
**Site Preparation and Clearance
Environmental Statement
Volume 3 – Appendix 13-04
Flood Consequence Assessment**

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Contents

1	Introduction	1
1.1	Overview.....	1
1.2	Study area	1
1.3	Natural Resources Wales (NRW) flood maps.....	1
1.4	Planning guidance for a FCA.....	2
1.5	Report objectives	2
2	Policy and planning	3
2.1	Planning context	3
2.2	PPW	3
2.3	TAN 15	3
2.4	Local planning policy	4
2.5	River Basin Management Plan	5
3	Baseline site context	6
3.1	Climate	6
3.2	Topography	6
3.3	Irish Sea	6
3.4	Surface water features.....	6
3.5	Geology	8
3.6	Groundwater	8
3.7	Services.....	9
3.8	Reservoirs	9
4	SPC proposals	10
5	Flood modelling	12
5.1	Sources of modelling data	12
5.2	NRW flood maps.....	12
5.3	Coastal and tidal flood modelling.....	14
5.4	Fluvial and pluvial flood modelling	14
	<i>Comparison to the NRW flood maps</i>	16
	<i>Fluvial flood risk</i>	16
	<i>Pluvial flood risk</i>	17
6	Flood risk assessment	19
6.1	FCA methodology	19
	<i>Sensitivity of receptors</i>	19
	<i>Severity of flooding</i>	19
	<i>Likelihood of occurrence</i>	19
	<i>Consideration of seasonality</i>	20
6.2	FCA screening.....	20
6.3	Sensitivity of receptors.....	22
6.4	Tidal flooding	22
6.5	Fluvial and pluvial flooding.....	23
	<i>Fluvial flood risk</i>	23

	<i>Pluvial flood risk to the SPC Application Site</i>	23
	<i>Increased fluvial flooding off-site due to SPC Proposals</i>	24
6.6	Groundwater	26
	<i>Groundwater emergence at surface</i>	26
6.7	Services.....	26
	<i>Sewerage systems</i>	26
6.8	Flood risks	27
7	Residual risks	30
8	Conclusions	31
9	Glossary and abbreviations	32
10	References	33
11	Figures.....	35

Appendices

- Appendix 1 DCO network results lines
- Appendix 2 Infoworks baseline fluvial flood model output
- Appendix 3 Infoworks baseline pluvial flood model outputs
- Appendix 4 Assessment methodology

List of Tables

Table 3-1	Flood risk study area baseline context	7
Table 5-1	Wylfa Newydd Development Area extreme sea levels.....	14
Table 5-2	Modelled baseline fluvial flood risk (summer) at observation lines.....	17
Table 5-3	Modelled baseline pluvial flood risk (30 minute) at observation lines	18
Table 6-1	Screening of potential flood sources	21
Table 6-2	Modelled fluvial flood risk (summer) to SPC areas at observation lines.	23
Table 6-3	Modelled pluvial flood risk (30-minute storm duration) to SPC areas at observation lines.....	24
Table 6-4	Flood risk summary table	28
Table 9-1	Table of abbreviations and acronyms.....	32
Table 10-1	Schedule of references	33

List of Figures

- Figure 1.1 Flood risk study area, catchments and surface water features
- Figure 1.2 Risk of flooding from rivers and sea
- Figure 1.3 Risk of flooding from surface water

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1 Introduction

1.1 Overview

- 1.1.1 This Flood Consequence Assessment (FCA) is submitted in support of the Town and Country Planning Act (1990) application for the Site Preparation and Clearance (SPC) Proposals that are required in advance of the construction of the Wylfa Newydd Power Station.
- 1.1.2 The FCA has assessed the flood risk posed to the SPC Application Site as well as any changes to flood risk arising from the SPC Proposals.
- 1.1.3 The hydrological baseline is outlined in a standalone Hydrology Baseline Report, contained as appendix 13.01 to the Environmental Statement (ES), information from which is used in this FCA. This FCA should be read in conjunction with the Environmental Statement and the Hydrology Baseline Report.
- 1.1.4 This assessment solely relates to the SPC Proposals covered within the Environmental Statement and excludes construction of the Wylfa Newydd Power Station. Consultation with relevant statutory bodies has taken place during the production of this FCA. A record of consultation can be found in chapter 13 of the Environmental Statement.

1.2 Study area

- 1.2.1 The SPC Application Site boundary is shown in figure 1.1. There are a number of watercourses within 1km of the SPC Application Site boundary that have the potential to affect or be affected by the SPC Proposals.
- 1.2.2 The flood risk study area for this FCA is based on the watercourse catchments shown in figure 1.1; these are the watercourses within 1km of the SPC Application Site boundary. The Irish Sea coastline defines the northern boundary of the flood risk study area. The eastern, southern and western boundaries are defined by the surface water catchment boundaries of relevant watercourses. Beyond this area, flood-related impacts associated with the SPC works are highly unlikely to occur as any effects would be confined to the catchments within which the proposed works are to take place.

1.3 Natural Resources Wales (NRW) flood maps

- 1.3.1 Flood mapping is available online, hosted by NRW on its website [RD1]. Shading on the fluvial flood maps shows whether areas are at high, medium, low or very low risk of flooding, defined as follows:
 - High risk – each year the area as a chance of flooding of greater than 1 in 30 (3.3%).
 - Medium risk – each year the area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%).

- Low risk – each year the area has a chance of flooding between 1 in 1,000 (0.1%) and 1 in 100 (1%).
- Very low risk – each year the area has a chance of flooding of less than 1 in 1,000 (0.1%).

1.3.2 Figure 1.2 shows the fluvial and tidal flood risk across the SPC Application Site. Land within the SPC Application Boundary is predominantly at low or very low flood risk, but small parcels of land adjacent to watercourses and on lower lying areas near Porth-y-pistyll are within a higher risk classification.

1.3.3 The dataset only includes flooding from catchments with an area equal to or larger than 3km². Therefore, the lack of areas defined as higher flood risk for the smaller watercourses and catchments within the study area does not mean that there is no flood risk associated with them.

1.3.4 Surface water flood maps are also available on the NRW website. Figure 1.3 shows the surface water risk to the SPC Application Site. It is seen that the majority of the surface water flood risk is associated with the location of watercourses.

1.4 Planning guidance for a FCA

1.4.1 In Wales, *Planning Policy Wales* (PPW) [RD2] and *Technical Advice Note* (TAN) 15: *Development and Flood Risk* [RD3] provide the national policy framework for the assessment and management of flood risk for new developments. Taken together, they establish a presumption against development in areas at the highest risk of flooding, setting a framework for the sequential assessment of the suitability of sites for development. They also set out an assessment methodology (the FCA methodology) for the systematic evaluation of flood risk and the need to integrate mitigation and flood resilience in the design of new development.

1.4.2 This FCA has been written to address the planning policy requirements listed above for the SPC Proposals, in association with TAN 15 guidance.

1.5 Report objectives

1.5.1 The objectives of this FCA are to:

1. identify possible mechanisms by which the SPC Application Site could flood;
2. identify any aspects of the design that could exacerbate flooding elsewhere;
3. undertake a formal assessment of the risks posed to the SPC Proposals from all identified flood risk sources and mechanisms;
4. confirm that the SPC works would not exacerbate flooding elsewhere;
5. consider the level and acceptability of any residual flood risk; and
6. produce an FCA compliant with TAN 15 and PPW.

2 Policy and planning

2.1 Planning context

2.1.1 The context for planning policy in Wales is set out within PPW 9 [RD2]. This provides the national policy framework for the assessment and management of flood risk for new developments and references a range of European and national legislation that relates to the flood risk. This is supplemented by TAN 15 [RD3] and local planning policy. Although these are the key policy documents, there is a range of additional policy and legislation that is relevant to flood risk. These are detailed in table 13-1 (legislation) and table 13-2 (policy) of chapter 13 (surface water and groundwater) of the Environmental Statement. The Overarching National Policy Statement for Energy (EN-1) and National Policy Statement for Nuclear Power Generation (EN-6) are also discussed in table 13-2 and section 13.2 of chapter 13.

2.2 PPW

2.2.1 The objective of PPW is to avoid the construction of new development within areas defined as being at flood risk, with planning authorities adopting a precautionary approach when formulating development plan policies, including the principle that climate change will likely increase the risk of coastal and river flooding. A strategic approach to flood risk that considers the catchment as a whole is encouraged.

2.2.2 PPW states that new development should not be at risk of flooding itself and should not increase the risk of flooding elsewhere. Additionally, hard-engineered flood defences should be considered likely to be unsustainable in the long term, and new development should avoid development in flood hazard zones.

2.2.3 Only essential transport and utilities infrastructure is considered acceptable within unobstructed floodplains, and then only when such infrastructure is designed to remain operational during times of flooding and with no net loss of floodplain storage or increase in flooding elsewhere.

2.3 TAN 15

2.3.1 TAN 15 provides technical guidance that supplements the policy set out in PPW in relation to development and flooding. It advises on development and flood risk relating to sustainability principles and provides a framework within which risks arising from both river and coastal flooding, and from additional runoff from development in any location, can be assessed. This incorporates climate change scenarios.

2.3.2 TAN 15 provides guidance on flood consequences that may not be acceptable for particular types of development. The location of the development needs to be justified in line with TAN 15 and flood risk areas, and the consequence needs to be acceptable given the vulnerability and use of the receptor.

- 2.3.3 The guidance defines a threshold for the frequency of flooding below which development should not be allowed. This threshold for General Infrastructure is equivalent to the 1% Annual Exceedance Probability (AEP) event, or an event with a 1 in 100 chance of occurring in any given year, for fluvial flooding and it is equivalent to the 0.5% AEP event, or an event with a 1 in 200 chance of occurring in any given year, for tidal flooding. Additionally, the depth of flooding, regardless of development type, should not be greater than 1m for any return period.
- 2.3.4 It is also a requirement of TAN 15 that future users and occupiers of the site are adequately aware of the flood risk and consequences, that effective flood warning is provided, that emergency flood plans are available and that safe access and egress is available. There is also a requirement that the site is designed to facilitate movement of goods/possessions away from flooding, to minimise structural damage and to facilitate recovery.
- 2.3.5 TAN 15 also states that new development should not increase flooding elsewhere. Although it acknowledges that there may be practical difficulties in achieving this aim, the guidance provides a number of ways that this risk can be mitigated and suggests that planning authorities may consider imposing these as conditions on developers.
- 2.3.6 TAN 15 states that consideration must be given to the impacts climate change may have on the risk of flooding over the lifetime of a development; to ensure that development does not take place where flooding would be unacceptable either now or in the future. The Welsh Government has provided guidance [RD4] on how the UK climate changes projections [RD5] should be used to determine the future flood consequences for developments in Wales and must be incorporated in all FCAs produced after December 2016.

2.4 Local planning policy

- 2.4.1 The Anglesey and Gwynedd Joint Local Development Plan forms the basis for land use planning in the Anglesey and Gwynedd areas. The Written Statement was published in 2017 [RD6] and is the main source of local planning policy. Within the Plan, the strategic objectives in relation to flood risk are the following.
- Strategic Objective 6 (SO6): *“Minimise, adapt and mitigate the impacts of climate change. This will be achieved by: ensuring that highly vulnerable development is directed away from areas of flood risk wherever possible;.....”*.
 - Strategic Objective 8 (SO8): *“Ensure that settlements are sustainable.....”*. This will be achieved by, amongst others, ensuring that: *“new developments that are vulnerable to harm will not be located in areas at risk from flooding”*.
- 2.4.2 In order to adapt to the effects of climate change Policy PS 6 (Alleviating and adapting to the effects of climate change) requires proposals to take account and respond to a number of concerns, including: *“Locating (developments) away from flood risk areas, and aim to reduce the overall risk of flooding within the Plan area and areas outside it, taking account of a 100 years and*

75 years of flood risk in terms of the lifetime of residential and non-residential development, respectively, unless it can be clearly demonstrated that there is no risk or that the risk can be managed” and to: “Aim for the highest possible standard in terms of water efficiency and implement other measures to withstand drought, maintain the flow of water and maintain or improve the quality of water, including using sustainable drainage systems”.

- 2.4.3 The Anglesey and Gwynedd Joint Local Development Plan Stage 1 Strategic Flood Consequence Assessment [RD7] forms a key part of the evidence base for planning with respect to review of FCAs. The document helps to determine appropriate development policies and land allocations that avoid or minimise flood risk from all sources, and helps to assess any future development proposals in line with the precautionary framework in PPW and TAN 15. This document and the IACC’s *Preliminary Flood Risk Assessment* [RD9] include information on surface water, groundwater, ordinary watercourses and small reservoir flooding. Information on the IACC flood strategy and the Council’s objectives in managing flood risk is provided in the *Anglesey Local Flood Risk Management Strategy* [RD8].

2.5 River Basin Management Plan

- 2.5.1 The SPC Application Site is wholly located within the Western Wales River Basin. The Western Wales River Basin Management Plan for 2015 – 2021 [summary in RD9] provides an overview of NRW’s approach to managing flood risk within the plan area and details measures designed to reduce the potential flooding, such as use of sustainable drainage systems and improvements and maintenance of flood defence schemes. In addition, the plan proposes improving the understanding of flood risk through the application of mapping and modelling.

3 Baseline site context

3.1 Climate

- 3.1.1 The UK Meteorological Office average annual rainfall data available online for the period 1981 to 2010 show that the average annual rainfall at Valley (19km to the south of the SPC Application site) is 841mm/year, which is below the UK average of 1,154mm/year.
- 3.1.2 Long-term data indicate rainfall is typically higher in the late autumn/early winter and lowest in late spring/early summer.

3.2 Topography

- 3.2.1 The land within the SPC Application Site is mostly above an elevation of approximately 12m Above Ordnance Datum (AOD) and consists of gently sloping hills. There are some low-lying areas, which are:
- at the Tre'r Gof Site of Special Scientific Interest (SSSI) where the land elevation is below 6m AOD; and
 - inland of Porth-y-pistyll beach, south-west of the Existing Power Station, where the land dips below 10m AOD.
- 3.2.2 The drumlins to the south of the SPC Application Site are at 20m to 25m AOD with crests at approximately 30m to 40m AOD.
- 3.2.3 Given the topography there are a number of lower-lying areas between hills, in which there is the potential for surface water to pool.

3.3 Irish Sea

- 3.3.1 North of the SPC Application Site is the Irish Sea. There are a number of inlets along the northern SPC Application Boundary, which include Porth-y-pistyll to the west of the Existing Power Station, Porth Wylfa to the north of the Tre'r Gof SSSI and Porth yr Ogof to the east of Wylfa Head.
- 3.3.2 The coast to the west of Wylfa Head is part of The Skerries, a coastal waterbody assessed under the Water Framework Directive (WFD) as having high ecological and chemical status. This waterbody also includes a number of river catchments as discussed in section 3.4.
- 3.3.3 The coast to the east of Wylfa Head is designated by NRW as the Anglesey North coastal unit (waterbody identification GB64101062000), assessed under the WFD Cycle 2 as having moderate overall status. The Cemaes Catchment and the Tre'r Gof Catchment both drain to this location and are classified as part of this waterbody.

3.4 Surface water features

- 3.4.1 The SPC Application Site is located within an area covered by the Ynys Môn Catchment Abstraction Management Strategy, part of the Western Wales River Basin District, prepared under the WFD.

3.4.2 The flood risk study area consists of five small surface water catchments (figure 1.1); in addition to these, there are a number of small ponds within the topic study area, apparently isolated from the small watercourses. The Existing Power Station is drained by three surface water drainage systems.

Table 3-1 Flood risk study area baseline context

Catchment	Description
Tre'r Gof Catchment	The Tre'r Gof Catchment has an area of 1.0km ² and comprises the Tre'r Gof SSSI, an inland "drainage basin" fed by four small drains (some of which are ephemeral), direct rainfall and shallow groundwater inflow. The Tre'r Gof basin drains north to the coast via a culvert and outfall at Porth Wylfa.
Afon Cafnan Catchment	The Afon Cafnan Catchment has an area of 9.9km ² . The Afon Cafnan originates to the south of the SPC Application Boundary and flows in a northerly direction through the west of the SPC Application Site to discharge to the sea at Porth-y-pistyll. This catchment includes the Cae Gwyn SSSI (0.3km ² in area), which drains via an incised channel referred to here as Nant Caerdegog Isaf.
Cemaes Catchment	The Cemaes Catchment has an area of approximately 3.0km ² . Nant Cemaes is located immediately to the east of the SPC Application Site, draining north from Llanfechell, via Tregale and discharging into Cemaes Bay.
Power Station Catchment	The Power Station Catchment has an area of 0.3km ² and drains a small catchment immediately south of the Existing Power Station. The stream in the catchment flows westward and discharges to the coast at Porth-y-pistyll. It is possible that the upper reaches of this channel are culverted; however, this has not been observed.
Cemlyn Catchment	The Cemlyn Catchment has an area of approximately 2.3km ² ; Nant Cemlyn is located west of the SPC Application Site. This channel drains north via a small south-western area of Wylfa Newydd Development Area to drain into the lagoon at Cemlyn Bay, an ecologically designated area (SSSI, Special Protection Area and Special Area of Conservation (SAC)).

3.4.3 The catchments listed in table 3-1 fall within three WFD waterbodies (see appendix 13.05 for more detail) as follows:

- The Skerries (waterbody identification GB611010390000), a coastal unit that includes the Afon Cafnan Catchment and the Power Station Catchment.

- Anglesey North (waterbody identification GB641010620000), a coastal unit that includes the Tre'r Gof Catchment and Cemaes Catchment.
- Cemlyn Lagoon (waterbody identification GB610100083000), a coastal unit that includes the Cemlyn Catchment.

3.5 Geology

- 3.5.1 The soils across the flood risk study area are defined [RD10] as “*freely draining, slightly acid loamy soils*” in the areas towards the coast, and “*slowly permeable, seasonally wet, acid loamy and clayey soil*” further inland. There is peat at Tre'r Gof SSSI [RD10].
- 3.5.2 The area around the SPC Application Site is mainly underlain by superficial deposits, predominantly of glacial origin (till). There are isolated areas within the SPC Application Site that are not underlain by superficial deposits. Alluvium superficial deposits underlie the Tre'r Gof SSSI, comprising peat, clay, silt, sand and gravel. The bedrock comprises heavily weathered metamorphic bedrock of Cambrian age with some more recent minor intrusions.
- 3.5.3 Due to the soils and superficial geology, rainfall falling within the SPC Application Site is likely to flow as surface water or shallow groundwater rather than migrate into the bedrock, especially towards the coast.

3.6 Groundwater

- 3.6.1 The Hydrogeology Baseline Report, which is appended to the ES as appendix 13.03, contains details of groundwater within the SPC Application Site. The groundwater forms part of the Ynys Môn Secondary WFD waterbody (waterbody identification GB41002G204400), details of which are provided in appendix 13.05.
- 3.6.2 Groundwater is found in both the superficial deposits and in discontinuities such as fractures in the underlying bedrock. Over most of the SPC Application Site, groundwater appears to form a continuous body with water in the bedrock, interacting with water in the superficial deposits. However, in some parts of the area, the groundwater in the two deposits is separate, whilst in other areas the superficial deposits have no groundwater and in some instances “confine” groundwater in the underlying bedrock.
- 3.6.3 The groundwater contours for the superficial deposits, which are shown in appendix G of the Hydrogeology Baseline Report, generally follow topographic contours from the south towards the sea.
- 3.6.4 There is ongoing monitoring of groundwater levels at a large number of monitoring boreholes, which have demonstrated that groundwater is generally shallow at a depth of between 0.1m and 3.2m below ground level within the SPC Application Site. Therefore, any excavations have the potential to encounter groundwater.
- 3.6.5 The water level data appear to show two groundwater flow pathways, with groundwater flowing towards the coast to the east of Tre'r Gof in the east of

the SPC Application Site, and groundwater flowing towards Porth-y-pistyll in the west.

3.7 Services

- 3.7.1 The utilities survey [RD11] shows that there are two surface and foul water sewer networks within the SPC Application Boundary.
- 3.7.2 A Dŵr Cymru Welsh Water (DCWW) foul water sewer originates in Tregele and flows in a north-easterly direction in the general direction of Nant Cemaes. The sewer conveys flows from Tregele, properties along the A5025 and Cemaes. Near to Cemaes Bay, the sewer flows in a westerly direction, north of Tre'r Gof, to the sewage works to the north of the Existing Power Station. Additionally, a surface water sewer discharges water from the Existing Power Station in a westerly direction to discharge to the Power Station Catchment.
- 3.7.3 The utilities survey does not show any DCWW sewers within the vicinity of the residential properties to the west of the SPC Application Site.
- 3.7.4 The utilities survey shows that there are water mains running beneath many of the roads within and immediately adjacent to the SPC Application Site, including beneath the A5025 from Cemaes to Tregele, and beneath the road from Tregele, west to Cemlyn Bay. The Existing Power Station is also served by a water main, which runs beneath the access road.

3.8 Reservoirs

- 3.8.1 There are no reservoirs in the vicinity of the SPC Application Site, and the study area is not located within the maximum extent of a reservoir flood; therefore, there is no risk to the SPC Proposals from reservoirs and this flood source will not be considered further within this report.

4 SPC proposals

- 4.1.1 The activities associated with the SPC Proposals would take place over approximately a 15-month period during 2018 and 2019, with completion by April 2019. Activities would include the establishment of compounds and erection of fencing followed by demolition of properties, removal of field boundary walls/hedges and other vegetation, localised soil remediation and watercourse realignment.
- 4.1.2 This section describes the SPC Proposals that have the greatest potential to impact on flooding. The complete list of SPC works is set out in chapter 3 of the ES.
- 4.1.3 The construction activities relevant to flooding, and the anticipated impacts of flood risk that are assessed within this report include:
- The establishment of main site compound with laydown area, soil remediation compound and satellite compounds may reduce infiltration capacity and increase runoff due to ground compaction.
 - Realignment of a tributary of the Afon Cafnan at Caerdegog Isaf could affect flood risk due to changes in channel form and alignment.
 - Installation of perimeter construction fencing could affect flood risk if it crosses watercourses as it could trap debris which would cause water to locally back up;
 - Removal of vegetation would reduce evapotranspiration and thereby increase runoff rates.
 - Demolition of remaining buildings, clearance of stone walls, gates and field boundaries down to ground level with storage of stone etc. in compounds. These activities could result in local changes to drainage paths and modify catchment areas. In addition, the activities could reduce infiltration capacity of land due to localised ground compaction. These could all change flood risk.
 - Ecological works such as installation of vole fencing could change surface water pathways or cause backing up of water and thereby change flood risk.
- 4.1.4 The assumptions and exclusions followed within this report are outlined below.
- No new watercourse crossings would be developed as part of the SPC Proposals.
 - Perimeter fencing would not cross any main watercourse, and would be sited back 15m from the edge of any such watercourse. Minor watercourses and ditches may be crossed by the perimeter fence. The Contractor undertaking such works would discuss the requirements for a Flood Defence Consent with the Lead Local Flood Authority and would include mitigation required to obtain that consent.

- There would be no requirement for dewatering and therefore no requirement to discharge to surface watercourses.
- To protect against flooding caused by blockages, there would be regular inspection and clearance of any sediment or debris blockages within channels, and inspection and clearance of blockages on the water vole fencing. The fencing would be sensitively placed to minimise impact on the channel and vegetated riparian corridor.

4.1.5 Embedded and good practice mitigation that has been taken into account in the FCA is detailed in chapter 13 of the Environmental Statement and includes the following:

- Where practicable and possible, a 15m buffer would be adopted from both banks of each major watercourse. Where practicable, stone storage, vegetation clearance or construction would not take place within these areas. Where works are required within a buffer, such as demolition, they would be subject to additional risk assessment and appropriate controls.
- To reduce potential effects on flooding, meanders have been incorporated into the design of the watercourse realignment to reduce flow rates. Flood storage has also been incorporated into the design to prevent increases to flooding off-site. The watercourse realignment would be designed to provide floodplain storage up to the 0.1% Annual Exceedance Probability storm event preventing flood increases off-site.
- The SPC Proposals include permeable surfacing to tracks, compounds and laydown areas, except for the secure area of the main contractor's compound as this includes the fuel storage and refuelling area.
- Foul sewage generated by welfare facilities would be stored on-site and removed by the contractor. There would be no foul sewage connections to the contractor's compound and no discharge of foul sewage to surface watercourses.

5 Flood modelling

5.1 Sources of modelling data

5.1.1 The sources of flood modelling data and flood mapping described below have been considered within the preparation of this FCA. It is noted that these maps are based on current day flood risk and do not include any allowance for the effects of climate change.

NRW flood mapping [RD1]: This mapping, delivered as part of a national programme, delineates indicative areas of elevated flood risk into four flood zones and includes both major fluvial (catchment area >3km²) and tidal sources.

Nuclear Safety, Meteorological and Hydrological Hazards Assessment (NSMHHA) [RD12]: This was carried out by Amec Foster Wheeler to model extreme flood risk events in line with guidance in the *Overarching National Policy Statement for Energy (EN-1)* [RD13] and *National Policy Statement for Nuclear Power Generation (EN-6)* [RD14]. This report includes marine modelling, taking into account tidal and wave action, and a combined pluvial and fluvial flood modelling.

SPC Infoworks flood modelling [RD15]: This work, undertaken by Amec Foster Wheeler in support of the SPC Proposals, expands the combined pluvial and fluvial flood modelling within NSMHHA to consider the current landform for differing flood types and return periods.

5.2 NRW flood maps

5.2.1 The NRW flood maps indicate that land within the SPC Application Site boundary and surrounding area is predominantly at low risk of fluvial and tidal flooding except:

- low-lying areas inland of Porth-y-pistyll where extreme sea levels result in inland flooding;
- along the main Afon Cafnan channel southwards to Ty-croes, and along the downstream end of Nant Caerdegog Isaf (which is tributary to the Afon Cafnan); and
- five low-lying marshy areas in the flood risk study area, including one inland of Porth Wylfa associated with the Tre'r Gof SSSI.

5.2.2 As previously discussed, this mapping only includes catchments >3km², so some areas at risk of fluvial flooding may not be shown. There are no fluvial flood defences protecting land within the SPC Application Boundary.

- 5.2.3 The surface water flood map provides more detail in relation to potential areas at risk of flooding across the study area, given that the majority of the catchments are small and therefore act as pluvial catchments. The surface water flood risk is generally associated with the watercourses outlined within the site context. The areas within the study area identified as being at risk of surface water flooding are described below for each catchment.
- 5.2.4 **Afon Cafnan Catchment** – There is surface water flood risk associated with Nant Caerdegog Isaf with many areas of ponding along the stream, and a surface water flow pathways risk associated with a tributary of Nant Caerdegog Isaf. The Afon Cafnan generally has a constrained floodplain within the SPC Application Site boundary, aside from a large and deep area of flooding upstream of Cemlyn Road and another area of ponding at the confluence with Nant Caerdegog Isaf.
- 5.2.5 **Cemlyn Catchment** – Generally, the surface water flood risk is constrained to a narrow channel along Nant Cemlyn within the SPC Application Boundary; however, some flooding of Cemlyn Road is anticipated from this catchment.
- 5.2.6 **Cemaes Catchment** – Nant Cemaes has some significant areas at risk of pluvial flooding associated with the channel in the vicinity of Tregel, with an area of ponding immediately upstream and downstream of the village. There is another area at risk of pluvial flooding immediately upstream of the A5025 and Cemaes. Within Cemaes, the floodplain is narrow and constrained to the channel.
- 5.2.7 **Tre'r Gof Catchment** – The surface water flood map indicates that the Tre'r Gof SSSI is at a high risk of flooding, though, as a low-lying basin that receives runoff from a number of small drains, this is not unexpected. Additionally, the access road is shown to be at risk of surface water flooding from the catchment.
- 5.2.8 **Power Station Catchment** – the surface water flood map indicates that there is a flow pathway along the road to the Existing Power Station, and a deep area of ponding to the north of the Wylfa Sports and Social Club.
- 5.2.9 In summary, areas of flood risk are typically constrained to the watercourses that they are associated with and are relatively minor in nature. There are some instances where areas in the vicinity of access roads are affected, such as Cemlyn Road and the A5025, and there may be ponding south of the Existing Power Station.

5.3 Coastal and tidal flood modelling

- 5.3.1 Extreme sea level data issued by the Environment Agency's 2011 National Extreme Coastal Water Level Project are listed in table 5-1 for the SPC Application Site, as summarised from the NSMHHA report. The extreme sea levels are estimated for 2023 and the levels provided are for a combined high meteorological tide and storm surge event. These values are conservative, as the SPC works would be likely to take place over a 15-month period commencing in January 2018.

Table 5-1 Wylfa Newydd Development Area extreme sea levels

Extreme sea level	AEP			
	1%	0.5%	0.1%	0.01%
Extreme sea level in 2023 (m AOD)	4.38	4.44	4.58	4.75
Stated confidence (m)	0.30	0.30	0.40	0.50

Source: NSMHHA Report (Environment Agency Report, Coastal flood boundary conditions for UK mainland and islands, No: SC060064/TR2: Design Sea Levels)

- 5.3.2 Most of the land within the SPC Application Site is above 12m AOD and so significantly above the sea levels in table 5-1.
- 5.3.3 An assessment of extreme wave heights, including assessment of the effect of local bathymetry and changes associated with climate change, has been undertaken together with an assessment of the joint probability of extreme sea levels and wave heights. This suggests that, even with very conservative input assumptions, extreme combinations of high tide and waves (0.01% AEP) are unlikely to exceed about 7.7m AOD.
- 5.3.4 The greatest potential for overtopping (by combined extreme sea levels and wave action) is in the area inland from Porth Wylfa. If wave overtopping were to occur here, it is assumed the water would flood the Tre'r Gof SSSI and be contained within the topographic depression in which it sits. The Tre'r Gof SSSI is surrounded by higher ground; this, combined with the limited duration and rate of overtopping, means it is unlikely that there would be further ingress of tidal flooding.

5.4 Fluvial and pluvial flood modelling

- 5.4.1 For flood probabilities, up to the 0.1% AEP event, the combined fluvial and pluvial modelling detailed within the NSMHHA has been superseded by fluvial and pluvial modelling of all watercourse catchments in the flood risk study area, for baseline conditions, for different return periods.

- 5.4.2 Fluvial and pluvial flooding was modelled separately for each catchment using an Infoworks 1D-2D linked model. Both the fluvial and pluvial flood models were run for 50% AEP, 3.33% AEP, 1% AEP and 0.1% AEP storm return periods. The fluvial flood model was run for both summer and winter storms, while the pluvial flood model was run for multiple storm durations (30 minutes, 60 minutes, 180 minutes, 360 minutes and 1,440 minutes) to identify the critical storm duration.
- 5.4.3 The modelling uses more-detailed topography/modelling methods and provides a more accurate representation of flood risk than the NRW flood map. All scenarios are run for the periods 2020s, 2080s and 2180s, and incorporate climate change allowances of 30% (reasonably foreseeable) and 75% (credible maximum) for the 2080s and 110% for the 2180s [RD4].
- 5.4.4 A number of observation lines have been included across the scheme as shown in appendix 1, from which flood depths and flows have been obtained. The following section presents the modelled fluvial and pluvial flood risk to the SPC Application Site for the baseline. The results are discussed in section 6, alongside discussion of any changes to sensitive off-site areas due to the proposed SPC works.
- 5.4.5 The combined baseline fluvial and surface water flooding areas within the SPC Application Site from each catchment are summarised below. These flood maps are shown in appendix 2.
- 5.4.6 **Tre'r Gof Catchment** – small catchment dominated by surface water flows to the Tre'r Gof SSSI. The deepest flooding across the SPC Application Site is within the Tre'r Gof SSSI, which is formed in a natural depression into which the surface runoff flows. There is additionally another small area of flooding indicated on a southern drain to the Tre'r Gof SSSI.
- 5.4.7 **Afon Cafnan Catchment** – dominated by fluvial flows. Flooding occurs along the southern edge of the SPC Application Site boundary associated with Nant Caerdegog Isaf. There is also some flooding along Afon Cafnan to the south (upstream) of the Cemlyn Bay Road.
- 5.4.8 **Cemaes Catchment** – dominated by fluvial flows. Deep flooding occurs in a small portion within the SPC Application Site to the north-east of Tregel. The floodplain further downstream adjacent to Cemaes is confined and does not extend onto the SPC Application Site nor significantly affect the village.
- 5.4.9 **Power Station Catchment** – small catchment dominated by surface water flows. Two flood flow routes are evident within the SPC Application Site and each is well defined and generally shallow. An area of ponding is predicted immediately south of the road to the Existing Power Station. The model simulates water flowing along the road and ponding in this area, before flowing across towards the coast at Porth-y-pistyll.

- 5.4.10 **Cemlyn Catchment** – this catchment is dominated by fluvial flows. The flood extent is predicted to be more significant in the lower reaches, with deep flooding to the north and along Cemlyn Road. The model also predicts flooding along the road to Cemlyn Bay car park; however, this is a separate catchment to Cemlyn Catchment.

Comparison to the NRW flood maps

- 5.4.11 The NRW fluvial flood map only shows the modelled flood risk along Afon Cafnan, and not any of the other watercourses. The NRW flood maps for the Afon Cafnan are comparable with the flood extent predicted by the Infoworks fluvial flood model; however, the Infoworks fluvial flood model also includes areas of flooding not identified by NRW. The Infoworks fluvial flood model has therefore been used as the basis of the fluvial flood risk assessment as it provides a more conservative assessment.
- 5.4.12 The Infoworks pluvial flood modelling results are very similar to the NRW surface water flood map, with flooding locations comparable; however, flood extents vary slightly between the two models. Given that the Infoworks model is based on more detailed topography and refined rainfall data, it is considered that the Infoworks flood model is more accurate and is used as the basis of the pluvial flood risk assessment.

Fluvial flood risk

- 5.4.13 Baseline fluvial flood risk scenario maps are presented in appendix 2. Only three of the five catchments have been modelled for fluvial flood risk, which are the Afon Cafnan Catchment, Cemlyn Catchment and Cemaes Catchment. Both the Tre'r Gof Catchment and the Power Station Catchment are pluvial catchments.
- 5.4.14 The majority of the SPC Application Site has a low risk of fluvial flooding, with no fluvial flooding predicted for events up to 0.1% AEP fluvial flood events across the majority of the SPC Application Site, as shown in appendix 2. The existing flood risks in key locations associated with the SPC Proposals are presented in table 5-2, below. The depths are the maximum flood depth across the observation lines shown on the figure in appendix 1. Fluvial flooding has been modelled for both summer and winter conditions. For all three scenarios, the summer flooding results in deeper and more extensive flooding, and as such, only the summer flooding is discussed.
- 5.4.15 The SPC Proposals and works areas that are at risk of fluvial flooding are described below, with the referenced areas shown in appendix 2.
- 5.4.16 The realigned reach of Nant Caerdegog Isaf would be immediately south of the existing Nant Caerdegog Isaf within the fluvial flood plain and would involve some work being carried out within the existing channel. The downstream end of the realignment has the highest modelled risk of flooding, while the centre and upstream end of the realignment have a lower risk of fluvial flooding.
- 5.4.17 The areas outside of the SPC Application Site most at risk of fluvial flooding are described below.

- Cemlyn Bay SSSI and SAC is within the Cemlyn Catchment and receives flows from Nant Cemlyn and a pluvial driven small road drain.
- Cemaes is a village within the Cemaes Catchment and is located to the north-east of the SPC Application Site. Nant Cemaes flows through the west of the town prior to discharging to Cemaes Bay via a culvert.
- Cemlyn Road runs from the A5025 west towards Cemlyn Bay; the road crosses both the Afon Cafnan and Nant Cemlyn.

5.4.18 The modelled existing fluvial flood outputs at the observation lines (appendix 1) corresponding to these locations are summarised in table 5-2.

Table 5-2 Modelled baseline fluvial flood risk (summer) at observation lines

SPC area	Description of flooding	Maximum flood depth (m)			
		50% AEP	3.3% AEP	1% AEP	0.1% AEP
Watercourse realignment	Upstream end of watercourse realignment (CAER4)	0.00	0.00	0.04	0.08
	Eastern portion of watercourse realignment (CAER9)	0.00	0.29	0.51	0.89
Cemlyn Bay SSSI and SAC	Flood depth at Nant Cemaes outfall to Cemlyn Bay (CEML7)	0.22	0.25	0.30	0.40
Cemaes	Nant Cemaes flood levels upstream of Cemaes (CEMA5)	0.00	0.58	0.68	0.84
	Nant Cemaes flood level within Cemaes (CEMA9)	0.00	0.40	0.55	0.74
Cemlyn Road	Nant Cemlyn at Cemlyn Road (CEML6)	0.41	0.70	0.79	0.93
	Afon Cafnan at Cemlyn Road (CAFN9)	0.24	0.67	0.94	1.33

Pluvial flood risk

5.4.19 Baseline pluvial flood risk scenario maps are shown in appendix 3. Pluvial flooding has been modelled for different storm durations; however, for both the baseline and SPC scenarios the 30-minute storm duration flooding resulted in deeper and more extensive flooding, and as such, only the 30-minute storm duration flooding is discussed in this section.

5.4.20 The pluvial flood model indicates a low risk of pluvial flooding across the entire SPC Application Site, with modelled flood depths of less than 0.05m across the majority of the site.

5.4.21 The areas within the SPC Application Site that are indicated to have a risk of pluvial flooding are described below. The maximum predicted pluvial flood

depths at the modelled observation lines for the baseline scenario are summarised in table 5-3. There is a risk of pluvial flooding along Nant Caerdegog Isaf associated with the watercourse realignment at similar locations to the fluvial flooding, and as such, the realignment of Nant Caerdegog Isaf is also subject to pluvial food risk.

Table 5-3 Modelled baseline pluvial flood risk (30 minute) at observation lines

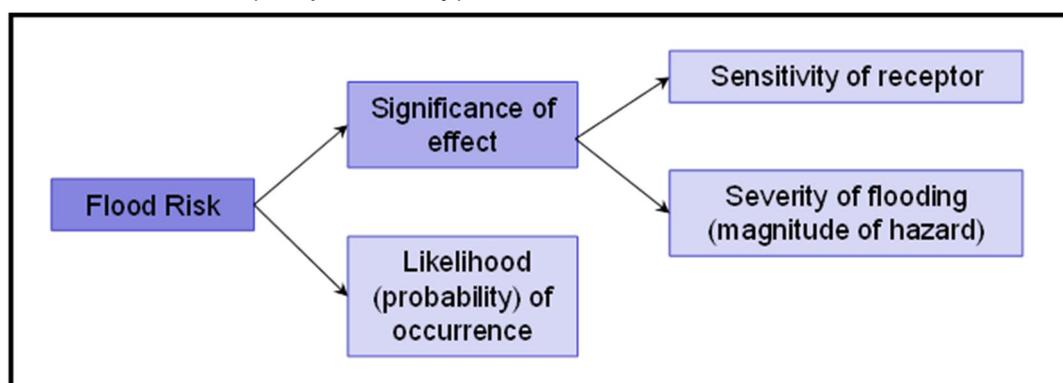
SPC area	Description of flooding	Maximum flood depth (m)			
		50% AEP	3.3% AEP	1% AEP	0.1% AEP
Watercourse realignment	Upstream end of watercourse realignment (CAER4)	0.03	0.04	0.06	0.10
	Eastern portion of watercourse realignment (CAER9)	0.18	0.23	0.26	0.50
Cemlyn Bay SSSI and SAC	Flood depth at Nant Cemaes outfall to Cemlyn Bay (CEML7)	0.22	0.26	0.32	0.45
Cemaes	Nant Cemaes flood levels upstream of Cemaes (CEMA5)	0.12	0.21	0.48	0.66
	Nant Cemaes flood level within Cemaes (CEMA9)	0.08	0.52	0.64	0.83
Cemlyn Road	Nant Cemlyn at Cemlyn Road (CEML6)	0.25	0.68	0.79	0.98
	Afon Cafnan at Cemlyn Road (CAFN9)	0.09	0.20	0.41	0.78

6 Flood risk assessment

6.1 FCA methodology

6.1.1 The risk assessment methodology used within this FCA is set out in appendix 4 and is based on PPW [RD2] and associated guidance [RD3]. The guidance recommends that flood risk be assessed through consideration of both the significance of potential effects and the likelihood of occurrence. The significance of effect is then dependent on two factors: the sensitivity of potential receptors and the severity of the flooding. Thus, the three criteria on which flood risk is assessed are:

- sensitivity of the receptor;
- severity of flooding (i.e. the magnitude of the hazard); and
- likelihood (i.e. probability) of occurrence.



Sensitivity of receptors

6.1.2 The sensitivity of receptors is defined according to the method outlined in appendix 4 with a range of sensitivities from very high through high, medium and low, to very low being defined. TAN15 guidance outlines the vulnerability of different types of on-site development and also classes all off-site receptors as highly sensitive to flooding. The sensitivity of the receptors are defined in section 6.3.

Severity of flooding

6.1.3 Appendix 1 of TAN 15 identifies acceptable thresholds of flooding for different types of development and also presents indicative consequences of flooding that may be acceptable subject to adequate warnings and preparation. This guidance has been used to define the magnitude of flooding that falls within the categories Negligible to High Hazard. Further information on the typical criteria against which the category is defined is presented in appendix 4.

Likelihood of occurrence

6.1.4 Given that the SPC Proposals would occur over a 15-month period, the chance of an event occurring during this time is significantly less than would

occur within a 100-year period. To ensure consistency of approach with the TAN 15 classification, the categorisation of a High risk within this shorter time period adopts the same chance of occurrence using the methodology contained within appendix 4. This results in a conservative approach. To illustrate this, a 5% AEP flood event (equivalent to a 1 in 20 year event) has a 9.75% chance of occurring in a two-year period, and as such, an event of this magnitude would be considered to have a High probability.

- 6.1.5 Beyond the 1 in 100 year frequency threshold, TAN 15 guidance states that it would not be sensible for the depth of flooding to exceed 1m in any instances for industrial developments.

Consideration of seasonality

- 6.1.6 Flooding can occur at any time of year, although it can exhibit quite different seasonal characteristics. Summer flooding is generally associated with localised, high intensity, convective rainfall events, resulting in rapid runoff response in which the peak flow is the main driver of flood risk. This can be a particular issue in urban catchments where significant areas of impermeable surfaces result in rapid runoff. Winter events are generally associated with slower moving frontal systems, they are often prolonged and less intensive and they occur on typically wetter catchments, resulting in longer hydrographs with lower peaks but substantially more volume.
- 6.1.7 The catchments of concern in this study are essentially rural, they are generally small in size and have shallow low permeability soils meaning that they are likely to be more susceptible to high intensity summer storms than to winter frontal events; a conclusion that is supported by predicted flood flows and levels from modelling of both winter and summer rainfall profiles. Presentation of the results for a summer event only is therefore risk-based, focussing on the source of key risks on the SPC site. Furthermore, the mitigation measures proposed are effective and appropriate for the hazards identified, and these are equally appropriate and no-less valid whether the hazard is derived from intense periods of runoff during summer events or longer volume-based events in the winter months.

6.2 FCA screening

- 6.2.1 Industry guidance [RD16] recommends that an FCA should consider all possible sources of flooding for a given site. This is also reflected in the TAN 15 guidance on flood risk. A number of specific mechanisms exist to identify possible sources of flooding, but many of these can be easily discounted. Table 6-1 summarises a range of potential risks and whether these are relevant to the SPC Application Site.

Table 6-1 Screening of potential flood sources

Flood type	Source	Pathway	Consider further?	
Tidal	Irish Sea flooding of the SPC Application Site	Storm surge, spring tide and wave overtopping causing overland flooding.	Yes	
Fluvial and pluvial	Fluvial flooding of the SPC Application Site	High fluvial flows or blockage of any structure within the SPC Application Boundary.	Yes	
	Pluvial flooding to the SPC Application Site	High rainfall within the SPC Application Boundary.	Yes	
	Site development		Increased fluvial flooding off-site due to the SPC Proposals altering infiltration capacity, evapotranspiration, in-channel changes and changes to drainage paths and catchment areas.	Yes
			Increased pluvial flooding off-site due to the SPC Proposals altering infiltration capacity, evapotranspiration, in-channel changes and changes to drainage paths and catchment areas.	Yes
			Potential increases in flooding due to decreased permeable area from site development, compounds and roads.	Yes
			Changes in drainage paths and flood conveyance due to fencing.	Yes
	In-channel water vole fencing across Nant Caerdegog Isaf causing fluvial flooding.	Yes		
Groundwater	Groundwater	Increase in groundwater levels causing breakout at the surface and subsequent change in surface water and fluvial flood conveyance.	Yes	
Services	Sewerage network	Blockage or surcharge of sewers causing overland flow.	Yes	
	Water mains	Local systems only.	No	
Reservoir flooding	Failure of reservoir walls	No reservoirs in the vicinity of the SPC Application Boundary and not located in the maximum extent of reservoir flooding.	No	
Other	None	N/A	No	

6.3 Sensitivity of receptors

- 6.3.1 The receptors have been divided into two groups, the first being the on-site receptor in the form of the proposed development and the second being all off-site receptors. As the work proposed as part of SPC are small scale and not the type of activities likely to result in significant flood risk, a generic approach has been adopted. This conservatively considers all off-site receptors (farms, houses, roads, infrastructure, coastline, agricultural land, statutory designated sites etc.) to have Very High sensitivity to flooding. In the event that a high risk of flooding is identified to off-site receptors at the generic stage, then a more detailed assessment would be completed for individual receptors to ascertain the risk specific to each receptor.
- 6.3.2 TAN 15 lists five categories of development: residential, commercial/retail, industrial, emergency services and general infrastructure. Of these, the SPC Proposals best fit the “industrial” site category, therefore classifying it as a “*less vulnerable development*”. Following appendix 4, this is classified as having Medium sensitivity within this assessment.

6.4 Tidal flooding

- 6.4.1 The TAN 15 flood map shows that the low-lying coastal area around Porth-y-pistyll is at risk of tidal flooding.
- 6.4.2 The NSMHHA tidal model for 2023 has been used to assess the SPC Proposals, as all activities would be completed by this date. Predicted tidal flood levels are shown in table 5-1 and are as follows:
- 4.38m AOD for a 1% AEP tidal flood event;
 - 4.58m AOD for a 0.1% AEP flood event; and
 - 7.7m AOD for maximum plausible level incorporating a combination of high tide and wave level.
- 6.4.3 The land at the coast is elevated to approximately 5m AOD; these areas are slightly above the 0.1% AEP flood level from a combined high tide and storm surge. These areas could be vulnerable under the maximum plausible level of flood risk from a combination of extreme waves, high tides and storm surge; however, the consequences of flooding in this scenario are considered to be Low, as it is wave action causing the hazard of flooding, which is likely to be low in depth and for a short duration. Given this, and given the Low probability of occurrence in the timeframe for the SPC Proposals, the overall flood risk to the coastal area adjacent to Porth-y-pistyll is assessed as Very Low.
- 6.4.4 Aside from the land adjacent to Porth-y-pistyll, the remainder of the SPC works would occur on land above 10m AOD, where there is no risk of tidal flooding or wave overtopping.
- 6.4.5 Overall, therefore, the risk of tidal and coastal flooding to the SPC Application Site is assessed as Very Low.

6.5 Fluvial and pluvial flooding

6.5.1 As stated, the Infoworks fluvial flood modelling mimics the NRW flood maps; however, it uses more detail available from the model data and more robust digital terrain data. The following assessment of fluvial and pluvial flood risk is based upon assessment of the Infoworks fluvial flood model output and, specifically, the impact of development on flood risk defined by any changes between the baseline model results and those for the SPC Proposals, with the drainage scenario as shown in appendix 2 and appendix 3.

Fluvial flood risk

6.5.2 The fluvial flood risk to the majority of the SPC Application Site is low, with no flooding predicted to the majority of the area up to the 0.1% AEP fluvial flood event. As such, these areas are consistent with the aims of TAN 15 to locate new development outside of Flood Zone C.

6.5.3 Based upon the Infoworks flood model output, there are, however, areas at risk from fluvial flooding in events more frequent than the 0.1% AEP event, and these are identified below and shown in appendix 2. The maximum modelled fluvial flood depth at the observation lines (appendix 1) corresponding to these areas are shown in table 6-2.

6.5.4 The watercourse realignment shows flooding at the 0.1% AEP at the upstream end and 3.33% AEP at the downstream end for the baseline scenario.

Table 6-2 Modelled fluvial flood risk (summer) to SPC areas at observation lines

SPC works area	Description of flooding	Model scenario	Maximum flood depth (m)			
			50% AEP	3.3% AEP	1% AEP	0.1% AEP
Watercourse realignment	Upstream end of watercourse realignment (CAER4)	Baseline	0.00	0.00	0.04	0.08
	Eastern portion of watercourse realignment (CAER9)	Baseline	0.00	0.29	0.51	0.89

6.5.5 The area of the proposed realignment of Nant Caerdegog Isaf is shown to be at risk of fluvial flooding. The diversion is assessed to be at risk for the 3.3% AEP event; the maximum flood depth for this is 0.29m. The flood depth increases to 0.51m AOD (a Medium hazard) for a 1% AEP event (Medium probability), resulting in flooding of Low consequence.

Pluvial flood risk to the SPC Application Site

6.5.6 The IACC Preliminary Flood Risk Assessment [RD17] does not present any records of pluvial flooding in the vicinity of the study area.

- 6.5.7 Pluvial flooding across the SPC Application Site is generally shallow, with modelled depths across the majority of the SPC Application Site less than 0.05m due to direct rainfall. Based upon the flood model output, areas at risk from pluvial flooding are flow pathways and areas of ponding within the watercourse realignment area.
- 6.5.8 The maximum flood depths (30-minute storm duration) for the model observation lines associated with the SPC work areas are summarised in table 6-3.
- 6.5.9 The watercourse realignment is at risk from shallow pluvial flooding for the 50% AEP event; however, the main area at risk is an area of pooling at the downstream end, which has a predicted depth of 0.23m AOD for the 3.33% AEP event. This increases to a predicted pluvial flood depth of 0.26m (Medium hazard) for the 1% AEP flood event (Medium probability). In this situation, the consequence of flooding is considered to be Low and the overall pluvial flood risk to the realignment is assessed as Low.

Table 6-3 Modelled pluvial flood risk (30-minute storm duration) to SPC areas at observation lines

SPC works area	Description of flooding	Model scenario	Maximum flood depth (m)			
			50% AEP	3.3% AEP	1% AEP	0.1% AEP
Watercourse realignment	Upstream end of watercourse realignment (CAER4)	Baseline	0.03	0.04	0.08	0.10
	Downstream end of watercourse realignment (CAER9)	Baseline	0.18	0.23	0.26	0.50

- 6.5.10 Although pluvial flooding is predicted across the majority of the SPC Application Site, the depths are generally below 0.05m (Very Low hazard) and represent direct rainfall runoff; given this, the pluvial flood risk to other areas has been assessed as Very Low.

Increased fluvial flooding off-site due to SPC Proposals

- 6.5.11 The watercourse realignment could potentially increase flooding downstream due to increasing the conveyance of the channel; however, the watercourse realignment has been designed to prevent any increase in flood risk. The existing watercourse would be left open at the downstream end of the diversion so that waters from the ditch to the north would flow around the existing channel and therefore not increase flood risk.

Increased fluvial and pluvial flood risk due to decreased permeable area

- 6.5.12 The potential effect of changes to the extent of permeable areas is described below.

- Site compound and laydown area – the majority of the site compound would be permeable, although there is a small area of hardstanding associated with the fuel storage area. Any runoff from the compound would be routed to adjacent swales and allowed to infiltrate. Therefore, there would not be any increase in the fluvial flood risk within each watercourse. In the event of the infiltration capacity of the swale being exceeded above 3.33% AEP storm event (Medium probability), any water would discharge via the surface water flow pathway to Porth-y-pistyll with no increases in fluvial or pluvial flooding to off-site receptors (Low hazard).
- Soil remediation compound – The mounding of treated soils in the remediation processing compound has the potential to locally increase the steepness of land surfaces. This would alter the surface water flows, potentially increasing both the speed and peak rate of runoff and reducing groundwater recharge. In addition, the compacted base of the mound could increase runoff and reduce infiltration. The changes to the level of flood risk are considered negligible.
- Satellite compounds – the satellite compounds would be constructed on existing hardstanding; therefore, there would be no increase in impermeable area and no potential impact on fluvial or pluvial flood risk.

6.5.13 Overall, the potential increases in impermeable area would have no impact on pluvial and fluvial flooding to off-site receptors, and therefore the flood consequence is assessed as low.

Increased fluvial flooding due to water vole fencing

6.5.14 Water vole fencing would be in place for approximately three months across the reach of the Nant Caerdegog Isaf to be realigned. The installation of this fencing would likely be subject to an Environmental Permit; therefore, any impacts would be identified and managed through the Permit. Additionally, the water vole fencing would be checked regularly as part of the works and any debris would be cleared. In the unlikely event of a flood caused by debris, the effects would be localised to the floodplain, without any impact on the built environment. As such, the flood consequence is considered to be Low.

Changes in pluvial and fluvial flood water conveyance due to fencing

6.5.15 The boundary fence does not cross any watercourses; however, it is located within the floodplain of the Afon Cafnan and potentially other watercourses. In the event of a flood, it is unlikely that fencing would result in any constriction of flood water, given the porous nature of the fencing. As such, the flood consequence due to the boundary fencing is Low.

6.6 Groundwater

Groundwater emergence at surface

- 6.6.2 The aquifers beneath the SPC Application Site have low storage and low transmissivity, and therefore do not store nor transmit a significant volume of groundwater. Based on this, any groundwater beneath the study area is unlikely to occur in great enough quantities to cause groundwater flooding to the majority of the SPC Application Site, with only low-lying areas potentially at risk of groundwater emergence at the surface.
- 6.6.3 When groundwater levels (in response to high rainfall) are significantly above average, it is likely these would be contemporaneous with high surface water flows and saturated ground conditions. There is therefore the potential for some localised groundwater flow through springs appearing in low-lying areas across the SPC Application Site, likely occurring in similar locations to those at risk of pluvial flooding.
- 6.6.4 Any groundwater flooding is likely to be localised in nature, and likely to be shallow in depth (low hazard) prior to discharging to drainage channels or watercourses. As such, the risk to the SPC Application Site is Low.

6.7 Services

Sewerage systems

- 6.7.2 The IACC Preliminary Flood Risk Assessment [RD17] does not include any records of sewer flooding in the vicinity of the SPC Application Site. There are no surface water sewers beneath the SPC Application Site, aside from those associated with the Existing Power Station, whilst the foul water sewers are located adjacent to Nant Cemaes and to the north of the Tre'r Gof SSSI.
- 6.7.3 In the event of the surface water sewers surcharging south of the Existing Power Station, water would be shallow and discharge west to Porth-y-pistyll.

6.7.4 In the unlikely event of the foul sewers becoming either blocked or surcharging, there is likely to be a limited volume of water discharging to the surface. This water is likely to discharge directly into either Nant Cemaes or the Tre'r Gof SSSI and from there discharge to the sea. With a worst-case Medium probability and Low hazard, the consequence and overall risk is assessed as Low.

6.8 Flood risks

6.8.1 The probability of each type of flooding has been assessed in line with the methodology and guidance set out in appendix 4. This is then combined with the assessment of receptor vulnerability and assessment of the hazard of flooding for the receptor, which define the consequence of flooding on a scale ranging from Negligible to High. The flood risk is based on a combination of the probability and the consequence. The flood risk assessment is contained in table 6-4.

6.8.2 Typically, consequences assessed to be Low are acceptable, whereas those assessed to be Moderate or High require additional mitigation or management to enable development to proceed.

Table 6-4 Flood risk assessment table

Flood type	Source	Pathway	Receptor	Sensitivity	Magnitude of potential effect	Significance of potential hazard	Likelihood of occurrence*	Flood risk
Tidal	Irish Sea flooding to the SPC Application Site	Storm surge, spring tide and wave overtopping causing overland flooding	All SPC areas	Medium	Low	Low	Low	Low
Fluvial and Pluvial	Fluvial	Increased fluvial flooding off-site due to the SPC works altering infiltration capacity, evapotranspiration, in-channel changes and changes to drainage paths and catchment areas. Fluvial flood increases due to SPC works altering floodplains and surface water flows.	Cemaes village	Very High	Very Low	Low	Medium	Low
	Pluvial	High rainfall leading to flooding within the SPC Application Site	Other off-site receptors	Very High	Very Low	Low	Medium	Low
	Site development	Increased pluvial flooding off-site due to the SPC Proposals altering infiltration capacity, evapotranspiration, in-channel changes and changes to drainage paths and catchment areas. Pluvial flood increases due to	Off-site receptors	Very High	Very Low	Low	Medium	Low

Flood type	Source	Pathway	Receptor	Sensitivity	Magnitude of potential effect	Significance of potential hazard	Likelihood of occurrence*	Flood risk
		SPC works altering surface water flows.						
		Potential increases in flooding due to decreased permeable area from site development.	Off-site receptors	Very High	Very Low	Low	Medium	Low
		Changes in drainage paths and flood conveyance due to fencing	Off-site receptors	Very High	Very Low	Low	Low	Low
		In-channel water vole fencing across Nant Caerdegog Isaf causing fluvial flooding	Off-site receptors	Very High	Very Low	Low	Low	Low
Groundwater	Groundwater	Groundwater flooding expressed at surface	All SPC areas	Medium	Very Low	Very Low to Low	Medium	Low
Services	Sewerage network	Surcharge, blockage or failure of existing sewers	SPC Proposals	Medium	Low	Low	Medium	Low

*Occurrence is related to the lifetime of the development. For flood risk to the SPC Proposals, this is the 15-month construction period

7 Residual risks

- 7.1.1 Based on this FCA, there are no predicted significant flood risks affecting the SPC Application Site. There are no predicted flood consequences to off-site receptors due to the SPC Proposals. This notwithstanding, good practice for managing flood risk will be in accordance with the Code of Construction Practice (CoCP).

8 Conclusions

- 8.1.1 This FCA has been developed in line with TAN 15 guidance, which states that development should be located within areas at low flood risk and result in no increased flooding off-site. The approach taken has assessed the probability of flooding occurring, the vulnerability of development to flooding and the flood hazard in order to define the consequences of flooding, and finally has combined the probability of flooding with the consequences to assess the overall flood risk to different facets of the scheme.
- 8.1.2 Since the SPC works would occur over only a 15-month period, the probability of a flood event occurring is less than the thresholds outlined in TAN 15. However, the probability of a flood event occurring during the lifetime of the SPC Proposals has been assessed in line with the methodology in appendix 4 of this report, which is in a manner consistent with the TAN 15 assessment of risk for developments with a longer anticipated lifespan. The assessment here is therefore conservative.
- 8.1.3 This FCA is supported by detailed fluvial and pluvial flood modelling of the baseline scenario.
- 8.1.4 The following summarises the outcome of the assessment.
- This flood modelling supplements the NRW flood maps in an assessment of flood risk. The flood consequence from fluvial sources to the SPC Application Site has been assessed as Low.
 - The flood consequence from tidal sources has been assessed as Low, given that the majority of the area would be constructed above the maximum combined tidal and wave elevation.
 - The predicted effect of the SPC works on other off-site receptors has also been assessed as Low.
 - There are no predicted increases in pluvial flood risk to off-site receptors, and as such, the consequences associated with these are assessed as Low.
 - Flooding from sewerage has been assessed and is considered to be Low.
- 8.1.5 Based upon the information referenced within this FCA and that in chapter 13 (surface water and groundwater) of the Environmental Statement, the SPC Application Site is assessed to have a Low flood risk from all sources to all receptors, based on the consequences of flooding and the probability of flooding during the 15-month construction period. Given this, the development is considered to be in line with TAN 15 guidance.

9 Glossary and abbreviations

Table 9-1 Table of abbreviations and acronyms

Term or abbreviation	Definition
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
DCWW	Dŵr Cymru Welsh Water
ES	Environmental Statement
FCA	Flood Consequence Assessment
FRMP	Flood Risk Management Plan
IACC	Isle of Anglesey County Council
NRW	Natural Resources Wales
NSMHHA	Nuclear Safety, Meteorological and Hydrological Hazards Assessment
PPW	Planning Policy Wales
SAC	Special Area of Conservation
SPC	Site Preparation and Clearance
SSSI	Site of Special Scientific Interest
TAN	Technical Advice Note
WFD	Water Framework Directive

10 References

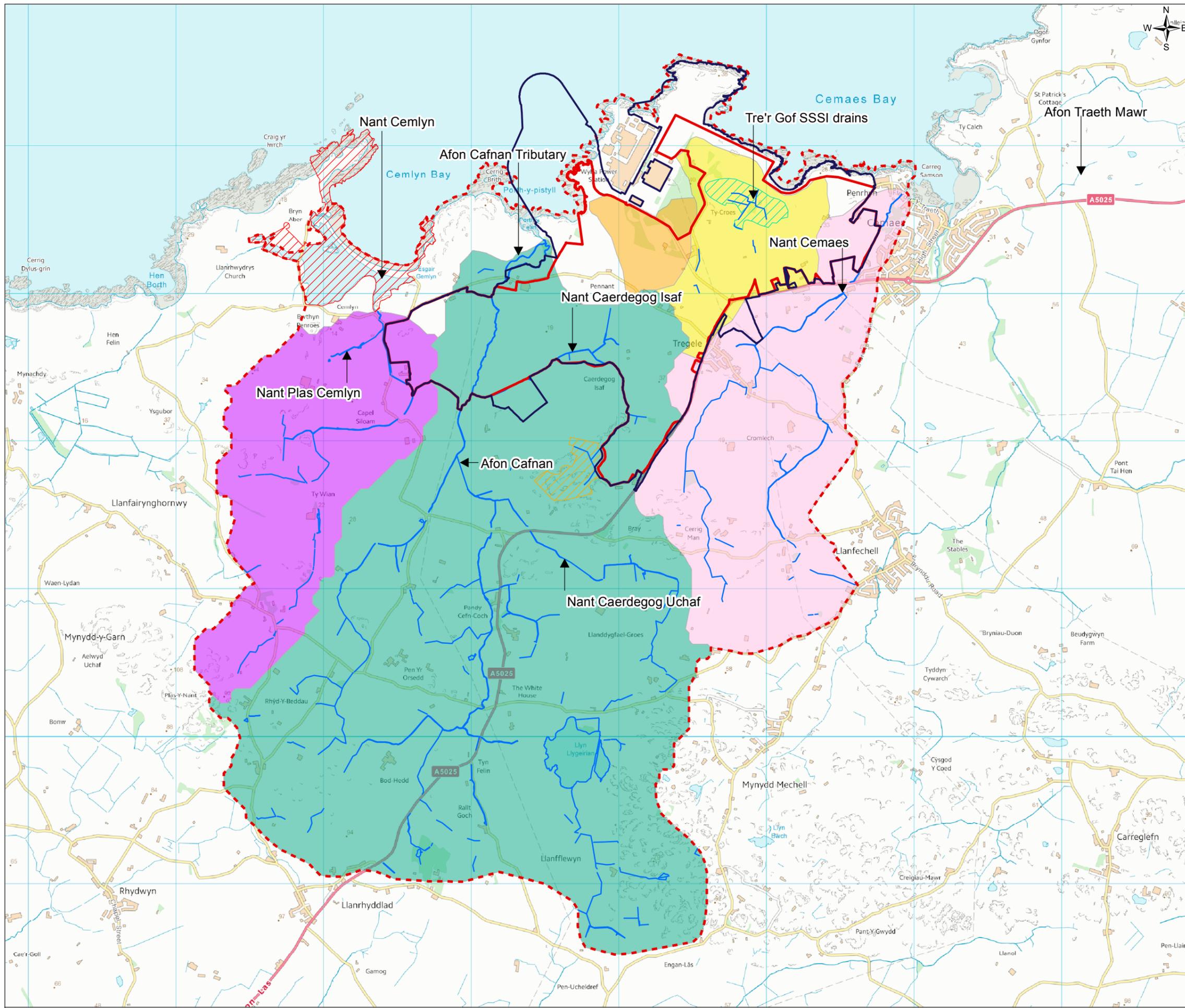
Table 10-1 Schedule of references

ID	Reference
RD1	Natural Resources Wales. 2016. <i>Flood Risk Map</i> . [Online] [Accessed: April 2017] Available from: https://naturalresources.wales/our-evidence-and-reports/maps/flood-risk-map/?lang=en .
RD2	Welsh Government. 2016. <i>Planning Policy Wales (PPW)</i> . Edition 9 [Online] [Accessed: April 2017] Available from: http://gov.wales/topics/planning/policy/ppw/?lang=enWelsh Government. 2016b. <i>Flood Consequence Assessments: Climate Change Allowances</i> . [Online] [Accessed: April 2017]. Available from: http://gov.wales/docs/desh/publications/160831guidance-for-flood-consequence-assessments-climate-change-allowances-en.pdf
RD3	Welsh Government. 2004. <i>Technical Advice Note (TAN) 15: Development and Flood Risk</i> . [Online] [Accessed: October 2016]. Available from: http://wales.gov.uk/docs/desh/publications/040701tan15en.pdf .
RD4	Welsh Government. 2016. <i>CL-03-16 Climate Change Allowances for Planning</i> . [Online] [Accessed April 2017] Available from http://gov.wales/topics/planning/policy/policyclarificationletters/2016/cl-03-16-climate-change-allowances-for-planning-purposes/?lang=en
RD5	Department for Environment and Rural Affairs. 2009. <i>UK Climate Projections</i> . [Online] [Accessed April 2017] Available from http://ukclimateprojections.metoffice.gov.uk/22530
RD6	Isle of Anglesey County Council (IACC) and Gwynedd Council. 2017. <i>Anglesey and Gwynedd Joint Local Development Plan 2011-2026, Written Statement</i> . [Online] [Accessed: September 2017] Available from: http://www.anglesey.gov.uk/planning-and-waste/planning-policy/joint-local-development-plan-anglesey-and-gwynedd/
RD7	Isle of Anglesey County Council (IACC) and Gwynedd Council. 2013. <i>Anglesey and Gwynedd Joint Local Development Plan, Topic Paper 8: Strategic Flood Consequence Assessment (Level 1)</i> . [Online] [Accessed: October 2016] Available from: http://www.anglesey.gov.uk/download/31094 .
RD8	Isle of Anglesey County Council (IACC). 2013. <i>Anglesey Local Flood Risk Management Strategy</i> . [Online] [Accessed: October 2016] Available from: http://www.anglesey.gov.uk/download/32358 .
RD9	Natural Resources Wales. 2015. <i>Western Wales River Basin Management Plan 2015-2021</i> . [Online] [Accessed: April 2017] Summary available from: https://naturalresources.wales/media/676165/wrbdssummary.pdf .
RD10	Cranfield Soil and Agrifood Institute. 2016. <i>Soils Site Reporter</i> . [Online] [Accessed: 1 April 2016] Available from: http://www.landis.org.uk/sitereporter/ .

ID	Reference
RD11	Horizon Nuclear Power Ltd. 2013. <i>Utilities Survey</i> . NUC/WFB/0161/AP4.
RD12	Amec Foster Wheeler. 2015. Nuclear Safety, Meteorological and Hydrological Hazards Assessments (NSMHHA), NSMHHA Report. Document number 200838-000-000-RPT-0003.
RD13	Department of Energy and Climate Change. 2011. <i>Overarching National Policy Statement for Energy (EN-1)</i> . London: The Stationery Office.
RD14	Department of Energy and Climate Change. 2011. <i>National Policy Statement for Nuclear Power Generation (EN-6)</i> . London: The Stationery Office.
RD15	Amec Foster Wheeler. 2016. <i>SP&C Hydrology and Infoworks Flood Modelling Factual Report</i> . Unpublished report. Document number 204530-0000-AA40-RPT-0008.
RD16	Lancaster, JW, M Preene and CT Marshall. 2004. <i>Development and flood risk - guidance for the construction industry</i> . Report C624. CIRIA.
RD17	Isle of Anglesey County Council (IACC). n.d. <i>Preliminary Flood Risk Assessment</i> . [Online] [Accessed: October 2016] Available from: http://webarchive.nationalarchives.gov.uk/20140328084622/http://cdn.environment-agency.gov.uk/flho1111bvfk-e-e.pdf .

11 Figures

FIGURE 1.1



Legend

- Site Preparation and Clearance Application Site
- Wylfa Newydd Development Area
- Flood Risk Study Area
- Surface Water Features
- Cae Gwyn SSSI
- Cemlyn Bay SSSI
- Tre'r Gof SSSI
- Afon Cafnan Catchment
- Cemaes Catchment
- Cemlyn Catchment
- Power Station Catchment
- Tre'r Gof Catchment

0	APR17	Initial Issue	FL	AJ	AJ	RB
Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd

Client
HORIZON
 NUCLEAR POWER

Project
 WYLFA NEWYDD PROJECT
 FLOOD CONSEQUENCE ASSESSMENT

Drawing Title
 FLOOD RISK STUDY AREA, CATCHMENTS
 AND SURFACE WATER FEATURES

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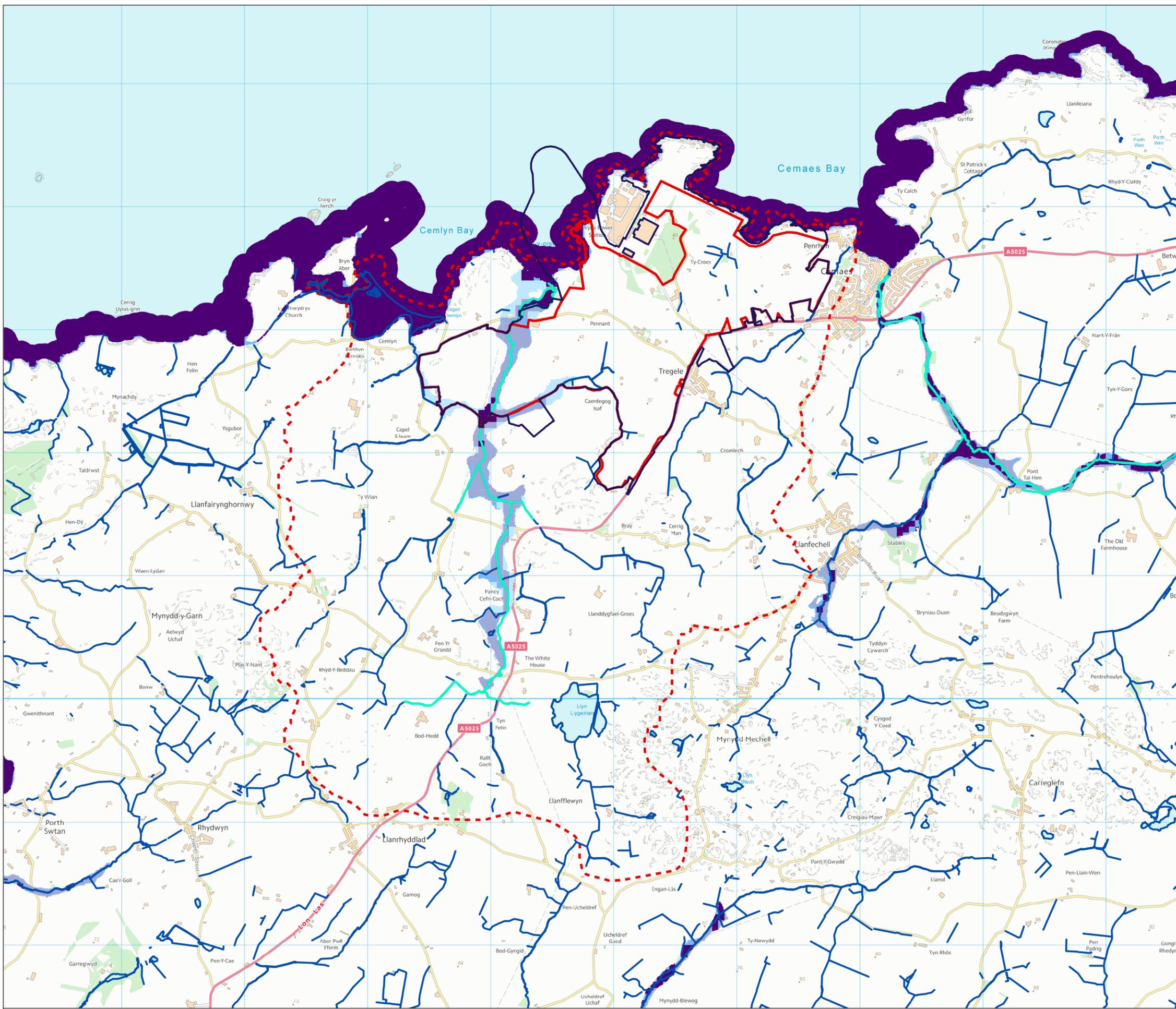
Jacobs No. 60PO8078

Client No.
 Drawing No. 60PO8078_SPC_FCA_01_01

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FIGURE 1.2



Legend

- Site Preparation and Clearance Application
- Wylfa Newydd Development
- Flood Risk Study Area
- Streams/ivers forming part of the Coastal WFD water body catchments
- Fluvial WFD water bodies

Risk of Flooding from Rivers and Sea

- High
- Medium
- Low
- Very Low

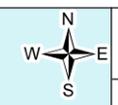
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Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
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Project						
<p>WYLFA NEWYDD PROJECT FLOOD CONSEQUENCE ASSESSMENT</p>						
Drawing Title						
<p>RISK OF FLOODING FROM RIVERS AND SEA</p>						
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Drawing No.	60PO8078_SPC_FCA_01_02					



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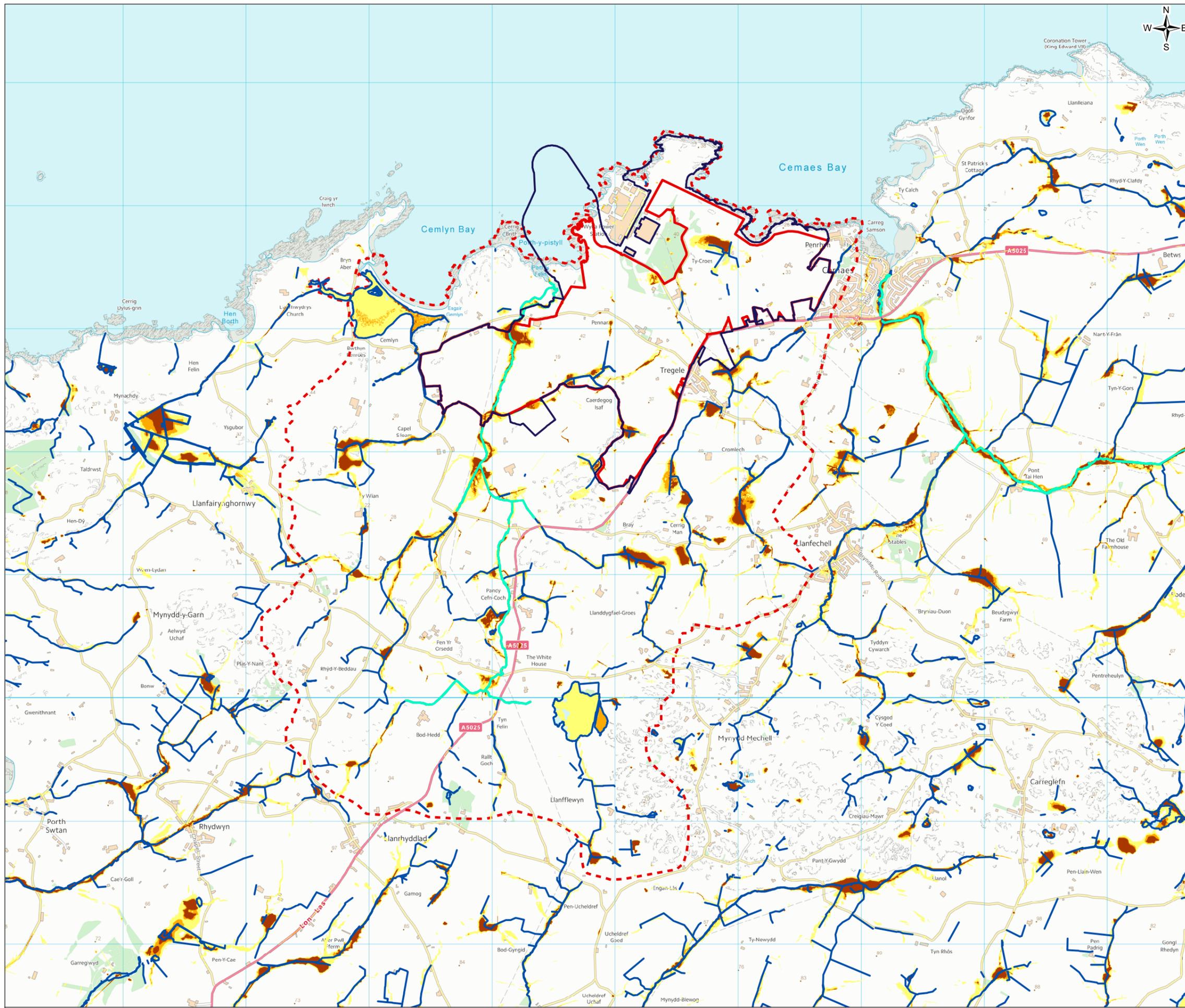
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FIGURE 1.3



Legend

- Site Preparation and Clearance Application
- Wylfa Newydd Development
- Flood Risk Study Area
- Streams/rivers forming part of the Coastal WFD water body catchments
- Fluvial WFD water bodies
- High surface water flood risk - extent
- Medium surface water flood risk - extent
- Low surface water flood risk - extent

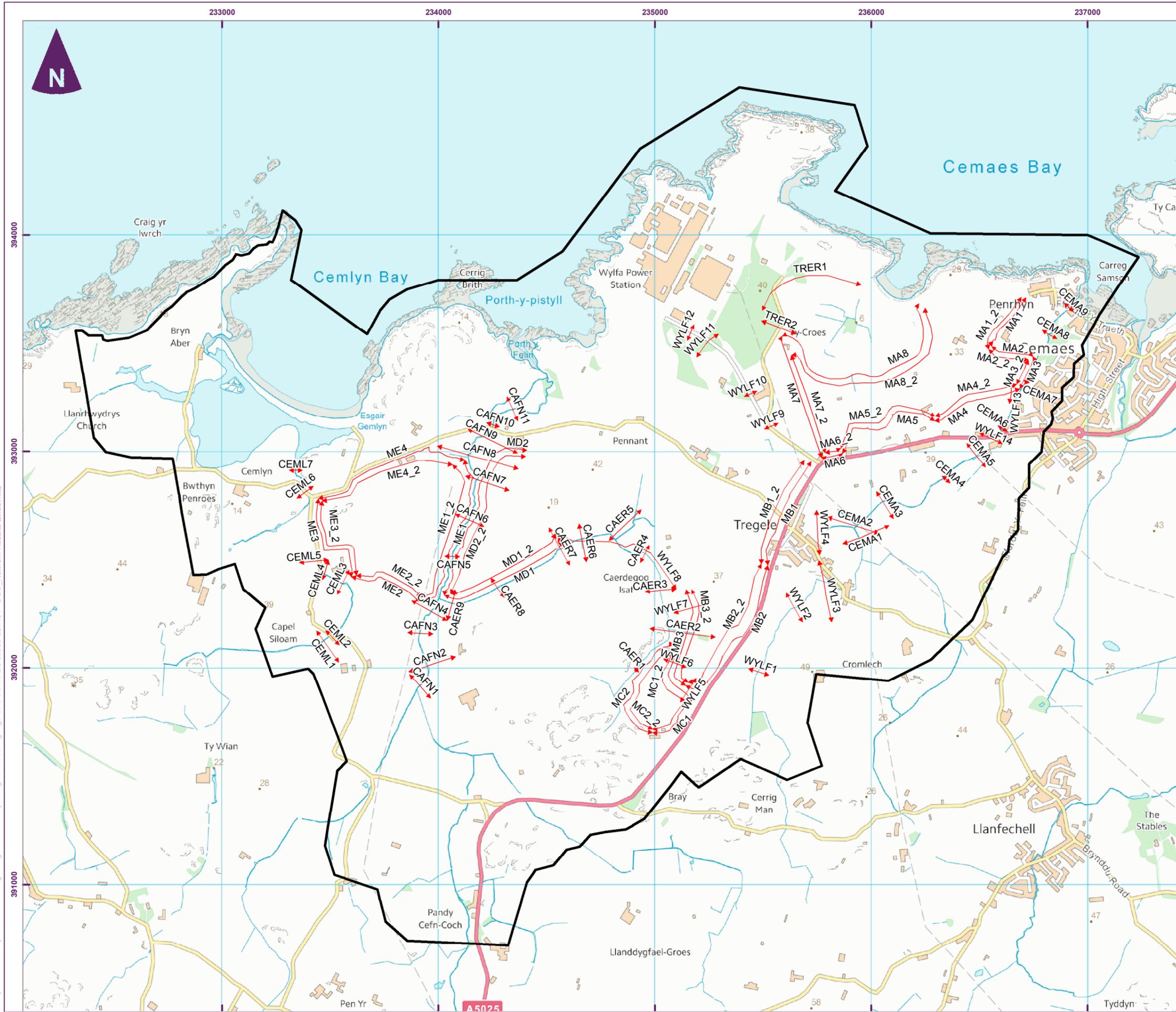


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Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
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Project						
<p>WYLFA NEWYDD PROJECT FLOOD CONSEQUENCE ASSESSMENT</p>						
Drawing Title						
<p>RISK OF FLOODING FROM SURFACE WATER</p>						
Scale @ A3	1:30,000	DO NOT SCALE				
Jacobs No.	60PO8078					
Client No.						
Drawing No.	60PO8078_SPC_FCA_01_03					

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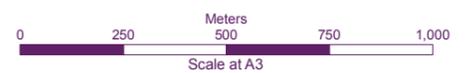
Appendix 1 DCO network results lines



Key

- Network results lines
- Model boundary

Notes:
 Results from observation line CAER5 are not provided for Phases 4 and 5 as they are located on a section of river that is diverted for these phases.

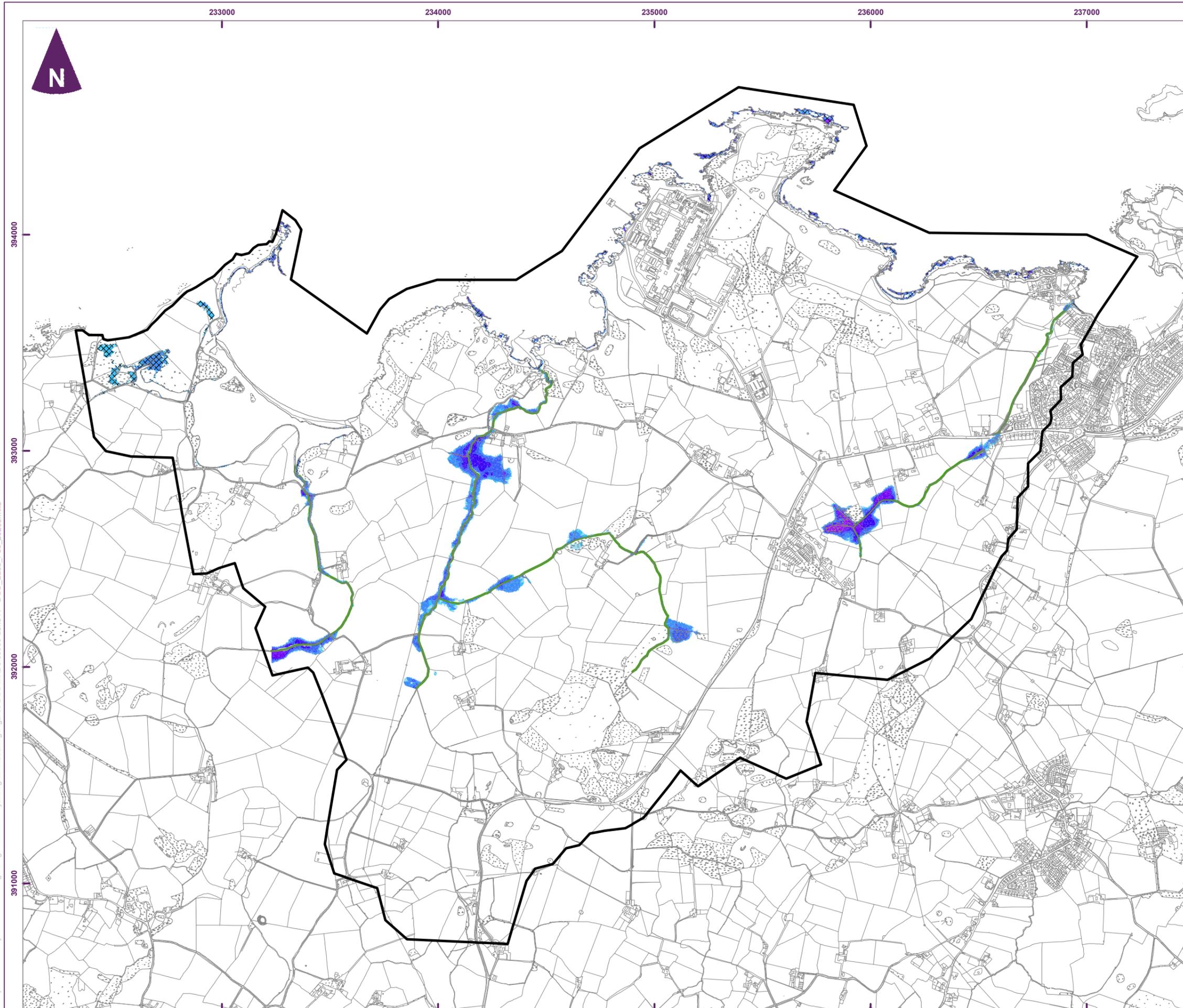


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Figure 2
 DCO network results lines

file: H:\Projects\35989 Wylfa NINB Modelling\Design\Task 28 - Hydrological Modelling\Figures\DCO\MXD\35989-Lon454 - DCO_Network Results Lines.mxd

Appendix 2 Infoworks baseline fluvial flood model output

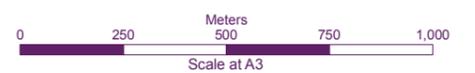


Key

- Peak flood depth (m)**
Baseline
1 : 30 year AEP fluvial
Climate change 2020s
- 0.01 - 0.05
 - 0.05 - 0.10
 - 0.10 - 0.25
 - 0.25 - 0.50
 - 0.50 - 0.75
 - 0.75 - 1.00
 - 1.00 - 1.50
 - 1.50 - 2.00
 - > 2.00
 - Model boundary
 - MHWs Extent 2020s
 - Model river centreline

Notes:
 The depths represent the maximum depth achieved. The flood prediction does not represent a moment in time as maximum depths can be achieved at different times.

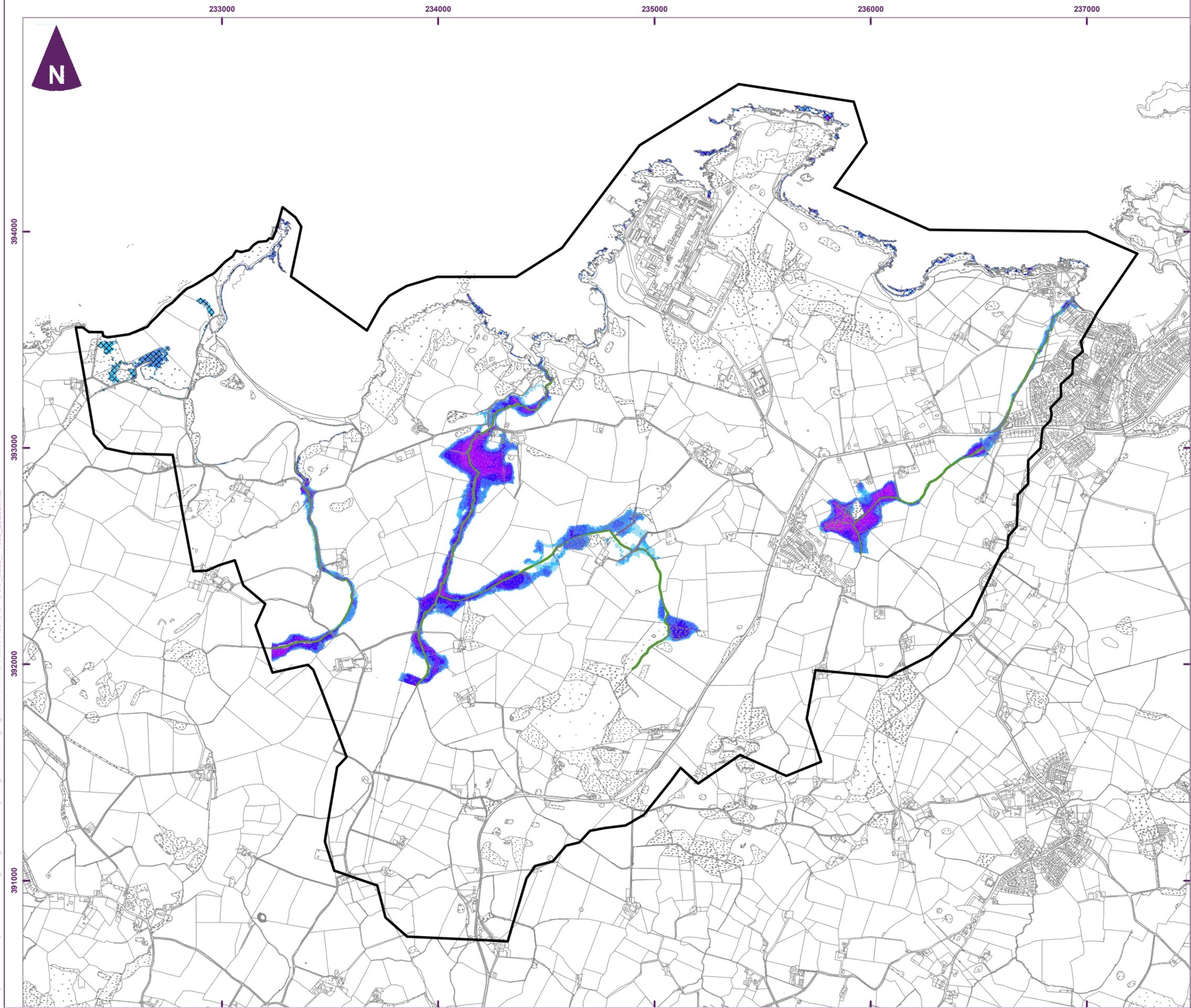
Model run date: 30/11/2016
 Corresponding data:
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Figure 12
DCO baseline peak fluvial depth 1:30
year AEP climate change 2020s

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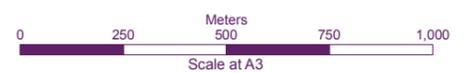


Key

- Peak flood depth (m)**
Baseline
1 : 1000 year AEP fluvial
Climate change 2020s
- 0.01 - 0.05
 - 0.05 - 0.10
 - 0.10 - 0.25
 - 0.25 - 0.50
 - 0.50 - 0.75
 - 0.75 - 1.00
 - 1.00 - 1.50
 - 1.50 - 2.00
 - > 2.00
 - Model boundary
 - MHS Extent 2020s
 - Model river centreline

Notes:
 The depths represent the maximum depth achieved. The flood prediction does not represent a moment in time as maximum depths can be achieved at different times.

Model run date: 30/11/2016
 Corresponding data: 35989-C1205_DCO_Base_F1000_2020s.xlsx

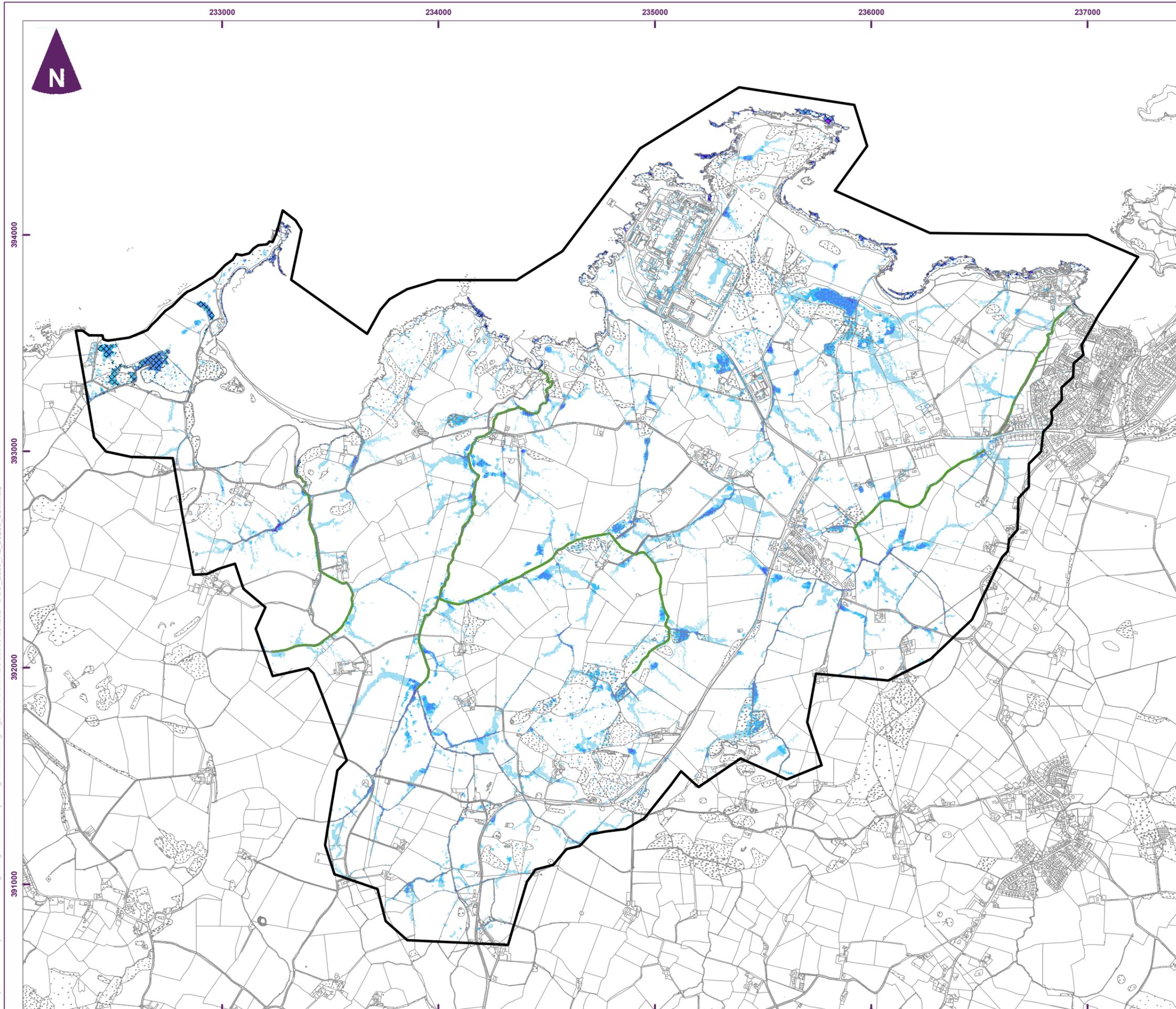


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Figure 14
DCO baseline peak fluvial depth
1:1000 year AEP climate change
2020s

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Appendix 3 Infoworks baseline pluvial flood model outputs

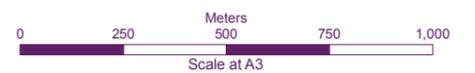


Key

- Peak flood depth (m)**
Baseline
1 : 2 year AEP pluvial
30 min duration
Climate change 2020s
- 0.01 - 0.05
 - 0.05 - 0.10
 - 0.10 - 0.25
 - 0.25 - 0.50
 - 0.50 - 0.75
 - 0.75 - 1.00
 - 1.00 - 1.50
 - 1.50 - 2.00
 - > 2.00
 - Model boundary
 - MHS Extent 2020s
 - Model river centreline

Notes:
 The depths represent the maximum depth achieved. The flood prediction does not represent a moment in time as maximum depths can be achieved at different times.

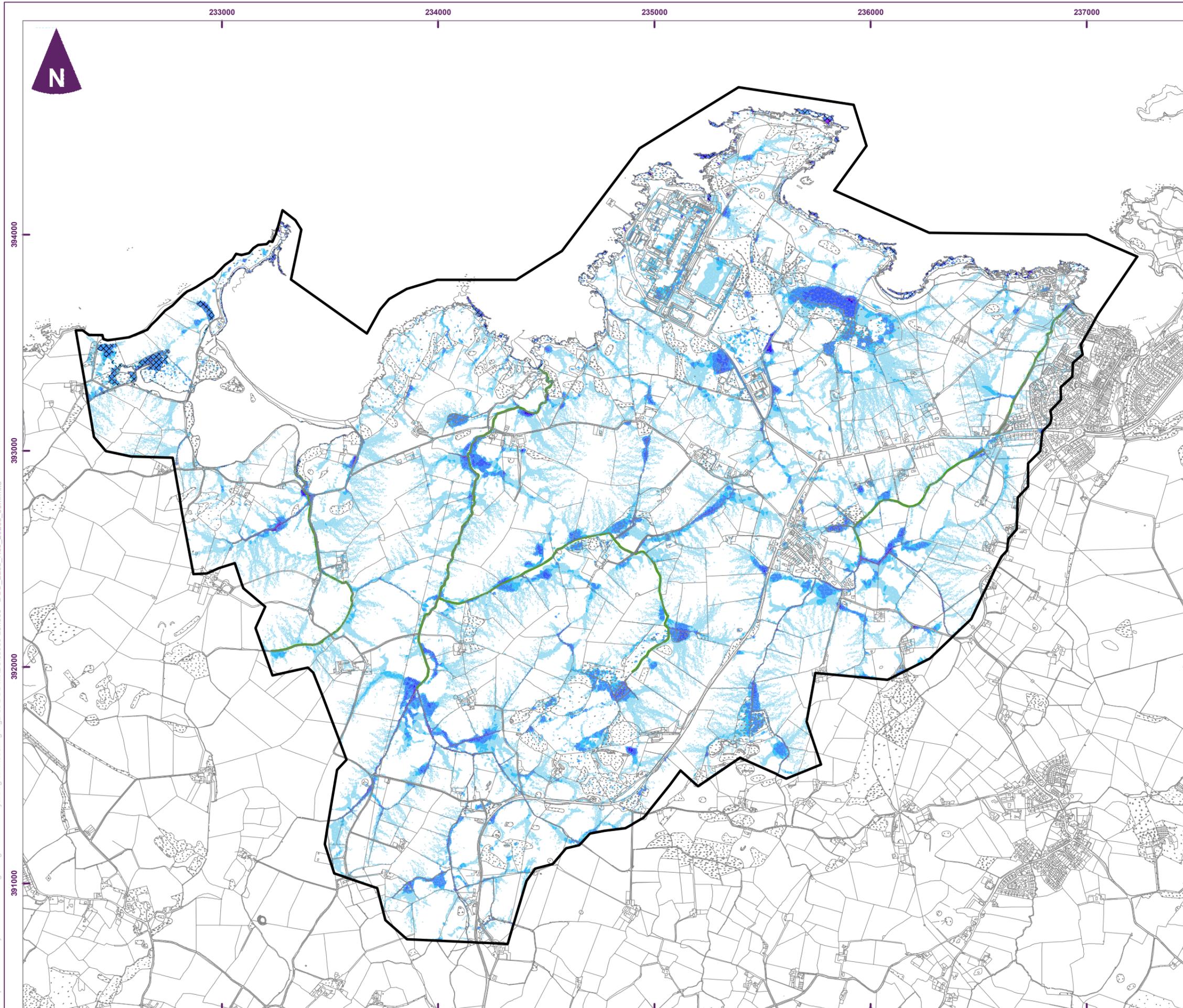
Model run date: 28/11/2016
 Corresponding data:
 35989-C1194_DCO_Base_R2_2020s_30m.xlsx



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Figure 3
 DCO baseline peak pluvial depth 1:2 year AEP 30 min duration climate change 2020s

file: H:\Projects\35989 Wylfa NNB Modelling\DesignTask 28 - Hydrological Modelling\Figures\DCO\MAXDA\35989-Lon332_DCO_Base_R2_2020s_30m.mxd



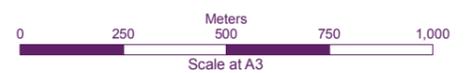
Key

Peak flood depth (m)
 Baseline
 1 : 30 year AEP pluvial
 30 min duration
 Climate change 2020s

- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00
- Model boundary
- MHS Extent 2020s
- Model river centreline

Notes:
 The depths represent the maximum depth achieved. The flood prediction does not represent a moment in time as maximum depths can be achieved at different times.

Model run date: 28/11/2016
 Corresponding data:
 35989-C1195_DCO_Base_R30_2020s_30m.xlsx

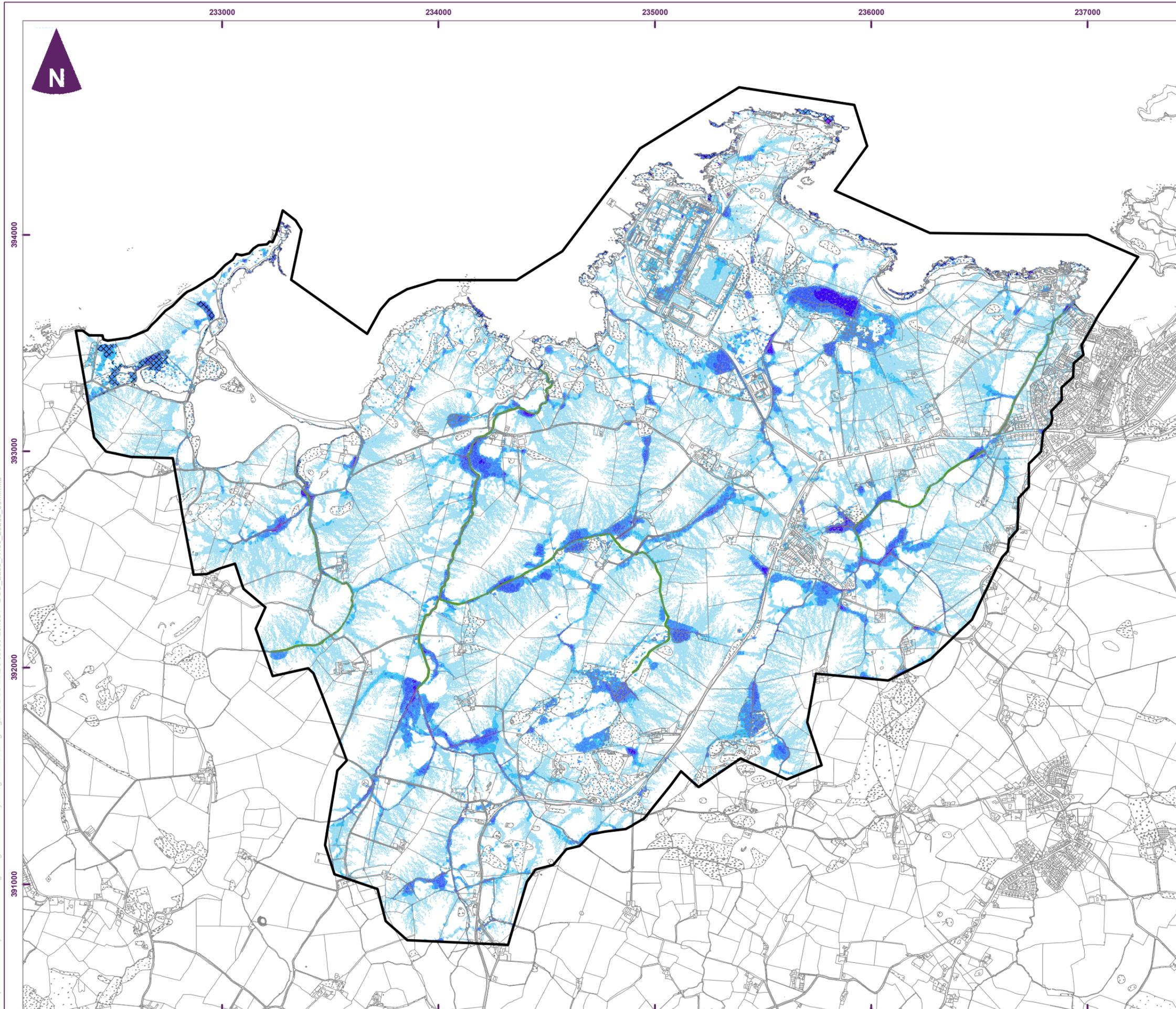


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 foster
 wheeler

Figure 4
 DCO baseline peak pluvial depth
 1:30 year AEP 30 min duration
 climate change 2020s

file: H:\Projects\35989_Wylfa_NWB_Modelling\Design\Task_28 - Hydrological Modelling\Figures\DCO\MAXDA\35989-Lon333 - DCO_Base_R30_2020s_30m.mxd



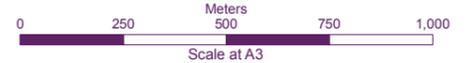
Key

Peak flood depth (m)
 Baseline
 1 : 100 year AEP pluvial
 30 min duration
 Climate change 2020s

- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00
- Model boundary
- MHS Extent 2020s
- Model river centreline

Notes:
 The depths represent the maximum depth achieved. The flood prediction does not represent a moment in time as maximum depths can be achieved at different times.

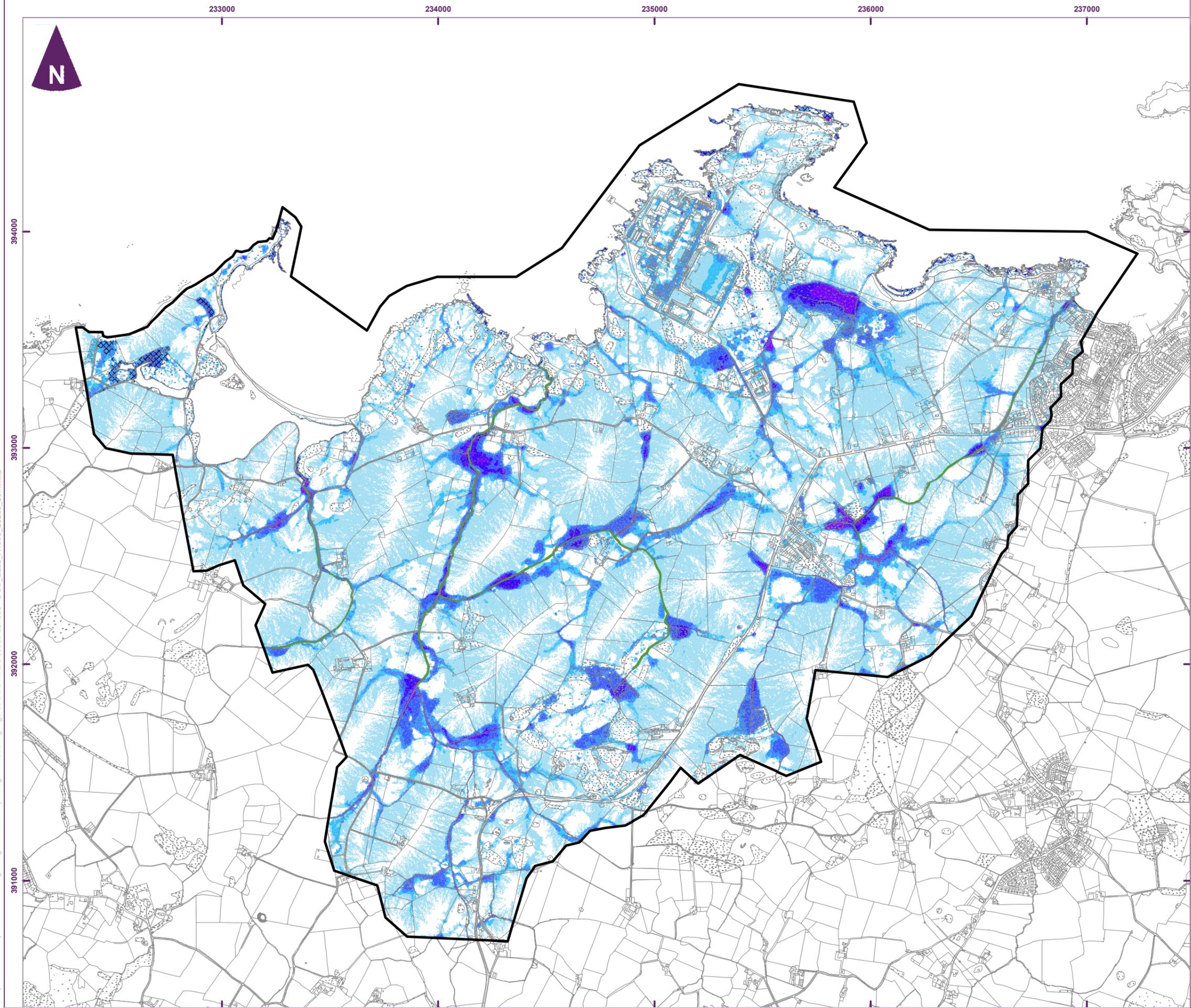
Model run date: 28/11/2016
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Figure 5
 DCO baseline peak pluvial depth
 1:100 year AEP 30 min duration
 climate change 2020s

file: H:\Projects\35989_Wylfa_NWB_Modelling\Design\Task_28 - Hydrological Modelling\Figures\DCO\MAXDA\35989-Lon334 - DCO_Base_R100_2020s_30m.mxd

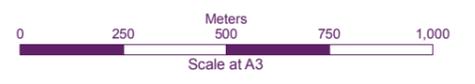


Key

- Peak flood depth (m)**
Baseline
1 : 1000 year AEP pluvial
30 min duration
Climate change 2020s
- 0.01 - 0.05
 - 0.05 - 0.10
 - 0.10 - 0.25
 - 0.25 - 0.50
 - 0.50 - 0.75
 - 0.75 - 1.00
 - 1.00 - 1.50
 - 1.50 - 2.00
 - > 2.00
 - Model boundary
 - MHWS Extent 2020s
 - Model river centreline

Notes:
 The depths represent the maximum depth achieved. The flood prediction does not represent a moment in time as maximum depths can be achieved at different times.

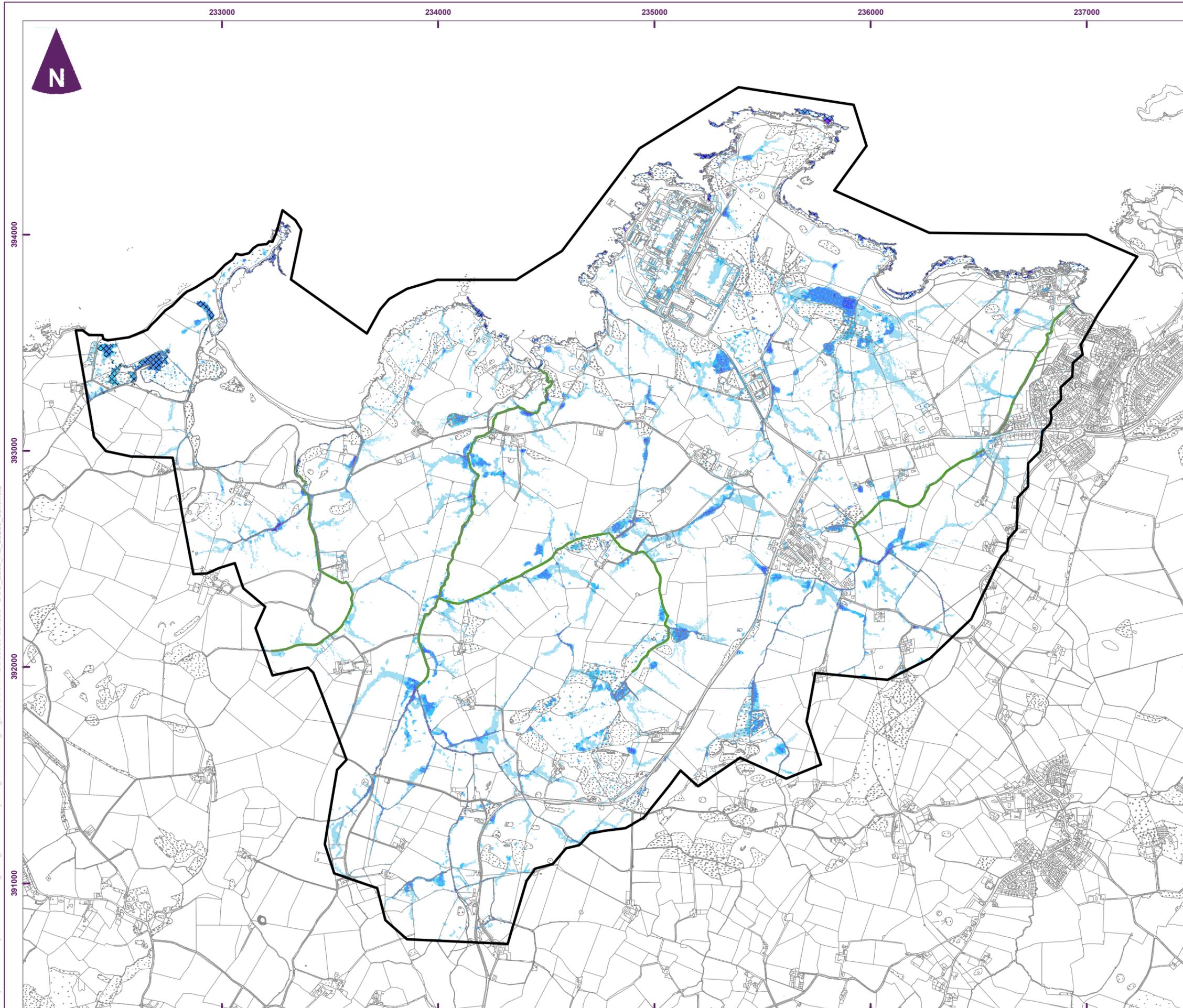
Model run date: 28/11/2016
 Corresponding data:
 35989-C1197_DCO_Base_R1000_2020s_30m.xlsx



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amec
 foster
 wheeler

Figure 6
DCO baseline peak pluvial depth
1:1000 year AEP 30 min duration
climate change 2020s

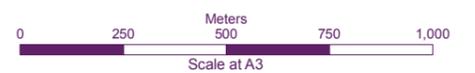


Key

- Peak flood depth (m)**
Baseline
1 : 2 year AEP pluvial
60 min duration
Climate change 2020s
- 0.01 - 0.05
 - 0.05 - 0.10
 - 0.10 - 0.25
 - 0.25 - 0.50
 - 0.50 - 0.75
 - 0.75 - 1.00
 - 1.00 - 1.50
 - 1.50 - 2.00
 - > 2.00
 - Model boundary
 - MHWs Extent 2020s
 - Model river centreline

Notes:
 The depths represent the maximum depth achieved. The flood prediction does not represent a moment in time as maximum depths can be achieved at different times.

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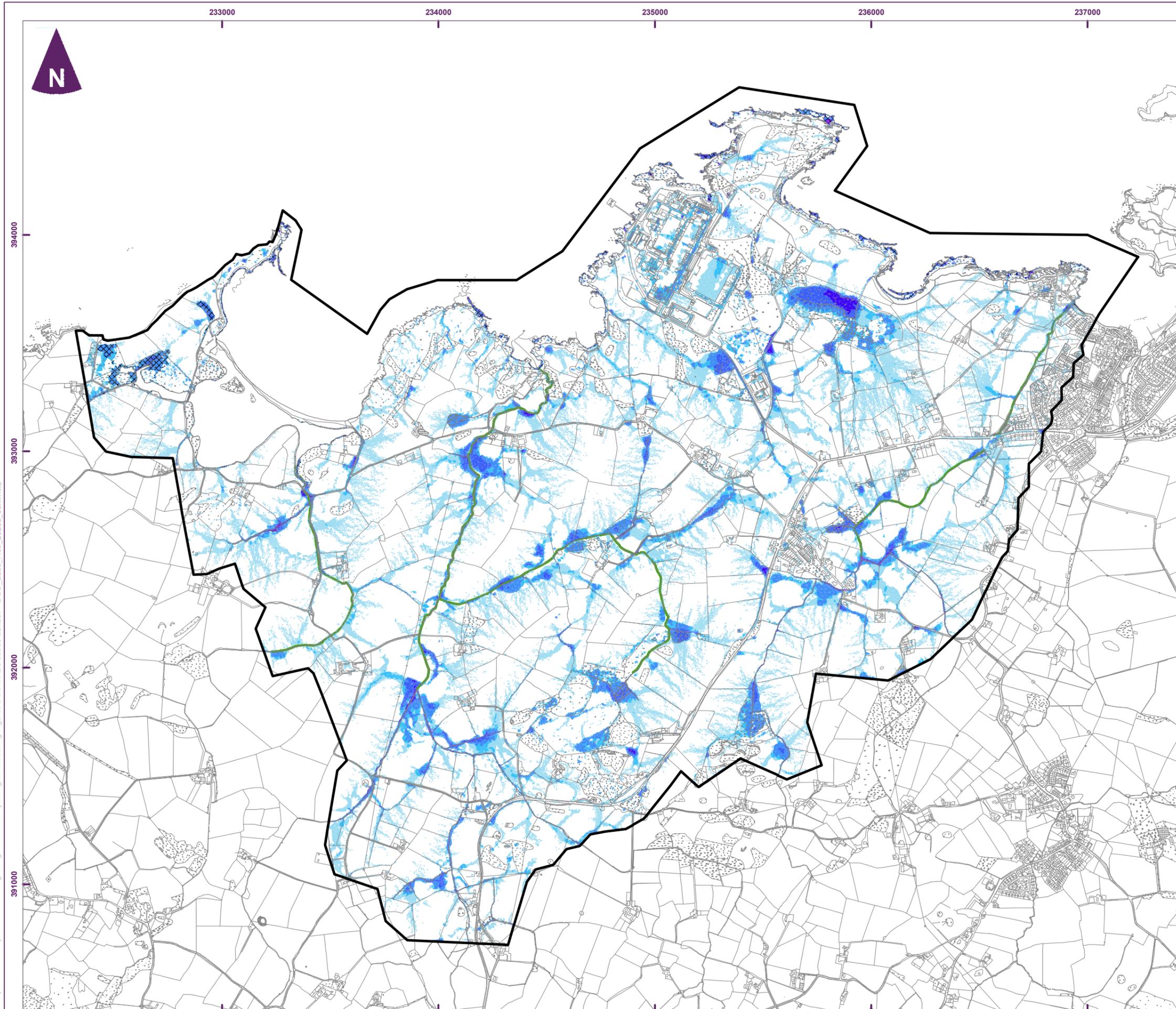


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Figure 7
 DCO baseline peak pluvial depth 1:2 year AEP 60 min duration climate change 2020s

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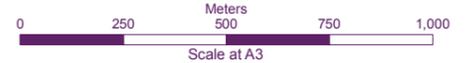
Key

Peak flood depth (m)
 Baseline
 1 : 30 year AEP pluvial
 60 min duration
 Climate change 2020s

- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00
- Model boundary
- MHWs Extent 2020s
- Model river centreline

Notes:
 The depths represent the maximum depth achieved. The flood prediction does not represent a moment in time as maximum depths can be achieved at different times.

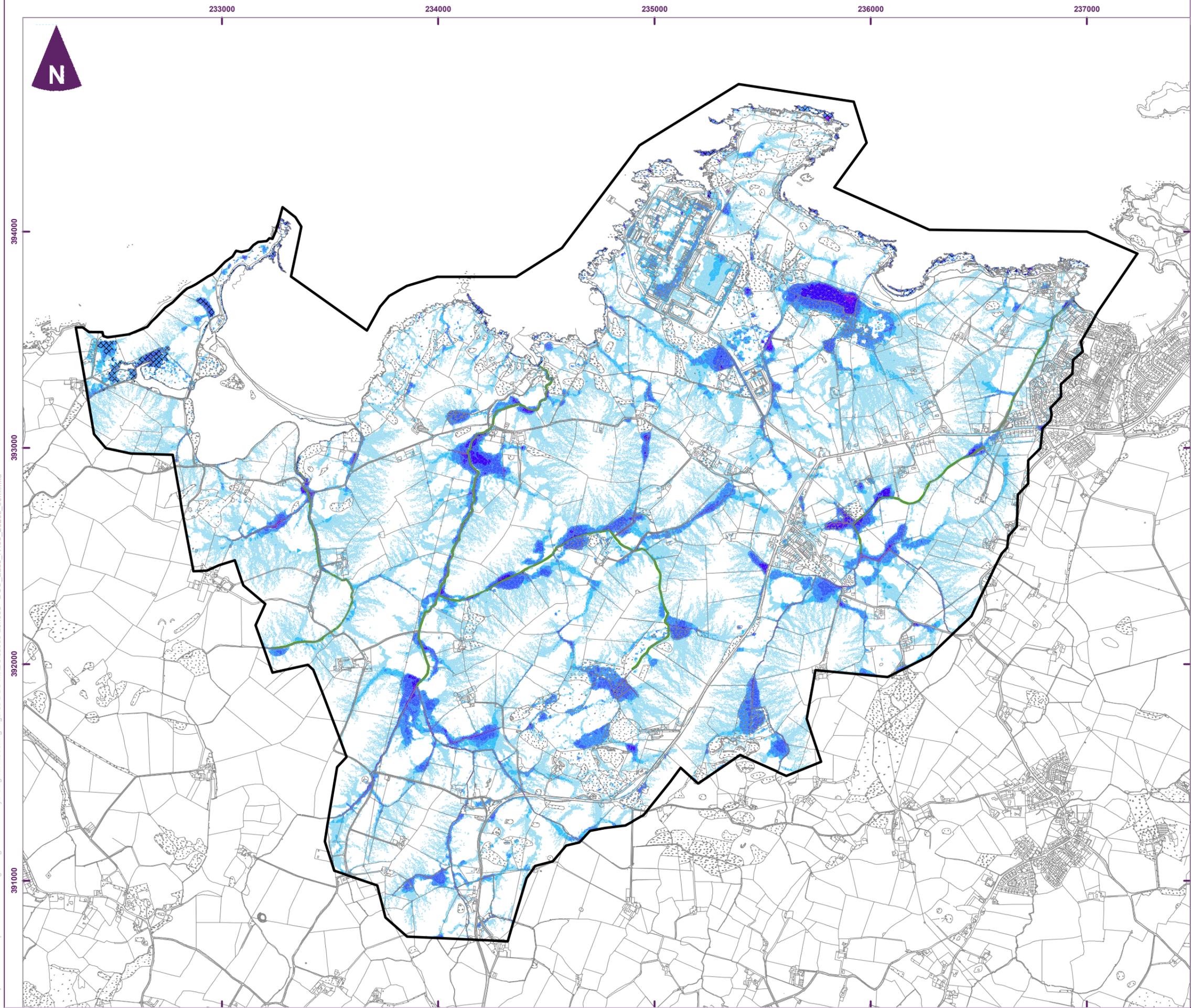
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Figure 8
 DCO baseline peak pluvial depth
 1:30 year AEP 60 min duration
 climate change 2020s

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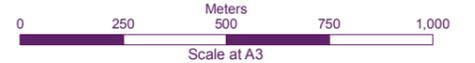
Key

Peak flood depth (m)
 Baseline
 1 : 100 year AEP pluvial
 60 min duration
 Climate change 2020s

- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00
- Model boundary
- MHWs Extent 2020s
- Model river centreline

Notes:
 The depths represent the maximum depth achieved. The flood prediction does not represent a moment in time as maximum depths can be achieved at different times.

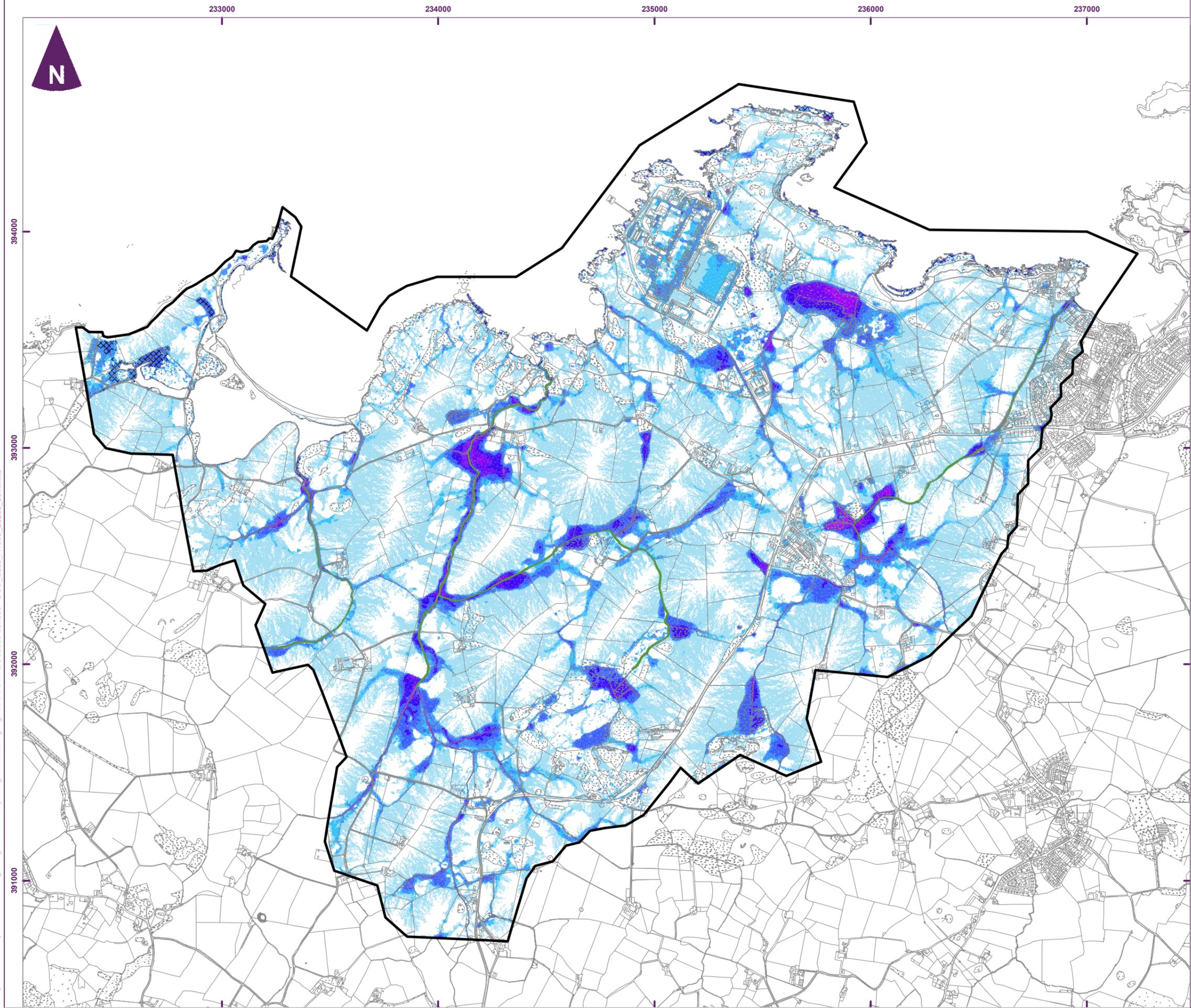
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Wylfa Newydd
 DCO
 Hydraulic Modelling

Figure 9
 DCO baseline peak pluvial depth
 1:100 year AEP 60 min duration
 climate change 2020s

file: H:\Projects\35989 Wylfa NINB Modelling\Design\Task 28 - Hydrological Modelling\Figures\DCO\MXDA\35989-Lon338 - DCO_Base_R100_2020s_60m.mxd



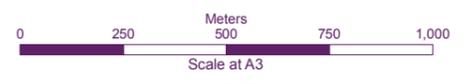
Key

Peak flood depth (m)
Baseline
1 : 1000 year AEP pluvial
60 min duration
Climate change 2020s

- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00
- Model boundary
- MHWS Extent 2020s
- Model river centreline

Notes:
 The depths represent the maximum depth achieved. The flood prediction does not represent a moment in time as maximum depths can be achieved at different times.

Model run date: 28/11/2016
 Corresponding data:
 35989-C1201_DCO_Base_R1000_2020s_60m.xlsx



Wylfa Newydd
 DCO
 Hydraulic Modelling

Figure 10
DCO baseline peak pluvial depth
1:1000 year AEP 60 min duration
climate change 2020s

Appendix 4 Assessment methodology

4.1 Introduction

4.1.1 In order to allow for the wider assessment of flood risk, a generalised assessment methodology has been developed.

4.2 Assessment methodology

4.2.1 In line with the risk-based approach detailed by the Welsh Government and recommended elsewhere in industry guidance (Lancaster *et al.*, 2004), the key to the classification is that the designation of significance (or risk) is based upon the consideration of:

- the sensitivity of the receptor – takes into account the nature of the proposals or receptor and its likely response to increased risk;
- the severity of flooding (or magnitude of the potential hazard) – takes into account the potential nature of the flooding; and
- the likelihood of occurrence (i.e. probability) – takes into account both the presence of the hazard and receptor, and the integrity of the pathway.

4.3 Classification of sensitivity of the receptor

4.3.1 When considering new developments, the classification of sensitivity is based (where possible) directly on the technical guidance set out within TAN 15 (Welsh Government, 2004). When considering off-site impacts, there is a general assumption that all developments are highly sensitive. This assumption can, however, typically be relaxed when considering a water compatible development or undeveloped land. Given this, the sensitivity of the receptor is ranked as shown in table D.1.

Table D.1 Classification of sensitivity of receptor

Sensitivity of receptor	New development	Off-site
Very High	Emergency services* developments	All built developments unless mitigating circumstances exist Key access routes
High	Highly vulnerable* developments	Other access routes
Medium	Less-vulnerable* developments	Undeveloped land
Low	Water-compatible ¹ developments	-

¹ Category not outlined within TAN 15, but would include any types of development that clearly by their nature often need to be in a floodplain, such as buildings associated with water-sports or pumping stations for low-lying areas.

Sensitivity of receptor	New development	Off-site
Very Low	Flood attenuation features	-

* For definitions of terms, please see figure 2 (in appendix 2) of TAN 15

4.4 Classification of the magnitude of potential hazard

4.4.1 To classify the severity of the potential effects, it is necessary to look at the nature and scale of the individual impacts. These include, but are not confined to, the extent, depth and duration of flooding, and the velocity of flood waters. For new developments, the assessment is based on the likely post-development situation; for off-site receptors, it is based solely on the likely deterioration.

4.4.2 Given this, the severity of flooding is then ranked in terms of its magnitude as shown below in table D.2.

Table D.2 Classification of magnitude of potential hazard

Magnitude of hazard	New development	Off-site
High	Any one of the following criteria achieved: <ul style="list-style-type: none"> • flood depths greater than 1m; • flood flow velocities greater than 0.45m/s; or • likely flood duration in excess of 24 hours. 	Any marked (>10%) increase in flood depth, flood flow velocity or flood duration Any change in flood extent that impacts additional properties, including access to those properties
Medium	Any one of the following criteria achieved: <ul style="list-style-type: none"> • flood depths between 0.3m and 1m; • flood flow velocity greater than 0.15m/s; • likely flood duration in excess of one hour; or • any restrictions to access and egress. 	Any other measurable increase of flood depths, durations, flow velocities or extent
Low	All of the following criteria achieved: <ul style="list-style-type: none"> • flood depths below 0.3m; • likely flood duration below one hour; and • flood-proofing measures planned. 	Likely, but unquantifiable small increases of flood depths, durations, flow velocities or extent

Magnitude of hazard	New development	Off-site
Very low	Planned or permitted flooding that does not adversely impact the built development	-
Negligible	No potential for flooding, or no identifiable impact of flooding	No likely increase in flood severity at any off-site location

4.5 Significance of potential effect

4.5.1 The magnitude of the hazard and the sensitivity of the receptor are combined using a matrix (shown below in table D.3) to determine the significance of the potential effect, if realised.

Table D.3 Matrix for determining the significance of the potential effect

		Sensitivity of receptor				
		Very Low	Low	Medium	High	Very High
Magnitude of potential hazard	High	Low	Moderate	Moderate	High	High
	Medium	Very Low	Low	Moderate	Moderate	High
	Low	Very Low	Very Low	Low	Moderate	Moderate
	Very Low	Negligible	Very Low	Very Low	Low	Low
	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

4.6 Classification of likelihood of occurrence

4.6.1 To classify the likelihood (probability) of occurrence for a potential effect, it is necessary to understand how regularly a given event or outcome will occur. This can be assessed in a number of ways, including assessments based on historical data, quantitative analysis or experience from other similar sites. Often, this assessment will be based on standard guidance. The classifications used for defining the likelihood of a potential effect occurring are as shown below in table D.4.

Table D.4 Classification of likelihood of occurrence

Likelihood of occurrence	Potential effect
High	Any consequence would likely appear in the medium term and inevitably in the long term (i.e. the lifetime of the proposed development).
	Equivalent to an annual probability of flooding of greater than 1% (0.5% for tidal).
Medium	Circumstances are such that an event is possible in the medium term and likely over the long term, although not necessarily inevitable.
	Equivalent to an annual probability between 0.1% and 1% (0.1% and 0.5% for tidal).
Low	It is unlikely that any consequence would arise within the lifetime of the proposed development.
	Equivalent to an annual probability of less than 0.1%.
Very Low	It is unlikely that any consequence will ever arise.

4.6.2 It should be noted that in circumstances where sites are defended, determining an accurate assessment of probability of flood occurrence is complex, and assumptions that defences will not fail are unlikely to be acceptable. In such cases, assessments cannot be prescriptive and site-specific assessments would be undertaken. Factors that would be considered include construction, age, condition, maintenance, exposure and other external pressures.

4.7 Risk assessment

4.7.1 Once the significance of the potential effect and likelihood of occurrence have been assessed, these are then combined using a risk matrix (table D.5) to assess the flood risk of each potential effect.

Table D.5 Risk matrix

		Likelihood of occurrence			
		Very Low	Low	Medium	High
Significance of potential effect	High	Low	Moderate	High	High
	Moderate	Low	Low	Moderate	High
	Low	Very Low	Low	Low	Moderate
	Very Low	Negligible	Very Low	Low	Low
	Negligible	Negligible	Negligible	Negligible	Negligible

4.7.2 Typically, flood risks assessed as Low or less are considered acceptable. If the assessment results in moderate or high risk, this is considered significant (i.e. equivalent to a significant impact under the Environmental

Impact Assessment regulations), and additional mitigation measures would be required to facilitate development.

- 4.7.3 In some situations, the risk assessment procedure will result in an artificially low assessment of risk. This is particularly the case in situations where consequences of very rare flooding (i.e. breach scenarios) are so extreme that any residual risk, however low, would not be allowed. In such instances, the assessed risk would be elevated. Such decisions must always be accompanied by detailed justification.

**Site Preparation and Clearance
Environmental Statement
Volume 3 – Appendix 13-05
Waste Framework Directive Compliance
Assessment**

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Contents

1	Introduction.....	5
1.1	Background.....	5
1.2	Water Framework Directive terminology.....	5
1.3	Legislative context	7
2	SPC works description	9
3	Methodology	12
3.1	The WFD assessment process	12
3.2	Surveys and modelling.....	12
3.3	Stakeholder liaison.....	13
4	Identification of relevant WFD water bodies	14
4.1	WFD water bodies screened into the assessment.....	14
4.2	Rationale for WFD water bodies screened out	14
5	Water body baseline data	16
5.1	Coastal WFD water bodies.....	17
5.2	Groundwater body	22
6	Identification of SPC works and relevant WFD water bodies.....	24
7	Assessment of effects on quality elements.....	25
8	Water body mitigation measures assessment	32
9	Cumulative assessment	34
10	Compliance with EU legislation	36
11	Conclusions	38
12	References	39

Table of Figures

Figure 1	WFD water bodies relevant to the SPC Proposals.....	11
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List of Tables

Table 1	WFD terminology.....	5
Table 2	Surveys and modelling relevant to the WFD Compliance Assessment	12
Table 3	Stakeholder consultation relating to the Water Framework Directive for the wider Wylfa Newydd Project.....	13
Table 4	Baseline water body information from the RBMP	16
Table 5	Identification of SPC works relevant to WFD water bodies	24
Table 6	Consideration of effects on watercourses and The Skerries WFD water body.....	26
Table 7	Consideration of effects on watercourses and the Anglesey North WFD water body	29

Water Framework Directive Compliance Assessment for Site Preparation and Clearance Proposals		Revision: 1
		Issue date: 18/05/17

Table 8 Consideration of effects on watercourses and the Cemlyn Lagoon WFD water body31

Table 9 Consideration of effects on the Ynys Môn Secondary WFD water body32

Table 10 Committed developments with potential effects on water bodies35

Table 10 Protected areas of relevance to this WFD assessment36

Table 11 Summary of WFD assessment compliance.....38

1 Introduction

1.1 Background

Horizon Nuclear Power Wylfa Limited (Horizon) is a UK energy company developing a new generation of Nuclear Power Stations to help meet the country's need for stable and sustainable low-carbon energy.

The Wylfa Peninsula on Anglesey, north Wales, has been listed as an approved site for the construction of a new nuclear facility in the *National Policy Statement for Nuclear Power Generation (EN-6)* [RD1]. The approved site (termed the 'Wylfa National Policy Statement Site') lies on land to the south of the Existing Power Station.

Horizon is proposing to construct and operate the Wylfa Newydd Project, which comprises the following.

- The Power Station – the proposed new Nuclear Power Station, including two UK Advanced Boiling Water Reactors to be supplied by Hitachi-GE Nuclear Energy Ltd., associated plant and Ancillary Structures, and Off-Site Power Station Facilities. Off-Site Power Station Facilities, which are an integral part of the Power Station, comprise the Alternative Emergency Control Centre, the Environmental Survey Laboratory and the Mobile Emergency Equipment Garage.
- Associated Development – development to support delivery of the Power Station, for example highway improvements along the A5025, Park and Ride Facilities for construction workers, a Logistics Centre and a Site Campus.

The development of the Wylfa Newydd Project will require a number of planning applications to be made under different legislation to different regulators. As the Power Station constitutes a Nationally Significant Infrastructure Project, Horizon would submit an application for development consent to the Secretary of State under the *Planning Act 2008* to authorise its construction and operation.

An application will be submitted to the Isle of Anglesey County Council for the Site Preparation and Clearance (SPC) Proposals. This Water Framework Directive Compliance Assessment forms an appendix to the Environmental Statement for the SPC Proposals. The 'Water Framework Directive' (*Directive 2000/60/EC of the European Parliament*) (WFD) is transposed into domestic law in England and Wales by the *Water Environment (Water Framework Directive) (England and Wales) Regulations 2017*.

1.2 Water Framework Directive terminology

Table 1 provides a definition of particular terms associated with the WFD.

Table 1 WFD 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

TERM	ABBREVIATION	EXPLANATION
		case the WFD.
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	-	WFD term denoting a slight deviation from 'natural reference conditions' in a water body, or the hydromorphological, chemical/physico-chemical and biological conditions associated with little or no human pressure.
Heavily Modified Water Body	HMWB	A water body not considered to be able to achieve 'natural reference conditions'. The WFD recognises the important uses of HMWBs (e.g. from past engineering works).
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	A requirement of the WFD, outlining the current status of all water bodies. It also outlines a plan 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 or a stretch of coastal water. Groundwater bodies are defined as distinct volumes of groundwater within an aquifer or aquifers.
Status/potential classes		
High	-	WFD term denoting only very minor or no deviation from undisturbed 'natural reference conditions' in a water body, for hydromorphological, chemical/physico-chemical and biological quality elements.
Good	GES	Good Ecological Status is a WFD term denoting a slight deviation from 'natural reference conditions' in a water body or the hydromorphological, chemical/physico-chemical and biological conditions associated with little or no human pressure.
	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.
Moderate	-	WFD term denoting a moderate deviation from the 'reference condition' in a water body, for hydromorphological, chemical/physico-chemical and

TERM	ABBREVIATION	EXPLANATION
		biological quality elements.
Poor	-	WFD term denoting a relatively significant deviation from the 'reference condition' in a water body, for hydromorphological, chemical/physico-chemical and biological quality elements.
Bad	-	WFD term denoting a complete deviation from the 'reference condition' in a water body, for hydromorphological, chemical/physico-chemical and biological quality elements.
Quality elements		
Biological quality element	-	Biological parameters, for example fish, aquatic flora and phytoplankton.
Hydromorphological quality element	-	Hydromorphological parameters, for example the structure of the intertidal zone and wave exposure.
Chemical/physico-chemical quality element		Chemical and physico-chemical parameters, for example transparency, thermal conditions and salinity

1.3 Legislative context

Natural Resources Wales (NRW) requires an assessment of the impact of any modification of water bodies in order to meet its obligations under the WFD. The primary aim of the WFD is to improve/maintain the ecological statuses/potential of all water bodies. In addition, the WFD requires no deterioration in overall status or the status of individual quality elements. Ecological quality comprises a series of biological, physico-chemical and hydromorphological quality elements.

For surface water bodies to achieve overall Good Ecological Status (GES) or Good Ecological Potential (GEP), a series of quality elements are assessed that fall within three categories: biological, physico-chemical and hydromorphological. Good Ecological Status refers to situations where the ecological characteristics show only a slight deviation from a natural reference condition. Artificial and Heavily Modified Water Bodies (AWB/HMWB) have a target to achieve GEP, which recognises their important societal uses, whilst ensuring that the water body is protected as far as possible.

The WFD outlines a number of objectives including:

- to prevent deterioration of the status of all bodies of surface water (Article 4.1 (a)(i));
- to protect, enhance and restore all bodies of surface water with the aim of achieving good surface water status by 2015 (cycle one) and 2021 (cycle two) (Article 4.1 (a)(ii));
- to protect and enhance all AWB/HMWB, with the aim of achieving GEP and good surface water chemical status by 2015 (Article 4.1 (a)(iii));
- to reduce pollution from priority substances and cease or phase out emissions, discharges and losses of priority hazardous substances (Article 4.1 (a)(iv));
- to prevent or limit the input of pollutants into groundwater and prevent deterioration of the status of all bodies of groundwater (Article 4.1 (b)(i));

- to protect, enhance and restore all bodies of groundwater and to ensure a balance between abstraction and recharge of groundwater (Article 4.1 (b)(ii));
- to ensure that the achievement of objectives in other water bodies is not compromised (Article 4.8); and
- to ensure compliance with other community environmental legislation (Article 4.9).

Where a scheme is considered likely to cause deterioration, or where it could contribute to a failure of the water body to meet GES/GEP, then an Article 4.7 assessment would be required. Article 4.7 of the WFD makes provision for a situation where the objectives of the WFD cannot be met, thereby allowing derogation from its requirements. Providing all of the conditions set out in Article 4.7 are met, then the scheme can be permitted.

The compliance of the SPC Proposals with the WFD can be determined based on the achievement of the following WFD objectives:

1. The SPC Proposals shall not cause deterioration of any quality element from one status class to the next at water body level on a non-temporary basis.¹
2. The SPC Proposals shall not jeopardise the attainment of GES/GEP in WFD surface water bodies (including the delivery of measures intended to facilitate such improvements).
3. The SPC Proposals shall prevent (or limit) the input of pollutants into groundwater and prevent deterioration of the status of all bodies of groundwater, including ensuring a balance between abstraction and recharge of groundwater.
4. The SPC Proposals shall not cause a permanent exclusion or jeopardise the attainment of the WFD objectives in other WFD water bodies within the same River Basin District.
5. The SPC Proposals shall be compliant with other European Union environmental legislation.

¹ The implications of the Court for Case C-461/13 (Bund für Umwelt und Naturschutz Deutschland eV v Bundesrepublik Deutschland) (the 'Bund case') are recognised within this objective. 'Deterioration of the status' of a body of surface water means deterioration in the status of one quality element by one class, even if that fall does not result in a fall in classification of the body of surface water as a whole. However, if the quality element concerned is already in the lowest class, any deterioration of that element constitutes a 'deterioration of the status' of a body of surface water.

2 SPC works description

The SPC works constitute a range of activities to be carried out in the delivery of the SPC Proposals. If planning permission is granted then the SPC works would take place over an approximate 15-month period from January 2018 to April 2019. Chapter 3 of the SPC Environmental Statement outlines the activities proposed during SPC works and includes:

- Provision of fencing and site security facilities, an area for material handling and storage, and a secure parking area for plant and machinery.
- Temporary structures to be used as offices, welfare and mess facilities, a fuel store and parking for office-based staff and the site workforce.
- An overflow parking area (the car park currently serving the Wylfa Sports and Social Club) would be used as necessary and a new footpath link formed between it and the Main Site Compound.
- The creation of a new vehicular crossing of the Existing Power Station access road for the ingress and egress of construction vehicles to the north of the site from the Main Site Compound.
- The formalisation of an existing vehicular crossing of Cemlyn Road for use by construction vehicles.
- Establishment of a Remediation Processing Compound and access track, and treatment of contaminated material. Remediation of contaminated soils and treatment of invasive non-native species.
- Creation of the Satellite Compounds and the Material Storage Compounds.
- Installation of a 2m-high fence around the perimeter of the SPC Application Site.
- Realignment of an existing small watercourse, located to the north of Caerdegeg Isaf.
- Clearance of buildings and all other existing above-ground structures.
- Species relocation and vegetation clearance activities would include some trees, (leaving tree stumps and roots) shrubs and hedges which make up road and field boundaries throughout the SPC Application Site.

Many activities included within the SPC Proposals either do not take place close to a WFD water body, and/or there is no pathway from the activity that could lead to an effect on water bodies or catchments. These activities have therefore not been considered further. The SPC works relevant to this WFD Compliance Assessment are listed below.

- Targeted removal of above-ground features; including gates and poles, demolition of remaining buildings, clearance of stone walls and field boundaries, clearance of large trees and vegetation that would be cut down to approximately ground level with stump and roots remaining for later removal.
- Watercourse realignment.
- Establishment of main site compound and satellite compounds.
- Ground improvement works comprising removal of contaminated soils from Areas of Potential Concern and treatment or removal of invasive non-native species.

Water Framework Directive Compliance Assessment for Site Preparation and Clearance Proposals		Revision: 1
		Issue date: 18/05/17

The SPC Proposals include realignment of a small watercourse, the Nant Caerdegog Isaf (part of the Afon Cafnan Catchment), located in the south of the SPC Application Site. The watercourse is located west of Tregale and flows from the Cae Gwyn Site of Special Scientific Interest (SSSI) in a northerly and then westerly direction, before it converges with the Afon Cafnan (Figure 1). Further details of the proposed realignment are provided in Watercourse Realignment Specification [RD2]. The proposed realignment would be naturalised by incorporating geomorphological features and habitats.

Depending on their nature, contaminated soils would either be removed from site or be treated in an on-site remediation processing compound. Within the compound the soils would be underlain by a geotextile separation layer, which would be free draining to allow rainfall to permeate the ground. The compound would not have a formal drainage system. However, checks would be made to confirm that there is no surface water runoff from the site that could result in sediment-laden water entering watercourses. There are no watercourses in close proximity to the compound. In the event that infiltration is insufficient to allow all incident rainfall to infiltrate to ground, runoff would be collected by the contractor, tested and, if contaminated, tankered off-site for disposal.

In the event that the application for development consent was not granted or the Wylfa Newydd Project did not proceed, the SPC Application Site would be restored in accordance with an agreed restoration plan. This would be in keeping with the surrounding landscape character and include the reinstatement of field boundaries and tree and shrub planting. The main haul roads and associated drainage works would also be removed. However, the demolished buildings would not be rebuilt, and because the realigned section of the Nant Caerdegog Isaf is a more naturalised feature compared to that existing and likely to have further re-naturalised over time (with, for example, established vegetation), it would not be restored to its current straightened state.

FIGURE 1

- Legend
- Site Preparation and Clearance Application Site
 - A5025
 - Water Framework Directive**
 - Main river water body
 - Other watercourse
 - Lake water body
 - Caerdegog Isaf—proposed section to be realigned
 - Coastal water body



0	MAY 17	Issue	HT	KK	EC	TK
Rev	Date	Purpose of revision	Drawn	Checked	Revised	Approved

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HORIZON
 NUCLEAR POWER

Client
 Project
 SITE PREPARATION AND CLEARANCE ENVIRONMENTAL STATEMENT

Drawings
 WFD WATER BODIES AND TRIBUTARIES IN RELATION TO SPC APPLICATION SITE

Scale @ A3	1:30,000	DO NOT SCALE
Client No.	60PO8078	
Client No.		
Drawing No.	60PO8078_SPC_ES_WFD_01	

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3 Methodology

3.1 The WFD assessment process

The methodology for this WFD Compliance Assessment for the SPC Proposals is summarised below.

- **Step 1:** Identification of relevant WFD water bodies with the study area. This sets out those WFD water bodies that could potentially be affected and provides a rationale for any water bodies screened out of the assessment.
- **Step 2:** Description of the baseline conditions (biological, physico-chemical and hydromorphological) derived from desk studies and surveys.
- **Step 3:** Identification of the SPC Proposals and relevant WFD water bodies. This takes each component in turn and identifies where there is potential for impacts resulting in deterioration of hydromorphological, chemical, physico-chemical or biological elements.
- **Step 4:** Assessment of the proposed scheme against biological, physico-chemical and hydromorphological quality elements. The assessment is made with embedded and good practice mitigation already in place.
- **Step 5:** Consideration of WFD water body mitigation measures and identification of any conflicts.
- **Step 6:** Assessment of cumulative effects.
- **Step 7:** Assessment of compliance with other EU legislation.

3.2 Surveys and modelling

The surveys and reports used to inform understanding of the baseline are shown in Table 2. Data were collected from within the SPC Application Site and immediately adjacent areas. The locations of the WFD water bodies and catchments in relation to the SPC Application Site are shown in Figure 1.

Table 2 Surveys and modelling relevant to the WFD Compliance Assessment

SURVEY OR MODELLING REPORT	DETAILS
<i>Western Wales River Basin Management Plan 2015 - 2021</i> [RD3]	Baseline data for all water bodies
<i>Freshwater Baseline Surveys Report 2011 to 2014</i> [RD4]	Biological and chemical/physico-chemical quality elements in fluvial water bodies and catchments
<i>Fluvial Geomorphology Baseline Report</i> [RD5]	Hydromorphological quality elements in fluvial water bodies and catchments
<i>Physical Habitat Characterisation Survey</i> [RD6]	Hydromorphological quality elements in fluvial water bodies and catchments
<i>Water Quality and Plankton Surveys Report 2010 to 2014</i> [RD7]	Biological and chemical/physico-chemical quality elements in coastal water bodies
<i>Benthic Surveys Report</i> [RD8]	Biological quality elements in coastal water bodies
Geomorphological coastal reconnaissance survey [RD9]	Hydromorphological quality elements in coastal water bodies

Water Framework Directive Compliance Assessment for Site Preparation and Clearance Proposals	Revision: 1
	Issue date: 18/05/17

SURVEY OR MODELLING REPORT	DETAILS
<i>Hydrogeology Baseline for the Wylfa Newydd Project</i> [RD10]	Groundwater quality and quantity Hydrological connections between fluvial and groundwater bodies
<i>Cemlyn Lagoon – an ecology review</i> [RD11]	Biological and physico-chemical quality elements in Cemlyn Lagoon
Hydrological Baseline Report [RD12]	Hydrological quality of surface water bodies

3.3 Stakeholder liaison

Stakeholder engagement specific to the development of the baseline conditions presented within this WFD Compliance Assessment is described within the relevant Environmental Statement chapters; these being surface water and groundwater (chapter 13), terrestrial and freshwater ecology (chapter 14) and marine environment (chapter 15).

The original WFD Compliance Assessment for the SPC Proposals were discussed with NRW. A Preliminary WFD Assessment for the SPC Proposals was sent to NRW in May 2016. A teleconference was then held with NRW in August to discuss their comments. The advice provided on the WFD assessment for the original SPC Proposals has been taken into account for this WFD Compliance Assessment.

Project-wide consultation has also been ongoing in relation to the WFD and this has also informed this report. The meetings held are listed in Table 3.

Table 3 Stakeholder consultation relating to the Water Framework Directive for the wider Wylfa Newydd Project

MEETING DATE	STAKEHOLDER	TITLE AND FORMAT	DESCRIPTION
11 Mar 2015	NRW and the IACC	Fluvial geomorphology and the WFD.	A technical meeting to discuss the methodology for the fluvial geomorphology baseline and impact assessments. This included initial consultation on the WFD water bodies and Compliance Assessment to agree the methodologies for the proposed assessments.
17 Sept 2015	NRW	WFD assessment conference call.	Call to discuss the format and contents of WFD assessments.
14 December 2016	NRW	Preliminary WFD assessment meeting	Meeting to discuss the Preliminary WFD assessment and comments on PAC2, including Article 4.7
23 February 2017	NRW	WFD working group meeting 1 (by teleconference)	NRW's comments on the technical memos on Article 4.7, temporary and non-temporary effects and migratory fish were discussed.
5 April 2017	NRW	WFD working group meeting 2	Meeting to discuss NRW's comments on the Preliminary WFD assessment and technical memos. Presentation of the methodology and format of the WFD Compliance Assessment.

4 Identification of relevant WFD water bodies

4.1 WFD water bodies screened into the assessment

NRW have been consulted on the screening of water bodies.

Six WFD water bodies have been identified within the Wylfa Newydd Development Area (Figure 1). Of these, four WFD water bodies were screened into the assessment, comprising three WFD coastal water bodies and one WFD groundwater body as follows:

- The Skerries (GB611010390000) – including the Afon Cafnan Catchment and Power Station Catchment (coastal);
- Anglesey North (GB641010620000) – including the Tre'r Gof Catchment and Cemaes Catchment (coastal);
- Cemlyn Lagoon (GB610100083000) – including the Cemlyn Catchment (coastal); and
- Ynys Môn Secondary (GB41002G204400) (groundwater).

Two WFD water bodies within the study area, namely Wygyr (GB110102059170²) and Llyn Llygeirian (GB31032435) have been screened out of the assessment due to their location and because of the lack of identified potential pathways to an effect.

The majority of rivers, streams and small drains within the SPC Application Site are not reported as WFD water bodies in their own right. NRW assesses these non reportable surface water bodies as components of the coastal water bodies into which they drain. Assessments of the coastal waterbodies therefore take account of the coastal streams draining the SPC Application Site.

4.2 Rationale for WFD water bodies screened out

4.2.1 Wygyr (GB110102059170)

The Wygyr water body flows from the south of Ysgellog to the Irish Sea at Traeth Mawr, Cemaes. The water body is located within Cemaes and is more than 400m from the SPC Application Boundary. The land surface between the SPC Application Boundary and the Wygyr supports a mixture of residential houses and fields.

The SPC works would not alter the drainage or runoff to or within the Wygyr Catchment. There are no hydrological connections between the Wygyr and any water bodies screened into the WFD Compliance Assessment. No effects have therefore been predicted for the Wygyr, and this water body is therefore not considered further in this assessment.

4.2.2 Llyn Llygeirian (GB31032435)

Llyn Llygeirian is a lacustrine water body located at the source of the Afon Cafnan, approximately 3km upstream from the SPC Application Site and approximately 3.6km from Nant Caerdegog Isaf. It is considered that effects on quality elements in the downstream reaches of the Afon Cafnan catchment would not result in effects further upstream. Given the distance

² The number provided in brackets is the WFD ID for each WFD water body.

from the location of SPC Application Site, there are no predicted effects on quality elements in Llyn Llygeirian, and therefore this water body is not considered further in this assessment.

5 Water body baseline data

A summary of the baseline information for the four WFD water bodies screened into the assessment is provided in Table 4. Coastal water bodies are shown in Figure 1. The groundwater body covers most of Anglesey. There are no fluvial WFD water bodies screened into the assessment of the SPC Proposals.

Table 4 Baseline water body information from the RBMP

	THE SKERRIES	ANGLESEY NORTH	CEMLYN LAGOON	YNYS MÔN SECONDARY
Water body type	Coastal	Coastal	Coastal	Groundwater
Water body ID	GB611010390000	GB641010620000	GB610100083000	GB41002G204400
Hydromorphological designation	Not designated AWB/HMWB	Not designated AWB/HMWB	HMWB	N/A
Overall status/potential	High status	Moderate status	Good potential	Poor status
Current ecological status/potential	High	Good	Good	N/A
Current quantitative status	N/A	N/A	N/A	Good
Current chemical status	Good	Fail	Good	Poor
Failing element(s)	N/A	Mercury	N/A	Chemical dependent surface water body status
Reasons for not achieving Good (GES/GEP)	N/A	Mercury and its compounds	N/A	Diffuse source (certainty: probable) Activity: abandoned mine (certainty: probable)
Overall objective	High	Good by 2021	Good	Poor (no known technical solution is available) ³

The following sections of the report summarise the data for each water body and catchment area. Since the majority of rivers, streams and small drains within the SPC Application Site are non reportable water bodies, they are referred to as part of the catchments of coastal WFD water bodies. The locations of these catchments are shown in Figure 1. The catchment names are based on the primary watercourse within the catchment, and for consistency these names are referred to throughout this report.

The majority of baseline data relating to the catchments has been derived from desk review, field surveys and assessments carried out for the Wylfa Newydd Project. The diverse nature of

³ In the WFD working group meeting on 5 April 2017 NRW indicated that the overall objective of the Ynys Môn Secondary groundwater body is being updated.

the fluvial watercourses seasonal variation in water level, and the availability of suitable sampling sites has resulted in different spatial and temporal levels of information being available for each catchment. The baseline data is considered representative and characteristic of the catchments present.

5.1 Coastal WFD water bodies

5.1.1 The Skerries (GB611010390000)

The Skerries water body comprises the coastal environment from the Existing Power Station to The Skerries in the west (as shown in Figure 1) and the following non reportable fluvial catchments:

- Afon Cafnan Catchment; and
- Power Station Catchment.

5.1.1.1 The Skerries coastal WFD water body

The Skerries coastal water body is characterised by strong tidal currents, semi-diurnal tides and localised eddies in the bays around Wylfa Head. The water body is well mixed all year round with no evidence of a permanent thermocline, halocline or seasonal stratification [RD7]. The coast mainly comprises hard rocky cliffs with sandy bays. The bedrock geology would have been covered by ice sheets in the last glaciation and loose material eroded/detached during that period has since been moved and sorted by currents driven by tidal and wave forces. Offshore, the sea floor is composed of a mixture of solid bedrock, boulders, cobbles, gravels and sands. Over the long term, the rocky coast will be extremely slow to change, even with strong tidal currents [RD9].

Surveys carried out between 2010 and 2014 showed expected concentrations of sampled chemicals to be mainly below the limit of detection. Values were found to be in line with previous studies and typical of coastal waters around the north of Anglesey [RD7].

Phytoplankton production is low, most likely as a consequence of low nutrient levels, which is a known feature of this area of the Irish Sea [RD7]. The intertidal ecological communities are characteristic of an exposed, western, rocky coastline, and the habitats support diverse assemblages of macrophytes [RD8]. The subtidal benthic communities are considered to be of high quality and generally undisturbed [RD8]. Sea trout, salmon, river lamprey and European eel are known to migrate through The Skerries coastal water body, utilising fluvial catchments with direct connectivity.

5.1.1.2 The Afon Cafnan Catchment

The Afon Cafnan, the main watercourse within the catchment, is a small stream channel flowing north from Llyn Llygeirian to Porth-y-pistyll. It has a relatively straight artificial planform and forms the boundary to several fields. During a geomorphological reconnaissance survey, the watercourse was found to exhibit some interaction between natural processes and channel form; through both erosion and deposition. Some recovery from previous artificial modification between Mynydd Ithel and Cafnan [RD5] was observed. The predominant land use within the Afon Cafnan Catchment appears on aerial photography to be agricultural for livestock grazing.

Surveys carried out between 2011 and 2016 recorded the average channel width to be between 0.8m and 1.0m and the channel depth between 0.1m and 0.3m [RD5]. Locations with poaching and erosion were noted and longitudinal connectivity observed to be affected by culverts and bridges throughout the length of the watercourse [RD5]. The gradients of the channels are such that the stream energies are relatively low and the channel banks are unlikely to migrate laterally.

During a physical habitat characterisation survey, some localities were found to exhibit diverse flow diversity with a number of flow types, including runs, glides and areas of slower flow [RD6]. Substrate was observed to be dominated by gravel, and riparian vegetation was present along both banks (providing shading/ cover). Thus, there is potentially good quality physical habitat for macroinvertebrates and fish. The watercourse was noted to be supporting a varied macrophyte assemblage in some locations, and the numbers of species and biomass of vegetation was greatest in reaches without overhanging trees and shrubs providing shade.

At the downstream reach by the Felin Gafnan confluence, large herbaceous riparian species were recorded during the survey, shading the left bank; ferns were observed to dominate the steeper right bank. The river was noted to flow over the rocky foreshore directly into Porth-y-pistyll and fucoid macroalgae were found to be present in the length furthest downstream, although physico-chemical water analysis indicated a dominant freshwater source, with no indication of saline intrusion.

From surveys carried out between 2011 and 2016, suspended solids concentrations within this watercourse were found to vary between sites and seasons [RD4]. Reactive phosphorus concentrations failed to meet good WFD status at two of the survey sites, indicating possible enrichment due to the adjacent agricultural land use.

The River Invertebrate Classification Tool (RICT)⁴ classified invertebrates on the Afon Cafnan as moderate, although only one site on this watercourse was sampled [RD4]. The Lotic-invertebrate Index for Flow Evaluation (LIFE) score reflected an invertebrate community of faster, consistently flowing waters. Analysis of Proportion of Sediment-sensitive Invertebrates (PSI) showed that the sites sampled were 'moderately sedimented' to 'sedimented'. The Ecological Quality Ratio suggested there were few flow-stressors at these sites that would not be present in pristine 'natural reference conditions'.

Fish species recorded on this watercourse during aquatic ecology surveys between 2011 and 2014 included brown trout and the European eel. The latter species indicates that the watercourses have sufficient connectivity to the sea to allow eel migration between fluvial and coastal components of the same water body.

5.1.1.3 Power Station Catchment

The Power Station Catchment is adjacent to the Existing Power Station. The main watercourse is the stream at Porth-y-pistyll running in a northwesterly direction along the southwestern boundary of the Existing Power Station through boggy/wet grassland. During a geomorphological reconnaissance survey, the stream was observed to first emerge from a culvert structure adjacent to the Existing Power Station gates. The presence of a drain cover

⁴ The RICT and LIFE tools are indices used for classification of macroinvertebrates.

suggests an extensive culverted watercourse beneath the ground and extending further upstream [RD5]. The headwaters of the watercourse lie close to an underground sump and valve chamber, draining the Existing Power Station (see chapter 11 of the Environmental Statement for more detail). Monitoring has indicated elevated concentrations of trichloroethylene at this location [RD12]. During surveys, the channel was observed to be wet for approximately 200m south of the shoreline in autumn and dry in the upper reaches over summer. A tributary was observed 75m upstream from the shoreline. This flows from an area of gorse and tall shrub suggesting a significant proportion of the downstream summer flow in the mainstream is derived from this tributary.

With the exception of the lower 75m of the watercourse, no defined channel was observed, with an increase in wetland vegetation species (emergent rush and reed) delineating the extent of the surface flow. The channel in the lower length appeared to be unmodified, and followed an undefined channel form. The lower reach had a more defined channel; with thick vegetation (95%) cover. This resulted in flow types being limited to slack with very low energy, depositional glides [RD5]. The channel was judged likely to be choked year round by terrestrial grasses and a mix of wetland and semi-aquatic plant species throughout this length. The wetted depth recorded was less than 0.1m and the channel width was noted as variable, but rarely more than 0.5m [RD5]. The stream was observed to disappear into a culvert immediately above the beach and was seen to run over the shingle foreshore to the sea.

Water quality conditions were found to be typical of a catchment dominated by rural land use. RICT classification of invertebrates on the Porth-y-pistyll watercourse was good and with species typical of cleaner waters. Stoneflies and some caddisflies contributed to the good classification [RD4]. European eels are known to be present within this watercourse and are thought to have entered the stream by migrating over the shoreline from Porth-y-pistyll, as there is limited connectivity between the marine and freshwater environments at this location.

5.1.2 Anglesey North (GB641010620000)

The Anglesey North water body comprises the coastal environment from the Existing Power Station to the east (as shown in Figure 1). The water body catchment includes the following non reportable fluvial catchments:

- Tre'r Gof Catchment; and
- Cemaes Catchment.

5.1.2.1 The Anglesey North WFD water body

The boundary of the Anglesey North water body lies just to the east of the Existing Power Station and follows the coast as far as Trwyn Du. It is characterised by strong tidal currents and semi-diurnal tides and is well mixed all year round with no evidence of seasonal stratification. The Existing Power Station Cooling Water discharge lies within this water body. The Anglesey North water body is located immediately adjacent to The Skerries water body.

Analysis of samples taken between 2010 and 2014 showed expected concentrations of chemicals. Many were below the limit of detection and values in line with previous studies and typical of coastal waters around the north of Anglesey [RD7]. The geology and seabed are the same as described for The Skerries water body.

As per The Skerries water body, phytoplankton production was found to be low and the ecological communities are characteristic of an exposed rocky coastline. In the immediate vicinity of the current Cooling Water discharge, the biota were noted to be clearly impoverished with the influence extending up to around 200m [RD8]. The subtidal benthic communities were assessed to be of high quality and generally undisturbed [RD8]. Sea trout and European eel have been reported from Anglesey North and are known to utilise the fluvial water bodies connected to the coastal water body.

5.1.2.2 *Tre'r Gof Catchment*

The Tre'r Gof Catchment is located to the southeast of the Existing Power Station. Within the catchment, there are three watercourses and the Tre'r Gof SSSI, which is recognised for its rich-fen habitat. The Tre'r Gof SSSI wetland area was found to be wetted all year round supported by a network of permanently wetted drainage ditches across the site.

During the geomorphological reconnaissance survey, the Tre'r Gof SSSI drains were recorded as having an artificially straight planform, with a uniform channel cross-section, typically noted as overdeep and overwide [RD5]. The watercourse was observed during the survey to be choked with terrestrial vegetation and to be acting as a sediment sink. The channel was observed to be narrowing along particular lengths and the channel substrate consisted predominantly of silt. Sampling of water quality carried out between 2011 and 2016 showed suspended sediment concentrations to vary across the catchment and over time (seasonally). Water quality conditions within the Tre'r Gof Catchment were found to be typical of a catchment dominated by rural land use, including livestock grazing. Occasional elevated metal concentrations were detected in sampling carried out between 2012 and 2014 [RD4].

LIFE scores from this catchment indicated that the invertebrate communities were characteristic of slow-flowing or standing waters, reflecting the fen/wetland nature of this site [RD4]. PSI was interpreted as 'sedimented' or 'heavily sedimented', indicating that a significant proportion of taxa present in the Tre'r Gof Catchment are tolerant of sedimentation.

In 2013 and 2014, incidental records were made of European eel at Porth Wylfa and in 2014, an additional incidental record of European eel was made at the Tre'r Gof SSSI [RD4]. A natural head drop of several metres between the Porth y Wylfa cliff and the beach was noted, resulting in limited upstream migratory access for fish.

5.1.2.3 *Cemaes Catchment*

Nant Cemaes, the main watercourse within the catchment, is a small watercourse flowing through Cemaes from a source west of Llanfechell for approximately 3.5km before discharging into Cemaes Bay. The predominant land use within the Cemaes Catchment appears from aerial images to be agricultural, with some tilled land and some livestock grazing.

During a geomorphological reconnaissance survey, the watercourse was recorded to have an artificially straightened planform with a uniform cross-section that was considered as over deep and overwide [RD5]. Glide flow was noted to be the predominant flow type. However, run flow was also observed at the mouth of the watercourse into Cemaes Bay. The upstream reach alongside the A5025 was recorded as artificially reinforced with a silty substrate. The downstream reach immediately upstream of Cemaes Bay was observed to have fully vegetated banks.

It is likely that Nant Cemaes has been historically modified, with visual evidence of realignment to form field boundaries and urban development [RD5]. Improved flow diversity and substrate was observed towards the lower lengths of the catchment [RD5].

Water quality sampling carried out between 2011 and 2016 showed suspended sediment concentrations to vary between sites in the catchment and between sampling seasons. Water quality conditions were within expected ranges and nutrient and metal concentrations recorded as generally low [RD4].

Both macroinvertebrate and macrophyte communities within the Cemaes Catchment were found to be of low value and typical of lowland coastal streams [RD4]. The value of fish communities was also considered to be low typically [RD4]. A single record of a European eel from 2013 was thought to indicate that migratory species could enter the lower reaches of the catchment and utilise available habitats. However, there was limited habitat for fish species recorded within the upper catchment due to channel modification and low flows [RD4].

5.1.3 Cemlyn Lagoon (GB610100083000)

The Cemlyn Lagoon WFD water body has one associated catchment, the Cemlyn Catchment.

5.1.3.1 Cemlyn Lagoon coastal WFD water body

Cemlyn Lagoon is a coastal water body located just to the northwest of the western boundary of the SPC Application Site. It is designated as an SSSI, a Special Area of Conservation (SAC) and a Special Protection Area (SPA) and is an Annex I priority habitat. The nature conservation status of this feature is currently favourable. Conditions are considered favourable when Conservation Objectives are shown to meet appropriate standards (habitat extent and / or quality standards) set by the relevant competent authority

The movement and sorting of glacially derived materials by tidal and wave forces has caused sediments to gather locally to form beaches, including the features known as Esgair Gemlyn in Cemlyn Bay. Cemlyn Lagoon is classified as a HMWB due to flood protection [RD3] but is still considered to be the best example of a saline coastal lagoon in Wales and is currently classified as having Good Potential. The lagoon is fed with freshwater from two main streams (Nant Cemlyn and Afon Hen Borth) and a number of minor drains and springs. Cemlyn Lagoon was classified by Bamber *et al.* [RD13; RD14] as a percolation lagoon, as there is an exchange of water between the sea (The Skerries water body) and the lagoon through the shingle bank, which is also occasionally overtopped [RD11]. It is also classified as a 'sluiced' lagoon, as seawater exchange occurs via the sluice, which is operated to control water levels for nature conservation purposes.

The lagoon supports specialist invertebrate fauna able to cope with the fluctuating environmental conditions (temperature and salinity). Surveys have demonstrated seasonal variation in the abundance of benthic invertebrates within the lagoon [RD15]. The lagoon supports aquatic flora species, most of which are typically associated with brackish and marine environments.

5.1.3.2 Cemlyn Catchment

The Nant Cemlyn, the main watercourse within the catchment, is a small channel that follows a field boundary, located just west of the SPC Application Site. The valley profile within the Cemlyn Catchment is shallow (without steep sides) with modified watercourses that appear to

have been artificially straightened for land drainage purposes. The main land use is agricultural with the fields being predominantly used as pasture for grazing, and some as tilled arable land.

The channel was noted to be approximately 2m wide where it heads north towards Neuadd. It became narrower, to approximately 1m in width, as it continued in a northerly direction alongside Nanner Road. Some locations of natural adjustment were observed during the survey in the form of erosion and deposition, locally creating a more natural sinuous planform for the confined channel. Several locations of poaching and consequent bank collapse were noted during the geomorphological survey alongside the left bank of the channel.

Culverts and bridges were noted as being present along the entire reach. During surveys carried out between 2011 and 2016, some terrestrial vegetation was observed within the channel, and the substrate was found to be composed of gravels, cobbles and pebbles [RD4]. Some features were noted to be present within the channel including riffles and runs. At Neuadd, a diverse range of macrophytes were recorded in the channel. The culvert upstream at Nanner is not thought to pose a significant impediment to fish passage.

5.2 Groundwater body

5.2.1 Ynys Môn Secondary (GB41002G204400)

The Ynys Môn Secondary groundwater body is screened into the WFD assessment for the SPC Proposals. This water body covers most of Anglesey. Table 4 presents a summary of key information on the groundwater body from the Water Watch Wales website [RD16].

The published data state that the Ynys Môn Secondary groundwater body is currently achieving Poor Status overall, as the current chemical status is poor. However, following discussions and a Scoping Opinion from NRW it is understood that the overall quality within the groundwater body is actually considered to be Good, but the formal classification for water chemistry is Poor because there are local discharges of metals from abandoned mines in some areas leading to some effects on local surface water quality [RD17].

The SPC Application Site is located in a geologically complex area. In brief, the area is underlain by superficial deposits, predominantly of glacial origin, overlying metamorphic bedrock with some minor igneous intrusions. The superficial geological materials are generally clayey in nature with varying thicknesses. More than 30m of deposits were estimated to be present beneath the high points of the drumlins with less than 2m at other locations.

Groundwater is encountered in both the superficial deposits (where they are sufficiently thick) and in the bedrock. Fracture flow is the dominant flow mechanism for groundwater movement in the bedrock. For the superficial deposits, intergranular flow within the pore spaces will be the dominant flow mechanism. However, whilst clay deposits will have a relatively high porosity and moisture content, actual groundwater movement through the clays will be very limited due to the low permeability.

Groundwater levels are monitored in boreholes across the SPC Application Site by a combination of manual dipping and pressure transducers, connected to data loggers. In general terms, the groundwater levels show that groundwater flow follows the ground levels with groundwater discharging locally to the streams and also directly to the sea through the rocks along the coastline. The highest water levels in the bedrock are recorded to the south of

Water Framework Directive Compliance Assessment for Site Preparation and Clearance Proposals		Revision: 1
		Issue date: 18/05/17

the SPC Application Site at around 30m Above Ordnance Datum with groundwater levels towards the coast being close to sea level.

Groundwater contours in the superficial deposits do show a different pattern to those in the bedrock with much greater topographic control than for the bedrock, although ultimately with groundwater flowing towards the coast, as is the case with the bedrock. There are groundwater 'mounds' to the south of the SPC Application Boundary associated with drumlins, and there is a further groundwater high associated with elevated land to the east of the Existing Power Station. There is a distinct groundwater low point for the superficial deposits associated with the basin at Tre'r Gof SSSI, with the levels indicating that groundwater flow in the superficial deposits in this area is into the Tre'r Gof Catchment.

The area is exempt from groundwater abstraction licensing due to an abundance of supply and limited potable water abstraction. However, the Isle of Anglesey County Council has identified three private water supplies within 1.5km of the centre of the SPC Application Site.

Groundwater quality has been measured over the last year on a quarterly basis in around 30 boreholes installed in the bedrock and superficial deposits across the SPC Application Site. Groundwater quality is considered to be generally good (when compared to surface water Environmental Quality Standards). However, elevated manganese was measured in several boreholes and localised elevated concentrations of ammoniacal nitrogen and metals were also recorded. In terms of electrical conductivity, the monitoring data do not show saline intrusion into the aquifer.

Further details of the hydrogeology of the study area are provided in chapter 13 (surface water and groundwater) of the SPC Environmental Statement.

6 Identification of SPC works and relevant WFD water bodies

Table 5 takes each component of the SPC Proposals and considers which WFD water bodies are relevant and identifies where there is potential for effects which could potentially result in deterioration in hydromorphological, chemical, physico-chemical or biological quality elements.

It is recognised that a pressure common to all activities is the risk of potential spills and leaks of fuel and oil from machinery. Adherence to good construction practice methods reduces this risk, and measures will be put in place to deal with such accidental spills. This will reduce the potential for occurrence of a pollution event and reduce the severity of the event if it were to occur. As the type of event cannot be predicted or quantified, the potential for effects on quality elements has not been assessed in relation to WFD objectives.

Table 5 Identification of SPC works relevant to WFD water bodies

SPC COMPONENT		FURTHER DETAIL RELEVANT WFD WATER BODIES
Targeted removal of above-ground features	Targeted removal of vegetation (including tree felling) and removal of above-ground features. Clearance of walls to ground level and only where these are inside the perimeter fence. Remaining demolitions to ground level (i.e. existing buildings).	The Skerries Anglesey North Cemlyn Lagoon Ynys Môn Secondary
Watercourse realignment	Realignment of a watercourse (Nant Caerdegog Isaf).	The Skerries
Establishment of main site compound and satellite compounds	Vegetation removal and preparing sites for compounds, establishment of compound.	The Skerries Anglesey North Ynys Môn Secondary
Ground improvement works	Removal of contaminated soils from areas of potential concern and treatment or removal of invasive non-native species. Contaminated soils would be treated in an on-site remediation processing compound.	The Skerries Ynys Môn Secondary

7 Assessment of effects on quality elements

The assessment of the effects on The Skerries, Anglesey North and Cemlyn Lagoon coastal water bodies and Ynys Môn Secondary groundwater body is detailed in Tables 5 to 8 respectively. The assessment includes an outline of the potential specific effects on the fluvial watercourses within the WFD water body catchments (where relevant). This takes each relevant SPC component identified in Section 6 and provides an assessment of whether there would be a risk to any quality elements.

The assessment of effects is undertaken assuming embedded and good practice mitigation is in place. Embedded and good practice mitigation is described within the relevant marine environment (chapter 15), surface water and groundwater (chapter 13), and terrestrial and freshwater ecology (chapter 14) chapters of the SPC Environmental Statement.

Examples of mitigation embedded into design include:

- A phase drainage system, including the use of sediment lagoons and oil interceptors
- Buffer zones around main watercourses, intertidal zone, mitigation features and sensitive designated areas,
- Low level lighting of site
- Permeable site fencing, not crossing main rivers
- Remediation of contaminated land,
- Flood storage incorporated into river realignment design
- Restriction on vehicle fuelling and maintenance locations
- Grassing of soil storage mounds, and
- Incorporation of permeable paving / access tracks

Examples of best practice mitigation incorporated into design include:

- Adherence to pollution prevention guidelines, construction code of practices and design standards
- Timing and phasing of works
- Presence of an Ecological Clerk of Works
- Biosecurity risk assessments
- Management plans for Air Quality, Sediment, Emergency Incident Response, and
- Translocation of affected species to an offsite enhancement area.

Table 6 Consideration of effects on watercourses and The Skerries WFD water body

SPC COMPONENT	EFFECTS ON HYDROMORPHOLOGY	EFFECTS ON CHEMISTRY AND PHYSICO-CHEMICAL PARAMETERS	EFFECTS ON BIOLOGY/ECOLOGY
Contributing fluvial watercourses (Afon Cafnan Catchment and Power Station Catchment)			
Removal of above-ground features	<p>Temporary localised removal of riparian habitat and floodplain connectivity due to construction activities and access. Localised destabilisation of watercourse banks may occur through adjacent removal of above ground features. Intermittent release of fine sediment may have a very localised effect on deposition and erosion. Embedded and good practice mitigation would reduce the potential effects (drainage strategy, buffer zones, sediment management plans).</p> <p>Potential positive effect to banks and riparian zone on lengths where a 15m buffer would be retained due to elimination of livestock poaching and potential for recovery of riparian vegetation.</p>	<p>Input of fine sediment could result in a brief period of increased turbidity and have a potential to increase nutrients into the watercourse. However, the effects would be localised and would be reduced by embedded and good practice mitigation.</p>	<p>Increase in turbidity from fine sediment release could affect aquatic flora, and there could be very localised smothering of benthic invertebrates and fish habitat. However, the effects would be small scale and would be reduced by embedded and good practice mitigation (buffer zones, drainage strategy, grassing of soil storage mounds).</p>
Watercourse realignment	<p>Channel realignment would require in-channel working. However, the watercourse realignment would lead to an overall improvement in morphological processes through the creation of a more sinuous planform with a pool-riffle sequence. Longitudinal connectivity would be improved, and lateral connectivity enhanced with a scrape incorporated into the design. Landscaping of the realignment would improve the riparian</p>	<p>The watercourse realignment has the potential to lead to a long-term improvement in physico-chemical quality through the creation of a more natural sinuous planform with pool-riffle sequence, which would improve oxygenation and reduce nutrient accumulation within the sediments.</p>	<p>Channel realignment would require in-channel working. The watercourse realignment would lead to a long-term improvement in habitat diversity through the creation of a more natural sinuous planform with a pool-riffle sequence, and has the potential to result in a net gain in biological communities.</p>

SPC COMPONENT	EFFECTS ON HYDROMORPHOLOGY	EFFECTS ON CHEMISTRY AND PHYSICO-CHEMICAL PARAMETERS	EFFECTS ON BIOLOGY/ECOLOGY
	corridor.		
Establishment of main site compound and satellite compounds	Temporary localised removal of riparian habitat and floodplain connectivity due to construction activities and access. Localised fine sediment release would affect the geomorphology of the watercourses, altering deposition and erosion regimes. Embedded and good practice mitigation considered to reduce the potential effects.	No change anticipated to chemical and physico-chemical quality elements.	No change anticipated to biological quality elements.
Ground improvement works	No changes to hydromorphology of the watercourses.	Potential for very localised increase in available pollutants from contaminated soils / substrate. However there are no watercourses in close proximity to the compound and testing of runoff would be carried out to ensure any contamination is managed. Therefore no change is anticipated to chemical and physico-chemical quality elements.	No change anticipated to biological quality elements.
The Skerries WFD water body			
Removal of above-ground features	There are anticipated to be no effects on the coastal hydromorphological quality elements, including morphological conditions (depth variation, structure and substrate of the coastal bed and structure of the intertidal zone) or tidal regime (direction of dominant current and wave	There are anticipated to be no effects on the chemical or physico-chemical quality elements, including transparency, thermal conditions, oxygenation conditions, salinity, nutrient conditions priority and specific	There are anticipated to be no effects on the biological quality elements, including benthic invertebrates, plankton and aquatic flora.
Watercourse realignment			
Establishment of main site compound and			

Water Framework Directive Compliance Assessment for Site Preparation and Clearance Proposals		Revision: 1
		Issue date: 18/05/17

SPC COMPONENT	EFFECTS ON HYDROMORPHOLOGY	EFFECTS ON CHEMISTRY AND PHYSICO-CHEMICAL PARAMETERS	EFFECTS ON BIOLOGY/ECOLOGY
satellite compounds	exposure).	pollutants.	
Ground improvement works			

Table 7 Consideration of effects on watercourses and the Anglesey North WFD water body

SPC COMPONENT	EFFECTS ON HYDROMORPHOLOGY	EFFECTS ON CHEMISTRY AND PHYSICO-CHEMICAL PARAMETERS	EFFECTS ON BIOLOGY/ECOLOGY
Contributing fluvial watercourses (Tre'r Gof Catchment and Cemaes Catchment)			
Removal of above-ground features	<p>Temporary localised removal of riparian habitat and floodplain connectivity due to construction activities and access. Localised destabilisation of watercourse banks may occur through adjacent removal of above ground features. Intermittent release of fine sediment may have a very localised effect on deposition and erosion. Embedded and good practice mitigation would reduce the potential effects (drainage strategy, buffer zones, sediment management plans).</p> <p>Potential positive effect to banks and riparian zone on lengths where a 15m buffer would be retained due to elimination of livestock poaching and potential for recovery of riparian vegetation.</p>	<p>Input of fine sediment could result in a brief period of increased turbidity and have a potential to increase nutrients into the watercourse. However, the effects would be localised and would be reduced by embedded and good practice mitigation.</p>	<p>Increase in turbidity from fine sediment release could affect aquatic flora, and there could be very localised smothering of benthic invertebrates and fish habitat. However, the effects would be small scale and would be reduced by embedded and good practice mitigation (buffer zones, drainage strategy, grassing of soil storage mounds).</p>
Establishment of satellite compounds	<p>Temporary localised removal of riparian habitat and floodplain connectivity due to construction activities and access. Localised fine sediment release would affect the geomorphology of the watercourses, altering deposition and erosion regimes. Embedded and good practice mitigation considered to reduce the potential effects.</p>	<p>No change anticipated to chemical and physico-chemical quality elements.</p>	<p>No change anticipated to biological quality elements.</p>
Anglesey North WFD water body			
Removal of above-ground features	<p>There are anticipated to be no effects on the coastal hydromorphological quality</p>	<p>There are anticipated to be no effects on the chemical and physico-chemical</p>	<p>There are anticipated to be no effects on the biological quality</p>

Water Framework Directive Compliance Assessment for Site Preparation and Clearance Proposals		Revision: 1
		Issue date: 18/07/17

SPC COMPONENT	EFFECTS ON HYDROMORPHOLOGY	EFFECTS ON CHEMISTRY AND PHYSICO-CHEMICAL PARAMETERS	EFFECTS ON BIOLOGY/ECOLOGY
Establishment of main site compound and satellite compounds	elements, including morphological conditions (depth variation, structure and substrate of the coastal bed and structure of the intertidal zone) or tidal regime (direction of dominant current and wave exposure).	quality elements, including transparency, thermal conditions, oxygenation conditions, salinity, nutrient conditions priority and specific pollutants.	elements, including benthic invertebrates, plankton and aquatic flora.

Table 8 Consideration of effects on watercourses and the Cemlyn Lagoon WFD water body

SPC COMPONENT	EFFECTS ON HYDROMORPHOLOGY	EFFECTS ON CHEMISTRY AND PHYSICO-CHEMICAL PARAMETERS	EFFECTS ON BIOLOGY/ECOLOGY
Contributing fluvial watercourses (Cemlyn Catchment)			
Removal of above-ground features	Temporary localised removal of riparian habitat and floodplain connectivity due to construction activities and access. Localised destabilisation of watercourse banks may occur through adjacent working encouraging lateral erosion. Intermittent release of fine sediment may have a very localised effect on deposition and erosion. Embedded and good practice mitigation would reduce the potential effects (drainage strategy, buffer zones, sediment management plans).	Input of fine sediment could result in a brief period of increased turbidity and have a potential to increase nutrients into the watercourse. However, the effects would be small scale and would be reduced by embedded and good practice mitigation.	Increase in turbidity from fine sediment release could affect aquatic flora, and there could be very localised smothering of benthic invertebrates and fish habitat. However, the effects would be small scale and would be reduced by embedded and good practice mitigation (buffer zones, drainage strategy, grassing of soil storage mounds).
Cemlyn Lagoon WFD water body			
Removal of above-ground features	There are anticipated to be no effects on the coastal hydromorphological quality elements, including morphological conditions (depth variation, structure and substrate of the coastal bed and structure of the intertidal zone) or tidal regime (direction of dominant current and wave exposure).	There are anticipated to be no effects on the physico-chemical and chemical quality elements, including salinity, pollution by priority substance and other substances discharged in significant quantities into the body of water. There would be no change in turbidity and nutrient condition.	There are anticipated to be no effects on the biological quality elements, including submerged aquatic flora, benthic invertebrate fauna, nekton and phytoplankton.

Table 9 Consideration of effects on the Ynys Môn Secondary WFD water body

SPC COMPONENT	EFFECTS ON QUANTITATIVE STATUS	EFFECTS ON CHEMICAL STATUS
Removal of above-ground features	Small scale changes to groundwater recharge rates and areas due to the removal of vegetation. This could either be a small increase in recharge as vegetation removal would reduce water loss from the soil by transpiration, or it could be a small decrease if vehicle movements compact the soil surface such that rainfall runs off rather than infiltrates the soil. These changes would be local and are unlikely to result in any significant change in quantity and would not have an effect on the quantitative status of the water body.	No change anticipated.
Establishment of main site compound and satellite compounds		Potential for changes to groundwater quality from the disturbance of ground including the exposure of contaminated soils in made ground and processing of soil at the remediation compound. Drainage channels would be installed around soil storage areas to collect runoff. Where the runoff meets pre-determined criteria for suitability it will be used to dampen soil or discharged to ground. Where these criteria are failed the water would be tankered for off-site disposal. Therefore no changes in groundwater quality are anticipated and there would be no effect on the chemical status of the water body.
Ground improvement works		

Localised effects arising from the removal of above ground features and the establishment of satellite compounds have been identified across the non-reportable waterbodies draining into the coastal catchment. Effects are principally related to the loss of riparian habitat and the potential for an increase in fine sediment to enter the aquatic environment. Additionally remediation of contaminated land, and the river realignment will also result in a localised, minor effect on hydromorphological, physico-chemical and biological quality elements.

Through the use of buffer zones, good construction practices, grassing of soil storage mounds and a phased drainage strategy there is predicted to be no significant effect on WFD status of the coastal water bodies. Activities undertaken for SPC works will not prevent any of the WFD water bodies from achieving Good Status or Potential

8 Water body mitigation measures assessment

There are 96 national mitigation measures, defined as practicable steps that can be taken to mitigate adverse impact from human activities. In the case of flood risk management and land drainage these are impacts from physical modifications to our watercourses, coasts and estuaries. Mitigation measures are grouped into the following categories; sediment management, vegetation management, removal of obsolete infrastructure, improving fish passage, modify or enhance structures, manage and restore the intertidal zone and the management and restoration of aquatic and riparian habitats.

The Preliminary WFD Assessment identified that the SPC Proposals would not compromise the delivery of any of the 96 national mitigation measures. There are no locally targeted measures listed in the NRW database for the four WFD waterbodies screened into this WFD Compliance Assessment.

Cemlyn Lagoon is classified as a HMWB due to flood protection use [RD3]. The mitigation measures assessment is Good, meaning that all of the relevant and required measures have been implemented for this water body. As part of the consultation with NRW on the Preliminary WFD Assessment for the SPC Proposals, up-to-date information was provided on the mitigation measures for Cemlyn Lagoon. This indicated that none of the mitigation measures that could be applied to this WFD water body were determined to be applicable. As a result, no assessment has been carried out to assess the SPC Proposals against the mitigation measures. Given the extent and nature of the SPC Proposals and the fact that there are no works within the Cemlyn Lagoon WFD water body, it is considered that the SPC Proposals would not prevent any future mitigation measures from being assigned or implemented.

9 Cumulative assessment

This step addresses the potential for cumulative effects on water bodies from the individual developments within the Wylfa Newydd Project. Whilst effects from a particular development may not cause deterioration alone, in combination the effects could prevent a water body from achieving WFD objectives. Cumulative effects include the following:

- intra-development: combined effects can arise when a single resource or water body is affected by more than one effect from the same development, usually at the same time;
- intra-project: in a complex project involving multiple developments, cumulative effects could arise when a single resource or water body is affected by different developments (in the same project) at the same time; and
- inter-project: cumulative effects can arise when a single resource or water body is affected by more than one project at the same time.

9.1.1 Intra-development

The assessment carried out in Section 7 has considered the potential for multiple effects on each quality element and each water body.

9.1.2 Intra-project

An application for planning permission for the SPC Proposals is being submitted to allow preparatory works to commence prior to determination of a Development Consent Order for the Wylfa Newydd Project in its entirety. A WFD Compliance Assessment for the Wylfa Newydd Project is currently being prepared to support the DCO application. The activities assessed for the SPC Proposals will also be covered as part of the 'project-wide' WFD Compliance Assessment which will include consideration of cumulative effects.

The effects on all quality elements of the water bodies which may result from the SPC Proposals alone have been shown to be very small scale and localised in nature. There is no risk of either deterioration in status of quality elements or any potential for the SPC Proposals to prevent water bodies from achieving good status. Therefore, no intra-project cumulative effects are predicted.

9.1.3 Inter-project

This list of reasonably foreseeable future projects, as provided in chapter 19 of the Environmental Statement have been considered. Six projects were identified that with reasonable certainty are likely to overlap in time and space with the SPC Proposals. Of these, only two are potentially relevant to this WFD assessment and the potential cumulative effects are described in Table 10.

Table 10 Committed developments with potential effects on water bodies

DEVELOPER	COMMITTED DEVELOPMENT	POTENTIAL CUMULATIVE EFFECTS
Magnox Limited	<p>Wylfa Decommissioning</p> <p>Decommissioning of the Existing Power Station, including care and maintenance of the existing facilities, followed by decommissioning and final site clearance.</p>	<p>There is the potential for additional disturbance to the Power Station Catchment hydrological regime in addition to input of fine sediment from construction. It is considered that these would be mitigated for as part of the decommissioning process, and therefore no cumulative effects are predicted for any water bodies.</p>
Utilities companies (various)	<p>Removal (and in some instances replacement or diversion) of utilities services currently in place on the SPC Application Boundary.</p> <p>Plans are in place to remove or replace existing services, e.g. electrical cables, which are currently installed on the SPC Application Boundary. This work would most likely be carried out by the relevant utilities companies under Permitted Development rights and funded by Horizon.</p>	<p>The removal of utilities services would be likely to lead to some compaction of soils around working areas and have the potential for fine sediment delivery to watercourses. However, it is not considered that this would be likely to result in non-temporary effects on quality elements in any water bodies, and therefore no cumulative effects are predicted.</p>

10 Compliance with EU legislation

Article 4.9 of the WFD 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 [of Article 4] guarantees at least the same level of protection as the existing Community legislation...”. The WFD specifies that areas requiring special protection under other Directives, and waters used for the abstraction of drinking water, be identified as protected areas. These areas have their own objectives and standards. Where water body boundaries overlap with protected areas, the most stringent objective applies – that is, the requirements of one particular Directive should not undermine the requirements of another. The protected areas relevant to the SPC Proposals are listed in Table 11 .

Table 11 Protected areas of relevance to this WFD assessment

TYPE OF PROTECTED AREA	THE SKERRIES	ANGLESEY NORTH	CEMLYN LAGOON	YNYS MÔN SECONDARY
Bathing water	✓	✓		
SPA	✓	✓	✓	
SAC	✓	✓	✓	
Drinking water				✓
Shellfish water				

Further details on the relevant protected areas and how these have been taken into consideration within the assessment of the SPC Proposals are provided below.

10.1.1 Bathing waters

The Bathing Water Directive (2006/7/EC) applies to The Skerries and Anglesey North water bodies. The only bathing water within the zone of influence is at Cemaes Bay, lying within the Anglesey North water body. The SPC Proposals are considered unlikely to result in an effect on bathing water quality due to the embedded and generic mitigation proposed.

10.1.2 Special Protection Areas and Special Areas of Conservation

The following designated sites of national/international importance are considered to be relevant to the assessment of the SPC Proposals:

- Bae Cemlyn / Cemlyn Bay SAC and SSSI;
- the North Anglesey Marine / Gogledd Môn Forol candidate SAC; and
- the Anglesey Terns / Morwenoliaid Ynys Môn SPA.

A Stage One Screening Report has been prepared as part of the Habitats Regulations Assessment for the SPC Proposals, and this has concluded that the SPC works would not affect the integrity of the European Designated Sites [RD18]. Therefore, the SPC Proposals are considered to be compliant with the Habitats Directive (92/43/EEC).

Water Framework Directive Compliance Assessment for Site Preparation and Clearance Proposals	Revision: 1
	Issue date: 18/05/17

10.1.3 Drinking water

The Drinking Water Directive (98/83/EC) makes provision for the designation of drinking water protected areas, designated for the abstraction of water for human consumption. The drinking water protected area associated with the Ynys Môn Secondary water body is over 4km from the SPC Application Boundary, and the SPC works would not affect the protected area.

10.1.4 Shellfish waters

There are no shellfish protected waters within the vicinity of the SPC Application Site, the closest being located 20km to the east near Benllech. As a result, it is considered that there would not be an effect on protected shellfish waters.

11 Conclusions

An assessment of the potential impacts of the SPC Proposals on the WFD water bodies has been carried out. The assessment takes into account embedded and good practice mitigation.

Following completion of the assessment, it has been determined that there would be no effects that would result in deterioration of any quality elements, nor would the SPC works prevent any of the WFD water bodies from achieving Good Status or Potential (Table 12). The WFD objectives and mitigation measures currently in place for each of the WFD water bodies would not be compromised. As a result, the SPC Proposals are considered to be fully compliant with the WFD.

Table 12 Summary of WFD assessment compliance

WFD OBJECTIVE	THE SKERRIES	ANGLESEY NORTH	CEMLYN LAGOON	YNYS MÔN SECONDARY
No deterioration	No deterioration in quality elements	No deterioration in quality elements	No deterioration in quality elements	No deterioration in quality or quantity elements
Preventing GEP/GES	Will not prevent water body achieving GES	Will not prevent water body achieving GES	Will not prevent water body achieving GEP	N/A
Prevent deterioration of groundwater status	N/A	N/A	N/A	No deterioration in quality or quantity elements
Preventing WFD objectives	No WFD objectives or mitigation measures will be prevented from being achieved/implemented	No WFD objectives or mitigation measures will be prevented from being achieved/implemented	No WFD objectives or mitigation measures will be prevented from being achieved/implemented	No WFD objectives or mitigation measures will be prevented from being achieved/implemented
Compliant with EU legislation	Compliant	Compliant	Compliant	Compliant

12 References

REF. No.	TITLE
[RD1]	Department of Energy and Climate Change. 2011. <i>National Policy Statement for Nuclear Power Generation (EN-6)</i> . London: The Stationery Office.
[RD2]	Jacobs. 2016. <i>Numbered Appendices Series 600 - Watercourse Realignment Specification</i> . Consultancy report prepared for Horizon. 60PO8028/DRGEO/R/0004.
[RD3]	Natural Resources Wales (NRW). 2015. <i>Western Wales River Basin Management Plan 2015 – 2021</i> . http://naturalresources.wales/evidence-and-data/research-and-reports/water-reports/river-basin-management-plans-published/?lang=en
[RD4]	Jacobs. 2015. <i>Freshwater Baseline Surveys Report 2011-2014</i> . Report no. 60PO8007/AQE/REP/002.
[RD5]	Jacobs. 2014. <i>Fluvial Geomorphology Baseline Report</i> . Consultancy report prepared for Horizon. 60PO8058/HYD/REP/005.
[RD6]	Jacobs. 2013. <i>Physical Habitat Characterisation Survey</i> . Consultancy report prepared for Horizon.
[RD7]	Jacobs. 2015. <i>Water Quality and Plankton Surveys Report 2010 – 2014</i> . Consultancy report prepared for Horizon. 60PO8007/AQE/REP/004.
[RD8]	Jacobs. 2015. <i>Benthic Surveys Report</i> . Consultancy report prepared for Horizon. 60PO8007/AQE/REP/005.
[RD9]	Jacobs. 2014. <i>Consultancy Report: Coastal Geomorphology Baseline for the Wylfa Newydd Project - 2014</i> . Consultancy report prepared for Horizon. 60PO8007/GEO/REP/002.
[RD10]	Jacobs. 2016. <i>Hydrogeology Baseline for the Wylfa Newydd Project</i> . Consultancy report prepared for Horizon.
[RD11]	Jacobs. 2013. <i>Cemlyn Lagoon – an ecology review</i> . Consultancy report prepared for Horizon.
[RD12]	Jacobs. 2017. <i>Wylfa Newydd Development Area Hydrological Baseline Report</i> . Consultancy report prepared for Horizon. 60PO8058/HYD/REP/001
[RD13]	Bamber, R.N., Evans, N.J. and Whittal, A. 2000. <i>Survey of Potential Coastal Saline Lagoons and Pools in Wales, December 1998</i> . Contract Science Report No. 377, Countryside Council for Wales, Bangor.
[RD14]	Bamber, R.N., Evans, N.J., Sanderson, W.G. and Whittal, A. 2001. <i>Coastal Saline Lagoons and Pools in Wales: Review and Proposals</i> . Contract Science Report No. 464, Countryside Council for Wales, Bangor.

Water Framework Directive Compliance Assessment for Site Preparation and Clearance Proposals		Revision: 1
		Issue date: 18/05/17

[RD15]	Stringell, T.B., Bamber, R.N., Nikitik, C., Skates, L.R. and Sanderson, W.G. (in prep). <i>Assessment and management of a highly variable saline lagoon MPA: the utility of control charts.</i>
[RD16]	Natural Resources Wales (NRW). 2016a. <i>WFD Rivers and Water Bodies in Wales.</i> [Online]. [Accessed: 11 May 2016]. Available from: http://waterwatchwales.naturalresourceswales.gov.uk/en/ .
[RD17]	Natural Resources Wales (NRW). 2016b. <i>Scoping opinion for site preparation and clearance proposals.</i> 11 March 2016.
[RD18]	Horizon. 2017. Site Preparation and Clearance. Report to Inform Habitats Regulations Assessment Screening. WN0903-JAC-OS-REP-00010

**Site Preparation and Clearance
Environmental Statement
Volume 3 – Appendix 14-01
Consultancy Report: A Phase 1 Habitat
Survey**

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Horizon Nuclear Power (Wylfa) Ltd

**Consultancy Report:
A Phase 1 Habitat Survey**

November 2013

Dr John Fowbert

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Executive Summary

Horizon Nuclear Power Wylfa Ltd. (Horizon) is currently planning to develop a new nuclear power station on Anglesey (the Wylfa Newydd Generating Station) as identified in the National Policy Statement for Nuclear Power Generation (EN-6). The Wylfa Newydd Project (the Project) will require a number of applications to be made under different legislation to different regulators. Jacobs UK Ltd (Jacobs) was commissioned to collect baseline data to inform the various applications, assessments and permits that will be submitted for approval to construct and operate the Wylfa Newydd Generating Station.

A Phase 1 habitat survey was undertaken of the area around the location of the Wylfa Newydd Generating Station in 2013. The study area covered all habitats within the Wylfa Newydd Development Area and a 500m buffer around it where access had been allowed.

Within the study area there are a number of statutory designated sites: one Special Area of Conservation (SAC), one Special Protection Area (SPA) and three Sites of Special Scientific Interest (SSSIs). There is also one non-statutory designated site, the Wylfa Head candidate Wildlife Site.

The survey assessed and categorised all areas of habitat within the study area and identified those where a more detailed (Phase 2) assessment would be appropriate. This included all designated sites.

The majority of land-use within the study area was for agricultural purposes; improved grassland accounted for 56.2%, poor semi-improved grassland 17.5% and arable land 4.8%. Semi-improved neutral grassland consisting of largely herb-rich hay meadows, accounted for 6.1% of the study area.

Outwith the statutory and non-statutory designated sites, coastal heathland, coastal grassland and some areas of semi-improved grassland were assessed as having conservation interest. Traditional field boundaries (cloddiau) were also assessed as having some conservation interest, although the quality of these varied across the study area.

No rare species were recorded during the survey. One national priority species (cornflower, *Centaurea cyanus*) was recorded but it formed part of a planted "wildflower mix". However, five species of conservation interest, either because they are classed as uncommon or because they are in decline, were recorded.

Three invasive non-native species were recorded across the study area:

- Japanese knotweed (*Fallopia japonica*) was recorded at four locations;
- giant rhubarb (*Gunnera sp.*) was recorded in Cemaes Bay village; and
- montbretia (*Crocsmia x crocosmiiflora*) was recorded on cliffs on the outskirts of Cemaes Bay village.

All three species are listed on Schedule 9 of the Wildlife and Countryside Act and it is an offence to plant or otherwise cause these species to grow in the wild. It is likely that exclusion zones or specialist treatment and disposal would be required to prevent an offence being caused if either plant is disturbed. Additionally any material that is likely to contain fragments of these plants is classed as controlled

waste and would require appropriate permits being obtained prior to any off-site disposal.

Recommendations for further survey were made to target known areas/habitat types of conservation interest. These are:

- species-rich meadows;
- heathland areas and associated species of conservation interest;
- saltmarsh and shingle beach vegetation; and
- traditional field boundaries.

Contents

1	Introduction	1
1.1	Overview	1
1.2	Wylfa Newydd Project	1
1.3	Site description	1
1.4	Survey aims and objectives	2
1.5	Previous work	2
2	Methodology	4
2.1	Study area	4
2.2	Desk study	4
2.3	Field surveys	5
2.4	Limitations	5
3	Results	6
3.1	Desk study	6
3.1.1	Statutory designated sites	6
3.1.2	Non-statutory designated sites	6
3.1.3	Biodiversity Action Plans	7
3.2	Field surveys	8
3.2.1	Overview of habitat types	8
3.3	Habitat descriptions	11
3.3.1	Statutory designated sites	11
3.3.2	Non-statutory designated sites	12
3.3.3	Improved, poor semi-improved and amenity grassland	13
3.3.4	Semi-improved neutral grassland	13
3.3.5	Coastal grassland	15
3.3.6	Woodland	15
3.3.7	Coastal heath	16
3.3.8	Saltmarsh	16
3.3.9	Boundaries	17
3.3.10	Invasive plants	18
4	Discussion	19
4.1	Phase 1 Habitats	19
4.2	Species recorded at within the study area	20
4.2.1	Great fen-sedge	20
4.2.2	Sea-kale	20
4.2.3	Sheep's-bit	21
4.2.4	Spring squill	22
4.2.5	Yellow bartsia	22
4.2.6	Invasive non-native species	23
5	Recommendations	24
6	References	25
	Appendix A Phase 1 habitat maps	27

Appendix B	Priority Plant Species in Wales	34
Appendix C	Phase 1 Target Notes	38

1 Introduction

1.1 Overview

Horizon Nuclear Power Wylfa Ltd. (Horizon) is currently planning to develop a new nuclear power station on Anglesey as identified in the National Policy Statement for Nuclear Power Generation (EN-6). The Wylfa Newydd Project (the Project) comprises the proposed new nuclear power station (the Wylfa Newydd Generating Station), including the reactors, associated plant and ancillary structures and features, together with all of the development needed to support its delivery, such as highway improvements, worker accommodation and specialist training facilities. The Project will require a number of applications to be made under different legislation to different regulators. As a nationally significant infrastructure project under the Planning Act 2008, the construction and operation must be authorised by a development consent order.

Jacobs UK Ltd (Jacobs) was commissioned by Horizon to undertake a full ecological survey programme within the vicinity of the Power Station Site. This work has included the gathering of baseline data to inform the various applications, assessments and permits that will be submitted for approval to construct and operate the Power Station and Associated Development.

This report presents the results of the Phase 1 habitat survey undertaken by Jacobs' ecologists in 2013.

1.2 Wylfa Newydd Project

The Project includes the Wylfa Newydd Generating Station and Associated Development¹. The Wylfa Newydd Generating Station includes two UK Advanced Boiling Water Reactors to be supplied by Hitachi-GE Nuclear Energy Ltd, associated plant and ancillary structures and features. In addition to the reactors, development on the Power Station Site (the indicative area of land and sea within which the majority of the permanent Wylfa Newydd Generating Station buildings, plant and structures would be situated) will include steam turbines, control and service buildings, operational plant, radioactive waste storage buildings, ancillary structures, offices and coastal developments. The coastal developments will include a Cooling Water System (CWS) and breakwater, and a Marine Off-Loading Facility (MOLF).

1.3 Site description

The Wylfa Newydd Development Area (the indicative areas of land and sea, including the Power Station Site, the Wylfa NPS Site² and the surrounding areas that would be used for the construction and operation of the Wylfa Newydd Generating Station) covers an area of approximately 380 ha. It is bounded to the north by the coast and the Existing Power Station. To the east, it is separated from Cemaes by a narrow corridor of agricultural land. The A5025 and residential

¹ Development needed to support delivery of the Wylfa Newydd Generating Station is referred to as Associated Development. This includes highway improvements along the A5025, park and ride facilities for construction workers, Logistics Centre, Temporary Workers' Accommodation, specialist training facilities, Horizon's Visitor Centre and media briefing facilities.

² The site identified on Anglesey by the National Policy Statement for Energy EN-6/NPS EN-6 as potentially suitable for the deployment of a new nuclear power station.

properties define part of the south-east boundary, with a small parcel of land spanning the road to the north-east of Tregele. To the south and west, the Wylfa Newydd Development Area abuts agricultural land, and to the west it adjoins the coastal hinterland.

The Wylfa Newydd Development Area includes the headland south of Mynydd-y-Wylfa candidate Wildlife Site. There is one designated site for nature conservation within the Wylfa Newydd Development Area; Tre'r Gof Site of Special Scientific Interest (SSSI). It is also within 1km of the Cae Gwyn SSSI, Cemlyn Bay Special Area of Conservation (SAC) SSSI, and the Ynys Feurig, the Skerries and Cemlyn Bay Special Protection Area (SPA).

Tre'r Gof SSSI is a small basin mire adjacent to the Existing Power Station, west of Cemaes. The area receives mineral-enriched waters from the surrounding boulder clay leading to the development of notable flora. It is the botanical interest that provides the reason for the designation of the site as a SSSI.

Cae Gwyn SSSI is located immediately to the south of the Wylfa Newydd Development Area to the west of Llanfechell. The SSSI comprises two wetland areas separated by an outcrop of rock with heathland vegetation. The southern wetland is confined by a rock basin and is dominated by bogmoss *Sphagnum* spp. and a wide variety of common wetland herbs. The northern wetland has a different flora containing denser areas of willow *Salix* spp. and common reed *Phragmites communis*.

1.4 Survey aims and objectives

The objective of the surveys is to characterise the environment and collect baseline data to inform the various applications, assessments and permits required to construct and operate the Wylfa Newydd Generating Station.

The Phase 1 habitat survey characterises the environment and record the inventory of habitats within the study area.

The aims included:

- identifying any designated or non-designated sites for nature conservation;
- classify all habitats according to standard Phase 1 habitat survey methodology;
- recording protected and invasive plant species;
- identifying further considerations and recommending further survey work as required with respect to habitats; and
- reporting on the findings from the above.

This report presents the findings of a background data search and Phase 1 habitat survey work undertaken in June and July 2013.

1.5 Previous work

A Phase 1 habitat survey was undertaken by Arup in 2012 (Arup, 2013) within the Power Station Site which was itself an update to surveys undertaken in 2009. Habitat surveys were first undertaken in 2009 with additional surveys being undertaken as the proposed development area changed (Arup, 2009).

The surveys identified that the most diverse habitat areas are situated predominantly along the coastal fringe with the exception of the Tre'r Gof SSSI. Wylfa Head and Trwyn Pencarreg were highlighted as areas of particular interest for maritime heathland. In addition, the presence of traditional field boundaries (stone walls with an earth top) was reported.

2 Methodology

2.1 Study area

The study area comprised the footprint of the Power Station Site and a 500m buffer. This is shown in Figure 1

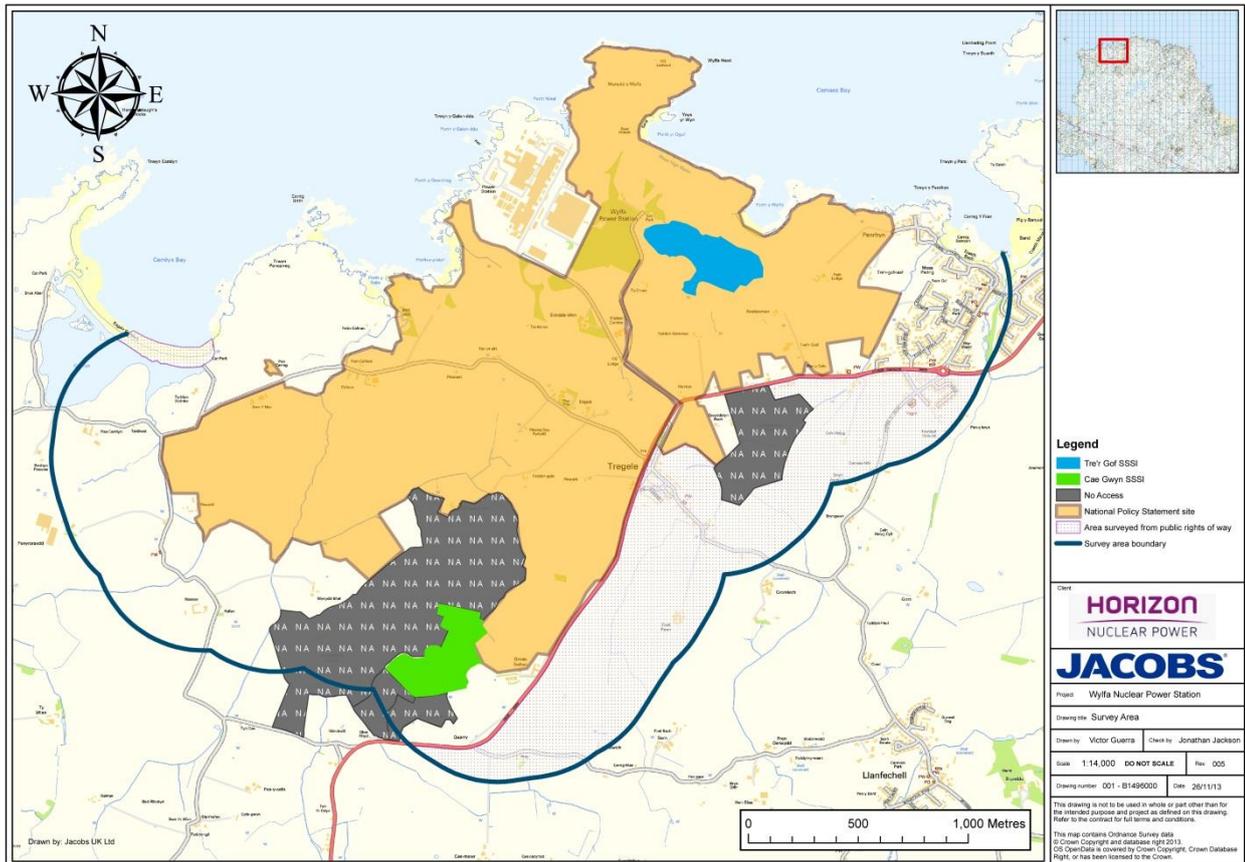


Figure 1: Study area

2.2 Desk study

A desk study was undertaken to identify sites of conservation interest within the study area and confirm their biological features. The previous study (Arup, 2013) was consulted and the following web resources were also used:

- Anglesey Nature: Natur Môn (<http://angleseynature.co.uk/>);
- Joint Nature Conservation Committee (JNCC) (<http://jncc.defra.gov.uk/>);
- Multi-Agency Geographical Information for the Countryside website, Coastal and Marine Resource Atlas (www.magic.gov.uk);
- Natural Resources Wales <http://naturalresourceswales.gov.uk/?lang=en>; and
- Wales Biodiversity Partnership (<http://www.biodiversitywales.org.uk/en-GB/Species>).

2.3 Field surveys

The survey used standard guidelines; *Handbook for Phase 1 Habitat Survey – A Technique for Environmental Audit*; Joint Nature Conservation Committee (JNCC, 2010). Target notes were made where applicable; the abundance of plant species being recorded using the DAFOR (D=dominant; A=abundant; F=frequent; O=occasional; R=rare) scale. All habitats within the study area except for intertidal and marine habitats were assessed and classified.

Any incidental observations of evidence of protected species/species of conservation interest were also recorded.

Scientific and common names of plants are after Stace (2010).

2.4 Limitations

Access was not available to all land parcels within the study area. Areas not surveyed are clearly indicated on Figure 1. Some areas could only be surveyed from publicly accessible areas and as a result detailed observations of the vegetation or ecological features (i.e. signs of protected species/habitats) could not be fully made at:

- all land to the east of the A5025;
- small parcels of land near Ty'n-y-mynydd; and
- Cemlyn Bay (see below).

At Cemlyn Bay, during the tern breeding season, the coastal footpath was re-routed away from the ridge and through the grassland to the shingle beach below. As a result, only a small part of the grassland was accessible at this location.

3 Results

3.1 Desk study

3.1.1 Statutory designated sites

One SAC lies partly within the study area – the Bae Cemlyn/Cemlyn Bay SAC (site code: UK0030114). The site covers an area of 43.43 ha and is primarily designated for the presence of the Annex 1 habitat *Coastal lagoon*. The Cemlyn lagoon is considered to be the best example of a saline coastal lagoon in Wales (JNCC, 2011, 2013). The site also qualifies as a SAC due to the presence of the Annex I habitat *Perennial vegetation of stony banks*. The site also forms part of the larger Ynys Feurig, Cemlyn Bay and The Skerries SPA (site code: UK9013061). The SPA is designated for the presence of four species of breeding terns/Arctic tern (*Sterna paradisaea*), common tern (*S. hirundo*), roseate tern (*S. dougallii*) and Sandwich tern (*S. sandvicensis*) (JNCC, 2009).

Cemlyn Bay SSSI is 44.5 ha and is concurrently within the area of the SPA. It is a tidal lagoon enclosed by a shingle ridge with saltmarsh communities and populations of sea kale (*Crambe maritima*), sea radish (*Raphanus raphanistrum* ssp. *maritimus*³), brackish water-crowfoot (*Ranunculus baudotii*) and beaked tasselweed (*Ruppia maritima*) (CCW, 2013c). The yellow horned-poppy (*Glaucium flavum*) is also present (CCW, 2013d). The main lagoon provides habitat for the terns which breed on low islands.

Most of the Cemlyn Bay designated site is managed by the North Wales Wildlife Trust/Ymddiriedolaeth Natur Gogledd Cymru (NWWT). The land is owned by the National Trust and has been leased by the NWWT since 1971 (<http://www.northwaleswildlifetrust.org.uk>).

Two other SSSIs are wholly within the study area; Tre'r Gof and Cae Gwyn.

Tre'r Gof SSSI is a representative example of rich fen habitat in north-west Wales (CCW, 2013a). It covers an area of 10.1 ha. There are stands of fen meadows which grade into a variety of other communities including fen, fen scrub and swamp. Of particular interest is the presence of a population of the marsh fern (*Thelypteris palustris*⁴) (CCW, 2013).

Cae Gwyn SSSI comprises two wetland areas, separated by an area of heathland with outcropping rock. It covers an area of 10 ha. The flora is distinguished by an abundance of royal fern (*Osmunda regalis*) which varies from very large old plants to young plants; other notable species are bog sedge (*Carex limosa*) and cranberry (*Vaccinium oxycoccus*) (CCW, 2013b).

3.1.2 Non-statutory designated sites

The desk study also found one statutory designated site within the study area, Trywyn yr Wylfa/Wylfa Head candidate Wildlife Site. This is a mixture of coastal grassland and heath (<http://angleseynature.co.uk/wylfalnr.html>).

³ Formerly *Raphanus maritimus*

⁴ Formerly *Thelypteris thelypteroides*

Table 1: Designated sites within the study area.

Site	Designations
Bae Cemlyn/Cemlyn Bay	SAC, SPA, SSSI, NWWT site
Tre'r Gof	SSSI
Cae Gwyn	SSSI
Trywyn yr Wylfa/Wylfa Head	candidate Wildlife Site

3.1.3 Biodiversity Action Plans

The Welsh Biodiversity Partnership, consisting of a steering group and a wider partnership, provide the leadership for biodiversity action priorities in Wales. Available on their website is a list of habitats and species of principal importance for conservation of biological diversity in Wales. The 36 terrestrial, coastal and freshwater habitats are listed in Table 2. There are also nineteen marine habitats including coastal saltmarsh.

Table 2: Terrestrial, coastal and freshwater habitats of principal importance for conservation of biological diversity in Wales.

Broad Habitat	Priority Habitat
Broadleaved, mixed and yew woodland	Traditional orchards
	Wood pasture and parkland
	Upland oak woodland
	Lowland beech and yew woodland
	Upland mixed ash woodland
	Wet woodland
	Lowland mixed deciduous woodland
Boundary and linear features	Hedgerows
Arable and horticultural	Arable field margins
Improved grassland	Coastal and floodplain grazing marsh
Neutral grassland	Lowland meadows
Calcareous grassland	Lowland calcareous grassland
	Upland calcareous grassland
Acid grassland	Lowland dry acid grassland
	Lowland dwarf shrub heath
Dwarf shrub heath	Upland dwarf shrub heath
	Upland flushes, fens and swamps
Fen, marsh and swamp	Lowland fens
	Purple moorgrass and rush pastures
	Reedbeds
	Lowland raised bog
Bogs	Blanket bog
	Mountain heaths and willow scrub
Montane habitat	Rivers
Rivers and streams	Oligotrophic and dystrophic lakes
Standing open waters and canals	Ponds
	Mesotrophic lakes
	Eutrophic standing waters
	Aquifer-fed naturally fluctuating water bodies
	Inland rock outcrop and scree habitats
Inland rock	Calaminarian grasslands
	Open mosaic habitats on previously developed land
	Limestone pavement
	Maritime cliff and slopes
Supralittoral rock	Coastal sand dunes
Supralittoral sediment	Coastal vegetated shingle

There are 77 vascular plant priority species listed for Wales (Appendix B), 67 lichen species/assemblages and 52 species of bryophyte (mosses and liverworts).

Anglesey's Biodiversity Action Plan (BAP) is undergoing a review during 2010-2015 (www.anglesey.gov.uk). Nineteen habitats and four plant species are listed on the current BAP (Table 3)

Table 3: Local priority habitats on Anglesey.

Local Priority Habitat
Coastal and floodplain grazing marsh
Coastal saline lagoons
Coastal sand dunes
Field edges
Flower-rich roadside verges
Gardens
Hedgerows
Lakes
Limestone pavement
Lowland fen
Lowland heathland
Maritime cliff and slope
Plantations
Ponds
River and stream
Sandy beaches
Seagrass beds
Wet reedbed
Woodland

The four local priority species are:

- Petalwort, a liverwort (*Petalophyllum ralfsii*);
- Shoredock (*Rumex rupestris*);
- Slender green feather moss (*Drepanocladus (Hamatocaulis) vernicosus*); and,
- Three-lobed water crowfoot (*Ranunculus tripartitus*).

3.2 Field surveys

3.2.1 Overview of habitat types

The Phase 1 habitat map produced from the results of the survey is shown in Figure 2. This map is also shown in greater detail in Appendix A.

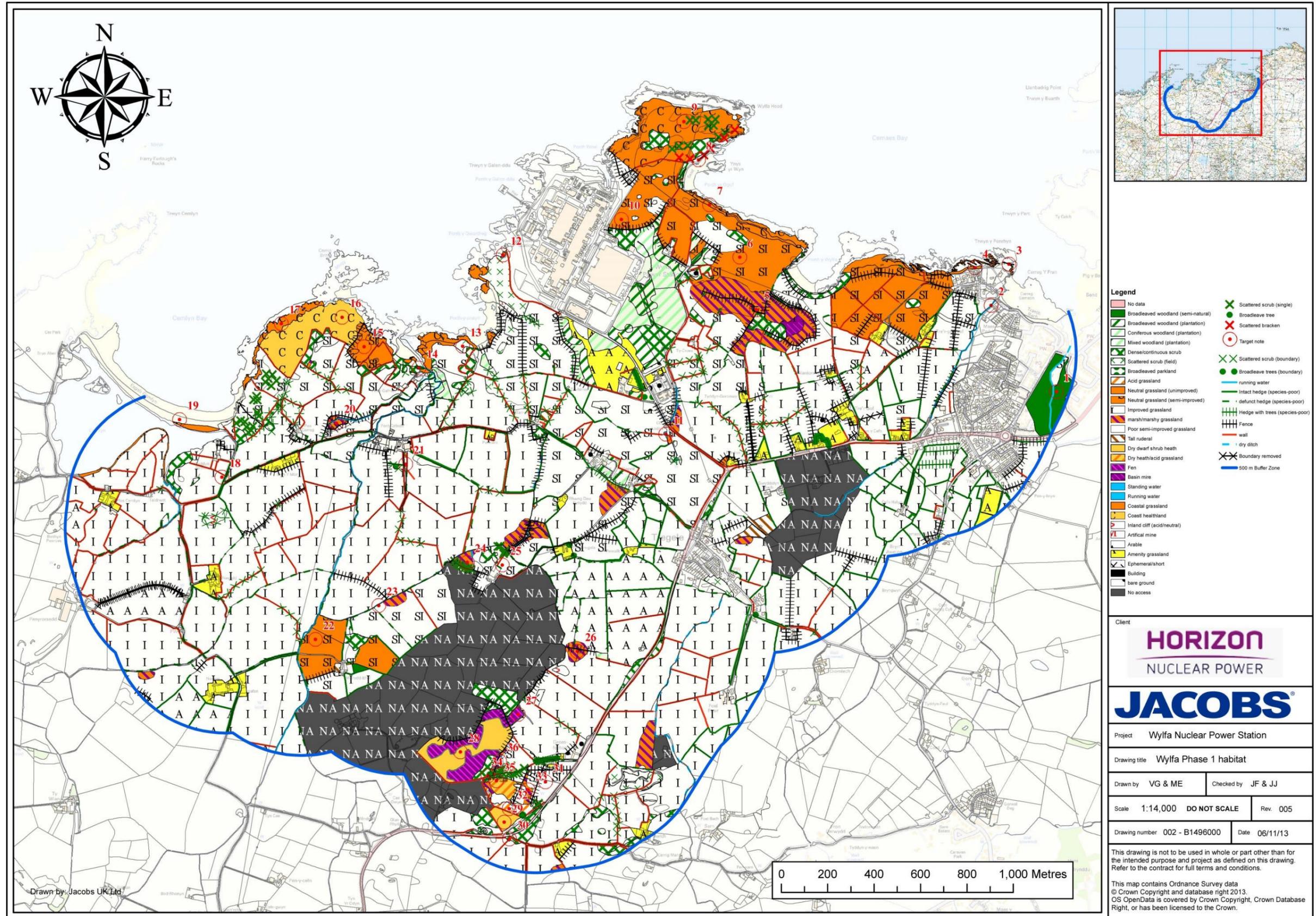


Figure 2: Phase 1 habitat map of study area

The majority of land within the study area (83.1%) was comprised of grassland of various types, for grazing, silage, etc., and of semi-improved or unimproved types. Of these, improved grassland accounted for 56.2% with poor semi-improved grassland accounting for another 17.5%.

Woodland and scrub habitats accounted for 6.5% of the area with nearly half of this comprising dense scrub (3.0%). Total plantation woodland (broad-leaved, coniferous and mixed) was 2.2% of the total area whilst semi-natural woodland (broad-leaved) was 0.6%.

Wetland habitats accounted for 2.9% of the total area. The majority of this (2.3%) was marshy grassland; the remainder (0.7%) comprised different types of mire habitat, including those recorded in the two SSSIs. Heathland habitat (including heath and/acid grassland mosaic) accounted for only 1.9% of the total area.

Other types of habitat accounted for 0.8% of the area. This included bare ground, tall ruderal vegetation and short perennial/ephemeral communities. Saltmarsh and shingle habitats were also recorded within the study area (see Target notes 12, 14 and 19) but due to their size and/or fragmented nature it was not possible to allocate areas to them. Maritime cliff vegetation also fell into this category (see Target note 8). A summary of habitat types recorded, the total area of the habitat, and the area by percentage of the whole study area is provided in Table 4.

Table 4: Habitats recorded within the study area.

Phase 1 Habitat Type	Total Area (ha)	Percentage
Improved grassland	343.3	56.2
Poor semi-improved grassland	106.7	17.5
Semi-improved neutral grassland	37.0	6.1
Coastal grassland	15.3	2.5
Amenity grassland	5.3	0.9
Acid unimproved grassland	0.6	0.1
Neutral unimproved grassland	0.5	<0.1
Grassland total	508.6	83.1
Dense scrub	18.5	3.0
Coniferous plantation woodland	8.2	1.4
Broad-leaved plantation woodland	5.0	0.8
Scattered scrub	4.1	0.7
Semi-natural broad-leaved woodland	3.8	0.6
Mixed plantation woodland	0.3	<0.1
Woodland and scrub total	40.0	6.5
Marshy grassland	14.0	2.3
Mire fen	3.4	0.6
Fen basin mire	0.5	<0.1
Wetlands total	18.0	2.9
Coastal heathland	6.3	1.0
Dry dwarf shrub heath	4.2	0.7
Dry heath/acid grassland mosaic	0.8	0.1
Heathland total	11.4	1.9
Other habitats	34	5.6

3.3 Habitat descriptions

3.3.1 Statutory designated sites

Cemlyn Bay SAC/SSSI, within the study area, comprised shingle, coastal grassland and a saline lagoon. Sea kale was a striking feature of the shingle beach (Photograph 1) with sea campion (*Silene uniflora*) and sea beet (*Beta vulgaris* ssp. *maritima*).

The area of grassland accessed was dominated by rough grassland species such as false oat-grass (*Arrhenatherum elatius*) and Yorkshire-fog (*Holcus lanatus*) both abundant with common ragwort (*Senecio jacobaea*) frequent.



Photograph 1: Sea kale at Cemlyn Bay. The coastal lagoon is on the left hand side.

Tre'r Gof SSSI comprised areas of wet scrub woodland dominated by goat willow (*Salix caprea*) with an understory of meadowsweet (*Filipendula ulmaria*), marshy grassland, basin mire and swamp vegetation. The basin mire vegetation was dominated by great fen-sedge⁵ (*Cladium mariscus*) whilst the swamp vegetation was represented by a stand of common reed.

The marshy grassland comprised two distinctive areas. In much of the habitat rush species (*Juncus* spp.) were abundant forming a characteristic example of marshy grassland. However, the western part of the marshy grassland was less typical and has previously been classified as SD17 dune-slack vegetation at the NVC level (Budd, 2013); it was dominated by a variety of species which included water horsetail (*Equisetum fluviatile*), sharp-flowered rush (*Juncus acutiflorus*), water mint (*Mentha aquatica*) and meadowsweet. However, the fit to the SD17 dune-slack type was relatively poor and the nature of the vegetation SD17d *Potentilla anserina* – *Carex nigra* community (*Hydrocotyle vulgaris* – *Ranunculus flammula* sub-community, its location and relationship with adjacent types, indicated that at the Phase 1 level, marshy grassland was the most appropriate category. A small group

⁵ Also known as saw-sedge

of northern marsh-orchid (*Dactylorhiza purpurella*) was also recorded towards the north-eastern edge of the area.

Cae Gwyn SSSI was a complex area of scrub, acid grassland and rock outcrops, with mires and heath. The scrub/heath comprised heather (*Calluna vulgaris*) and western gorse (*Ulex gallii*) vegetation with an acid grassland and bracken (*Pteridium aquilinum*) understory. Marshy/wetland comprised areas dominated by rush species or mire/big species such as carnation sedge (*Carex panicea*) and purple moor-grass (*Molinia caerulea*). Adjacent land parcels showed characteristics of the habitats within the SSSI. To the east of the site, wetland (fen and pond) habitat (Target note 34 and 36) and heathland and acid grassland habitats (Target note 35) were also found.

3.3.2 Non-statutory designated sites

Wylfa Head candidate Wildlife Site was comprised of mainly coastal⁴ grassland with small flush areas. Towards the south of the site, patches of grassland became less maritime influenced and more akin to semi-improved grassland. Patches of scrub were scattered, especially on the eastern side. Also on this side it was evident that bracken would dominate the grassland later in the season. Small patches of heath were present on some of the rocky outcrops. The steep cliffs on the eastern side overlooking Porth yr Ogof were herb-rich with thrift (*Armeria maritima*), oxeye daisy (*Leucanthemum vulgare*) (Photograph 2), sea campion and sheep's-bit (*Jasione montana*) being distinctive features (Target note 8).



Photograph 2: Thrift and oxeye daisy on cliffs at Wylfa Head.

⁴ This type of habitat is referred to as coastal for Phase 1 habitat surveys and maritime for NVC surveys



Photograph 3: Sheep's-bit and English stonecrop (*Sedum anglicum*) at Wylfa Head cWS.

3.3.3 Improved, poor semi-improved and amenity grassland

These were grasslands of low species richness or containing only common or “weedy” species. Grass species recorded were typical of agriculturally improved habitats and included perennial rye-grass (*Lolium perenne*), Yorkshire-fog, cock's-foot (*Dactylis glomerata*), crested dog's-tail (*Cynosurus cristatus*), sweet vernal-grass (*Anthoxanthum odoratum*), meadow foxtail (*Alopecurus pratensis*) and, in damper areas, marsh foxtail (*A. geniculatus*). Meadow-grass species, mainly smooth and rough meadow-grass (*Poa pratensis* and *P. trivialis*) were also present.

Herb species were similarly characteristic of these grassland types and included broad-leaved dock (*Rumex obtusifolius*), curled dock (*R. crispus*), common ragwort, creeping buttercup (*Ranunculus repens*), creeping thistle (*Cirsium arvense*), common sorrel (*Rumex acetosa*), hogweed (*Heracleum sphondylium*), lesser trefoil (*Trifolium dubium*), dandelion (*Taraxacum officinale*), common mouse-ear (*Cerastium fontanum*) and white clover (*Trifolium repens*). Less improved grasslands had a greater species richness including such species as meadow buttercup (*Ranunculus acris*), bulbous buttercup (*R. bulbosus*), yellow-rattle (*Rhinanthus minor*) and ribwort plantain (*Plantago lanceolata*). Where adjacent to coastal areas, spring squill (*Scilla verna*) was occasionally encountered. Highly improved grasslands comprised only a few grass or herb species.

Damp areas within the grasslands were characterised by stands of soft-rush which had a tendency to spread. Dense stands of the species were mapped as marshy grassland.

3.3.4 Semi-improved neutral grassland

The semi-improved neutral grassland was clearly agriculturally derived containing species characteristic of these habitats such as crested dog's-tail and perennial rye-grass. However, they contained a wider variety of herb species which were indicative of lower nutrient inputs. Species such as common knapweed (*Centaurea nigra*), red clover (*Trifolium pratense*), common bird's-foot trefoil (*Lotus corniculatus*)

and yellow-rattle. Meadow buttercup and bulbous buttercup were also recorded and pignut (*Conopodium majus*) was occasionally seen.

The vegetation varied widely. Semi-improved neutral grassland overlooking Porth yr Ogof (Target note 6) tended to be more improved than other examples, but also contained a greater range of species due to transitions to the wetland areas of Tre'r Gof SSSI to the south and coastal vegetation on the cliffs to the north. Grassland by Wylfa Head (Target note 10) appeared to be grazed and showed signs of enrichment with small clumps of creeping thistle and common nettle (*Urtica dioica*). Scrub species and common ragwort were also present. However, the soils appeared to be thinner here than in other areas and species such as sheep's-sorrel (*Rumex acetosella*), common centaury (*Centaureum erythraea*) and eyebright (*Euphrasia nemorosa*) were relatively common. In addition, yellow bartsia (*Parentucellia viscosa*) was recorded in this location (Photograph 4).



Photograph 4: Yellow bartsia near Wylfa Head.

Two fields near Porth y Felin were identified as being particularly herb-rich (Target note 15) (Photograph 5). Red clover and buttercup species were prominent features and, in parts, yellow-rattle was abundant. Yellow-rattle is a hemi-parasitic species, often parasitising grass species and reducing their prominence in grasslands. This can result in a greater biodiversity in hay meadows (Cuthbert, 2008; Pywell *et al.*, 2004).



Photograph 5: Species-rich hay meadows near Porth y Felin.

3.3.5 Coastal grassland

Coastal grassland was generally limited to thin strips around Cemaes Bay (Target note 7) and Cemlyn Bay (Target note 17). It occurred in scattered patches elsewhere but was often relatively species-poor or contained species indicative of the surrounding semi-improved grasslands.

The coastal grassland also varied in its composition. In some areas around Cemaes Bay spring squill was particularly abundant in short tightly grazed grassland. Elsewhere, taller plants, such as sea campion, sheep's-bit, ribwort plantain and thrift were prominent features.

3.3.6 Woodland

The majority of woodland within the study area comprised dense scrub much of which was within Tre'r Gof SSSI and was mainly goat willow. Dense scrub was present scattered across the study area comprising western gorse patches. It is likely that the total area of dense scrub is under-recorded as many of these patches cannot be adequately mapped at the standard Phase 1 mapping scale. For instance, gorse was frequent in the area of coastal heathland and in the adjacent grasslands.

Across the entire study area woodland habitats were only a small component, although significant in certain areas, such as around Dame Sylvia's Mound and within Cemaes Bay village (Target note 1). At the former site, woodland was comprised of various plantation types including coniferous (various non-native species) mixed and broad-leaved woodland. The broad-leaved woodland comprised a range of native species. The ground flora was generally species-poor. In the older, dense coniferous areas, ground flora was largely absent. Much of the broad-leaved woodland was relatively young and the ground-flora here tended to be rough grassland with species such as Yorkshire-fog often dominant.

The ground flora in the woodland at Cemaes Bay village was species-rich but was heavily managed with areas set aside for amenity use, including an area of “flower-rich annuals” (Photograph 6). This included cornflower (*Centaurea cyanus*) which is a Welsh priority plant species (Appendix B).



Photograph 6: Planted flower-rich area in woodland in Cemaes Bay village.

3.3.7 Coastal heath

Coastal dwarf shrub heath was largely confined to an area on the western side of the Wylfa Newydd Development Area (Target note 16), although small patches occurred elsewhere particularly at Wylfa Head. Dwarf shrubs were a distinctive feature of the habitat comprising mainly heather and bell heather with cross-leaved heath in the damper areas. Western gorse was also prominent in parts although some clearance of this had clearly taken place. Within the coastal heath vegetation were patches of acid grassland, bracken, and wet flush areas. Towards the coast, the heath transitioned into coastal grassland.

A broad range of species was recorded in the heathland; as well as dwarf shrub species, flea sedge (*Carex pulicaris*), long-bracted sedge (*Carex extensa*), creeping willow (*Salix repens*), devil’s-bit scabious (*Succisa pratensis*), spring squill, heath milkwort (*Polygala serpyllifolia*), northern marsh-orchid and wild thyme (*Thymus praecox*).

The heather varied in its state and growth form; in some locations the plant had taken on a “carpet” growth form which can be indicative of heavy-grazing. However, in this location, it is likely to be a result of exposure and thin soils.

3.3.8 Saltmarsh

Saltmarsh vegetation was limited to small fragmented patches at Porth y Felin (Photograph 7) and due to its extent could not be included in the list of mapped habitats. It transitioned into scattered shingle vegetation towards the top of the beach which formed a narrow band. The vegetation was dominated by a small number of species with sea arrowgrass (*Triglochin maritima*), saltmarsh rush

(*Juncus gerardii*) and sea plantain (*Plantago maritima*) prominent, at least in parts. Thrift and sea aster (*Aster tripolium*) were also distinctive features.



Photograph 7: Saltmarsh vegetation at Porth y Felin.

3.3.9 Boundaries

Field boundaries comprised a number of different types including hedges, mortared walls, dry stone walls, post and wire fences and cloddiau. No hedges were species rich. Cloddiau are traditional boundary features and comprise a dry stone outer face with a compacted earth, or earth/rubble core. They may often have a hedge or ditch associated with them.

Within the study area, the cloddiau varied in their extent, form and condition. At some locations, the walls appeared intact but with little or no vegetation elsewhere the walls were in poor condition but vegetation growth was extensive. Some walls also featured lines of over-mature scrub, mainly hawthorn (*Crataegus monogyna*) or blackthorn (*Prunus spinosa*) (Photographs 8 and 9).

Due to the complex nature of many field boundaries, interpretation and application of the standard Phase 1 habitat mapping codes was problematic. The Phase 1 habitat maps shown on Figures 2 – 5 therefore frequently show combined habitat features. These have been done according to the following rules:

- Cloddiau have been classified as walls.
- Where there are cloddiau with tall scrub present in the earth bank these are represented as walls with overlaid scattered scrub.
- Where there are cloddiau with fences, this is recorded as a wall only as fences are generally of little ecological value.
- The determination of a boundary as being a species-poor defunct/gappy hedge or a line of scattered scrub was frequently very difficult. Where this is the case the species-poor defunct/gappy hedge classification was used in preference. This is due to scattered scrub not being a true Phase 1 habitat boundary classification. However, there are some linear sections of scattered

scrub that cannot be classified as any form of hedge and so have been recorded as such.



Photograph 8: Example of a traditional field boundary. The wall is partly dilapidated and mature blackthorn and hawthorn are distinctive features.



Photograph 9: Example of a traditional field boundary. The wall is in good condition with some turf remaining. Scrub (hedge) vegetation is sparse.

3.3.10 Invasive plants

The invasive non-native species, Japanese knotweed, was found at four locations across the study area; two sites were on road sides (Target notes 18, 21, 25 and 30). Montbretia and giant rhubarb were found at one location each in and around Cemaes Bay village (Target notes 4 and 2 respectively).

4 Discussion

4.1 Phase 1 Habitats

The majority of land within the study area comprised low quality agricultural habitats (arable, improved grassland, poor semi-improved grassland 479.3 ha, 78.3%). However, there was 37 ha of semi-improved neutral grassland (6.1% of the study area) which was mainly herb-rich hay meadows.

A number of the habitats recorded during the Phase 1 habitat survey are listed as priority habitats in Wales or Anglesey (Table 5). Not all of the habitats were of good quality and/or of a great extent. For instance, outwith the SSSIs and coastal edge, rock outcrops were mainly encountered in low quality grassland habitats and were subsequently of limited quality themselves.

Reedbed habitat was limited to a small area of common reed within the Tre'r Gof SSSI. Fen habitat occurred as small isolated patches in wetland areas such as at Tre'r Gof SSSI or Caerdegog Isaf. The saltmarsh vegetation was also limited in its extent being recorded only at Porth y Felin and not large enough to map.

Coastal vegetated shingle occurred wherever there were shingle beaches. However, much of the shingle is often unvegetated and the plants are scattered across a relatively wide area (Photograph 1). These habitats are inherently unstable due to the action of tides and storms resulting in a dynamic habitat.

Some of the semi-improved neutral grassland would be covered by the lowland meadows national priority habitat, whilst the coastal heath and dwarf shrub heath areas would be covered by the lowland dwarf shrub heath/lowland heath national/local priority habitats.

Table 5: Priority habitats recorded within the study area. The saline lagoon at Cemlyn Bay was not formally surveyed during this Phase 1 habitat survey.

Broad Habitat	Priority Habitat	
	Wales (National)	Anglesey (Local)
n/a	n/a	Gardens
Arable and horticultural	Arable field margins	Field edges
Boundary and linear features	Hedgerows	Hedgerows
Dwarf shrub heath	Lowland dwarf shrub heath	Lowland heathland
Fen, marsh and swamp	Lowland fens	Lowland fen
	Reedbeds	Wet reedbed
Inland rock	Inland rock outcrop and scree habitats	n/a
Neutral grassland	Lowland meadows	n/a
Rivers and streams	Rivers	River and stream
Standing open waters and canals	Ponds	Ponds
Woodland	Wet woodland	Woodland
	n/a	Plantations
Supralittoral rock	Maritime cliff and slopes	Maritime cliff and slope
Supralittoral sediment	Coastal vegetated shingle	n/a
Littoral sediment	Coastal saltmarsh	n/a
Sublittoral sediment	Saline lagoons	Coastal saline lagoons

Outwith those communities and habitat areas assessed in 2013, it is possible to tentatively allocate NVC community types to some habitats within the study area.

The sea kale dominated vegetation, the coastal vegetated shingle priority habitat, is likely to be the SD1 *Rumex crispus-Glaucium flavum* shingle community (Rodwell, 2000) as sea kale is found only in a very few communities of SD1.

Some of the grasslands are likely to be variants of MG5 *Cynosurus cristatus-Centaurea nigra* grassland. It is typical of grazed meadows but is becoming increasingly rare due to agricultural improvement (Rodwell, 1992); it is still widespread though often fragmented.

4.2 Species recorded within the study area

No rare species or species listed as national or local priority species were recorded during the survey except for cornflower in woodland at Cemaes Bay. However, as this species was planted (as part of a species-rich mix), it will not be discussed further. A number of other species of conservation interest were recorded including two plants classed as “uncommon” (sea kale and yellow bartsia).

Three invasive non-native species, Japanese knotweed, montbretia and giant rhubarb, were also recorded.

4.2.1 Great fen-sedge

Great fen-sedge was recorded only within Tre'r Gof SSSI. It is scattered across the British Isles but with a locally common distribution (Stace, 2010). In England and Wales it is largely restricted to calcareous sites (Preston *et al.*, 2002), and in Wales the majority of its known sites are in the north, especially on Anglesey. It has declined as a result of drainage, eutrophication and scrub invasion (Preston *et al.*, 2002).

4.2.2 Sea kale

Sea-kale (Photograph 1 and 10) occurred around the coasts of the study area on shingle but only in significant amounts at Cemlyn Bay. It has declined across its range probably due to habitat loss as a result of the construction of sea-defence works. However, it has increased elsewhere possibly as a result of reduced collection for culinary use (Preston *et al.*, 2002).

Although the plant does not have any formal conservation status it is classed as “uncommon” by Stace (2010) and nationally rare by Rodwell (2000). In the UK, the plant occurs mainly on the south and north-west coasts of England, the south-west coast of Scotland and the coast of north Wales and Anglesey (Preston *et al.*, 2002).



Photograph 10: Sea kale on a shingle beach.

4.2.3 Sheep's-bit

Sheep's-bit (Photograph 11) was recorded on the cliffs and steep banks around the coasts, and occasionally inland, within the study area. The plant generally has a westerly distribution in the British Isles occurring on maritime cliffs, grasslands and heaths, and inland on heathland and other habitats (Preston *et al.*, 2002). However, the plant is believed to be declining due to the loss of heaths and other habitats, including as a result of the growth of coarser vegetation from a decline in rabbit grazing.



Photograph 11: Sheep's-bit on coastal cliff habitat.

4.2.4 Spring squill

Spring squill occurred, often at a high frequency, in short coastal grassland vegetation within the study area. Spring squill has no conservation status and is not threatened as its sites are usually too exposed for any major threat from land-use change or vegetation succession (Preston *et al.*, 2002). The plant has a strong oceanic distribution occurring on western coasts and, in Wales, mainly around Anglesey, the Llyn Peninsula and Pembrokeshire.



Photograph 12: Spring squill in coastal grassland

4.2.5 Yellow bartsia

Yellow bartsia (Photograph 4) was found scattered across parts of the Wylfa Head candidate Wildlife Site and the adjacent grassland. It has been found previously in the area. In 2010 it was found on the western edge of the Wylfa Head candidate Wildlife Site (SH 353 942) and again in 2011 when c. 200 plants were found scattered over an area of 12m x 10m (Bonner, 2012).

Although the plant does not have any formal conservation status it is classed as “uncommon” by Stace (2010). Yellow bartsia is also only known from one other location on Anglesey being recorded in 2004 on the banks of the A55 near Caergeiliog (SH 3079) (Bonner, 2012), indeed the most recent national botanical survey did not record it in the area (Preston *et al.*, 2002). However, the plant is known to be increasing northwards and eastwards in Britain, largely through introductions from seed mixtures (Preston *et al.*, 2002).

Like yellow-rattle, yellow bartsia is a hemiparasitic annual (it invades the roots of a variety of other plants) and reproduces entirely from seed. The species is often included in the seed mix for enhancing species richness of grassland areas as it inhibits grass species domination.

4.2.6 Invasive non-native species

All three species recorded, Japanese knotweed, giant rhubarb and montbretia are listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). It is an offence to plant or otherwise cause these species to grow in the wild. The giant rhubarb and montbretia were adjacent to domestic properties in Cemaes Bay and are most likely to be garden escapes.

5 Recommendations

It is recommended that additional detailed surveys be undertaken, targeted at specific habitats. The two SSSIs wholly within the study area and the candidate Wildlife Site have been assessed in this way and would not require further assessment.

The areas of semi-improved neutral grassland (grazing and hay meadows) should be assessed in further detail. They can be very diverse and species-rich. In particular, the two small fields at Porth y Felin (Target note 15) and the horse-grazed fields (Target note 22) would benefit from additional survey to determine their conservation value. It is possible that they are good examples of Welsh priority habitats. Some of the other grasslands between Wylfa Head and Cemaes Bay also showed a high species-richness although, in general, they appeared to be of a lesser quality due to agricultural improvement.

The coastal heathland at Trwyn Pencarreg (Target note 16) and at Wylfa Head candidate Wildlife Site was subject to a detailed assessment (Jacobs, 2013). Lowland heath (of which coastal heath is an example) is a priority habitat at both the national and local level, but the vegetation at both sites is subject to scrub invasion from gorse, bracken and bramble. Wylfa Head candidate Wildlife Site also suffers from areas of agricultural improvement. Detailed mapping using hand-held data loggers could be undertaken in these habitats to assist in the determination of future management options and potential mitigation. This could also include mapping of the locally uncommon plant yellow bartsia as the available information indicates that Wylfa Head is an important site for this species on Anglesey. This information would allow a baseline assessment of the sites' condition to be undertaken for future monitoring.

Should it be considered likely that areas of shingle at Cemlyn Bay and saltmarsh vegetation at Porth y Felin could be affected by future development work, it would be appropriate to monitor changes in these communities. The saltmarsh vegetation, although limited, is uncommon in the immediate area. Sea kale is an important constituent of shingle vegetation and is at risk from habitat loss. Accurate mapping of these habitats would therefore be necessary to ensure the potential for loss could be assessed.

Cloddiau and hedgerows are an important landscape feature of the wider area and, as indicated, they occur in variable condition across the study area. Good quality examples also provide important wildlife habitat and serve as important wildlife corridors. A survey could be undertaken to map their presence more effectively, recording specific features such as height, width, degree of degradation, vegetation presence etc. indicating those which may provide biodiversity benefits.

Those areas which it was indicated could not be fully assessed (see Section 2.4) could be formally surveyed should the potential for adverse effects from development be determined. In particular, the small area of dwarf shrub heath (Target note 29) could be surveyed. Due to its proximity to Cae Gwyn SSSI there is a possibility that this site is ecologically significant.

6 References

Arup, (2009), *Wylfa New Nuclear Power Station, Phase 1 Habitat & Protected Species Survey Report 2013*, Unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd.

Arup, (2013), *Wylfa New Nuclear Power Station, Phase 1 Habitat Update and Desk Study Report 2012*, Unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd.

Bonner, I., (2012), Anglesey Flora Group, *Anglesey Plants in 2012*. http://bsbi.org.uk/Anglesey_Plants_in_2012.pdf

Jacobs (2013), *An assessment of the vegetation of key habitats within the Wylfa NPS area using National Vegetation Classification (NVC) methods*, Jacobs UK Ltd, Report Ref: B1496000/WP6-2/R005.ref. W202.01-S5-PAC-REP-00015

CCW, (2013a), *Site of Special Scientific Interest: Citation, Gwynedd/Anglesey Tre'r Gof SSSI*, Available online at: <http://angleseynature.co.uk/webmaps/tregof.html>

CCW, (2013b), *Site of Special Scientific Interest: Citation, Anglesey Cae Gwyn SSSI*, Available online at: <http://angleseynature.co.uk/webmaps/caegwyndesc.htm>

CCW, (2013c), *Site of Special Scientific Interest: Citation, Anglesey Cemlyn Bay SSSI*, Available online at: <http://angleseynature.co.uk/webmaps/cemlynbaydesc.htm>

CCW, (2013d), *Cemlyn Bay Site of Special Scientific Interest. Site Management Statement*, Available online at: <http://angleseynature.co.uk/webmaps/cemlynbaysms.html>

Cuthbert, H., (2008), *Recreating species rich grasslands using the hemiparasitic plant *Rhinanthus minor**, Whitley Wildlife Conservation Trust, Research report, Available online at: <http://www.wwct.org.uk/userfiles/pagefiles/conservation-research/south-west-uk/primley/Research%20report%202008%20-%20meadow%20restoration%20Primley.pdf>

JNCC, (2009), *Natura 2000 Standard Data Form, Ynys Feurig, Cemlyn Bay and The Skerries Special Protection Area*, Produced 19/09/09, Available online at: <http://jncc.defra.gov.uk/pdf/SPA/UK9013061.pdf>

JNCC, (2010), *Handbook for Phase 1 habitat survey - a technique for environmental audit*, JNCC, Peterborough, UK, Available online at: <http://jncc.defra.gov.uk/page-2468>

JNCC, (2011), *Natura 2000 Standard Data Form, Cemlyn Bay SAC*, Produced 27/07/11, Available online at: <http://jncc.defra.gov.uk/ProtectedSites/SACselection/n2kforms/UK0030114.pdf>

Preston, C.D., Pearman, D.A. and Dines, T.A., (2002), *New Atlas of the British and Irish Flora*, Oxford University Press, Oxford.

Pywell, R.F., Bullock, J.M., Walker K.J., Coulson, S.J., Gregory, S.J. and Steveson, M.J., (2004), Facilitating grassland diversification using the hemiparasitic plant *Rhinanthus minor*, *Journal of Applied Ecology*, 41 (5), 880-887.

Stace, C., (2010), *New Flora of the British Isles, Third edition*, Cambridge University Press, Cambridge, UK.

Appendix A Phase 1 habitat maps

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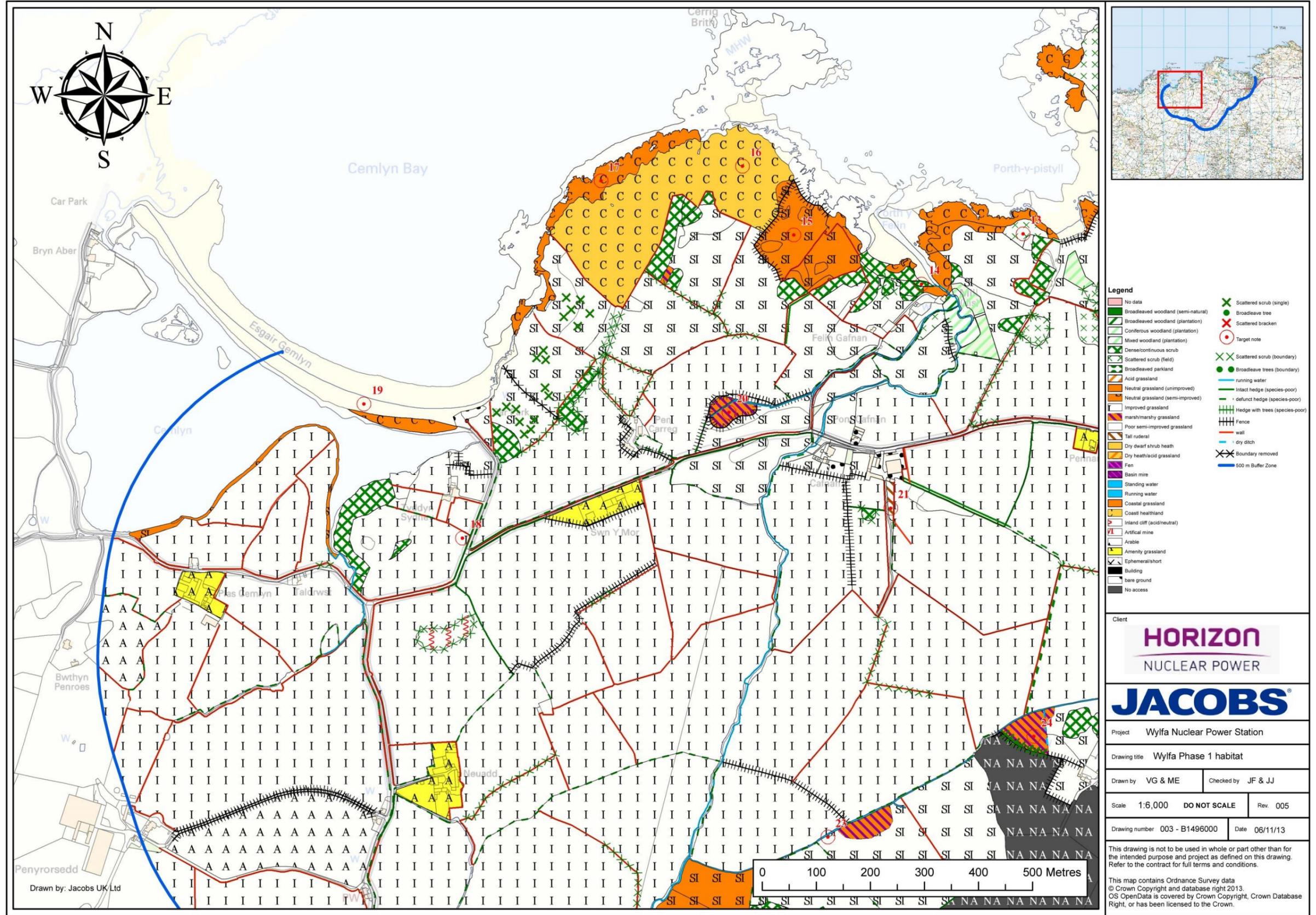


Figure 3: Phase 1 habitat map of study area

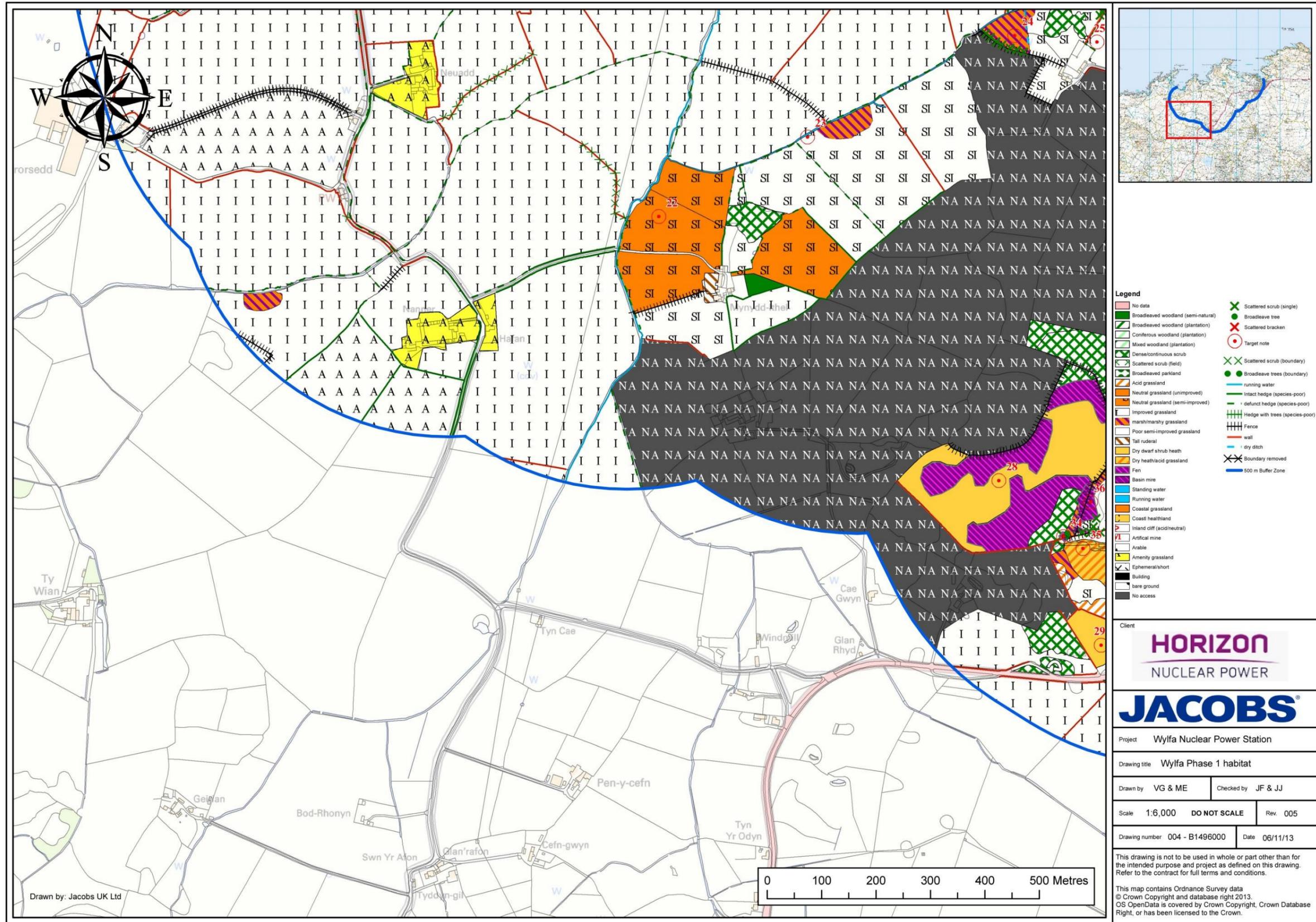


Figure 4: Phase 1 habitat map of study area

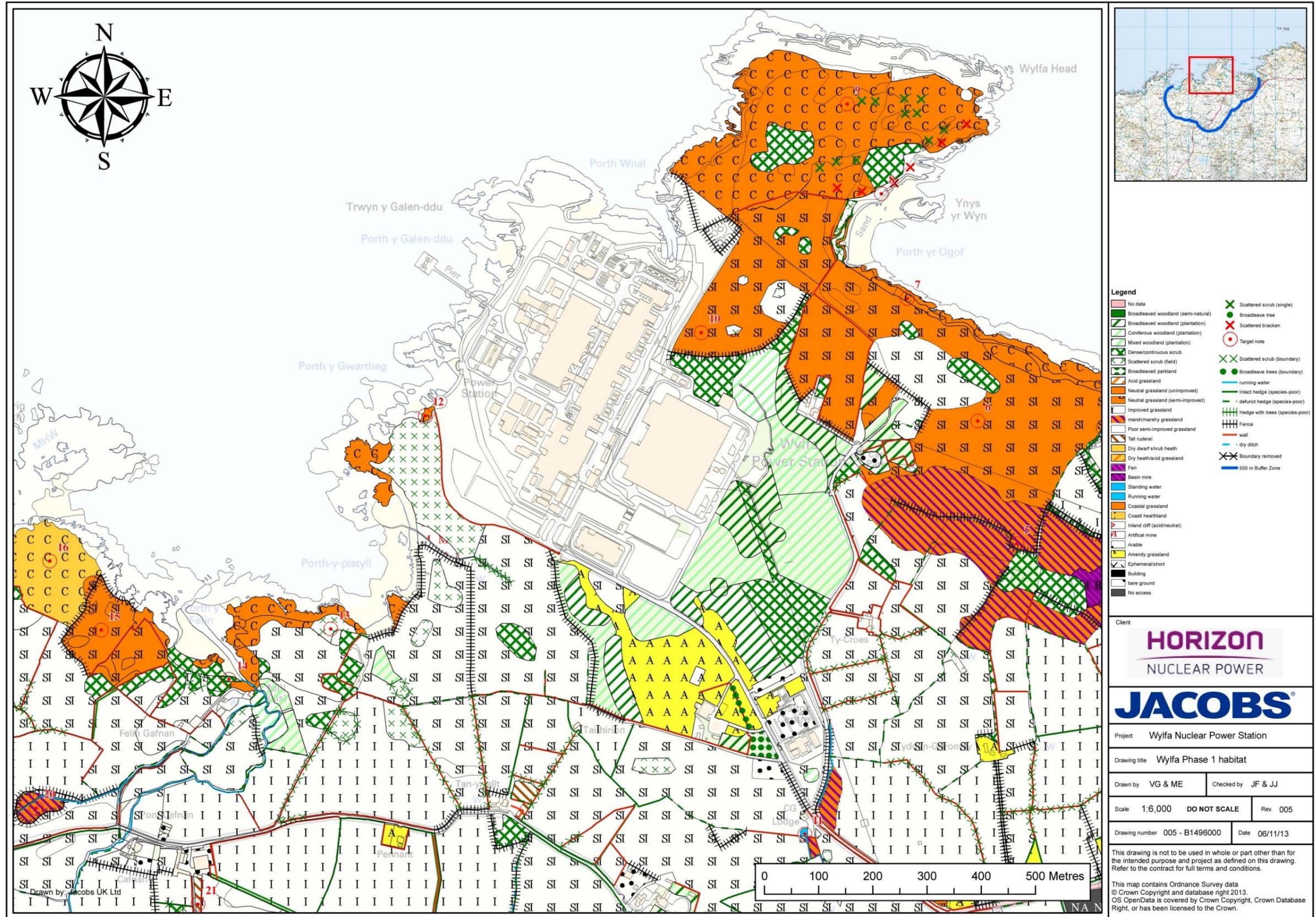


Figure 5: Phase 1 habitat map of study area

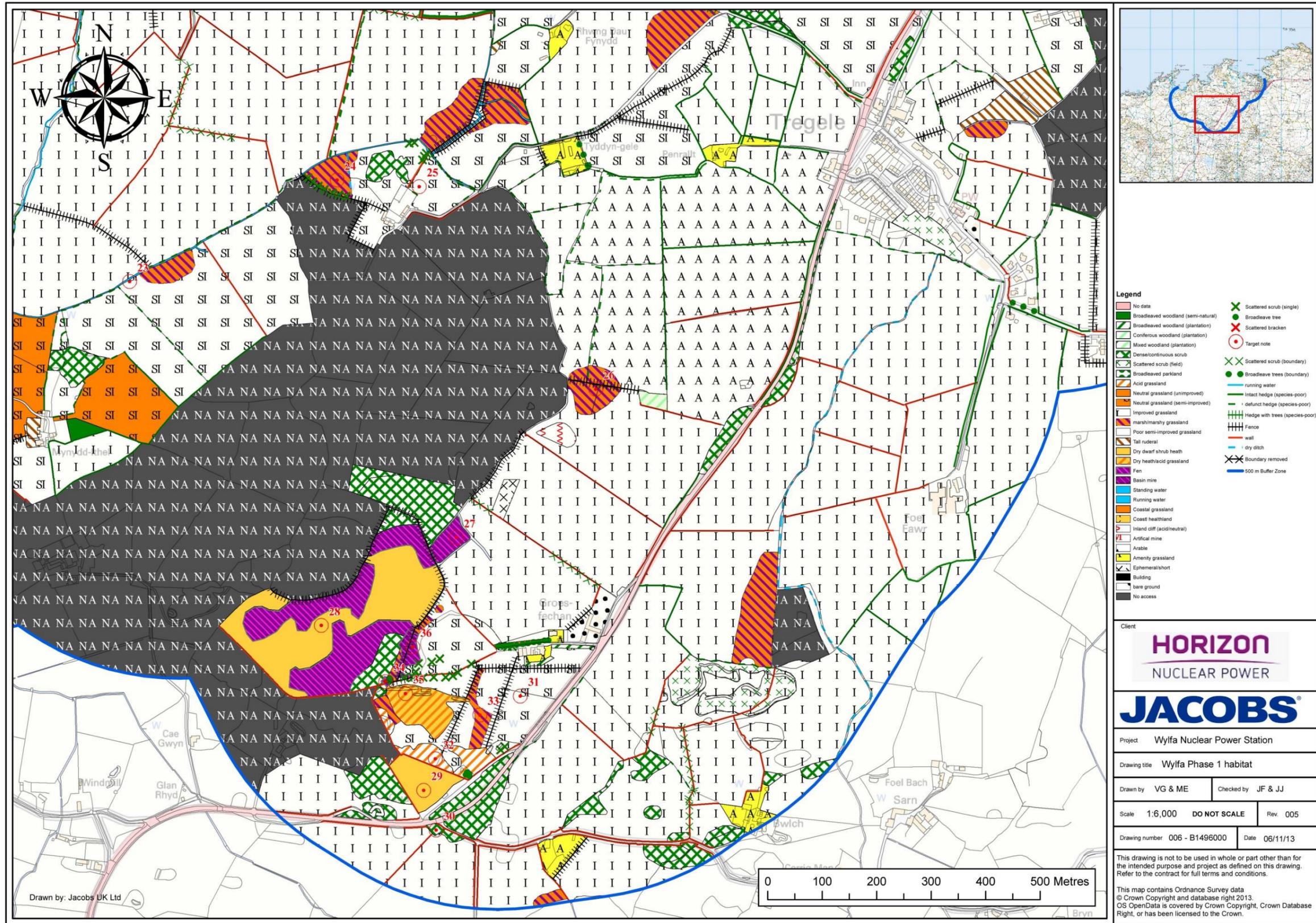


Figure 6: Phase 1 habitat map of study area

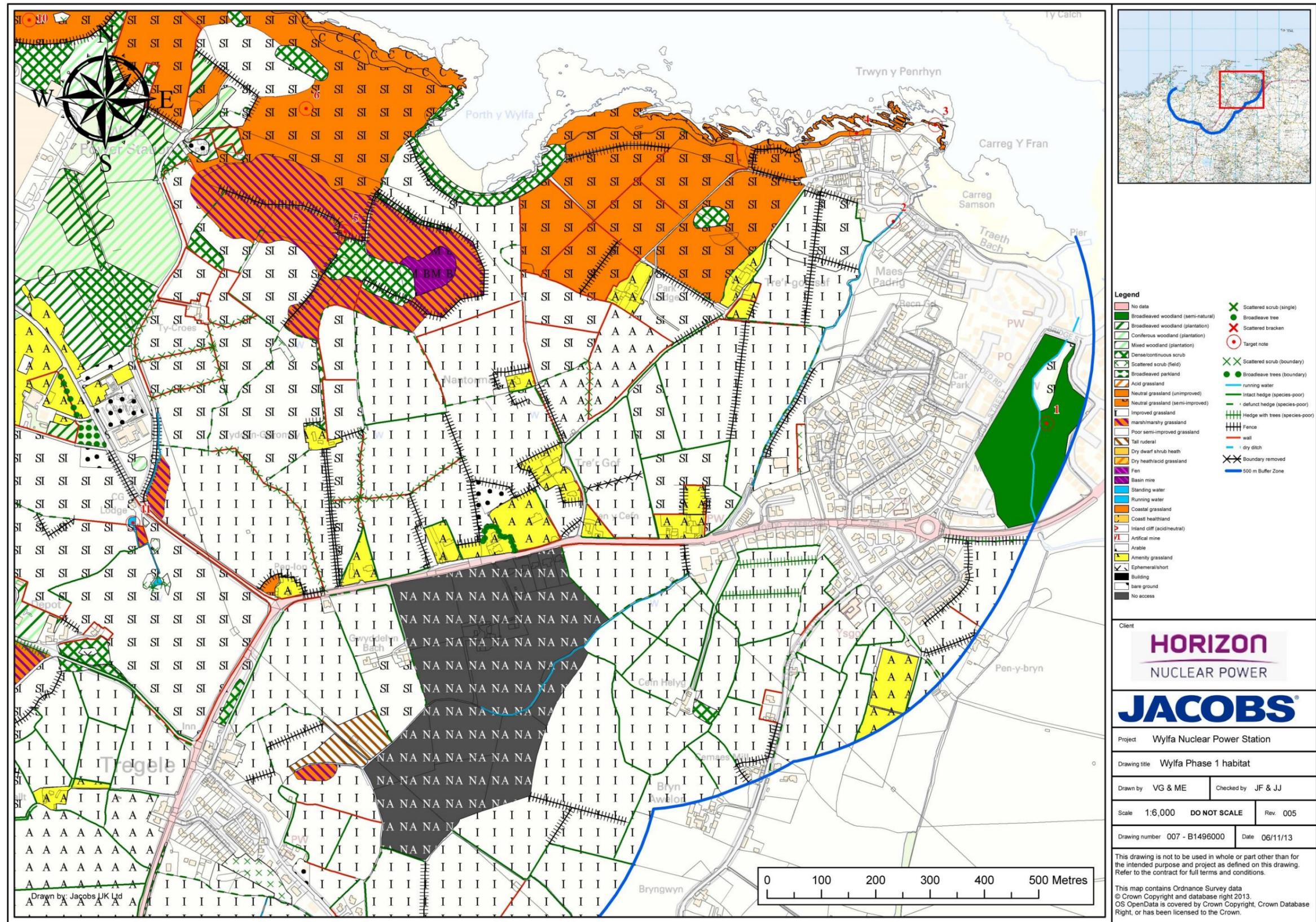


Figure 7: Phase 1 habitat map of study area

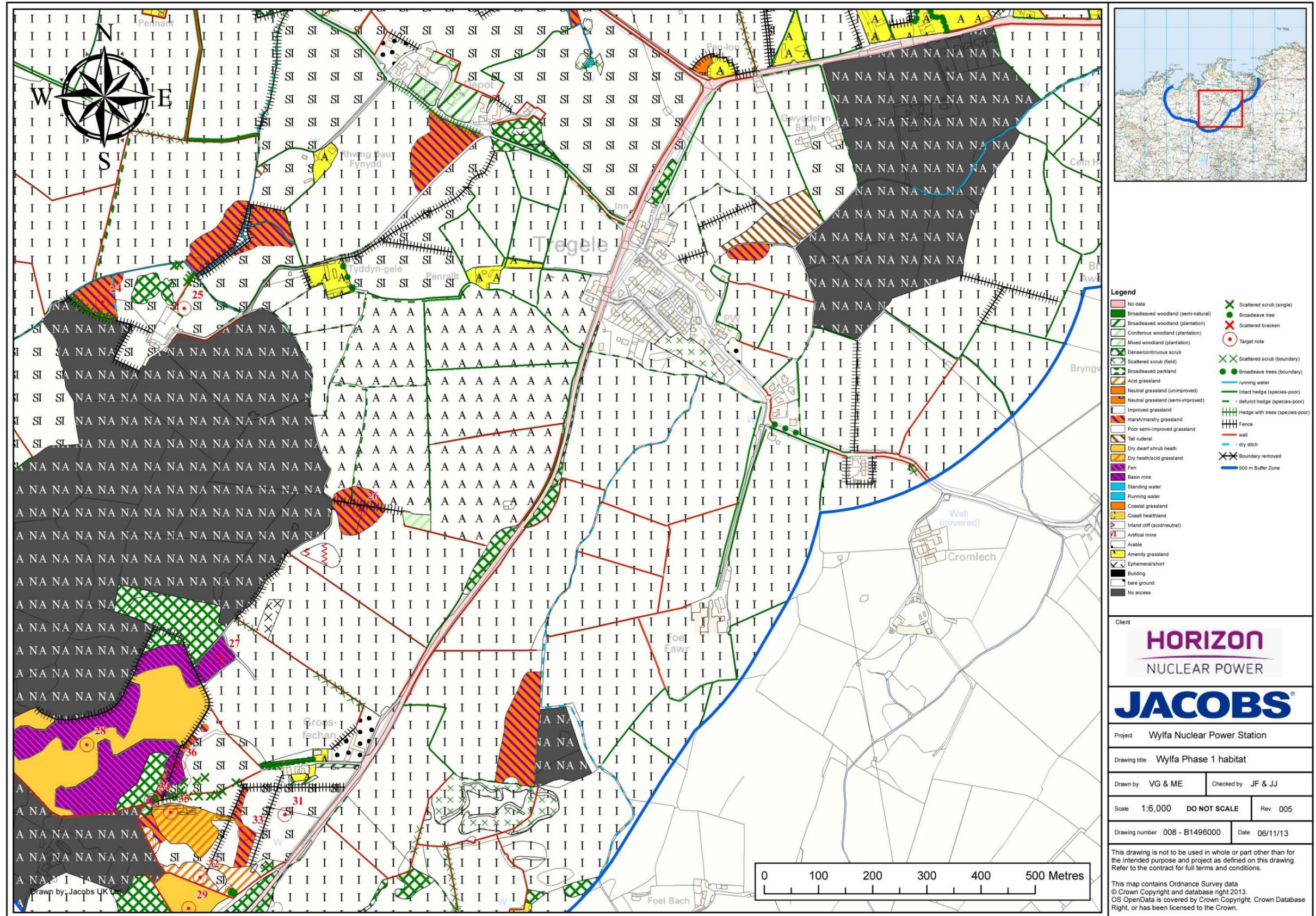


Figure 8: Phase 1 habitat map of study area

Appendix B Priority Plant Species in Wales

Vascular Plants

Scientific Name	Common Name
<i>Artemisia campestris</i> ssp. <i>maritima</i>	Field wormwood
<i>Asparagus prostratus</i>	Wild asparagus
<i>Asplenium trichomanes</i> ssp. <i>pachyrachis</i>	A maidenhair spleenwort
<i>Blysmus compressus</i>	Flat-sedge
<i>Bupleurum tenuissimum</i>	Slender hare's-ear
<i>Campanula patula</i>	Spreading bellflower
<i>Carex divisa</i>	Divided sedge
<i>Centaurea cyanus</i>	Cornflower
<i>Centaureum scilloides</i>	Perennial centaury
<i>Cephalanthera longifolia</i>	Narrow-leaved helleborine
<i>Cerastium nigrescens</i> (= <i>Cerastium arcticum</i>)	Arctic mouse-ear
<i>Chamaemelum nobile</i>	Chamomile
<i>Cicendia filiformis</i>	Yellow centaury
<i>Clinopodium acinos</i>	Basil thyme
<i>Cotoneaster cambricus</i>	Wild cotoneaster
<i>Dactylorhiza purpurella</i> var. <i>cambrensis</i> (= <i>Dactylorhiza purpurella</i> ssp. <i>cambrensis</i>)	A marsh orchid
<i>Dactylorhiza viridis</i>	Frog orchid
<i>Dianthus armeria</i>	Deptford pink
<i>Euphrasia cambrica</i>	An eyebright
<i>Euphrasia officinalis</i> ssp. <i>anglica</i> (= <i>Euphrasia anglica</i>)	Glandular eyebright
<i>Euphrasia ostenfeldii</i>	An eyebright
<i>Euphrasia pseudokernerii</i>	Chalk eyebright
<i>Euphrasia rivularis</i>	An eyebright
<i>Euphrasia officinalis</i> ssp. <i>monticola</i> (= <i>Euphrasia rostkoviana</i> ssp. <i>montana</i>)	An eyebright
<i>Fumaria purpurea</i>	Purple ramping-fumitory
<i>Galeopsis angustifolia</i>	Red hemp-nettle
<i>Galeopsis segetum</i>	Downy hemp-nettle
<i>Galeopsis speciosa</i>	Large-flowered hemp-nettle
<i>Gentianella anglica</i>	Early gentian
<i>Gentianella campestris</i>	Field gentian
<i>Gentianella uliginosa</i>	Dune gentian
<i>Gymnadenia borealis</i>	Northern fragrant orchid
<i>Gymnadenia conopsea</i>	Fragrant orchid
<i>Gymnadenia densiflora</i>	Marsh fragrant orchid
<i>Hammarbya paludosa</i>	Bog orchid
<i>Hieracium</i> spp. <i>Hieracium angustatiforme</i> <i>Hieracium breconicola</i> <i>Hieracium reticulum</i> <i>Hieracium radyrense</i> <i>Hieracium snowdoniense</i> <i>Hieracium subminutidens</i>	Six threatened endemic species
<i>Hordeum marinum</i>	Sea barley
<i>Hypopitys monotropa</i> (= <i>Monotropa hypopitys</i>)	Yellow bird's-nest
<i>Hypopitys monotropa</i> ssp. <i>hypophegea</i> (= <i>Monotropa hypopitys</i> ssp. <i>hypophegea</i>)	A bird's-nest
<i>Hypopitys monotropa</i> ssp. <i>monotropa</i>	A bird's-nest

Scientific Name	Common Name
(= <i>Monotropia hypopitys</i> ssp. <i>hypopitys</i>)	
<i>Juniperus communis</i>	Juniper
<i>Juniperus communis</i> ssp. <i>hemisphaerica</i>	A juniper
<i>Liparis loeselii</i>	Fen orchid
<i>Luronium natans</i>	Floating water plantain
<i>Lycopodiella inundata</i>	Marsh clubmoss
<i>Lycopodium clavatum</i>	Stag's-horn clubmoss
<i>Matthiola sinuate</i>	Sea stock
<i>Melittis melissophyllum</i>	Bastard balm
<i>Mentha pulegium</i>	Pennyroyal
<i>Neotinea ustulata</i>	Burnt orchid
<i>Oenanthe fistulosa</i>	Tubular water-dropwort
<i>Ophrys insectifera</i>	Fly orchid
<i>Pilularia globulifera</i>	Pillwort
<i>Platanthera bifolia</i>	Lesser butterfly-orchid
<i>Poa glauca</i>	Glaucous meadow-grass
<i>Polystichum lonchitis</i>	Holly-fern
<i>Potamogeton compressus</i>	Grass-wrack pondweed
<i>Potentilla rupestris</i>	Rock cinquefoil
<i>Pseudorchis albida</i>	Small-white orchid
<i>Pulicaria vulgaris</i>	Small fleabane
<i>Ranunculus arvensis</i>	Corn buttercup
<i>Ranunculus tripartitus</i>	Three-lobed water-crowfoot
<i>Rumex rupestris</i>	Shore dock
<i>Salsola kali</i> ssp. <i>kali</i>	Prickly saltwort
<i>Saxifraga cespitosa</i>	Tufted saxifrage
<i>Scandix pecten-veneris</i>	Shepherd's needle
<i>Scleranthus annuus</i>	Annual knawel
<i>Scleranthus annuus</i> ssp. <i>annuus</i>	Annual knawel
<i>Silene gallica</i>	Small-flowered catchfly
<i>Sorbus eminens</i>	A whitebeam
<i>Sorbus leptophylla</i>	A whitebeam
<i>Sorbus leyana</i>	Ley's whitebeam
<i>Sorbus minima</i>	A whitebeam
<i>Stellaria palustris</i>	Marsh stitchwort
<i>Trollius europaeus</i>	Globe-flower
<i>Vicia orobus</i>	Wood bitter-vetch
<i>Viola lactea</i>	Pale dog-violet
<i>Woodsia ilvensis</i>	Oblong woodsia

Lichens and lichen assemblages

Scientific Name	Common Name
<i>Anaptychia ciliaris</i> ssp. <i>ciliaris</i>	A lichen
<i>Arthonia atlantica</i>	A lichen
<i>Bacidia circumspecta</i>	A lichen
<i>Bacidia incompta</i>	A lichen
<i>Biatoridium monasteriense</i>	A lichen
<i>Blarneya hibernica</i>	A lichen
<i>Bryoria smithii</i>	A lichen
<i>Buellia hyperbolica</i>	A lichen
<i>Calicium adpersum</i>	A lichen
<i>Caloplaca atroflava</i>	A lichen
<i>Caloplaca flavorubescens</i>	A lichen
<i>Caloplaca herbidella</i>	A lichen
<i>Caloplaca lucifuga</i>	A lichen
<i>Caloplaca luteoalba</i>	Orange-fruited elm lichen
<i>Chaenotheca phaeocephala</i>	A lichen

Scientific Name	Common Name
<i>Cladonia peziziformis</i>	A lichen
<i>Collema dichotomum</i>	River-jelly lichen
<i>Collema fasciculare</i>	A lichen
<i>Collema fragile</i>	A lichen
<i>Collema fragrans</i>	A lichen
<i>Cryptolechea carneolutea</i>	A lichen
<i>Endocarpon adscendens</i>	A lichen
<i>Fulgensia fulgens</i>	A lichen
<i>Fuscopannaria sampaiana</i>	A lichen
<i>Gomphillus calycioides</i>	A lichen
<i>Graphina pauciloculata</i>	A lichen
<i>Gyalecta flotowii</i>	A lichen
<i>Heterodermia leucomela</i>	Ciliate strap-lichen
<i>Lecania chlorotiza</i>	A lichen
<i>Lecanographa amylacea</i>	A lichen
<i>Lecanora achariana</i>	Tarn lecanora
<i>Lecanora quercicola</i>	A lichen
<i>Lecanora sublivescens</i>	A lichen
<i>Leptogium brebissonii</i>	A lichen
<i>Leptogium cochleatum</i>	A lichen
Lobarion community	A lichen community
<i>Megalospora tuberculosa</i>	A lichen
<i>Melaspilea lentiginosa</i>	A lichenicolous fungus
Mine site community	A lichen community
<i>Opegrapha prosodea</i>	A lichen
<i>Parmelina carporrhizans</i> (= <i>Parmelina quercina</i>)	A lichen
<i>Parmeliella testacea</i>	A lichen
<i>Parmelinopsis horrescens</i>	A lichen
<i>Parmotrema robustum</i>	A lichen
<i>Peltigera venosa</i>	A lichen
<i>Pertusaria velata</i>	A lichen
<i>Physcia tribacioides</i>	Southern grey physcia
<i>Porina effilata</i>	A lichen
<i>Porina hibernica</i>	A lichen
<i>Pseudocyphellaria intricata</i>	A lichen
<i>Pseudocyphellaria lacerata</i>	Ragged pseudocyphellaria
<i>Pseudocyphellaria norvegica</i>	A lichen
<i>Pyrenula hibernica</i>	A lichen
<i>Pyrenula nitida</i>	A lichen
<i>Ramonia chrysophaea</i>	A lichen
<i>Ramonia dictyospora</i>	A lichen
<i>Rinodina isidioides</i>	A lichen
<i>Schismatomma graphidioides</i>	A lichen
<i>Stereocaulon delisei</i>	A lichen
<i>Stereocaulon symphycheilum</i>	A lichen
<i>Sticta canariensis</i>	A lichen
<i>Strangospora microhaema</i>	A lichen
<i>Strigula stigmatella</i> var. <i>stigmatella</i>	A lichen
<i>Synalissa symphorea</i>	A lichen
<i>Teloschistes flavicans</i>	Golden hair-lichen
<i>Toninia sedifolia</i>	A lichen
<i>Usnea articulata</i>	A lichen
<i>Usnea florida</i>	A lichen
<i>Wadeana dendrographa</i>	A lichen

Bryophytes (mosses and liverworts)

Scientific Name	Common Name
<i>Aloina rigida</i>	Rigid Aloe-moss
<i>Anomodon longifolius</i>	Long-leaved tail-moss
<i>Barbilophozia kunzeana</i>	Bog paw-wort
<i>Bartramia stricta</i>	Rigid apple-moss
<i>Bryum calophyllum</i>	Matted bryum
<i>Bryum gemmiparum</i>	Welsh thread-moss
<i>Bryum intermedium</i>	Many seasoned thread-moss
<i>Bryum knowltonii</i>	Knowlton's thread-moss
<i>Bryum marratii</i>	Baltic bryum
<i>Bryum muehlenbeckii</i>	Muehlenbeck's thread-moss
<i>Bryum warneum</i>	Sea bryum
<i>Buxbaumia aphylla</i>	Brown shield-moss
<i>Cephaloziella calyculata</i>	Entire threadwort
<i>Cephaloziella nicholsonii</i>	Greater copperwort
<i>Cephaloziella massalongii</i>	Lesser copperwort
<i>Daltonia splachnoides</i>	Irish Daltonia
<i>Dendrocryphaea lamyana</i> (= <i>Cryphaea lamyana</i>)	Multi-fruited river moss
<i>Dicranodontium asperulum</i>	Orange bow-moss
<i>Dicranum undulatum</i> (= <i>Dicranum bergeri</i>)	Waved fork-moss
<i>Didymodon tomaculosus</i>	Sausage beard-moss
<i>Ditrichum plumbicola</i>	Lead-moss
<i>Ditrichum subulatum</i>	Awl-leaved ditrichum
<i>Entosthodon pulchellus</i> (= <i>Funaria pulchella</i>)	Pretty cord-moss
<i>Fissidens curvatus</i>	Portuguese pocket-moss
<i>Fossombronia fimbriata</i>	Fragile frillwort
<i>Fossombronia foveolata</i>	Pitted frillwort
<i>Grimmia arenaria</i>	Nodding Donn's Grimmia
<i>Habrodon perpusillus</i>	Lesser squirrel-tail moss
<i>Leiocolea fitzgeraldiae</i>	Fitzgerald's notchwort
<i>Leptodon smithii</i>	Prince of Wales feather-moss
<i>Meesia uliginosa</i>	Broadnerved hump-moss
<i>Micromitrium tenerum</i>	Millimetre moss
Oceanic Ravine Assemblage	A bryophyte assemblage
<i>Orthotrichum obtusifolium</i>	Blunt leaved Bristle-moss
<i>Orthotrichum pumilum</i>	Dwarf bristle-moss
<i>Pallavicinia lyellii</i>	Veilwort
<i>Paraleptodontium recurvifolium</i>	Drooping leaved beard-moss
<i>Petalophyllum ralfsii</i>	Petalwort
<i>Pseudocalliergon lycopodioides</i>	Large hookmoss
<i>Radula voluta</i>	Pale scalewort
<i>Riccia canaliculata</i>	Channelled crystalwort
<i>Riccia nigrella</i>	Black crystalwort
<i>Scopelophila cataractae</i>	Tongue-leaved copper-moss
<i>Seligeria oelandica</i>	Irish rock-bristle
<i>Sematophyllum demissum</i>	Prostrate signal-moss
<i>Sphagnum balticum</i>	Baltic bog-moss
<i>Tomentypnum nitens</i>	Woolly feather-moss
<i>Tortula canescens</i>	Dog screw-moss
<i>Tortula cuneifolia</i>	Wedge-leaved screw-moss
<i>Tortula wilsonii</i>	Wilson's pottia
<i>Weissia levieri</i>	Levier's beardless-moss
<i>Weissia multicapsularis</i>	Many-fruited Beardless-moss
<i>Weissia squarrosa</i>	Spreading-leaved beardless-moss

Appendix C Phase 1 Target Notes

Target Note	Grid Reference	Description
1	SH 37184 93302	<p>Semi-natural Broad-leaved Woodland</p> <p>Amenity woodland along the Afon Wygyr with paths, mown and unmanaged grassland areas, man-made pools and sown wildflower mix areas. Areas of dense scrub and tall ruderal vegetation were also recorded, as well as garden escapes including snowberry (<i>Symphoricarpos albus</i>) (R) and green alkanet (<i>Pentaglottis sempervirens</i>) (R).</p> <p>The woodland canopy was dominated by sycamore (<i>Acer pseudoplatanus</i>) and oak (<i>Quercus</i> sp.), with alder (<i>Alnus glutinosa</i>) (O), ash (<i>Fraxinus excelsior</i>) (O), beech (<i>Fagus sylvatica</i>) (F), blackthorn (<i>Prunus spinosa</i>) (O), cherry (<i>Prunus</i> sp.) (O), elm (<i>Ulmus</i> sp.) (O), hawthorn (F), holly (<i>Ilex aquifolium</i>) (R), horse chestnut (<i>Aesculus hippocastanum</i>) (R) and rowan (<i>Sorbus aucuparia</i>) (R). An area of species-poor rough grassland of perennial rye-grass (F), false oat-grass (LD), common couch (<i>Elytrigia repens</i>) (F) and Yorkshire-fog (A) featured towards the northern parts of the woodland.</p> <p>Other species recorded: Alexanders (<i>Smyrniolum olusatrum</i>) (O), bramble (<i>Rubus fruticosus</i>) (O), common nettle (O), creeping thistle (O), curled dock (O), foxglove (<i>Digitalis purpurea</i>) (O), great willowherb (<i>Epilobium hirsutum</i>) (LF), hard fern (<i>Blechnum spicant</i>) (O), hart's-tongue (<i>Phyllitis scolopendrium</i>) (LF), herb-Robert (<i>Geranium robertianum</i>) (F), hogweed (F), honeysuckle (<i>Lonicera periclymenum</i>) (O), ivy (<i>Hedera helix</i>) (LF), meadowsweet (O-R), navelwort (<i>Umbilicus rupestris</i>) (LF), nipplewort (<i>Lapsana communis</i>) (R), reed canary-grass (<i>Phalaris arundinacea</i>) (LA), red campion (<i>Silene dioica</i>) (O), tutsan (<i>Hypericum androsaemum</i>) (R) and wood avens (<i>Geum urbanum</i>) (O).</p>
2	SH 36899 93651	<p>Invasive non-native plant</p> <p>Giant rhubarb (<i>Gunnera</i> sp.) on side of small watercourse in Cemaes Bay. Probable escape from adjacent garden.</p>
3	SH 36980 93819	<p>Coastal grassland</p> <p>Coastal and cliff grassland with a wide range of herb species. More species-rich on the steeper cliffs and banks further west of the village.</p> <p>Species recorded: common bird's-foot trefoil (F), common sorrel (F), sweet vernal-grass (F), thrift (F), yarrow (F), glaucous sedge (<i>Carex flacca</i>) (LF), alexanders (O), buck's-horn plantain (<i>Plantago coronopus</i>) (O), cat's-ear (<i>Hypochaeris radicata</i>) (O), common knapweed (O), English scurvygrass (<i>Cochlearia anglica</i>) (O), kidney vetch (<i>Anthyllis vulneraria</i>) (O), orpine (<i>Sedum telephium</i>) (O), oxeye daisy (O), sea campion (O), sea plantain (O), sheep's-bit (R), spring squill (O) and English stonecrop (O).</p>
4	SH 36831 93813	<p>Invasive non-native plant</p>

Target Note	Grid Reference	Description
	SH 36823 93815	Montbretia on cliffs by gardens at two locations. Likely to be garden escapes.
5	SH 35910 93654	Tre'r Gof SSSI Area of marshy grassland, basin mire and associated wetland habitats including wet woodland. Full details of the NVC survey can be found in Budd (2013).
6	SH 35885 93890	Semi-improved Neutral Grassland Species-rich grassland probably for hay making. Transitions into species-poor grassland but with species indicative of the adjacent SSSI and coastal grassland/cliff habitats colonising at various locations. Generally tall vegetation, but shorter nearer the coast and rocky outcrops. Farmyard manure had been spread. Grass species recorded: sweet vernal-grass (F), perennial rye-grass (F-LA), Yorkshire-fog (F), crested dog's-tail (F-LA), red fescue (<i>Festuca rubra</i>) (F). Herb species included: common bird's-foot trefoil (F), common knapweed (F), common sorrel (F), meadow buttercup (F), red clover (F), ribwort plantain (F), white clover (F), yellow-rattle (F), bulbous buttercup (O-F), pignut (O-LF), common mouse-ear (O), common vetch (O) (<i>Vicia sativa</i>), dandelion (O), hogweed (O), lesser trefoil (O), yarrow (O), bluebells (<i>Hyacinthoides non-scripta</i>) (R), curled dock (R), creeping thistle (R), daisy (<i>Bellis perennis</i>) (R) and foxglove (R). In shorter grassy areas associated with stone outcrops spring squill and English stonecrop were common. Bluebells (F), cock's-foot (F), common sorrel (F), pignut (F) Yorkshire-fog (F), and yellow-rattle (R) were also recorded. On the thinner soils there was noticeably less Yorkshire-fog. Western gorse and bramble were also common.
7	SH 35686 94093	Coastal grassland Grassland with some scrub, bracken and tall ruderal above Porth y Ogor and adjacent to semi-improved neutral grassland. Species recorded: bulbous buttercup (F), spring squill (F), sweet vernal-grass (F) yarrow (F), yellow-rattle (F), Yorkshire-fog (F), common knapweed (O), tormentil (<i>Potentilla erecta</i>) (O), mouse-ear hawkweed (O), sea plantain (O), thrift (O), bluebell (R), common restharrow (<i>Ononis repens</i>) (R), eyebright (R), primrose (<i>Primula vulgaris</i>) (R) and purple-loosestrife (<i>Lythrum salicaria</i>) (R).
8	SH 35644 94279	Maritime cliff vegetation Steep rocky cliffs with a variety of herb species and also bramble, ivy, western gorse and hawthorn scrub. Other species recorded: thrift (A-F), oxeye daisy (LA), sea campion (F), common bird's-foot trefoil (O), English scurvygrass (O), foxglove (O), great wood-rush (<i>Luzula sylvatica</i>) (O), red campion (O), red fescue (O), sheep's-bit (O), honeysuckle (R) and primrose (R).
9	SH 35569 94428	Wylfa Head cWS

Target Note	Grid Reference	Description
		<p>Complex area of grassland and heath, including areas dominated by small sedge species, bracken and western gorse, with rocky outcrops with maritime cliff-type vegetation and flush areas. Also, near the dividing wall to the south, the grassland becomes more improved with perennial rye-grass dominant. Unimproved grassland areas tend to be very short.</p> <p>Species recorded include: common nettle (LA), common bird's-foot trefoil (LA-LF), ribwort plantain (F), sweet vernal-grass (F), bluebells (LF), bulbous buttercup (LF), English stonecrop (LO), heather (LF), red clover (LF), spring squill (LF), white clover (LF), cock's-foot (O), common ragwort (O), common sorrel (O), Yorkshire-fog (O), yarrow (O), cat's-ear (LO), creeping thistle (LO), common knapweed (LO), sea campion (LO), sea plantain (LO), sheep's-bit (LO), wood sage (<i>Teucrium scorodonia</i>) (LO), buck's-horn plantain (R), foxglove (R), ground ivy (<i>Glechoma hederacea</i>) (R), heath bedstraw (<i>Galium saxatile</i>) (R), eyebright (R), hogweed (R), lousewort (<i>Pedicularis sylvatica</i>) (R), sheep's sorrel (R), tormentil (R), trailing St John's-wort (<i>Hypericum pulchrum</i>) (R) and violet sp. (R).</p>
10	SH 35330 94011	<p>Semi-improved Neutral Grassland Grassland with scrub (mainly western gorse) invading. Grass is on often thin soils and has a tendency to be short. It varies between species-rich, especially on the thin soil areas, to species-poor and dominated by agricultural grasses and weeds.</p> <p>Species recorded include: perennial rye-grass (LA), sweet vernal-grass (LA), Yorkshire-fog (LA-F), common bird's-foot trefoil (F), yarrow (F), common knapweed (LF), creeping cinquefoil (<i>Potentilla reptans</i>) (O), crested dog's-tail (F), common ragwort (F), ribwort plantain (F), yellow bartsia (LF), yellow-rattle (O-F), buck's-horn plantain (O), common mouse-ear (O), hogweed (O), red bartsia (<i>Odontites vernus</i>) (LO), common centaury (R), field wood-rush (<i>Luzula campestris</i>) (R), lady's bedstraw (<i>Galium verum</i>) (R) and sheep's sorrel (R).</p>
11	SH 35498 93097	<p>Pond Small pond near visitor centre heavily overgrown. Species-poor. Soft-rush (<i>Juncus effusus</i>) (A), articulated rush (<i>J. articulatus</i>) (F), cuckooflower (<i>Cardamine pratensis</i>) (O), sedge species (<i>Carex</i> spp.) (O), sweet-grass (<i>Glyceria</i> sp.) (O), watercress (<i>Nasturtium officinale</i>) (O) and common figwort (<i>Scrophularia nodosa</i>) (R).</p>
12	SH 34786 93898	<p>Shingle beach vegetation Small areas of shingle beach with specimens of sea-kale, sea beet and a number of small yellow sedges.</p> <p>These occur almost wherever there is shingle and transition to maritime cliff and/or grassland. Occasional wet flushes.</p> <p>Also on shingle, rocks and developing patches of coastal grassland: buck's-horn plantain (F), common</p>

Target Note	Grid Reference	Description
		sorrel (F), fat-hen (<i>Chenopodium album</i>) (F), silverweed (<i>Potentilla anserina</i>) (F), sea campion (F), sea plantain (F), spring squill (F), thrift (F), Yorkshire-fog (F), sea milkwort (<i>Glaux maritima</i>) (O-F), annual sea-blite (<i>Suaeda maritima</i>) (O), common bird's-foot trefoil (O), common mouse-ear (O), common ragwort (O), creeping cinquefoil (O), cuckooflower (O), ribwort-plantain (O), sea sandwort (<i>Honckenya peploides</i>) (O), bramble (O-R), cat's-ear (R), crested dog's-tail (R), English stonecrop, (R), kidney vetch (R), lesser trefoil (R), sheep's-sorrel (R). Bell heather (<i>Erica cinerea</i>), common centaury, common knapweed, common restharrow and wild thyme, were scattered on rocky cliffs nearby.
13	SH 34641 93488	Marshy grassland and heath Complex area of marshy grassland, heath and acid grassland with some characteristic coastal species. Transitions into small patches of scrub and tall ruderal vegetation. Species recorded: common reed (<i>Phragmites australis</i>) (LA), jointed rush (LA), silverweed (LA), rough meadow-grass (O-F), common bird's-foot trefoil (F), common sedge (<i>Carex nigra</i>) (F), crested dog's-tail (F), meadow buttercup (F), red fescue (F), sweet vernal-grass (F), Yorkshire-fog (F), bell heather (LF), devil's-bit scabious (LF), heather (LF), sea plantain (LF), spring squill (LF), thrift (LF), tormentil (LF), water horsetail (<i>Equisetum fluviatile</i>) (LF), common sorrel (O-F), cat's-ear (O), common mouse-ear (O), English stonecrop (O), red campion (O), ribwort plantain (O), white clover (O), bramble (LO), English scurvygrass (LO), fat-hen (LO), foxglove (LO), goat willow (LO), western gorse (LO), bluebells (R), bur-reed (<i>Sparganium</i> sp.) (R), daisy (R), false fox-sedge (<i>Carex otrubae</i>) (R), field wood-rush (R), heath milkwort (R), lousewort (R), red clover (R) and sheep's sorrel (R).
14	SH 34413 93475	Saltmarsh Saltmarsh vegetation at Porth Y Felin in small clumps and patches, fragmented. Species recorded: sea arrowgrass (<i>Triglochin maritima</i>) (A), saltmarsh rush (<i>Juncus gerardii</i>) (LA), sea plantain (LA), thrift (F), sea aster (<i>Aster tripolium</i>) (O), sea beet (O), sea milkwort (O), sea sandwort (O) and annual sea-blite (R). The vegetation transitions to shingle vegetation.
15	SH 34208 93483	Semi-improved Neutral Grassland Two adjacent herb-rich hay-meadows. Species recorded: meadow buttercup (A), crested dog's-tail (F-A), ribwort plantain (F-A), cat's-ear (F), common bird's-foot trefoil (F), common knapweed (F), common sorrel (F), red clover (F), sweet vernal-grass (F), yellow rattle (F), Yorkshire-fog (F), common mouse-ear (O) and tufted vetch (<i>Vicia cracca</i>) (O).
16	SH 34084 93585	Coastal Heath Area of dwarf shrub heath with wet flushes and transitions to coastal grassland (see Target note 17). Some areas show evidence of management with gorse clearance and regeneration of acid grassland occurring. Heather, bell heather and western gorse

Target Note	Grid Reference	Description
		<p>dominate in some areas. Bracken invading elsewhere. A variety of small sedge species were present.</p> <p>Other species recorded: bell heather (LA), rush spp. (LA), common bird's-foot trefoil (F), Yorkshire-fog (F), devil's-bit scabious (LF), sweet vernal-grass (LF), thrift (LF), common sedge (O-F), creeping willow (O-F), red fescue (O-F), common knapweed (O), heath bedstraw (O), milkwort (O), silverweed (O), spring squill (O), tormentil (O), wild thyme (O), common sorrel (LO), English stonecrop (LO), foxglove (LO), marsh cinquefoil (<i>Comarum palustris</i>) (LO), red campion (LO), flea sedge (O-R), red clover (O-R), sheep's-sorrel (O-R), violet sp. (<i>Viola</i> sp.) (O-R), common spotted orchid (<i>Dactylorhiza fuschii</i>) (R), eyebright (R), lady's-bedstraw (R), lesser spearwort (<i>Ranunculus flammula</i>) (R), long-bracted sedge (R), lousewort (R), marsh willowherb (<i>Epilobium palustre</i>) (R), northern marsh orchid (R), marsh pennywort (<i>Hydrocotyle vulgaris</i>) (R) and purple moor-grass (F).</p>
17	SH 33838 93576	<p>Coastal grassland Grassland with maritime influence on the edge of heathland and agriculturally improved grasslands. Particularly herb-rich in rocky (cliff) areas and locations where grazing is absent. Species spread a short distance into the agriculturally improved grasslands. Species recorded: common bird's-foot trefoil (F), thrift (F), buck's-horn plantain (LF), crested dog's-tail (LF), sea plantain (O-F), sheep's-bit (LF), spring squill (LF), sweet vernal-grass (O-F), white clover (O-F), Yorkshire-fog (O-F), bell heather (O), cat's-ear (O), cock's-foot (O), common knapweed (O), common mouse-ear (O), common ragwort (O), English scurvygrass (O), English stonecrop (O), heather (O), perennial rye-grass (O), red fescue (O), sea campion (O), wavy hair-grass (<i>Deschampsia flexuosa</i>) (O), western gorse (O), wild thyme (O), yarrow (O), heath bedstraw (O-R), sheep's-sorrel (O-R), common centaury (R), daisy (R), lesser trefoil (R) and ribwort plantain (R).</p>
18	SH 33597 92896	<p>Invasive Non-native Plant Japanese knotweed in hedge, three stands up to 1.5 m.</p>
19	SH 33429 93142	<p>Shingle beach vegetation and rough grassland. Shingle beach with sea-kale (F), sea beet (O) and sea campion (O). Adjacent on ridge of shingle is rough grassland, most of which could not be accessed due to limitations to prevent disturbance to breeding terns. The area surveyed, at the eastern end, was species poor. False oat-grass and Yorkshire-fog were the most distinctive species. By the adjacent saline lagoon, Sea club rush (<i>Bolboschoenus maritimus</i>) and false fox-sedge were present in small patches.</p>
20	SH 34095 93150	<p>Wetland with Poor Semi-improved Grassland Wetland area with swamp and marshy grassland areas in originally agriculturally improved grassland reverting to wet grassland. Large monoculture stands of some wetland species such as: bogbean (<i>Menyanthes trifoliata</i>), common</p>

Target Note	Grid Reference	Description
		<p>cottongrass (<i>Eriophorum angustifolium</i>), meadowsweet. Other wetland species recorded: bottle sedge (<i>Carex rostrata</i>) (LA), redshank (<i>Persicaria maculosa</i>) (LA), water horsetail (F), marsh marigold (<i>Caltha palustris</i>) (LF), greater bird's-foot-trefoil (<i>Lotus pedunculatus</i>) (O-F), marsh thistle (<i>Cirsium palustre</i>) (O-F), soft-rush (O-F), bulrush sp. (<i>Typha</i> sp.) (O), great willowherb (O), jointed rush (O), water mint (<i>Mentha aquatica</i>) (O), marsh cinquefoil (LO), marsh willowherb (O-R), unbranched bur-reed (<i>Sparganium emersum</i>) (O-R), cuckooflower (R), marsh bedstraw (<i>Galium palustre</i>) (R), marsh foxtail (R) and yellow iris (<i>Iris pseudacorus</i>) (R).</p> <p>Grassland species recorded: creeping buttercup (A), crested dog's-tail (F-A), Yorkshire-fog (F-A), common bird's-foot trefoil (F), common sorrel (F), perennial rye-grass (F), silverweed (F), white clover (F), red clover (O), tufted vetch (O), yellow rattle (O) and northern marsh orchid (R).</p>
21	SH 34378 92968	<p>Invasive Non-native Species Two small stands of Japanese knotweed adjacent to a farm track south of Cafnan.</p>
22	SH 34013 92186	<p>Semi-improved Neutral Grassland Two horse-grazed fields, one extremely short and the other long. Some degradation with creeping thistle and other tall species invading. Species recorded: common knapweed (LA), Yorkshire-fog (LA), common bird's-foot-trefoil (F), creeping buttercup (F), crested dog's-tail (F), meadow buttercup (F), ribwort plantain (F), sweet vernal-grass (F), creeping thistle (LF), yellow rattle (LF), white clover (O-F), yarrow (O-F), common mouse-ear (O), creeping cinquefoil (O), common sorrel (O), hogweed (O), red clover (O), selfheal (<i>Prunella vulgaris</i>) (O), common ragwort (O-R), cat's-ear (R) and oval sedge (<i>Carex leporina</i>) (R).</p>
23	SH 34294 92382	<p>Dense riparian vegetation Riparian vegetation often dense along many of the watercourses in the area – some clearly get occasionally managed. Species recorded: great willowherb (A), meadowsweet (A), purple-loosestrife (F), water mint (F), bittersweet (<i>Solanum dulcamara</i>) (O), bur-reed (O), greater bird's-foot-trefoil (O), soft-rush (O), silverweed (LO) and water horsetail (R).</p>
24	SH 34643 92546	<p>Marshy grassland Wet field at Caerdegog Isaf Mosaic of small patches of wetland habitat, including patches of yellow iris, meadowsweet with areas of abundant sweet-grass sp. Other species recorded: creeping buttercup (A), common sedge (LA), jointed rush (LA), soft-rush (A-F), sweet vernal-grass (F), wild angelica (<i>Angelica sylvestris</i>) (F), water mint (LF), cuckooflower (O), lesser spearwort (O), marsh cinquefoil (O), marsh foxtail (O), redshank (O), tufted hair-grass (<i>Deschampsia cespitosa</i>) (O), water horsetail (O), marsh bedstraw (R) and water forget-me-not (<i>Myosotis scorpioides</i>) (R).</p> <p>Along adjacent ditch, dense riparian vegetation (in parts) and in water including meadowsweet (A), great</p>

Target Note	Grid Reference	Description
		willowherb (A), water cress (F), water mint (O), yellow iris (O) and water forget-me-not (R). Some parts are almost entirely meadowsweet.
25	SH 34791 92512 SH 34801 92526 SH 34794 92534	Invasive Non-native Plant Three stands (at least) of Japanese knotweed mixed in with scrub and tall ruderal vegetation. Stands are approximately 1m x 1m, 2m x 2m and 9m x 6m.
26	SH 35123 92160	Marshy Grassland Dominated mainly by soft-rush, but around drain more species-rich and rather swampy. Species recorded: meadowsweet (F), purple-loosestrife (F), sweet-grass (F), water-cress (F), bulrush (O), bur-reed (O), greater bird's-foot-trefoil (R), lesser spearwort (O), water horsetail (O), water mint (O), water forget-me-not (R), and water plantain (<i>Alisma plantago-aquatica</i>) (R).
27	SH 34857 91879	Marshy Grassland Large areas dominated by soft-rush but with other areas where purple moor-grass becomes abundant. Patches of meadowsweet and common cottongrass. On slightly higher (and drier) ground, areas of bramble and western gorse occur. A series of ditches create wetter areas with characteristic species. Species recorded: bottle sedge (LA), jointed rush (F-A), common sorrel (F), creeping buttercup (F), greater bird's-foot-trefoil (F), marsh thistle (F), Yorkshire-fog (F), pennywort (LF), sweet vernal-grass (LF), marsh bedstraw (O), ragged-robin (<i>Silene flos-cuculi</i>) (O), red clover (O), sweet-grass (O), water-cress (O), water mint (O), marsh cinquefoil (O-R), marsh willowherb (O-R), bulrush (R), selfheal (R), star sedge (<i>Carex echinata</i>) (R), tormentil (R), tufted vetch (R) and water forget-me-not (R).
28	SH 34700 91800	Cae Gwyn SSSI Complex area of scrub, acid grassland and rock outcrops, with mires and heath. Full details of the NVC survey can be found in Budd (2013).
29	SH 34802 91439	Dry dwarf shrub heath Area of dense heath and scrub. Access not possible
30	SH 34825 91355	Invasive Non-native Plant Large stand (10m x 5m) of Japanese knotweed at the junction of the A5025 road and the minor road to Bwlch.
31	SH 34978 91600	Semi-improved grassland Species-poor grassland. Species recorded: perennial rye-grass (LD), crested dog's-tail (LA), creeping buttercup (LA), common mouse-ear (LF), creeping bent (LF), marsh foxtail (LF), white clover (LF), Yorkshire-fog (LF), black medick (<i>Medicago lupulina</i>) (O), wall speedwell (<i>Veronica arvensis</i>) (O), Timothy (<i>Phleum pratense</i>) (R), soft-rush (R) and spear thistle (R).
32	SH 34856 91475	Rock-outcrop/grassland mosaic Habitat mosaic with rock outcrops, species-poor semi-improved grassland and acid grassland. Species recorded: Yorkshire-fog (A), creeping bent (<i>Agrostis stolonifera</i>) (LA), English stonecrop (LA), red fescue

Target Note	Grid Reference	Description
		(LA), sweet vernal-grass (LA), sheep's sorrel (LF), cat's-ear (O), common bent (<i>Agrostis capillaris</i>) (O), foxglove (O), bracken (R), heath bedstraw (R), heath wood-rush (<i>Luzula multiflora</i>) (R), tormentil (R) and wood sorrel (R).
33	SH 34908 91563	Marshy grassland Species recorded: soft-rush (LD), creeping bent (LF), jointed rush (LF), marsh foxtail (LF), Yorkshire-fog (LF), creeping buttercup (O), crested dog's-tail (O), cuckooflower (O), greater bird's-foot-trefoil (O), hairy sedge (<i>Carex hirta</i>) (O) and small sweet-grass (<i>Glyceria declinata</i>) (O)
34	SH 34734 91626	Pond Species recorded: bogbean (LA), marsh cinquefoil (LA), marsh bedstraw (LF), soft-rush (LF), water horsetail (LF), common cottongrass (O), lesser spearwort (O), ragged robin (O), tufted forget-me-not (<i>Myosotis laxa</i>) (O) and wild angelica (O).
35	SH 34760 91616	Rock outcrop and dry dwarf shrub heath Fields with a mosaic of acid grassland, dry dwarf shrub heath and rock outcrops. Species recorded: creeping bent (LF), sweet vernal-grass (LF), tormentil (LF), bell heather (O), cat's-ear (O), English stonecrop (O), heath milkwort (O), purple moor-grass (O), sheep's sorrel (O), spring squill (O) and western gorse (O).
36	SH 34790 91718	Fen Extension of fen habitat in Cae Gwyn SSSI. Species recorded: bulrush (LA), common cottongrass (LA), soft-rush (LA), greater bird's-foot-trefoil (LF), false fox-sedge (LF), heath wood-rush (LF), jointed rush (LF), lesser spearwort (LF), marsh pennywort (LF), marsh thistle (LF), ragged robin (LF), tufted forget-me-not (LF), marsh bedstraw (O), water horsetail (O), wild angelica (O) and northern marsh-orchid (R).

**Site Preparation and Clearance
Environmental Statement
Volume 3 – Appendix 14-02
Consultancy Report: NVC Technical
Summary Report**

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Wylfa Newydd

Horizon Nuclear Power (Wylfa) Ltd

Technical Summary Report - National Vegetation Classification

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Contents

Executive Summary	1
1. Introduction	3
1.1 Overview.....	3
1.2 Wylfa Newydd Project	3
1.3 Site Description	3
1.4 Aims and Objectives.....	4
1.5 Summary of Work to Date	4
1.6 Legal Status.....	5
2. Methodology	8
2.1 Desk Study	8
2.2 Field Survey.....	8
2.2.1 National Vegetation Classification (NVC).....	8
2.2.2 DAFOR survey	8
2.2.3 Perennial vegetation of stony banks	9
2.2.4 Uncommon plant species	9
2.2.5 Terminology and identification references.....	9
2.2.6 Data analysis and TABLEFIT	9
2.2.7 Interpretation of results.....	9
2.3 Limitations	9
3. Results	11
3.1 Desk Study	11
3.2 Field Survey.....	13
3.2.1 Site 1 – South-west of Magnox Visitor Centre (from Arup, 2010)	13
3.2.2 Site 2 – South of Porth-y- pistyll (from Arup, 2010).....	15
3.2.3 Site 3 – Wylfa Head South (from Arup, 2010).....	15
3.2.4 Site 4 – East of Porth-y-Wylfa (from Arup, 2010).....	17
3.2.5 Site 5 – South-west of Existing Power Station (from Arup, 2010).....	17
3.2.6 Site 6 – Trwyn Pencarreg and Felin Gafnan (from Arup, 2012).....	19
3.2.7 Site 7 – Wylfa Head, Ty-Croes, north of Tre'r Gof SSSI and Porth-y-wylfa to Penrhyn (from Arup, 2012).....	21
3.2.8 Site 8 – Tre'r Gof SSSI (from Jacobs, 2013b).....	24
3.2.9 Site 9 – Cae Gwyn SSSI (from Jacobs, 2013b)	24
3.2.10 Site 10 – Wylfa Head West (from Jacobs, 2013b)	25
3.2.11 Site 11 – Trwyn Pencarreg (from Arup, 2013)	26
3.2.12 Site 12 – Mynydd Ithel (from Jacobs, 2014).....	26
3.2.13 Site 13 – Groes-fechan heathland (from Jacobs, 2014)	28
3.2.14 Sites 14 to 23 (from Jacobs, 2015)	31
3.2.15 Wylfa Head East.....	33
3.2.16 Uncommon plant species	36

4.	Discussion	39
4.1	Notable Species	39
4.2	Habitats of Conservation Interest	41
4.2.1	Lowland grassland.....	41
4.2.2	Lowland heath	41
4.2.3	Lowland fens	42
4.2.4	Purple moor grass and rush pastures	42
4.2.5	Wet woodland.....	42
4.2.6	Maritime cliff and slopes	42
4.2.7	Perennial vegetation of stony banks	42
5.	Conclusions	46
6.	References	48

Figures

Appendix A. Cofnod Plant Species Records

Executive Summary

Horizon Nuclear Power Wylfa Ltd. (Horizon) is currently planning to develop a new nuclear power station on Anglesey (the Wylfa Newydd Generating Station) as identified in the National Policy Statement for Nuclear Power Generation (EN-6). The Wylfa Newydd Project (the Project) will require a number of applications to be made under different legislation to different regulators. Jacobs UK Ltd (Jacobs) was commissioned to collect baseline data to inform the various applications, assessments and permits that will be submitted for approval to construct and operate the Wylfa Newydd Generating Station.

This report provides a technical summary of the data collected on selected sites of semi-natural habitat identified as having potential nature conservation, especially botanical, interest within the Wylfa Newydd Development Area and from sites within a 500m buffer zone around its boundary (referred to as the study area). These sites were identified during the Phase 1 habitat surveys undertaken in 2009 and 2013 and following feedback from consultation on the Project. The results of all secondary botanical surveys to National Vegetation Classification (NVC) level are provided in this report.

Field surveys took place in 2010, 2012 and each year between 2013 and 2015. Twenty-four sites were surveyed in total with some overlap of boundaries in coastal areas, around Wylfa Head and Trwyn Pencarreg. It is considered that the coverage of these surveys is sufficient to determine the botanical value and sensitivity of all areas of botanical interest within the study area.

No legally protected vascular plant species as listed on Schedule 5 of The Conservation of Habitats and Species Regulations 2010 (as amended) were recorded. Bluebell was recorded and is listed on Schedule 8 of the Wildlife and Countryside Act 1981 (as amended).

No plant species of principal importance as listed according to the requirements of Section 42 of the Natural Environment and Rural Communities (NERC) Act 2006 were recorded. A number of vascular plant species listed in a variety of Local Biodiversity Action Plans from the North Wales region were identified during the surveys, but only marsh fern is specifically referred to in the Anglesey plan. However, several uncommon vascular plant species were found, including adder's-tongue, allseed, chaffweed, heath pearlwort, lesser water plantain, petty whin, sea kale, spring squill, tufted sedge species and yellow bartsia.

The surveys to determine the presence and abundance of perennial vegetation of stony banks also recorded the presence and abundance of sea kale, a notable species of local significance. This was recorded in Porth-y-pistyll and Cemlyn Bay and is a key species of interest for the determination of the relative value of vegetated shingle within the study area. Surveys showed that the abundance was significantly greater at Cemlyn Bay than Porth-y-pistyll, potentially identifying that habitats in the latter site are of much lower quality.

Only native plant species were identified in areas surveyed using the NVC methodology, indicating that areas of potentially greater botanical interest were generally maintained by low impact management regimes and not regularly disturbed.

The majority of vegetation communities identified were reasonably common and widespread in the north and west of the UK. The exceptions were:

- M5 *Carex rostrata* – *Sphagnum squarrosum* and M9 *Carex rostrata* – *Calliergon cuspidatum/giganteum* mire communities at Cae Gwyn Site of Special Scientific Interest (SSSI);
- S2 *Cladium mariscus* swamp and sedge-beds at Tre'r Gof SSSI; and
- SD1 *Rumex crispus* – *Glaucium flavum* shingle community and MC6 *Atriplex prostrata* – *Beta vulgaris* ssp. *maritima* sea-bird cliff community at Porth-y-pistyll and Cemlyn Bay.

These NVC vegetation types are of conservation importance, as identified by Rodwell (2006), and are fragmented with limited distribution across the study area. The majority of these areas of habitat were located outside of the Wylfa Newydd Development Area, and were within designated sites for nature conservation.

The M5 *Carex rostrata* – *Sphagnum squarrosum* and M9 *Carex rostrata* – *Calliergon cuspidatum/giganteum* mire communities were located within Cae Gwyn SSSI, and are both of high value and are legally protected.

The S2 *Cladium mariscus* swamp and sedge-beds were located in Tre'r Gof SSSI, and, therefore, are both of high value and are legally protected. This NVC classification translates into a habitat type listed under Annex 1 of the European Community Directive of the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) (JNCC, 2007) (the Habitat Regulations). Under the Habitats Regulations, the S2 habitat type translates to H7210 Calcareous fens with *Cladium mariscus* and species of *Caricon davalliana*. However, there are not considered to be any European designated sites selected for the presence of this habitat type that would be affected by the Project.

The SD1 *Rumex crispus* – *Glaucium flavum* shingle community and MC6 *Atriplex prostrate* – *Beta vulgaris* ssp. *maritima* sea-bird cliff community similarly translates to an Annex 1 habitat type under the Habitat Regulations. These translate to the H1220 Perennial vegetation of stony banks, and is present at the Cemlyn Bay Special Area of Conservation (SAC), but is not a primary reason for section. However, because it is within the Cemlyn Bay SAC it is legally protected.

Surveys also found small areas of shingle banks in Porth-y-pistyll with habitats that fit the same description as H1220, albeit lacking several key indicator species. These areas were small in extent and so are of limited value in the wider context of the study area and the local area. Porth-y-pistyll is also geographically separated from Cemlyn Lagoon by a distance of approximately 1.2km overland, and the Trwyn Pencarreg headland and Cerrig Briith rocks prevent connectivity of habitats along the coast. It was considered that the separation, geography and the prevailing westerly winds make it unlikely that there are any interactions between the habitats at Porth-y-pistyll that could affect the ecological integrity of the Cemlyn Bay SAC.

The NVC survey results are also interpreted in this report to determine if there are any habitats of principal importance for conservation as listed under the requirements in Section 42 of the NERC Act 2006. As such, seven habitat types were identified within the study area comprising lowland grassland, lowland heaths, lowland fens, purple moor grass and rush pastures, wet woodland, maritime cliffs and slopes, and coastal vegetated shingle (see SD1 *Rumex crispus* – *Glaucium flavum* shingle community and MC6 *Atriplex prostrate* – *Beta vulgaris* ssp. *maritima* sea-bird cliff community).

1. Introduction

This report provides a summary of the data collected on semi-natural habitats of potential botanical and conservation interest to National Vegetation Classification (NVC) level at specified sites within the Wylfa Newydd Development Area and from sites within a 500m buffer zone around its boundary.

1.1 Overview

Horizon Nuclear Power Wylfa Ltd. (Horizon) is currently planning to develop a new nuclear power station on Anglesey as identified in the National Policy Statement for Nuclear Power Generation (EN-6). The Wylfa Newydd Project (the Project) comprises the proposed new nuclear power station (the Wylfa Newydd Generating Station), including the reactors, associated plant and ancillary structures and features, together with all of the development needed to support its delivery, such as highway improvements, worker accommodation and specialist training facilities. The Project will require a number of applications to be made under different legislation to different regulators. As a nationally significant infrastructure project under the Planning Act 2008, the construction and operation must be authorised by a development consent order.

Jacobs UK Ltd (Jacobs) was commissioned by Horizon to undertake a full ecological survey programme within the vicinity of the Power Station Site. This work has included the gathering of baseline data to inform the various applications, assessments and permits that will be submitted for approval to construct and operate the Power Station and Associated Development.

1.2 Wylfa Newydd Project

The Project includes the Wylfa Newydd Generating Station and Associated Development¹. The Wylfa Newydd Generating Station includes two UK Advanced Boiling Water Reactors to be supplied by Hitachi-GE Nuclear Energy Ltd, associated plant and ancillary structures and features. In addition to the reactors, development on the Power Station Site (the indicative area of land and sea within which the majority of the permanent Wylfa Newydd Generating Station buildings, plant and structures would be situated) will include steam turbines, control and service buildings, operational plant, radioactive waste storage buildings, ancillary structures, offices and coastal developments. The coastal developments will include a Cooling Water System (CWS) and breakwater, and a Marine Off-Loading Facility (MOLF).

1.3 Site Description

The Wylfa Newydd Development Area (the indicative areas of land and sea, including the Power Station Site, the Wylfa NPS² Site and the surrounding areas that would be used for the construction and operation of the Wylfa Newydd Generating Station) covers an area of approximately 380ha. It is bounded to the north by the coast and the existing Magnox power station (the Existing Power Station). To the east, it is separated from Cemaes by a narrow corridor of agricultural land. The A5025 and residential properties define part of the south-east boundary, with a small parcel of land spanning the road to the north-east of Treglele. To the south and west, the Wylfa Newydd Development Area abuts agricultural land, and, to the west, it adjoins the coastal hinterland.

The Wylfa Newydd Development Area includes the headland south of Mynydd-y-Wylfa candidate Wildlife Site. There is one designated site for nature conservation within the Wylfa Newydd Development Area: the Tre'r Gof SSSI. It is also within 1km of the Cae Gwyn SSSI, Cemlyn Bay SAC and SSSI, and the Ynys Feurig, the Skerries and Cemlyn Bay Special Protection Area (SPA).

¹ Development needed to support delivery of the Wylfa Newydd Generating Station is referred to as Associated Development. This includes highway improvements along the A5025, park and ride facilities for construction workers, Logistics Centre, Temporary Workers' Accommodation, specialist training facilities, Horizon's Visitor Centre and media briefing facilities.

² The site identified on Anglesey by the National Policy Statement for Energy EN-6/NPS EN-6 as potentially suitable for the deployment of a new nuclear power station.

Tre'r Gof is a small basin mire adjacent to the Existing Power Station, west of Cemaes. The area receives mineral-enriched waters from the surrounding boulder clay leading to the development of notable flora. The botanical interest provides the reason for the designation of the site as an SSSI.

Cae Gwyn SSSI is located immediately to the south of the site to the west of Llanfechell. The site comprises two wetland areas separated by an outcrop of rock with heathland vegetation. The southern wetland is confined by a rock basin and is dominated by bogmoss (*Sphagnum* spp.) and a wide variety of common wetland herbs. The northern wetland has a different flora containing denser areas of willow (*Salix* spp.) and common reed (*Phragmites communis*).

1.4 Aims and Objectives

The purpose of this technical summary report is to provide a single resource regarding all NVC field survey data and background data available for the semi-natural habitats of potentially greater botanical and conservation interest present within the study area. This will then be used to inform the various applications, assessments and permits required for development of the Wylfa Newydd Generating Station.

This includes supporting the Ecological Chapter of the Environmental Impact Assessment (EIA) and Habitats Regulation Assessments (HRAs). For HRA elements, the need for surveys of habitats in the study area potentially similar to those nearby that are designating features of European protected sites was also required. Specifically, this included a survey to establish the extent of any habitats with similarities to those present in Cemlyn Bay SAC. This would determine if there were any pathways for interaction between habitats that would be affected within the study area, which could be deleterious to the selection features present. Specific surveys for the Annex I³ habitat type H1220 perennial vegetation of stony banks were therefore undertaken in 2015.

1.5 Summary of Work to Date

Vegetation surveys of selected sites within the study area have taken place in 2010 and 2012 by Arup ecologists and then by Jacobs ecologists in 2013, 2014 and 2015. The surveyed sites during this time have been allocated a number with the location of each shown in Figure 1.1 and Figure 1.2.

The 2010 surveys were carried out in grassland habitats at five sites (Arup, 2010):

- Site 1 – An area south-west of Magnox Visitor Centre;
- Site 2 – An area of coastal grassland south of Porth-y-pistyll;
- Site 3 – Wylfa Head South;
- Site 4 – Cliff-top vegetation east of Porth-y-Wylfa; and
- Site 5 – An area south-west of the Existing Power Station.

The Arup 2012 surveys comprised 145 quadrats at two sites (Arup, 2012):

- Site 6 – Trwyn Pencarreg and Felin Gafnan; and
- Site 7 – Wylfa Head, Ty Croes, north of Tre'r Gof SSSI and Porth-y-Wylfa to Penrhyn.

The locations of the Jacobs surveys were determined by the findings from the Phase 1 habitat survey completed in 2013 (Jacobs, 2013a). The survey sites were:

- Site 8 – Tre'r Gof SSSI;
- Site 9 – Cae Gwyn SSSI;
- Site 10 – Wylfa Head West; and
- Site 11 – Trwyn Pencarreg.

³ EC Habitats Directive (92/43/EEC)

The 2014 survey locations were also identified during the Phase 1 habitat survey completed in 2013 (Jacobs, 2013a). These were:

- Site 12 – Mynydd lthel (three fields); and
- Site 13 – Groes-fechan heathland.

The 2015 survey sites (Jacobs, 2015) were selected following feedback on the Preliminary Environmental Information Report as part of the Pre-application Consultation for the Project. Specifically, Natural Resources Wales (NRW) and the Isle of Anglesey County Council (IACC) raised concerns that areas of vegetation similar to those present at Cemlyn Bay were present in the study area and could be affected by the Project. Primarily, the vegetation type of interest that could be present is H1220 perennial vegetation of stony banks. This is an Annex I habitat present at Cemlyn Bay SAC as a qualifying feature, although not a primary reason for the site's designation. Concerns were also raised regarding the distribution of sea kale (*Crambe maritima*) in the study area because of the importance of the presence of the species when classifying vegetation types on shingle banks. Furthermore, NRW and the IACC did not consider that the level of detail on the communities present on Wylfa Head was acceptable. This included determination of the presence of coastal heath on Wylfa Head, a habitat that is a characteristic feature of the Wylfa Head candidate Wildlife Site.

The following locations were therefore surveyed to provide a finer level of detail in habitats that could support the community and species mentioned previously:

- Sites 14a-14c – Cemlyn Bay to Cerrig Brith;
- Site 15 – Cerrig Brith;
- Sites 16a-16e – Porth-y-Felin;
- Sites 17a-17g – Porth-y-pistyll;
- Sites 18a-18b – West of Existing Power Station;
- Sites 19a-19b – Wylfa Head Coast;
- Site 20 – Porth yr Ogof;
- Site 21 – Porth yr Ogof to Porth-y-Wylfa;
- Site 22 – Porth-y-Wylfa;
- Site 23 – Porth-y-Wylfa to Penrhyn; and
- Site 24 – Wylfa Head East⁴.

1.6 Legal Status

Protection of plant species at the European level in Great Britain is covered by The Conservation of Habitats and Species Regulations 2010 (as amended), with nine wild plant species listed on Schedule 5.

The legislative provisions in Great Britain for the protection of wild plants are contained primarily in Section 13 of the Wildlife and Countryside Act 1981 (as amended) with protected wild plants listed on Schedule 8. These pieces of legislation make it an offence to intentionally pick, uproot or destroy specific species.

Section 42 of the NERC Act 2006 lists the habitats and species of principal importance for conservation in Wales. Although not specifically legally protected, these habitats and species are material considerations in planning applications. There are 77 species of vascular plants included on Section 42.

⁴ Wylfa Head was surveyed in 2013 (Jacobs, 2013a). The habitats across Wylfa Head East have historically been very varied as shown in previous surveys by Arup (2012) and Jacobs (2013a), and this variety of habitats reduces the efficacy of NVC as a survey methodology. As such, 10 additional quadrats were surveyed in 2015.

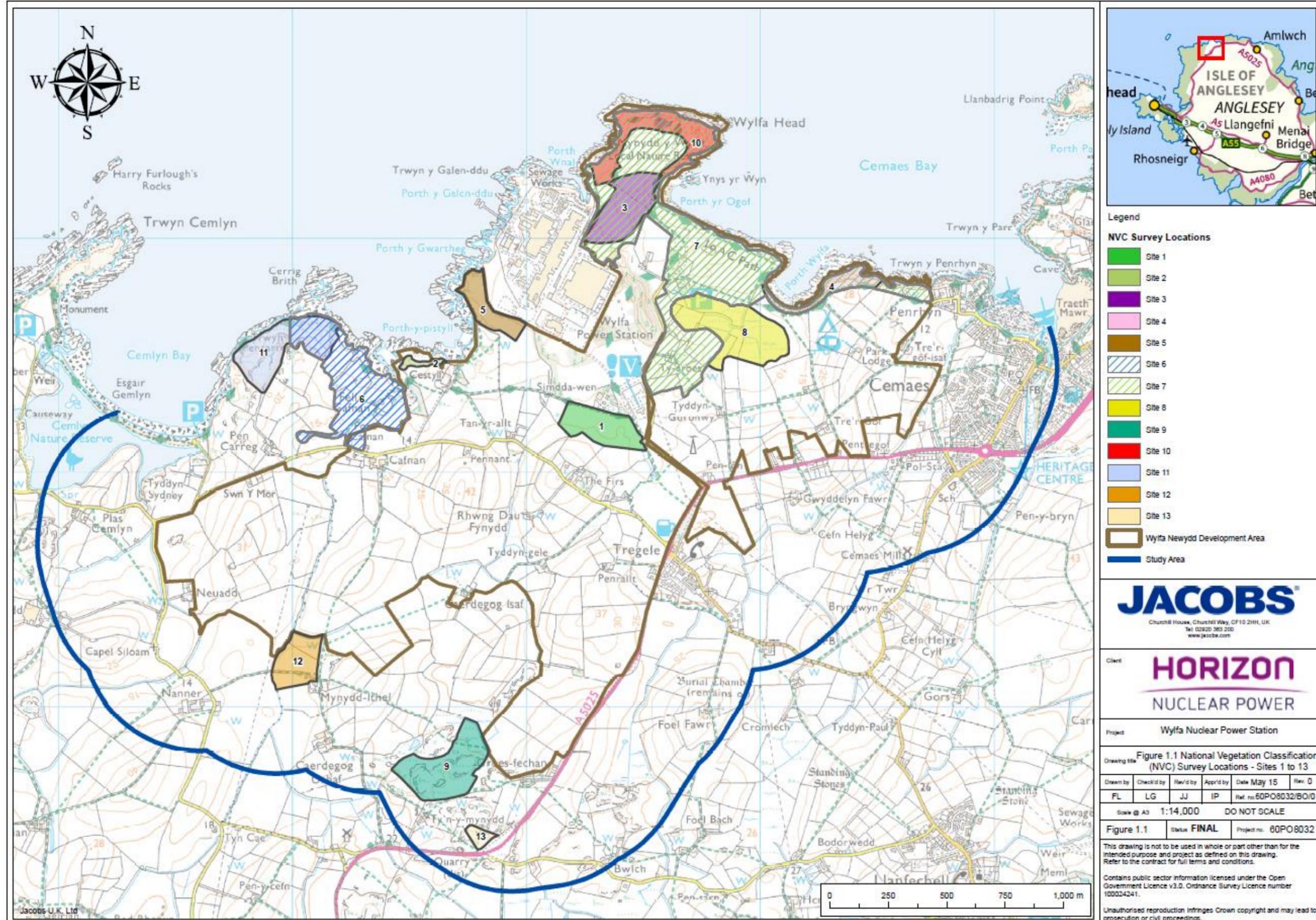


Figure 1.1 National Vegetation Classification (NVC) Survey Locations – Sites 1 to 13

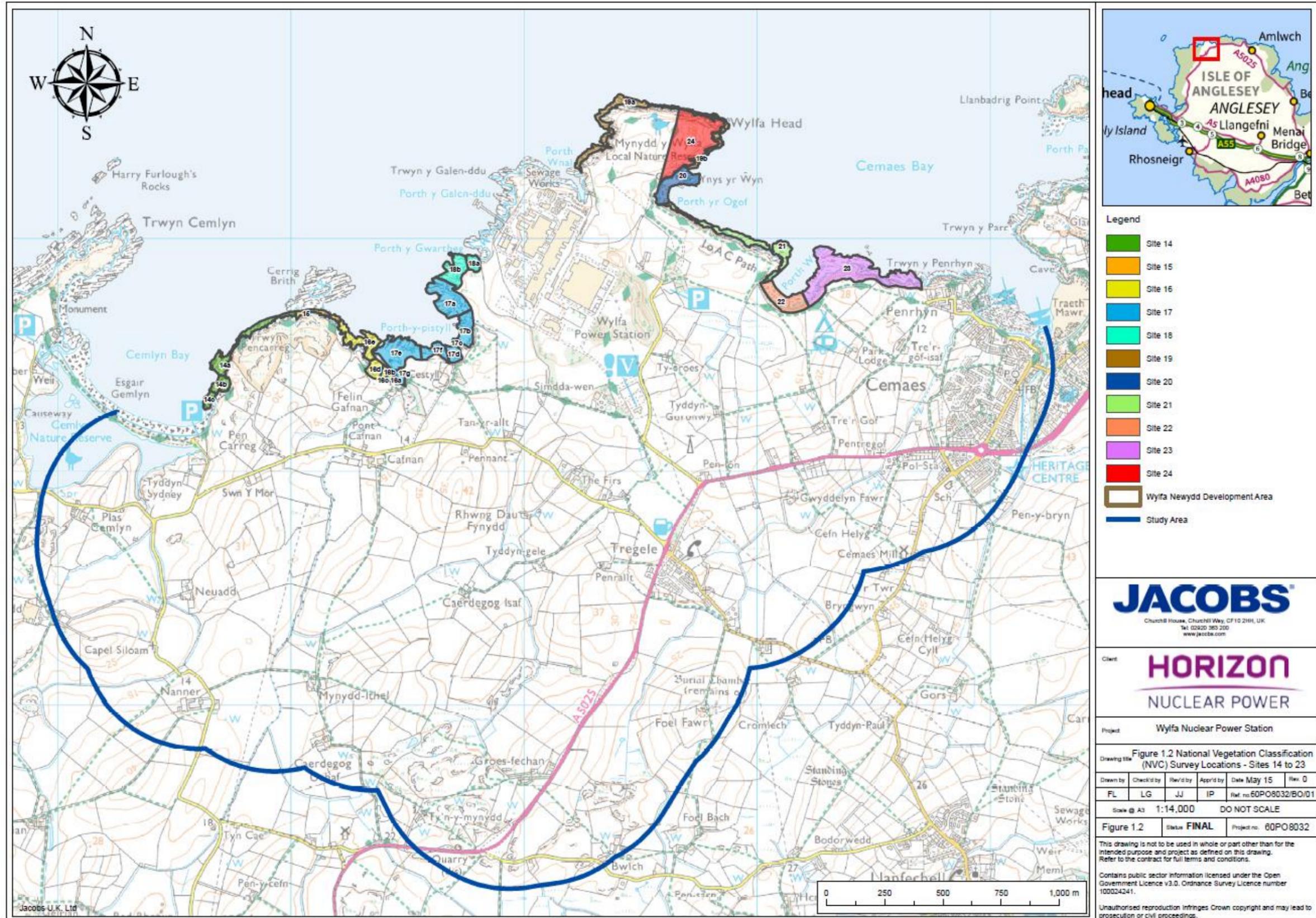


Figure 1.2 National Vegetation Classification (NVC) Survey Locations – Sites 14 to 24

2. Methodology

2.1 Desk Study

A background data search was requested from Cofnod (North Wales Environmental Information Service) and included all species records, including notable plant species, within 2km of the study area. Notable species are those with legal protection or that are listed in policy documents or conservation lists. This dataset was searched for any historic records of notable or protected plant species that had not been found during the surveys, and to provide information to support the determination of the relative value and sensitivities of the habitats present.

2.2 Field Survey

Habitats and plant communities of potentially higher botanical and conservation interest were surveyed. These were identified following Phase 1 habitat surveys (Arup, 2009 and Jacobs, 2013a). A combination of quadrats based on the NVC approach and DAFOR surveys (dominant, abundant, frequent, occasional and rare) were undertaken. This provided a greater degree of flexibility to surveyors and therefore facilitated a much more accurate interpretation of habitat types to be made.

Surveyed sites were visited as follows (see Figure 1.1 and Figure 1.2):

- Sites 1 to 5 – August 2010;
- Sites 6 and 7 – July 2012;
- Sites 8 to 11 – July 2013;
- Sites 12 and 13 – June 2014; and
- Sites 14 – 24 June 2015.

2.2.1 National Vegetation Classification (NVC)

The NVC survey method followed that described by Rodwell (2006) based on a sample of 2m x 2m quadrats. All plant species and their relative abundances were recorded from each quadrat. Where possible, a minimum of five quadrats were completed in each site recorded.

2.2.2 DAFOR survey

The DAFOR survey methodology was only used where there was an area of habitat too small in extent for the NVC method to be practical or where there was a larger area of habitat considered to be relatively unimportant ecologically. The quantitative values for vegetation cover known as the DAFOR scale and the relationship to NVC frequency classes are provided in Table 2.1.

Table 2.1 DAFOR Scale

DAFOR rating	Description	NVC Frequency Class	Percentage cover	Percentage cover entered into Tablefit
D	Dominant	V	81% - 100%	90%
A	Abundant	IV	61% - 80%	70%
F	Frequent	III	41% - 60%	50%
O	Occasional	II	21% - 40%	30%
R	Rare	I	1% - 20%	10%

2.2.3 Perennial vegetation of stony banks

As described in Section 1.5, surveys were completed in 2015 in order to determine the presence or absence of perennial vegetation of stony banks as a characteristic (but not designating feature) of the nearby Cemlyn Bay SAC. The potential for perennial vegetation of stony banks was identified using standard NVC methods described above. This was completed in all coastal areas that could support this vegetation type as shown in Figure 1.2.

2.2.4 Uncommon plant species

During the 2015 surveys to determine the presence of perennial vegetation of stony banks, any occurrence of sea kale, sea radish (*Raphanus raphanistrum* ssp. *maritimus*), brackish water-crowfoot (*Ranunculus baudotii*) and beaked tasselweed (*Ruppia maritima*) were recorded and mapped individually. These were recorded, as they are characteristic of the perennial vegetation of stony banks Annex 1 habitat.

2.2.5 Terminology and identification references

The terminology for vascular plant and bryophyte species identified follows those of Mapmate Version 2.4.0., Stace (2010), and Atherton *et al.* (2010) for bryophytes (liverworts and mosses).

2.2.6 Data analysis and TABLEFIT

The analysis of the data from the NVC surveys primarily used the botanical and vegetation science expertise of the ecologist who undertook the work. Plant community NVC types were identified using the binomial keys of Rodwell (1998a and 1998b) with TABLEFIT software (Hill, 1996) being used to confirm identification where necessary.

For the TABLEFIT analysis, only the commoner species recorded were entered into the software to ensure a high value for the key coefficient of 'goodness-of-fit'. The 'goodness-of-fit' is an index which allows vegetation types to be graded depending on the degree of similarity between the sampled area and known plant communities (Hill, 1996). Only those species with a frequency class of III, IV or V were entered into TABLEFIT or any other species showing a maximum Domin Value⁵ >6 (corresponding to greater than 25% vegetation cover).

2.2.7 Interpretation of results

In some cases, the NVC survey sites in the study area overlap. This is due to the purpose of surveys varying between years and habitats changing over time. Therefore, where there is complete overlap in a particular area, only the most up-to-date survey information is provided, as this will be used to determine the value and sensitivity of that area. This applies to many of the coastal sites resurveyed in 2015 that supersede previous survey data.

For all of the survey sites, an evaluation of the importance of both the identified NVC communities and of individual nationally uncommon species was undertaken. In each case, this included an evaluation of both their national and regional significance.

2.3 Limitations

Site 1 – The areas had been mown in the days preceding the survey meaning quadrat samples were not possible. Cut vegetation had been left and some identification of species was therefore possible. However, there were contiguous uncut areas along the northern margin of the site, and it is unlikely that these were significantly different or of greater botanical interest.

⁵ Domin scale percentage vegetation coverage used as follows: 10 = 91%-100%, 9 = 76%-90%, 8 = 51%-75%, 7 = 34%-50%, 6 = 26%-33%, 5 = 11%-25%, 4 = 4%-10%, 3 = <4% (many individuals), 2 = <4% (several individuals), 1 = <4% (few individuals).

Site 4 – High winds at the time of the survey of Site 4 meant that it was not mapped or sampled. However, the vegetation was surveyed in detail, and confidence in that description as being representative of the habitat is high.

Site 9 – Only part of the site could be accessed due to landowner access constraints, as shown in Figure 3.9. However, these areas were visible from nearby and appeared to consist of scrub or bare rock. This was supported by aerial images. Therefore, it is considered that these inaccessible areas were not significant in determining the ecological value of the site.

Sites 14 to 23 – Access to some coastal habitats was restricted due to steep rock faces, which prevented full survey. This is not considered to have significantly affected results.

3. Results

3.1 Desk Study

A total of 256 records of 112 different vascular plant species within 2km of the study area were provided by Cofnod. Full details are provided in Appendix A and shown on Figure 3.1.

Figure 3.1 includes references to UK Biodiversity Action Plan (UK BAP) species. This has since been replaced by the UK post-2010 Biodiversity Framework whereby the conservation status of the UK BAP species was devolved to England, Northern Ireland, Scotland and Wales respectively rather than a UK-wide approach. In Wales the strategy that has been adopted has been the transfer of the species and habitats listed under the defunct UK BAP to being listed under the responsibilities of Section 42 of the NERC Act (described above). However, many of the tools and resources originally developed under the UK BAP still remain of use, including background information on UK BAP priority habitats and species which form the basis of county level biodiversity protection initiatives e.g. LBAPs.

Notable vascular plants with legal protection under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) were: bluebell (*Hyacinthoides non-scripta*); pedunculate sea-purslane (*Atriplex pedunculata*), which was recorded before 1990 in Cemaes and is now found only in Essex coastal fringes; and peacock's tail (*Padina pavonica*). Peacock's-tail is a marine brown algae and would not have been encountered in the habitats surveyed.

Twenty-one records of notable vascular plant species were provided by Cofnod from within the Wylfa Newydd Development Area. Of these, eight have been recorded in the last 20 years:

- hoary ragwort (*Senecio erucifolius*) near Cemaes;
- lesser tussock-sedge (*Carex diandra*), early marsh-orchid (*Dactylorhiza incarnata subsp. pulchella*) and marsh fern (*Thelypteris palustris*) at Tre'r Gof;
- petty whin (*Genista anglica*), allseed (*Radiola linoides*) and vervain (*Verbena officinalis*) on Wylfa Head; and
- pale flax (*Linum bienne*) at the Existing Power Station.

These species are notable for being Red Data Book species⁶ or having LBAPs in the North Wales region. Of these, only marsh fern is listed on the Anglesey LBAP, with the rest having neighbouring county LBAPs only.

⁶ In addition to the classifications above, the background data search refers to those species that are listed in Red Data Books. The Red Data Book system was initiated by the International Union for Conservation of Nature (IUCN) in 1996. The books deal with many plants, fungi and animals at a global, country and regional scale. The aim has been to identify those species at greatest risk of extinction and to identify the factors responsible in order to inform conservation approaches. Species are classified according to their breeding status within each site and by their conservation status.

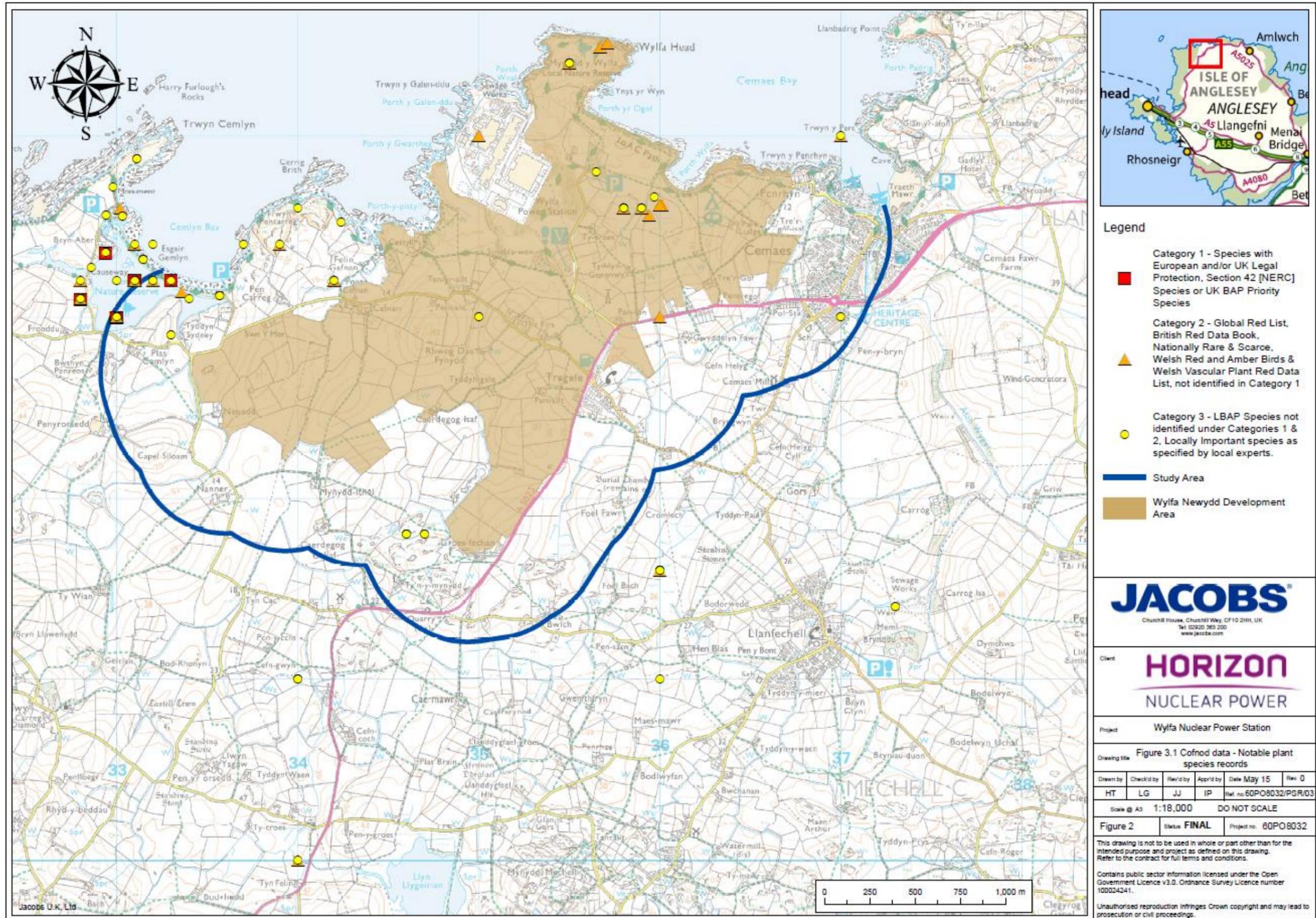


Figure 3.1 Cofnod data – Notable plant species

3.2 Field Survey

Sites 1 to 13 are inland habitats, which are all located at least 50m from the approximate mean high-tide mark. Habitats recorded include mesotrophic, acid and coastal grasslands, heathland, rush pastures, mire, fen and swamps and wet woodland and scrub.

Coastal habitats within 50m of the approximate mean high-tide mark are discussed in the coastal habitats site descriptions in Section 3.2.14.

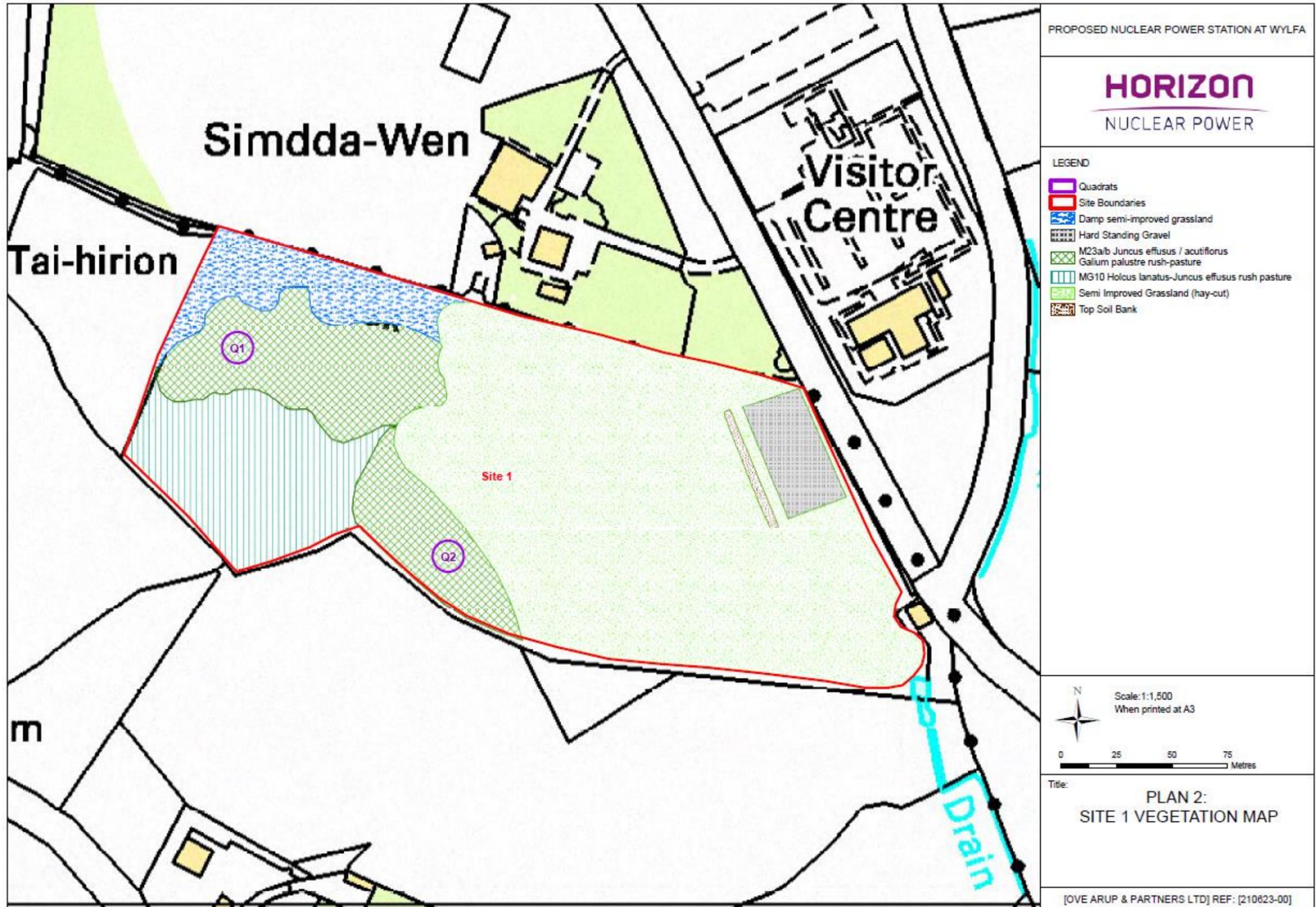
3.2.1 Site 1 – South-west of Magnox Visitor Centre (from Arup, 2010)

From examination of cut hay, the main grass species appeared to be cock's-foot (*Dactylis glomerata*), common bent grass (*Agrostis capillaris*) and Yorkshire fog (*Holcus lanatus*). Herbs included black knapweed (*Centaurea nigra*) and creeping buttercup (*Ranunculus repens*). Soft rush (*Juncus effusus*) became more prominent in the hay along the southern margin of this area.

The level, central area on the western side of the site was dominated by tall (approximately 1m high) soft rush and has been classified as M23 *Juncus effusus/acutiflorus* – *Galium palustre* rush pasture. The number of other species recorded in this area was very low with constant species including greater bird's-foot trefoil (*Lotus pedunculatus*), compact rush (*Juncus conglomeratus*), silverweed (*Potentilla anserina* now *Argentina anserina*), velvet bent grass (*Agrostis canina*) and hairy sedge (*Carex hirta*). The typical species marsh bedstraw (*Galium palustre*) was not recorded within the stand. The classification of this stand into one of the two sub-communities was not attempted, as the division between them is hard to fix; however, the species present indicated that the vegetation would be more likely to fit with the M23a *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus acutiflorus* sub-community.

As the land rises to the south, the vegetation grades into a grassier sward classified as MG10 *Holcus lanatus* – *Juncus effusus* rush pasture. The vegetation here was characterised by creeping buttercup, greater bird's-foot trefoil, compact rush, Yorkshire fog and sweet vernal grass (*Anthoxanthum odoratum*).

A further area of M23 *Juncus effusus* – *Galium palustre* rush pasture was identified on the relatively steep bank on the southern boundary. This vegetation was more diverse than the other M23 vegetation on the site. Soft rush and compact rush were abundant, with a high proportion of grasses including common bent, sweet vernal grass and Yorkshire fog. Characteristic herbs included greater bird's-foot trefoil, meadow vetchling (*Lathyrus pratensis*), black knapweed and creeping cinquefoil (*Potentilla reptans*). The community showed some affinities with the MG10 community description in Rodwell (1998a), but M23 is considered the better fit because of the herb species recorded. Figure 3.2 is an extract from the Arup report (Arup, 2010) illustrating the communities of interest.



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Figure 3.2 Site 1 – Vegetation Map (from Arup, 2010)

3.2.2 Site 2 – South of Porth-y- pistyll (from Arup, 2010)

Site 2 comprised a narrow fringe of grassland on a coastal headland (Figure 1.1), on the edge of a larger enclosure of agriculturally improved grassland. The majority of the grassland was of limited size and interest and did not warrant mapping or sampling. This area was characterised by red fescue (*Festuca rubra*), Yorkshire fog, perennial rye grass, common bent and cock's-foot. Forb species included mouse-ear (*Cerastium fontanum*), yarrow (*Achillea millefolium*), ribwort plantain (*Plantago lanceolata*) and tufted vetch (*Vicia cracca*).

The eastern extremity of Site 2 included a small (less than 20m x 10m) stand which was sampled and attributable to the MC10c *Festuca rubra* – *Plantago* spp. maritime grassland, *Schoenus nigricans* sub-community. Red fescue, ribwort plantain and buck's-horn plantain (*Plantago coronopus*) were constants with fen species, notably saw-wort (*Serratula tinctoria*), devil's-bit scabious (*Succisa pratensis*), heath grass (*Danthonia decumbens*) and carnation sedge (*Carex panicea*) also present. Maritime species quickly dropped out of the vegetation away from the rocky foreshore, with an increase in purple moor-grass (*Molinia caerulea*).

3.2.3 Site 3 – Wylfa Head South (from Arup, 2010)

This site comprised the southern half of a large enclosure bounded to the north by the Wylfa Head candidate Wildlife Site with the Existing Power Station grounds and infrastructure to the south and west (Figure 1.1). Agricultural land and the coastline bordered the area to the east. The southern half of the enclosure was gently sloping with a north-easterly aspect, before the land rose up toward Wylfa Head with a south-westerly aspect.

The northern part of the enclosure was largely agriculturally improved grassland, with small rock exposures vegetated with scrub comprising gorse (*Ulex europaeus*), and short unimproved grassland. The southern limit of this agricultural improvement appeared very distinct both on the ground and from available aerial photography (see Figure 3.3).

The southern part of the enclosure was best described as MG5a *Cynosurus cristatus* – *Centaurea nigra* grassland, *Lathyrus pratensis* subcommunity. Constant species in this community included crested dog's tail (*Cynosurus cristatus*), bird's-foot trefoil (*Lotus corniculatus*), black knapweed, red fescue and ribwort plantain. The species and their abundances made this vegetation a very good fit with the community description in Rodwell (1998a).

Species indicative of agricultural improvement were present only at low frequencies. A small area of shallower soils on rock exposures to the south of site had a shorter turf with species indicative of base-rich conditions, e.g. burnet saxifrage (*Pimpinella saxifraga*) and pale flax (*Linum bienne*). Small, isolated patches of semi-improved grassland were present, mostly associated with taller vegetation in and around patches of gorse scrub. The northern part of the site may be cut for hay/silage, but this does not extend to the southern area. It is likely that this area is open to any aftermath grazing as part of the larger enclosure. Figure 3.3 is an extract from the Arup report (Arup, 2010) detailing this range of vegetation recorded at the site.

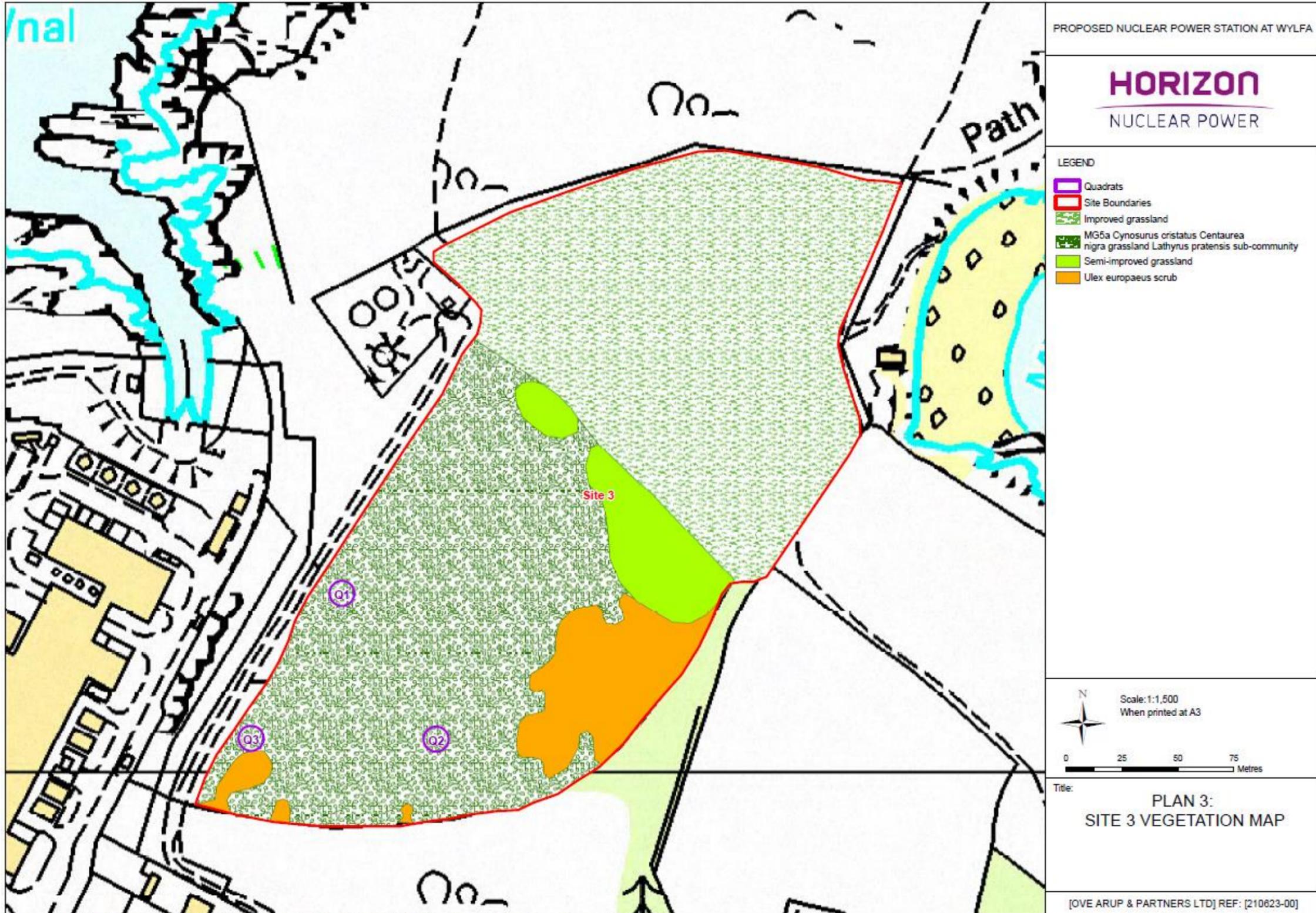


Figure 3.3 Site 3 – Vegetation Map (from Arup, 2010)

3.2.4 Site 4 – East of Porth-y-Wylfa (from Arup, 2010)

Data recorded at Site 4 in 2010 (Arup, 2010) has been superseded by the 2015 survey and is covered in the descriptions of Sites 22 and 23, given in Section 3.2.14.

3.2.5 Site 5 – South-west of Existing Power Station (from Arup, 2010)

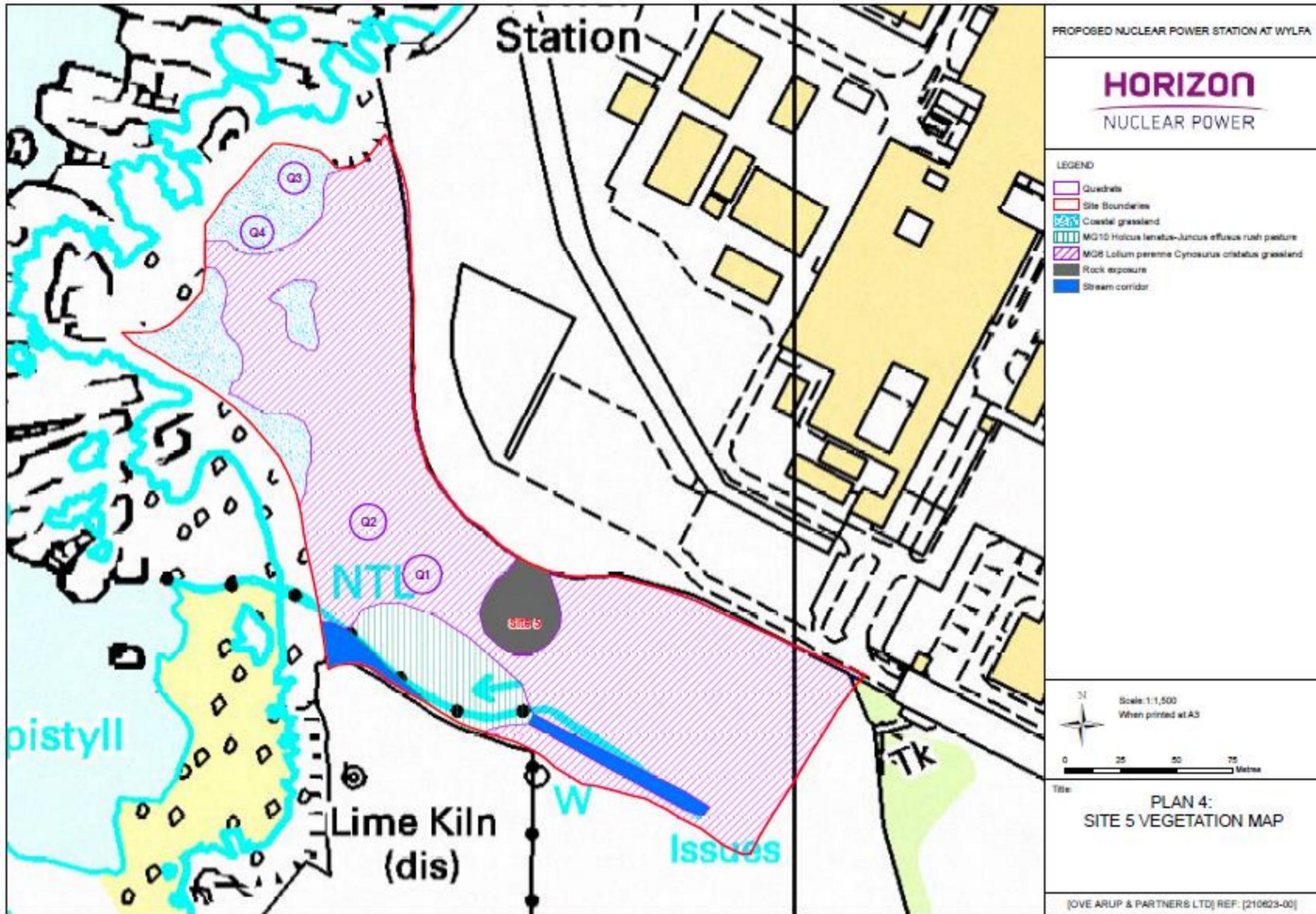
Site 5 is adjacent to the south-west corner of the Existing Power Station boundary (Figure 1.1). The area is part of a larger enclosure vegetated by species-poor, semi-improved grassland extending to the south. The land dips gently to the south and west, with a small stream draining from the east to the beach. The western half of the site is undulating, with several small rock outcrop plateaux.

The majority of the site is best classified as MG6 *Lolium perenne* – *Cynosurus cristatus* grassland. Perennial rye grass was the most abundant grass, and common bent, Yorkshire fog and crested dog's tail were also present. Constant forb species recorded were white clover (*Trifolium repens*), ribwort plantain, cat's ear (*Hypochaeris radicata*) and daisy (*Bellis perennis*). There were areas where bird's-foot trefoil was locally frequent (a species indicative of less nutrient-rich communities), but other constant grass and forb species clearly place this vegetation within the MG6 community.

This vegetation gave way to short-turf vegetation and areas of bare rock on the small plateau. Immediately above the rock headland of the coast, the MG6 community was transitional toward a narrow fringe of remnant maritime grassland with frequent red fescue, buck's-horn plantain and a variety of poor-fen species, including heath grass, devil's-bit scabious, and tormentil (*Potentilla erecta*). This vegetation did not fit well with any one of the NVC community descriptions. From the range of species, the area was considered to have been partially improved through agricultural management and described as a degraded example of the MC10c *Festuca rubra* – *Plantago* spp. maritime grassland, *Schoenus nigricans* sub-community.

A small area of waterlogged ground associated with the stream was mapped on the southern boundary of the site. The area was disturbed by grazing livestock, with evidence of poaching. Constant species included compact rush, Yorkshire fog, creeping buttercup, hairy willowherb (*Epilobium hirsutum*), cuckoo flower (*Cardamine pratensis*), silverweed and chickweed. This vegetation was not sampled due to the small size of the area, but has been tentatively assigned to the MG10 *Holcus lanatus* – *Juncus effusus* rush pasture community.

Figure 3.4 is an extract from the Arup report (Arup, 2010) detailing the range of vegetation recorded at the site.



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Figure 3.4 Site 5 – Vegetation Map (from Arup, 2010)

3.2.6 Site 6 – Trwyn Pencarreg and Felin Gafnan (from Arup, 2012)

Site 6 (Figure 1.1) was dominated by MG5 *Cynosurus cristatus* – *Centaurea nigra* grassland, also present was MG6 *Lolium perenne* – *Cynosurus cristatus* grasslands, rocky outcrops, scrub and U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland. The northern areas contained high quality H8d *Calluna vulgaris* – *Ulex gallii* heath, *Scilla verna* sub-community with dwarf shrubs, mainly heather (*Calluna vulgaris*), bell heather (*Erica cinerea*) and western gorse (*Ulex gallii*) and coastal habitats that were characterised by the presence of MC8 *Festuca rubra* – *Armeria maritima* and MC9 *Festuca rubra* – *Holcus lanatus* maritime grassland communities. Wetter (freshwater) vegetation communities were inland with M25 *Molinia caerulea* – *Potentilla erecta* mire found to the north of the site with cross-leaved heath (*Erica tetralix*) and creeping willow (*Salix repens*) and S27 *Carex rostrata* – *Potentilla palustris* tall-herb fen with tufted clubrush (*Isolepis cernua*) recorded to the south.

Full details are shown in Figure 3.5 which is an extract from the Arup report (Arup, 2012) detailing the range of vegetation communities recorded at the site.

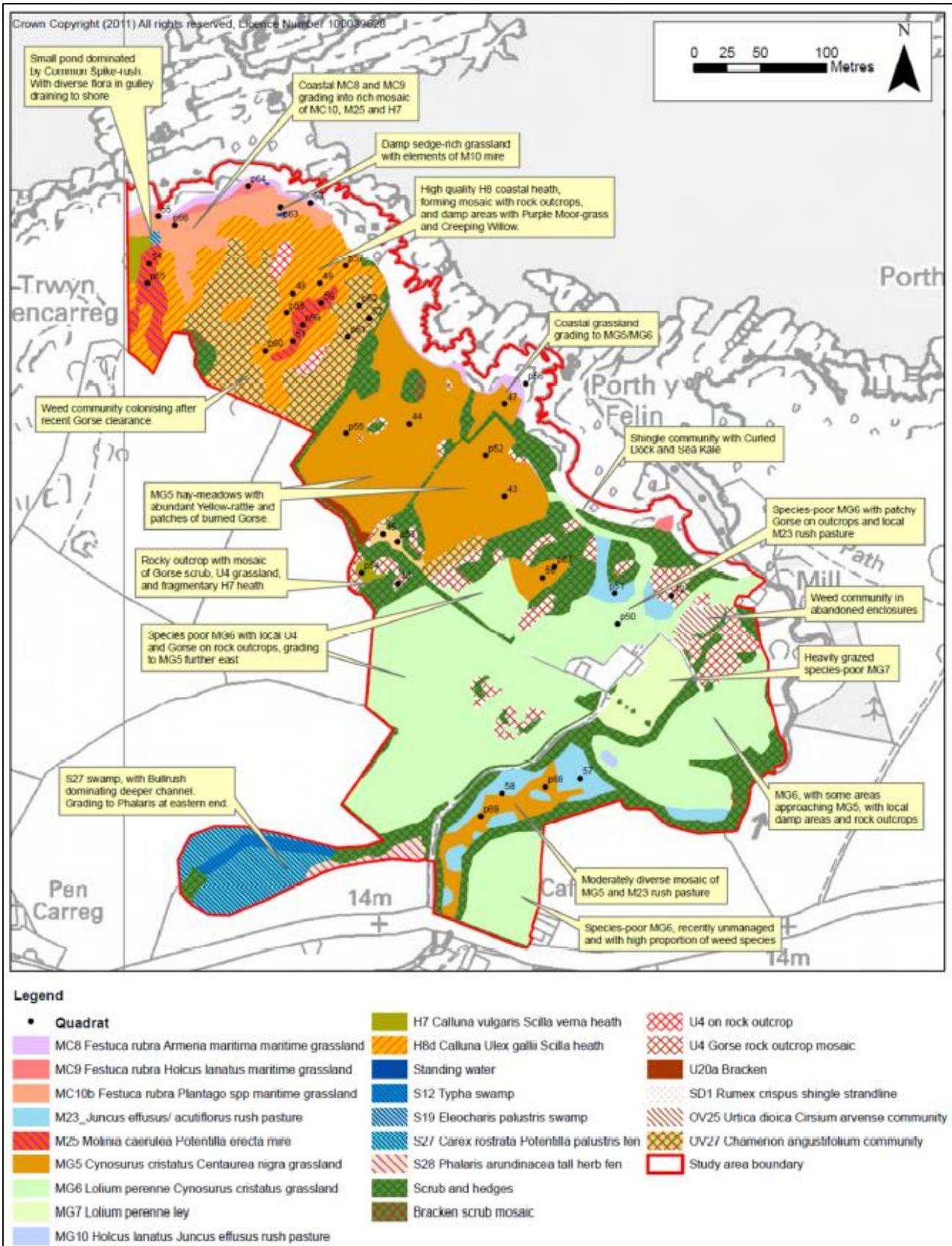


Figure 3.5 Site 6 – Vegetation Map (from Arup, 2012)

3.2.7 Site 7 – Wylfa Head, Ty-Croes, north of Tre'r Gof SSSI and Porth-y-wylfa to Penrhyn (from Arup, 2012)

Site 7 is a large area east of the Existing Power Station and includes:

- fields south-west of Tre'r Gof around the demolished property called Ty-Croes;
- fields north of Tre'r Gof SSSI;
- Wylfa Head; and
- Wylfa Head South.

These areas have been surveyed numerous times, and, as a result, there is overlap between Sites 3, 10 and 24, and 2015 coastal habitat sites 19a, 19b, 20, 21 and 22. The description below therefore only includes those areas that have not been covered by descriptions of the latter sites, i.e. fields around Ty-Croes, fields north of Tre'r Gof and inland areas of Wylfa Head.

The fields around Ty-Croes (Figure 3.6) were consistent with pasture grazing in the area with MG5 *Cynosurus cristatus* – *Centaurea nigra*, MG6 *Lolium perenne* – *Cynosurus cristatus* and MG7 *Lolium perenne* leys, and MG10 *Holcus lanatus* – *Juncus effusus* rush pasture in damper areas. M23 *Juncus effusus* – *Juncus acutiflorus* rush pasture was recorded in the very wet grassy areas. Rocky outcrops and disturbed areas were characterised by U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland and OV25 *Urtica dioica* – *Cirsium arvense*, respectively.

Fields north of Tre'r Gof SSSI (Figure 3.7) comprised a large expanse of MG6 *Lolium perenne* – *Cynosurus cristatus* grassland grading out to low diversity MG5 *Cynosurus cristatus* – *Centaurea nigra* and variants of MC9 *Festuca rubra* – *Holcus lanatus* maritime grassland communities on the coastal fringes (see Sites 19a, 19b, 20, 21 and 22 (Section 3.2.14)). An area of MG1 *Arrhenatherum elatius* grassland and W24 *Rubus fruticosus* – *Holcus lanatus* underscrub was located to the west and M22/M23 fen-meadow/rush pasture mosaic was recorded along the southern boundary.

Data recorded on coastal habitats at Wylfa Head in 2012 (Arup, 2012) have been superseded by more recent surveys undertaken in 2015 and are discussed in Section 3.2.15. Wylfa Head comprised a mosaic of bracken (*Pteridium aquilinum*), bramble (*Rubus fruticosus* agg.) and blackthorn (*Prunus spinosa*) with a narrow MC9 *Festuca rubra* – *Holcus lanatus* maritime grassland community at its base.

Wylfa Head South is described in greater detail as Site 3 in Section 3.2.3 and is omitted from the description of Site 7.

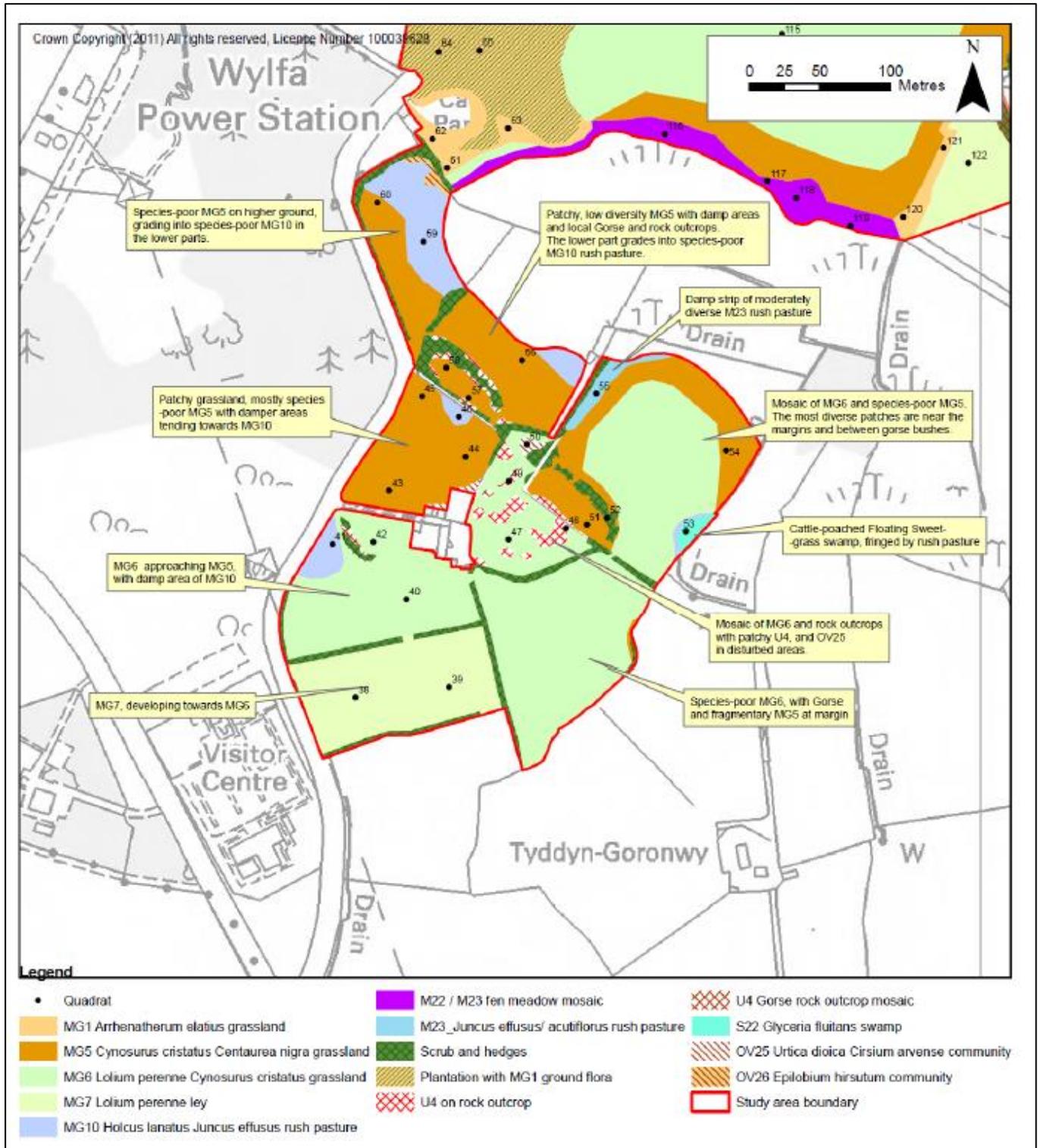


Figure 3.6 Site 7 – Ty-Croes Vegetation Map (from Arup, 2012)

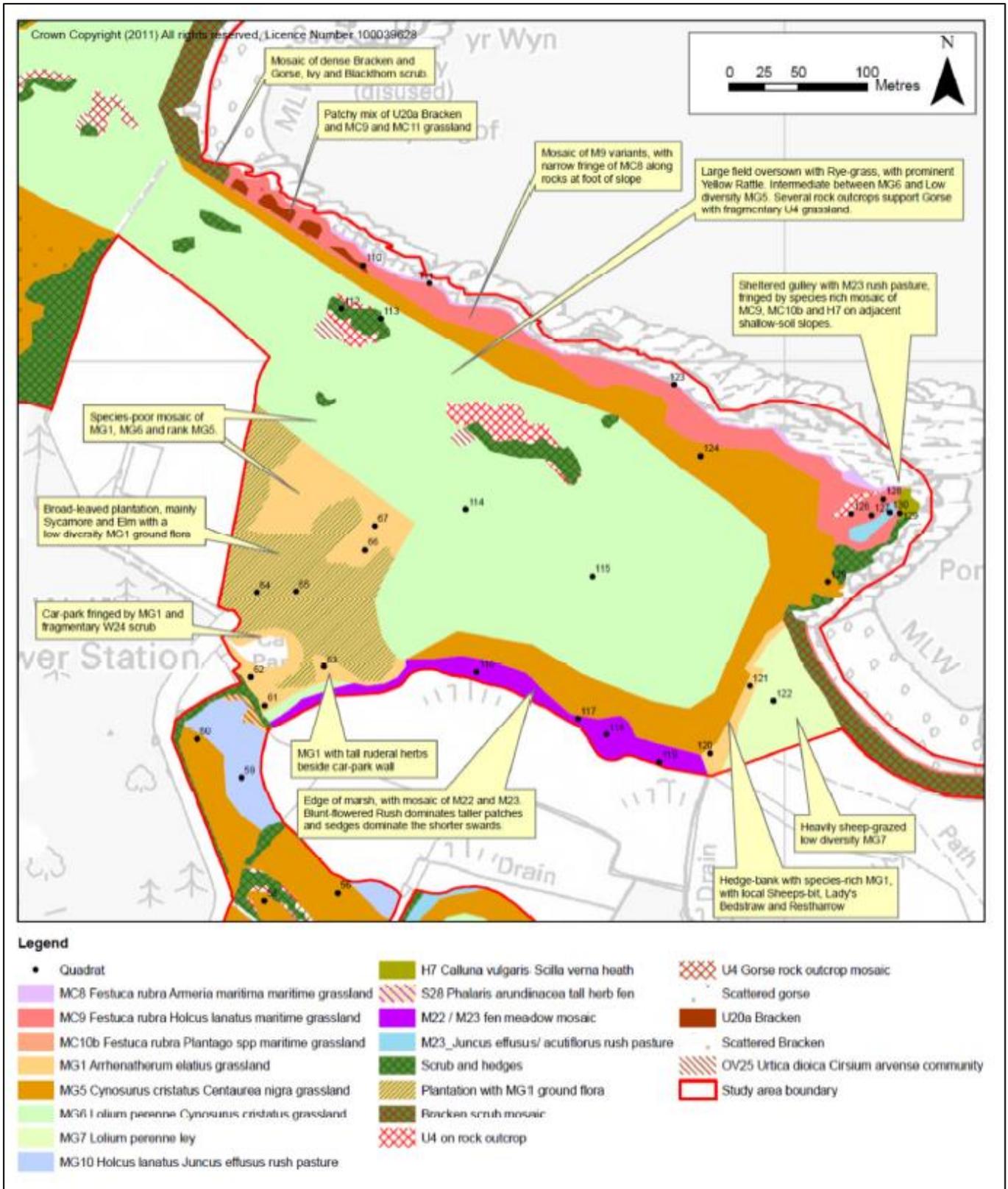


Figure 3.7 Site 7– North of Tre'r Gof SSSI Vegetation Map (from Arup, 2012)

3.2.8 Site 8 – Tre'r Gof SSSI (from Jacobs, 2013b)

Figure 3.8 details the habitats and vegetation communities recorded at Site 8 – Tre'r Gof SSSI. In summary, it was estimated that most of the habitats were either M22 *Juncus subnodulosus* – *Cirsium palustre* fen-meadow or M23 *Juncus effusus* – *Juncus acutiflorus* rush pasture. The exceptions to this were the areas identified as 'Habitat E' and 'Habitat F' that were considered to be S2 *Cladium mariscus* swamp and sedge-beds and W1 *Salix cinerea* – *Galium palustre* woodland, respectively.

Species of notable interest recorded during the survey included: tufted sedge (*Carex elata*), slender-leaved sedge (*Carex lasiocarpa*), saw-sedge (*Cladium mariscus*), black bog rush (*Schoenus nigricans*) and marsh fern.

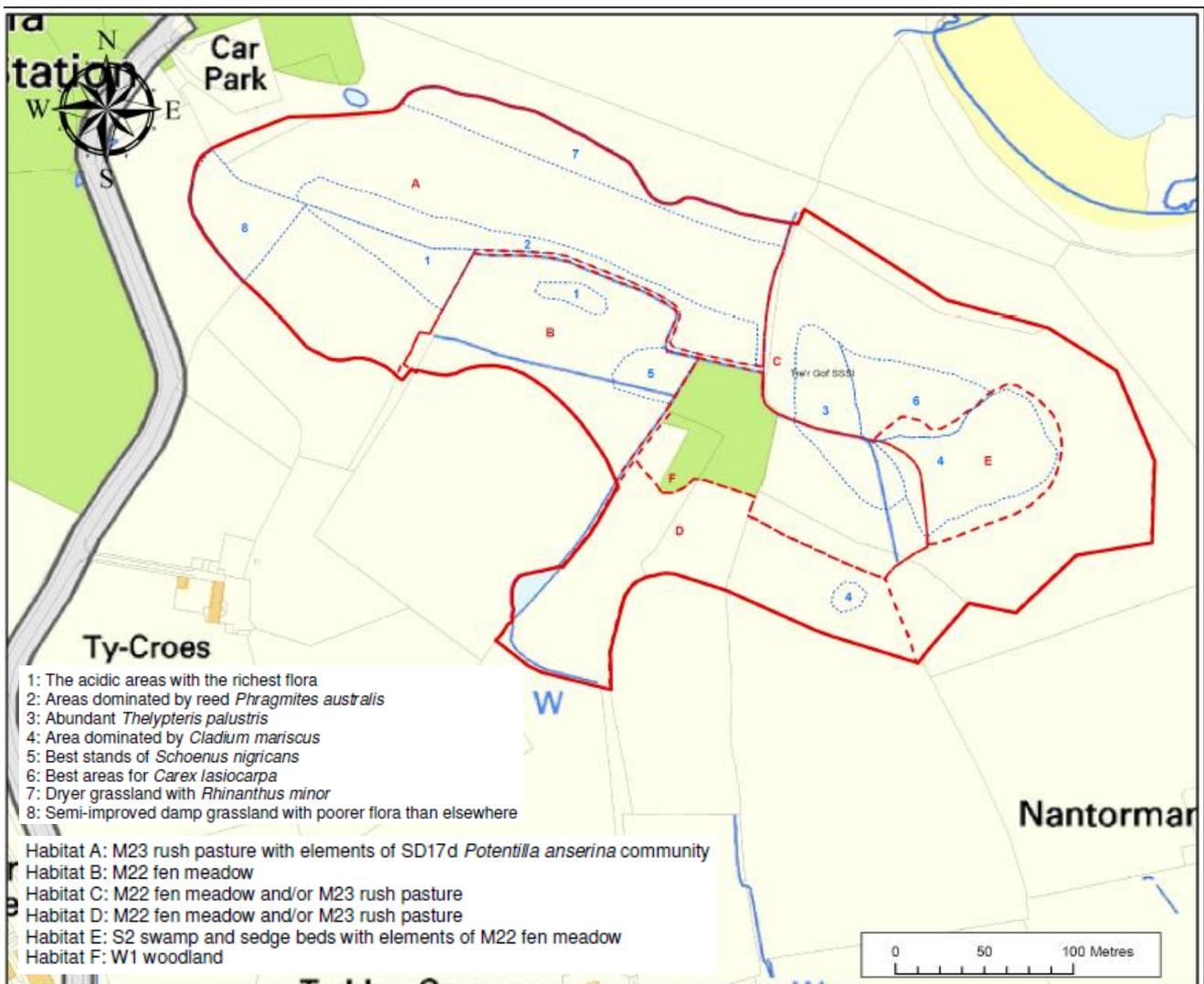


Figure 3.8 Site 8 – Tre'r Gof SSSI Vegetation Map (from Jacobs, 2013b)

3.2.9 Site 9 – Cae Gwyn SSSI (from Jacobs, 2013b)

Figure 3.9 details the habitats and vegetation communities recorded at Site 9 – Cae Gwyn SSSI, which is located outside of the Wylfa Newydd Development Area in the southern half of the study area.

The central high ground comprised scrub, acid grassland and rock outcrops, with an affinity to W23 *Ulex europaeus* – *Rubus fruticosus* scrub community.

A series of mires were recorded on the western and northern boundaries. These were assessed as having affinities with M25 *Molinia caerulea* – *Potentilla erecta* mire, M23 *Juncus effusus/acutiflorus* – *Galium palustre*

rush pasture and M9 *Carex rostrata* – *Calliergonella cuspidatum/giganteum* mire. Vegetation with an affinity to M29 *Hypericum elodes* – *Potamogeton polygonifolius* soakway was also possibly present as a mosaic. Royal fern (*Osmunda regalis*) and cranberry (*Vaccinium oxycoccos*) were notable species recorded in these vegetation types.

On the south-eastern side of this higher ground was a larger area of very high-quality mire (labelled C1 in Figure 3.9 below) with affinity to both M21 *Narthecium ossifragum* – *Sphagnum papillosum* valley mire community and M5 *Carex rostrata* – *Sphagnum squarrosum* mire. Visual assessment of this habitat suggested that a mosaic of the two communities was present; slender-leaved sedge and bog-sedge (*Carex limosa*) were recorded from here. M25 *Molinia caerulea* – *Potentilla erecta* mire was present to the west.

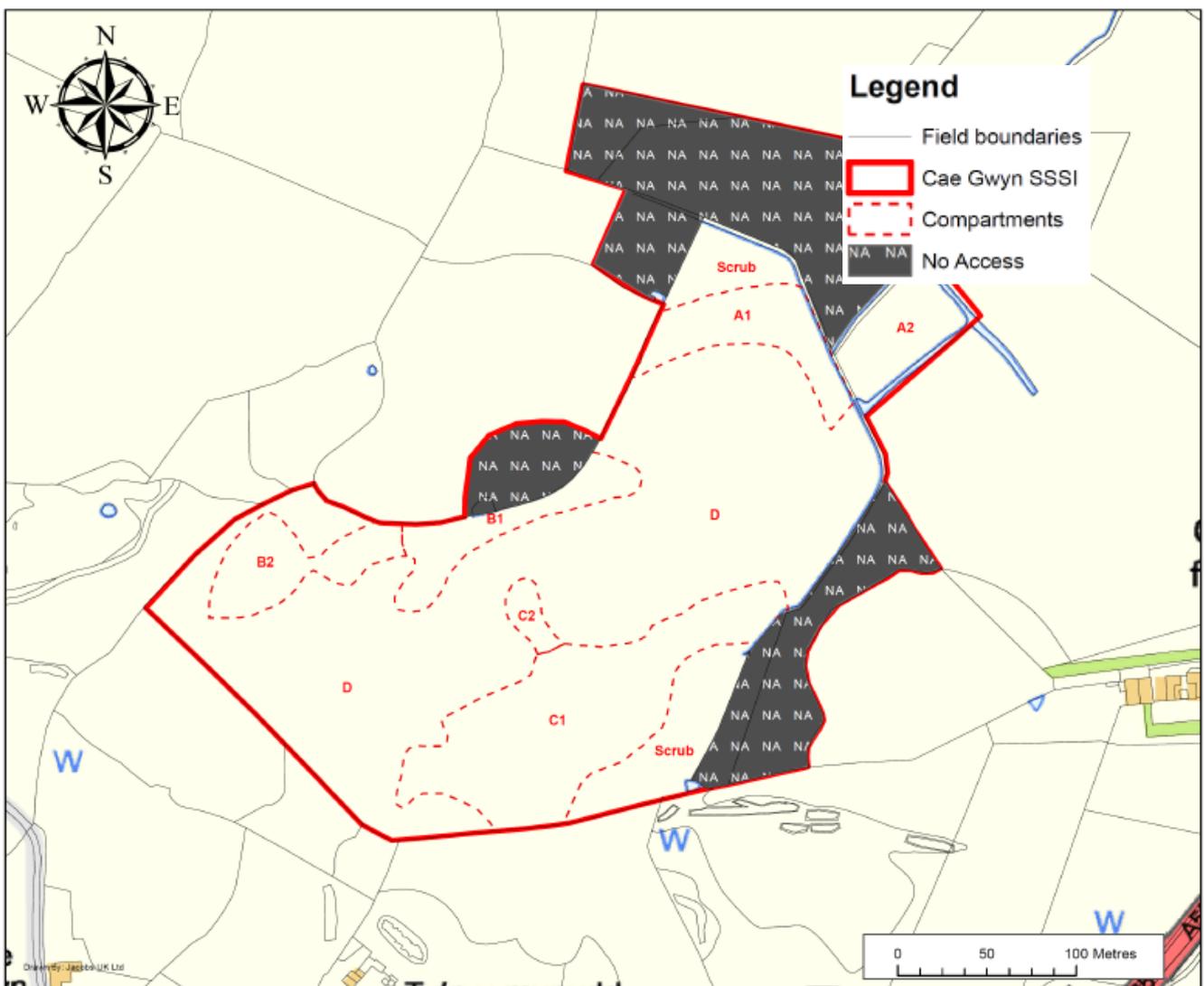


Figure 3.9 Cae Gwyn SSSI Vegetation Map (from Jacobs, 2013b)

3.2.10 Site 10 – Wylfa Head West (from Jacobs, 2013b)

The grasslands on the western side of Wylfa Head were heavily rabbit grazed with a typical turf height of around 5cm while the eastern side was ungrazed resulting in two separate plant communities. As such, the headland was split in to two sections: west and east. The west is discussed below while the data collected for the eastern side has been updated by a survey in 2015, which is discussed in full in Section 3.2.15. Figure 3.10 details the sampling points within each plant community on the eastern side of Wylfa Head. In summary, grassland communities were assessed as having good and consistent affinity with MC9 *Festuca rubra* – *Holcus lanatus maritime* grassland community.

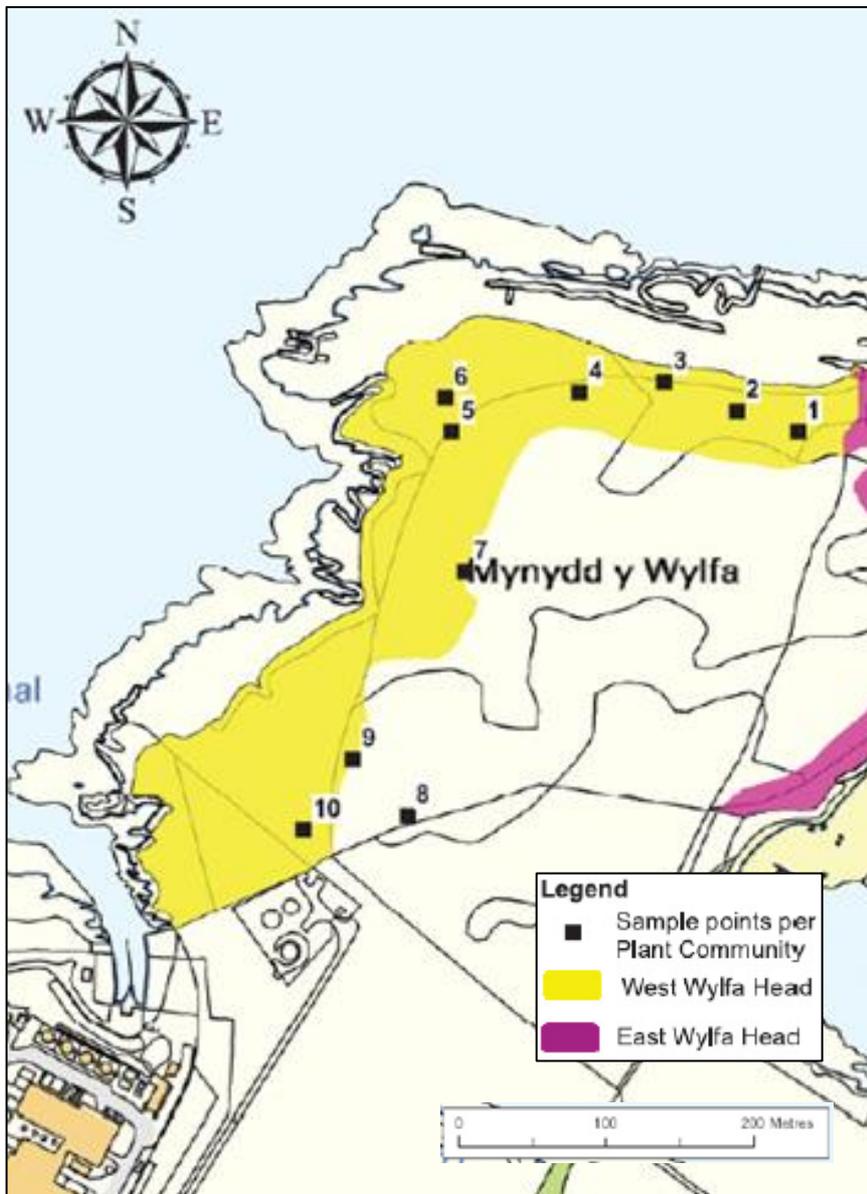


Figure 3.10 Site 10 – Wylfa Head Vegetation Map (from Jacobs, 2013b)

3.2.11 Site 11 – Trwyn Pencarreg (from Arup, 2013)

The NVC survey at inland Trwyn Pencarreg (Figure 1.1) indicated the community to have excellent affinity with H8 *Calluna vulgaris* – *Ulex gallii* heath. The NVC results, confirmed by ‘Tablefit’ analysis, validated this with a very good ‘goodness of fit’ score of 80. Such excellent results for ‘best fit’ under ‘Tablefit’ analysis are rarely obtained and indicate a homogenous habitat with a long period of management continuity without disturbance.

3.2.12 Site 12 – Mynydd Ithel (from Jacobs, 2014)

Grassland habitats at Mynydd Ithel (Figure 3.11) are floristically rich and differ greatly from the surrounding grasslands, which have been agriculturally improved and are floristically poor.

Figure 3.11 details the habitats and vegetation communities recorded at Site 12. All three agricultural grazing fields were best described as the mesotrophic grassland sub-community MG5a *Cynosurus cristatus* – *Centaurea nigra* grassland, *Lathyrus pratensis* sub-community. Additional habitat features within the three fields (Figure 3.11), included scrub, patches of nettle (*Urtica dioica*), a rocky outcrop and a wetter area where moonwort (*Botrychium lunaria*) was recorded.

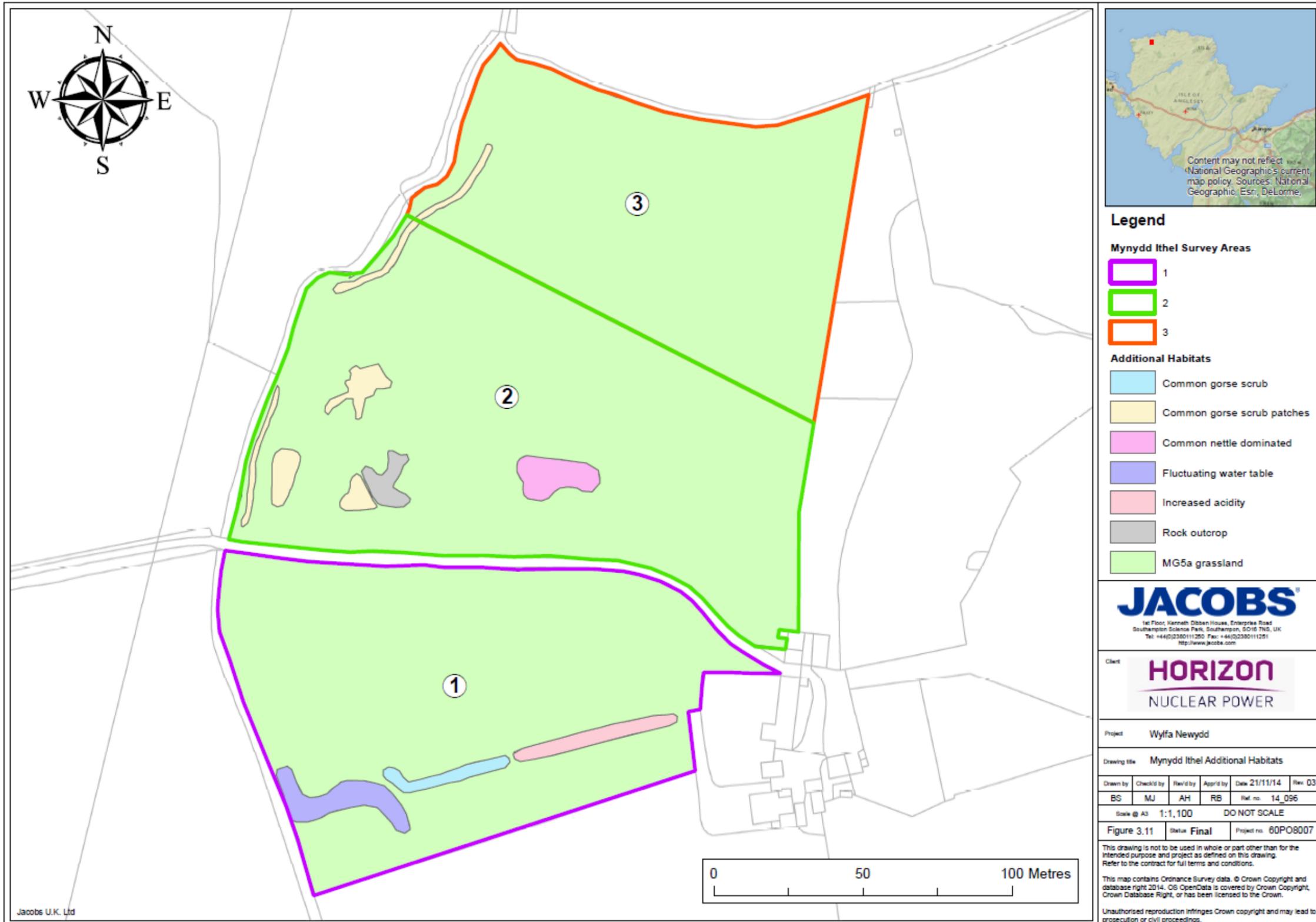


Figure 3.11 Mynydd Ithel Vegetation Map (from Jacobs, 2014)

3.2.13 Site 13 – Groes-fechan heathland (from Jacobs, 2014)

Figure 3.12 details the habitats and vegetation communities recorded at Groes-fechan. This single parcel of land was found to comprise plant communities with affinities to H8 *Calluna vulgaris* – *Ulex gallii* heathland. The species composition varied to a certain extent throughout the sward, creating a mosaic of habitats with mostly heather and western gorse dominating the central region of the compartment. Surrounding the central region, there were significant areas of habitat that did not conform strictly to the H8 community type. These included patches dominated by bracken and others dominated by common gorse (*Ulex europaeus*). The locations of these habitats are shown as Areas 2, 3 and 4 respectively in Figure 3.12. Several rock outcrops were also found to be present and these created a drier environment which was dominated by a cover of bryophytes and lichen. This is shown in Figure 3.12 as Area 5.



Figure 3.12 Groes-fechan Heathland Vegetation Map (from Jacobs, 2014)

3.2.14 Sites 14 to 23 (from Jacobs, 2015)

Figure 1.2 shows the coastal survey Sites 14 to 23. These coastal sites extended from the approximate mean high-tide mark up to 50m inland and included four habitat types:

- perennial vegetation of stony banks;
- wet coastal habitats;
- shingle beaches; and
- coastal rocks.

Perennial vegetation of stony banks

Vegetation types SD1 *Rumex crispus* – *Glaucium flavum* shingle community were recorded at Sites 14b, 17b, 17d and 17f. MC6 *Atriplex prostrate* – *Beta vulgaris* ssp. *maritima* sea-bird cliff community was recorded at Sites 16a, 16d and 22. These habitats resembled the Annex 1 habitat perennial vegetation of stony banks, a qualifying feature of the Cemlyn Bay SAC.

Wet coastal habitats

Wet coastal habitats indicated by NVC type SM16 *Festuca rubra* saltmarsh community, *Juncus gerardii* sub-community saltmarsh were characterised by abundant saltmarsh rush (*Juncus gerardii*) and sea milkwort (*Glaux maritima*). At Site 17g, a saltmarsh form of red fescue (*Festuca rubra*) was dominant. Distant sedge (*Carex distans*), glaucous sedge (*Carex flacca*) and sea rush (*Juncus maritimus*) were also recorded.

Shingle beaches

Sites 20 and 22 were entirely composed of shingle beaches, and Sites 14b, 16a, 16d, 17b, 17d and 17f also fell into this category. These habitats contained vegetation consistent with open vegetation and coastal shingle with some tendencies towards grassland and dry salt marsh. These habitats tended to grade into each other to some extent.

The commonest NVC community present at these locations was SD1 *Rumex crispus* – *Glaucium flavum* shingle community. Of the other surveyed sites that fall into this category, Sites 16a and 22 showed a poor Tablefit correlation for the MC6 *Atriplex prostrate* – *Beta vulgaris* ssp. *maritima* sea-bird cliff community, with most of the vegetation being found on low, eroding cliffs or the area of slumping below them. At both sites, species common to cliff faces, such as sheep's-bit scabious (*Jasione montana*), were recorded. At both survey locations, spear-leaved orache (*Atriplex prostrata*), sea beet (*Beta vulgaris* subspecies *maritimum*), curled dock (*Rumex crispus*) and sea mayweed (*Tripleurospermum maritimum*) were significant components of the vegetation.

Site 20 was identified as the mesotrophic grassland community MG11 *Festuca rubra* - *Agrostis stolonifera* - *Potentilla anserina* mesotrophic grassland, although this is unusual as only silverweed was present and neither of the grasses were. The dominance of spear-leaved orache at this site and the low number of taxa present would suggest that it is really a different community than indicated by the results. Visually, the site appeared more in line with the MC6 community than MG11 despite the abundance of goose-grass (*Galium aparine*) and the presence of silverweed.

Coastal rocks

The coastal rocks included all of Sites 15, 21 and 23 and the remaining sites. Visually, the communities at these sites were typical of the hard coastal cliffs of the north and west of Britain. Due to the acidic nature of many of the rocks, there was a tendency toward acidic grassland and maritime heath in many places. The dominant NVC community of MC5 *Armeria maritima*-*Cerastium diffusum* ssp. *diffusum* maritime therophyte community and associated sub-communities were recorded here.

Site 23 was a very convincing MC1 *Crithmum maritimum* – *Spergularia rupicola* maritime rock-crevice community typical of exposed hard cliffs of the west coast of the UK. Thrift (*Armeria maritima*) was also abundant here, as it was throughout much of the coastal rocks in the whole study area.

Site 15 showed a very poor correlation with the MC5 maritime cliff community. This was perhaps due to the presence of several salt marsh plants including sedges, such as distant sedge (*Carex distans*) and long-bracted sedge (*C. extensa*), and heathland plants including mat-grass (*Nardus stricta*), heath milkwort (*Polygala serpyllifolia*) and western gorse. The presence of these species appears to have distorted the result of the analysis, but the abundance of thrift and the presence of such species as English stonecrop (*Sedum anglicum*), sea campion (*Silene uniflora*), sea pearlwort (*Sagina maritima*) and spring squill (*Scilla verna*) seem to suggest a maritime cliff community, possibly MC5 again.

Table 3.1 Sites 14 to 23 – Coastal Habitat NVC survey results

Site Name	Sites	Central Grid Ref.	Actual NVC community (Best fit)	Goodness of Fit ⁷
Cemlyn Bay to Cerrig Brith	14a	SH 3394 9363	MC5 <i>Armeria maritima</i> - <i>Cerastium diffusum</i> ssp. <i>diffusum</i> maritime therophyte community and H7 <i>Calluna</i> – <i>Scilla verna</i> heath.	68 and 60 - both good
	14b	SH 3374 9334	SD1 <i>Rumex crispus</i> – <i>Glaucium flavum</i> shingle community.	92 - very good
	14c	SH 3369 9328	No meaningful result; best fit S23 Other water-margin vegetation.	26 - extremely poor
Cerrig Brith	15	SH 3418 9361	MC5c <i>Armeria maritima</i> - <i>Cerastium diffusum</i> ssp. <i>diffusum</i> maritime therophyte community, <i>Desmazeria marina</i> sub-community.	46 - very poor
Porth-y-Felin	16a	SH 3444 9338	MC6 <i>Atriplex prostrata</i> – <i>Beta vulgaris</i> ssp. <i>maritima</i> sea-bird cliff community ⁸ .	52 - poor
	16b	SH 3443 9338	SM16 <i>Juncus gerardii</i> saltmarsh.	77 - good
	16c	SH 3440 9341	MC5 <i>Armeria maritima</i> - <i>Cerastium diffusum</i> ssp. <i>diffusum</i> maritime therophyte community.	81 - very good
	16d	SH 3434 9347	MC6 <i>Atriplex prostrata</i> – <i>Beta vulgaris</i> ssp. <i>maritima</i> sea-bird cliff community ⁸ .	45 - very poor
	16e	SH 3427 9351	MC5 <i>Armeria maritima</i> – <i>Cerastium diffusum</i> and MC10 <i>Festuca rubra</i> – <i>Plantago</i> spp.	59 and 42 - both poor

⁷ Using 'tablefit' (Hill, 1996) as described in Section 2.2.6.

⁸ The *Atriplex* species named for this community in Rodwell (1992) is *Atriplex hastata*, synonymous with the recorded taxon *Atriplex prostrata*.

⁹ MG11b was also identified as a possible fit for Site 16d.

Site Name	Sites	Central Grid Ref.	Actual NVC community (Best fit)	Goodness of Fit ⁷
Porth-y-pistyll	17a	SH 3469 9378	MG11 <i>Festuca rubra</i> – <i>Agrostis stolonifera</i> – <i>Potentilla anserina</i> mesotrophic grassland.	46 - poor
	17b	SH 3478 9369	SD1 <i>Rumex crispus</i> – <i>Glaucium flavum</i> shingle community.	66 - fair
	17c	SH 3473 9353	MC5 <i>Armeria maritima</i> – <i>Cerastium diffusum</i> maritime cliff community.	58 - poor
	17d	SH 3470 9346	SD1 <i>Rumex crispus</i> – <i>Glaucium flavum</i> shingle community.	94 - very good
	17e	SH 3464 9349	MC5 <i>Armeria maritima</i> – <i>Cerastium diffusum</i> and MC6 <i>Atriplex prostrata</i> – <i>Beta vulgaris</i> ssp. <i>maritima</i> sea-bird cliff community.	70 - good and 56 - poor
	17f	SH 3454 9348	SD1 <i>Rumex crispus</i> – <i>Glaucium flavum</i> shingle community.	66 - fair
	17g	SH 3448 9304	SM16c <i>Festuca rubra</i> salt – marsh community, <i>Festuca rubra</i> – <i>Glaux maritima</i> sub-community	80 - very good
West of Existing Power Station	18a	SH 3481 9387	SM16 <i>Juncus gerardii</i> saltmarsh and SM15 <i>Juncus maritima</i> – <i>Triglochin maritima</i> .	60 - fair and 56 - poor
	18b	SH 3474 9384	MC5 <i>Armeria maritima</i> – <i>Cerastium diffusum</i> maritime cliff community.	70 - good
Wylfa Head Coast	19a	SH 3538 9448	MC5 <i>Armeria maritima</i> – <i>Cerastium diffusum</i> maritime cliff community.	59 - poor
	19b	SH 3581 9447	H7a <i>Calluna vulgaris</i> – <i>Scilla verna</i> heath (<i>Armeria maritima</i> subcommunity).	68 - fair
Porth yr Ogof	20	SH 3558 9422	MG11b <i>Festuca rubra</i> – <i>Agrostis</i> – <i>Potentilla anserina</i> (<i>Atriplex prostrata</i> subcommunity).	64 - fair
Porth yr Ogof to Porth-y-wylfa	21	SH 3580 9402	MC5 <i>Armeria maritima</i> – <i>Cerastium diffusum</i> maritime cliff community.	57 - poor
Porth-y-Wylfa	22	SH 3605 9375	MC6 <i>Atriplex prostrata</i> – <i>Beta vulgaris</i> ssp. <i>maritima</i> sea-bird cliff community.	55 - poor
Porth-y-Wylfa to Penrhyn	23	SH 3660 9379	MC1 <i>Crithmum maritimum</i> – <i>Spergularia rupicola</i> maritime cliff community.	77 - good

3.2.15 Wylfa Head East

Ten quadrats were set out on the eastern side of Wylfa Head. The results from this survey are summarised in Table 3.2. The study area and quadrat locations are shown in Figure 3.13.

The results, combined, produced a fair goodness of fit rating of 60 for MC9 *Festuca rubra* – *Holcus lanatus* maritime grassland community, with only a slightly poorer goodness of fit rating of 57 for MG5 *Cynosurus cristatus* – *Centaurea nigra* mesotrophic grassland. This combined result would suggest a variable mosaic of the mesotrophic grassland and maritime grassland communities MG5 and MC9, respectively. However, Wylfa Head East is considered to be more variable and there are likely to be at least four habitat types present. The additional two are H7 *Calluna* – *Scilla verna* heath and MC8a *Festuca rubra* – *Armeria maritima* maritime grassland, typical sub-community.

Notable species recorded at Wylfa Head were lesser tufted sedge, chaffweed (*Anagallis minima*), lesser water plantain (*Baldellia ranunculoides*), yellow bartsia (*Parentucellia viscosa*), allseed (*Radiola linoides*), heath pearlwort (*Sagina subulata*), spring squill, petty whin (*Genista anglica*) and adder's-tongue (*Ophioglossum vulgatum*).

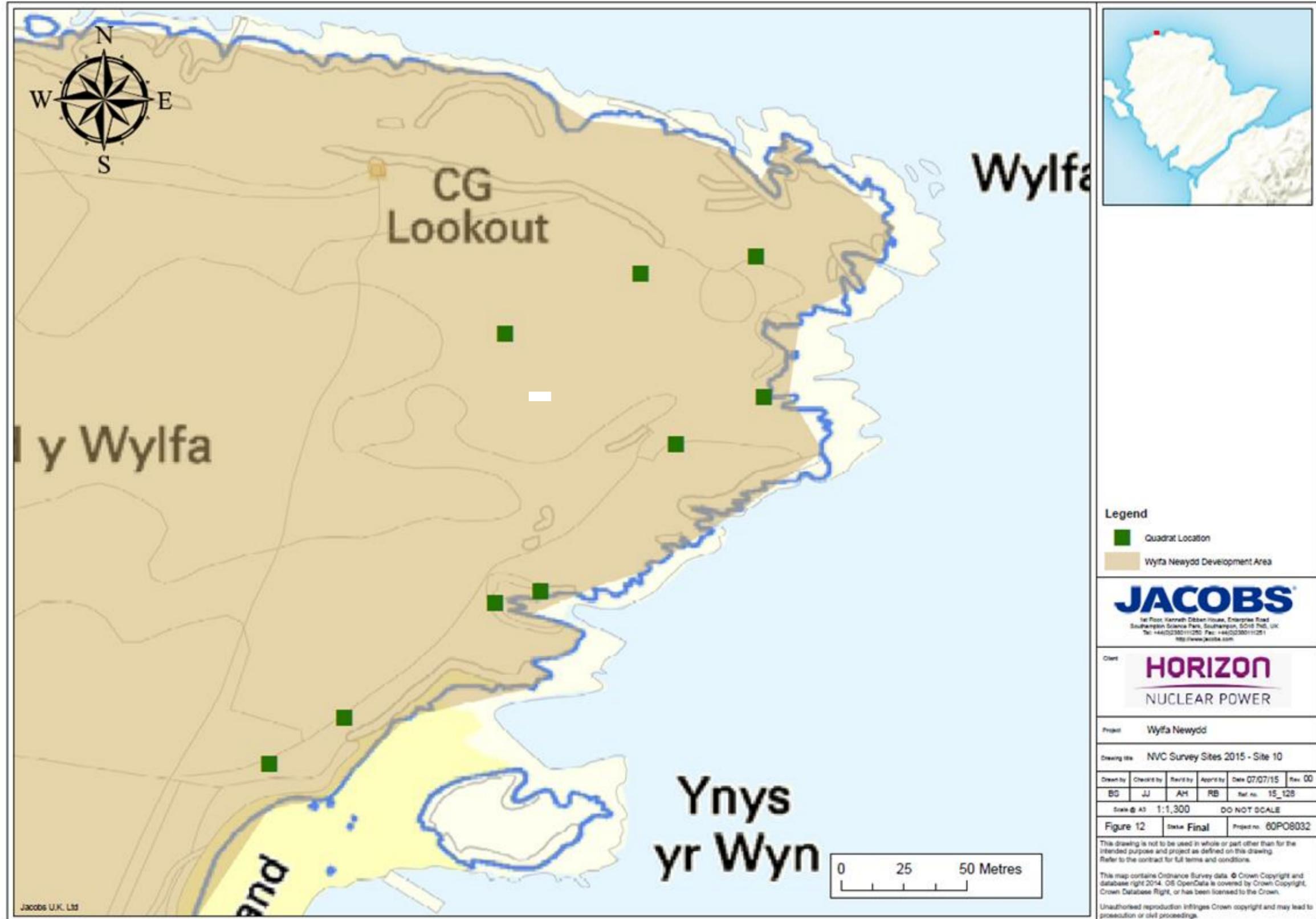


Figure 3.13 Site 24 – Wylfa Head East Quadrat Survey Locations (from Jacobs, 2015)

Table 3.2 : Wylfa Head East

Quadrat	Grid Reference	NVC Community (Best fit)	Goodness of Fit
1	SH 35687 94493	H7 <i>Calluna</i> – <i>Scilla verna</i> heath.	51 - poor
2	SH 35708 94443	MC9c <i>Festuca rubra</i> – <i>Holcus lanatus</i> maritime grassland community (<i>Achillea</i> subcommunity).	62 - fair
3	SH 35762 94467	MC9c <i>Festuca rubra</i> – <i>Holcus lanatus</i> maritime cliff community (<i>Achillea</i> subcommunity).	73 - very good
4	SH 35808 94474	MC8a <i>Festuca rubra</i> – <i>Armeria maritima</i> maritime cliff community.	53 - poor
5	SH 35811 94418	MC8a <i>Festuca rubra</i> – <i>Armeria maritima</i> maritime cliff community.	66 - fair
6	SH 35776 94399	MC5a <i>Armeria maritima</i> – <i>Cerastium diffusum</i> (<i>Aira praecox</i> subcommunity).	51 - poor
7	SH 35724 94336	MC9 <i>Festuca rubra</i> – <i>Holcus lanatus</i> maritime cliff community.	46 - very poor
8	SH 35704 94336	No meaningful result; best fit OV23 <i>Lolium perenne</i> – <i>Dactylis glomerata</i> community.	27 - very poor
9	SH 35644 94290	MC9c <i>Festuca rubra</i> – <i>Holcus lanatus</i> maritime cliff community (<i>Achillea</i> subcommunity).	72 - good
10	SH 35614 94272	MC9c <i>Festuca rubra</i> – <i>Holcus lanatus</i> maritime cliff community (<i>Achillea</i> subcommunity).	72 - good
Combined best result		MC9 <i>Festuca rubra</i> – <i>Holcus lanatus</i> maritime cliff community.	60 - fair
Alternative best result		MG5 <i>Cynosurus cristatus</i> – <i>Centaurea nigra</i> mesotrophic grassland.	57 - poor

3.2.16 Uncommon plant species

Sea kale is a notable species and was recorded in 12 locations during the 2015 audit of the study area. These were in Sites 15, 16 and 17 between Cerrig Brith and Porth-y-pistyll, as shown in Figure 3.14 and Table 3.3.

Table 3.3 : Sea Kale Locations

Grid reference	Number of plants	Grid reference	Number of plants
SH 34176 93621	2	SH 34785 93686	3
SH 34339 93430	10	SH 34788 93678	3
SH 34354 93416	5	SH 34740 39486	1
SH 351 942	10	SH 34556 93485	10
SH 34786 93693	4	SH 34550 93486	6

Grid reference	Number of plants	Grid reference	Number of plants
SH 2480 893868	18	SH 34578 93486	1

No sea radish, brackish water-crowfoot or beaked tasselweed (characteristic species of perennial vegetation of stony banks) was recorded within any of the survey areas. No plant species listed under Section 42 of the NERC Act 2006 were recorded.

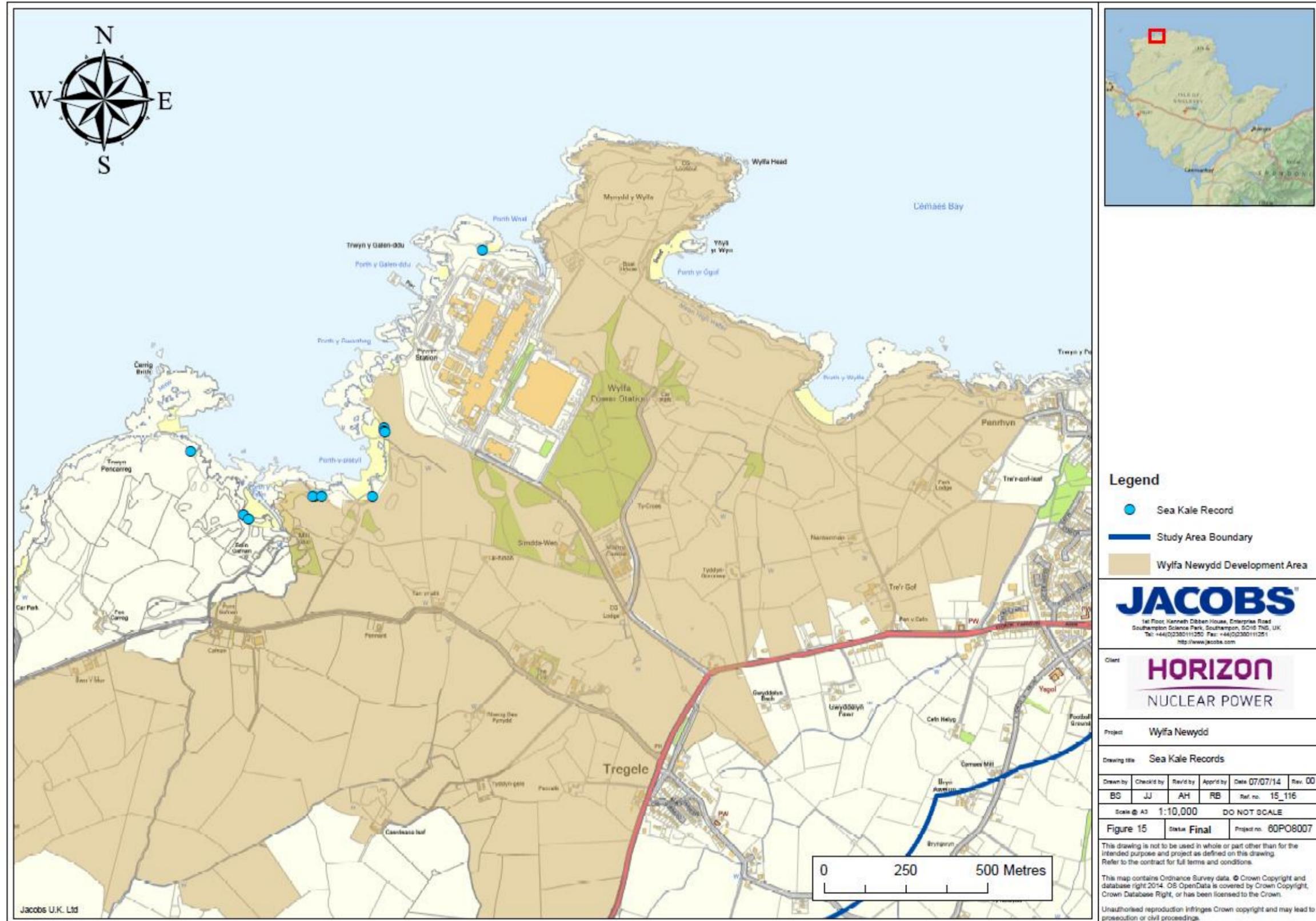


Figure 3.14 Location of Sea Kale Plants Recorded during 2015 surveys (from Jacobs, 2015)

4. Discussion

4.1 Notable Species

No plant species listed in Schedule 5 of The Conservation of Habitats and Species Regulations 2010 (as amended) were recorded during the surveys or identified during the desk study. Bluebell was identified in the desk study and found in the study area. This species is listed in Schedule 8 of The Wildlife and Countryside Act 1981 (as amended) but is protected against unlawful sale only.

A number of notable vascular plants (but with no legal protection) were identified during the desk study and are listed in Appendix A. These species are listed in LBAPs (Anglesey, Conwy, Denbighshire, Flintshire and Gwynedd) or have been described as 'locally important' by plant recording experts. The locations of the records are on Figure 3.1. Of these species, bluebell, marsh fern, petty whin and allseed were also recorded during the field survey. The majority of other notable species provided in the Cofnod data were located in habitats that are not found in the survey area or were records from before 1995. Additional records of notable species were also made during the field surveys and are detailed below.

According to the *New Atlas of the British and Irish Flora* (Preston *et al.*, 2002), some species recorded at Wylfa Head were not particularly common or widespread in the UK as a whole. These species were tufted sedge species, chaffweed, lesser water plantain, yellow bartsia, allseed, heath pearlwort and spring squill. Yellow bartsia was a particularly significant discovery as it was considered absent from the Isle of Anglesey in 2000 (Preston *et al.*, 2002).

Four species recorded at Trwyn Pencarreg were not particularly common or widespread in the UK as a whole (Preston *et al.*, 2002). These species included the previously mentioned lesser water plantain, black bog rush and spring squill. A fourth species falling into this category was tufted clubrush; this is a scarce coastal plant widespread along western coasts from the Outer Hebrides to the Isle of Wight and probably commonest on the coasts of Wales, including Anglesey.

According to the *New Atlas of the British and Irish Flora* (Preston *et al.*, 2002), five species recorded at Tre'r Gof SSSI are not particularly common or widespread in the UK. These were tufted sedge, slender-leaved sedge, saw-sedge, black bog rush and marsh fern. All of these species are present elsewhere on Anglesey, marsh fern is present in at least four sites in the study area and all of the others are even more widespread and common on the island.

At Cae Gwyn SSSI, four scarce plants were recorded. These species were royal fern, cranberry, slender-leaved sedge and bog sedge. These species are widespread on Anglesey (Preston *et al.*, 2002) with the exception of cranberry for which Cae Gwyn SSSI appears to be its only site.

Sea kale, an uncommon plant in the UK, was recorded in 12 locations between Cerrig Brith and Porth-y-pistyll, as shown in Figure 3.14. These plants were recorded approximately 700m north-east of the population known to be present at Cemlyn Bay where sea kale is found along much of the length of the foreshore (Sneddon and Randall, 1993). Additional sea kale has been recorded at Site 6 and north of the Existing Power Station, approximately 1.9km from Cemlyn Bay. These areas are separated by habitat unsuitable for sea kale producing a barrier effect such that it is unlikely that there are any direct interactions between the different populations. A total of 54 sea kale plants were recorded during the survey suggesting any minor loss of individual sea kale plants in the Wylfa Newydd Development Area is unlikely to have a significant impact on the wider distribution along the coast of Anglesey. Sea kale distribution on Anglesey is shown in .



Plate 1 Sea kale at Cemlyn Bay (from Jacobs, 2013a)

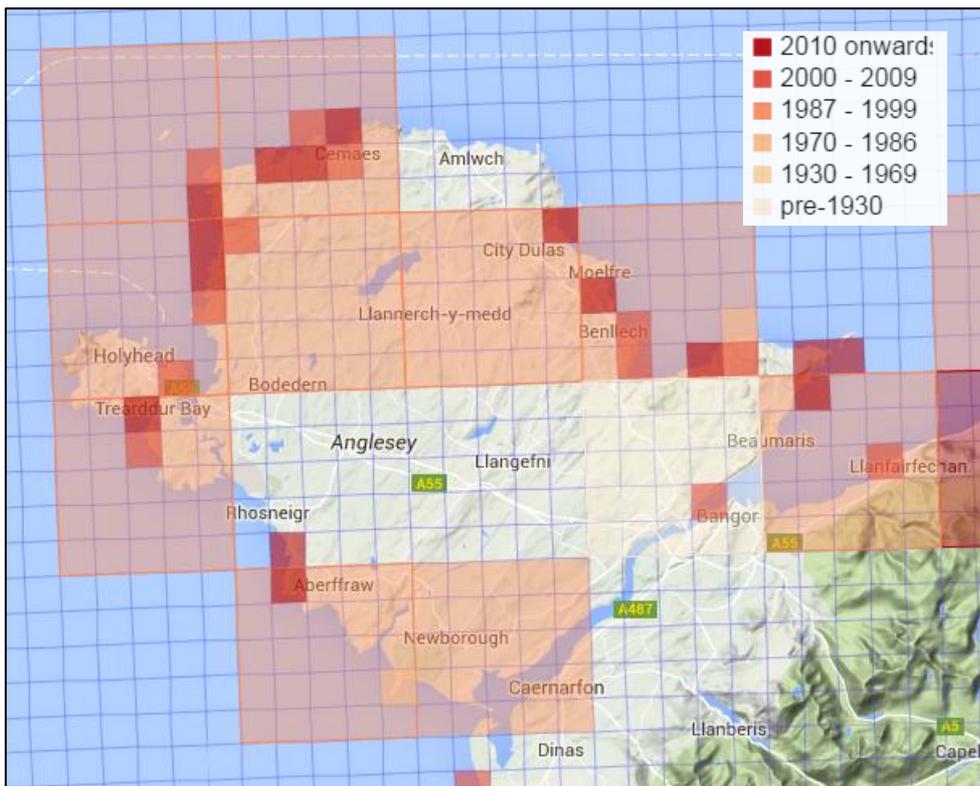


Figure 4.1 Distribution of Sea kale along Anglesey Coast (BSBI, 2015)

All of the bryophyte species found during survey were common and/or widespread, at least in upland parts of the UK, according to Atherton, Bosanquet and Lawley (2010).

4.2 Habitats of Conservation Interest

The NVC groups recorded in the study area have been collated in the following section into their respective Section 42 habitat types, which are of conservation importance. The locations of these habitats are shown in Figure 4.3 .

4.2.1 Lowland grassland

The MG5 *Cynosurus cristatus* – *Centaurea nigra* grassland NVC category identified across the study area is recognised as ‘lowland grassland’, a habitat that is listed under Section 42 of the NERC Act 2006.

This habitat was identified at five sites across the study area: Site 3 and Site 24 at Wylfa Head; Site 6 – Trwyn Pencarreg and Felin Cafnan; Site 7 – Fields at Ty-Croes; and at Site 12 – Mynydd lthel. The total area of MG5 grassland within the study area equates to approximately 14.3ha (2% of study area). The three fields at Mynydd lthel represent the largest component at 3.8ha, approximately 27% of the total MG5 grassland that can be found within the study area, outside of the Wylfa Newydd Development Area.

Much of the lowland grassland habitat on Anglesey is fragmented and interspersed with other semi-improved natural habitats and improved grassland. However, on the exposed west and north coasts, a series of sites supports some of the finest maritime grassland on the island (WBP, 2014), including areas south of Cemlyn Bay. The lowland grassland types identified in the study area are located outside of the priority lowland grasslands and heathland identified by the Wales Biodiversity Partnership (WBP), as shown in Figure 4.2 **Error! Reference source not found.**



Figure 4.2 Priority Lowland Grassland and Heathland (Wales Biodiversity Partnership, 2014)

4.2.2 Lowland heath

The H8 *Calluna vulgaris* – *Ulex gallii* heath NVC category is recognised as “Lowland Heath”, which is a habitat of principle importance for conservation that is listed under Section 42 of the NERC Act 2006.

Dry lowland heath is fragmented and sparsely represented in the study area. In addition to the land parcel at Site 13 – Groes-fechan, H8 can be found at one other site in the study area: at Site 6 – Trwyn Pencarreg and Felin Gafnan (Arup, 2012). The total area of H8 heath within the study area equates to approximately 2.1ha (0.3% of the study area). The land parcel at Groes-fechan represents a smaller component at 0.4ha, approximately 23% of the total H8 lowland heath that can be found in the study area.

The compartment at Site 13 – Groes-fechan can probably be regarded as not being as important as the coastal heathland found at Site 6 – Trwyn Pencarreg and Felin Gafnan, as it is in the early stages of succession and is showing signs of encroachment by both bracken and common gorse. On the other hand, the heathland at Trwyn Pencarreg is listed as part of the Anglesey coastal grassland/heathland inventory (WBP, 2014), which,

when combined with other sites on Anglesey, account for 5% of this habitat remaining in Britain. Both sites are located outside of the Wylfa Newydd Development Area.

One of the 10 quadrats surveyed on Wylfa Head in 2015 produced an NVC result indicative of heathland habitat (H7 *Calluna vulgaris* – *Scilla verna* heath community). This result had a poor (51%) goodness of fit, suggesting either a highly fragmented and isolated remnant habitat type or a transition to a different community.

4.2.3 Lowland fens

The sparsely represented swamp communities recorded at Site 6 – Felin Gafnan and the Site 8 – Tre'r Gof SSSI are considered 'lowland fens: a habitat of principle importance for conservation that is listed under Section 42 of the NERC Act 2006. In addition, the S2 *Cladium* swamp and sedge-beds recorded at Tre'r Gof SSSI (see Figure 4.3) are also listed as H7210 (Calcareous fens with *Cladium mariscus*) under Annex 1 of the Habitat Regulations (JNCC, 2007).

The mire communities at Site 9 – Cae Gwyn SSSI (M9 *Carex rostrata* – *Calliergonella cuspidatum/giganteum* mire and M5 *Carex rostrata* – *Sphagnum squarrosum* mire) are also included in the Section 42 list.

There are approximately 470ha of fen habitat on Anglesey with all larger areas designated as SSSI, including SAC and Ramsar sites, as exemplified by the designation at Site 8 – Tre'r Gof SSSI. Smaller areas of undesignated, isolated habitat were found at Site 6. Although these habitats are rare in the study area, they contribute to less than 1% of lowland fen habitat identified on Anglesey as a whole.

Lowland fens identified at Site 6 – Felin Gafnan and Site 9 – Cae Gwyn SSSI are located outside of the Wylfa Newydd Development Area while Site 8 – Tre'r Gof SSSI is located within this area.

4.2.4 Purple moor grass and rush pastures

The M23 *Juncus effusus/acutiflorus* rush pasture identified at Site 9 – Cae Gwyn SSSI, as well as the M25 *Molinia caerulea* – *Potentilla erecta* mire at Site 6 – Trwyn Pencarreg and Felin Cafnan, are recognised as 'purple moor grass and rush pastures', a habitat of principle importance for conservation that is listed under Section 42 of the NERC Act 2006. These habitat types are both located outside of the Wylfa Newydd Development Area.

4.2.5 Wet woodland

The W1 *Salix cinerea* – *Galium palustre* woodland NVC category identified at Tre'r Gof SSSI is recognised as "Wet Woodland", a habitat listed under Section 42 of the NERC Act 2006. This habitat is sparse across the study area but is considered widespread across the UK.

4.2.6 Maritime cliff and slopes

All of the coastal grassland slopes and cliff edges in the study area are considered to be "Maritime Cliff and Slopes", a habitat listed under Section 42 of the NERC Act 2006. This habitat extends along the entire coastal aspect of the study area.

4.2.7 Perennial vegetation of stony banks

Perennial vegetation of stony banks is an Annex I habitat type that is comparable to the Section 42 habitat of 'coastal vegetated shingle'. The two NVC types recorded in the study area that constitute perennial vegetation of stony banks were SD1 *Rumex crispus* – *Glaucium flavum* shingle community and MC6 *Atriplex prostrata* – *Beta vulgaris* ssp. *maritima* sea-bird cliff community (JNCC, 2004).

SD1 was identified at Sites 14b, 17b, 17d and 17f, with MC6 recorded at sites 16a, 16b and 22 (see Figure 4.3). The NVC type, Tablefit correlation and interpretation of significance for these communities are provided in Table 4.1.

Table 4.1 Summary of survey sites with potential to support perennial vegetation of stony bank communities MC6 and SD1

Site	NVC Type	TABLEFIT correlation	Interpretation of significance
14b	SD1	Poor	Site 14d is outside of the Power Station Site and is separated from it by the headland that includes Cerrig Brith. The site substrate and associated communities are, therefore, unlikely to be affected by the Project.
16a	MC6	Poor	Site 16a has a poor affiliation to the MC6 community and it is more likely to be a community in flux than truly representative of MC6.
16d	MC6	Very poor	Site 16b has a very poor affiliation to the MC6 community and it is more likely to be a community in flux than truly representative of MC6.
17b	SD1	Fair	Site 17b is discussed in greater detail below.
17d	SD1	Very good	Site 17d is discussed in greater detail below.
17f	SD1	Fair	Site 17f is discussed in greater detail below.
22	MC6	Very good	Site 22 is outside of the Power Station Site and is sheltered from it by being in Porth-y-Wylfa. The site substrate and its habitats are, therefore, unlikely to be affected by the Project.

It is considered that Sites 14b, 16a, 16d and 22 are not of significant importance for the reasons given in Table 4.1 and are not discussed further in terms of affecting the determination of the value and sensitivity of the habitats in the study area. However, Sites 17b, 17d and 17f in Porth-y-pistyll do support habitats that resemble those of the description of the SD1 habitat and therefore Annex 1 habitat type H1220.

The Porth-y-pistyll sites with SD1 habitat are 0.8 ha, 0.4ha and 0.6ha respectively: a total of 1.8ha. In the nearby shingle bar community of the Cemlyn Bay SAC, the perennial vegetation of stony banks represents 3.1% of the 46ha total (JNCC, 2015a) and so is approximately 1.3ha in size. This means that there are a total of 2.1ha of H1220 perennial vegetation of stony banks habitat if the areas in the study area are combined with those present in Cemlyn Bay SAC, and the 1.8ha within Porth-y-pistyll represents 58% of the total. However, in national terms the amount of perennial vegetation of stony bank vegetation in the study area is not considered to be significant.

In national terms, there are some 4000ha of stable or semi-stable vegetated shingle around the coast of the UK (JNCC, 2015b). This would suggest that 1.8ha is highly unlikely to be significant on anything other than a local scale. This is supported when comparing the other SACs for which perennial vegetation of stony banks is listed, either as a reason for selection (see Table 4.2), or being present but not as a reason for selection (see Table 4.3). Table 4.2 shows that the smallest area for which perennial vegetation of stony banks is used as a primary selection feature is over 45 times larger than that present at Cemlyn Bay SAC (see Morcambe Bay SAC). Furthermore, Table 4.3 shows that sites with areas of perennial vegetation of stony banks that are between 100 and 335 times larger than those at Cemlyn Bay SAC exist but still have not been used as reasons for site selection (see Strangford Lough SAC and Solway Firth SAC respectively).

Table 4.2 UK SACs where perennial vegetation of stony banks is a primary reason for selection

SAC name	Total area (ha)	Proportion of shingle habitat	Area of shingle (ha)
Chesil and the Fleet (JNCC, 2015c)	1,632	32%	522
Culbin Bay (JNCC, 2015d)	613	20%	123
Dungeness (JNCC, 2015e)	3,224	64%	2,063
Lower River Spey – Spey Bay (JNCC, 2015f)	653	16%	104
Morecambe Bay (JNCC, 2015g)	61,506	0.1%	62
North Norfolk Coast (JNCC, 2015h)	3,207	19.1%	613
Orfordness – Shingle Street (JNCC, 2015i)	901	40%	360

Table 4.3 UK SACs where perennial vegetation of stony banks is present but is not a reason for selection

SAC name	Total area (ha)	Proportion of shingle habitat	Area of shingle (ha)
Cemlyn Bay	46	3.1%	1.3
Minsmere to Walberswick Heaths and Marshes (JNCC, 2015j)	1,266	15%	190
Solent Maritime (JNCC, 2015k)	11,325	3%	340
Solway Firth (JNCC, 2015l)	43,637	<1%	437 (max)
Strangford Lough (JNCC, 2015m)	13,599	<1%	136 (max)

In a more local context, Porth-y-pistyll is close to Cemlyn Bay SAC and, by sharing similar habitats, there may be the potential for interaction between the sites. In terms of significance of these effects, the previous paragraphs suggest that Porth-y-pistyll is of very limited value. Therefore, only changes in interactions that lead to deleterious impacts to the SAC would be of concern. No such interactions have been identified but the potential for Porth-y-pistyll to act as a source population of pioneer species does exist. This would be of benefit to the habitats of Cemlyn Bay SAC should recolonisation be required following a catastrophic denudation of the bar, e.g. as a result of a violent storm. However, the geography of the area means that Porth-y-pistyll is separated from Cemlyn Bay SAC by 1.2km overland, and by sea it is separated by the Trwyn Pencarreg headland and Cerrig Brith rocks. These factors would undoubtedly hinder potential dispersal of viable plant material between areas, and would be reduced further by prevailing westerly winds. The similar habitats at Site 14b could also fulfil this function and would be more likely to do so as it is closer and lacks a geographical barrier to dispersal.

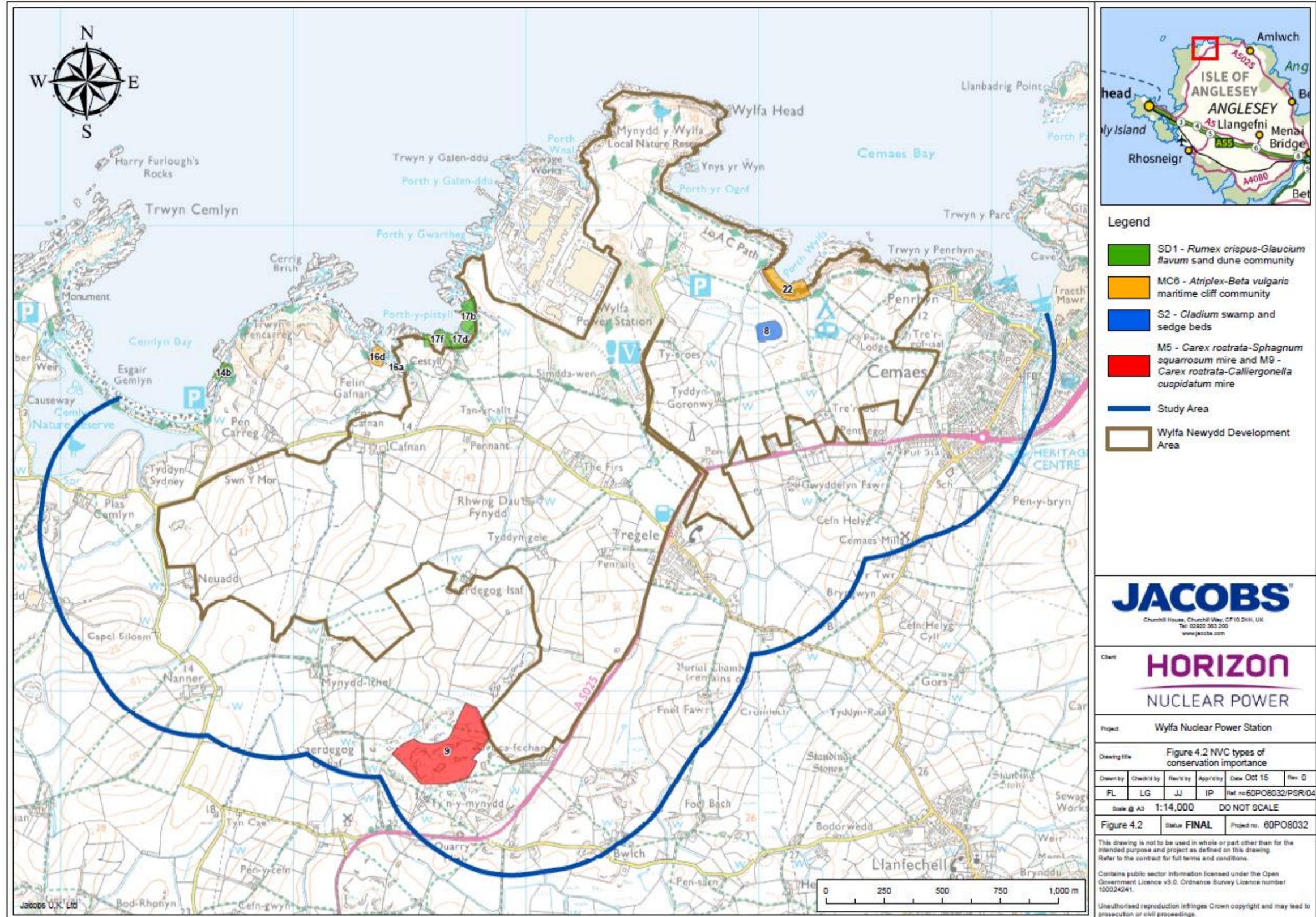


Figure 4.3 Habitats of conservation importance

5. Conclusions

The majority of vegetation communities identified were reasonably common and widespread in the north and west of the UK. The exceptions were:

- M5 *Carex rostrata* – *Sphagnum squarrosum* and M9 *Carex rostrata* – *Calliergon cuspidatum/giganteum* mire communities at Cae Gwyn SSSI;
- S2 *Cladium mariscus* swamp and sedge-beds at Tre'r Gof SSSI; and
- SD1 *Rumex crispus* – *Glaucium flavum* shingle community and MC6 *Atriplex prostrata* – *Beta vulgaris* ssp. *maritima* sea-bird cliff community at Porth-y-pistyll and Cemlyn Bay.

These NVC vegetation types of conservation importance were fragmented with limited distribution across the study area. Many of these habitats were located outside the Wylfa Newydd Development Area.

The NVC surveys of Wylfa Head and Trwyn Pencerrag showed both sites support varied plant communities with several uncommon native species. The coastal grasslands at Wylfa Head were primarily MC9 *Festuca rubra* – *Holcus lanatus* communities, and, at Trwyn Pencarreg, the dominant habitat was *Ulex gallii* heathland. These habitats were assessed as common types in the UK and the maritime grassland communities present are likely to be widespread along western coasts. Further detailed surveys at Wylfa Head East suggested that the dominant NVC community was MC9 maritime cliff community, associated with more sheltered coastal rocks than is typical of the Wylfa Head area as a whole. The NVC analysis also supported the visual assessment of a high degree of variability across the site, and the more exposed, and heavily rabbit-grazed, areas of the site showed a tendency towards other maritime cliff communities such as MC5 and MC8. In general, the vegetation community here was distinctly that of maritime cliff vegetation as opposed to mesotrophic grassland. These habitats are considered to be of medium conservation value.

Tre'r Gof SSSI has maintained its botanical interest and diversity, although much of the surrounding landscape has been agriculturally improved. The habitats found were very different in character from their surroundings and, as such, they represent unique examples of their type within the study area and are considered to have a high conservation value.

Cae Gwyn SSSI proved to be both more fragmented and also more acidic in character than Tre'r Gof SSSI, with a considerable small scale variation in NVC vegetation types indicative of the presence of small basic flushes. Most of the NVC communities identified at Cae Gwyn SSSI were either widespread and/or common nationally or common on Anglesey but much rarer elsewhere. The exception being M5 *Carex rostrata* – *Sphagnum squarrosum* mire community which is scarce both nationally and on Anglesey. Cae Gwyn SSSI is considered to have a high conservation value.

The surveys showed that the fields at Mynydd Ithel are important ecologically due to their isolation and percentage cover of the study area. Although the plants present in the fields are common and widespread, it is the diversity of plant species within the community as a whole that provides ecological value.

Combined with its limited extent of only 0.4 ha, unfavourable condition and isolation from Trwyn Pencarreg, the heathland at Groes-fechan is considered to be of less ecological importance than the coastal heathland found at Trwyn Pencarreg.

The coastal vegetated shingle representative of the Annex 1 habitat perennial vegetation on stony banks was identified in four locations in the study area. Three of these could be affected by the Project and are all in Porth-y-pistyll. This habitat type is considered to have a high level of conservation importance. However, the extent of the habitat type in the Wylfa Newydd Development Area is 1.8 ha, which represents only 10% of the total in the local area and an extremely small fraction of the UK total. The limited number of sea kale plants supported by the sites in Porth-y-pistyll, and the absence of the other key species, supports further the argument to suggest that the SD1/H1220 habitats present are of limited value.

Bluebell was the only legally protected plant species recorded in the study area. No additional notable species were recorded. However, a number of locally important species were recorded: adder's-tongue, allseed, chaffweed, heath pearlwort, lesser water plantain, petty whin, spring squill, sea kale, tufted sedge and yellow bartsia.

Finally, across all surveyed sites it was noted that no vascular plant species were found described as non-native to the UK in the New Atlas of the British and Irish Flora (Preston *et al.*, 2002). This is indicative of a long period of habitat continuity combined with a very low past human impact.

6. References

- Arup. (2009). *Wylfa Proposed Nuclear Power Station – Phase 1 Habitat Survey*. Unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd.
- Arup. (2010). *Wylfa Proposed Nuclear Power Station – Grassland Habitat Survey*. Unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd.
- Arup. (2012). *Wylfa Proposed Nuclear Power Station – Grassland and Heath NVC Survey*. Unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd.
- Atherton, I., Bosanquet, S. and Lawley, M. (2010). *Mosses and Liverworts of Britain and Ireland – a Field Guide*. British Bryological Society: London.
- Botanical Society of Britain and Ireland (BSBI). (2015). Online Atlas – Distribution of Sea kale. [Online]. Available at: <http://bsbi.org/maps/?taxonid=2cd4p9h.vcf>. [Accessed 18/12/2015].
- Hill, M. O. (1989). Computerized matching of relevés and association tables, with an application to the British National Vegetation Classification. *Vegetation*. 83: 187-194.
- Hill, M.O. (1996). *TABLEFIT Version 1.0 for identification of vegetation types*. Institute of Terrestrial Ecology: Huntingdon.
- Jacobs. (2013a). *Consultancy Report: Phase 1 extended habitat survey report*. Unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd. Ref. W202.01-S5-PAC-REP-00015.
- Jacobs. (2013b). *Consultancy Report: An assessment of the vegetation of key habitats within the Wylfa Newydd site using National Vegetation Classification (NVC) methods*. Unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd. Ref. W202.01-S5-PAC-REP-00019.
- Jacobs. (2014). *Consultancy Report: An assessment of the vegetation of key habitats within the Wylfa NPS and buffer area using National Vegetation Classification (NVC) methods*. Unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd. Ref. WN03.01.01-S5-PAC-REP-00009.
- Jacobs. (2015). *National Vegetation Classification Surveys 2015 – Addendum to 2014 Report*. Unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd. WN034-JAC-PAC-REP-00032.
- JNCC. (2004). Common Standards Monitoring Guidance for Vegetated Coastal Shingle Habitats. [Online]. Available at: http://jncc.defra.gov.uk/pdf/csm_coastal_shingle.pdf. [Accessed 18/12/2015].
- JNCC. (2007). *Second Report by the UK under Article 17 of the Directive from January 2001 to December 2006*. JNCC: Peterborough.
- JNCC. (2015a). *Natura 2000 Standard Data Form – Bae Cemlyn/Cemlyn Bay SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/ProtectedSites/SACselection/n2kforms/UK0030114.pdf>. [Accessed 18/12/2015].
- JNCC. (2015b). *Habitat account – Marine, coastal and halophytic habitats*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/habitat.asp?FeatureIntCode=H1220>. [Accessed 18/12/2015].
- JNCC. (2015c). *Natura 2000 Standard Data Form – Chesil and the Fleet SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0017076.pdf>. [Accessed 18/12/2015].
- JNCC. (2015d). *Natura 2000 Standard Data Form – Culbin Bay SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0019807.pdf>. [Accessed 18/12/2015].

JNCC. (2015e). *Natura 2000 Standard Data Form – Dungeness SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0013059.pdf>. [Accessed 18/12/2015].

JNCC. (2015f). *Natura 2000 Standard Data Form – Lower Rover Spey – Spey Bay SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0019978.pdf>. [Accessed 18/12/2015].

JNCC. (2015g). *Natura 2000 Standard Data Form – Morecambe SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0013027.pdf>. [Accessed 18/12/2015].

JNCC. (2015h). *Natura 2000 Standard Data Form – North Norfolk Coast SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0019838.pdf>. [Accessed 18/12/2015].

JNCC. (2015i). *Natura 2000 Standard Data Form – Orfordness – Shingle Street SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0014780.pdf>. [Accessed 18/12/2015].

JNCC. (2015j). *Natura 2000 Standard Data Form – Minsmere to Walberswick Heaths and Marshes SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUcode=UK0012809>. [Accessed 18/12/2015].

JNCC. (2015k). *Natura 2000 Standard Data Form – Solent Maritime SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0030059.pdf>. [Accessed 18/12/2015].

JNCC. (2015l). *Natura 2000 Standard Data Form – Solway Firth SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0013025.pdf>. [Accessed 18/12/2015].

JNCC. (2015m). *Natura 2000 Standard Data Form – Stangford Lough SAC*. [Online]. Available at: <http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0016618.pdf>. [Accessed 18/12/2015].

MapMate Version 2.4.0. Copyright 2013. MapMate Limited.

Preston, C.D., Pearman D.A. and Dines T.D. (2002). *New Atlas of the British and Irish Flora*. Oxford University Press: Oxford.

Rodwell, J. S. (ed.). (1992). *British Plant Communities. Volume 3. Grassland and montane communities*. Cambridge University Press: Cambridge.

Rodwell, J.S. (1998a). *British Plant Communities. Volume 2: Key to Mires and heaths*. Cambridge University Press: Cambridge.

Rodwell, J.S. (1998b). *British Plant Communities. Volume 3: Key to Grassland and montane communities*. Cambridge University Press: Cambridge.

Rodwell, J.S. (2006). *National Vegetation Classification: Users' Handbook*. Joint Nature Conservation Committee: Peterborough.

Sneddon, P. and Randall, R.E. (1993). Coastal vegetated shingle structures of Great Britain: Appendix 1 Shingle sites in wales. [Online]. Available at: http://jncc.defra.gov.uk/pdf/pub94_Sneddon_Randall_Appendix1_Wales.pdf. [Accessed 18/12/2015].

Stace, C. (2010). *New Flora of the British Isles: Third Edition*. Cambridge University Press: Cambridge.

Wales Biodiversity Partnership (WBP). (2014). *Lowland Grassland and Heathland Priority Habitats in Wales – Anglesey Coastal Heath and Grassland Priority habitat map*. [Online]. Available at: <http://www.biodiversitywales.org.uk/Lowland-Grassland-Heathland>. [Accessed 18/12/2015].

Appendix A. Cofnod Plant Species Records

Key:

ANG:	Isle of Anglesey
CITES:	Convention on International Trade in Endangered Species
CON:	Conwy
DEN:	Denbighshire
FLI:	Flintshire
GWY:	Gwynedd
HDir:	EU Habitats Directive
LBAP:	Local Biodiversity Action Plan
LI:	Locally Important Species – identified by the County Recorder as being of particular importance in the specified Vice-County
RD1:	Red Data Book listing for the UK based on IUCN guidelines
RD2:	Red Data Book listing for the UK not based on IUCN guidelines
SNP:	Snowdonia
UKBAP:	UK Biodiversity Action Plan Priority Species
WCA8:	Wildlife and Countryside Act Schedule 8
WVP:	IUCN Threat Listing of Welsh Vascular Plants

Scientific Name	Common name	Status List	Grid Reference	Location	Date
<i>Apium graveolens</i>	Wild celery	LI[VC52]	SH 3293	Cemlyn	1994
<i>Apium graveolens</i>	Wild celery	LI[VC52]	SH 331932	Cemlyn	Before September 1990
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 330932	Cemlyn	2008
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 3314893316	Cemlyn	02/06/2012
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 331932	Cemlyn Bay	06/06/1989 – 07/06/1989
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 331932	Cemlyn	Before September 1990
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 33579312	Anglesey	15/11/2003
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 3393	Cemlyn	2009
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 3393	Cemlyn	Aug-98
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 3393	Cemlyn	16/06/1986 – 28/06/1986
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 3393	Cemlyn	23/04/2010 – 08/08/2010

Scientific Name	Common name	Status List	Grid Reference	Location	Date
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 3393	Cemlyn	23/05/2001 – 26/07/2001
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 3393	Cemlyn	April 2011 – August 2011
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 355944	Mynydd y Wylfa	13/07/1983
<i>Armeria maritima</i>	Sea pink	LBAP[ANG]	SH 355944	Tre'r Gof SSSI and Mynydd y Wylfa	1986 approx
<i>Armeria maritima</i> subsp. <i>maritima</i>	Thrift	LBAP[ANG]	SH 3293993356	Cemlyn	02/06/2012
<i>Armeria maritima</i> subsp. <i>maritima</i>	Thrift	LBAP[ANG]	SH 32949356	Cemlyn; north car park	03/06/2012
<i>Armeria maritima</i> subsp. <i>maritima</i>	Thrift	LBAP[ANG]	SH 3303293555	Cemlyn	02/06/2012
<i>Armeria maritima</i> subsp. <i>maritima</i>	Thrift	LBAP[ANG]	SH 3311193874	Cemlyn	02/06/2012
<i>Atriplex laciniata</i>	Frosted orache	LBAP[GWY]	SH 3393	Cemlyn	Aug-98
<i>Atriplex laciniata</i>	Frosted orache	LBAP[GWY]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Atriplex littoralis</i>	Grass-leaved orache	LBAP[CON, GWY]	SH 3393	Cemlyn	Jul-98
<i>Atriplex littoralis</i>	Grass-leaved orache	LBAP[CON, GWY]	SH 3393	Cemlyn	Aug-98
<i>Atriplex pedunculata</i>	Pedunculate sea-purslane	RD1, RD2, UKBAP, WCA8	SH 331932	Cemlyn	Before September 1990
<i>Atriplex portulacoides</i>	Sea-purslane	LBAP[GWY]	SH 328931	Cemlyn	25/05/1981 – 17/08/1981
<i>Atriplex portulacoides</i>	Sea-purslane	LBAP[GWY]	SH 3303293555	Cemlyn	02/06/2012
<i>Atriplex portulacoides</i>	Sea-purslane	LBAP[GWY]	SH 332932	Cemlyn	25/05/1981 – 17/08/1981
<i>Atriplex portulacoides</i>	Sea-purslane	LBAP[GWY]	SH 3393	Cemlyn	Aug-98
<i>Atriplex portulacoides</i>	Sea-purslane	LBAP[GWY]	SH 3393	Cemlyn	23/05/2001 – 26/07/2001
<i>Atriplex portulacoides</i>	Sea-purslane	LBAP[GWY]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Baldellia ranunculoides</i>	Lesser water-plantain	RD1, LBAP[GWY]	SH 358936	SSSI: Tre'r Gof	01/08/1983
<i>Bidens cernua</i>	Nodding bur-marigold	LBAP[GWY]	SH 360916	Cors Cromlech	14/06/1983

Scientific Name	Common name	Status List	Grid Reference	Location	Date
<i>Bromopsis erecta</i>	Upright brome	LBAP[CON], LI[VC52]	SH 355944	Mynydd y Wylfa	13/07/1983
<i>Bromopsis erecta</i>	Upright brome	LBAP[CON], LI[VC52]	SH 355944	SSSI: Tre'r Gof; Mynydd y Wylfa	1986 approx
<i>Bromus racemosus</i>	Smooth brome	LBAP[GWY], LI[VC52]	SH 3393	Cemlyn	Spring 1998 – Summer 1998
<i>Bromus secalinus</i>	Rye brome	RD1, RD2, WVP	SH 331932	Cemlyn Bay	06/06/1989 – 07/06/1989
<i>Calliergon giganteum</i>	Giant spear-moss	LBAP[CON, FLI]	SH 3691	Llanfechell, west of	1981
<i>Caloplaca granulosa</i>	Caloplaca granulosa	RD1, RD2	SH 3794	Llanbadrig Churchyard, Anglesey	1995
<i>Carduus crispus</i>	Wetted thistle	LI[VC52]	SH 331934	SSSI: Cemlyn Bay	Summer 1999
<i>Carduus crispus</i>	Wetted thistle	LI[VC52]	SH 3393	Cemlyn	23/05/2001 – 26/07/2001
<i>Carex acutiformis</i>	Lesser pond-sedge	LBAP[GWY]	SH 360916	Cors Cromlech	14/06/1983
<i>Carex arenaria</i>	Sand sedge	LBAP[CON]	SH 331932	Cemlyn	Before September 1990
<i>Carex diandra</i>	Lesser tussock-sedge	RD1, LBAP[GWY]	SH 36019362	Tre'r Gof	02/07/2004
<i>Carex distans</i>	Distant sedge	LBAP[CON]	SH 331932	Cemlyn	Before September 1990
<i>Carex disticha</i>	Brown sedge	LBAP[CON, GWY]	SH 331932	Cemlyn	Before September 1990
<i>Carex limosa</i>	Bog-sedge	LBAP[CON], LI[VC52]	SH 346918	SSSI: Cae Gwyn	17/08/1978
<i>Carex limosa</i>	Bog-sedge	LBAP[CON], LI[VC52]	SH 347918	Cae Gwyn	1980
<i>Carex limosa</i>	Bog-sedge	LBAP[CON], LI[VC52]	SH 3491	Cae Gwyn	01/09/1999
<i>Carex pallescens</i>	Pale sedge	LI[VC52]	SH 3491	Cae Gwyn	1970 – 1986
<i>Carex viridula subsp. oedocarpa</i>	Common yellow-sedge	LBAP[DEN]	SH 355944	Mynydd y Wylfa	13/07/1983
<i>Carex viridula subsp. oedocarpa</i>	Common yellow-sedge	LBAP[DEN]	SH 355944	SSSI: Tre'r Gof; Mynydd y Wylfa	1986 approx
<i>Carex viridula subsp. oedocarpa</i>	Common yellow-sedge	LBAP[DEN]	SH 358936	SSSI: Tre'r Gof	01/08/1983
<i>Centaurium littorale</i>	Seaside centaury	RD2, LBAP[ANG, CON, FLI, GWY]	SH 3393	Trwyn Cemlyn	01/09/2001
<i>Cerastium arvense</i>	Field mouse-ear	WVP, LI[VC52]	SH 3393	Cemlyn	23/05/2001 – 26/07/2001
<i>Cladium mariscus</i>	Great fen-sedge	LBAP[GWY]	SH 358936	SSSI: Tre'r Gof	01/08/1983

Scientific Name	Common name	Status List	Grid Reference	Location	Date
<i>Cladium mariscus</i>	Great fen-sedge	LBAP[GWY]	SH 359936	Tre'r Gof	1980
<i>Climacium dendroides</i>	Tree-moss	LBAP[CON]	SH 360916	Cors Cromlech	14/06/ 1983
<i>Cochlearia anglica</i>	English scurvygrass	LBAP[GWY]	SH 331932	Cemlyn	Before Septem ber 1990
<i>Cochlearia anglica</i>	English scurvygrass	LBAP[GWY]	SH 3393	Cemlyn	Aug-98
<i>Cochlearia anglica</i>	English scurvygrass	LBAP[GWY]	SH 3393	Cemlyn	Spring 1997 – Summe r 1997
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 3314893316	Cemlyn	02/06/ 2012
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 3314893316	Cemlyn	25/05/ 1981 – 17/08/ 1981
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 331932	Cemlyn Bay	06/06/ 1989 – 07/06/ 1989
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 331932	Cemlyn	Before Septem ber 1990
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 332932	SSSI: Cemlyn Bay	Before 1996
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 334931	Cemlyn	03/06/ 2012
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 33579312	Anglesey	Nov-03
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 33579312	Anglesey	15/11/ 2003
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 337934	Cemlyn, below Pen Carreg	02/06/ 2002
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 3393	Cemlyn	Aug-98
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 3393	Cemlyn	16/06/ 1986 – 28/06/ 1986
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 3393	Cemlyn shingle ridge	23/05/ 2001 – 26/07/ 2001
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 3393	Cemlyn	Spring 1995 – Summe r 1995
<i>Crambe maritima</i>	Sea kale	LBAP[ANG, CON]	SH 3393	Cemlyn	Spring 1999 – Summe r 1999
<i>Crepis biennis</i>	Rough Hawk's-beard	WVP, LBAP[CON]	SH 331932	Cemlyn	Before Septem ber 1990
<i>Crepis paludosa</i>	Marsh Hawk's-beard	LI[VC52]	SH 3393	Cemlyn; road to Tyn Llan.	23/05/ 2001 – 26/07/

Scientific Name	Common name	Status List	Grid Reference	Location	Date
					2001
<i>Crepis paludosa</i>	Marsh Hawk's-beard	LI[VC52]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Dactylorhiza incarnata</i> subsp. <i>pulchella</i>	Early marsh-orchid	CITES, LBAP[CON, DEN, GWY], LI[VC52]	SH 35979366	Tre'r Gof	02/07/2004
<i>Drosera rotundifolia</i>	Round-leaved sundew	LBAP[ANG]	SH 346918	SSSI: Cae Gwyn	17/08/1978
<i>Drosera rotundifolia</i>	Round-leaved sundew	LBAP[ANG]	SH 358936	SSSI: Tre'r Gof	01/08/1983
<i>Elatine hexandra</i>	Six-stamened waterwort	LBAP[ANG, CON, GWY], LI[VC52]	SH 3490	Llyn Llygeirian, nr. Causeway	1970 – 1986
<i>Elatine hydropiper</i>	Eight-stamened waterwort	RD2, LBAP[ANG, GWY]	SH 3490	Llyn Llygeirian	13/07/1983
<i>Eleocharis uniglumis</i>	Slender spike-rush	LBAP[CON, GWY]	SH 331932	Cemlyn	Before September 1990
<i>Elytrigia atherica</i>	Sea couch	LI[VC52]	SH 331932	Cemlyn Bay	06/06/1989 – 07/06/1989
<i>Elytrigia atherica</i>	Sea couch	LI[VC52]	SH 331932	Cemlyn	Before September 1990
<i>Elytrigia atherica</i>	Sea couch	LI[VC52]	SH 3393	Cemlyn	1994
<i>Elytrigia atherica</i>	Sea couch	LI[VC52]	SH 3393	Cemlyn	Aug-98
<i>Elytrigia juncea</i>	Sand couch	LBAP[CON]	SH 331932	Cemlyn	Before September 1990
<i>Erophila majuscula</i>	Hairy whitlowgrass	LI[VC52]	SH 3794	Llanbadrig	14/06/1998
<i>Euphorbia paralias</i>	Sea spurge	CITES, LBAP[CON]	SH 3393	Cemlyn	Aug-98
<i>Eurhynchium praelongum</i>	Common feather-moss	LBAP[CON]	SH 331932	Cemlyn Bay	06/06/1989 – 07/06/1989
<i>Galium mollugo</i>	Hedge bedstraw	LI[VC52]	SH 3311193874	Cemlyn	23/05/2001 – 26/07/2001
<i>Galium mollugo</i>	Hedge bedstraw	LI[VC52]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Galium mollugo</i>	Hedge bedstraw	LI[VC52]	SH 3793	Cemaes by-pass	1991
<i>Genista anglica</i>	Petty whin	RD1, LBAP[GWY]	SH 35679449	Wylfa Head	20/05/2007
<i>Glaucium flavum</i>	Yellow horned-poppy	LI[VC52]	SH 3314893316	Cemlyn	02/06/2012
<i>Glaucium flavum</i>	Yellow horned-poppy	LI[VC52]	SH 3314893316	Cemlyn	25/05/1981 – 17/08/1981
<i>Glaucium flavum</i>	Yellow horned-poppy	LI[VC52]	SH 331932	Cemlyn	Before

Scientific Name	Common name	Status List	Grid Reference	Location	Date
					September 1990
<i>Glaucium flavum</i>	Yellow horned-poppy	LI[VC52]	SH 332934	Cemlyn	26/07/2005
<i>Glaucium flavum</i>	Yellow horned-poppy	LI[VC52]	SH 3393	Cemlyn	Aug-98
<i>Glaucium flavum</i>	Yellow horned-poppy	LI[VC52]	SH 3393	Cemlyn; Weir end of ridge.	23/05/2001 – 26/07/2001
<i>Glaucium flavum</i>	Yellow horned-poppy	LI[VC52]	SH 3393	Cemlyn	April 2011 – August 2011
<i>Glaucium flavum</i>	Yellow horned-poppy	LI[VC52]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Gnaphalium sylvaticum</i>	Heath cudweed	RD1, WVP	SH 342932	Cafnan Marsh	22/07/1983
<i>Hippuris vulgaris</i>	Mare's-tail	WVP, LI[VC52]	SH 3393	Cemlyn; on road to east car park.	23/05/2001 – 26/07/2001
<i>Hyacinthoides non-scripta</i>	Bluebell	WCA8, LBAP[ANG, CON, FLI, SNP]	SH 328931	Cemlyn	25/05/1981 – 17/08/1981
<i>Hyacinthoides non-scripta</i>	Bluebell	WCA8, LBAP[ANG, CON, FLI, SNP]	SH 3293993356	Cemlyn	02/06/2012
<i>Hyacinthoides non-scripta</i>	Bluebell	WCA8, LBAP[ANG, CON, FLI, SNP]	SH 331932	Cemlyn	Before September 1990
<i>Hyacinthoides non-scripta</i>	Bluebell	WCA8, LBAP[ANG, CON, FLI, SNP]	SH 333932	Cemlyn	25/05/1981 – 17/08/1981
<i>Hyacinthoides non-scripta</i>	Bluebell	WCA8, LBAP[ANG, CON, FLI, SNP]	SH 3393	Cemlyn	16/06/1986 – 28/06/1986
<i>Hyacinthoides non-scripta</i>	Bluebell	WCA8, LBAP[ANG, CON, FLI, SNP]	SH 3393	Cemlyn	23/05/2001 – 26/07/2001
<i>Hyacinthoides non-scripta</i>	Bluebell	WCA8, LBAP[ANG, CON, FLI, SNP]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Inula crithmoides</i>	Golden samphire	RD2, LBAP[ANG, GWY]	SH 3293	W. of Cemlyn Point	1978
<i>Jasione montana</i>	Sheep's-bit	WVP	SH 328931	Cemlyn	25/05/1981 – 17/08/1981
<i>Jasione montana</i>	Sheep's-bit	WVP	SH 331932	Cemlyn	Before September 1990

Scientific Name	Common name	Status List	Grid Reference	Location	Date
<i>Jasione montana</i>	Sheep's-bit	WVP	SH 332932	Cemlyn	25/05/1981 – 17/08/1981
<i>Jasione montana</i>	Sheep's-bit	WVP	SH 3393	Cemlyn	Aug-98
<i>Jasione montana</i>	Sheep's-bit	WVP	SH 3393	Cemlyn	Spring 1998 – Summer 1998
<i>Jasione montana</i>	Sheep's-bit	WVP	SH 339934	SSSI: Cemlyn Bay; Trwyn Pencarreg	24/05/1991
<i>Jasione montana</i>	Sheep's-bit	WVP	SH 355944	Mynydd-y-Wylfa	13/07/1983
<i>Jasione montana</i>	Sheep's-bit	WVP	SH 355944	SSSI: Tre'r Gof; Mynydd y Wylfa	1986 approx
<i>Juncus castaneus</i>	Chestnut rush	RD1, RD2	SH 331932	Cemlyn	Before September 1990
<i>Juncus gerardii</i>	Saltmarsh rush	LBAP[CON]	SH 331932	Cemlyn Bay	06/06/1989 – 07/06/1989
<i>Juncus gerardii</i>	Saltmarsh rush	LBAP[CON]	SH 331932	Cemlyn	Before September 1990
<i>Juncus maritimus</i>	Sea rush	LBAP[CON]	SH 331932	Cemlyn	Before September 1990
<i>Juncus subnodulosus</i>	Blunt-flowered rush	LBAP[GWY]	SH 358936	SSSI: Tre'r Gof	01/08/1983
<i>Juncus subnodulosus</i>	Blunt-flowered rush	LBAP[GWY]	SH 358936	SSSI: Tre'r Gof	24/07/1985
<i>Juncus subnodulosus</i>	Blunt-flowered rush	LBAP[GWY]	SH 359936	Tre'r Gof	1980
<i>Leontodon hispidus</i>	Rough hawkbit	LI[VC52]	SH 331932	Cemlyn Bay	06/06/1989 – 07/06/1989
<i>Leontodon hispidus</i>	Rough hawkbit	LI[VC52]	SH 333932	Cemlyn	25/05/1981 – 17/08/1981
<i>Leontodon hispidus</i>	Rough hawkbit	LI[VC52]	SH 3393	Cemlyn; on the ridge (Esgair).	23/05/2001 – 26/07/2001
<i>Linum bienne</i>	Pale flax	LI[VC52]	SH 3593	Existing Power Station	1997
<i>Mentha aquatica</i>	Water mint	LBAP[ANG]	SH 333929	Cemlyn	25/05/1981 – 17/08/1981
<i>Mentha aquatica</i>	Water mint	LBAP[ANG]	SH 3393	Cemlyn	Spring 1998 – Summer 1998
<i>Mentha aquatica</i>	Water mint	LBAP[ANG]	SH 3393	Cemlyn	Spring 1999 –

Scientific Name	Common name	Status List	Grid Reference	Location	Date
					Summer 1999
<i>Mentha aquatica</i>	Water mint	LBAP[ANG]	SH 342932	Cafnan Marsh	22/07/1983
<i>Mentha aquatica</i>	Water mint	LBAP[ANG]	SH 342932	Cafnan Farm	1986 approx
<i>Mentha aquatica</i>	Water mint	LBAP[ANG]	SH 346918	SSSI: Cae Gwyn	17/08/1978
<i>Mentha aquatica</i>	Water mint	LBAP[ANG]	SH 358936	SSSI: Tre'r Gof	01/08/1983
<i>Mentha aquatica</i>	Water mint	LBAP[ANG]	SH 358936	SSSI: Tre'r Gof	24/07/1985
<i>Mentha aquatica</i>	Water mint	LBAP[ANG]	SH 360916	Cors Cromlech	14/06/1983
<i>Mentha aquatica</i>	Water mint	LBAP[ANG]	SH 373914	Carrog Isa, Afon Meddanen	22/07/1999
<i>Mertensia maritima</i>	Oysterplant	RD1, RD2, WVP, LBAP[CON]	SH 3293	Cemlyn	1914
<i>Microbryum starckeanum</i>	Starke's pottia	RD2, LBAP[CON, DEN]	SH 3693	Cemaes Bay	1973
<i>Oenanthe lachenalii</i>	Parsley water-dropwort	LBAP[CON, GWY]	SH 328931	Cemlyn	25/05/1981 – 17/08/1981
<i>Oenanthe lachenalii</i>	Parsley water-dropwort	LBAP[CON, GWY]	SH 331932	Cemlyn	Before September 1990
<i>Oenanthe lachenalii</i>	Parsley water-dropwort	LBAP[CON, GWY]	SH 3393	Cemlyn; road by Bryn Aber.	23/05/2001 – 26/07/2001
<i>Oenanthe lachenalii</i>	Parsley water-dropwort	LBAP[CON, GWY]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Osmunda regalis</i>	Royal fern	LI[VC52]	SH 346918	SSSI: Cae Gwyn	17/08/1978
<i>Osmunda regalis</i>	Royal fern	LI[VC52]	SH 347918	Cae Gwyn	1980
<i>Osmunda regalis</i>	Royal fern	LI[VC52]	SH 3491	Cae Gwyn	01/09/1999
<i>Padina pavonica</i>	Peacock's tail	RD2, S42, UKBAP	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Persicaria bistorta</i>	Common bistort	LBAP[GWY]	SH 3393	Cemlyn	Aug-98
<i>Plagiomnium elatum</i>	Tall thyme-moss	LBAP[CON, FLI]	SH 360916	Cors Cromlech	14/06/1983
<i>Plantago media</i>	Hoary plantain	LI[VC52]	SH 3393	Cemlyn	23/05/2001 – 26/07/2001
<i>Plantago media</i>	Hoary plantain	LI[VC52]	SH 3393	Cemlyn	Spring 1998 – Summer 1998
<i>Plantago media</i>	Hoary plantain	LI[VC52]	SH 3393	Cemlyn	Spring 1999 – Summer 1999

Scientific Name	Common name	Status List	Grid Reference	Location	Date
<i>Puccinellia maritima</i>	Common saltmarsh-grass	LBAP[CON]	SH 331932	Cemlyn	Before September 1990
<i>Puccinellia maritima</i>	Common saltmarsh-grass	LBAP[CON]	SH 3393	Cemlyn	Aug-97
<i>Puccinellia maritima</i>	Common saltmarsh-grass	LBAP[CON]	SH 3393	Cemlyn	Aug-98
<i>Radiola linoides</i>	Allseed	RD1, LBAP[GWY]	SH 35719451	Wylfa Head	20/05/2007
<i>Ranunculus baudotii</i>	Brackish water-crowfoot	LBAP[GWY], LI[VC52]	SH 3293	Cemlyn	15/10/1987
<i>Ranunculus fluitans</i>	River water-crowfoot	LBAP[CON], LI[VC52]	SH 3793	Afon Wygyr, Cemaes	Jun-99
<i>Ranunculus trichophyllus</i>	Thread-leaved water-crowfoot	LBAP[GWY], LI[VC52]	SH 358936	SSSI: Tre'r Gof	01/08/1983
<i>Ranunculus trichophyllus</i>	Thread-leaved water-crowfoot	LBAP[GWY], LI[VC52]	SH 359936	Tre'r Gof	1980
<i>Raphanus raphanistrum subsp. maritimus</i>	Sea radish	LBAP[GWY], LI[VC52]	SH 3393	Trwyn Cemlyn	1971
<i>Rhinanthus minor</i>	Yellow-rattle	LBAP[ANG]	SH 331932	Cemlyn	Before September 1990
<i>Rhinanthus minor</i>	Yellow-rattle	LBAP[ANG]	SH 3393	Cemlyn	16/06/1986 – 28/06/1986
<i>Rhinanthus minor</i>	Yellow-rattle	LBAP[ANG]	SH 346918	SSSI: Cae Gwyn	17/08/1978
<i>Rhinanthus minor</i>	Yellow-rattle	LBAP[ANG]	SH 360916	Cors Cromlech	14/06/1983
<i>Ruppia cirrhosa</i>	Spiral tasselweed	RD1, RD2, WVP	SH 33369314	Cemlyn	22/08/2006
<i>Ruppia maritima</i>	Beaked Tasselweed	WVP, LI[VC52]	SH 331932	Cemlyn	Before September 1990
<i>Ruppia maritima</i>	Beaked tasselweed	WVP, LI[VC52]	SH 331934	SSSI: Cemlyn Bay	Sep-87
<i>Salicornia europaea</i>	Common glasswort	LBAP[CON, GWY]	SH 331932	Cemlyn	Before September 1990
<i>Salicornia europaea</i>	Common glasswort	LBAP[CON, GWY]	SH 3393	Cemlyn	Aug-97
<i>Salicornia europaea</i>	Common glasswort	LBAP[CON, GWY]	SH 3393	Cemlyn	Aug-98
<i>Salicornia europaea</i>	Common glasswort	LBAP[CON, GWY]	SH 3393	Cemlyn; on the ridge (Esgair).	23/05/2001 – 26/07/2001
<i>Salicornia europaea</i>	Common glasswort	LBAP[CON, GWY]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Salix pentandra</i>	Bay willow	WVP	SH 342932	Cafnan Marsh	22/07/1983
<i>Salix pentandra</i>	Bay willow	WVP	SH 342932	Cafnan Farm	1986 approx
<i>Samolus valerandi</i>	Brookweed	LBAP[CON]	SH 358936	SSSI: Tre'r Gof	01/08/1983
<i>Sarcocornia perennis</i>	Perennial wlasswort	RD2, WVP	SH 3393	Cemlyn	Spring

Scientific Name	Common name	Status List	Grid Reference	Location	Date
					1999 – Summer 1999
<i>Scapania lingulata</i>	Tongue earwort	RD2	SH 3594	Cemaes Bay	14/06/ 1986
<i>Schoenoplectus lacustris</i>	Common club-rush	LBAP[GWY]	SH 360916	Cors Cromlech	14/06/ 1983
<i>Schoenoplectus tabernaemontani</i>	Grey club-rush	LBAP[CON]	SH 331932	Cemlyn	Before Septem ber 1990
<i>Senecio erucifolius</i>	Hoary ragwort	LBAP[GWY], LI[VC52]	SH 3393	Cemlyn; road br Bryn Aber.	23/05/ 2001 – 26/07/ 2001
<i>Senecio erucifolius</i>	Hoary ragwort	LBAP[GWY], LI[VC52]	SH 3393	Cemlyn	Spring 1999 – Summe r 1999
<i>Senecio erucifolius</i>	Hoary ragwort	LBAP[GWY], LI[VC52]	SH 3593	nr. Cemaes	1987 – 1999
<i>Serratula tinctoria</i>	Saw-wort	LBAP[CON]	SH 360916	Cors Cromlech	14/06/ 1983
<i>Sparganium erectum subsp. erectum</i>	Branched bur-reed	WVP	SH 360916	Cors Cromlech	14/06/ 1983
<i>Sparganium erectum subsp. neglectum</i>	Branched bur-reed	WVP	SH 342932	Cafnan Farm	1986 approx
<i>Sparganium erectum subsp. neglectum</i>	Branched Bur-reed	WVP	SH 358936	SSSI: Tre'r Gof	01/08/ 1983
<i>Spergularia arvensis</i>	Corn spurrey	RD1, WVP, LBAP[GWY]	SH 328932	Cemlyn	30/08/ 2005
<i>Spergularia media</i>	Greater sea-spurrey	LBAP[CON]	SH 328931	Cemlyn	25/05/ 1981 – 17/08/ 1981
<i>Spergularia media</i>	Greater sea-spurrey	LBAP[CON]	SH 332932	Cemlyn	25/05/ 1981 – 17/08/ 1981
<i>Spergularia media</i>	Greater sea-spurrey	LBAP[CON]	SH 3393	Cemlyn	Aug-98
<i>Spergularia media</i>	Greater sea-spurrey	LBAP[CON]	SH 3393	Cemlyn	16/06/ 1986 – 28/06/ 1986
<i>Spergularia media</i>	Greater sea-spurrey	LBAP[CON]	SH 3393	Cemlyn; path to memorial + ridge.	23/05/ 2001 – 26/07/ 2001
<i>Spergularia media</i>	Greater sea-spurrey	LBAP[CON]	SH 3393	Cemlyn	Spring 1999 – Summe r 1999
<i>Spergularia rupicola</i>	Rock sea-spurrey	LBAP[CON]	SH 331932	Cemlyn	Before Septem ber 1990
<i>Spergularia rupicola</i>	Rock sea-spurrey	LBAP[CON]	SH 3393	Cemlyn; path to heathland + ridge.	23/05/ 2001 – 26/07/ 2001

Scientific Name	Common name	Status List	Grid Reference	Location	Date
<i>Spergularia rupicola</i>	Rock sea-spurrey	LBAP[CON]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Spergularia rupicola</i>	Rock sea-spurrey	LBAP[CON]	SH 355944	Mynydd y Wylfa	13/07/1983
<i>Spergularia rupicola</i>	Rock sea-spurrey	LBAP[CON]	SH 355944	SSSI: Tre'r Gof; Mynydd y Wylfa	1986 approx
<i>Spiranthes spiralis</i>	Autumn lady's-tresses	CITES, RD1, LBAP[CON, GWY]	SH 33029360	Trwyn Cemlyn	1997
<i>Spiranthes spiralis</i>	Autumn lady's-tresses	CITES, RD1, LBAP[CON, GWY]	SH 331934	SSSI: Cemlyn Bay	03/09/1977
<i>Stachys arvensis</i>	Field woundwort	RD1, WVP, LBAP[GWY]	SH 328932	Cemlyn	30/08/2005
<i>Suaeda vera</i>	Shrubby sea-blite	RD2	SH 3393	Cemlyn	Aug-97
<i>Suaeda vera</i>	Shrubby sea-blite	RD2	SH 3393	Cemlyn	Aug-98
<i>Tephrosia integrifolia</i>	Field fleawort	RD1, RD2	SH 3393	Cemlyn	Spring 1998 – Summer 1998
<i>Thelypteris palustris</i>	Marsh fern	RD2, LBAP[ANG, GWY]	SH 358936	SSSI: Tre'r Gof	01/08/1983
<i>Thelypteris palustris</i>	Marsh fern	RD2, LBAP[ANG, GWY]	SH 35949356	Tre'r Gof	02/07/2004
<i>Thelypteris palustris</i>	Marsh fern	RD2, LBAP[ANG, GWY]	SH 359936	Tre'r Gof	1980
<i>Thelypteris palustris</i>	Marsh fern	RD2, LBAP[ANG, GWY]	SH 36009362	Tre'r Gof	02/07/2004
<i>Trifolium ornithopodioides</i>	Bird's-foot clover	LBAP[ANG], LI[VC52]	SH 32869327	Cemlyn	02/06/2012
<i>Trifolium ornithopodioides</i>	Bird's-foot clover	LBAP[ANG], LI[VC52]	SH 32989372	Cemlyn	11/07/1998
<i>Trifolium ornithopodioides</i>	Bird's-foot clover	LBAP[ANG], LI[VC52]	SH 3311193874	Cemlyn	02/06/2012
<i>Trifolium ornithopodioides</i>	Bird's-foot clover	LBAP[ANG], LI[VC52]	SH 3393	Cemlyn	Spring 1997 – Summer 1997
<i>Trifolium ornithopodioides</i>	Bird's-foot clover	LBAP[ANG], LI[VC52]	SH 34249352	nr. Cestyll	02/06/2002
<i>Trifolium subterraneum</i>	Subterranean clover	LBAP[GWY], LI[VC52]	SH 3393	Cemlyn	Spring 1997 – Summer 1997
<i>Trifolium subterraneum</i>	Subterranean clover	LBAP[GWY], LI[VC52]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Typha angustifolia</i>	Lesser bulrush	LI[VC52]	SH 331932	Cemlyn	Before September 1990
<i>Ulex gallii</i>	Western gorse	LBAP[ANG, CON, SNP]	SH 339934	SSSI: Cemlyn Bay; Trwyn Pencarreg	24/05/1991
<i>Ulex gallii</i>	Western gorse	LBAP[ANG, CON, SNP]	SH 340936	SSSI: Cemlyn Bay; Trwyn Pencarreg	24/05/1991
<i>Ulex gallii</i>	Western gorse	LBAP[ANG, CON, SNP]	SH 346918	SSSI: Cae Gwyn	17/08/1978
<i>Ulex gallii</i>	Western gorse	LBAP[ANG, CON, SNP]	SH 355944	Mynydd y Wylfa	13/07/1983

Scientific Name	Common name	Status List	Grid Reference	Location	Date
<i>Ulex gallii</i>	Western gorse	LBAP[ANG, CON, SNP]	SH 355944	SSSI: Tre'r Gof; Mynydd y Wylfa	1986 approx
<i>Utricularia minor</i>	Lesser bladderwort	LBAP[CON, GWY], LI[VC52]	SH 3491	Cae Gwyn	01/09/1999
<i>Vaccinium oxycoccos</i>	Cranberry	LI[VC52]	SH 346918	SSSI: Cae Gwyn	17/08/1978
<i>Vaccinium oxycoccos</i>	Cranberry	LI[VC52]	SH 347918	Cae Gwyn	1980
<i>Vaccinium oxycoccos</i>	Cranberry	LI[VC52]	SH 3491	Cae Gwyn	01/09/1999
<i>Verbena officinalis</i>	Vervain	LBAP[GWY], LI[VC52]	SH 35659380	Wylfa Head	05/08/2002
<i>Veronica anagallis-aquatica</i>	Blue water-speedwell	LBAP[CON]	SH 333929	Cemlyn	25/05/1981 – 17/08/1981
<i>Vicia lutea</i>	Yellow-vetch	RD1, RD2	SH 3393	Cemlyn	Spring 1998 – Summer 1998
<i>Vicia tetrasperma</i>	Smooth tare	LBAP[GWY]	SH 328932	Cemlyn; Causeway	02/06/2012
<i>Vicia tetrasperma</i>	Smooth tare	LBAP[GWY]	SH 3293993356	Cemlyn	02/06/2012
<i>Viola reichenbachiana</i>	Early dog-violet	LI[VC52]	SH 3393	Cemlyn	Spring 1999 – Summer 1999
<i>Weissia perssonii</i>	Persson's stubble-moss	RD2	SH 3594	Wylfa Head	1986

**Site Preparation and Clearance
Environmental Statement
Volume 3 – Appendix 14-03
Ancient Woodland Botanical Survey
Report**

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Wylfa Newydd

Horizon Nuclear Power

Ancient Woodland Botanical Survey Report

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Wylfa Newydd

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Contents

1.	Introduction	1
1.1	Ancient Woodland in Wales	1
1.2	Ancient Woodland Indicators	1
2.	Survey Methodology	3
2.1	National Vegetation Classification	3
3.	Results and Discussion	5
3.1	Woodland Flora and NVC Affinities	5
3.1.1	Manor Garden	5
3.1.2	Simdda-Wen	6
3.1.3	The Firs Hotel	6
3.2	Status as Ancient Woodland.....	6
4.	Bibliography	8

Appendix A. Species Lists

Appendix B. Photographs

1. Introduction

The Wylfa Newydd Development Area contains three small units of woodland identified as ancient in the Ancient Woodland Inventory for Wales (Table 1, Figure 1). Section 1.1 provides a description of the Ancient Woodland Inventory categories.

Table 1. Ancient woodlands within the Wylfa Newydd Development Area (Forestry Commission, 2016)..

Woodland name	Ancient Woodland Inventory 2011 ID number	National Grid Reference	Area	Ancient Woodland Inventory 2011 category
Manor Garden	26060	SH 356 938	0.3 ha	Ancient Semi Natural Woodland
Simdda-Wen	26059	SH 353 932	0.32	Ancient Semi Natural Woodland
The Firs Hotel	26075	SH 352 929	0.52	Restored Ancient Woodland Site

This memorandum presents the results of botanical surveys of these woods and discusses how these results relate to the identification of the woodlands as ancient woodland. The concept of ancient woodland and the origin of the Ancient Woodland Inventory are first described in order to fix ideas for later reference.



Figure 1. Location of designated Ancient Woodland according to the Ancient Woodland Inventory

1.1 Ancient Woodland in Wales

Ancient woodland is defined as land that has been tree-covered since at least 1600 A.D. This can include a diversity of woodland origins and types, either woodland derived from primary post-glacial forest or secondary woodland that arose before this date (e.g. following abandonment of land associated with agricultural depressions or plagues). An ancient woodland can have passed through a variety of specific uses since 1600 A.D., but it shall never have been destroyed and converted to another kind of land use, such as arable farming. The long continuity of an ancient woodland makes it potentially of great nature conservation value as a habitat for rare flora and fauna, or assemblages of such not found elsewhere.

The concept of ancient woodland has its origins in the work of Oliver Rackham and George Peterken in the late twentieth century (e.g. Rackham (1980) and Peterken (1981)). In order to establish continuity of woodland, these researchers combined primary documentary evidence (maps, court rolls, etc.) with field evidence in the form of archaeological features (ancient earthworks, saw pits, etc.), ancient trees, and aspects of flora and fauna suggestive of ecological continuity.

Using this historical approach, the Nature Conservancy Council, as it was, instigated the Ancient Woodland Inventory; an attempt to identify all ancient woodlands in England, Wales and Scotland. The digital version of the Inventory for Wales was first published in 2004 and is available from the Forestry Commission (Forestry Commission, 2016). The Ancient Woodland Inventory places woodland into one of four categories (Natural Resources Wales, 2016):

- **Ancient Semi-Natural Woodland (ASNW)** – broadleaf woodlands comprising mainly native tree and shrub species which are believed to have been in existence for over 400 years.
- **Plantation on Ancient Woodland Sites (PAWS)** – sites which are believed to have been continuously wooded for over 400 years and currently have a canopy cover of more than 50 percent non-native conifer tree species.
- **Restored Ancient Woodland Sites (RAWS)** – woodlands which are predominately broadleaves now and are believed to have been continually wooded for over 400 years. These woodlands will have gone through a phase when canopy cover was more than 50 percent non-native conifer tree species and now have a canopy cover of more than 50 percent broadleaf.
- **Ancient Woodland Site of Unknown Category (AWSU)** – woodlands which may be ASNW, RAWS or PAWS. These areas are predominantly in transition and existing tree cover is described as 'shrubs', 'young trees', 'felled' or 'ground prepared for planting'.

Boundaries of woodland within the Inventory were deduced from the earliest available mapping. For most of Wales, in particular for Anglesey, this is the 1st edition of the Ordnance Survey (OS), *circa* 1830 and at a scale of one inch to the mile. The later six inch to the mile OS county series dates from 1888 to 1913. Given such recent documentary evidence, Natural Resources Wales provide the following caveat: 'the Ancient Woodland Inventory was always considered to be provisional and subject to refinement and was never intended as a definitive listing of ancient ... woods' (Natural Resources Wales, 2016).

1.2 Ancient Woodland Indicators

The work of Rackham, Peterken and others gave rise to the concept of Ancient Woodland Indicator (AWI) plants. These are species of fern and flowering plant associated primarily with woodland which, on other grounds would be accepted as ancient in origin, and which might be slow to disperse into more recent woodland. Lists of AWI have been published for the southern-most regions of England (collated e.g. in Rose & O'Reilly (2006)), where the documentary evidence is sufficient to substantiate a correlation between continuity of woodland and the occurrence of certain plant species. The concept of AWI is widely applied by analogy to other parts of Britain where such evidence is lacking.

The AWI concept is not without its limitations. Some listed AWI species are popular garden plants (e.g. primrose [*Primula vulgaris*] or hart's-tongue fern [*Asplenium scolopendrium*]); the use of these as AWI for a given wood

therefore needs to be weighed against the proximity of habitation and signs of human influence on the woodland flora. Some species are also considered as AWI in some parts of the country but not others, due to absence or being non-native there, or because they are found widely outside of ancient woodland.

A convincing ancient woodland may contain at least 15 to 20 AWI, but some may contain very few. Some species, especially those forming colonies (e.g. bluebell [*Hyacinthoides non-scripta*]), spread readily from ancient woodland into suitable neighbouring habitat, while other species are more reliable indicators (such as oxlip [*Primula elatior*]). A range of evidence should therefore be used when investigating the origin of woodland.

2. Survey Methodology

The botanical survey of the three woodlands aimed to:

- Assign, where possible, each woodland to a community code within the National Vegetation Classification;
- Compile a list of vascular plants and mosses and liverworts (bryophytes) found in each wood, paying particular attention to AWI species and non-native species; and
- Take note of human influences on the woodland, ancient or recent.

Vascular plant nomenclature follows Stace (2010), that for bryophytes follows Hill *et al* (2008). Bryophytes of walls and other man-made structures within the woods were ignored, as were those of weedy situations.

Photographs were taken of each wood and are included in Appendix B.

2.1 National Vegetation Classification

The National Vegetation Classification (NVC) is based upon a sample of semi-natural vegetation across the UK, and aims to describe the national range of floristic trends. The assignment of units within this classification relies upon the identification of floristically uniform stands, i.e. the largest area of vegetation in which the most conspicuous species are present at a more-or-less constant frequency. Zones where these community dominants change are ignored or sampled separately.

The NVC sampling methodology for woodlands is outlined in Hall, et al. (2004), and is by means of quadrats of fixed size with at least five replicates. From the replicates, a so-called floristic table is compiled, and this is either input into a computer programme able to calculate which NVC community statistically best fits the results, or used more informally to work through the keys to communities published in the above guide or in the woodland volume of the NVC (Rodwell, 1991).

For the present survey, the small size of the woodlands meant that sufficient replicates would overlap considerably. Moreover, the Manor Garden and Simdda-Wen woodlands were perceived to be so uniform as to make recording these small woods *in toto* the most sensible approach. While slightly larger and less uniform, the ground and shrub layers of The Firs Hotel woodland were found to consist almost entirely of either non-native garden plants or 'weedy' plants, and bore no resemblance to any semi-natural woodland ground or shrub layer flora. This wood was therefore also recorded in entirety with more attention paid to the canopy composition, which was more uniform, in the determination of an NVC category.

For each species recorded in each wood, its frequency across the wood was assigned using the DAFOR system:

- D: dominant species;
- A: abundant;
- F: frequent;
- O: occasional; and,
- R: rare.

The prefix 'local' may be added to the first three to indicate heterogeneity in distribution; thus, LA means 'locally abundant'.

While not standard practice, this approach is sufficient to enable the keys to woodland communities to be used, together with their descriptions, to reach a determination. This was felt to be the simplest approach for such small, uniform woodlands with limited sampling options.

3. Results and Discussion

The flora of the three woods surveyed is described below and NVC affinities explained. The extent to which these and other results of the survey support the status of the woods as ancient is then discussed.

3.1 Woodland Flora and NVC Affinities

Lists of vascular plant and bryophyte taxa for each wood, together with their relative frequency can be found in Appendix A.

The canopies of all three woods were found to be dominated by mature sycamore (*Acer pseudoplatanus*), a non-native species. That of The Firs Hotel was a little more varied than the others, with frequent ash (*Fraxinus excelsior*) and common lime (*Tilia x europaea*), and occasional wild cherry (*Prunus avium*). Manor Garden and The Firs Hotel both contained a small number of mature pine trees (*Pinus* spp.). There was no direct evidence of planting of any of the trees, but at least common lime and pine species are presumed to have been planted. None of the trees appeared to be older than a hundred and fifty years, most were likely much younger; those in Simdda-Wen were mostly not more than fifty years in age.

Assuming that these woods are semi-natural, the overall prevalence of sycamore with an appearance by ash, and the lack of oak (*Quercus* spp.) or other generally more calcifugous trees, indicates for all three woodlands an affinity with either W8 *Fraxinus excelsior* – *Acer campestre* – *Mercurialis perennis* woodland or its more oceanic relative W9 *F. excelsior* – *Sorbus aucuparia* – *M. perennis* woodland. The complete absence, however, of dog's mercury (*Mercurialis perennis*) casts some doubt on these assignments, though it could have been grazed out of the Manor Garden woodland. Indeed, the ground flora tended to be of rather generic shade tolerant species, with none of the species usually indicative of these calcicolous woodland types, e.g. wood false-brome (*Brachypodium sylvaticum*).

The woods are further discussed individually.

3.1.1 Manor Garden

The canopy composition of Manor Garden is described above. Two footpaths/tracks pass through the wood, meeting at the gate at its southern boundary: that running to the west has very little tree cover and is very grassy; the canopy over the main track heading north is more-or-less complete (Photo 1). The woodland ends abruptly in neutral grassland.

Manor Garden was largely lacking in a native shrub layer except for the occasional hawthorn (*Crataegus monogyna*). There were three moderately sized elms (*Ulmus*) intermediate between shrub and canopy layers. Two of these trees most resembled wych elm (*U. glabra*) but the third appeared to be a cultivar. Wych elm is frequently regarded as an AWI but it is a common tree in the west of Britain, where it is not an especially strong indicator of old woodland, and may also be planted. There were also several bushes of garden privet (*Ligustrum ovalifolium*) and a laburnum (*Laburnum anagyroides*).

In the field layer, lesser celandine (*Ficaria verna* subsp. *verna*) appeared to have been widespread and abundant earlier in the year and, together with the frequent occurrence of wood dock (albeit as the presumed non-native red-veined variety *Rumex sanguineus* var. *sanguineus*), suggested an affinity with the W8b *Anemone nemorosa* subcommunity rather than either of the subcommunities of W9. Otherwise, the ground flora was a species-poor sward dominated by rough meadow grass (*Poa trivialis*) with a small number of weedy herbs of low total cover, a situation likely attained through grazing by sheep. The southern corner by the wall held a small colony of bluebell (*Hyacinthoides non-scripta*), but there were otherwise no species considered as AWI. There were also several plants of the non-native pink sorrel (*Oxalis articulata*), usually a garden relict

3.1.2 Simdda-Wen

The Simdda-Wen woodland was in two parts: a small block in the west, closest to the sports and social club, and a larger one to the east; a treeless, grassy area separated the two and the southern perimeter was bounded by walls (Photo 4).

Of the three woodlands surveyed, this had perhaps the most natural shrub flora, with English elm (*Ulmus procera*) and hawthorn frequent and hazel (*Corylus avellana*) occasional in the eastern part of the wood, and wych elm present in the western.

The ground flora had abundant cleavers (*Galium aparine*) and cow parsley (*Anthriscus sylvestris*), frequent herb robert (*Geranium robertianum*) stinging nettle (*Urtica dioica*), and was also rather grassy with rough meadow grass frequent (Photo 5). Garden cultivars of daffodil (*Narcissus* sp.) were present in some quantity in the western block of the wood, but of less certain origin were the frequent primrose and, in the eastern half, abundant ramsons (*Allium ursinum*). There was some bluebell in the eastern block of woodland; this was difficult to identify at the time of survey but was probably the hybrid garden bluebell (*H. x massartiana*). Under the wall in the western block were also a few plants of hart's-tongue fern and male fern (*Dryopteris filix-mas*). The former species, considered an AWI in southern Britain, appeared to be a natural population.

The general 'weedy' appearance of the ground flora described above suggests an affinity with W8e *Geranium robertianum* subcommunity. The abundance of ramsons in the western block of the wood might also suggest an affinity with W8f *Allium ursinum* subcommunity, but this was such a small area as to be not thought of as significant.

3.1.3 The Firs Hotel

There was a drive running through The Firs Hotel woodland either side of which were mature trees. These did not meet over the track, leaving it well illuminated (Photo 6). The woodland was confined to either side of the track, with the tree cover breaking around a small glade, and a large opening where once there had been a building (Photo 7).

The highly derivative nature of the ground and shrub layers, which contained many non-native garden herbs (such as elephant ears [*Bergenia crassifolia*] and monk's hood [*Aconitum napellus*]) and shrubs (such as New Zealand holly [*Olearia macrodonta*] and rhododendron [*Rhododendron ponticum*]) together with 'weedy' plants suggestive of abandonment, makes it impossible to determine the precise NVC affinities of this wood. Indeed, the NVC was devised to describe semi-natural vegetation, which The Firs Hotel gave very little appearance of being.

Garden bluebell was abundant in one corner of the wood, together with a small colony of ramsons and several plants of hart's-tongue fern. The latter two species might be considered AWI but are also common garden plants, and so their status as AWI is questionable in this situation.

3.2 Status as Ancient Woodland

All three of the woods were associated with built structures: Manor Garden with a gateway and drive (the house, Wylfa, being long since demolished; Figure 2), the wood having the appearance of an avenue of trees (Appendix B, Photo 2); Simdda-Wen with the adjacent sports and social club, its carpark and enclosing walls (Photo 4); while The Firs Hotel was clearly the woodland garden of a demolished dwelling (Photo 6). This same relationship between the woods and buildings is clear also on the OS six inch map of 1888-1913 (Figure 2). The modern structures were clearly relatively recent, and there was no evidence of older land use. Indeed, such evidence (e.g. earthworks) is unlikely to be found in such small woods.



Figure 2. The three woodlands on the OS six inch map with ancient woodland inventory boundary overlaid (in green): Manor Garden along the drive to Wylfa; Sports and Social Club next to Simdda-wen; and The Firs Hotel, around the house of that name. OS six inch series 1888-1913 courtesy of National Library of Scotland

Given the above, the lack of support for ancient ecological continuity and the frequency of non-native tree, shrub and herb species, it is considered that there is insufficient evidence to regard any of the three woods as ancient in origin.

4. Bibliography

Forestry Commission, 2016. *Wales Map Viewer*. [Online]

Available at: http://maps.forestry.gov.uk/imf/imf.jsp?site=fcwales_ext&

[Accessed 10 June 2016].

Hall, J. E., Kirby, K. J. & Whitbread, A. M., 2004. *National Vegetation Classification: Field Guide to Woodland*. 2 ed. Peterborough: JNCC.

Hill, M. O., Blackstock, T. H., Long, D. G. & Rothero, G. P., 2008. *A checklist and census catalogue of British and Irish bryophytes*. Edinburgh: British Bryological Society.

Natural Resources Wales, 2016. *Ancient Woodland Inventory*. [Online]

Available at: <https://naturalresources.wales/forestry/woodlands-and-the-environment/ancient-woodland-inventory/?lang=en>

[Accessed 10 June 2016].

Peterken, G., 1981. *Woodland conservation and management*. London & New York: Chapman and Hall.

Rackham, O., 1980. *Ancient Woodland: its history, vegetation and uses in England*. London : Edward Arnold.

Rodwell, J., 1991. *British Plant Communities*, Cambridge: CUP.

Rose, F. & O'Reilly, C., 2006. *The Wildflower Key*, London: Frederick Warne.

Stace, C. A., 2010. *A New Flora of the British Isles*. 3 ed. Cambridge: Cambridge University Press.

Appendix A. Species Lists

Table 2. Vascular plants recorded from the Manor Garden woodland

Scientific name	Common name	Frequency
Canopy layer		
<i>Acer pseudoplatanus</i>	sycamore	D
<i>Fraxinus excelsior</i>	ash	R
<i>Pinus pinaster</i>	maritime pine	R
<i>Quercus robur</i>	oak	R
<i>Ulmus cf. x hollandica</i>	Dutch elm	R
<i>Ulmus glabra</i>	wych elm	R
Shrub layer		
<i>Crataegus monogyna</i>	hawthorn	O
<i>Laburnum anagyroides</i>	laburnum	R
<i>Ligustrum ovalifolium</i>	garden privet	R
<i>Rubus fruticosus</i> agg.	bramble	R
<i>Sambucus nigra</i>	elder	R
<i>Ulex europaeus</i>	gorse	R
Ground layer - grasses		
<i>Anthoxanthum odoratum</i>	sweet vernal-grass	O
<i>Dactylis glomerata</i>	cock's-foot	F
<i>Festuca rubra</i>	red fescue	R
<i>Poa annua</i>	annual meadow grass	R
<i>Poa trivialis</i>	rough meadow grass	D
Ground layer - forbs		
<i>Acer pseudoplatanus</i> (seedling)	sycamore	R
<i>Anthriscus sylvestris</i>	cow parsley	R
<i>Arctium minus</i>	lesser burdock	R
<i>Cerastium fontanum</i>	common mouse-ear	R
<i>Ficaria verna</i> subsp. <i>verna</i>	lesser celandine	A
<i>Galium aparine</i>	cleavers	F
<i>Glechoma hederacea</i>	ground ivy	R
<i>Heracleum sphondylium</i>	hogweed	F
<i>Hyacinthoides non-scripta</i>	bluebell	R
<i>Oxalis articulata</i>	pink sorrel	R
<i>Potentilla reptans</i>	creeping cinquefoil	R
<i>Ranunculus repens</i>	creeping buttercup	O
<i>Rumex acetosa</i>	common sorrel	R
<i>Rumex sanguineus</i> var. <i>sanguineus</i>	wood dock	F
<i>Stellaria media</i>	chickweed	F
<i>Taraxacum officinale</i> agg.	dandelion	R
<i>Trifolium repens</i>	white clover	R
<i>Urtica dioica</i>	stinging nettle	F
<i>Veronica hederifolia</i> subsp. <i>lucorum</i>	ivy-leaved speedwell	F
Bryophytes		
<i>Kindbergia praelonga</i>		R

Table 3. Vascular plants recorded from the Simdda-Wen woodland

Scientific name	Common name	Frequency
Canopy layer		
<i>Acer pseudoplatanus</i>	sycamore	D
<i>Aesculus hippocastanum</i>	horse chestnut	R
<i>Fraxinus excelsior</i>	ash	R
<i>Tilia x europaeus</i>	common lime	R
Shrub layer		
<i>Corylus avellana</i>	hazel	O
<i>Crataegus monogyna</i>	hawthorn	F
<i>Ilex aquifolium</i>	holly	R
<i>Ulmus glabra</i>	wych elm	R
<i>Ulmus procera</i>	English elm	F
Ground layer - grasses		
<i>Alopecurus pratensis</i>	meadow foxtail	F
<i>Dactylis glomerata</i>	cock's foot	F
<i>Festuca rubra</i>	red fescue	F
<i>Holcus lanatus</i>	Yorkshire fog	F
<i>Poa trivialis</i>	rough meadow grass	A
Ground layer - forbs		
<i>Allium ursinum</i>	ramsons	LA
<i>Anthriscus sylvestris</i>	cow parsley	A
<i>Asplenium scolopendrium</i>	hart's-tongue fern	R
<i>Chamerion angustifolium</i>	rosebay willowherb	R
<i>Dryopteris filix-mas</i>	male fern	R
<i>Ficaria verna</i> subsp. <i>verna</i>	lesser celandine	F
<i>Galium aparine</i>	cleavers	A
<i>Geranium robertianum</i>	herb robert	F
<i>Hedera helix</i>	ivy	F
<i>Heracleum sphondylium</i>	hogweed	F
<i>Hyacinthoides x massartiana</i>	garden bluebell	F
<i>Lapsana communis</i>	nipplewort	O
<i>Narcissus</i> sp. (cultivar)	daffodil	F
<i>Primula vulgaris</i>	primrose	F
<i>Ranunculus repens</i>	creeping buttercup	F
<i>Rumex obtusifolius</i>	broad-leaved dock	O
<i>Senecio jacobaea</i>	ragwort	R
<i>Smyrniium olusatrum</i>	alexanders	F
<i>Urtica dioica</i>	stinging nettle	F
<i>Veronica hederifolia</i> subsp. <i>lucorum</i>	ivy-leaved speedwell	O
Bryophytes		
<i>Kindbergia praelonga</i>		R

Table 4. Vascular plants recorded from the Firs Hotel woodland

Scientific name	Common name	Frequency
Canopy layer		
<i>Acer pseudoplatanus</i>	sycamore	A
<i>Aesculus hippocastanum</i>	horse chestnut	F
<i>Fraxinus excelsior</i>	ash	F
<i>Pinus nigra</i>	black pine	R
<i>Prunus avium</i>	wild cherry	O
<i>Salix caprea</i>	pussy willow	R
<i>Tilia x europaea</i>	common lime	O
Shrub layer		
<i>Berberis</i> sp.	a berberis	R
<i>Buddleja davidii</i>	Buddleja	R
<i>Crataegus monogyna</i>	hawthorn	O
<i>Eucalyptus</i> sp.	a eucalyptus	R
<i>Laurus nobilis</i>	laurel	R
<i>Olearia macrodonta</i>	New Zealand holly	F
<i>Rhododendron ponticum</i>	rhododendron	F
<i>Rosa multiflora</i>	many-flowered rose	R
<i>Rosa rugosa</i>	Japanese rose	R
<i>Rubus fruticosus</i> agg.	bramble	F
<i>Thuja plicata</i> (cultivar)	western red-cedar	R
<i>Ulmus glabra</i>	wych elm	R
<i>Viburnum opulus</i> (cultivar)	guelder rose	R
Ground layer - grasses		
<i>Anthoxanthum odoratum</i>	sweet vernal-grass	R
<i>Arrhenatherum elatius</i>	false oat-grass	O
<i>Festuca rubra</i>	red fescue	F
<i>Holcus lanatus</i>	Yorkshire fog	F
<i>Poa trivialis</i>	rough meadow grass	F
Ground layer - forbs		
<i>Aconitum napellus</i>	monkshood	R
<i>Allium ursinum</i>	ramsons	R
<i>Anthriscus sylvestris</i>	cow parsley	O
<i>Asplenium scolopendrium</i>	hart's-tongue fern	R
<i>Bellis perennis</i>	daisy	F
<i>Bergenia crassifolia</i>	elephant ears	R
<i>Carex pendula</i>	pendulous sedge	O
<i>Cerastium fontanum</i>	common mouse-ear	F
<i>Chamerion angustifolium</i>	rosebay willowherb	R
<i>Cirsium arvense</i>	creeping thistle	F
<i>Cirsium vulgare</i>	spear thistle	F
<i>Crocosmia x crocosmiiflora</i>	crocosmia	F
<i>Epilobium montanum</i>	broad-leaved willowherb	F

<i>Galium aparine</i>	cleavers	A
<i>Geranium robertianum</i>	herb robert	A
<i>Hedera helix</i>	ivy	A
<i>Helminthotheca echioides</i>	prickly oxtongue	O
<i>Hyacinthoides x massartiana</i>	garden bluebell	O
<i>Matricaria discoidea</i>	pineapple weed	R
<i>Medicago lupulina</i>	black medick	R
<i>Myosotis arvensis</i>	field forget-me-not	F
<i>Narcissus</i> sp. (cultivar)	daffodil	O
<i>Pentaglottis sempervirens</i>	green alkanet	R
<i>Plantago lanceolata</i>	ribwort plantain	F
<i>Plantago major</i>	greater plantain	R
<i>Prunella vulgaris</i>	self-heal	O
<i>Ranunculus repens</i>	creeping buttercup	F
<i>Rumex sanguineus</i> var. <i>viridis</i>	wood dock	F
<i>Ruscus aculeatus</i>	butcher's broom	R
<i>Sagina procumbens</i>	procumbent pearlwort	R
<i>Sedum album</i>	white stonecrop	R
<i>Senecio jacobaea</i>	ragwort	O
<i>Silene dioica</i>	red campion	A
<i>Smyrniolus olusatrum</i>	alexanders	A
<i>Stellaria media</i>	chickweed	O
<i>Trifolium repens</i>	white clover	F
<i>Urtica dioica</i>	stinging nettle	A

Appendix B. Photographs



Photo 1. Manor Garden looking north along the track from gate

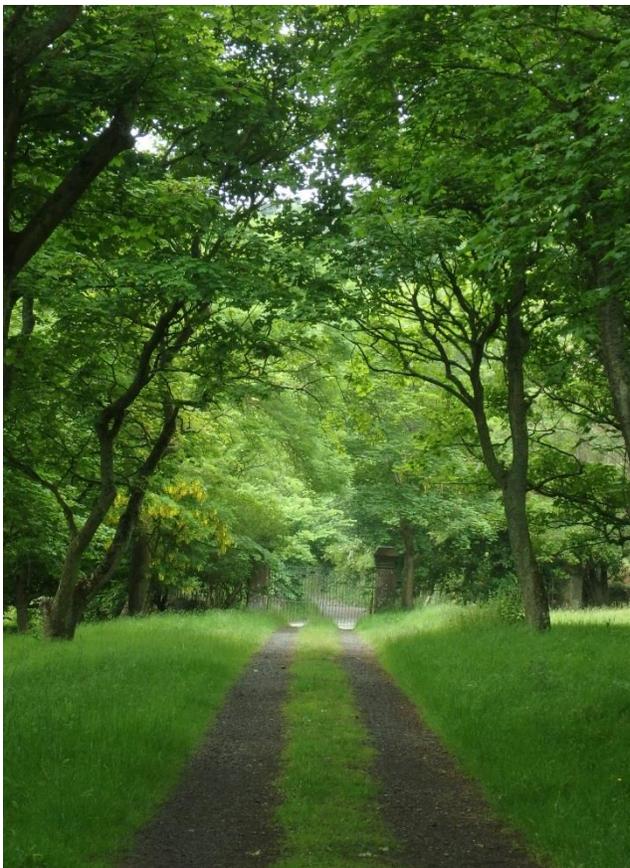


Photo 2. Looking south back along the track toward the gated entrance



Photo 3. The corner of the woodland along the wall with a few bluebells, beginning to fruit and not visible



Photo 4. Simdda-Wen, looking towards the woodland from the sports and social club carpark: the Ancient Woodland Inventory refers to the block of woodland on the left and the small group of trees on the right as ancient woodland.



Photo 5. The ground flora of Simdda-Wen, dominated by cow parsley and cleavers. Note the youth of the trees.



Photo 6. The drive running through The Firs Hotel from the road. The concrete raised bed along the drive is visible on the left.



Photo 7. Open area adjacent to woodland, site of former habitation, colonized by wild and garden plants

**Site Preparation and Clearance
Environmental Statement
Volume 3 – Appendix 14-04
Consultancy Report: A Baseline
Assessment of the Fungi of Key Habitats
within the Wylfa NPS Site**

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Horizon Nuclear Power (Wylfa) Ltd

**Consultancy Report:
A Baseline Assessment of the Fungi of Key
Habitats within the Wylfa NPS Site**

March 2017

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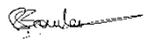
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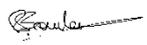
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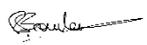
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Executive Summary

Horizon Nuclear Power Wylfa Ltd. (Horizon) is currently planning to develop a new nuclear power station on Anglesey (the Wylfa Newydd Generating Station) as identified in the National Policy Statement for Nuclear Power Generation (EN-6). The Wylfa Newydd Project (the Project) will require a number of applications to be made under different legislation to different regulators. Jacobs UK Ltd (Jacobs) was commissioned to collect baseline data to inform the various applications, assessments and permits that will be submitted for approval to construct and operate the Wylfa Newydd Generating Station. This report details the methods and findings of a fungi survey that was undertaken as part of this work.

The survey work concentrated on the habitats that were thought to be more significant for fungi based on the experience of the surveyor and Phase 1 habitat survey data. These habitats included areas of coastal scrub, heath and grassland; amenity areas and woodland near to the Existing Power Station and inland pastoral fields with semi-improved grassland. Some previous data on fungi were obtained from the North Wales Environmental Information Service (Cofnod, 2013) but this did not provide any significant additional useful information on the fungi inside or within 2km of the centre of the study area.

High numbers of fungi, both in terms of individuals and of species, were found during the course of the survey. The woodland and scrub areas were found to be productive but the species found in these areas were mostly common and expected species.

The grasslands proved to be more interesting and many semi-improved grasslands rich in fungi species, especially indicative species of the genus *Hygrocybe*, were found within the study area. One grassland site was found to support a sufficient number of species to be of regional importance; six grassland sites were found to be of local importance.

Contents

1	Introduction	1
1.1	Overview	1
1.2	Wylfa Newydd Project	1
1.3	Site Description	1
1.4	Study Aims and Objectives	4
1.5	Previous Work	4
1.6	The Physiology and Metabolism of Fungi	4
2	Methodology	6
2.1	Desktop Study	6
2.2	Survey Methodology	6
2.3	Analysis of Data	6
2.4	Limitations	10
3	Results	11
3.1	Background Data Search	11
3.2	General	11
3.3	Woodland Habitats	13
3.4	Gorse Habitats	13
3.5	Grassland Habitats	13
4	Discussion	15
4.1	Woodland Habitats	15
4.2	Gorse Habitats	15
4.3	Grassland Habitats	15
4.4	Evaluation of Grassland Diversity in the Study Area	17
5	Conclusions	18
6	References	20
	Appendix A Species Lists	22

1 Introduction

1.1 Overview

Horizon Nuclear Power Wylfa Ltd. (Horizon) is currently planning to develop a new nuclear power station on Anglesey as identified in the National Policy Statement for Nuclear Power Generation (EN-6). The Wylfa Newydd Project (the Project) comprises the proposed new nuclear power station (the Wylfa Newydd Generating Station), including the reactors, associated plant and ancillary structures and features, together with all of the development needed to support its delivery, such as highway improvements, worker accommodation and specialist training facilities. The Project will require a number of applications to be made under different legislation to different regulators. As a nationally significant infrastructure project under the Planning Act 2008, the construction and operation must be authorised by a development consent order.

Jacobs UK Ltd (Jacobs) was commissioned by Horizon to undertake a full ecological survey programme within the vicinity of the Power Station Site. This work has included the gathering of baseline data to inform the various applications, assessments and permits that will be submitted for approval to construct and operate the Power Station and Associated Development¹.

This report details the findings of a baseline survey of fungi undertaken from 26th to 28th November 2013. Further records collected 18th November 2016 are also included. The study area is shown in figure 1 and the areas surveyed in figure 2.

1.2 Wylfa Newydd Project

The Project includes the Wylfa Newydd Generating Station and Associated Development. The Wylfa Newydd Generating Station includes two UK Advanced Boiling Water Reactors to be supplied by Hitachi-GE Nuclear Energy Ltd, associated plant and ancillary structures and features. In addition to the reactors, development on the Power Station Site (the indicative area of land and sea within which the majority of the permanent Wylfa Newydd Generating Station buildings, plant and structures would be situated) will include steam turbines, control and service buildings, operational plant, radioactive waste storage buildings, ancillary structures, offices and coastal developments. The coastal developments will include a Cooling Water System (CWS) and breakwater, and a Marine Off-Loading Facility (MOLF).

1.3 Site Description

The Wylfa Newydd Development Area (the indicative areas of land and sea, including the Power Station Site, the Wylfa NPS Site² and the surrounding areas that would be used for the construction and operation of the Wylfa Newydd Generating Station) covers an area of approximately 380ha. It is bounded to the north by the coast and the Existing Power Station. To the east, it is separated from

¹ Development needed to support delivery of the Wylfa Newydd Generating Station is referred to as Associated Development. This includes highway improvements along the A5025, park and ride facilities for construction workers, Logistics Centre, Temporary Workers' Accommodation, specialist training facilities, Horizon's Visitor Centre and media briefing facilities.

² The site identified on Anglesey by the National Policy Statement for Energy EN-6/NPS EN-6 as potentially suitable for the deployment of a new nuclear power station.

Cemaes by a narrow corridor of agricultural land. The A5025 and residential properties define part of the south-east boundary, with a small parcel of land spanning the road to the north-east of Tregele. To the south and west, the Wylfa Newydd Development Area abuts agricultural land, and to the west it adjoins the coastal hinterland.

There is one designated site for nature conservation within the Wylfa Newydd Development Area; Tre'r Gof Site of Special Scientific Interest (SSSI). It is also within 1km of the Cae Gwyn SSSI, Cemlyn Bay Special Area of Conservation (SAC) and SSSI, the Anglesey Terns Special Protection Area (SPA), and the North Anglesey Marine candidate Special Area of Conservation (cSAC).

Tre'r Gof is a small basin mire adjacent to the Existing Power Station, west of Cemaes. The area receives mineral-enriched waters from the surrounding boulder clay leading to the development of notable flora. It is the botanical interest that provides the reason for the designation of the site as a SSSI.

Cae Gwyn SSSI is located immediately to the south of the Wylfa Newydd Development Area to the west of Llanfechell. The SSSI comprises two wetland areas separated by an outcrop of rock with heathland vegetation. The southern wetland is confined by a rock basin and is dominated by bogmoss (*Sphagnum* spp.) and a wide variety of common wetland herbs. The northern wetland has a different flora containing denser areas of willow (*Salix* spp.) and common reed (*Phragmites communis*).

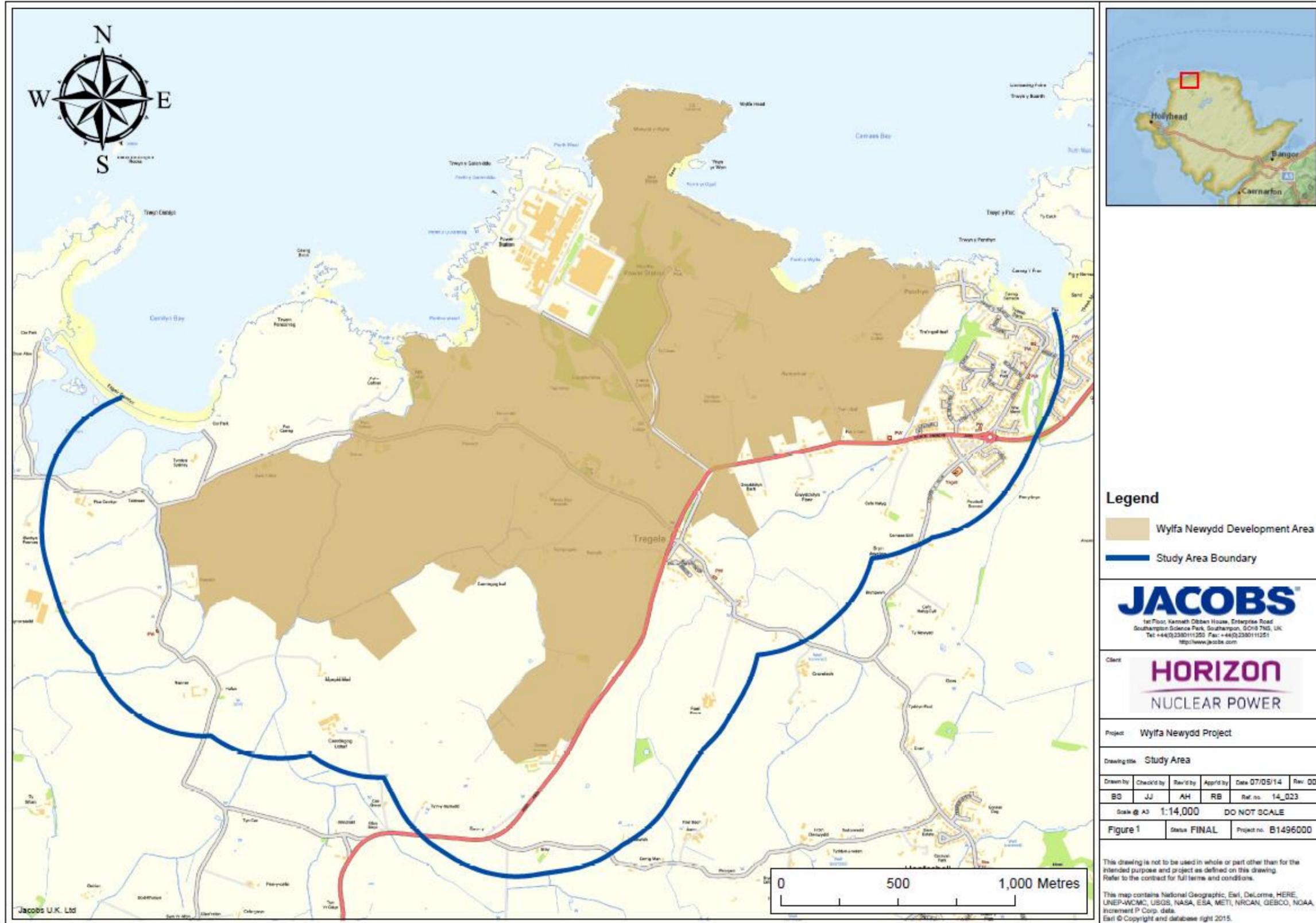


Figure 1: The study area

1.4 Study Aims and Objectives

The objective of the surveys is to characterise the environment and collect baseline data to inform the various applications, assessments and permits required to construct and operate the Wylfa Newydd Generating Station.

As part of the Environmental Impact Assessment (EIA) the need for detailed knowledge of ectomycorrhizal and saprotrophic fungi was identified. This report presents the findings of work undertaken in 2013.

There was a particular focus on the semi-natural grassland habitats along the coast as these were thought most likely to have higher numbers of species of fungi of conservation interest, and therefore more sites were surveyed here. A smaller number of sites in the amenity areas around the Existing Power Station and in the agricultural areas to the south were also surveyed. The survey effort at each location was consistent.

All other fungi that could be found and identified within the study area were also recorded. Lichenised fungi and fungi parasitic on lichens were mostly covered by the separate lichen survey (Jacobs, 2014).

1.5 Previous Work

In 2012 Arup produced a Lower Plant Appraisal Report that included a search of the Wylfa Newydd Development Area for fungi and habitats likely to support fungi (Arup, 2012). This report did not record any fungi species but did identify short coastal grassland areas as being the most likely to support significant species of fungi. Waxcap fungi in particular were mentioned as potentially being present in these areas. As a result further surveys were recommended.

1.6 The Physiology and Metabolism of Fungi

In Britain, ectomycorrhizal fungi are important because most of the native woodland trees, for example birch, oak, willow, hazel and Scots pine make associations with this group (Spooner and Roberts, 2005). This means that the species diversity of fungi on the woodland floor can also be used as indicators of quality of habitat. These comments also apply to some grassland fungi; especially CHEG species (see section 2.3.1) that are indicators of quality grassland habitat.

Fungi have a cryptic lifestyle existing on dead matter or as symbionts of plants, animals or other fungi and have a crucial role in nutrient cycling in many ecosystems. For the purposes of this survey, ectomycorrhizal fungi and saprotrophic fungi are the species that are relevant and important for any future ecological appraisal and impact assessment of the study area. These groups are discussed further below.

It is estimated that at least 90% of plants form symbiotic associations with fungi in the form of mycorrhizal relationships (Spooner and Roberts, 2005). This is where the main component of the fungus, the microscopic threads known as mycorrhiza, interact with plant tissues in some way. In mycorrhizal associations there is an exchange of sugars from the plant to the fungus and of certain chemicals produced by the fungus to the plant; these chemicals include nitrates and phosphates (Spooner and Roberts, 2005). Without this exchange, neither the fungi nor its host plant is likely to survive. Mycorrhizal relationships comprise two different types, endo- and ecto- mycorrhizal fungi.

All mycorrhizal fungi ultimately produce spores but only certain types develop above-ground, spore-producing fruiting bodies; these are known as ectomycorrhizal fungi.

Some fungi obtain their necessary sugars to survive through the decomposition of dead matter; such fungi are known as saprotrophs or decomposers. Litter saprotrophs obtain nutrients from decaying leaf litter, soil saprotrophs from the upper soil layers, and dung saprotrophs from dung. The fruiting bodies of these species were also recorded during the survey and can be important indicators of habitat quality.

2 Methodology

2.1 Desktop Study

A request for all records of fungi within 2.5km of the centre of the NPS site was made to the North Wales Environmental Information Service (Cofnod).

2.2 Survey Methodology

Most of the area within the study area was considered to be low quality habitat for fungi i.e. mostly agricultural land with improved pasture and not many trees. These comments apply particularly to the southern half of the study area. Therefore the survey was concentrated on the potentially richer fungal habitats to the north in the areas near to the coast and the Existing Power Station.

The survey areas selected are shown in figure 2. A simple search, find and identify method was used to survey the fungi. Some species were readily identified in the field but many others were collected using a plastic tool box with dividers. These were later examined by a 20x magnification hand lens or by light microscope up to 250x magnification. Under a microscope key features of the cellular structure and the spores could be seen.

Identification references were used and these included Ellis and Ellis (1985; 1988; 1990), Moser (1983) and Pegler *et al.* (1995). In certain cases identification reference was also made to certain well-illustrated popular field guides for further confirmation. These field guides included Courtecuisse and Duhem (1995) and Sterry and Hughes (2009).

The survey had a particular emphasis on habitats likely to hold significant numbers of species and individual fruit bodies. Such habitats included semi-natural grassland, areas of gorse *Ulex* spp. scrub (especially where it had been cut) and areas where there were trees. Other habitats on site which could support fungi included dead wood and the living or dead leaf and stems of certain herbaceous plants; therefore these areas were also searched. The 2013 Phase 1 habitat survey maps and habitat descriptions were used to identify these areas (Jacobs, 2013).

The field survey took place from 26th to 28th November 2013 with each site visited once by an experienced Jacobs mycologist. Additional records of fungi from the Wylfa Newydd NPS site were collected by a Horizon Nuclear Power Ltd. site ecologist on 18th November 2016. These were collected from grassland on Wylfa Head (survey area A, figure 3), not previously visited, and an area to the south of Wylfa Head (survey area 9, figure 3), visited in 2013.

2.3 Analysis of Data

There were two quantitative methodologies employed to analyse the survey results. This included using the ectomycorrhizal fungi and CHEG grassland approach, and Fungal Diversity Scores. Both of these methods mainly apply to the grassland species as these are potentially more significant than those of woodland habitats in the study area. The methods are described below.

2.3.1 Mycorrhizal fungi and CHEG grasslands

Mycorrhizal fungi in grasslands, as opposed to woodland species are collectively known as ‘CHEG’ fungi. This term was first used by M. Rotheroe in 2001 and is based on the initials of four main taxonomic groups as follows (Griffith et al., 2004):

- C = Clavariaceae (fairy clubs);
- H = *Hygrocybe* (waxcaps);
- E = *Entoloma* (pink gills); and
- G = Geoglossaceae (earth tongues).

Fungi species from these taxonomic groups tend to occur in association with each other in unimproved and semi-improved grasslands; the greater the number of species present, the greater the ‘quality’ of the grassland. However, it must be noted that a high fungal diversity does not necessarily correspond to a high species diversity of flowering plants, therefore the best grasslands for fungi cannot necessarily be determined from Phase 1 habitat surveys (Griffith *et al.*, 2004). Furthermore the seasonal timing of any survey of ‘CHEG’ fungi and the prevailing weather conditions can influence any attempt to ascertain the quality of grasslands on the basis of their fungal assemblages.

2.3.2 Fungal diversity scores

Table 1 shows a system for ascertaining fungal diversity in grassland using a points score and is based on Griffith *et al.* (2004), derived from the selected areas marked yellow in figure 3. As can be seen this analysis incorporates grassland fungi from all of the functional groups, although only ‘CHEG’ fungi score more than one point. *Entoloma* species score two points, *Hygrocybe* between two points and seven points dependent on sensitivity to chemical improvement and both Geoglossaceae and Clavariaceae five points per species. In considering the diversity of each grassland site, the total number of CHEG species is the main driver in determining the diversity of the sites in the study area and not just the scores derived from *Hygrocybe* species alone. However, during the survey the *Hygrocybe* species were far more evident than were fungi from the other CHEG groups and therefore provided the best indication of grassland quality in this survey.

Table 1: Fungal diversity scores (FDS).

FDS Guide for individual species/genera of grassland fungi (adapted from Griffith <i>et al.</i>, 2013)	
Small brown/grey/white agarics	1 point per species
Fungi in dung (coprophilus)	1 point per species
<i>Agaricus</i> spp.	1 point per species
Puffballs	1 point per species
<i>Entoloma</i> spp.	2 points per species
Earth tongues	5 points per species
Clavarioid fungi (fairy clubs etc.)	5 points per species
White <i>Hygrocybe</i> (<i>Hygrocybe virginea</i>)	2 points
<i>Hygrocybe conica</i> and <i>H.psittacina</i>	2 points each
Yellow <i>Hygrocybe</i> spp.	2 points per species
<i>Hygrocybe pratensis</i> and <i>H.laeta</i>	3 points each
Red <i>Hygrocybe</i> spp.	7 points per species

2.3.3 Site evaluation

The simplest method of site evaluation for grassland fungi is that of Rald (1985), in which the conservation value of a site is classified at increasing levels of geographic importance according to the number of *Hygrocybe* species recorded (Table 2). This is used to evaluate the importance of each grassland area surveyed.

Table 2. Rald's (1985) guidelines for assessing the quality of waxcap grasslands. Numbers in brackets refer to a single visit.

Conservation value	Total no. of <i>Hygrocybe</i> species:
Nationally important.	17-32 (11-20)
Regionally important.	9-16 (6-10)
Locally important	4-8 (3-5)
Of no importance.	1-3 (1-2)

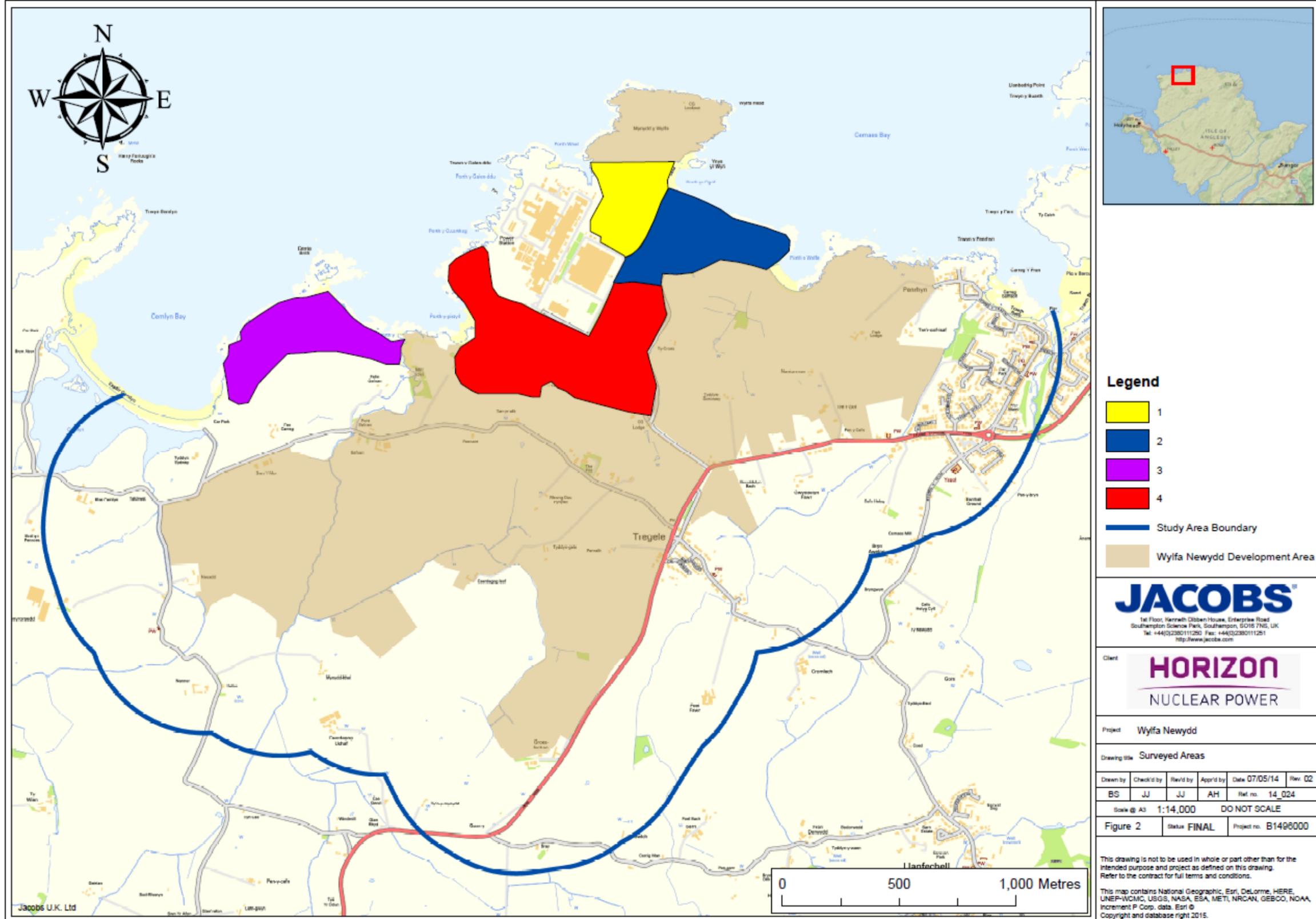


Figure 2: Areas surveyed for fungi November 2013

2.4 Limitations

The unusually dry weather conditions may have imposed some limitations on the quantity of fungi that were found.

November is often the most productive month for grassland fungi but woodland associates tend to reach maximum abundance earlier, in late September or October. Examples of species that should be found fruiting in greater abundance earlier in the season include fungi from the Boletaceae family, *Russula* spp., *Lactarius* spp., *Amanita* spp. and *Cortinarius* spp. There is therefore the potential for these species to be under-represented in the survey data.

3 Results

3.1 Background Data Search

The only previous surveys for fungi within the vicinity of the Power Station site are a small number of records of four common species: *Agaricus campestris*, *A. xanthodermus*, *Geastrum* sp. and *Peziza badia* between 1998 and 2001. These data were obtained from the North Wales Environmental Information Service (Cofnod, 2014).

3.2 General

The results showed that within the survey areas (figure 3) there were three main habitat types that supported more diverse fungal communities:

- woodland;
- gorse; and
- grassland.

Tables containing lists for those species recorded in each area are provided in appendix A.

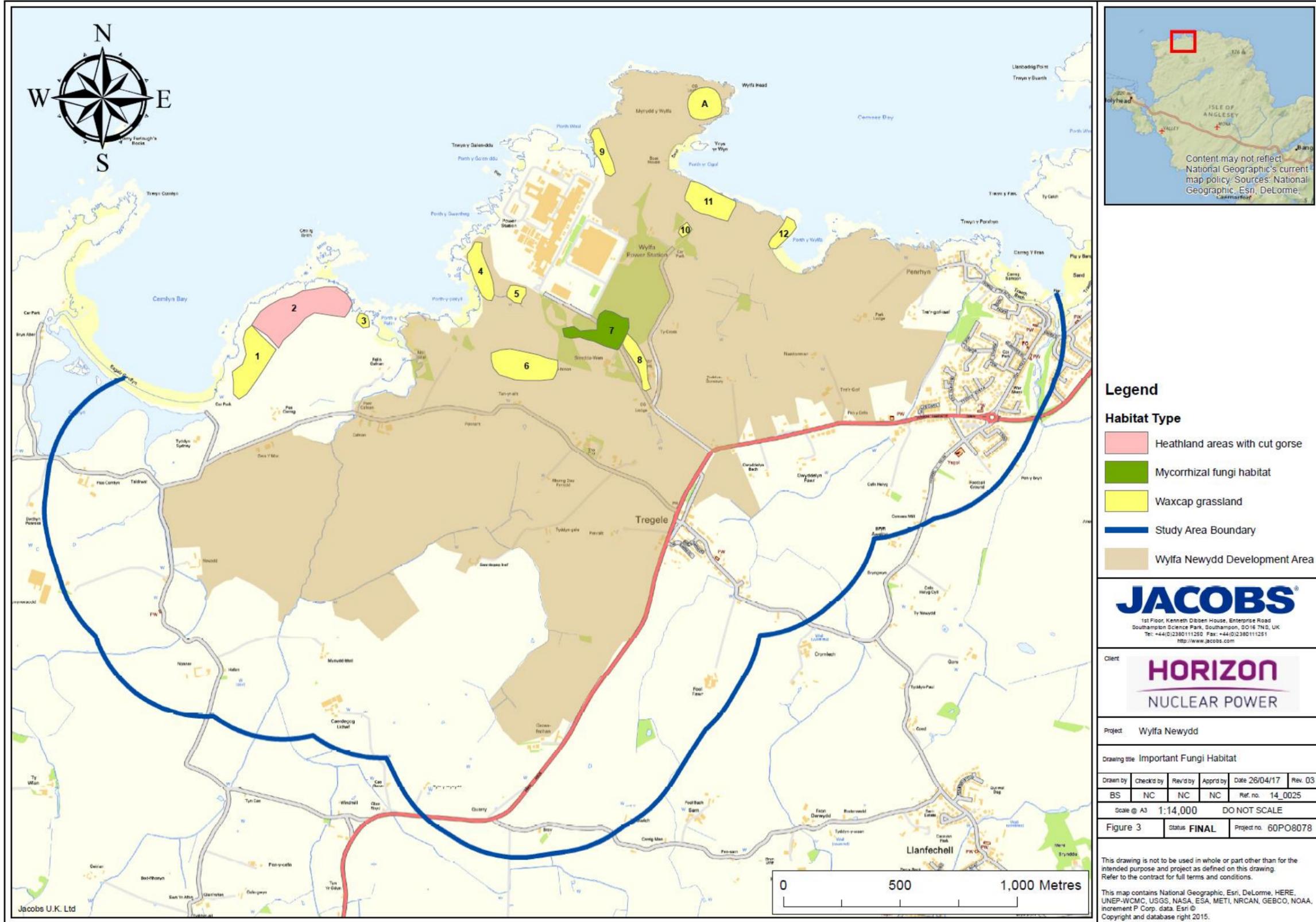


Figure 3: Important fungi habitats

3.3 Woodland Habitats

The only significant woodland habitats within the study area were the plantation woodlands around the Existing Power Station, and the area of woodland north of habitat area 10 and the Wylfa public car park (figure 3).

In the former area the planted woodland consisted of non-native species such as black pine *Pinus nigra* and sycamore *Acer pseudoplatanus* and also more recent plantings of birch *Betula* sp. and aspen *Populus tremula*. The earlier plantings of pine and sycamore were less than 50 years old and occurred during the construction of the Existing Power Station between 1963 and 1971 (Magnox, 2013).

The woodland north of habitat area 10 (figure 3) and the Wylfa public car park was mainly comprised of sycamore and other non-native species. However, this woodland was likely to have been planted at an earlier date and contained a good quantity of dead wood habitat.

3.4 Gorse Habitats

There were some areas of gorse habitat under which a variety of species of fungi were found, particularly members of the genera *Agaricus*, *Lepista* and *Clitocybe*. There were also some dead wood fungi associated with two species of gorse *Ulex europaeus* and *U. gallii*, for example *Tremella mesenterica*. Areas of old cut gorse were particularly productive for fungi especially in the Trwyn Pencerrag area and on the rocky outcrops along the coast south-east of Wylfa Head. The area of cut gorse at Trwyn Pencerrag is shown as habitat area 2 (pink) on figure 3.

3.5 Grassland Habitats

Grassland was the dominant habitat type in the study area, and occurred in all of the survey areas (1 to 4). Most of the grasslands comprised heavily grazed sheep pasture, and varied considerably in the degree of agricultural improvement.

Table 2 shows that the Fungal Diversity Score (FDS) was highest for habitat areas 1, 6, 8, 11 and 12. All these areas are along the coast except for areas 6 and 8. Area 6 is some grassland around the Leisure Centre and area 8 is a section of the entrance road adjacent to the Magnox Visitors Centre.

Some of the more species-poor habitat areas, such as area 4, the fields south-west of the Existing Power Station, have a low FDS score and very few (one or two) species of *Hygrocybe*. The *Hygrocybe* species present are those such as *H. virginea* and *H. pratensis*, which are more resistant to chemical (nitrate) input than are most of the other *Hygrocybe* species. The other fungi that contribute to the score are typically dung or soil saprotrophs such as *Lepista*, *Psilocybe* and *Clitocybe* (see 4.3 for explanation). Some of these species, especially *Psilocybe*, may occur in very large quantities giving the impression of high fungal diversity when this is not the case.

Table 3: Waxcap grasslands identified within the survey areas and shown on figure 3.

Grassland site	OS grid reference	Habitat area (figure 3)	FDS (points)	No. of <i>Hygrocybe</i> species
Trwyn Pencerrag - West	SH3393	1	19	5
Trwyn Pencerrag	SH3493	3	2	1

Grassland site	OS grid reference	Habitat area (figure 3)	FDS (points)	No. of <i>Hygrocybe</i> species
- East				
Fields SW of Existing Power Station	SH3493	4	5	2
Grassland by Porth-y-pistyll	SH3493	5	4	2
Rocky outcrop SW of station	SH349937	6	21	4
By Existing Power Station entrance road	SH3593	8	22	5
South of Wylfa Head	SH3594	9	6	1
Grassland at former Wylfa House	SH3593	10	2	1
Grassland SE of Wylfa Head	SH3593	11	14	3
Grassland by Porth Wylfa	SH360938	12	39	8

A summary of the results of the 2016 visit is given in Table 4. Table 9 provides a list of species recorded.

Table 4: Waxcap grasslands identified within the survey areas and shown on figure 3.

Grassland site	OS grid reference	Habitat area (figure 3)	No. of <i>Hygrocybe</i> species
South of Wylfa Head	SH3594	9	3
Wylfa Head	SH357944	A	5

4 Discussion

4.1 Woodland Habitats

The most significant woodland habitat for fungi in the study area was the planted pine (*Pinus* sp.) woodland around the Existing Power Station, which includes isolated pine trees. In these areas there is high fungal abundance. Another tree which forms ectomycorrhizal associations, birch (*Betula* sp.) was also present and provided additional associations including with *Taphrina deformans*. However, since the woodland habitats were limited in extent within the study area and were all planted within the past 50 years they were not considered to be particularly significant for rare or notable fungi. Although ectomycorrhizal associations of common species of fungi can develop very quickly it does take time for a fuller assemblage of species to develop (100 years or more). Furthermore the non-native tree species present e.g. black pine, are unlikely to develop the fungal associations present within their native ranges in Europe.

Another factor is that ectomycorrhizal fungi tend to fruit most abundantly early in the season, in this instance 'early' can mean anywhere from August to early November. However a few species were still visible during the survey period and examples of these included *Lactarius deliciosus* and several *Russula* species associated with pine and birch e.g. *Russula sanguinea* and *R. aeruginea*, respectively.

These results are from one year of survey alone and are not an exhaustive list of species present; further surveys would be required to compile a full species list. However, given the age and composition of the woodland, and the fungi species recorded, it is considered that the woodland as a habitat supporting fungi was valuable only in terms of the study area rather than at a local, regional or national context.

4.2 Gorse Habitats

The species associated with the gorse habitats were:

- growing directly on the gorse wood;
- associated with gorse wood and leaf decomposition; or
- were incidental species associated with grassland in areas where the gorse had been cut.

These included species such as *Agaricus augustus*, *Clitocybe angustissima* and *Lycoperdon nigrescens*. These habitats are very common in the wider countryside, especially on Anglesey.

4.3 Grassland Habitats

There are four functional groupings of grassland fungi i.e. groupings based on the mode of living of these fungi.

4.3.1 Litter, soil and dung saprotrophs

The first three groups of fungi can be found readily in any undisturbed grasslands, regardless of the degree of improvement and were widespread within the study area. In fact some of the species seemed to increase in abundance in the more

improved grasslands e.g. *Stropharia semiglobata* and *Psilocybe semilanceata* in particular. These species do not have conservation designations and it is a reasonable assumption that they occur very widely elsewhere in the area and also throughout Anglesey in similar habitats.

4.3.2 Mycorrhizal Fungi

The most significant grassland fungi are the fourth group i.e. the mycorrhizal fungi comprising both endo- and ecto- mycorrhizal species. However, only the ectomycorrhizal species have been surveyed. Although many of the associations are poorly known it is clear that most of the species in the ectomycorrhizal functional group are sensitive to the chemistry involved in the improvement of grassland. Improved grassland contains almost no species in this group and even the semi-improved areas varied considerably in quality.

In the study area there were no records of Geoglossaceae at all and few records of either *Entoloma* spp. or of Clavariaceae. Table 3 and table 4 (appendix A) show that only three species of grassland Clavariaceae were recorded; *Clavaria fumosa*, *Clavulinopsis corniculata* and *C. fusiformis*. Likewise for *Entoloma* species there were only two species recorded; *E. hirtipes* and *E. mammosus*. In contrast 13 different species of *Hygrocybe* were identified. The most important site for *Hygrocybe*, where eight species were found was in the grassland at Porth Wylfa.

In the points system, the presence of Clavariaceae or Geoglossaceae is generally considered to be more significant than the presence of most individual *Entoloma* and *Hygrocybe* species. Of the *Hygrocybe* species, the red ones i.e. *H. cantharellus*, *H. coccineus* (shown in Plate 1) and *H. puniceus* were the most significant and the best quality areas supported these species. In contrast the two most common *Hygrocybe* at Wylfa, the white *H. virginea* and the buff coloured *H. pratensis* are awarded scores of two and three respectively. A third particularly common species on the coastal grasslands at Wylfa, *H. russiicoriacea* was not scored by Griffith *et al.* (2004) and, for the purposes of this survey, was awarded a score of three. The presence of these *Hygrocybe* species (in the absence of most or all other *Hygrocybe* species) indicates semi-improved grasslands, but not ones of the highest quality.



Plate 1: The waxcap *Hygrocybe coccineus*.

4.4 Evaluation of Grassland Diversity in the Study Area

By far the highest point score for grassland diversity in the study area is the grassland ‘valley’ immediately west of Porth Wylfa at SH 360938 (habitat area 12, figure 3). At Porth Wylfa *Clavulinopsis corniculata* was recorded, as were three red *Hygrocybe* species. In a short period nine species of CHEG fungi were recorded here including eight species of *Hygrocybe*. Other coastal grassland areas were productive for CHEG fungi as well with a score of around 20 points for habitat areas 1, 6 and 11 (shown on figure 3). In these areas the highest fungal diversity occurred where the soil was thinner, especially near to the rock outcrops. The areas along the entrance road to the Existing Power Station, especially immediately south of the Magnox Information Centre car park (SH354932 and habitat area 8 on figure 3) were also rich with *Clavaria fumosa* and one of the red *Hygrocybe* species present.

In contrast the grazed fields inland of the Existing Power Station contained far more coprophilus fungi such as *Panaeolus* spp., *Psilocybe* spp. or *Stropharia* spp. and few *Hygrocybe* spp., mainly the less sensitive *Hygrocybe virginea* and *H. pratensis*. Ecologically these grasslands were much less significant for fungi.

Table 5 shows the conservation value of each grassland site based on the single site visit of 2013.

Table 5. Evaluation of grassland sites for waxcap conservation (Rald, 1985)

Grassland site	Habitat area (figure 3)	No. of <i>Hygrocybe</i> species	Conservation value
Trwyn Pencerrag - West	1	5	Locally important
Trwyn Pencerrag - East	3	1	No importance
Fields SW of Existing Power Station	4	2	No importance
Grassland by Porth-y-pistyll	5	2	No importance
Rocky outcrop SW of station	6	4	Locally important
By Existing Power Station entrance road	8	5	Locally important
South of Wylfa Head	9	1	No importance
Grassland at former Wylfa House	10	1	No importance
Grassland SE of Wylfa Head	11	3	Locally important
Grassland by Porth Wylfa	12	8	Regionally important

In the 2016 visit, three *Hygrocybe* species were recorded from the grassland site south of Wylfa Head (survey area 9, figure 3; Table 9). According to the classification of Rald (1985) this grassland site is therefore of local importance. Three *Hygrocybe* species have been recorded in total from this site.

In 2016 five *Hygrocybe* species were also recorded from survey area A, (figure 3; Table 9). Based on this single visit, the Wylfa Head site is therefore of regional importance.

5 Summary and Conclusions

The primary objective of the fungi survey was to obtain baseline data on fungi at a time of the year when a high number of species should be fruiting. Previously there has been only very limited recording of fungi in the study area and data on this group have been requested as part of the Environmental Impact Assessment (EIA) for the site.

Several habitat types were identified as being of potential interest and the survey concentrated on these areas. Conversely areas of poor habitat, especially the areas of improved pasture were mostly not surveyed. Emphasis was placed on the semi-improved grasslands and any woodland or scrub areas where either dead wood were present or where mycorrhizal species of tree were identified.

Despite the relatively dry conditions for the time of year and the comparatively late date of the survey, a sufficient number of fruiting fungi bodies were found for this assessment of fungal habitat. The findings for the three main habitat types of interest are summarised below.

- I. **Woodland:** there is an absence of natural woodland in the study area but significant areas of secondary planted woodland occur around the Existing Power Station. There is some older sycamore-dominated woodland near to the Wylfa public car park. In the latter location the dead-wood fungi were more speciose and diverse but in the amenity areas nearest to the Existing Power Station mycorrhizal fungi, mostly associated with the 40 to 50 year old plantations of pine, were of greatest interest. None of these habitats or their fungi were considered valuable in terms of potential conservation designation or rarity in a local, regional or national context.
- II. **Gorse scrub:** this habitat proved to be rich for fungi, especially where the gorse had been cut or previously burnt. Since this habitat is likely to be very common in Anglesey or the UK as a whole, the fungi here were not considered to be of value beyond the study area itself. As in the woodland areas, only relatively common species of fungi were recorded in this habitat.
- III. **Grassland:** in the grassland areas the quantity of fungi found varied considerably but some places, especially south-west of the Existing Power Station, were found to be very rich in dung saprotrophs. These fungi were all common species that were likely to be present in areas of similar habitats across much of Anglesey.

The other functional group of grassland fungi present were mycorrhizal species associated with semi-improved grasslands of relatively low nutrient input. Of these, *Hygrocybe* species were found in sufficient number to allow the accurate determination of the quality of grassland over a wider area. Pockets of relatively rich semi-improved grassland were identified in the coastal areas, along the entrance road to the Existing Power Station and in grassland areas immediately south-west of the Existing Power Station in particular.

Semi-improved grassland with fungal communities of conservation value occurred within the study area but was localised. The locations of these sites and their importance are summarised in Table 6.

Table 6. Summary of grassland sites of conservation value for their fungal assemblages.

Grassland site	Survey area (figure 3)	Conservation value
Trwyn Pencerrag - West	1	Locally important
Rocky outcrop SW of station	6	Locally important
By Existing Power Station entrance road	8	Locally important
South of Wylfa Head	9	Locally important
Grassland SE of Wylfa Head	11	Locally important
Grassland by Porth Wylfa	12	Regionally important
Wylfa Head	A	Regionally important

6 References

Arup, (2012), *Lower Plant Appraisal Report*, consultancy report on behalf of Horizon Nuclear Power (Wylfa) Ltd.

Courtecuisse, R. and Duhem, B., (1995), *Collins Field Guide Mushrooms and Toadstools of Britain and Europe*, Harper Collins Publishers Ltd, London.

Cofnod, (2014), *Metadata: Fungi*, available online at <http://www.cofnod.org.uk/Metadata>, accessed 6th January 2014.

Ellis, M. B. and Ellis, J. P., (1985), *Microfungi on Land Plants*, Richmond Publishing Co. Ltd, Slough.

Ellis, M. B. and Ellis, J. P., (1988), *Microfungi on Miscellaneous Substrates*, Richmond Publishing Co. Ltd, Slough.

Ellis, M. B. and Ellis, J. P., (1990), *Fungi without Gills (Hymenomyces and Gasteromyces)*, Chapman and Hall, London.

Griffith, G. W., Bratton, J. H. and Easton, G., (2004), Charismatic megafungi the conservation of waxcap grasslands, *British Wildlife*, 16 (1): 31-43.

Jacobs, (2013), *Consultancy Report: A Phase 1 Habitat Survey*, consultancy report on behalf of Horizon Nuclear Power (Wylfa) Ltd. Ref. W202.01-S5-PAC-REP-00015.

Jacobs, (2014), *Lichen Baseline Surveys 2014*, consultancy report on behalf of Horizon Nuclear Power (Wylfa) Ltd. Ref. W202.01-S5-PAC-REP-00025.

Magnox, (2013), *Wylfa Nuclear Power Station: Site History*, available online at www.magnoxsites.co.uk, accessed 5th December 2013.

Moser, M., (1983), *Keys to Agarics and Boleti*, Roger Phillips, London.

Pegler, N., Lassoë, T. and Spooner, B. M., (1995), *British Puffballs, Earthstars and Stinkhorns*, Royal Botanic Gardens, Kew.

Rald, E. (1985). Vokshatte som indikatorarter for mykologisk værdifulde overdrevslokaliteter. *Svampe*. 11, 1-9.

Spooner, B. and Roberts P., (2005), *The New Naturalist Library: Fungi*, Harper Collins Publishers Ltd, London.

Sterry, P. and Hughes, B., (2009), *Collins Complete Guide to British Mushrooms and Toadstools*, Harper Collins Publishers Ltd, London.

Appendix A Species Lists

Table 7: Systematic list of fungi recorded in alphabetical order of taxa.

Taxon	Site description	Habitat area (see figure 3)	Date	Comment
<i>Agaricus augustus</i>	SE of Wylfa Head along coast	11	27-Nov-13	Old specimens under gorse
<i>Agaricus moelleri</i>	Wylfa Head - old garden NW of public car park	SE of 10	27-Nov-13	-
<i>Auricularia auricula-judae</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On gorse and elder
<i>Auricularia mesenterica</i>	Existing Power Station amenity areas	8	28-Nov-13	On sycamore in Social Club area
<i>Bovista nigrescens</i>	Wylfa Head	9	28-Nov-13	Near sewage farm NE of Existing Power Station outflow
<i>Cheilymenia stercorea</i>	Trwyn Pencarreg - east	2	26-Nov-13	On cow dung
<i>Chondrostereum purpureum</i>	Trwyn Pencarreg - east	2	26-Nov-13	On gorse
<i>Chondrostereum purpureum</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Clavaria fumosa</i>	Existing Power Station amenity areas	8	28-Nov-13	On bank of entrance road at SH354931
<i>Clavulina cristata</i>	Cestyll Gardens	Not applicable	26-Nov-13	Found by Mark Jackson and identified by photo
<i>Clavulina rugosa</i>	Existing Power Station amenity areas	-	28-Nov-13	-
<i>Clavulina rugosa</i>	Cestyll Gardens	Not applicable	26-Nov-13	Found by Mark Jackson and identified by photo
<i>Clavulinopsis corniculata</i>	SW of Existing Power Station	6	28-Nov-13	On rocky outcrop with Cladonia at SH349937
<i>Clavulinopsis corniculata</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Clavulinopsis fusiformis</i>	Trwyn Pencarreg	1	26-Nov-13	-
<i>Clitocybe angustissima</i>	SE of Wylfa Head along coast	11	27-Nov-13	-
<i>Clitocybe angustissima</i>	Trwyn Pencarreg	2	26-Nov-13	Cut gorse areas
<i>Clitocybe fragrans</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Clitocybe langei</i>	SE of Wylfa Head along coast	11	27-Nov-13	-
<i>Clitocybe langei</i>	Trwyn Pencarreg	2	26-Nov-13	Cut gorse areas
<i>Clitocybe nebularis</i>	Trwyn Pencarreg	2	26-Nov-13	Cut gorse areas
<i>Clitocybe rivulosa</i>	Existing Power Station amenity areas	8	28-Nov-13	On bank of entrance road at SH354931

Taxon	Site description	Habitat area (see figure 3)	Date	Comment
<i>Conocybe tenera</i>	Trwyn Pencarreg	2	26-Nov-13	Cut gorse areas
<i>Coprinus atramentarius</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Coprinus comatus</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Coprinus micaceus</i>	Trwyn Pencarreg	2	26-Nov-13	Cut gorse areas
<i>Cystoderma amianthinum</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Entoloma hirtipes</i>	Existing Power Station amenity areas	8	28-Nov-13	In area of Wylfa Information Centre Car Park
<i>Entoloma mammosum</i>	Existing Power Station amenity areas	8	28-Nov-13	On bank of entrance road at SH354931
<i>Flammulina velutipes</i>	Trwyn Pencarreg - east	2	26-Nov-13	Cut gorse areas
<i>Galerina hypnorum</i>	Existing Power Station amenity areas	8	28-Nov-13	In area of Wylfa Information Centre Car Park
<i>Ganoderma australe</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore
<i>Ganoderma australe</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Gymnopilus penetrans</i>	SW of Existing Power Station	4	28-Nov-13	In area of cut pine trees at SH348935
<i>Gymnopus peronatus</i>	SE of Wylfa Head	11	27-Nov-13	Under gorse
<i>Hygrocybe cantharellus</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe ceracea</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe chlorophana</i>	Existing Power Station amenity areas	8	28-Nov-13	Grassland along entrance road
<i>Hygrocybe coccinea</i>	SW of Existing Power Station	6	28-Nov-13	On rocky outcrop with Cladonia at SH349937
<i>Hygrocybe coccinea</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe coccinea</i>	Existing Power Station amenity areas	8	28-Nov-13	On bank of entrance road at SH354931
<i>Hygrocybe conica</i>	SW of Existing Power Station	6	28-Nov-13	On rocky outcrop with Cladonia at SH349937
<i>Hygrocybe conica</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe conica</i>	Existing Power Station amenity areas	8	28-Nov-13	On bank of entrance road at SH354931
<i>Hygrocybe insipida</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Hygrocybe laeta</i>	Trwyn Pencarreg	1	26-Nov-13	-
<i>Hygrocybe pratensis</i>	SE of Wylfa Head	11	27-Nov-13	-

Taxon	Site description	Habitat area (see figure 3)	Date	Comment
<i>Hygrocybe pratensis</i>	SW of Existing Power Station	4 and 5	28-Nov-13	Common
<i>Hygrocybe pratensis</i>	Trwyn Pencarreg	1	26-Nov-13	-
<i>Hygrocybe pratensis</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe pratensis</i>	Existing Power Station amenity areas	8	28-Nov-13	In almost improved grassland to the south
<i>Hygrocybe psittacina</i>	SE of Wylfa Head	10 and 11	27-Nov-13	-
<i>Hygrocybe psittacina</i>	Trwyn Pencarreg	1	26-Nov-13	-
<i>Hygrocybe psittacina</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe psittacina</i>	Existing Power Station amenity areas	8	28-Nov-13	Social Club area
<i>Hygrocybe punicea</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	About 25 fruit bodies seen
<i>Hygrocybe quieta</i>	Existing Power Station amenity areas	8	28-Nov-13	Grassland along entrance road
<i>Hygrocybe russocoriacea</i>	SW of Existing Power Station	4 and 5	28-Nov-13	Mostly on short turf very close to the coast
<i>Hygrocybe russocoriacea</i>	Trwyn Pencarreg	2	26-Nov-13	Coastal grassland at SH342934 east of heathland
<i>Hygrocybe russocoriacea</i>	Trwyn Pencarreg	1	26-Nov-13	-
<i>Hygrocybe russocoriacea</i>	Wylfa Head	9	28-Nov-13	Near sewage farm NE of Existing Power Station outflow
<i>Hygrocybe virginea</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Hygrocybe virginea</i>	SW of Existing Power Station	4 and 5	28-Nov-13	-
<i>Hygrocybe virginea</i>	Trwyn Pencarreg	1	26-Nov-13	-
<i>Hygrocybe virginea</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe virginea</i>	Existing Power Station amenity areas	8	28-Nov-13	Locally common
<i>Hypholoma fasciculare</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Hypocrea argillacea</i>	Wylfa Head - woodland north of public car park	SE OF 10	27-Nov-13	On sycamore bark
<i>Laccaria laccata</i>	Existing Power Station amenity areas	8	28-Nov-13	In pine woods
<i>Lactarius deliciosus</i>	Existing Power Station amenity areas	8	28-Nov-13	Under pine
<i>Lepista nuda</i>	SE of Wylfa Head	11	27-Nov-13	Under gorse
<i>Lepista nuda</i>	Existing Power Station amenity	8	28-Nov-13	-

Taxon	Site description	Habitat area (see figure 3)	Date	Comment
	areas			
<i>Lepista saeva</i>	SE of Wylfa Head along coast	11	27-Nov-13	Under gorse
<i>Lepista saeva</i>	Trwyn Pencarreg	2	26-Nov-13	Cut gorse areas
<i>Lepista saeva</i>	Wylfa Head	9	28-Nov-13	Near sewage farm NE of Existing Power Station outflow
<i>Lycoperdon nigrescens</i>	Trwyn Pencarreg	2	26-Nov-13	Cut gorse areas
<i>Mycena arcangeliana</i>	Wylfa Head - old garden NW of public car park	SW of 10	27-Nov-13	-
<i>Mycena filopes</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Mycena leptcephala</i>	Existing Power Station amenity areas	8	28-Nov-13	In area of Wylfa Information Centre Car Park
<i>Nectria cinnabarina</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore
<i>Nectria cinnabarina</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Neottiella rutilans</i>	SW of Existing Power Station	6	28-Nov-13	On rocky outcrop with Cladonia at SH349937
<i>Omphalina ericetorum</i>	Trwyn Pencarreg	2	26-Nov-13	Sterile lichenised state identified
<i>Panaeolus acuminatus</i>	Trwyn Pencarreg	2	26-Nov-13	On cow dung
<i>Panaeolus rickenii</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Panaeolus rickenii</i>	Trwyn Pencarreg	2	26-Nov-13	-
<i>Panaeolus rickenii</i>	Trwyn Pencarreg	1	26-Nov-13	-
<i>Panaeolus rickenii</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Panaeolus rickenii</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Panaeolus sphinctrinus</i>	SW of Existing Power Station	4 and 5	28-Nov-13	-
<i>Pholiota squarrosa</i>	Existing Power Station amenity areas	8	28-Nov-13	At the base of an ash tree in the Social Club area
<i>Phoma longissima</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On dead hogweed stems
<i>Phragmidium violaceum</i>	Existing Power Station amenity areas	8	28-Nov-13	On living bramble leaves
<i>Psathyrella gracilis</i>	Existing Power Station amenity areas	8	28-Nov-13	In area of Wylfa Information Centre Car Park
<i>Psilocybe semilanceata</i>	SW of Existing Power Station	4 and 5	28-Nov-13	Common
<i>Psilocybe semilanceata</i>	Trwyn Pencarreg	2	26-Nov-13	-
<i>Psilocybe semilanceata</i>	Existing Power Station amenity areas	8	28-Nov-13	In almost improved grassland to the south
<i>Puccinia</i>	Wylfa Head -	SE of 10	27-Nov-13	On ground ivy

Taxon	Site description	Habitat area (see figure 3)	Date	Comment
<i>glechomatis</i>	woodland north of public car park			Glechoma living leaves
<i>Puccinia smyrnii</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On living Alexanders <i>Smyrnium</i> leaves
<i>Puccinia smyrnii</i>	Existing Power Station amenity areas	8	28-Nov-13	On living leaves of Alexanders <i>Smyrnium</i>
<i>Rhodocollybia butyracea</i>	Wylfa Head	Not applicable	28-Nov-13	Amongst bracken
<i>Rhodocollybia butyracea</i>	Existing Power Station amenity areas	8	28-Nov-13	Under pine
<i>Rhytisma acerinum</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore leaves
<i>Rhytisma acerinum</i>	Existing Power Station amenity areas	8	28-Nov-13	On dead leaves of sycamore
<i>Rickenella swartzii</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Russula aeruginea</i>	Existing Power Station amenity areas	8	28-Nov-13	Under pine
<i>Russula caerulea</i>	Existing Power Station amenity areas	8	28-Nov-13	Under pine
<i>Russula sanguinea</i>	Existing Power Station amenity areas	8	28-Nov-13	Under pine
<i>Schizopora paradoxa</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore bark
<i>Scleroderma bovista</i>	Existing Power Station amenity areas	8	28-Nov-13	Near Existing Power Station at SH352938
<i>Scutellinia subhirtella</i>	Existing Power Station amenity areas	8	28-Nov-13	Social Club area
<i>Stropharia cyanea</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Stropharia cyanea</i>	SW of Existing Power Station	4 and 5	28-Nov-13	-
<i>Stropharia cyanea</i>	Trwyn Pencarreg	2	26-Nov-13	-
<i>Stropharia cyanea</i>	Existing Power Station amenity areas	8	28-Nov-13	In area of Wylfa Information Centre Car Park
<i>Stropharia semiglobata</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Stropharia semiglobata</i>	SW of Existing Power Station	4 and 5	28-Nov-13	-
<i>Stropharia semiglobata</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Stropharia semiglobata</i>	Wylfa Head	9	28-Nov-13	Near sewage farm NE of Existing Power Station outflow
<i>Taphrina deformans</i>	Existing Power Station amenity areas	8	28-Nov-13	Witches brooms on birch
<i>Trametes versicolor</i>	SW of Existing Power Station	4	28-Nov-13	In area of cut pine trees at SH348935

Taxon	Site description	Habitat area (see figure 3)	Date	Comment
<i>Tremella mesenterica</i>	SW of Existing Power Station	4 and 5	28-Nov-13	On gorse
<i>Tremella mesenterica</i>	Trwyn Pencarreg	2	26-Nov-13	On gorse
<i>Tremella mesenterica</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On gorse
<i>Tricholomopsis rutilans</i>	Existing Power Station amenity areas	8	28-Nov-13	Under pine
<i>Tubaria furfuracea</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Tubaria furfuracea</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Tubaria furfuracea</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Vascellum pratense</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Vascellum pratense</i>	SW of Existing Power Station	5	28-Nov-13	-
<i>Vascellum pratense</i>	Wylfa Head	9	28-Nov-13	Near sewage farm NE of Existing Power Station outflow
<i>Xylaria hypoxylon</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore
<i>Xylaria polymorpha</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore
<i>Xylaria polymorpha</i>	Existing Power Station amenity areas	8	28-Nov-13	On sycamore in Social Club area

Table 8: Systematic list of fungi recorded by survey area (figure 2)

Taxon	Survey area	Habitat area (see figure 3)	Date	Comment
<i>Clavulina cristata</i> and <i>C. rugosa</i>	Cestyll Gardens	Not applicable	26-Nov-13	Found by Mark Jackson and identified by photo
<i>Gymnopus peronatus</i>	SE of Wylfa Head	11	27-Nov-13	Under gorse
<i>Hygrocybe insipida</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Hygrocybe pratensis</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Hygrocybe psittacina</i>	SE of Wylfa Head	10 and 11	27-Nov-13	-
<i>Hygrocybe virginea</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Lepista nuda</i>	SE of Wylfa Head	11	27-Nov-13	Under gorse
<i>Panaeolus rickenii</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Stropharia cyanea</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Stropharia semiglobata</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Tubaria furfuracea</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Vascellum pratense</i>	SE of Wylfa Head	11	27-Nov-13	-
<i>Agaricus augustus</i>	SE of Wylfa Head along coast	11	27-Nov-13	Old specimens under gorse
<i>Clitocybe angustissima</i>	SE of Wylfa Head along coast	11	27-Nov-13	-
<i>Clitocybe langei</i>	SE of Wylfa Head along coast	11	27-Nov-13	-
<i>Lepista saeva</i>	SE of Wylfa Head	11	27-Nov-13	Under gorse

Taxon	Survey area	Habitat area (see figure 3)	Date	Comment
	along coast			
<i>Clavulinopsis corniculata</i>	SW of Existing Power Station	6	28-Nov-13	On rocky outcrop with Cladonia at SH349937
<i>Gymnopilus penetrans</i>	SW of Existing Power Station	4	28-Nov-13	In area of cut pine trees at SH348935
<i>Hygrocybe coccinea</i>	SW of Existing Power Station	6	28-Nov-13	On rocky outcrop with Cladonia at SH349937
<i>Hygrocybe conica</i>	SW of Existing Power Station	6	28-Nov-13	On rocky outcrop with Cladonia at SH349937
<i>Hygrocybe pratensis</i>	SW of Existing Power Station	4 and 5	28-Nov-13	Common
<i>Hygrocybe russocoriacea</i>	SW of Existing Power Station	5	28-Nov-13	Mostly on short turf very close to the coast
<i>Hygrocybe virginea</i>	SW of Existing Power Station	4 and 5	28-Nov-13	-
<i>Neottiella rutilans</i>	SW of Existing Power Station	6	28-Nov-13	On rocky outcrop with Cladonia at SH349937
<i>Panaeolus sphinctrinus</i>	SW of Existing Power Station	4 and 5	28-Nov-13	-
<i>Psilocybe semilanceata</i>	SW of Existing Power Station	4 and 5	28-Nov-13	Common
<i>Stropharia cyanea</i>	SW of Existing Power Station	4 and 5	28-Nov-13	-
<i>Stropharia semiglobata</i>	SW of Existing Power Station	4 and 5	28-Nov-13	-
<i>Trametes versicolor</i>	SW of Existing Power Station	4	28-Nov-13	In area of cut pine trees at SH348935
<i>Tremella mesenterica</i>	SW of Existing Power Station	4 and 5	28-Nov-13	On gorse
<i>Vascellum pratense</i>	SW of Existing Power Station	4 and 5	28-Nov-13	-
<i>Cheilymenia stercorea</i>	Trwyn Pencarreg - east	2	26-Nov-13	On cow dung
<i>Chondrostereum purpureum</i>	Trwyn Pencarreg - east	2	26-Nov-13	On gorse
<i>Clitocybe angustissima</i>	Trwyn Pencarreg - east	2	26-Nov-13	Cut gorse areas
<i>Clitocybe langei</i>	Trwyn Pencarreg - east	2	26-Nov-13	Cut gorse areas
<i>Clitocybe nebularis</i>	Trwyn Pencarreg - east	2	26-Nov-13	Cut gorse areas
<i>Conocybe tenera</i>	Trwyn Pencarreg - east	2	26-Nov-13	Cut gorse areas
<i>Coprinus micaceus</i>	Trwyn Pencarreg - east	2	26-Nov-13	Cut gorse areas
<i>Flammulina velutipes</i>	Trwyn Pencarreg - east	2	26-Nov-13	Cut gorse areas
<i>Hygrocybe russocoriacea</i>	Trwyn Pencarreg - east	3	26-Nov-13	-
<i>Lepista saeva</i>	Trwyn Pencarreg - east	2	26-Nov-13	Cut gorse areas
<i>Lycoperdon nigrescens</i>	Trwyn Pencarreg - east	2	26-Nov-13	Cut gorse areas
<i>Omphalina ericetorum</i>	Trwyn Pencarreg - east	2	26-Nov-13	Sterile lichenised state identified
<i>Panaeolus</i>	Trwyn Pencarreg	2	26-Nov-13	On cow dung

Taxon	Survey area	Habitat area (see figure 3)	Date	Comment
<i>acuminatus</i>	- east			
<i>Panaeolus rickenii</i>	Trwyn Pencarreg - east	2	26-Nov-13	-
<i>Psilocybe semilanceata</i>	Trwyn Pencarreg - east	2	26-Nov-13	-
<i>Stropharia cyanea</i>	Trwyn Pencarreg - east	2	26-Nov-13	-
<i>Tremella mesenterica</i>	Trwyn Pencarreg - east	2	26-Nov-13	On gorse
<i>Clavulinopsis fusiformis</i>	Trwyn Pencarreg - west	1	26-Nov-13	-
<i>Hygrocybe laeta</i>	Trwyn Pencarreg - west	1	26-Nov-13	-
<i>Hygrocybe pratensis</i>	Trwyn Pencarreg - west	1	26-Nov-13	-
<i>Hygrocybe psittacina</i>	Trwyn Pencarreg - west	1	26-Nov-13	-
<i>Hygrocybe russocoriacea</i>	Trwyn Pencarreg - west	1	26-Nov-13	-
<i>Hygrocybe virginea</i>	Trwyn Pencarreg - west	1	26-Nov-13	-
<i>Panaeolus rickenii</i>	Trwyn Pencarreg - west	1	26-Nov-13	-
<i>Clavulinopsis corniculata</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe cantharellus</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe ceracea</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe coccinea</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe conica</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe pratensis</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe psittacina</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Hygrocybe punicea</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	About 25 fruit bodies seen
<i>Hygrocybe virginea</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Panaeolus rickenii</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Stropharia semiglobata</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Tubaria furfuracea</i>	Coastal grassland west of Porth Wylfa	12	27-Nov-13	-
<i>Agaricus moelleri</i>	Coastal grassland west of Porth Wylfa	SW of 10	27-Nov-13	-
<i>Mycena arcangeliana</i>	Wylfa Head - old garden NW of	SW of 10	27-Nov-13	-

Taxon	Survey area	Habitat area (see figure 3)	Date	Comment
	public car park			
<i>Auricularia auricula-judae</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On gorse and elder
<i>Ganoderma australe</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore
<i>Hypocrea argillacea</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore bark
<i>Nectria cinnabarina</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore
<i>Phoma longissima</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On dead hogweed stems
<i>Puccinia glechomatis</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On ground ivy <i>Glechoma</i> living leaves
<i>Puccinia smyrnii</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On living Alexanders <i>Smyrnium</i> leaves
<i>Rhytisma acerinum</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore leaves
<i>Schizopora paradoxa</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore bark
<i>Tremella mesenterica</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On gorse
<i>Xylaria hypoxylon</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore
<i>Xylaria polymorpha</i>	Wylfa Head - woodland north of public car park	SE of 10	27-Nov-13	On sycamore
<i>Bovista nigrescens</i>	Wylfa Head	9	28-Nov-13	Near sewage farm NE of Existing Power Station outflow
<i>Hygrocybe russocoriacea</i>	Wylfa Head	9	28-Nov-13	Near sewage farm NE of Existing Power Station outflow
<i>Lepista saeva</i>	Wylfa Head	9	28-Nov-13	Near sewage farm NE of Existing Power Station outflow
<i>Rhodocollybia butyracea</i>	Wylfa Head	Not applicable	28-Nov-13	Amongst bracken
<i>Stropharia semiglobata</i>	Wylfa Head	9	28-Nov-13	Near sewage farm NE of Existing Power Station outflow
<i>Vascellum pratense</i>	Wylfa Head	9	28-Nov-13	Near sewage farm NE of Existing Power Station outflow
<i>Auricularia mesenterica</i>	Existing Power Station amenity areas	8	28-Nov-13	On sycamore in Social Club area
<i>Chondrostereum purpureum</i>	Existing Power Station amenity	8	28-Nov-13	-

Taxon	Survey area	Habitat area (see figure 3)	Date	Comment
	areas			
<i>Clavaria fumosa</i>	Existing Power Station amenity areas	8	28-Nov-13	On bank of entrance road at SH354931
<i>Clavulina rugosa</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Clitocybe fragrans</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Clitocybe rivulosa</i>	Existing Power Station amenity areas	8	28-Nov-13	On bank of entrance road at SH354931
<i>Coprinus atramentarius</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Coprinus comatus</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Cystoderma amianthinum</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Entoloma hirtipes</i>	Existing Power Station amenity areas	8	28-Nov-13	In area of Wylfa Information Centre Car Park
<i>Entoloma mammosum</i>	Existing Power Station amenity areas	8	28-Nov-13	On bank of entrance road at SH354931
<i>Galerina hypnorum</i>	Existing Power Station amenity areas	8	28-Nov-13	In area of Wylfa Information Centre Car Park
<i>Ganoderma australe</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Hygrocybe chlorophana</i>	Existing Power Station amenity areas	8	28-Nov-13	Grassland along entrance road
<i>Hygrocybe coccinea</i>	Existing Power Station amenity areas	8	28-Nov-13	On bank of entrance road at SH354931
<i>Hygrocybe conica</i>	Existing Power Station amenity areas	8	28-Nov-13	On bank of entrance road at SH354931
<i>Hygrocybe pratensis</i>	Existing Power Station amenity areas	8	28-Nov-13	In almost improved grassland to the south
<i>Hygrocybe psittacina</i>	Existing Power Station amenity areas	8	28-Nov-13	Social Club area
<i>Hygrocybe quieta</i>	Existing Power Station amenity areas	8	28-Nov-13	Grassland along entrance road
<i>Hygrocybe virginea</i>	Existing Power Station amenity areas	8	28-Nov-13	Locally common
<i>Hypholoma fasciculare</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Laccaria laccata</i>	Existing Power Station amenity areas	8	28-Nov-13	In pine woods
<i>Lactarius deliciosus</i>	Existing Power Station amenity	8	28-Nov-13	Under pine

Taxon	Survey area	Habitat area (see figure 3)	Date	Comment
	areas			
<i>Lepista nuda</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Mycena filopes</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Mycena leptcephala</i>	Existing Power Station amenity areas	8	28-Nov-13	In area of Wylfa Information Centre Car Park
<i>Nectria cinnabarina</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Panaeolus rickenii</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Pholiota squarrosa</i>	Existing Power Station amenity areas	8	28-Nov-13	At the base of an ash tree in the Social Club area
<i>Phragmidium violaceum</i>	Existing Power Station amenity areas	8	28-Nov-13	On living bramble leaves
<i>Psathyrella gracilis</i>	Existing Power Station amenity areas	8	28-Nov-13	In area of Wylfa Information Centre Car Park
<i>Psilocybe semilanceata</i>	Existing Power Station amenity areas	8	28-Nov-13	In almost improved grassland to the south
<i>Puccinia smyrnii</i>	Existing Power Station amenity areas	8	28-Nov-13	On living leaves of Alexanders <i>Smyrnium</i>
<i>Rhodocollybia butyracea</i>	Existing Power Station amenity areas	8	28-Nov-13	Under pine
<i>Rhytisma acerinum</i>	Existing Power Station amenity areas	8	28-Nov-13	On dead leaves of sycamore
<i>Rickenella swartzii</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Russula aeruginea</i>	Existing Power Station amenity areas	8	28-Nov-13	Under pine
<i>Russula caerulea</i>	Existing Power Station amenity areas	8	28-Nov-13	Under pine
<i>Russula sanguinea</i>	Existing Power Station amenity areas	8	28-Nov-13	Under pine
<i>Scleroderma bovista</i>	Existing Power Station amenity areas	8	28-Nov-13	Near electricity generating station at SH352938
<i>Scutellinia subhirtella</i>	Existing Power Station amenity areas	8	28-Nov-13	Social Club area
<i>Stropharia cyanea</i>	Existing Power Station amenity areas	8	28-Nov-13	In area of Wylfa Information Centre Car Park
<i>Taphrina deformans</i>	Existing Power Station amenity areas	8	28-Nov-13	Witches brooms on birch
<i>Tricholomopsis rutilans</i>	Existing Power Station amenity areas	8	28-Nov-13	Under pine

Taxon	Survey area	Habitat area (see figure 3)	Date	Comment
	areas			
<i>Tubaria furfuracea</i>	Existing Power Station amenity areas	8	28-Nov-13	-
<i>Xylaria polymorpha</i>	Existing Power Station amenity areas	8	28-Nov-13	On sycamore in Social Club area

Table 9. Fungi recorded in November 2017

Taxon	Survey area	Habitat area (see figure 3)	Date
<i>Hygrocybe conica</i>	South of Wylfa Head	9	18-Nov-17
<i>Hygrocybe pratensis</i>	South of Wylfa Head	9	18-Nov-17
<i>Hygrocybe russocoriacea</i>	South of Wylfa Head	9	18-Nov-17
<i>Clavulinopsis helvola</i>	Wylfa Head	A	18-Nov-17
<i>Hygrocybe mucronella</i>	Wylfa Head	A	18-Nov-17
<i>Hygrocybe pratensis</i>	Wylfa Head	A	18-Nov-17
<i>Hygrocybe psittacina</i>	Wylfa Head	A	18-Nov-17
<i>Hygrocybe punicea</i>	Wylfa Head	A	18-Nov-17
<i>Hygrocybe reidii</i>	Wylfa Head	A	18-Nov-17

**Site Preparation and Clearance
Environmental Statement
Volume 3 – Appendix 14-05
Consultancy Report: Baseline Lichen
Surveys 2013**

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Horizon Nuclear Power (Wylfa) Ltd.

**Consultancy Report:
Baseline Lichen Surveys 2013**

February 2014

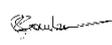
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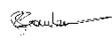
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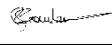
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Executive Summary

Horizon Nuclear Power Wylfa Ltd. (Horizon) is currently planning to develop a new nuclear power station on Anglesey (the Wylfa Newydd Generating Station) as identified in the National Policy Statement for Nuclear Power Generation (EN-6). The Wylfa Newydd Project (the Project) will require a number of applications to be made under different legislation to different regulators. Jacobs UK Ltd (Jacobs) was commissioned to collect baseline data to inform the various applications, assessments and permits that will be submitted for approval to construct and operate the Wylfa Newydd Generating Station.

A lichen survey focusing on specific locations which are representative of a wide range of semi-natural and synanthropic habitats on land proposed for the Wylfa Newydd Generating Station was undertaken in November 2013. The survey recorded a total of 262 taxa of lichens (252) and lichenicolous fungi (10), including 26 Nationally Scarce, two Nationally Rare, three Welsh Red Data List Vulnerable, four International Responsibility species and 21 species (17 lichens and four lichenicolous fungi) new for Vice County (VC) 52 Anglesey - the majority being recently recognised taxonomic 'splits' or under-recorded and common lichenicolous fungi. In addition, an undescribed crustose lichen common in upland Britain and of no conservation concern was found.

High quality maritime lichen habitats associated with Trwyn Pencarreg supported a rich flora comparable in quality with some of the best coastal locations elsewhere on the island. The rare *Pertusaria monogona* was re-found at its sole known Anglesey location on Wylfa Head. Further areas of rich coastal lichen habitat were identified east of Wylfa Head at Location 6 and Location 7, at the latter of which the recently recognised macro-lichen *Parmotrema pseudoreticulatum* was found.

Lichen epiphytic habitats were found to be of less interest, but old estate ornamental woodland east of the station at Location 5 supported the rare Section 42 (the Natural Environment and Rural Communities Act, 2006 (NERC)) species of 'Principle importance' *Schismatomma graphidioides*. Other conservation-significant epiphytes included *Eopyrenula grandicula*, *Ramalina fraxinea* and *Strigula taylorii*.

Representative lengths of old wall and field banks (cloddiau) surveyed in detail were found to support minimal lichen interest.

Contents

1	Introduction	1
1.1	Overview	1
1.2	Wylfa Newydd Project	1
1.3	Site Description	1
1.4	Study Aims and Objectives	2
1.5	Terminology	2
1.6	Glossary	3
1.7	Previous Work	3
2	Methodology	6
3	Results	7
3.1	Location 1: Concrete sea wall by Esgair Gemlyn car park	7
3.2	Location 2: Trwyn Pencarreg headland, west section: coastal rock exposures (cliff top exposures, sea-cliffs and rocky shore).	7
3.3	Location 3: Trwyn Pencarreg headland, E section: Coastal heath and rock outcrops	8
3.4	Location 4: Sheltered E-facing shore at W end of Porth y Felin	9
3.5	Location 5: Woodland near Candidate Wildlife Site Car Park, centred on GR23 (SH) 356.938	9
3.6	Location 6: Coastal rock outcrop in pasture	9
3.7	Location 7: Rock outcrops along small N-S coastal valley running c. 40 m down to the rocky shore, W of bay inlet, centred on GR2 (SH) 36044.93876.	10
3.8	Location 8: Old stone field walls, centred on GR23 (SH) 35625.93997.	10
3.9	Location 9: Old walls and grounds of demolished property.	11
3.10	Location 10: Picnic benches and paving slabs near the Magnox Visitor Centre Car Park.	11
3.11	Location 11: Sandstone entranceway gate pillars and old estate walls alongside the driveway in the grounds of the Wylfa Sports and Social Club.	11
3.12	Location 12: Trees in the grounds of the Wylfa Sports and Social Club.	11
3.13	Location 13: Trackside trees and track surface	12
3.14	Location 14: Lengths of drystone walls around small pastures, centred on GR23 (SH) 35079327	12
3.15	Location 15: Low rock outcrops in field, centred on GR2 (SH) 3476.8337, alt 18 m	12
3.16	Location 16: Consolidated soil and shingle face on beach head terrace	12
3.17	Location 17: Headland and coastal rocks directly W of the station	13
3.18	Location 18: Concrete drain cover in field	13
3.19	Location 19: Trees in planted shelter strip beside sports field	13
3.20	Location 20: Sports centre wall	13
3.21	Location 21: Planted trees on verges beside road	13
3.22	Location 22: Planted trees on verge beside road	13

3.23	Location 23: Edge of haul road around station	13
3.24	Summary	15
4	Discussion	16
5	Conclusions	18
6	References	19
	Appendix A Complete species list	20
	Appendix B List of Notable/Significant Species	25
	Appendix C Legislation and Conservation Designations	27

1.1 Overview

Horizon Nuclear Power Wylfa Ltd. (Horizon) is currently planning to develop a new nuclear power station on Anglesey as identified in the National Policy Statement for Nuclear Power Generation (EN-6). The Wylfa Newydd Project (the Project) comprises the proposed new nuclear power station (the Wylfa Newydd Generating Station), including the reactors, associated plant and ancillary structures and features, together with all of the development needed to support its delivery, such as highway improvements, worker accommodation and specialist training facilities. The Project will require a number of applications to be made under different legislation to different regulators. As a nationally significant infrastructure project under the Planning Act 2008, the construction and operation must be authorised by a development consent order.

Jacobs UK Ltd (Jacobs) was commissioned by Horizon to undertake a full ecological survey programme within the vicinity of the Power Station Site. This work has included the gathering of baseline data to inform the various applications, assessments and permits that will be submitted for approval to construct and operate the Power Station and Associated Development.

This report details the results of a systematic lichen survey targeting various locations of potential higher lichenological interest within the study area.

1.2 Wylfa Newydd Project

The Project includes the Wylfa Newydd Generating Station and Associated Development¹. The Wylfa Newydd Generating Station includes two UK Advanced Boiling Water Reactors to be supplied by Hitachi-GE Nuclear Energy Ltd, associated plant and ancillary structures and features. In addition to the reactors, development on the Power Station Site (the indicative area of land and sea within which the majority of the permanent Wylfa Newydd Generating Station buildings, plant and structures would be situated) will include steam turbines, control and service buildings, operational plant, radioactive waste storage buildings, ancillary structures, offices and coastal developments. The coastal developments will include a Cooling Water System (CWS) and breakwater, and a Marine Off-Loading Facility (MOLF).

1.3 Site Description

The Wylfa Newydd Development Area (the indicative areas of land and sea, including the Power Station Site, the Wylfa NPS Site² and the surrounding areas that would be used for the construction and operation of the Wylfa Newydd Generating Station) covers an area of approximately 380ha. It is bounded to the north by the coast and the Existing Power Station. To the east, it is separated from

¹ Development needed to support delivery of the Wylfa Newydd Generating Station is referred to as Associated Development. This includes highway improvements along the A5025, park and ride facilities for construction workers, Logistics Centre, Temporary Workers' Accommodation, specialist training facilities, Horizon's Visitor Centre and media briefing facilities.

² The site identified on Anglesey by the National Policy Statement for Energy EN-6/NPS EN-6 as potentially suitable for the deployment of a new nuclear power station.

Cemaes by a narrow corridor of agricultural land. The A5025 and residential properties define part of the south-east boundary, with a small parcel of land spanning the road to the north-east of Tregele. To the south and west, the Wylfa Newydd Development Area abuts agricultural land, and to the west it adjoins the coastal hinterland.

The Wylfa Newydd Development Area includes the headland south of Mynydd-y-Wylfa candidate Wildlife Site. There is one designated site for nature conservation within the Wylfa Newydd Development Area; Tre'r Gof Site of Special Scientific Interest (SSSI). It is also within 1km of the Cae Gwyn SSSI, Cemlyn Bay Special Area of Conservation (SAC) SSSI, and the Ynys Feurig, the Skerries and Cemlyn Bay Special Protection Area (SPA).

Tre'r Gof is a small basin mire adjacent to the Existing Power Station, west of Cemaes. The area receives mineral-enriched waters from the surrounding boulder clay leading to the development of notable flora. It is the botanical interest that provides the reason for the designation of the site as a SSSI.

Cae Gwyn SSSI is located immediately to the south of the Wylfa Newydd Development Area to the west of Llanfechell. The SSSI comprises two wetland areas separated by an outcrop of rock with heathland vegetation. The southern wetland is confined by a rock basin and is dominated by bogmoss (*Sphagnum* spp.) and a wide variety of common wetland herbs. The northern wetland has a different flora containing denser areas of willow (*Salix* spp.) and common reed (*Phragmites communis*).

1.4 Study Aims and Objectives

The objective of the surveys is to characterise the environment and collect baseline data to inform the various applications, assessments and permits required to construct and operate the Wylfa Newydd Generating Station.

As part of the Environmental Impact Assessment (EIA) and the need for detailed knowledge of temporal and spatial data on lichens has been identified. This report presents the findings of survey work undertaken in November 2013.

Of particular concern were specific areas identified from Phase 1 and Phase 2 vegetation maps and scoping discussions with Jacobs ecologists. Section 1.7 provides details of the previous work carried out in the study area. These comprised a representative selection of landscape features including:

- freestanding trees;
- groups of trees;
- traditional stone field boundaries (cloddiau); and
- coastal rock outcrops.

1.5 Terminology

Lichen nomenclature follows Smith, C.W., et al (2009) *The Lichens of Great Britain and Ireland*, updated by more recent changes published in the 'Literature Pertaining to British Lichens' series in the biennial Bulletin of the British Lichen Society. Marine littoral zone species of *Verrucaria* recently transferred to segregate genera are here retained in *Verrucaria* for ease of referencing names.

1.6 Glossary

Apothecia – This is the fruiting body of an ascomycete fungus.

Apothecium – A fungal reproductive structure.

Ascomycetes (Ascomycota) – A large phylum of fungi that includes species which have formed symbiotic associations with green algae to form lichens.

Ascospore – This is a kind of spore specific to fungi classified as ascomycetes.

Basidia – A microscopic, spore-producing structure found on the hymenophore of fruiting bodies of basidiomycete fungi.

Basidiomycetes – A class of fungi.

Calcicoles – A fungi that thrives in a calcareous soil (a term also applied to plants).

Commensals – Commensal species relate to commensalism which is a class of relationship between two organisms where one organism benefits without affecting the other.

Conidia – Asexual non-motile spores of fungi.

Crustose – The habitat of lichen to grow tightly pressed to a substrate forming a biological layer of the adhering organism.

Epiphytes – A lichen (or plant) that grows non-parasitically upon another plant (such as a tree).

Heterobasidiomycetes – Includes jelly fungi, smuts and rusts, which are basidiomycetes with septate basidia.

Hymenium – The tissue layer on the hymenophore of a fungal fruiting body where the cells develop into basidia, which produce spores.

Hymenophore – Refers to the hymenium-bearing structure of a fungal fruiting body.

Lichenicolous – Lichenicolous fungi live exclusively on lichen, most commonly as host-specific parasites, but also as broad-spectrum pathogens, saprotrophs or commensals.

Lignicole – Growing or living on or in wood.

Muscicolous – Growing on mosses.

Nitrophile – A lichen with an affinity for growing on improved nitrogen rich substrates.

Obligate – Lichen requiring specific growing conditions e.g. saline conditions.

Saprotrophs – Organisms that get their energy from non-living organic matter e.g. rotting wood.

Saxicolous – Growing on or living among rocks.

Segregate species – A species of lichen that has been recently taxonomically split from previous historical groupings.

Siliceous – Sedimentary rocks that have silica as the principle constituent.

Squamules – Small scales.

Synanthropic – Synanthropes are organisms often (but not necessarily) considered pests, which are not domesticated but live near and benefit from humans and their dwellings.

Terricolous – Living on the ground or in the soil.

Thalii (thallus singular) – The body of the lichen.

Vice-County (VC) – A geographical division of the British Isles used for the purposes of biological recording and other scientific data-gathering (sometimes also called Watsonian Vice Counties).

1.7 Previous Work

Previous vegetation surveys in the study area have comprised Phase 1 habitat surveys completed in 2009, 2010, and 2012a by Ove Arup and Partners Ltd, and most recently in 2013 by Jacobs. Additionally a Lower Plant Appraisal Report was completed in 2012b and a Phase 2 Lichen Report in 2013, both by Ove Arup and

Partners Ltd. A review of all these reports was used to produce a targeted approach to the survey methodology.

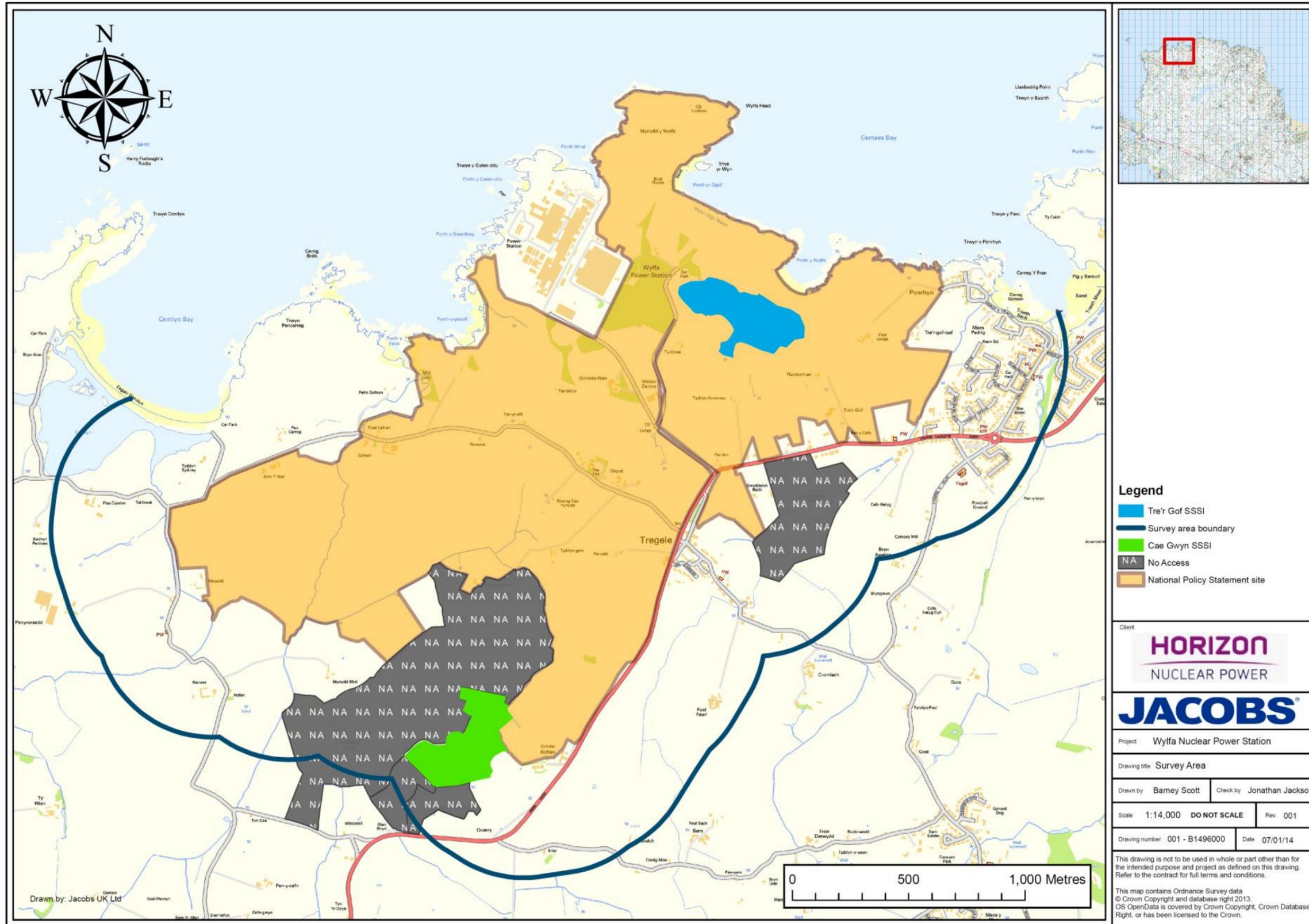


Figure 1 Study area

Specific areas identified in advance from Phase 1 and Phase 2 vegetation maps and scoping discussions with Jacobs ecologists/project managers were visited, together with a representative selection of landscape features, such as freestanding trees, groups of trees, traditional stone field banks (cloddiau) and sundry miscellaneous habitats, having the potential to support lichen interest.

At each location lichen species were identified by the selective scanning of supporting substrata using x10 hand-lens. Standard lichen reagent spot tests were employed to identify and/or confirm species in the field. For species requiring microscopic examination for critical determination or confirmation, small samples were removed for later anatomical study. The amount of time spent at each survey location varied and was dependent on its extent, habitat scale, complexity and inherent richness.

Comprehensive species inventories were not made for each and every study location, except for some of the richer semi-natural habitats, e.g. coastal rock outcrops. Instead over the survey period an additive, sequential list of species was assembled, covering all locations and habitats. For minor locations lichen species best typifying the habitat were listed, together with any species of particular note.

In the summaries below as a general rule the fuller the description, the better the habitat quality and significance of the location for lichens. Notable species are **emboldened** in the following text and their statuses described in Appendix C. In this case 'Notable' refers to a species' listing on one or a combination of the following:

- UK Post-2010 Biodiversity Framework (WBP, 2013);
- Section 42 NERC 2006 species of 'principle importance' (WBP, 2013);
- Welsh Red data list (Woods, 2010); and/or
- Rarity categories established by IUCN Red list (IUCN, 2001).

Each subsection below gives species lists and habitat descriptions for each of the numbered survey locations shown in Figure 2.

3.1 Location 1: Concrete sea wall by Esgair Cemlyn car park

The concrete of the sea wall fronting the car park supported a range of common calcicoles, including *Agonimia tristicula* (sterile squamules), *Candelariella aurella*, ***Caloplaca arcis***, *C.flavescens*, *Lecania erysibe* f. *erysibe*, *L.erysibe* f. *sorediata*, *Lecanora albescens*, *L.campestris*, *L.dispersa*, *Rinodina gennarii*, *Sarcogyne regularis*, *Verrucaria nigrescens* and *V.viridula*. A smaller boulder block wall perpendicular to the sea front on the east side of the car park had ***Amandinea lecideina*** and frequent ***Caloplaca vitellinula*** on the vertical side faces of siliceous blocks.

3.2 Location 2: Trwyn Pencarreg headland, west section: coastal rock exposures (cliff-top exposures, sea-cliffs and rocky shore).

Hard rock maritime lichen communities were well developed all around the headland, displaying full zonation from eulittoral to supralittoral to terrestrial. Only parts of the cliff where it was possible to descend were examined. Species recorded included *Acarospora fuscata*, *Anaptychia runcinata* (very fertile), ***Arthonia phaeobaea***, *Aspicilia leproscens*, *Buellia aethalea*, ***B.stellulata***, *B.subdisciformis*, *Candelariella vitellina*, *Catillaria chalybeia*, *Cladonia cervicornis* ssp. *cervicornis*, *Cliostomum tenerum*, *Diplotomma chlorophaeum*, ***Lecania atrynoides***, *Lecanora actophila*, *L.fugiens*, *L.gangaleoides*, *L.helicopis*, *L.orosthea*, *L.polytropa*, *L.rupicola*, *Lecidella asema*, *L.scabra*, *Melanelixia fuliginosa* (fertile), *M.glabratula*, *Myriospora smaragdula*, *Ochrolechia parella*, *Opegrapha calcarea* ('conferta' morphs), *O.gyrocarpa*, *Peltigera hymenina*, *Pertusaria lactescens*, *P.pseudocorallina*, *Physcia tenella* ssp. *marina*, *Polysporina simplex*, *Porpidia platycarpoides*, *P.tuberculosa*, *Ramalina cuspidata*, *R.siliquosa*, *Rhizocarpon geographicum*, *R.richardii*, *Rinodina gennarii*, *Scoliosporum umbrinum*, *Solenopsora vulturiensis*, *Tephromela atra*, *Verrucaria fusconigrescens*, *Xanthoparmelia loxodes*, *Xanthoria aureola* and *X.parietina*.

Exposed ground-level cliff-top outcrops, sheltered but not over-shaded by gorse *Ulex* sp. thickets in the terrestrial zone just back from the sea cliff edge, supported such species as ***Caloplaca arenaria***, *C.crenularia*, *Fuscidea cyathoides*, *Hypotrachyna britannica*, *Parmelia saxatilis*, *P.sulcata*, ***Pertusaria excludens***, *Ramalina subfarinacea*, *Rinodina atrocinnerea*, *Solenopsora vulturiensis*, *Trapeliopsis wallrothii*, ***Xanthoparmelia delisei*** and *X.verruculifera*. Maritime grass-heath in the vicinity of the outcrops had *Cetraria aculeata*, *Cladonia diversa*, *C. foliacea*, *C.furcata*, *C.portentosa*, *C.rangiformis* and *Peltigera membranacea*. Farther inland still more terrestrial exposures supported additional species, including *Buellia ocellata*, *Cladonia chlorophaea* agg., *C.uncialis* ssp. *biuncialis*, *Flavoparmelia caperata*, *Lecanora orosthea*, *L.sulphurea* (seen once), *Lecidea fuscoatra* (hosting *Marchandiomyces corallinus*), *Ochrolechia parella* (hosting *Dactylospora parellaria*), *Parmelia omphalodes*, *Parmotrema perlatum*, *Pertusaria corallina*, ***Rimularia furvella*** (seen once, inhabiting the periphery of *Rhizocarpon geographicum* thalli) and *Trapelia glebulosa* s.s.

Low tide on the shore coinciding with the time of the visit enabled survey of the littoral communities on sea cliff base and rocky shore, species recorded included *Caloplaca ceracea*, *C.marina*, *C.microthallina*, *C.thallicola*, *Collembopsidium foveolatum* (barnacles), *C.halodytes*, *Lecanora helicopis*, *Lichina confinis*, *L.pygmaea*, ***Verrucaria ditmarsica***, ***V.halioza***, ***V.prominula***, *V.striatula*, *V.maura* and *V.mucosa*.

Dry soil terracettes on the cliff edge were searched for specialist terricoles of the habitat, but only ***Leptogium tenuissimum*** was seen. A few tiny lobelets of *Anaptychia runcinata* were found growing directly on soil. *Lepraria ecorticata* occurred in a dry underhang.

Towards the east end of the open cliff section, west of the boundary drystone wall marking the start of the coastal heath area (see Location 3 below), an underhung dry rock cavity below a large cliff top boulder at GR23 (SH) 33748.93453, alt 13m, had *Opegrapha cesareensis*, and on damp, partly salt-encrusted soil on the floor of the recess, a small colony (c.7 thalli) of ***Solenopsora holophaea***.

On many occasions during the survey, at different places around the headland and elsewhere on the coast, pinkish-orange-red discoloured thalli of a number of normally whitish-grey lichens were observed, affected species included *Pertusaria pseudocorallina* (commonly), *Ramalina siliquosa* (occ.) and *R.subfarinacea* (rarely), probably damaged as a result of severe salt spray loading in recent storms.

3.3 Location 3: Trwyn Pencarreg headland, east section: Coastal heath and rock outcrops

The east part of the headland supported extensive areas of high quality common heather *Calluna vulgaris* coastal heathland in which *Cladonia*-dominated communities were locally well developed. A specific search was made for the rare *Cladonia peziziformis*, without success. Although the heathland habitat looked ideal for this species the apparent absence of burning management was presumably the causative factor precluding its presence. Gorse areas appeared to be managed by cutting alone.

Lichen species within the coastal heath areas included *Baeomyces rufus*, *Cladonia cervicornis* ssp. *cervicornis*, *C.cervicornis* ssp. *verticillata*, *C.ciliata* var *ciliata*, *C.diversa*, *C.floerkeana*, *C.macilenta*, *C.portentosa*, *C.ramulosa*, *C.squamosa* var. *squamosa*, *C.subcervicornis*, *Hypogymnia physodes*, ***Lichenomphalia umbellifera***, *Micarea lignaria* (on peaty soil and muscicolous on *Polytrichum piliferum*), *Placynthiella uliginosa*, *Platismatia glauca*, *Trapeliopsis granulosa*, *T.pseudogranulosa* and *T.wallrothii* (fertile on a peaty path edge). Small stones in peaty gullies had *Porpidia crustulata* and *P.macrocarpa*. The overlooked ***Catillaria atomarioides*** was seen on a sun-exposed rock fragment.

Tump-like rock exposures added ***Aspicilia intermutans***, *A.leproscens* (very fertile on bird perches), *Lecidea swartzioidea*, *Ochrolechia androgyna*, *Pertusaria aspergilla*, *Porpidia cinereoatra*, *P.tuberculosa* (hosting *Endococcus propinquus*) and *Xanthoria candelaria* (nutrient enriched bird perch apexes)

Around a low flushed outcrop at GR23 (SH) 33923.93488, alt 20m, a few small (2-3cm across) patches of *Cladonia strepsilis* occurred over an area c. 5 x 8m on damp, seasonally flushed peaty ground, and nearby *Cladonia furcata* and *C.gracilis* nestled in amongst *Calluna*, and on a dead *Calluna* stem, *Micarea peliocarpa*. An enriched rock spine had *Acarospora fuscata* hosting ***Polycoccum microsticticum***.

A flushed rockface had *Trapelia glebulosa* 'big pink', the field name for an undescribed crustose lichen in the *T.glebulosa* group, common in Wales.

3.4 Location 4: Sheltered east-facing shore at west end of Porth y Felin

Ramalina cuspidata was notably abundant and commonly fertile on shelving rock exposed on the upper shore, together with *R.subfarinacea* and, in the mesic supralittoral zone, *Caloplaca maritima*, *C.thallincola* and abundant *Lichina confinis*. The maritime lichen communities here were of good quality, but no species were seen that were not present elsewhere.

Mortared wall of footpath gate: *Caloplaca holocarpa* s.s., **C.oasis**, *Clauzadea monticola*, *Lecanora campestris*, *Protoblastenia rupestris*.

A patch of willow *Salix* sp. scrub above the bay produced *Anisomeridium bifforme*, *Lecanora chlorotera*, *Lecidella elaeochroma* f. *elaeochroma* and *L.elaeochroma* f. *soralifera* and *Xanthoria parietina*.

3.5 Location 5: Woodland near Candidate Wildlife Site Car Park, centred on GR23 (SH) 356.938

This site was surveyed in detail in 2012 and was consequently not resurveyed this visit, except to look briefly for the Red Data Book (Woods, 2010), UKBAP (now superseded see Appendix C Legislation), NERC Section 42 and Nationally Rare ***Schismatomma graphidioides***, which was re-found on the sycamore *Acer pseudoplatanus* by the north wall where it had been recorded in 2012. ***Strigula taylorii*** was seen again on sycamore and elm *Ulmus* sp. *Bacidia viridifarinosa* (not recorded in 2012) was seen on a damp rockface beside a path while passing through. *Lecania hutchinsiae* and *Porina chlorotica* were noted on a damp stone. A picnic bench had *Amandinea punctata*, *Buellia griseovirens*, *Lecanora saligna*, *Melanelixia glabratula* and *M.subaurifera*. Rusting metal of an abandoned farm roller had *Buellia aethalea* and a gorse stem in an *Ulex* sp. scrub patch, *Bacidia laurocerasi*. ***Normandina acroglypta*** was noted on the mossy trunk of a sycamore. At the north end of the wood a small stone quarry pit had *Cladonia chlorophaea* agg., *Peltigera membranacea* and *Porpidia soredizodes*. Limestone gateway pillars beside the track entranceway had *Caloplaca citrina sensu auct. brit.*, *C.flavocitrina*, *C.saxicola* and *Diplotomma alboatrum*.

3.6 Location 6: Coastal rock outcrop in pasture

Centred on GR23 (SH) 35760.93958, an extensive outcrop of hard, white, quartz rock, in open sheep pasture, cloaked in common gorse *Ulex europaeus* scrub at the east end, supported a very rich lichen flora due to the combination of size, the range of aspects, from fully open brightly lit south-facing to north-facing on the seaward side, a strongly maritime position and the rock type.

An attempt at a comprehensive inventory of saxicoles and terricoles produced the following list (52 spp.): *Anaptychia runcinata* (abundant and very fertile), *Acarospora fuscata* (hosting ***Polycoccum microsticticum***), ***Amandinea lecideina***, *Aspicilia caesiocinerea*, ***A.intermutans*** (locally abundant on south side at west end, forming large patches c. 5-8 (-10) cm across; material confirmed microscopically: conidia c.7-9 x 0.5um; ascospores c. 24-29 x 10.8-18 um), *A.leproscens*, *Buellia aethalea*, *B.ocellata*, ***B.stellulata***, *B.subdisciformis*, *Candelariella vitellina*, *Catillaria chalybeia*, *Cladonia diversa*, *C.fimbriata*, *C.furcata*, *Diploicia canescens*, *Flavoparmelia caperata*, *Hypotrachyna britannica*, *Lecanora fugiens*,

L.gangaleoides, *L.polytropa*, *L.rupicola*, *Lecidea fuscoatra*, *Lecidella scabra*, *Melanelixia fuliginosa*, *Ochrolechia parella*, *Parmelia omphalodes*, *P.saxatilis*, *P.sulcata*, *Parmotrema perlatum*, *Peltigera hymenina*, *Pertusaria corallina*, *P.lactescens*, *P.pseudocorallina*, *Polysporina simplex*, *Porpidia cinereoatra*, *P.platycarpoides*, *P.tuberculosa*, *Protoparmeliopsis muralis*, *Ramalina siliquosa*, *R.subfarinacea*, *Rhizocarpon geographicum*, *R.richardii*, *Trapelia glebulosa* s.s., *Rinodina atrocinerea*, *Verrucaria fusconigrescens*, ***Xanthoparmelia delisei***, *X.loxodes*, *X.verruculifera* and *Xanthoria parietina*. Of particular note ***Buellia abstracta*** [(Nyl.) Olivier] was seen growing along fine cleavage crevices on the south side of the outcrop.

An area of smaller, lower outcrops to the north, close to the sea cliff edge, in addition had *Arthonia varians* (on *Lecanora rupicola*) and, in short turf, *Cladonia rangiformis* and *Hypogymnia tubulosa* (one tuft seen).

The short coastal turf around and between the outcrops was carefully searched on hands and knees for a lengthy period for *Teloschistes flavicans* and *Heterodermia* spp. without these species being found.

3.7 Location 7: Rock outcrops along small north-south coastal valley running c. 40m down to the rocky shore, west of bay inlet, centred on GR2 (SH) 36044.93876.

Sheltered outcrops dispersed along this short and shallow valley produced a number of interesting species, including some not seen elsewhere along the surveyed coast, including *Buellia subdisciformis* (superabundant on a long face), ***Cercidospora epipolytropa*** (on *Lecanora polytropa*), *Cladonia foliacea* (on a dry slope with *Thymus polytrichus*), ***Diploschistes caesioplumbeus*** (several thalli on a well-lit rock rib), ***Pertusaria excludens***, ***Rimularia insularis*** (lichenicolous on *Lecanora rupicola*; one thallus c.3-4mm across).

Near the seaward end, on the south-facing north side, a weakly nutrient-enriched, sloping-topped large boulder had ***Tephromela grumosa***. A short distance below, a large outcrop just on the upper edge of the rocky shore had a strong colony (several patches) of ***Parmotrema pseudoreticulatum***, a segregate species in the *P.reticulatum* group only recently recognised in Britain. The same outcrop on its vertical south-facing side had three small thalli of *Schaereria fuscocinerea*.

3.8 Location 8: Old stone field walls, centred on GR23 (SH) 35625.93997.

Lengths of old field walls in this area, many sections tumbled and/or in part derelict, were inspected and found to support a range of common and expected saxicoles, such as ***Amandinea lecideina***, *Buellia aethalea*, *Lecanora gangaleoides*, *L.orosthea*, *L.polytropa*, *L.rupicola*, *Lecidella scabra* (fertile), *Porina chlorotica*, *Porpidia tuberculosa*, *Ramalina siliquosa* (mainly grazed down holdfasts) and *Scoliciosporum umbrinum*. Exposed soil had *Cladonia pyxidata*. Further to the west the wall joined a perpendicular mortared length where a large limestone gatepost in a trackway gap had *Caloplaca saxicola*, *Lecanora albescens*, *L.crenulata* and *Xanthoria parietina*.

3.9 Location 9: Old walls and grounds of demolished property.

Common species noted on the old walls included *Amandinea lecideina*, *Caloplaca citrina* s.l., *C.flavescens*, *C.flavocitrina*, *Collema crispum*, *Diploicia canescens*, *Lecanora campestris*, *L.rupicola*, *Lecidella scabra*, *Lepraria lobificans*, *Ramalina siliquosa*, *Verrucaria hochstetteri* and *V.muralis* (mortar). Old ash *Fraxinus excelsior* and sycamore trees against the wall on the field-side had, *inter alia*, *Anisomeridium biforme*, *Enterographa crassa*, *Lecidella elaeochroma*, *Opegrapha atra*, *O.vulgata*, *Pyrenula chlorospila*, *P.macrospora*, *Ramalina canariensis*, *R.farinacea*, *R.fastigiata* and *Xanthoria parietina*.

Within the grounds of the demolished property a mature ash tree had *Arthonia radiata*, *Caloplaca obscurella*, *C.ulcerosa* (sparsely fertile on trunk), *Hyperphyscia adglutinata*, *Lecanora chlarotera*, *L.expallens*, ***L.persimilis***, *Pertusaria hymenea*, *P.leioplaca* and ***Strigula taylorii***. A large sycamore had *Diploicia canescens*, *Opegrapha herbarum*, *O.varia* and *Pyrrhospora quernea*.

3.10 Location 10: Picnic benches and paving slabs near the Magnox Visitor Centre Car Park.

Weathered surfaces of the worked softwood picnic benches supported common lignicoles, including *Buellia griseovirens*, *Fuscidea lightfootii*, *Lecanora confusa*, *Micarea denigrata*, *M.peliocarpa* and *Trapeliopsis flexuosa*. Of note, a few apothecia of ***Caloplaca asserigena***, only recently reported in Britain, were present on one tabletop slat and another slat had a small basal holdfast of *Ramalina siliquosa*. Concrete patio slabs had *Caloplaca flavovirescens*.

3.11 Location 11: Sandstone entranceway gate pillars and old estate walls alongside the driveway in the grounds of the Wylfa Sports and Social Club.

Lecania hutchinsiae was noted on the damp north-west side of a sandstone pillar, while the old estate wall, of mortared siliceous slab construction, had *Bilimbia sabuletorum* (over bryophyte mats on base of the south wall), *Botryolepraria lesdainii*, *Collema tenax* var. *tenax*, *Lecania erysibe* var. *erysibe*, *Leptogium teretiusculum* (lime mortar-washed block faces), *Placopyrenium fuscillum*, *Toninia aromatica* and *Verrucaria elaeina*.

3.12 Location 12: Trees in the grounds of the Wylfa Sports and Social Club.

Mature trees, mainly sycamore and ash, originally forming part of the old estate plantings, supported a range of typical epiphytes, including *Caloplaca obscurella*, *Cliostomum griffithii*, *Diploicia canescens* (occasionally fertile), *Evernia prunastri*, *Flavoparmelia caperata*, *F.soredians* (seen on c. four trees), *Lecanora expallens*, *Melanelixia glabratula*, *Parmelia sulcata*, *Parmotrema perlatum*, *Pertusaria hymenea*, *Phlyctis argena*, *Physconia enteroxantha* (fertile on one tree, rarely so), *Ramalina canariensis* (extensive swards on well-ventilated trunks), *R.farinacea* and *R.fastigiata*. ***Strigula taylorii*** was present on smooth bark on the trunks of a number of sycamore trees.

3.13 Location 13: Trackside trees and track surface

A good, strong, solitary tuft of *Ramalina fraxinea* was seen on a canopy branch of a young well-branched sycamore. Other species on sycamore branches included *Candelariella reflexa*, *Lecanora carpinea*, *Phaeographis dendritica*, *Physcia adscendens* and *P.tenella*. The dry side of one tree had several small thalli of the under-recorded and likely spreading nitrophile *Lecanora compallens*. The heterobasidiomycete lichenicolous parasite *Syzygospora physciacearum* was seen on *P.tenella* on the branch of an elm species. Tarmac on the track had *Amandinea punctata* and *Physcia caesia*.

3.14 Location 14: Lengths of drystone walls around small pastures, centred on GR23 (SH) 35079327

Low (to c. 0.75m high), partly derelict fieldwall lengths constructed from un-mortared slaty-siliceous blocks and typical of those in the general area supported a range of common saxicoles, including *Acarospora fuscata*, *Amandinea lecideina*, *Buellia aethalea*, *Lecanora gangaleoides*, *L.polytropa*, *L.rupicola* (the dominant 'white lichen'), *Melanelixia fuliginosa*, *Parmelia sulcata*, *Pertusaria pseudocorallina*, *Porpidia tuberculosa* and *Ramalina siliquosa*. The under-recorded and often overlooked *Pertusaria lactescens* was seen on one block top.

3.15 Location 15: Low rock outcrops in field, centred on GR2 (SH) 3476.8337, alt 18m

Extensive shelving rock outcrops here, plus a smaller extent north of the track crossing the field to the west of the station, supported a well-developed, high quality and species-rich community of sub-coastal-maritime saxicoles, especially rich in *Xanthoparmelia* spp.

The following list represents an attempt at a complete inventory of all species present (42): *Abrothallus caerulescens* (lichenicolous on *Xanthoparmelia conspersa*), *Acarospora fuscata*, *Amandinea lecideina*, *Anaptychia runcinata*, *Aspicilia caesiocinerea*, *Buellia aethalea*, *B.subdisciformis*, *Caloplaca ceracea*, *Candelariella vitellina*, *Cladonia chlorophaea* agg. *C.furcata*, *C.pyxidata*, *C.ramulosa*, *C.rangiformis*, *Hypotrachyna britannica*, *Lecanora dispersa*, *L.gangaleoides*, *L.polytropa*, *L.rupicola*, *Lecidea fuscoatra*, *Lecidella scabra*, *Melanelixia fuliginosa*, *Ochrolechia parella*, *Parmotrema perlatum*, *Pertusaria pseudocorallina*, *Physcia tenella* ssp. *tenella*, *Porpidia platycarpoides*, *P.tuberculosa* (hosting *Endococcus propinquus*), *Protoparmeliopsis muralis*, *Punctelia subrudecta*, *Ramalina siliquosa*, *Rhizocarpon reductum*, *R.richardii*, *Rinodina atrocinerea*, *Scoliciosporum umbrinum*, *Verrucaria fusconigrescens*, *Xanthoparmelia conspersa*, *X.delisei* (locally very frequent), *X.loxodes* (abundant and occasionally fertile), *X.verruculifera* and *Xanthoria parietina*.

3.16 Location 16: Consolidated soil and shingle face on beach head terrace

Abundant *Solenopsisora vulturiensis* was very locally frequent on compacted moist soil, while stones embedded in the soil had *Myriospora smaragdula*.

3.17 Location 17: Headland and coastal rocks directly W of the station

Leptogium schraderi was present in crevices in a mound of tipped concrete on top of the low sea cliff. *Cladonia humilis* was noted on a dry slope by a small colony of *Koeleria macrantha* crested hair-grass. In the bay the guano-enriched sloping top of a small prominent sea stack had abundant *Caloplaca verruculifera*, many thalli of which were fertile.

3.18 Location 18: Concrete drain cover in field

A drain cover supported a number of common mural calcicoles, including *Aspicilia contorta* ssp. *contorta*, *Clauzadea monticola*, *Placynthium nigrum*, *Protoblastenia rupestris* and *Verrucaria nigrescens*.

3.19 Location 19: Trees in planted shelter strip beside sports field

Young stems of aspen *Populus tremula* yielded *Arthopyrenia punctiformis* and *Bacidia arceutina*, while dust-impregnated *Betula* birch twigs had *Arthonia punctiformis* and *Physcia aipolia*.

3.20 Location 20: Sports centre wall

An old wall had *Caloplaca flavocitrina*, the recently recognised (in Britain) ***C.limonia*** and *Verrucaria viridula*. A damp slab on the ground nearby at the edge of a shrubbery produced *Verrucaria dolosa* and ***V.elaeina***.

3.21 Location 21: Planted trees on verges beside road

Open groups of established planted trees, predominantly *Acer pseudoplatanus* sycamore, on the wide verge on the W side of the road. A strong population of ***Ramalina fraxinea*** was noted (c.15 tufts seen on a total of c. six trees) on the canopy branches of sycamore. Other species included *Flavoparmelia soledians*, *Physconia distorta*, *Vouauxiella lichenicola* (on *Lecanora chlarotera*) and *Xanthoriicola physciae* (on *Xanthoria parietina*).

3.22 Location 22: Planted trees on verge beside road

Smooth bark islands on the trunks of white willow *Salix alba* had ***Eopyrenula grandicula***, normally a species of well-established and old-growth woodland, and (on branches) fertile *Parmelia sulcata*. A single small tuft of *Usnea subfloridana* was seen on a branch of a *Populus alba* white poplar. A large roadside stone boulder had a colony of saxicolous *Flavoparmelia soledians*.

3.23 Location 23: Edge of haul road around station

Open, dry, sandy road edges had locally frequent concentrations of pulpy tufts of *Collema tenax* var. *ceranoides*.

3.24 Summary

In total 262 taxa of lichens (252) and lichenicolous fungi (10) were recorded from all habitats (see Appendix A).

Twenty-one species (17 lichens and four lichenicolous fungi) are reported new to VC52 Anglesey, viz. *Abrothallus caerulescens*, *Caloplaca arcis*, *Caloplaca asserigena*, *Caloplaca limonia*, *Caloplaca oasis*, *Caloplaca vitellinula*, *Catillaria atomarioides*, *Cercidospora epipolytropa*, *Eopyrenula grandicula*, *Lecanora compallens*, *Lecanora persimilis*, *Leptogium tenuissimum*, *Normandina acroglypta*, *Lichenomphalia umbellifera*, *Parmotrema pseudoreticulatum*, *Polycoccum microsticticum*, *Rimularia furvella*, *Rimularia insularis*, *Syzygospora physciacearum*, *Tephromela grumosa* and an undescribed species of *Trapelia* in the *T.glebulosa* group.

The relatively large number of species (262 taxa) encountered during the survey is a reflection of the spatially broad scope of the study area (for what are diminutive organisms), the wide range of habitats encompassed, ranging from near-natural to fully synanthropic, across wide ecological spectra (from marine to coastal to terrestrial), and the inclusion of some notably lichen-rich semi-natural habitats, in particular the marine and supralittoral communities of the rocky shore, sea-cliff and coastal heathland around Trwyn Pencarreg (Location 3). The littoral and supralittoral maritime lichens associated with Trwyn Pencarreg are of high quality and its lichen flora is typical of the best sites represented for these species on Anglesey, where hard rock coastal lichen habitats are among some of the best in the British Isles.

Comparing the two principal maritime lichen locations within the study area, Trwyn Pencarreg and survey location 6, overall Trwyn Pencarreg is the richer of the two, due in the main to the more extensively developed lower to upper shore communities. However, survey location 6 is not without interest, supporting for example the notable *Aspicilia intermutans*, and *Pertusaria monogona* being recorded on the Wylfa Head peninsula (figure 2).

As an artefact of the British biological grid-recording system, maritime species are statistically disproportionately more likely to be categorised as Nationally Scarce (NS) than non-maritime species, as demonstrated by 14 of the recorded 26 NS species (53.8%, i.e. over half) being either obligate or near-faithful maritime lichens, viz. *Amandinea lecideina*, *Arthonia phaeobaea*, *Buellia abstracta*, *B.stellulata*, *Caloplaca maritima*, *Diploschistes caesioplumbeus*, *Lecania atrynoides*, *Pertusaria excludens*, *P.monogona*, *Rimularia insularis*, *Solenopsora holophaea*, *Verrucaria ditmarsica*, *V.halioza* and *V.prominula*.

Although 21 species were found new for VC52 Anglesey, compared with other Welsh vice-counties the island has been relatively under-recorded in the last decade or so, during which time considerable taxonomic change, revision of species concepts and dismemberment of artificial morphological aggregates resulting from new molecular/DNA approaches affecting mycological systematics in general, have occurred, and many of the 'new' species represent recently recognised segregates that are proving to be common in Britain, especially members of the large genus *Caloplaca*, e.g. *C.arcis*, *C.asserigena*, *C.limonia* and *C.oasis*. The VC novelties also include a number of lichenicolous fungi, which as a group are poorly known and little-studied or recorded even by lichenologists, for example *Abrothallus caerulescens* and *Syzygospora physciacearum*. The latter species is very common in Wales.

With a couple of notable exceptions lichen epiphytes overall were fairly unremarkable due to the lack of ancient semi-natural or old-growth woodland areas, or ancient trees. Although established old ornamental deciduous trees were present about the former estate grounds and woodland (e.g. Location 5 and Location 12) they supported in the main only common and expected epiphytes. Of the species of note, *Ramalina fraxinea* (Location 13 and Location 21) (International Responsibility (IR)) (Woods and Coppins, 2012), of which a strong population was found at Location 21, is widespread in coastal areas in Wales. Being a canopy species it tends to grow high up and in consequence is probably under-recorded. *Eopyrenula grandicula* (IR) is a sub-microscopic, minute and inconspicuous species of smooth bark, found mostly on hazel *Corylus avellana*, in both ancient and secondary

woodland, and is significantly under-recorded in most of Wales. *Strigula taylorii* (IR) is also locally common in Wales, mainly on ash in woodland in mild coastal areas, and is significantly under-recorded and in west Wales seems to be spreading. Location 5 is the standout woodland area, supporting *Schismatomma graphidioides* (NS, Red List VU, s.42) and *Normandina acroglypta* (Red List VU) was added on this visit.

The lengths of field walls looked at in detail (Location 8 and Location 14) were typical of others in the study area and all were unremarkable, supporting only common saxicoles. Most were in a semi-dilapidated state. New wall lengths could be constructed, or old ones repaired, to enhance their value as lichen habitats. It is highly unlikely that walls and banks of similar construction and condition elsewhere within the study area would support any significant lichen interest.

Due to the variety of habitats present and the wide extent of the study area the combined survey locations together produced a large number (262) of taxa of lichens and lichenicolous fungi. Notable species (Appendix B) included 26 Nationally Scarce, two Nationally Rare, three Welsh Red Data List Vulnerable, four International Responsibility and 21 first VC52 Anglesey records, plus an undescribed crustose lichen common in upland Britain but of no conservation concern.

Species of prime conservation significance in the context of Anglesey/Wales and the United Kingdom are: *Pertusaria monogona*, recorded on the Wylfa Head peninsula *Schismatomma graphidioides* recorded in woodland (survey location 5) and the recently recognised macro-lichen *Parmotrema pseudoreticulatum* recorded at the rock outcrops of survey location 7.

IUCN, (2001), *IUCN Red List Categories Criteria. Version 3.1*. Gland Switzerland: IUCN

Jacobs, (2013), *Consultancy Report: A Phase 1 Habitat Survey*, unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd. Ref. W202.01-S5-PAC-REP-00015.

Ove Arup and Partners, (2009), *Phase 1 Habitats and Protected Species Survey*, unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd.

Ove Arup and Partners, (2010), *Phase 1 Survey Report*, unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd.

Ove Arup and Partners, (2012a), *Phase 1 Habitats and Protected Species Survey*, unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd.

Ove Arup and Partners, (2012b), *Lower Plants Appraisal Report*, unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd.

Ove Arup and Partners, (2013), *Lichen Report*, unpublished report on behalf of Horizon Nuclear Power (Wylfa) Ltd.

Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. and Wolseley, P.A. (eds.) (2009) *The Lichens of Great Britain and Ireland*. London: British Lichen Society.

WBP, (2013), *Wales Biodiversity Partnership* (Online), available at <http://www.biodiversitywales.org.uk/> (Accessed 12/02/14).

Woods, R.G., (2010) *A Lichen Red Data List for Wales*, Plantlife, Salisbury.

Woods, R.G. and Coppins, B.J., (2012), *A Conservation Evaluation of British Lichens and Lichenicolous Fungi. Species Status 13*, Joint Nature Conservation Committee, Peterborough.

Appendix A Complete species list

Lichens and Lichenicolous Fungi [LF] Recorded at Wylfa Survey Locations, November 2013.

Abrothallus caerulescens [LF]
Acarospora fuscata
Agonimia tristicula
Amandinea lecideina
Amandinea punctata
Anaptychia runcinata
Anisomeridium bifforme
Anisomeridium polypori
Arthonia phaeobaea
Arthonia punctiformis
Arthonia radiata
Arthonia varians [LF]
Arthopyrenia punctiformis
Aspicilia caesiocinerea
Aspicilia contorta ssp. *contorta*
Aspicilia intermutans
Aspicilia leproscens
Bacidia arceutina
Bacidia laurocerasi
Bacidia viridifarinoso
Bilimbia sabuletorum
Botryolepraria lesdainii
Buellia abstracta
Buellia aethalea
Buellia griseovirens
Buellia ocellata
Buellia stellulata
Buellia subdisciformis
Caloplaca arcis
Caloplaca arenaria
Caloplaca asserigena
Caloplaca ceracea
Caloplaca citrina sensu auct. *brit.*
Caloplaca crenularia
Caloplaca flavescens
Caloplaca flavocitrina
Caloplaca flavovirescens
Caloplaca holocarpa s.s.
Caloplaca limonia
Caloplaca marina
Caloplaca maritima
Caloplaca microthallina
Caloplaca oasis
Caloplaca obscurella
Caloplaca saxicola
Caloplaca thallicola
Caloplaca ulcerosa
Caloplaca verruculifera

Caloplaca vitellinula
Candelariella aurella
Candelariella reflexa
Candelariella vitellina
Catillaria atomarioides
Catillaria chalybeia
Cercidospora epipolytropa [LF]
Cetraria aculeata
Cladonia cervicornis ssp. *cervicornis*
Cladonia cervicornis ssp. *verticillata*
Cladonia chlorophaea agg.
Cladonia ciliata var. *ciliata*
Cladonia diversa
Cladonia fimbriata
Cladonia floerkeana
Cladonia foliacea
Cladonia furcata
Cladonia gracilis
Cladonia humilis
Cladonia macilenta
Cladonia portentosa
Cladonia pyxidata
Cladonia ramulosa
Cladonia rangiformis
Cladonia squamosa var. *squamosa*
Cladonia strepsilis
Cladonia subcervicornis
Cladonia uncialis ssp. *biuncialis*
Clauzadea monticola
Cliostomum griffithii
Cliostomum tenerum
Collema crispum
Collema tenax var. *ceranoides*
Collema tenax var. *tenax*
Collemopsidium foveolatum
Collemopsidium halodytes
Dactylospora parellaria [LF]
Diploicia canescens
Diploschistes caesioplumbeus
Diplotomma alboatrum
Diplotomma chlorophaeum
Endococcus propinquus [LF]
Enterographa crassa
Eopyrenula grandicula
Evernia prunastri
Flavoparmelia caperata
Flavoparmelia soledians
Fuscidea cyathoides
Fuscidea lightfootii
Hyperphyscia adglutinata
Hypogymnia physodes
Hypogymnia tubulosa
Hypotrachyna britannica
Lecania atrynoides
Lecania cyrtella

Lecania erysibe forma *erysibe*
Lecania erysibe forma *sorediata*
Lecania hutchinsiae
Lecania naegelii
Lecanora actophila
Lecanora albescens
Lecanora dispersa
Lecanora campestris
Lecanora carpinea
Lecanora chlarotera
Lecanora compallens
Lecanora confusa
Lecanora crenulata
Lecanora expallens
Lecanora fugiens
Lecanora gangaleoides
Lecanora helicopis
Lecanora orosthea
Lecanora persimilis
Lecanora polytropa
Lecanora rupicola
Lecanora saligna
Lecanora sulphurea
Lecanora symmicta
Lecidea swartzioidea
Lecidella asema
Lecidella elaeochroma forma *elaeochroma*
Lecidella elaeochroma forma *soralifera*
Lecidea fuscoatra
Lecidella scabra
Lepraria ecorticata
Lepraria lobificans
Leptogium schraderi
Leptogium tenuissimum
Leptogium teretiusculum
Lichenomphalia umbellifera
Lichina confinis
Lichina pygmaea
Marchandiomyces corallinus [LF]
Melanelixia fuliginosa
Melanelixia glabratula
Melanelixia subaurifera
Micarea denigrata
Micarea lignaria
Micarea peliocarpa
Myriospora smaragdula
Normandina acroglypta
Normandina pulchella
Ochrolechia androgyna
Ochrolechia parella
Opegrapha atra
Opegrapha calcarea ('conferta' morphs),
Opegrapha cesareensis
Opegrapha gyrocarpa
Opegrapha herbarum

Opegrapha niveoatra
Opegrapha varia
Opegrapha vulgata
Parmelia omphalodes
Parmelia saxatilis
Parmelia sulcata
Parmotrema perlatum
Parmotrema pseudoreticulatum
Peltigera hymenina
Peltigera membranacea
Pertusaria aspergilla
Pertusaria corallina
Pertusaria excludens
Pertusaria hymenea
Pertusaria lactescens
Pertusaria leioplaca
Pertusaria monogona
Pertusaria pertusa
Pertusaria pseudocorallina
Phaeographis dendritica
Phaeophyscia orbicularis
Phlyctis argena
Physcia adscendens
Physcia aipolia
Physcia caesia
Physcia tenella ssp. *marina*
Physcia tenella ssp. *tenella*
Physconia distorta
Physconia enteroxantha
Placopyrenium fuscillum
Placynthiella uliginosa
Placynthium nigrum
Platismatia glauca
Polycoccum microsticticum [LF]
Polysporina simplex
Porina chlorotica
Porpidia cinereoatra
Porpidia crustulata
Porpidia macrocarpa
Porpidia platycarpoides
Porpidia soledizodes
Porpidia tuberculosa
Protoblastenia rupestris
Protoparmeliopsis muralis
Punctelia subrudecta
Pyrenula chlorospila
Pyrenula macrospora
Pyrrhospora quernea
Ramalina canariensis
Ramalina cuspidata
Ramalina farinacea
Ramalina fastigiata
Ramalina fraxinea
Ramalina siliquosa
Ramalina subfarinacea

Rhizocarpon geographicum
Rhizocarpon reductum
Rhizocarpon richardii
Rimularia furvella
Rimularia insularis
Rinodina atrocinerea
Rinodina gennarii
Sarcogyne regularis
Schaereria fuscocinerea
Schismatomma decolorans
Schismatomma graphidioides
Scoliciosporum umbrinum
Solenopsora holophaea
Solenopsora vulturiensis
Strigula taylorii
Syzygospora physciacearum [LF]
Tephromela atra
Tephromela grumosa
Toninia aromatica
Trapelia glebulosa s.s.
Trapelia glebulosa 'big pink'
Trapeliopsis flexuosa
Trapeliopsis granulosa
Trapeliopsis pseudogranulosa
Trapeliopsis wallrothii
Usnea subfloridana
Verrucaria ditmarsica
Verrucaria dolosa
Verrucaria elaeina
Verrucaria fusconigrescens
Verrucaria halizoa
Verrucaria hochstetteri
Verrucaria maura
Verrucaria mucosa
Verrucaria muralis
Verrucaria nigrescens
Verrucaria prominula
Verrucaria striatula
Verrucaria viridula
Vouauxiella lichenicola [LF]
Xanthoparmelia conspersa
Xanthoparmelia delisei
Xanthoparmelia loxodes
Xanthoparmelia verruculifera
Xanthoria aureola
Xanthoria candelaria
Xanthoria parietina
Xanthoriicola physciae [LF]

Appendix B List of Notable/Significant Species

Conservation evaluations follow Woods, R.G., (2010), *A Lichen Red Data List for Wales*, Plantlife, Salisbury.

Abrothallus caerulescens: 1st VC52 Anglesey record.

Amandinea lecideina: Nationally Scarce.

Arthonia phaeobaea: Nationally Scarce.

Aspicilia intermutans: Data Deficient; Nationally Rare; 2nd and subsequent VC52 Anglesey records.

Buellia abstracta: Nationally Scarce.

Buellia stellulata: Nationally Scarce.

Caloplaca arcis: 1st VC52 Anglesey record. Data Deficient. Nationally Scarce.

Caloplaca arenaria: Nationally Scarce.

Caloplaca asserigena: 1st VC52 Anglesey record. Nationally Scarce.

Caloplaca limonia: 1st VC52 Anglesey record. Nationally Scarce (too recently recognised for considered evaluation).

Caloplaca maritima: Nationally Scarce.

Caloplaca oasis: 1st VC52 Anglesey record. A common species previously grouped in the *C.holocarpa* agg.

Caloplaca vitellinula: 1st VC52 Anglesey record. Data Deficient. Nationally Rare.

Catillaria atomarioides: 1st VC52 Anglesey record. Nationally Scarce.

Cercidospora epipolytropa: 1st VC52 Anglesey record.

Diploschistes caesioplumbeus: Nationally Scarce.

Eopyrenula grandicula: 1st VC52 Anglesey record. Nationally Scarce. International Responsibility.

Lecania atrynoides: Nationally Scarce.

Lecanora compallens: 1st VC52 Anglesey record. Data Deficient. Nationally Scarce.

Lecanora persimilis: 1st VC52 Anglesey record. Data Deficient. Nationally Scarce.

Leptogium tenuissimum: 1st VC52 Anglesey record. Vulnerable. Nationally Scarce.

Lichenomphalia umbellifera: 1st VC52 Anglesey record.

Normandina acroglypta: 1st VC52 Anglesey record. Vulnerable. Nationally Scarce.

Parmotrema pseudoreticulatum: A recently recognised segregate of *P.reticulatum* s.l. The respective distributional range and status of the two species in Britain is currently unclear, though both are present in Wales, where *P.pseudoreticulatum* has otherwise only been confirmed from VC46 Cardiganshire.

Pertusaria excludens: Nationally Scarce.

Pertusaria monogona: Wales Red Data List: Vulnerable; Nationally Scarce; Sole VC 52 Anglesey location. First found (new for Anglesey) in 2012; the same single individual thallus re-found on its rockface on Wylfa Head this survey.

Polycoccum microsticticum: 1st VC52 Anglesey records.

Ramalina fraxinea: International Responsibility.

Rimularia furvella: 1st VC52 Anglesey record.

Rimularia insularis: 1st VC52 Anglesey record. Nationally Scarce.

Schismatomma graphidioides: Wales Red Data List: Vulnerable; British Red List Threat Status: Vulnerable; Nationally Scarce; International Responsibility. NERC Act s.42 species. Sole known VC 52 Anglesey locality, discovered in 2012, re-found during this survey.

Solenopsora holophaea: Nationally Scarce.

Strigula taylorii: Nationally Scarce; International Responsibility.

Syzygospora physciacearum: 1st VC52 Anglesey record.

Tephromela grumosa: 1st VC52 Anglesey record.

***Trapelia glebulosa* 'big pink'**: the working/fieldname for an apparently undescribed crustose lichen in the *Trapelia glebulosa* group. A common species of damp siliceous rocks in Wales, especially in the uplands (Chambers, unpublished).

Verrucaria ditmarsica: Nationally Scarce.

Verrucaria elaeina: Nationally Scarce.

Verrucaria halizoa: Nationally Scarce.

Verrucaria prominula: Nationally Scarce.

Xanthoparmelia delisei: Nationally Scarce.

Appendix C Legislation and Conservation Designations

NERC Act

The Natural Environment and Rural Communities (NERC) Act (2006) places a statutory duty on public bodies to take, or promote the taking by others, steps to further the conservation of the listed habitats and species. In Wales, this is sanctioned by Section 42 which requires the identification of habitats and species of 'Principal importance'. These are material considerations in the planning process. There are currently 67 lichen species listed in accordance with Section 42 (WBP, 2013).

UK Post 2010 Biodiversity Framework

The UK Biodiversity Action Plan (UK BAP), published in 1994, was the UK's response to the commitments of the Rio Convention on Biological Diversity (1992). This has since been replaced by the UK Post-2010 Biodiversity Framework. This framework covers the period 2011 - 2020 and forms the UK government's response to the new strategic plan of the United Nations Convention on Biodiversity (CBD) published in 2010. The UK BAP partnership therefore no longer operates, with the framework that replaces it promoting a focus on individual countries delivering targets for protection for biodiversity through their own strategies.

In Wales the strategy adopted has been the transfer of the species and habitats listed under the defunct UK BAP, to accord with Section 42 of the NERC Act (described above). However, many of the tools and resources originally developed under the UK BAP still remain of use, including background information on UK BAP priority habitats and species which form the basis of county level biodiversity protection initiatives e.g. Local Biodiversity Action Plans (LBAP).

International Responsibility

British populations identified by the symbol "IR" are considered to be of international significance (in a European or global context). This is an attempt to place British populations of lichen species in an international context. This classification should be used with caution until a well-researched database can be created to support these listings and well-defined criteria are established. For the present Woods and Coppins (2012) consider that on the balance of probabilities it is likely that further research will demonstrate that Britain supports more than 10% of the extant European and/or World's population of these species.

Nationally Scarce

The term Nationally Scarce, originally coined for plants, is applied to species that are only known to occur in 16 to 100 ten-km squares (or hectads) in the UK (Woods & Coppins, 2012).

Nationally Rare

The term Nationally Rare is used for plant and lichen species that occur in 15 or fewer hectads in Britain and is used in SSSI designation and Common Standards Monitoring (Woods & Coppins, 2012).

Vulnerable

The term vulnerable is one of three categorisations that comprise the IUCN Red List Categories and Criteria as set out in Version 3.1 of the Guidance (IUCN, 2001 from Woods & Coppins, 2012). A taxon is Vulnerable when the best available evidence suggests that it is considered to be facing a high risk of extinction. This risk is quantified by assessing the population status of a taxon based on elements of the following five criteria:

1. The relative reduction in population size.
2. The relative reduction in geographic range.
3. Population size estimated to number <10 000 mature individuals.
4. Population very small or restricted.
5. Quantitative analysis showing the probability of extinction in the wild is at least 10% within 100 years.

