales (NRW). 2015. Western Wales River Basin Management Plan 2015 – 2021.
RD18	Clean Growth Strategy (2017). [Accessed 15 January 2018] Available online from: https://www.gov.uk/government/publications/clean-growth-strategy
RD19	EDF closure plans. [Accessed 15 January 2018] Available online from: https://www.edfenergy.com/energy,.
RD20	Ofgem (2017), 'State of the energy market'. [Accessed 22 February 2018] Available online from: https://www.ofgem.gov.uk/publications-and-updates/state-energy-market-2017
RD21	Consultation on the siting criteria and process for a new national policy statement for nuclear power with single reactor capacity over 1 gigawatt beyond 2025. [Accessed 29 January 2018] Available online from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/666057/061217_FINAL_NPS_Siting_Consultation_Document-1.pdf
RD22	Updated Energy and Emissions Projections 2016 (March 2017). [Accessed 15 January 2018] Available online from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/599539/Updated_energy_and_emissions_projections_2016.pdf.
RD23	National Audit Office (2016). Nuclear Power in the UK. [Accessed 15 January 2018] Available online from: https://www.nao.org.uk/report/nuclear-power-in-the-uk/
RD24	National Grid (2017). Future Energy Scenarios. [Accessed 15 January 2018] Available online from: http://fes.nationalgrid.com/fes-document/
RD25	Ministerial statement on Energy Infrastructure (Written Statement December 2017) HLWS316. [Accessed 29 January 2018] Available online from: http://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Lords/2017-12-07/HLWS316/

ID	Reference
RD26	Department for Business, Energy and Industrial Strategy (2017), 'Hinkley Point C', [Accessed 15 January 2018] Available online from: https://www.gov.uk/government/collections/hinkley-point-c
RD27	Working Group III Technical Support Unit (2014), 'Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change'
RD28	See Bloomberg New Energy Finance (2017), 'Beyond the tipping point'. [Accessed 15 January 2018] Available online from: https://uk.eaton.com/content/content-beacon/RE-study/GB/home.html
RD29	Heard, B.P., Brook, B.W., Wigley, T.M.L. and Bradshaw, C.J.A. (2017), 'Burden of proof: a comprehensive review of the feasibility of 100% renewable-electricity systems', Renewable and Sustainable Energy Reviews, p. 1122-1133, [Accessed 11 January 2018] Available online from: https://www.sciencedirect.com/science/article/pii/S1364032117304495
RD30	UK Government (2016), 'Hinkley Point C Value for Money', [Accessed 15 January 2018] Available online from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/556917/3_-_Value_for_Money_Assessment.pdf
RD31	Updated Energy and Emissions Projections 2016 (March 2017). [Accessed 29 January 2018] Available online from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/599539/Updated_energy_and_emissions_projections_2016.pdf.
RD32	Planning Policy Wales. [Accessed 15 January 2018] Available online from: http://gov.wales/topics/planning/policy/ppw/?lang=en
RD33	Halcrow. 2010. Site Development. Heavy Route and MOLF Strategic Study. Halcrow Final Report for Horizon Nuclear Power Ltd. MPC 1059.
RD34	Jacobs. 2012. Ecological Options Appraisal for the Location of the Cooling Water Intake and Outfall and Marine Offloading Facility. Client report to Horizon Nuclear Power.
RD35	Jacobs. 2016. Marine Elements Options Review: Cooling Water Intake and Outfall, MOLF and associated structures. Document number: 60PO8007/AQE/REP/019.
RD36	Jacobs. 2014. Options Review for the Marine Off Loading Facility and Breakwaters.
RD37	Royal Haskoning DHV. 2017. Wylfa Bulk MOLF Floating Berth Feasibility Study Report. Document number: M&APB6454R001D0.1. March 2017.
RD38	Central Electricity Generating Board (CEGB). (1988). Wylfa 'B' power station preapplication studies. Volume 3 Section 11 General Civil Engineering, Cooling water structures. CF2365, 69 pp.

Table 9-2 Schedule of supplementary references

ID	Reference
SUP-RD1	Environment Agency. 2006. Shoreline Structures Assessment.
SUP-RD2	Welsh Government. 2016. Energy Wales: a low carbon transition. https://gov.wales/topics/environmentcountryside/energy/energywales/?lang=en Accessed 22 January 2019.
SUP-RD3	Horizon. 2018. Minutes of WFD Working Group Meeting #8 with Natural Resources Wales. November 2018.
SUP-RD4	Department for Business, Energy & Industrial Strategy. 2017a. The Clean Growth Strategy. October 2017.

Appendix 1 Ynys Môn Secondary – Saline intrusion

Rationale relating to the acceptance or rejection of mitigation measures relating to Saline Intrusion (see Table 5.1)

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
YM1.1 -Placement of a semi-dry cofferdam in Porth-y-pistyll at the same time as deep excavations	Construction of the marine cofferdam and excavation in the dry behind the cofferdam means that the flow reversal occurs offshore at the start of the excavations.	Proven methodology	Yes	Yes -	Yes	High
		YES - Proceed to environmental assessment				
YM1.2 - Appropriate monitoring will be undertaken to determine if there is significant saline intrusion into the aquifer.	The monitoring will include continuous water level monitoring at selected groundwater monitoring boreholes with monthly or quarterly water level dips at other locations and quarterly water quality sampling (for major ions) at selected locations. Monitoring of sump water quality (for major ions) would also be undertaken on a monthly or quarterly basis. Where practicable existing boreholes will be used, although it is recognised that many of these will be lost during the construction works and some replacements may be required.	Proven methodology	Yes	Yes -	Yes	High
		YES - Proceed to environmental assessment				
YM1.3 - Additional mitigation	If a significant effect is identified additional mitigation may be required. Options would include:	Proven methodology	Yes	Yes -	Yes	High

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
triggered by monitoring.	(1) grouting major inflow fractures, (2) alter pumping regime, Aim is to prevent further saline inflow.	**YES - Proceed to environmental assessment**				
YM1.4 - Artificial ground freezing	Pipes with refrigerant are run through the subsurface to freeze the ground to prevent any groundwater flow into the excavation.	Proven methodology. Artificial ground freezing (AGF) is a highly effective geotechnical process commonly used to stabilise water-bearing low-strength soils, provide temporary ground support, and control water ingress through fractured or faulted rocks and aquifers.	Yes - artificial ground freezing is utilised in the creation of barriers in deep excavation	Yes -	Applicability on site dependent on ground investigation. The Wylfa Newydd site is complex. The excavation for reactors has been chosen in hard bedrock, limiting the usefulness of ground freezing, with low moisture content in deeper substratum,	Low - Site investigation is required prior to ground freezing design. Significant number of unknowns: subsurface soil and rock conditions, groundwater conditions, moisture content, requirement to model heat transform mechanism and thaw settlement/heave. High degree of uncertainty over whether ground freezing would be successful
		NO - MITIGATION REJECTED				
WM1.5 - Vertical grout curtains	This technique involves a row of vertically drilled holes filled with grout under pressure. The holes are drilled at intervals in such a way that they create a curtain.	Proven methodology. Early uses since the late 1800s, more widely used in European since 1970, and the US since 1980.	No - Grout curtains are typically used within shallow depths (10-12m) and therefore will not meet the full excavation depth (-18m) and prevent saline intrusion	No - Grout curtains are typically used within shallow depths (10-12m) and therefore will not meet the full excavation depth (-18m) and prevent saline intrusion	No - typically absolute massive unjointed rock masses cannot o, nor need not be grouted. The Wylfa Newydd Development Area is located in a geologically complex area. The hardness of the underlying substrata would make it very difficult to insert physical barriers and require a high number of	High - method is predicted to be inefficient at the working depths required.

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
					boreholes to be drilled very close together as the grout would not spread far from the borehole.	
		NO - MITIGATION REJECTED				
WM1.6 - Low permeability cut off walls using piling	Installation of a vertical bored pile wall around the excavation to prevent ingress of water.	Proven technique	No	No - Vertical cut off walls are typically used within shallow depths (10-15m) and therefore will not meet the full excavation depth (-18m) and prevent saline intrusion	No - typically absolute massive unjointed rock masses cannot, nor need not be grouted. The Wylfa Newydd Development Area is located in a geologically complex area. The hardness of the underlying substrata would make it very difficult to insert physical barriers.	High - method is predicted to be inefficient at the working depths required.
		NO - MITIGATION REJECTED				

Mitigation Measure	Environmental benefits				Mitigation planning	Costs
	Will the measure have a measurable benefit?	What scale will the benefit be measurable at?	Will this measure ensure Compliance (on its own)?	Will this measure ensure Compliance (cumulatively)?	Mitigation measure replace an already proposed measure?	Is there a clear argument for costs being disproportionate?
YM1.1 -Placement of a semi-dry cofferdam in Porth-y-pistyll at the same time as deep excavations	Yes	Local	No	Unlikely	n/a	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
YM1.2 - Appropriate monitoring will be undertaken to determine if there is significant saline intrusion into the aquifer.	No direct effect on quality element.					Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
YM1.3 - Additional mitigation triggered by monitoring.	Yes	Local	No	Unlikely	n/a	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
YM1.4 - Artificial ground freezing	**NO - MITIGATION REJECTED**					
WM1.5 - Vertical grout curtains	**NO - MITIGATION REJECTED**					

Mitigation Measure	Environmental benefits				Mitigation planning	Costs
	Will the measure have a measurable benefit?	What scale will the benefit be measurable at?	Will this measure ensure Compliance (on its own)?	Will this measure ensure Compliance (cumulatively)?	Mitigation measure replace an already proposed measure?	Is there a clear argument for costs being disproportionate?
WM1.6 - Low permeability cut off walls using piling	**NO - MITIGATION REJECTED**					

Ynys Môn Secondary – Tre'r Gof SSSI

Rationale relating to the acceptance or rejection of mitigation measures relating to Tre'r Gof SSSI (See Table 5.2)

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
YM2.1 - Establish buffer strips between the western and northern toe of Mound A and Tre'r Gof SSSI prior to the commencement of earthworks and maintain thereafter.	Some of the groundwater supplying Tre'r Gof SSSI emerges as springs and seeps on the edge of the basin. They are thought to be recharged by infiltration and flow within a zone 50m to 150m to the south and east of Tre'r Gof SSSI. The buffer strip in conjunction with the other mitigation aims to maintain these key groundwater discharges by encouraging residence time and infiltration to the aquifer. The buffer zone would also allow overland flow to Tre'r Gof SSSI to continue as at present. No construction works will take place within the boundary of the Tre'r Gof SSSI. Suitably demarcated buffer zones will be established. • For the north and west of the Tre'r Gof SSSI adjacent to the site Campus, the buffer zone will be 20m; • To the south of the Tre'r Gof SSSI, the buffer zone will be established at 50m; • For the more sensitive eastern end of the Tre'r Gof SSSI, the buffer zone will be established at 100m.	Proven method	Yes	Yes	Yes	Medium
		YES - Proceed to environmental assessment				
YM2.2 - Landscape mounding has been designed to avoid changes in catchment boundaries as far as practical.	Some catchment boundary changes do result from the mounding. The overall contributing catchment area remains close to the baseline situation with <10% change in catchment area.	n/a	Yes	Yes - but it is not possible to keep mounds wholly outside of Tre'r Gof SSSI Catchment as this would mean that there would not be any landscape mounds or noise barriers.	Yes	High, with respect to area. There will be low to medium uncertainty related to the new runoff recharge characteristics of the new landscape mounding.

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
		YES - Proceed to environmental assessment				
YM2.3 - Use of a permeable inert crushed rock drainage blanket below Mound A to the south and east of Tre'r Gof SSSI, and use of overflow pipes in drainage system.	Permeable drainage blanket to allow the shallow groundwater and surface water runoff flowing from the south and east of Mound A to flow under the mound into the SSSI as it currently does. The use of inert rock will seek to ensure that the shallow groundwater chemistry does not change appreciably from the baseline conditions.	Technically the blanket is easy to place, but it needs to be constructed to avoid instability of overlying materials. The overflow pipes and weirs are technically feasible.	Yes	Yes	Yes	There is significant uncertainty as to its effectiveness in replicating the quality and quantity of water sources that feed Tre'r Gof SSSI. It is not possible to accurately predict the changes in the quality of shallow groundwater chemistry or to have certainty in the resulting groundwater levels and discharges.
		YES - Proceed to environmental assessment				
YM2.4 - Timing of mounding	Complete all associated earthworks on north and west side of mounding A and B (facing Tre'r Gof SSSI) during dry weather conditions, preferably within the drier months (Apr - Sep), of the first earthworks season. Objective is to slow down runoff to mimic natural runoff characteristics and avoid excess sedimentation via natural processes to remove sediment. Would also manage rainwater close to where it falls.	n/a	n/a	Yes	Will require rigorous planning and is subject to weather patterns once commenced.	Weather and climate dependent
		YES - Proceed to environmental assessment				

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
YM2.5 - Drainage - The drainage system has been designed to maintain surface water balance within existing drainage catchments as far as is practicable.	This will maintain surface water elements of flow into and out of Tre'r Gof SSSI and ensure no flooding as a result of the development.	Yes	Yes	Yes	Yes	Medium - There is uncertainty as to replication of individual components of flow, which is where the deterioration potential lies.
		YES - Proceed to environmental assessment				
YM2.6 - Drainage of the landscaped areas has been designed to incorporate as much flexibility as possible so that changes can be made to drainage water treatment and to the volume of water being released at various discharge points during the construction period.	In addition to the drainage blanket, the drainage design for the Tre'r Gof SSSI will include the use of overflow pipes at 50m intervals in the drainage ditch to the north and west of Mound A such that during times of higher rainfall, water will flow to the ground adjacent to the drain, allowing overland flow to the SSSI to be maintained. Monitoring and control weirs in the overflow pipes will be used to control the flow to the SSSI.	n/a	n/a	Yes	Yes	Low
		YES - Proceed to environmental assessment				
YM2.7 - The drainage design strategy will seek to be implemented to reduce potential effects on receiving water bodies and ecological receptors, most notably the Tre'r Gof SSSI.	Where practicable, a treatment train of Sustainable Drainage System (SuDS) methods will be utilised for discharges including site drainage, surface water runoff from exposed topsoil during construction and later from the newly formed landscape mounds and from dewatering discharges. Sediment settlement ponds will be used in conjunction with other measures including silt traps, silt curtains, silt fences and vegetated channels to manage flows and meet water quality thresholds as per the findings of the Wylfa Newydd DCO Project Water Framework Directive Compliance Assessment.	Yes	Yes	Yes	Yes, but will require regular and detailed long-term attention, development and engineering modifications in the early years of operation.	Medium
		YES - Proceed to environmental assessment				

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
YM2.8 - Drainage - A SuDS treatment train will be placed for drainage operation of the Site Campus and will include attenuation of discharge to surface water and groundwater recharge.	After each phase of site campus construction, surface water drainage from the completed elements of the Site Campus will either run into the ground around the site, or into surface water channels to the east of the site. Drainage design for operation of the Site Campus, will include attenuation of discharge to surface water (e.g. geocellular attenuation tank), and recharge of storm water runoff (e.g. via infiltration trenches, reno mattress, swales), in order to reduce potential hydrological effects on the SSSI arising from surface water flows.	Proven technique	Yes	Yes	Yes	High
		YES - Proceed to environmental assessment				
YM2.9 - Monitoring and active management of the drainage system to mitigate the effects of construction activities on surface water flow and quality at the Tre'r Gof SSSI.	Monitoring will continue up to the start of construction in order to improve the robustness of the baseline data. These data will be used during detailed design to refine the drainage system to reduce potential effects. Active management of the drainage system to include monitoring of every discharge point will determine if there is a significant departure from baseline conditions. Will include monitoring upstream and downstream of all outfall points to determine if the outfall is having an effect on water quality and to allow treatment to be adjusted. Frequency will be a mix of continuous, daily, weekly or monthly. Will continue into operation.	Proven technique	Yes	Yes	Additional mitigation may be required as agreed with the regulator. Options could include: (1) implementing dosing using polyelectrolytes, (2) installation of additional treatment capacity, (3) greater manual intervention/ management of the system, (4) new drainage channels, (5) new pumping systems, (6) automated treatment and/or	High - relating to monitoring, medium relating to associated mitigation

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
					pumping systems.	
		YES - Proceed to environmental assessment				
YM2.10 - Tre'r Gof SSSI compensation package	Horizon is committed to delivering a compensation package, in order to offset a potential adverse effect on Tre'r Gof SSSI, which will create new areas of rich-fen habitat and enhance areas of existing rich-fen habitat at three sites on Anglesey. Habitat creation and management schemes for each site will be developed, in line with the principles set out in the LHMS. All three sites are in the Ynys Mon Secondary groundwater body, although one also overlaps with the contiguous Ynys mon Central Carboniferous Limestone groundwater body.	n/a	Dependent on land secured	Dependent on land secured	The availability of land for purchase is also a constraint which would determine the feasibility of habitat creation.	Medium to high
		YES - Proceed to environmental assessment				
YM2.11 - Pollution prevention measures	Horizon will employ protective measures to control the risk of pollution to groundwater, which will, in particular, be consistent with the Environmental Permitting (England and Wales) Regulations 2016 In addition, Horizon will avoid using materials that could result in direct or indirect discharge of hazardous substances or non-hazardous pollutants to groundwater.	Proven technique	Yes	Yes	Yes	High
		YES - Proceed to environmental assessment				
YM2.12 - Prevention of contaminated runoff.	Horizon will address the handling of material from excavations being a potential source of contamination and will ensure measures are put in place to prevent contaminated runoff reaching open ground. Materials that could	Proven technique	Yes	Yes	Yes	High

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
	result in direct or indirect discharge of hazardous substances or non-hazardous pollutants to groundwater will be avoided.	**YES - Proceed to environmental assessment**				
YM2.13 - Dewatering. Appropriate monitoring will be undertaken to determine if there is an effect on Tre'r Gof SSSI from dewatering and mounding activities.	The monitoring will include continuous water level monitoring at selected groundwater monitoring boreholes with monthly or quarterly water level dips at others and quarterly water quality monitoring. Where practicable, existing boreholes would be used, although it is recognised that many of these will be lost during the construction works and some replacements may be required. The monitoring would include continuous monitoring of existing piezometers in Tre'r Gof and will build upon the existing baseline dating from June 2011.	Proven technique	Yes	Yes	Yes	High
		YES - Proceed to environmental assessment				
YM2.14 - Dewatering. Additional mitigation options	If groundwater monitoring identifies an effect on the qualifying groundwater dependent terrestrial ecosystems (GWDTE) at Tre'r Gof, additional mitigation options could include: Controlling water loss from the site via the underground culvert at VN5 during critical periods, to avoid the drying and oxidation of the peat body. [as identified by NRW in response to ExA question p107 [REP2-325] Construction methodologies to reduce groundwater ingress to the Cooling water tunnels, e.g. by grouting major inflow fractures Recharging groundwater, particularly in areas potentially affected by dewatering during the construction period. [as identified by NRW in response to ExA question p107 [REP2-325]	Proven technique	n/a	Yes	Yes	Medium
		YES - Proceed to environmental assessment				
YM2.15 - Dewatering. Hydrological Clerk of Works	Water level management of Tre'r Gof will be overseen by a hydrological clerk of works	Proven technique	n/a	Yes	Yes	Medium
		YES - Proceed to environmental assessment				

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
YM2.16 - Dewatering. Excavation lining	CW tunnels will be lined during operation to prevent the egress of groundwater. Lining will be undertaken using cement grouting.	Proven technique	n/a	Yes	Yes	Medium
		YES - Proceed to environmental assessment				

Mitigation Measure	Environmental benefits				Mitigation planning	Costs
	Will the measure have a measurable benefit?	What scale will the benefit be measurable at?	Will this measure ensure Compliance (on its own)?	Will this measure ensure Compliance (cumulatively)?	Mitigation measure replace an already proposed measure?	Is there a clear argument for costs being disproportionate?
YM2.1 - Establish buffer strips between the western and northern toe of Mound A and Tre'r Gof SSSI prior to the commencement of earthworks and maintain thereafter.	Buffer strips will provide some protection to the SSSI from surface water discharges. Standard practice working near sensitive habitats.	Site level	No	Yes	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
YM2.2 - Landscape mounding has been designed to avoid changes in catchment boundaries as far as practical.	n/a	Site level	No	Uncertain	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
YM2.3 - Use of a permeable inert crushed rock drainage blanket below Mound A to the south and east of Tre'r Gof SSSI, and use of	Yes - use of inert material will prevent changes to water quality from baseline conditions.	Site level	No	Yes	No	Not considered disproportionately costly

Mitigation Measure	Environmental benefits				Mitigation planning	Costs
	Will the measure have a measurable benefit?	What scale will the benefit be measurable at?	Will this measure ensure Compliance (on its own)?	Will this measure ensure Compliance (cumulatively)?	Mitigation measure replace an already proposed measure?	Is there a clear argument for costs being disproportionate?
overflow pipes in drainage system.	YES - Proceed to cost assessment					MITIGATION SECURED
YM2.4 - Timing of mounding	Yes - compared to unmitigated scenario	Site level	No	Potentially	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					MITIGATION SECURED
YM2.5 - Drainage - The drainage system has been designed to maintain surface water balance within existing drainage catchments as far as is practicable.	Yes - maintain base flows into Tre'r Gof	Site level	No	Potentially	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					MITIGATION SECURED
YM2.6 - Drainage of the landscaped areas has been designed to incorporate as much flexibility as possible so that changes can be made to drainage water treatment and to the volume of water being released at various discharge points during the construction period.	Yes - maintain base flows and control the movement of water around the site	Site level	No	Potentially	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					MITIGATION SECURED
YM2.7 - The drainage design strategy will seek to be implemented to reduce potential effects on receiving water bodies and ecological	Yes - maintain base flows, treatment of water and control the movement of water around the site	Site level	No	Yes	No	Not considered disproportionately costly

Mitigation Measure	Environmental benefits				Mitigation planning	Costs
	Will the measure have a measurable benefit?	What scale will the benefit be measurable at?	Will this measure ensure Compliance (on its own)?	Will this measure ensure Compliance (cumulatively)?	Mitigation measure replace an already proposed measure?	Is there a clear argument for costs being disproportionate?
receptors, most notably the Tre'r Gof SSSI.	**YES - Proceed to cost assessment**					**MITIGATION SECURED**
YM2.8 - Drainage - A SuDS treatment train will be placed for drainage operation of the Site Campus and will include attenuation of discharge to surface water and groundwater recharge.	Yes - maintain base flows, treatment of water and control the movement of water around the site	Site level	No	Yes	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
YM2.9 - Monitoring and active management of the drainage system to mitigate the effects of construction activities on surface water flow and quality at the Tre'r Gof SSSI.	No direct effect on quality element.					Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
YM2.10 - Tre'r Gof SSSI compensation package	Yes - provision of new wetland habitats.	Waterbody scale	No - as a compensatory rather than a mitigation issues this will not ensure compliance	No	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
YM2.11 - Pollution prevention measures	Yes - prevention of contaminants reaching groundwater compared to a no mitigation scenario	Local	No	Yes	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**

Mitigation Measure	Environmental benefits				Mitigation planning	Costs
	Will the measure have a measurable benefit?	What scale will the benefit be measurable at?	Will this measure ensure Compliance (on its own)?	Will this measure ensure Compliance (cumulatively)?	Mitigation measure replace an already proposed measure?	Is there a clear argument for costs being disproportionate?
YM2.12 - Prevention of contaminated runoff.	Yes - prevention of contaminants reaching groundwater compared to a no mitigation scenario	Local	No	Yes	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
YM2.13 - Dewatering. Appropriate monitoring will be undertaken to determine if there is an effect on Tre'r Gof SSSI from dewatering and mounding activities.	No direct effect on quality element.					Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
YM2.14 - Dewatering. Additional mitigation options	Yes - replacement of water into aquifer. Control movement of surface water across the site. No overall change in groundwater quantity	Local	No	Yes	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
YM2.15 - Dewatering. Hydrological Clerk of Works	Yes, maintain favourable surface water conditions within the boundary of the SSSI. Use of specialist HCoW will ensure appropriate water level management	Benefit at the SSSI site level	No	Yes	No	Not considered disproportionately costly

Mitigation Measure	Environmental benefits				Mitigation planning	Costs
	Will the measure have a measurable benefit?	What scale will the benefit be measurable at?	Will this measure ensure Compliance (on its own)?	Will this measure ensure Compliance (cumulatively)?	Mitigation measure replace an already proposed measure?	Is there a clear argument for costs being disproportionate?
	YES - Proceed to cost assessment					MITIGATION SECURED
YM2.16 - Dewatering. Excavation lining	Yes - prevention of loss of water from excavation during construction	Local scale	No	Yes	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					MITIGATION SECURED

Skerries – hydromorphology and marine benthic invertebrates

Rationale relating to the acceptance or rejection of mitigation measures relating to The Skerries waterbody (See Table 6.1)

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
S1 - The footprint of the breakwaters, Cooling Water Intake and Outfall structures, temporary causeway, including associated dredging activities will be designed to be as small as practicable (whilst meeting operational requirements).	The aim is to ensure that the structures are sufficiently large to perform the required role, but no larger than necessary.	n/a	Yes	Yes	n/a	High
		YES - Proceed to environmental assessment				

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
S2 - Dredging of soft sediments in Porth-y-pistyll will be restricted to the area identified in the dredging plan and the duration will be shortened as far as practicable, in order to minimise the release of suspended solids and sediment bound contaminants.	This mitigation would ensure only the targeted areas of intertidal habitat that would be lost.	n/a	Yes	Yes	Yes	High
		YES - Proceed to environmental assessment				
S3 - Provision of marine ecological enhancement measures in suitable locations unconstrained by engineering design and functionality, to include pre-cast ecological units (e.g. rock pools or features similar to bio-blocks) and modification of the permanent artificial structures (e.g. construction material, surface roughness or the addition of surface features). For more information, see PINS	80 precast vertical rockpools will be installed at various heights on the MOLF wall (initial installations will be immediately following construction of the MOLF, with final installations occurring at the end of Main Construction); • 10 precast rockpools will be installed in armour rock on the western breakwater; • areas of armour rock (including the harbour side of the western breakwater, and any rock revetment) will be seeded with natural rock won from the site, where practicable (alternatively,		Yes	Yes	Yes, although it is noted that there are only certain locations where this measure can be implemented due to technical (engineering) constraints related to the integrity of structures.	There is some uncertainty about the degree to which ecological enhancements will result in an increase in colonisation and productivity of marine flora and fauna.

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
reference Number REP4-023 Marine Benthic Invertebrate only	imported material akin to natural rock will be used); • ecological enhancement of 16m3 precast concrete units on the breakwaters, to include textured surfaces; • retaining surface roughness within the dredged area to promote recolonisation; • seeding or transplanting of marine kelp of subtidal areas; • a monitoring programme to assess the effectiveness of the enhancement measures against a suite of clearly defined ecological objectives; and • provision of relevant monitoring data to local schools and universities to promote ecological enhancement of the marine environment.	**YES - Proceed to environmental assessment**				
S4 - Implementation of a monitoring programme for the marine ecological enhancement measures and permanent structures. The aim will be to determine the success of habitat enhancement by monitoring. the colonisation of new structures, this will allow adaptive management. Marine Benthic Invertebrate only	To monitor the success of the marine ecological enhancement measures against a set of ecological objectives agreed with the IACC in consultation with NRW. This information will be used to inform the decision to implement further ecological enhancement if necessary, with the dual purpose of facilitating academic research and the development of an evidence base demonstrating the commercial application of ecological enhancement as	Proven method	Yes	Yes	Yes	High

Mitigation Measure	Description of measure	Technical feasibility				
		How novel is the technique?	Capacity to be scaled to meet requirements of project?	Ability to meet project needs?	Applicability on site?	Certainty?
	mitigation for effects to benthic habitats and species.	**YES - Proceed to environmental assessment**				
S5 - Removal of hard engineering structures or modification of existing structures	Removal of other structures in The Skerries water body could reduce the net loss of the intertidal zone.	n/a	n/a	n/a	No - no obsolete hard engineering structure within the Skerries waterbody that can be removed	High - insufficient hard engineering that can be removed
		NO - MITIGATION REJECTED				
S6 - Indirect/offsite mitigation (offsetting measures)	Creation of new intertidal habitat to replace the habitat lost in a different location but still within The Skerries water body.	Good UK experience of marine/coastal habitat creation	Considered unlikely to fully meet the requirement for offsetting	No	n/a	High certainty that scaleability is unlikely to be effective
		NO - MITIGATION REJECTED				
S7 - Replace hard shoreline protection with soft engineering Hydromorpholgy only	In the areas where hard shoreline protection is proposed, seek an alternative softer approach.	n/a	n/a	No - will not meet project requirements	No - will not meet project requirements	High certainty that soft engineering will not meet project requirements
		NO - MITIGATION REJECTED				

Skerries - hydromorphology

Mitigation Measure	Environmental benefits				Mitigation planning	Costs
	Will the measure have a measurable benefit?	What scale will the benefit be measurable at?	Will this measure ensure Compliance (on its own)?	Will this measure ensure Compliance (cumulatively)?	Mitigation measure replace an already proposed measure?	Is there a clear argument for costs being disproportionate?
S1 - The footprint of the breakwaters, Cooling Water Intake and Outfall structures, temporary causeway, including associated dredging activities will be designed to be as small as practicable (whilst meeting operational requirements).	Yes - reducing the overall footprint will reduce the effect on subtidal and intertidal habitats	Local	n/a	n/a	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
S2 - Dredging of soft sediments in Porth-y-pistyll will be restricted to the area identified in the dredging plan and the duration will be shortened as far as practicable, in order to minimise the release of suspended solids and sediment bound contaminants.	Yes - reducing the overall footprint will reduce the effect on subtidal and intertidal habitats	Local	n/a	n/a	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**

Mitigation Measure	Environmental benefits				Mitigation planning	Costs
	Will the measure have a measurable benefit?	What scale will the benefit be measurable at?	Will this measure ensure Compliance (on its own)?	Will this measure ensure Compliance (cumulatively)?	Mitigation measure replace an already proposed measure?	Is there a clear argument for costs being disproportionate?
S3 - Provision of marine ecological enhancement measures in suitable locations unconstrained by engineering design and functionality, to include pre-cast ecological units (e.g. rock pools or features similar to bio-blocks) and modification of the permanent artificial structures (e.g. construction material, surface roughness or the addition of surface features). For more information, see PINS reference Number REP4-023	The purpose of marine ecological enhancement measures would be to increase surface and structural heterogeneity, encouraging the colonisation of native marine species and the establishment of diverse and productive intertidal and subtidal habitats within the footprint of the Marine Works. To enhance the development of biodiversity and biomass on artificial structures and to create new additional intertidal habitat on the permanent marine structures.	Local	No	No	n/a	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**

Mitigation Measure	Environmental benefits				Mitigation planning	Costs
	Will the measure have a measurable benefit?	What scale will the benefit be measurable at?	Will this measure ensure Compliance (on its own)?	Will this measure ensure Compliance (cumulatively)?	Mitigation measure replace an already proposed measure?	Is there a clear argument for costs being disproportionate?
S4 - Implementation of a monitoring programme for the marine ecological enhancement measures and permanent structures. The aim will be to determine the success of habitat enhancement by monitoring. the colonisation of new structures, this will allow adaptive management.	n/a	n/a	n/a	n/a	No	Not considered disproportionately costly
	YES - Proceed to cost assessment					**MITIGATION SECURED**
S5 - Removal of hard engineering structures or modification of existing structures	Technically infeasible (unable to scale to project need)					Not considered further
S6 - Indirect/offsite mitigation (offsetting measures)	Technically infeasible (unable to scale to project need)					Not considered further
S7 - Replace hard shoreline protection with soft engineering	Technically infeasible (does not meet project needs)					Not considered further

Appendix 2 Rationale for alternatives

Element of the design /construction	Options considered	Technical feasibility	Environmental impacts	Disproportionate cost	Decision and justification
Delivery of AILs - Several land (road) and/or sea transport options were examined in an options review	Delivery by sea to the port of Holyhead and transhipment to the Wylfa Newydd Development Area by road (option 1).	Technically feasible although barge length would be limited and upgrades to the berths and load capacity may be required as well as remedial works to roads and culverts. There is also limited space nearby to locate a fabrication facility or for temporary land storage of AILs.	Transport by road would require significant modification to the road network and furniture to accommodate AIL transport from Holyhead to Wylfa. Approx. 210 AIL are to be delivered to site over a 12-month period. The largest individual module is 24m x 19.6m x 18m (wt. 628t) and will require significant road modification to allow transport from Holyhead. Modification of road network will have significant effects on ecological receptors due to land take, modification to drainage. Transporting AIL via road is likely to result in a deterioration of air quality to residents and other road users between Holyhead and the Wylfa Newydd site. It is therefore considered that this option is not a significantly better environmental option and is therefore not considered further.	Not considered further.	Direct delivery of AILs to the Wylfa Newydd Development Area via a MOLF (option 3) is a technically and financially feasible option which has considerable environmental and social benefits compared with option 1, requiring transhipment by road. There was some uncertainty regarding option 2 and the feasibility of direct transhipment of AIL using the Anglesey Aluminium Jetty to berth delivery vessels. Overall, option 2 was not considered to be a significantly better environmental option than option 3. Given the Government's preference for delivery by sea and the wider environmental impacts caused by road transport (e.g. congestion, deterioration in air quality, noise disturbance and increased carbon footprint), 'delivery by sea to the Wylfa Newydd Development Area using a MOLF' (option 3) is the preferred option.
	Delivery by sea to the port of Holyhead and transhipment to the Wylfa Newydd Development Area by sea using a MOLF (option 2).	Technically feasible although barge length at Holyhead would be limited and upgrades to the berths and load capacity may be required. There is also limited space nearby to locate a fabrication facility or for temporary land storage of AILs. Direct vessel to vessel transhipment at the port of Holyhead using the Anglesey Aluminium Jetty to berth delivery vessels would be practical providing the jetty is not required for increased cruise ship traffic in the future.	Effects on marine receptors (water quality, flora, fauna, birds, marine INNS and habitat integrity) are similar to direct delivery to Wylfa Newydd Development Area using a MOLF. Therefore, it is assessed that this option is not a significantly better environmental options and is therefore not considered further	Not considered further.	
	Delivery by sea to the Wylfa Newydd Development Area using a MOLF (option 3).	Technically feasible taking into consideration operational availability and layout, construction and protection requirements of the MOLF and associated structures.	Delivery by sea could impact marine water quality, flora, fauna, birds, marine INNS and habitat integrity. Transport by sea is the Government's preferred method of transport with direct delivery of AILs to the site offering the widest environmental, social, and landscape benefits.	Costs would include provision of the MOLF (and associated structures) and new haul road at the Wylfa Newydd Development Area. The cost is not considered disproportionate.	

Element of the design /construction	Options considered	Technical feasibility	Environmental impacts	Disproportionate cost	Decision and justification
Delivery of bulk materials Several land (road and rail) and/or sea transport options were examined in an options review.	Delivery by rail and transhipment to the Wylfa Newydd Development Area by road (option 1).	Technically feasible although new railhead and transhipment facilities would be required depending on the chosen station (e.g. Rhosgoch, Gaerwen and Valley). In the case of Rhosgoch, the Amlwch branch line would need to be reinstated. At Rhosgoch and Gaerwen, there is the option to transport bulk materials from the railway station to the Wylfa Newydd Development Area via a conveyor belt as well as via road.	Rail delivery to Rhosgoch, Gaerwen and Valley could impact geology and soils, land quality, surface water quality, ground water quality, sediment quality, Areas of Outstanding Natural Beauty (AONB) and terrestrial flora, fauna, birds and habitat integrity. RSPB nature reserves could also be impacted if bulk materials were transported from Rhosgoch and Gaerwen railway stations to the Wylfa Newydd Development Area by road. Transport by road may require significant modification to the road network and road furniture to accommodate bulk transport from Holyhead to Wylfa. 594,000m3 of concrete, 133,000t of steel reinforcement and 4,200 structural steel will need to be transported from the chosen rail station to Wylfa Newydd by lorry. Transporting bulk material via road is likely to result in a significant increase in construction traffic utilising the A5025. Deterioration of air quality to residents, increases in noise and travel times to a wide range of residents and other road users. It is therefore considered that this option is not a significantly better environmental option that delivery by sea and is therefore not considered further.	Not considered further.	Delivery of bulk materials to the Wylfa Newydd Development Area via provision of a MOLF (option 4) is a technically feasible option which has lower and more localised environmental impacts than those options which require the transport of bulk materials by road and/or rail (options 1, 2 and 5). Option 3 was not considered to be technically feasible. Given the Government's preference for delivery by sea and the wider environmental, social and landscape impacts caused by road and rail transport, 'delivery by sea to the Wylfa Newydd Development Area using a MOLF' (option 4) is the preferred option.
	Delivery by sea to the port of Holyhead and transhipment to the Wylfa Newydd Development Area by road (option 2).	Technically feasible with the Anglesey Aluminium jetty used as an import berth; materials transferred by existing conveyors to the Anglesey Aluminium Plant for storage and loading onto trucks going to the Wylfa Newydd Development Area. The jetty is only suitable for the delivery of bulk sand, aggregate and cement. Steel imports would need to be delivered by either road or rail.	Rail delivery to Rhosgoch, Gaerwen and Valley could impact geology and soils, land quality, surface water quality, ground water quality, sediment quality, Areas of Outstanding Natural Beauty (AONB) and terrestrial flora, fauna, birds and habitat integrity. RSPB nature reserves could also be impacted if bulk materials were transported from Rhosgoch and Gaerwen railway stations to the Wylfa Newydd Development Area by road. Transport by road may require significant modification to the road network and road furniture to accommodate bulk transport from Holyhead to Wylfa. 594,000m3 o concrete, 133,000t of steel reinforcement and 4,200 structural steel will need to be transported from Holyhead to Wylfa Newydd. Transporting bulk material via road is likely to result in a deterioration of air quality to residents	Not considered further.	

Element of the design /construction	Options considered	Technical feasibility	Environmental impacts	Disproportionate cost	Decision and justification
			and other road users between Holyhead and the Wylfa Newydd site, resulting from a significant increase in construction traffic utilising the A5025. It is therefore considered that this option is not a significantly better environmental option and is therefore not considered further.		
	Delivery by sea to the port of Holyhead and transhipment to the Wylfa Newydd Development Area via sea using an on-site MOLF (option 3).	Not considered to be technically feasible option owing to the lack of space available for stockpiling materials at the port of Holyhead.	Not considered further.	Not considered further.	
	Delivery by sea to the Wylfa Newydd Development Area using a MOLF (option 4).	Technically feasible although consideration would need to be given to the deeper draft of bulk vessels.	Delivery by sea and construction of the MOLF could impact marine water quality, marine sediment quality, flora, fauna, birds, marine INNS and habitat integrity. Construction of the MOLF could impact air quality and noise disturbance. Terrestrial receptors could also be impacted including the North Anglesey Heritage Coast, RSPB reserves, terrestrial flora, fauna and birds.	Not considered disproportionately costly	
	Delivery by road from mainland UK (option 5).	Technically feasible however practically difficult to source sufficient truck capacity and schedule deliveries.	This option would require significant numbers of road movements to deliver AILs and bulk material from the mainland. The required increase in road traffic using the Britannia Bridge crossing of the Menai Strait and traffic on the A55 and A5025 will result in extensive noise and air quality issues, and would be unlikely to be supported by the Department of Transport with a technically feasible sea option available. It is therefore assessed that this option is not significantly better environmental alternative and is therefore not considered further.	Not considered further.	

Element of the design /construction	Options considered	Technical feasibility	Environmental impacts	Disproportionate cost	Decision and justification
Location of the MOLF for delivery of AILs and bulk materials	Site 1 (Porth-y-pistyll).	Technically feasible to construct a MOLF. Offers the best direct access to the Power Station Site but would require significant protection works and dredging owing to the exposed nature of the site and the shallow depths offshore hindering navigation.	Construction of the MOLF in Porth-y-pistyll could potentially impact marine water quality, marine sediment quality, flora, fauna, birds, marine INNS and habitat integrity. Terrestrial receptors could also be impacted including flora, fauna, birds, habitat integrity however the required haul roads are not considered to have the same effect on important sites and habitats as options 3 and 4. Locating the MOLF within Porth-y-pistyll does not provide sufficient depth for the berthing of larger vessels and therefore a n extensive dredging programme would be required to ensure feasibility of this option. A large dredging programme will adverse effect marine flora, fauna and water quality and as such it is assessed that this option is not a significantly better environmental alternative to the preferred option and is not considered further.	Not considered further.	Locating the MOLF at site 2 (north of Porth-y-pistyll) is a technically and financially feasible option which has considerably lower environmental impacts with respect to terrestrial receptors, compared with site 3 (Porth-y-Ogof) and site 4 (Porth Wylfa). In the options appraisal in 2012 [RD20] site 2 was considered to be too exposed, however with the decision to co-locate the intake and MOLF site 2 became a viable option.
	Site 2 (north of Porth-y-pistyll).	Technically feasible to construct a MOLF. Located close to the site so haul road requirements would be minimal but developing an access route to the water's edge would be difficult due to high cliffs. Significant protection works would also be required owing to the exposure of this location.	Construction of the MOLF just north of Porth-y-pistyll could potentially impact marine water quality, marine sediment quality, flora, fauna, birds, marine INNS and habitat integrity. Terrestrial receptors could also be impacted including flora, fauna, birds, habitat integrity however the required haul roads are not considered to have the same effect on important sites and habitats as options 3 and 4.	Not considered disproportionately costly	Locating the MOLF at site 1 (Porth-y-pistyll) does not represent a significantly better environmental option as the environmental impacts would be approximately the same.
	Site 3 (Porth-y-Ogof).	Technically feasible to construct a MOLF. Represents the most sheltered location. No protection works would be required.	Owing to the seabed profile, dredging requirements would be minimal. This location is some distance from the Power Station Site so significant amounts of earthworks would be required to construct a haul road, with a significant elevation gain required from beach to land. Construction in this location would require haul roads to either cross directly, or in very close vicinity to a wide range of environmental receptors, with significant impact terrestrial flora, fauna (e.g. reptiles and bats), birds, habitat integrity (e.g. chough nests and SSSI qualifying grassland), an AONB, the Anglesey Coastal Path and ecologically	Not considered further.	Environmental impacts to marine receptors would be reduced by the co-location of the MOLF and Cooling Water intake within a single bay (Porth-y-pistyll), with protection works (e.g. breakwaters) affording both structures protection from wave surges. Site 2 is the preferred option.

Element of the design /construction	Options considered	Technical feasibility	Environmental impacts	Disproportionate cost	Decision and justification
			designated sites (e.g. Tre'r Gof SSSI). Marine receptors could also be impacted including marine water quality, flora, fauna, birds, marine INNS and habitat integrity. As a result, it is assessed that this option does not form a significantly better environmental alternative over the preferred option and is not considered further.		
	Site 4 (Porth Wylfa).	Not considered technically feasible to construct a MOLF which could accommodate delivery of both AIL and bulk material. Owing to the small size of the inlet, a combined facility could only be constructed offshore, requiring significant protection works and dredging. This location is furthest from the Power Station Site and significant earthworks would be required to construct a haul road.	Not considered further.	Not considered further.	
Configuration of MOLF within Porth-y-pistyll	Ro-Ro MOLF (for delivery of AIL) and bulk materials MOLF located some 150m apart on either side of intake structure (option 1). Both breakwaters would be connected to the land.	Technically feasible option representing a compact harbour area and footprint although substantial dredging volumes would be required.	Potential impacts on marine and terrestrial flora, fauna, birds, marine INNS and habitat integrity. Loss of rocky reef habitat from western breakwater at Cerrig Brith. Hydrodynamics within the embayment will reduce current and bed sheer stress, leading to change in habitats. As a result, it is assessed that this option does not represent a significantly better environmental alternative to the preferred option and is not considered further.	Not considered further.	Option 3 represents a technically and financially feasible option which has considerably lower environmental impacts compared with the other options examined. Option 5 is not considered to be technically feasible. Options 1, 2 and 4 do not represent a significantly better environmental option given the key and additional environmental impacts identified. Whilst it is recognised that option 3 would have several impacts on marine ecological receptors, these impacts are not considered to be greater than options 1, 2 or 4 and mitigation measures have been proposed to reduce effects. Option 3 is the preferred option.
Four designs were identified and examined within a series of options reviews	Ro-Ro MOLF (for delivery of AIL) and bulk materials MOLF located some 200m apart on either side of intake structure (option 2). Both	Technically feasible option representing a medium-sized open harbour arrangement.	Potential impacts on marine and terrestrial flora, fauna, birds, marine INNS and habitat integrity. This option has the largest dredging and blasting extent resulting in loss of intertidal and subtidal habitats. Also being larger in extent, this could impact landscape and visual receptors.		

Element of the design /construction	Options considered	Technical feasibility	Environmental impacts	Disproportionate cost	Decision and justification
	breakwaters isolated from land.				
	Ro-Ro MOLF and bulk materials MOLF located next to each other to the north of the intake structure. (option 3). Gap between the land and the western breakwater only.	Technically feasible option representing a medium-sized open harbour arrangement with both breakwaters isolated from land.	Potential impacts on marine and terrestrial flora, fauna, birds, marine INNS and habitat integrity across all options. Largest dredge area of all options (7% increase on HGNE-1 and HNP-1). Smallest MOLF footprint with adjacent structures. Gap in breakwater providing migratory pathway	Not disproportionately costly.	
	Ro-Ro MOLF and bulk materials MOLF (two berths) located next to each other to the north of the intake structure (option 4).	Technically feasible option representing a large closed harbour arrangement with smaller dredging volumes, larger harbour entrance, larger MOLF footprint (with land reclamation) and longer intake structure to accommodate an additional Cooling Water unit. Both breakwaters would be connected to land.	Potential impacts on marine and terrestrial flora, fauna, birds, marine INNS and habitat integrity. This option has the largest construction footprint resulting in loss of intertidal, subtidal and terrestrial habitats. As a result, it is assessed that this option does not represent a significantly better environmental alternative to the preferred option and is not considered further.	Not considered further.	
	Floating bulk MOLF structure (two berths) (option 5).	Not considered technically feasible to construct two inline berths. It was also not feasible to build and operate the two berths at separate locations within the harbour given the position of the breakwaters (same as option 3).	Not considered further.	Not considered further.	

Element of the design /construction	Options considered	Technical feasibility	Environmental impacts	Disproportionate cost	Decision and justification
Location and design of the Cooling Water intake - Fifteen locations were identified and examined within a series of option reviews.	Offshore (300m-1,200m) in Porth-y-pistyll (locations A1-A3, B1-B2 and F1-F3) (option 1).	Technically feasible option which would include a horizontal conduit; a vertical shaft for installation of pre-constructed intake structure; and an additional tunnel to connect to onshore pump house.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. Vertical shafts would result in a pressure differential which could impact the survivability of organisms impinged in the Cooling Water intake. Locations F1 and F2 represent offshore/longer conduits which could impact the survivability of organisms entrained in the Cooling Water intake during transit to the screens. It is assessed that this option does not represent a significantly better environmental alternative and is not considered further.	Not considered further. A1: £384,696,790 A2: £385,348,802 A3: £375,760,589 B1: £399,537,126 B2: £407,901,316 F1: £467,782,603 F2: £430,405,786 F3: £394,052,992	Offshore intake options at D1, D2 and F5 (option 5) were ruled out due to extent of habitat loss as a result of the cut and cover technique required for these options. F1 and F2 were also ruled out on an environmental basis as the longer tunnels would have a considerable effect on entrained organisms due to longer residence times. An onshore intake located at E1 in Porth-y-Pistyll (option 2) is a technically and financially feasible option which has lower impacts on terrestrial receptors compared to other locations (e.g. option 4). A nearshore intake (option 3 (at location C1)) or an offshore intake (options 1, 3, 4 and 5) are not considered to represent a significantly better environmental option given the key and additional environmental impacts identified. The existing intake (option B1) could not be used as it is required for decommissioning of the Magnox station.
	Onshore in Porth-y-pistyll, requiring breakwaters for protection (E1) (option 2).	Technically feasible option which would include an onshore intake structure; an open channel or culvert to the Cooling Water pump house; and two breakwater structures.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. European eel could be vulnerable to impingement in the Cooling Water intake. Presence of breakwaters could impact landscape and visual receptors (Wales Coast Path). Onshore intake structure removes requirement for vertical shaft pressure differentials (improving survivability of entrained organisms and minimises habitat loss from additional tunnelling.	Not disproportionately costly although the requirement for breakwater structures adds cost. **£372,937,965**	Whilst it is recognised that an onshore intake located at E1 would have several impacts on marine ecological receptors (e.g. habitat loss on the foreshore), these impacts are not considered to be greater than option 2 and mitigation measures have been proposed to reduce effects. An onshore intake at E1 in Porth-y-pistyll is the preferred option.

Element of the design /construction	Options considered	Technical feasibility	Environmental impacts	Disproportionate cost	Decision and justification
	Nearshore and offshore in Porth-y-pistyll, requiring breakwaters for protection (C1 and F4, respectively) (option 3).	Technically feasible option which would require a horizontal conduit constructed; a vertical shaft for installation of pre-constructed intake structure; an additional tunnel to connect to onshore pump house; and two breakwater structures.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. C1 could potentially impact a Regional Important Geological Site (RIGS). Presence of breakwaters could impact landscape and visual receptors (Wales Coast Path). Vertical shafts would result in a pressure differential which could impact the survivability of organisms impinged in the Cooling Water intake. Overall it is assessed that this option does not represent a significantly better environmental alternative and is not considered further.	Not considered further. C1: £468,938,323 F4: £424,657,316	
	Offshore (100m) of Wylfa Head (C2) (option 4).	Technically feasible option which would also include a horizontal conduit; a vertical shaft for installation of pre-constructed intake structure; and an additional tunnel to connect to onshore pump house.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. C2 could potentially interact / impact a RIGS. It is assessed that this option does not represent a significantly better environmental alternative and is not considered further.	Not considered further. C2 £505,899,420	
	Offshore (100m-500m) in Cemaes Bay (D1-D2, F5) (option 5).	Technically feasible option which would include a horizontal conduit; a Cooling Water intake structure; and an additional tunnel to connect to onshore pump house.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity. Large area of marine habitat loss. Locations D1 and D2: could impact surface water receptors (cut through Tre'r Gof catchment). Habitat in Tre'r Gof SSSI as well as areas of reptile habitat and chough foraging habitat would be impacted. Potential for impingement of flatfish and sea trout found in Cemaes Bay. Overall It is assessed that this option does not represent a significantly better environmental alternative compared to the preferred option and is not considered further	Not considered further. D1: £500,899,420 D2: £522,915,902 F5: £470,790,760	
Location of the Cooling Water outfall - Sixteen locations were identified and examined in a series of	Offshore north of Porth-y-pistyll (HNP1, HNP2), Porth Wnal (J2, G1 and G2), Wylfa Head (H1), Cemaes Bay (I1, I2, I3 and I4) (option 1).	Technically feasible. This option would include a capped radial flow or direct port outfall constructed in precast concrete, and a horizontal conduit.	All locations could potentially impact marine and terrestrial flora, fauna, birds and habitat integrity. Locations HNP1, HNP2, J2, G1, G2, H1, I1, I2, I3 and I4: entrained organisms would be subject to a pressure differential and exposed to biocides for a longer period depending on length of conduit. Locations I1 to I4: heat and biocide retention within Cemaes Bay from Cooling Water discharge with possible impacts on benthic habitats and fish (notably sea trout). There would be significant	HNP1: £118,430,298* HNP2: £ 91,805,716* J2: £131,961,852 G1: £179,458,088 G2: £149,249,428 H1: £181,578,144 I1: £204,142,614 I2: £174,957,976 I3: £148,333,395	An onshore outfall at K1 at Porth Wnal is a technically and financially feasible option which has fewer impacts on marine receptors compared to several other locations examined (e.g. I3 and I4). An offshore Cooling Water outfall at locations J2 or G2, or an onshore Cooling Water outfall at locations HNP3, CEGB1, G3, J1, H2, I3 or I4

Element of the design /construction	Options considered	Technical feasibility	Environmental impacts	Disproportionate cost	Decision and justification
option reviews.			habitat loss and disturbance to terrestrial and marine features under options I1-I4 with a tunnel under Tre'r Gof SSSI and new outfall structure into Cemaes Bay. Locations I1-2 and J2: Potentially impact archaeology and cultural heritage receptors (RIGS). Overall It is assessed that these options do not represent a significantly better environmental alternative compared to the preferred option and is not considered further		are not considered to represent significantly better environmental option given the environmental impacts identified. Whilst it is recognised that an onshore outfall located at K1 would have several impacts on marine ecological receptors, the quality of benthic habitats in Porth Wnal is low (silted habitats) and these impacts are not considered to be greater than other options. An onshore outfall at K1 in Porth Wnal is the preferred option.
	Onshore north of Porth-y-pistyll (HNP3), Porth Wnal (CEGB1 and G3 and J1), Wylfa Head (H2) (option 2).	Technically feasible. This option would include an open channel or closed conduit that carries Cooling Water across the foreshore to the point of discharge.	All locations could potentially impact marine and terrestrial flora, fauna, birds and habitat integrity. Locations HNP3, G3, J1, and H2: could impact public access and recreation. Location H2 would result in significant disturbance to Wylfa Head protected area. Overall It is assessed that these options do not represent a significantly better environmental alternative compared to the preferred option and are not considered further	Not considered further. HNP3: £97,964,847 CEGB: £121,581,385 G3: £117,645,295 J1: £119,613,340 H2: £127,977,530 14: £102,884,959	
	Porth Wnal (K1)	Technically feasible. This option would include an open channel or closed conduit that carries Cooling Water across the foreshore to the point of discharge.	Potential impacts on marine and terrestrial flora, fauna, birds and habitat integrity during operation common to all locations. Small footprint resulting in an environmentally better option.	Not disproportionately costly **K1: £105,837,027**	

[This page is intentionally blank]

Appendix 3 Further evidence to support assessment of alternatives (CW intakes, outfalls, MOLF, mounds and basement depths)

A number of key sources of information have been drawn upon in the determination of appropriateness of alternative options to CW intake, outfall and MOLF design and location. These documents are listed within the Reference section of this report. The key summaries and conclusions of these reports [RD33, RD34, RD35, RD36, RD37, RD38] are also provided below. This summary should not be used in place of a comprehensive understanding of the content of these reports. It should be noted that these reports were accurate at the time of publish but may not account for assessment undertaken since publication.

Halcrow. 2010. Site Development. Heavy Route and MOLF Strategic Study. Halcrow Final Report for Horizon Nuclear Power Ltd. MPC 1059.

Key conclusions

Eight potential delivery scenarios for Abnormal Indivisible Loads (AILs) to site were evaluated in terms of technical feasibility, cost, impact on programme and environmental and social impact. The scenarios were ranked based on potential environmental impact including potential CO2 emissions and cost.

It was concluded that there is insufficient space at the Port of Holyhead for the fabrication of large modules therefore sub modules or completed modules must either be shipped directly to site or transferred to site for fabrication.

The Port of Holyhead has facilities for the discharge of AILs by barge as well as for direct vessel to vessel transhipment operations. Onward transport of AILs by road from Holyhead to site is considered to be technically feasible and a cost effective method of transportation. The viability of the route is subject to confirmation from the local authority that if, as expected; the structures along the route can accommodate the axle loads from the SPMTs.

The impact of the road delivery of AILs on the local environment and local population is considered to be significant based on the number of deliveries required during the project cycle. These deliveries will undoubtedly cause severe local disruption and will require over 200 separate road closures. Such disruption in unlikely to acceptable to the local population of local authorities particularly in light of the governments water preferred strategy for AIL movement.

The construction of a MOLF at the site is considered to be technically feasible at a cost believed justifiable in the wider context of the project. Construction of the MOLF, whilst having an impact on the local environment and landscape, would remove any social impact on the local population caused by a road delivery. In terms of programme, whilst the MOLF would take approximately 9 months to construct, no authorisation period would be required from the local authority for each subsequent AIL delivery unlike for the road option. The preferred location of the MOLF facility is at Site 3 and it is considered that given the disruption that would be caused by moving in

excess of 200 AILs by road from Holyhead, direct shipment to site via a MOLF is the preferred option for AIL transport.

Nine alternatives for the Bulk Delivery Strategy were assessed. Sea delivery to Holyhead and delivery to site by road scored the highest on the options appraisal however, the ranking table does not account for the severity of the impact that transport by road will have on the local environment and community. The next highest ranked Scenario, the MOLF option, is therefore considered to be the principal option. The major drawback of the majority of the delivery scenarios analyzed is the need for bulk material road traffic to use the A5025. This is considered to have a major impact on the population of the local area given the noise and air quality issues surrounding the use of large HGVs for material transfer. There are numerous small villages along the route, the populations of which would suffer as a result of this delivery method.

The only delivery scenario which completely eradicates the need for road transfer along local routes is the construction of a large scale MOLF at the site. This is one of the more expensive scenarios and would have a social and environmental impact itself as a result of its construction. The impact on programme would also be significant due to the likely 16-month construction period of the MOLF. The preferred MOLF solution is the Option 3 layout involving a combined bulk and AIL delivery facility for vessels up to 5,000DWT.

In terms of rail delivery scenarios, the Rhosgoch option offers a significant reduction in road miles for the onward transfer of materials to site but is also the most expensive. The railhead option requiring the least investment is the Anglesey Aluminium option as much of the necessary infrastructure is already in place. However, again road transfer via the A5025 is still necessary.

The question of bulk material delivery is likely to cause concern locally and is therefore a very sensitive issue. The MOLF option is preferred due to its reduced impact on the local surrounding community and environment. Given the quantity of material involved it is likely that this is the only scheme that will gain support locally and despite its capital cost may prove the most cost effective option as it eradicates the need for any major mitigation measures such as local road improvements or community compensation.

Jacobs. 2012. Ecological Options Appraisal for the Location of the Cooling Water Intake and Outfall and Marine Offloading Facility. Client report to Horizon Nuclear Power.

By assessing the ecological impacts of the CW options described above, a number of intake / outfall options have been screened out. These options are:

- Intakes within Cemaes Bay (D1-D2) and F5 owing to the terrestrial impacts associated with the construction process.
- Intakes offshore of Cemlyn Bay (F1-F2) owing to the greater impacts predicted on entrapped organisms.

- Outfalls in Cemaes Bay (I1-I4) owing to the pooling of residual heat within the bay and impacts on benthic and fish species.

The remaining options still provide a large number of permutations. Therefore, to aid the decision making process further, these can now summarised into the following main groups with broadly similar potential impacts:

- Offshore intake, circa 300 – 600 m from shoreline (A1-3, B1-2 and F3)
- Nearshore intake, circa 50 – 150 m from the shoreline (C1, C2 and F4)
- Onshore intake (E1)
- Offshore outfall, circa 400 -1000 m from shoreline (HNP1-2, G1-2 and H1)
- Nearshore outfall, circa 50 – 150 m from shoreline (HNP3, G3, J2 and H2)
- Onshore outfall (J1, K1 and CEGB1)

The above CW intake / outfall locations are at present deemed preferable from an ecological impact perspective given the present knowledge about the marine environment along the coast and the mitigation options that exist.

Previous and on-going surveys at the present Wylfa Power Station indicate that impingement rates are already very low compared with other UK power stations. Appropriate design of the new CW intake should ensure that these rates can be lowered even further. Intake velocities will be easier to control with an onshore intake.

Data from the vantage point bird surveys suggests that development of the intake and outfall options to the west of Wylfa Head should have little impact on the food source of the terns that breed in Cemlyn Lagoon as they do not forage with regularity in this area.

The rapid dispersal of the thermal plume by the strong tidal currents off Wylfa Head will limit the impacts of the CW discharge at the remaining locations listed above. An onshore discharge will have greater impacts on the nearshore habitats but these are expected to be limited to the outfall bay. A discharge at the present location is predicted to have a similar thermal impact on the communities at Wylfa Head as a discharge just north of Wylfa Head. The deeper-water, tide swept, benthic communities off Wylfa Head are not expected to incur any major impacts as a result of any of the outfall options remaining.

MOLF options remaining for consideration from an ecological perspective are for the MOLF to be integrated into a breakwater within Porth-y-Pistyll or for it to be separate from the breakwater on the foreshore within Porth-y-Pistyll.

Intake

The preferred option, is for an onshore intake at position E1 in Porth-y-Pistyll. The design would be for a foreshore structure with a number of intake apertures opening directly into screen wells or via a forebay. To meet Best Practice, intake openings would be sized to maintain mean approach velocities of <0.15 ms^{-1} at full CW demand (120 m3 s^{-1}) at tidal levels down to lowest astronomical tide (LAT). Similar (but smaller capacity) onshore intake designs are used at a number of other UK power stations, including Pembroke, Marchwood, Shoreham, Hartlepool, Heysham and Longannet

(EA, 2010). This has a number of intrinsic environmental advantages over offshore intakes:

- no hydrostatic pressure change (provided a free surface is maintained from the sea to the screen wells);
- reduced transit / handling time for fish and other biota entering and returned to sea via FRR system;
- reduced exposure time of fish and other biota to biocides (when used); and less likely to need chemical biocides upstream of fine screens.

Porth-y-Pistyll is an open embayment with north/north-easterly exposure and would require protective breakwaters to shelter the intake from excessive wave action

Outfall

Horizon's preferred option at present for the new CW outfall is for an onshore outfall at position J1. It may be possible to include diffuser jets with this design to direct the CW away from the shoreline and reduce the extent of any impacts on the seabed and intertidal area. There also remains a possibility of re-using the existing infrastructure of the present outfall at position K1. Advantages of an onshore outfall to the west of Wylfa Head include:

- minimal pressure changes for entrained organisms;
- educed CW transit time and biocide exposure for entrained organisms; and
- no need for development on the seabed or shoreline to the north of Wylfa Head where more diverse benthic communities are present.

An onshore outfall will have the disadvantage of benthic impacts in the intertidal and shallow subtidal but the cost and infrastructure associated with an onshore outfall are likely to be considerably less.

MOLF

Horizon's preferred MOLF location is within Porth-y-Pistyll with the preferred option of associating it with the eastern breakwater. Each of the options to create a MOLF in Porth-y-Pistyll will have terrestrial and marine environmental impacts, but the option of associating it with the breakwater will result in a smaller shoreline footprint and therefore less ecological impact. Minimizing the impacts to one bay rather than two bays is obviously going to be preferred from an ecological point of view.

Royal Haskoning DHV. 2017. Wylfa Bulk MOLF Floating Berth Feasibility Study Report. Document number: M&APB6454R001D0.1. March 2017.

Executive Summary

A harbour is planned at Wylfa for the import of materials for construction of the new nuclear power station. Two marine facilities are required - a bulk marine offloading facility (Bulk MOLF) for unloading aggregates, cement and rebar used for production

of concrete and a Ro-Ro MOLF for import of heavy abnormal indivisible loads (AILs). The harbour will also incorporate the cooling water intakes for the power station.

The harbour will be protected from the prevailing wave climate by an east and a main west breakwater. The original design for the Bulk MOLF berths is based on a blockwork quay wall concept. This quay takes time to construct and also requires time for dredging of a substantial quantity of hard rock to form the foundations for the quay. The original construction programme shows the Bulk MOLF completed just over 18 months after the issue of a Development Consent Order (DCO).

The objective of this study was to investigate the feasibility of shortening the duration of the construction of the Bulk MOLF by using floating berths requiring less construction work and allowing production of concrete for the new power station to commence earlier.

The production of concrete for the new power station is expected to average about 27,000m^3/month with a peak production of some 46,200m^3/month. It is envisaged that a fleet of chartered ships will shuttle materials for concrete from the port of loading to the harbour at Wylfa. 5,000 DWT and 8,000 DWT specialised aggregates or bulk carriers will be used to transport aggregates to the site. Cement in bulk will be shipped in 1,500 DWT specialised cement carriers and rebar in 1,500 DWT general cargo coasters.

Two Bulk MOLF berths are required to handle the expected throughput of construction materials and ships. The size of the berths and the depth of dredging in the harbour basin and at the berths were determined. Two floating berth options (one based on floating pontoons and linkspans and the other based on floating crane barges) were identified and evaluated. These options suffer from various drawbacks and a third option with a fixed platform for a mobile harbour crane (MHC) unloader on each berth is preferred.

A temporary cofferdam will be installed during construction of the harbour to allow the Ro-Ro MOLF and the power station cooling water intakes to be constructed in the dry. This temporary cofferdam together with the east and west breakwaters limits the space available for the Bulk MOLF berths and the area for turning ships to berth. It is considered that two bulk MOLF berths cannot be built with the cofferdam in place.

The scheme comprises the following:

- Two berths (Berth 1 and Berth 2). Berth 2 incorporates a temporary barge quay approximately 80m long with a berth 25m wide and depth -1.5mAOD. The temporary barge berth will be used by contractor's construction barges for unloading precast (PC) units for construction of the east and west breakwaters, the Ro-Ro MOLF and Berth 1 of the Bulk MOLF.
- Each berth comprises a platform (approximately 65m long, 30m wide at +5.0mAOD) for a single MHC unloader equipped with a grab for unloading aggregates or a hook for bundles of rebar or other loads.
- The crane unloads the aggregates into a hopper discharging onto a belt conveyor running to the concrete batching plant bins. Cement is discharged

through a pipeline with flexible hose connection to the cement carrier. Rebar is unloaded onto trailers behind the platform.

- Dredging of the harbour basin to -10.0mAOD with 30m wide berth pockets dredged to -11.5mAOD.

Berth 1 and the harbour dredging are expected to be completed less than 15 months after issue of a DCO, about 3½ months ahead of the original construction programme. The critical activities for the construction are the production of PC concrete blocks for the platform and dredging of the harbour basin. Since these activities progress concurrently, a delay in either will delay completion of Berth 1. The duration of both activities will need to be shortened in order to expedite completion of Berth 1.

Waves penetrating the site, particularly during the winter when the breakwaters are partially built, will have an impact on dredging production and the duration of construction of marine works.

Berth 2 cannot be constructed until the temporary barge berth has been decommissioned and the temporary cofferdam removed. This is estimated to be completed some 25 months after issue of a DCO. It is assessed that Berth 1 should be able to accommodate a throughput of aggregates, bulk cement and rebar for a concrete production of up to 24,000m^3/month in the winter when wave conditions will restrict the entry of ships into the harbour. In the summer, the berth capacity is sufficient to support about 31,000m^3/month of concrete production. This capacity is dependent on the achievement of a high degree of scheduling of ship arrivals to minimise congestion and queuing of ships to berth. It is also greatly influenced by the offshore wave conditions limiting harbour tug operation to assist the entry of ships into the harbour.

Berths 1 & 2 when constructed should be able to handle the throughput of construction materials required for peak concrete production during all seasons. The estimated cost of construction of the Bulk MOLF berths is about £30 million. This is a preliminary order of- magnitude cost.

The following principal risks to implementation and operation of the proposed scheme are foreseen:

- Delays in PC block production or rock dredging delaying completion of Berth 1.
- Berth 1 may, for various reasons, be unable to handle the required throughput of materials in the early days of construction of the power station prior to commissioning of Berth 2. These reasons could include delays in the supply chain, extreme wave conditions preventing entry of ships into the harbour during winter, low unloading rates for small aggregates ships and delay in commissioning of Berth 2.
- Delay in construction and completing Berth 2 due to delays in decommissioning the temporary barge berth or removal of the temporary cofferdam.

The amount of work required to construct the proposed Bulk MOLF is less than in the original blockwork quay wall scheme and this should reduce the potential environmental impacts during construction (e.g. less duration of noise from dredging

and less impacts from blockwork quay wall construction). With the proposed berth layout, the corner at the root of the east breakwater may be filled with surplus suitable material excavated from the power station construction– this will also prevent the accumulation of floating debris in the area.

During operation, although light and noise pollution are likely to be environmental issues particularly with 24 hour operation 365 days per year, these are no different to the original Bulk MOLF with a blockwork quay wall construction.

The following recommendations are made:

- Elaborate the design of the Bulk MOLF to optimise the PC blocks required for construction of Berth 1 platform and the quantities of rock dredging required. Confirm the duration for precasting and installation of PC blocks and the productions rates for dredging rock.
- The preliminary programme for construction of the Bulk MOLF shows completion of Berth 1 before the west breakwater. It is recommended that further wave modelling is carried out to determine the potential downtime due to waves penetrating the harbour affecting ship unloading operations at Berth 1 with the west breakwater in its partially completed state.
- Real-time navigation simulation (full-bridge) of ships entering and manoeuvring in the harbour to ensure that there is adequate area in the harbour basin for turning and manoeuvring of ships to berth. The west breakwater may need to be shifted north-west to provide sufficient turning area.
- Simulate the construction materials supply chain to confirm the estimated capacity of Berth 1, identify bottlenecks and the impact of potential sources of delays. Identify contingency measures for handling concrete materials in the event that Berth 1 becomes congested during peak periods of concrete production.
- Further investigate the possibility of handling AILs over the temporary barge berth including examining whether the berth may be deepened to accommodate the AILs barges without impacting the construction programme. Establish if there is spare capacity at the temporary barge berth to handle either the AILs or concrete construction materials in the event Berth 1 becomes congested during peak periods of concrete production in the winter.

Jacobs. 2014. Options Review for the Marine Off Loading Facility and Breakwaters

The review has identified a number of comparatively high risks associated with the options. Despite the scope for potentially reducing consenting risk by implementation of certain mitigation measures it is clear that the main environmental risks relate to option HGNE-3. The impact of this option on various environmental receptors means the comparative risk is significantly higher than for the other options in terms of direct

habitat loss, adverse effects to European eels and overall visual impact. The additional plan to encompass the southern edge of the bay with the breakwater is likely to result in large changes to the intertidal habitats, which could also impact upon animals and birds utilising this area such as otters (a European Protected Species). When this is considered in tandem with the complete modification of the eastern shoreline and embayment the result is likely to be direct habitat loss and habitat fragmentation to most of the intertidal area in Porth-y-pistyll, along with a significant proportion of the subtidal habitat.

Although option HGNE-3 is likely to offer a good level of protection from the sea there are several engineering constraints that vary significantly from those outlined in other options. The considerably larger extent of HGNE-3 is likely to result in a longer construction programme than the other options and increasing the level of indirect impacts (noise/light/pollution etc). The potentially longer programme and magnitude of this scheme are likely to make this the most costly option of those under consideration in this review; and size of the development would be likely to be of concern to local residents along with commercial and recreational users of the sea.

The benefit of the considerably reduced scope of the dredging work required in HGNE-3 is potentially offset by the requirement for land reclamation, effectively removing the eastern embayment of Porth-y-pistyll. Greater operational costs are also anticipated from maintenance requirements e.g. breakwater repairs following storm damage, maintenance dredging etc.

In option HNP-1 the removal and modification of the eastern side of Cerrig Brith has been identified as a high consenting risk in relation to the direct loss of important intertidal habitat. A further risk with this option is the terrestrial footprint of the breakwater which overlaps with known otter habitat. There is also considerable concern as to whether option HNP-1 provides a safe stopping distance (approximately 300 m) for the incoming cargo ships. In contrast, the safe stopping distance provided by all other options is ~500 m which should be sufficient to enable vessels to stop safely after entering the harbour. The breakwater arms in HNP-1 do not project as far north as in other options, and although this reduces some of the impacts on subtidal habitats it greatly reduces the available working area of the harbour. To make this option viable would involve modifications to the design, such as extending the western breakwater north, which would result in increased environmental impacts.

HGNE-1 has the lowest environmental impact however, the operational considerations of splitting the MOLFs (north and south margins of eastern embayment) may reduce the efficiency of offloading cargo and also increase the likelihood of a vessel collision with the CW intake. The adjacent MOLFs in option HGNE-2 is likely to increase the operational efficiency of offloading whilst reducing the risk of collision with the CW intake. However, the larger dredging programme would be expected to incur greater costs and environmental impact than HGNE-1, with an overall increase in construction time anticipated despite the MOLFs being adjacent to one another.

It should be noted that the designs in this review do not allow an entirely like-for-like comparison as HNP-1 represents an earlier concept layout (which has since been developed) and HGNE-3 represents a design for three as opposed to two cooling water intake units even though the third unit is no longer a requirement. Furthermore,

the MOLF sizes vary noticeably between designs, as does the width of the harbour mouth, despite being required to serve the same design vessels.

At this stage, relatively scant information has been provided on the materials handling equipment and the hinterland facilities for each option. These are fundamental considerations in the operation of a MOLF to ensure material demand profiles can be met. These aspects would normally be the key considerations when developing the location and sizing of MOLFs and consequently in arriving at a preferred solution. This report forms an initial stage of the process to identify an appropriate option and it is recommended that future assessments give consideration to the entire offloading process i.e. the availability and location of hinterland facilities and also how the materials will be offloaded.

Some suggested modifications to the schemes have been summarised which might provide benefits to construction and operation of the options. Among these are the possibility of moving the Ro-Ro MOLF in HGNE-1 to a position adjacent to the bulk materials MOLF, and the potential for connecting the isolated breakwaters of options HGNE-1 and 2 to the land. However, these modifications would incur changes to the level of environmental impacts.

In a more general context, careful consideration should be given to those issues that are common to all of the options. Issues such as the introduction of non-native species and water pollution may be effectively mitigated in a Construction Environmental Management Plan (CEMP), yet other issues, for example the impact on commercial fishing, impact on sea trout habitat and chronic changes to the local hydrodynamics will require additional consideration. An added concern is the potential for vessel collision with the CW intake. It is assumed that some level of protection will be provided but this is currently only shown in plans for HGNE-1 and 2.

Physical processes such as tidal current regime and wave climate may require further modelling studies specific to the breakwater designs of HGNE-1 and 2, especially if these structures are modified. There would also be significant benefit in carrying out vessel simulation studies (navigation), vessel motions studies (offloading), Ports Marine Safety Code Assessment and further Ground Investigation (GI) work. A detailed GI programme will commence this year, and combined with more specific ecological studies to Porth-y-pistyll will better identify project constraints and aid future assessments of the options.

This report represents an options review and does not consider costs of the options at this stage. However, the greater viability of options HGNE-1 and 2 is clear in terms of the considerations covered by the report. A more detailed assessment of these two options (and modified versions thereof) is recommended. This should include a balanced appraisal of costs and due regard to any additional information e.g. GI works, modelling studies, intertidal surveys etc. specific to Porth-y-pistyll and the proposed MOLF development.

Jacobs. 2016. Marine Elements Options Review: Cooling Water Intake and Outfall, MOLF and associated structures. Document number: 60PO8007/AQE/REP/019

Since the 1980s when plans for a new power station on the site of the Existing Power Station at Wylfa were first muted, numerous options for the locations of CW intakes and outfalls have been considered. These options have ranged from onshore intakes and outfalls to those located at distances up to 1 km off the shore. Each intake and outfall location carries with it a number of construction or operational advantages and disadvantages.

Intakes constructed onshore may have greater implications for habitat loss and be at greater risk of inundation from seaweed but construction will be faster causing fewer disturbances. In addition, control of intake velocities and maintenance of fish deterrent systems will be easier, reducing the quantities and species of organisms entrained and impinged within the CW system. An onshore intake might also require protection from wave surges in the form of a breakwater structure. Offshore intakes will take longer to construct whilst control of intake velocities may be more difficult to control in strongly tide-swept environments. Fish drawn into the CW system will also be subjected to greater mechanical and pressure stresses, reducing their probability of survival. Additionally, maintenance of fish deterrent systems at these sites will be harder, especially during inclement weather, putting more fish at risk of entrapment.

Outfalls located close inshore or onshore may not be afforded such efficient dispersal as those further offshore in stronger currents. However, owing to the currents off Wylfa Head, the thermal plume will still be dispersed efficiently, limiting the effects to a restricted area of coastline. Outfalls located further offshore may take some years to construct due to the extensive tunnelling required but the discharged CW would be dispersed more rapidly.

The Department of Transport (DfT) operates a policy to encourage the transportation of abnormal indivisible loads (AIL) away from roads and rail and towards marine solutions. DfT state ‘Road movements will only be authorised where the Department has considered the possibility but believes water transportation is not feasible’. As a result of this water-preferred policy, a MOLF is required to receive certain AILs and possibly other bulk materials required for the construction of the Initially four location options were put forward for the MOLF (Halcrow, 2012): two to the east of Wylfa Head (Porth yr Ogof, Porth Wylfa) and two to the west (south eastern embayment of Porth-y-pistyll, just north of Porth-y-pistyll). The site at Porth Wylfa was later discounted based on perceived operational issues. A report by Bromley et al. (2012), identified the ecological constraints on the various MOLF options, determined that a MOLF located at Porth yr Ogof would have significant effects on the nearby terrestrial features. Consequently the two options to the west of Wylfa Head have been taken forward and form the focus of the MOLF review.

A combination of environmental baseline surveys and desk-based research has been carried out since 2010. These have allowed targeted consideration of the potential effects associated with construction of the various CW intake/outfall options as well as the MOLF, and the resulting data have been used to evaluate the options.

Key environmental effects identified from the construction and operation of the CW system and MOLF include:

- the entrapment of fish, invertebrates and seaweed into the CW system,
- the loss of some of these organisms from the marine environment and associated impacts on predator species (e.g. seabirds and marine mammals);
- the discharge of residual heat and anti-biofouling products to the surrounding sea area via the CW outfall;
- the loss of habitat associated with the CW and MOLF infrastructure;
- visual impacts from associated infrastructure (such as any breakwaters, pontoons and causeways);
- impacts on public recreation and tourism during construction (and to a lesser extent, operation) noise and disturbance during construction and operation (the latter namely for the MOLF);
- changes to coastal hydrodynamics from the placement of submerged structures (specifically the western breakwater); and
- effects on terrestrial species and habitats in the landfall zone.

The effects listed above will vary in their severity depending on the exact location of the CW intake and outfall, and the MOLF. Construction methods will also have varying degrees of effect depending on the methods used.

Horizon's Preferred Options

Although the finalised design is not yet confirmed, Horizon has a preferred concept for the final CW site layout. This involves an onshore intake within Porth-y-pistyll protected by a breakwater structure; and an outfall adjacent to the present location to the west of Wylfa Head. The preferred option for the MOLF is the more northerly of the two options. The preferred options take into consideration factors including sustainability criteria, constructability, operability safety and cost, all of which are beyond the scope of consideration of this report.

Numerous mitigation measures are available to reduce the environmental effects of the preferred options. These include landscaping mounds, fish deterrent systems, reduced intake velocities, fish recovery and return systems, and sympathetic design of breakwater structures to promote biodiversity and act as artificial reefs.

In conclusion, this document has 'screened out' a number of locations put forward for the CW intake/outfall locations and the MOLF structures based on the perceived environmental effects when compared to other potential locations. Horizon's preferred options have been presented, their effects discussed and potential mitigation options put forward. Ultimately the final decisions will be made following discussions with regulators and key stakeholders.

Central Electricity Generating Board (CEGB). 1988. Wylfa 'B' power station preapplication studies. Volume 3 Section 11 General Civil Engineering, Cooling water structures. CF2365, 69 pp.

11.2 Conclusions and Recommendations

11.2.1 Conclusions

Construction of the proposed direct CW system comprising an offshore submerged intake and an onshore outfall is feasible. The intake arrangement provides for twin intake structures connected by vertical shafts to a single intake tunnel.

Exact replication of the Sizewell 'B' pumphouse is not possible at Wylfa 'B' owing to differences in the tidal range, site level and alignment of intake conduit.

Preliminary designs have been prepared for CW systems corresponding to three alternative intake locations. In selecting the scheme for final design development, further consideration will have to be given to the method of handling the seaweed entering the system.

If the intake is sited at the -14.0m OD contour, it is anticipated that the amount of seaweed entering the system could be removed by the drum screens at the CW pumphouse. The cost estimate for this scheme is £20.3M.

If the intake is sited at the -12.5m OD or -13.0m OD contour, mechanical back raked screens would be required at the pumphouse to remove the increased quantity of seaweed that would be drawn into the system. The cost estimates for these schemes, including raked screens, are £21.2M and £21.6M respectively.

If mechanical back raked screens are provided at the pumphouse, the length of the screen bay would be increased by approximately 4.5m and the security zone in the vicinity of the pumphouse would be modified accordingly.

11.2.2 Recommendations

The submerged sea water intake structures should be constructed by the same method that was used successfully for the 'A' station submerged intakes.

Subject to the results of the offshore site investigation, the vertical shafts and tunnels of the CW system should be constructed using drill and blast techniques. The effect of blasting on the 'A' station is discussed in Section 7 of this report.

Construction of the intake tunnel and shafts should take place before that of the CW pumphouse to avoid interference between the two activities. Commissioning of the intake tunnel and shafts should follow completion of the CW pumphouse.

The outfall tunnel should be constructed in parallel with the CW pumphouse using the shaft at the syphon seal weir for access.

In addition to the offshore site investigation, it is recommended that the following studies are carried out during the next stage in the development of the engineering design.

a) Blasting trials and a study of the vibration sensitive facilities at the 'A' station. See Section 7 of this report.

b) A detailed sounding survey for the site of the CW outfall structure. See Section 10 of this report.

c) A hydraulic model of the CW pumphouse to test and confirm the satisfactory performance of the pump suctions. The need for a model of the forebay should be reviewed in the light of the results of the proposed model study of the Hinkley Point 'C' forebay.

d) Model tests to establish the optimum configuration of intake tunnel in the vicinity of the intake shafts.

On completion of the hydraulic gradient for the CW system and determination of the syphon seal weir level, the hydraulic design of the seal weir and the outfall system should be reviewed and consideration should be given to the possibility of oscillations building up in the shaft downstream of the seal weir as a result of air entrainment.

[This page is intentionally blank]