HORIZON NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

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Contents

1. About this Report

1.1 Purpose and Applicability

The purpose of this report is to document the methodology and findings of the exercise to identify sites that form the compensation proposal to offset potential significant effects to rich-fen habitat at Tre'r Gof Site of Special Scientific Interest (SSSI) resulting from the Wylfa Newydd Project. The final selection of sites follows initial identification, survey and evaluation of sites with potential to form part of this compensation proposal, the results of which process are presented in this report.

The compensation proposal comprises three sites:

- Cae Canol-dydd;
- Cors Gwawr; and
- Ty du.

The identified proposal delivers 49.5ha of land which Horizon intends to secure under an option for purchase. Of this land, 13.8ha are suitable for rich-fen habitat creation and 20ha for the enhancement of existing but unmanaged or degraded fen and mire habitat. Furthermore, the proposed sites would extend and provide landscape connectivity between existing rich-fen sites of international importance.

The proposals for each site included in the final compensation proposal are outlined in Tre'r Gof SSSI Compensation Strategy Volume II (Appendix D9-23. SSSI Compensation Strategy - Volume II. Application Reference Number: 6.4.57). Detailed designs will be produced in accordance with principles set out in the Landscape and Habitat Management Strategy (Application Reference Number: 8.16) and the Phasing Strategy (Application Reference Number: 8.29), and secured through a DCO requirement, Draft Development Consent Order (Application Reference Number: 3.1). The proposals within Tre'r Gof SSSI Compensation Strategy Volume II have been assessed within Appendix D1-2 Ecological Compensation Sites: Assessment of Environmental Effects, (Application Reference Number: 6.4.18).

1.2 Report outline

This report is structured as follows:

- section 2 provides background to the compensation proposal and a rationale for the site identification process;
- section 3 provides background information on the ecology of the rich-fen habitats that are the subject of the compensation proposal;
- section 4 provides an overview of the process used to identify the sites initially considered in this report;

- section 5 outlines the methodology followed in the investigations into the suitability of sites to form part of the compensation proposal;
- section 6 describes the results of investigations and evaluation process, where each site is assigned to a category of 'none', 'low', 'medium' or 'high' according to its suitability to form part of the compensation proposal, and the results of this process are summarised in section 7; and
- section 8 identifies the preferred sites, including final site names and boundaries, that will be taken forward as part of the compensation proposal.

The appendices provide full results of the surveys, including figures and photographs.

2. Introduction

2.1 Overview of the Wylfa Newydd Project

Horizon Nuclear Power Wylfa Ltd. (Horizon) is planning to develop a new nuclear power station on the north coat of Anglesey. Land adjacent to the Existing Power Station at Wylfa Head, west of Cemaes on the north coast of Anglesey, is identified by the UK Government in the *Overarching National Policy Statement for Energy (EN-1)* (NPS EN-1) [RD1] and *National Policy Statement for Nuclear Power Generation (EN-6)* (NPS EN-6) [RD2] as potentially suitable for the construction of a new nuclear power station. Horizon proposes to construct and operate a new nuclear power station, known as Wylfa Newydd, on this land and adjacent land. The Power Station would deliver approximately 3,000 megawatts of electricity, enough power for around five million homes.

The Wylfa Newydd Project comprises the proposed new nuclear power station and associated plant and ancillary structures and features, together with all of the Associated Development needed to support its delivery and operation. This includes highway improvements, worker accommodation, specialist training facilities, radioactive waste storage buildings, ancillary structures, offices and coastal developments. The coastal developments include a Cooling Water System, breakwater, and a Marine Off-Loading Facility.

The Wylfa Newydd 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 of the Wylfa Newydd Project must be authorised by a Development Consent Order (DCO).

2.2 Tre'r Gof SSSI

Tre'r Gof SSSI is located within the Wylfa Newydd Development Area (figure 2-1) and is a rich-fen habitat with a wide range of wetland plant species, including the nationally scarce marsh fern (*Thelypteris palustris*). The site supports rich-fen habitats of national importance and the internationally important habitats 'Alkaline fens' and 'Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*' listed on Annex 1 of the Habitats Directive [RD3]. The areas of some rich-fen plant communities are small, including those referable to 'Alkaline fens', and Tre'r Gof SSSI also supports habitats of acid to neutral conditions in addition to base-rich conditions (figure 2-1, [RD4]).

The environmental impact assessment for the Wylfa Newydd Project (Chapter D8 – Surface Water and Groundwater. Application Reference Number: 6.4.8; and chapter D9 - Terrestrial and freshwater ecology. Application Reference Number: 6.4.9) conclude that there is potential for significant residual adverse effects on Tre'r Gof SSSI, principally resulting from hydrological changes during construction and operation of the Power Station. To offset the potential for adverse effects, Horizon has committed to delivering a compensation proposal which will create new areas of rich-fen habitat and enhance areas of existing rich-fen habitat within Anglesey.

2.3 Tre'r Gof SSSI compensation proposal

The development of the Tre'r Gof SSSI compensation proposal is an ongoing process, informed through discussions within a Technical Advisory Group (TAG) consisting of representatives from Horizon, the Isle of Anglesey County Council (IACC) and Natural Resources Wales (NRW). This group has discussed a list of sites considered for evaluation for their potential to form part of the compensation proposal, discussed a methodology for this evaluation, and discussed the selection of the final sites that will form the proposal presented in this document.

The following objectives for the compensation proposal have been established through discussions with the TAG:

(a) The target habitat for any compensation works would be rich-fen, including alkaline and/or calcareous fen, as found at Tre'r Gof SSSI.

(b) Creation of new rich-fen habitat would be prioritised to offset the potential loss of habitat at Tre'r Gof.

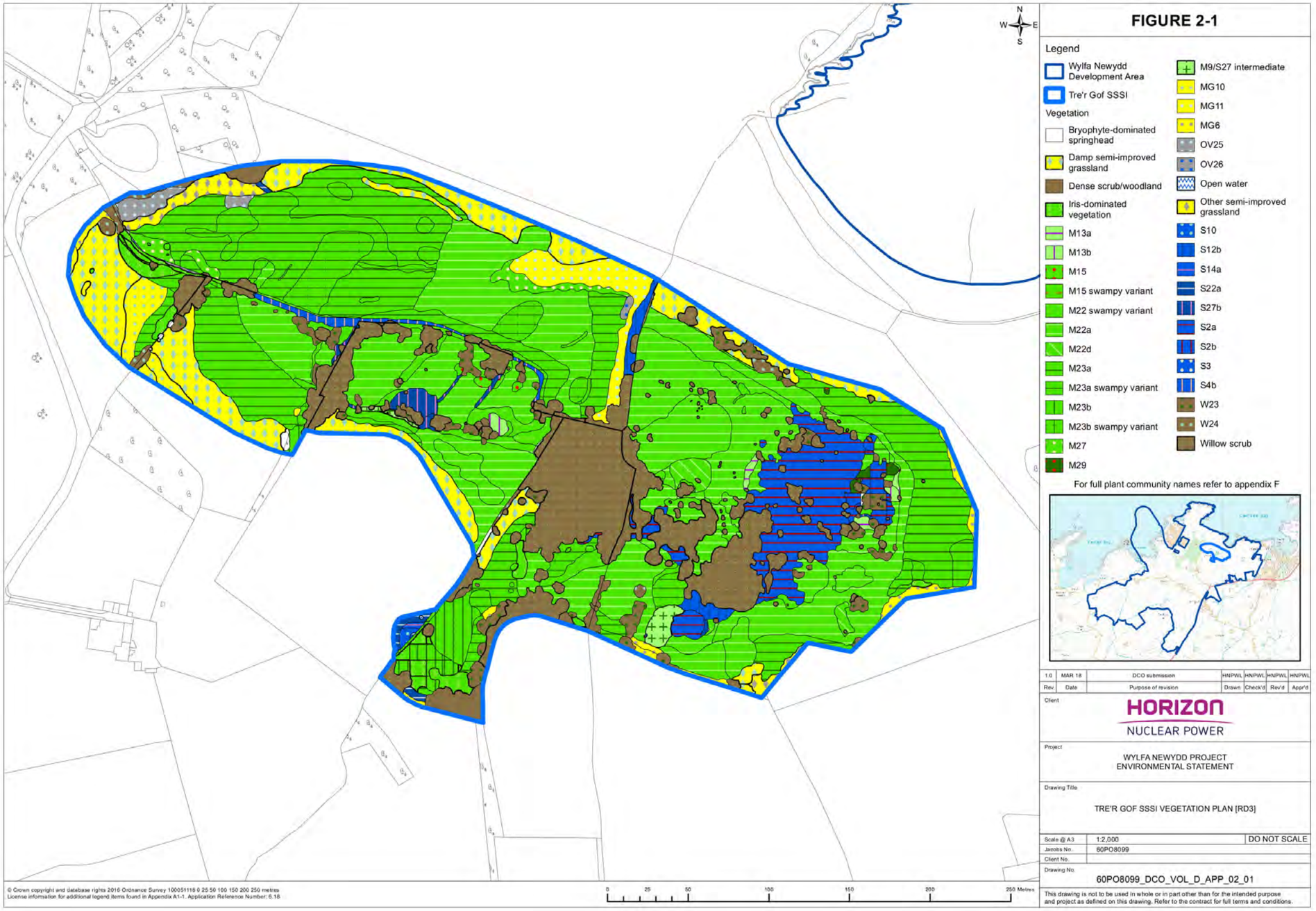
(c) In order to achieve 'no net loss' of biodiversity, an area for fen creation at least the size of Tre'r Gof SSSI (approx.10ha) would be sought.

(d) Enhancement of existing rich-fen or other mire habitat would be sought to supplement rich-fen creation, in order to make a more rapid contribution to the compensation delivery during the long time period over which newly created habitat would take to establish.

(e) Proximity to Tre'r Gof SSSI would be preferable for any compensation sites.

The above objectives have provided a rationale for the initial selection of sites, their evaluation and the final selection of sites for inclusion in the compensation proposal, and will inform the development of the compensation proposal.

Figure 2-1: Tre'r Gof SSSI vegetation plan [RD4]



3. Rich-fen ecology and conservation

3.1 Introduction

Rich-fen habitats such as those at Tre'r Gof SSSI are a species-rich and threatened semi-natural wetland habitat associated with alkaline conditions resulting primarily from the supply of mineral-rich and calcareous groundwater. Rich-fen habitats can encompass a number of types listed under Annex I of the Habitats Directive, but the following are the most important for conservation:

- 7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; and
- 7230 Alkaline fens.

These habitats have undergone significant declines in Europe due primarily to drainage and agricultural intensification [R2]. Calcareous fens have the additional status of priority habitat, a semi-natural habitat in danger of disappearance and which the European Community has particular responsibility to conserve. The extent of Annex I habitats and plant communities as a proportion of total site area within rich-fens is generally low [RD5] reflecting the largely natural constraints on the extent of rich-fen development. Many of the rich-fen plant communities not captured by Annex I types are also of UK importance [RD6].

Anglesey provides one of the key concentrations of rich-fen habitat in the UK (figure 3-1), with nine individual sites in the south-east of the island constituting the Corsydd Môn / Anglesey Fens Special Area of Conservation (SAC). The Anglesey Fens SAC was selected primarily for its calcareous and alkaline fen habitats. Tre'r Gof SSSI is not included in the SAC.

3.2 Rich-fen vegetation and hydroecology

Rich-fens can support a diversity of plant communities referable to units of the National Vegetation Classification (NVC) [RD7] or other schemes [RD8], [RD9]. The vegetation of rich-fens has a prominent cover of grass-like plants, particularly members of the sedge family (Cyperaceae), chiefly sedges (*Carex* species), black bog-rush (*Schoenus nigricans*), common cottongrass (*Eriophorum angustifolium*) and great fen-sedge (*Cladium mariscus*), rushes such as blunt-flowered rush (*Juncus subnodulosus*) and larger grasses such as common reed (*Phragmites australis*) and purple moor-grass (*Molinia caerulea*). Bryophytes can also be prominent, particularly the so-called brown mosses of the genera *Campylium*, *Scorpidium* and *Drepanocladus*. In contrast to bogs and related habitats, species of bog-moss (*Sphagnum*) are rare or absent from rich-fens.

The vegetation and hydroecology of the above two key Annex I rich-fen habitat types together with associated types are briefly described below.

Figure 3-1: Anglesey Fens SAC

3.2.1 7230 Alkaline fens

Alkaline fens occur on peat or mineral substrates such as marl or tufa and are typically the most groundwater dependent plant communities within rich-fens. They are usually situated at the edges of sites where groundwater input tends to be most pronounced, such as at discrete springs or along more diffuse seepage zones on slopes. In larger sites alkaline fen can also extend some distance from such sources where groundwater flushes across the surface. The two main plant communities comprising alkaline fens within rich-fens on Anglesey are summarised in table 3-1.

Table 3-1: The main alkaline fen communities of rich-fens, [RD5]

PLANT COMMUNITY	ECOLOGY
M9 *Carex rostrata-Calliergon cuspidatum/giganteum* mire	This community is usually only present as small stands in wet calcareous sumps and troughs, both natural and artificial. The floristic composition of the community is highly variable, ranging from species-poor stands dominated by bottle sedge (*Carex rostrata*) or common cotton grass over a layer of bryophytes dominated by *Calliergonella cuspidata*, to species-rich forms supporting scarce species such as lesser tussock sedge (*C. diandra*) and a range of brown mosses.
M13 *Schoenus nigricans-Juncus subnodulosus* mire	This community is characteristic of spring-heads or areas of strong seepage of calcareous groundwater, often where there is tufa deposition, and is found on shallower peat profiles or marl or tufa mineral substrates, and can be extensive in comparison to M9. The community comprises tussocks of black bog-rush which is dominant to varying degrees together with blunt-flowered rush or purple moor-grass, and with open areas between the tussocks. These open areas frequently support lawns of brown mosses, small sedges and stoneworts. Tussocks can also support calcifuge species, and where one or both of these elements of the community are well-developed this represents the most species-rich of all rich-fen plant communities.

3.2.2 7210 Calcareous fens with Cladium mariscus and species of the Caricion davallianae

Calcareous fens have significant floristic elements in common with alkaline fens but lack the dominant cover of black bog-rush that is a feature of many alkaline fens and instead support variable amounts of great fen-sedge. Most examples of calcareous fen occur on peat of

depths greater than 0.5m and the habitat can occur in rheo-topogenous or topogenous situations away from the edges of sites [R3]. A number of discrete vegetation types are included within this Annex I type, including stands of both M9 *Carex rostrata-Calliergon cuspidatum/giganteum* mire and M13 *Schoenus nigricans-Juncus subnodulosus* where great fen-sedge is present.

The most significant component of calcareous fen in Anglesey in terms of extent is the non-NVC community *Cladio Molinieteum* [RD9] which has bog myrtle (*Myrica gale*), blunt-flowered rush and purple moor-grass as constant species, often with ericoids, e.g. cross-leaved heath (*Erica tetralix*) [RD5]. Not all *Cladio-Molinieteum* vegetation can be treated as calcareous fen, particularly areas remote from groundwater influence, and some stands may reflect succession from alkaline fen following cessation of management [R3].

3.2.3 Other vegetation of rich-fens

The two key rich-fen Annex I habitats and plant communities occur as components of a generally much more extensive rich-fen habitat [RD5]. The most frequent communities in the rich-fens of Anglesey are summarised in table 3-2.

Table 3-2: **Other plant communities of rich-fens [RD5], [RD7], [RD10]**

PLANT COMMUNITY	ECOLOGY
Fen-meadow/pasture communities: M22 *Juncus subnodulosus-Cirsium palustre* fen-meadow M24 *Molinia caerulea-Cirsium dissectum* fen-meadow M25 *Molinia caerulea-Potentilla erecta* mire	M22 comprises vegetation usually dominated by blunt-flowered rush and is a common and often extensive feature of many rheo-topogenous and soligenous rich-fens, and can succeed alkaline fen vegetation where this is unmanaged. M24 and M25 are communities in which purple moor-grass is prominent or dominant. M25 is often species-poor, especially where under-managed, and is found on peat and more acidic mineral soils, while M24 is an often species-rich community characterised by a range of small sedges indicative of base-rich conditions. Both communities are usually found in better drained, sometimes artificially drained, situations giving way to M22 and communities of alkaline and calcareous fen habitats in wetter, groundwater-influenced areas
Swamp communities: S1 *Carex elata* swamp S2 *Cladium mariscus* swamps and sedge-beds	Swamps are usually found in transitions to open water, such as ditches or the edges of waterbodies, or may result from the neglect of other fen vegetation, such as S2 derived from calcareous fen. They are usually species-poor, dominated by large graminoid species.

PLANT COMMUNITY	**ECOLOGY**
	Other swamp communities occur but are widespread outside of fens, such as S4 *Phragmites australis* swamp and reed-beds.
Tall-herb communities: S25 *Phragmites australis-Eupatorium cannabinum* tall-herb fen S26 *Phragmites australis-Urtica dioica* tall-herb fen S27 *Carex rostrata-Potentilla palustris* tall-herb fen	Tall-herb vegetation is characterised by a range of tall herbaceous wetland species such as meadowsweet (*Filipendula ulmaria*) or stinging nettle (*Urtica dioica*) together with common reed or other larger graminoids. Such vegetation can be found within the more landward part of open water transitions or in less managed areas of rich-fen. More intensive management can result in succession to alkaline fen or fen meadow. Other tall-herb communities occur but are widespread outside of fens, such as S28 *Phalaris arundinacea* tall-herb fen and M27 *Filipendula ulmaria-Angelica sylvestris* mire.

A variety of other wetland plant communities are often found within or around rich-fen sites and are part of the natural succession to or from rich-fen, such as areas of acid peat within rich-fens which can develop into wet heath or bog, while permanent standing or flowing waters such as ditches can provide transitions to aquatic vegetation with stoneworts. Zonations involving dry neutral, calcareous and acid grassland are also to be seen where the conditions are suitable. Woodland cover on the rich-fens of Anglesey is mostly limited to areas of secondary birch (*Betula*) or willow (*Salix*), the expansion of which has led to localised losses of Annex I habitat in the Anglesey Fens SAC [RD5].

4. Initial site identification

In total, 18 sites were surveyed and an assessment undertaken of their potential to form part of the compensation proposal. The process by which sites were identified for survey and assessment is described below.

4.1 Non-statutory sites

Initially, through discussion with the TAG, Horizon identified 13 sites in north Anglesey which might meet the objectives of the compensation proposal as defined in section 2.3. Several of the sites identified are now designated Wildlife Sites (WS), but in the early stages of this investigation had candidate Wildlife Site (cWS) status.

Of these 13 sites, four could not be surveyed due to access restrictions: Llanlleiana Pond; Amlwch; Bonw; and Mynydd y Garn. These four sites were not considered further. The remaining sites were surveyed between October 2015 and June 2016, with further visits in July 2017. The names and locations of the surveyed sites are given in table 4.1, and all 13 sites are shown in figures 4-1 and 4-2.

Table 4-1: Initial nine sites surveyed to assess their suitability to form part of the compensation proposal

SITE NAME	NATIONAL GRID REFERENCE
Burwen North	SH 4217 9312
Burwen South & West	SH 4196 9277
Cae Adda	SH 3942 9432
Cae Owen	SH 3821 9446
Mynachdy	SH 3133 9219
Neuadd	SH 3852 9414
Tregynrig Fawr	SH 4085 9309
Ty du	SH 3958 9405
Tyddyn-y-Waun	SH 4189 9370

Site boundaries were established in one of two ways. For those sites that were WS, site boundaries were obtained from Cofnod. The survey boundaries of the remaining sites were identified from Google Earth by identifying likely mire vegetation or following field boundaries.

4.2 Sites adjacent to SSSI

In addition to the above sites, desk-based research was conducted by Jacobs to identify further land which might meet the objectives of the compensation proposal as defined in section 2.3. Specifically, land around wetland SSSI on Anglesey was searched using aerial

photography and Ordnance Survey (OS) mapping for areas with potential to form part of the compensation proposal. The motivation was to identify land that, if included in the compensation proposal, would extend, connect or otherwise make more robust the network of fen SSSI on Anglesey, particularly those SSSI comprising the Anglesey Fens SAC. This follows the recommendations of documents such as the Lawton report [RD11] to expand sites of importance for nature conservation and establish resilient ecological networks.

Thirty-four areas of interest were identified from a desk study as potentially meeting the objectives of the compensation proposal, of which 17 were short-listed as offering greater potential than the others. Many of these sites were large and therefore shared between numerous land owners, making identification of all the land owners and agreement of survey access a lengthy process. The first three sites to which access was granted (Sites 3, 18 and 19) were surveyed in May 2016. Following further discussion with the TAG in July 2016, the list of sites was revisited to focus on land with the most potential for rich-fen habitat creation, resulting in a short-list of five sites (Sites 8, 24, 25, 26, and 32). These were surveyed between September and November 2016, with further visits between April and July 2017.

The eight sites surveyed are listed in table 4.2 and shown in figures 4-3 and 4-4. While each site was visited, survey access was not granted to all land parcels within every site.

Table 4-2: Eight sites adjacent to SSSI surveyed to assess their suitability to form part of the compensation proposal

SITE NUMBER	NATIONAL GRID REFERENCE
3	SH 4716 8392
8	SH 4751 7983
18	SH 4959 8161
19	SH 4993 8106
24	SH 4943 7671
25	SH 4780 7821
26	SH 4741 7775
32	SH 4796 7925

4.3 Further sites

Subsequent to surveys of the above sites, an area of Caeau Talwrn SSSI, referred to as Caeau Talwrn SSSI (North) (SH 4739 7788, figure 4-4), was surveyed in order to assess its relation to adjacent and nearby survey areas (Sites 25 and 26) and to explore the potential for habitat enhancement or other works within the SSSI. This site was surveyed in November 2017.

Figure 4-1: Non-statutory sites - east

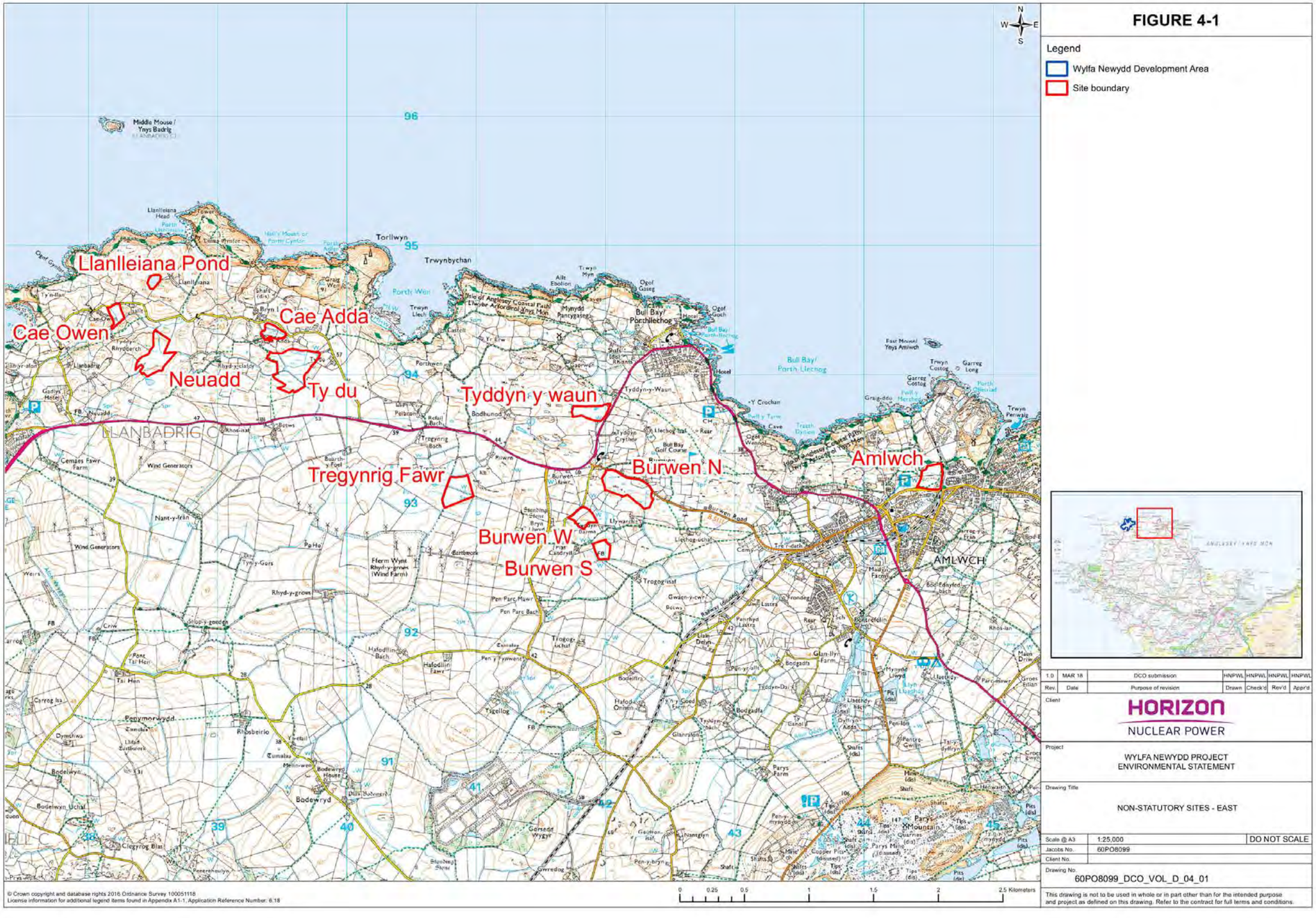


Figure 4-2: Non-statutory sites – west

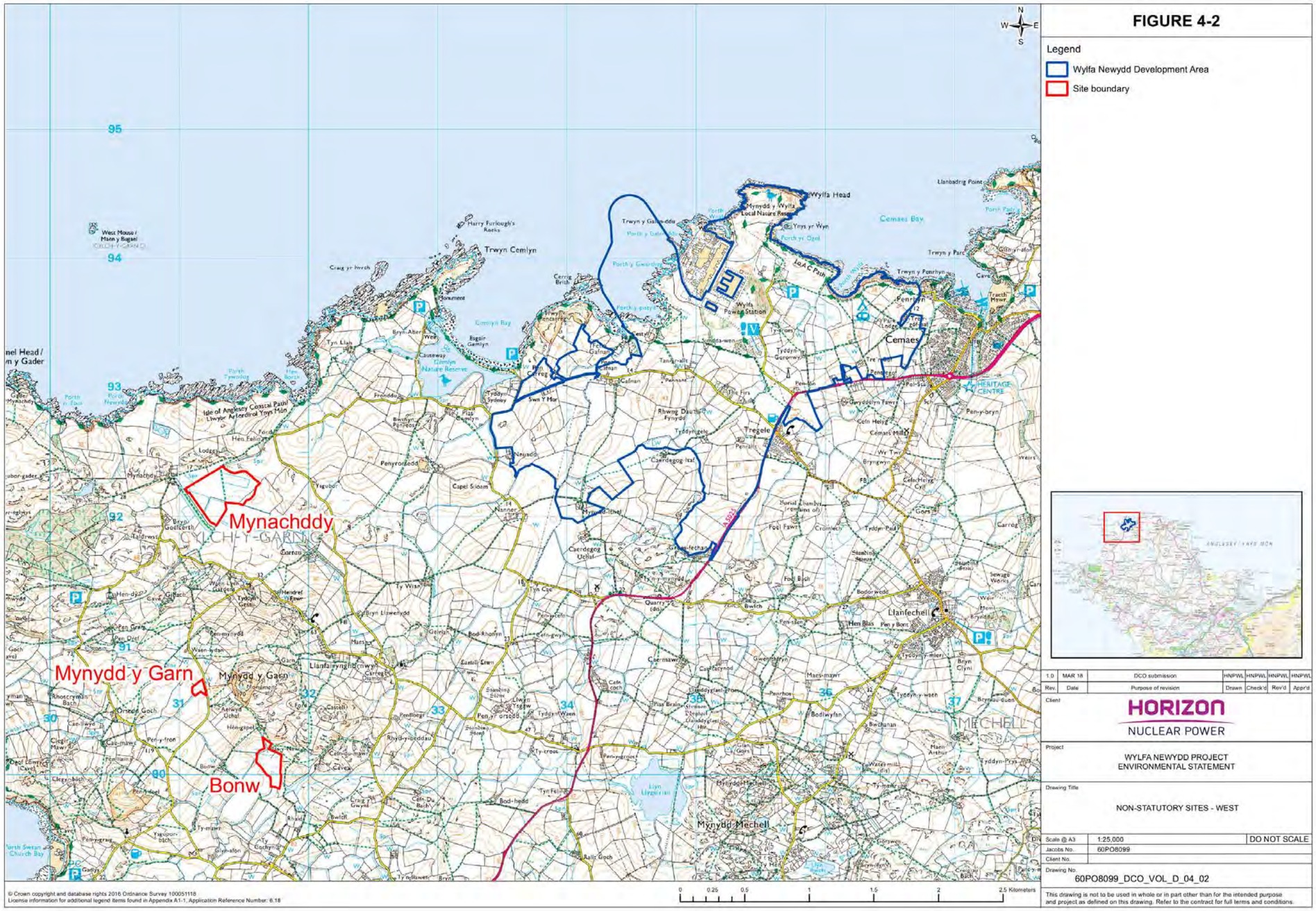


Figure 4-3: Sites adjacent to SSSI - north

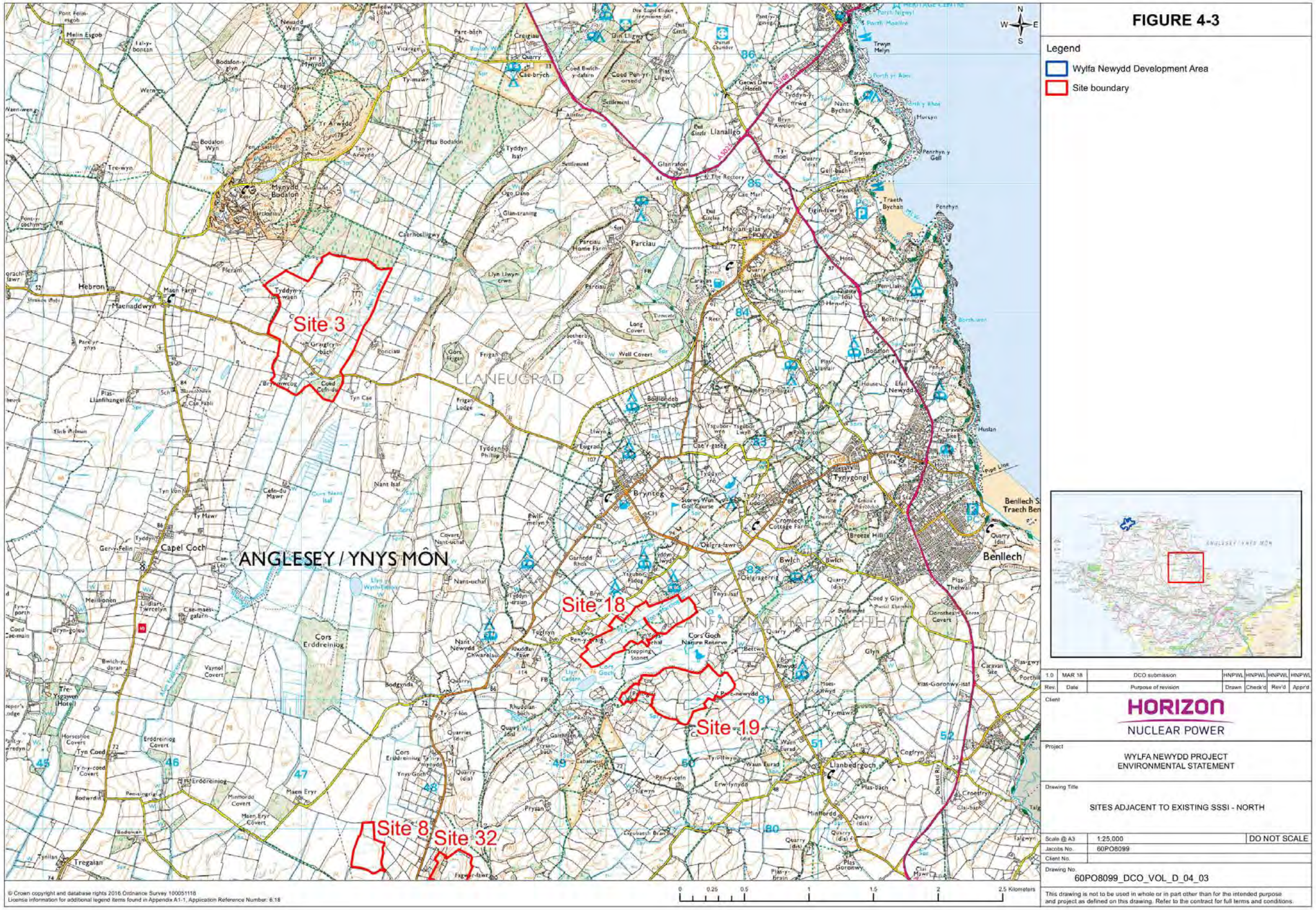
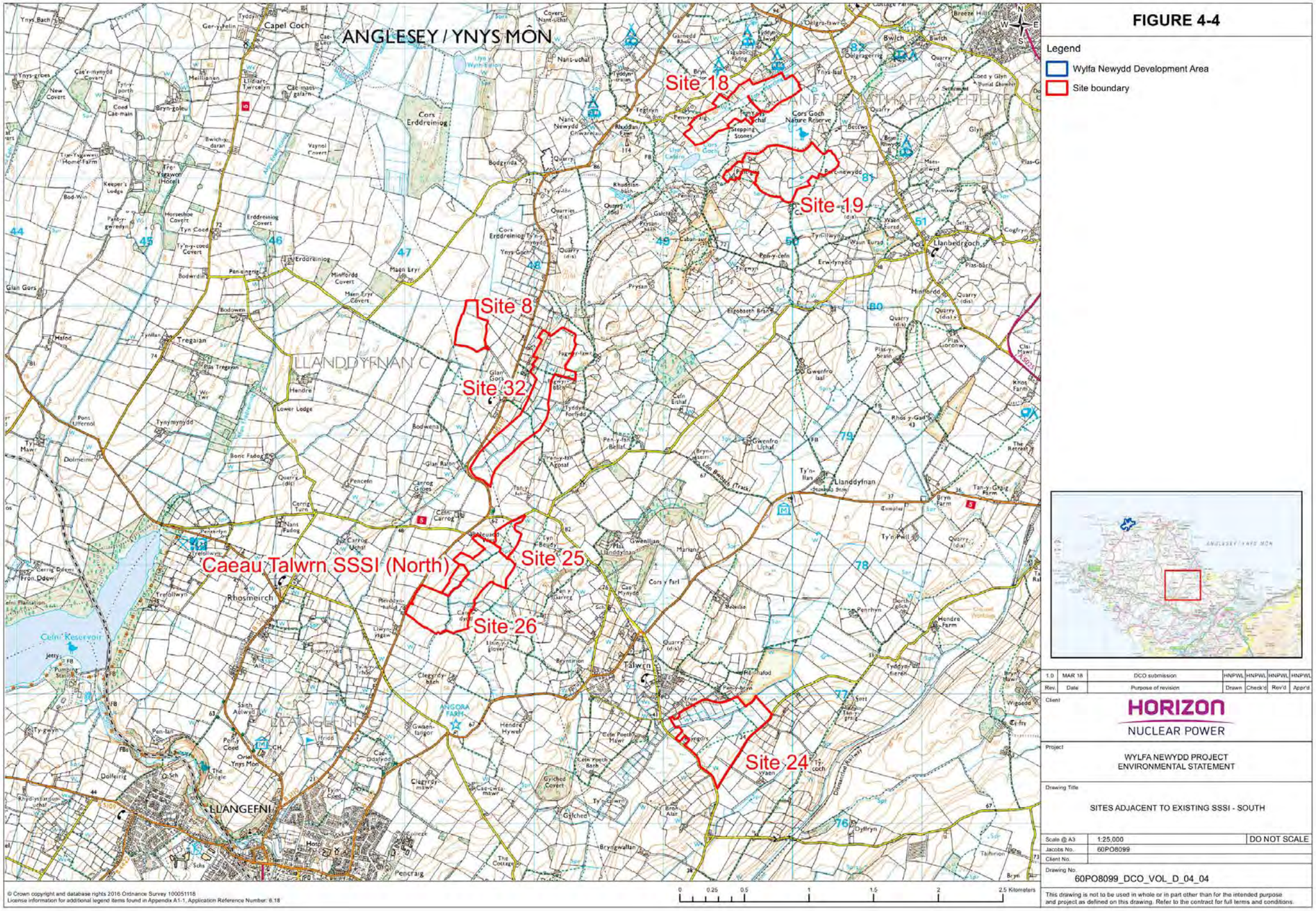


Figure 4-4: Sites adjacent to SSSI - south



5. Site survey and evaluation methodology

5.1 Desk study

A desk-based study was undertaken to collate the following information for each site:

- ownership;
- designation;
- surrounding land use / habitat connectivity;
- ecological information, such as obtained by the Lowland Peatland Survey of Wales or the Wales Lowland Grassland Survey and made available by NRW, or biological records available from the National Biodiversity Network (NBN) [RD12].

In addition, to provide an initial understanding of the functioning or viability of each site as a wetland, a desk-based hydrogeological assessment was carried out. This consisted of:

- a review of OS mapping and aerial photography to identify the land use of each site and its upstream catchment;
- a review of freely available LiDAR data, or topographic data obtained by Horizon, to gain an understanding of the topography of each site and its potential for retaining water;
- a review of the British Geological Survey's (BGS) 1:50,000-scale bedrock and superficial geology mapping [RD13] for each site to identify the nature and type of bedrock and drift deposits present;
- a review of OS mapping and aerial photography to identify watercourses, drainage ditches, springs and ponds present within or close to the site. This would enable a picture of the hydrological functioning of the site to be determined, including elements such as the key hydrological inputs, and the upstream surface water catchment area;
- a review of NRW online flood maps [RG12] to determine whether the site lies within a fluvial Flood Zone or whether it could be at risk of surface water flooding and hence susceptible to ponding; and
- based on the above information and BGS 1:625,000 hydrogeology mapping [RD15], a review of the local hydrogeology of each site (bedrock and superficial), in relation to any springs, seepage areas, abstractions or wells in the area to aid understanding of the hydrogeological functioning of each site.

5.2 Field survey

The field surveys took place between October 2015 and November 2017. Their purpose was to:

- Identify wetland plant communities at each site and to make notes on their composition, extent and condition. The habitat classification used combines that of the NVC [RD7], additional vegetation units identified by the Lowland Peatland Survey of Wales [RD8], and an *ad hoc* classification where assignment to an NVC community was uncertain or considered to be irrelevant. As many site visits were conducted out of the main season for botanical surveys NVC affinities are employed in an approximate way only, being used to indicate the pattern of semi-natural vegetation types relevant to the purposes of the project, namely mire and swamp.
- Make observations on land use and site management to identify potential sources of contamination or other management issues.
- Ground truth the presence of springs, watercourses, seepages, flushes and drainage channels and identify the presence of any hydrological features that aren't indicated on OS mapping, such as private abstractions or new drainage ditches.
- Obtain a maximum of five soil cores at each site to identify the presence of peat or mineral soils and any source of calcium, such as marl or shelly deposits. Where peat was present, key characteristics were noted from the core, such as Von Post saturation and decomposition values.
- Collect soil samples for leach tests in the laboratory to determine leachable concentrations of major ions (ammoniacal nitrogen, calcium, magnesium, potassium, phosphate), alkalinity and pH of the leachate from each sample to evaluate the baseline soil quality on site.
- Collect water quality samples at each site; for each sample, *in-situ* field measurements were carried out (pH, electrical conductivity, temperature, dissolved oxygen and redox potential) to establish baseline water quality and how this might affect any future fen habitat. Each water sample was submitted for laboratory analysis to determine concentrations of major ions, dissolved solids and alkalinity to identify whether the mineral concentrations of each site are high or low and whether the site is nutrient poor.
- Photograph the landscape setting, main vegetation types and hydrological features of each site.

A plan showing the hydroecological features, sampling locations and locations of photographs was prepared for each site.

As site investigations progressed, a number of sites began to emerge as potentially suitable to form part of the compensation package, and through discussion with the TAG it was agreed that these would be subject to detailed botanical survey to better determine their potential. Detailed surveys were undertaken of seven sites: Cae Adda, Cae Owen, Neuadd and Ty du in June 2016, and Sites 24, 25 and 26 in July 2017. This comprised vegetation sampling following NVC methodology [RD14], vegetation mapping and the recording of botanical taxa and their occurrence using the DAFOR scale.

Throughout, the nomenclature for vascular plants follows the *New Flora of the British Isles* [RD17], for bryophytes *A checklist and census catalogue of British and Irish mosses and liverworts* [RD18], and for stoneworts *A checklist of Characeae of the British Isles* [RD7].

5.3 Site evaluation

Based on the results of the desk study and field surveys, each site was assigned a category based on its suitability to form part of the compensation proposal with reference to the objectives set out in section 2.3. Sites that might be suitable for the creation of a significant proportion of the minimum area of 10 ha of rich-fen habitat were considered to be of 'High' potential. Sites suitable only for habitat enhancement were considered to be of 'Medium' or 'Low' potential, according to the amount and value of suitable habitat. The suitability of sites that offered no potential for habitat creation or enhancement, including sites that were already in good condition, was assessed as 'None'. Most sites were considered in isolation, but where a site formed part of an ecological network, this was also taken into consideration.

Evaluation of the suitability of each site in achieving the objectives set out in section 2.3 was informed by:

- Existing site vegetation and condition – the presence of certain kinds of vegetation might be favourable to the objectives of the compensation proposal, such as existing rich-fen or other mire habitat, that, depending on its condition, offered potential to be enhanced as part of the proposal. Other habitats of less value for nature conservation, such as marshy improved grassland, might be indicative of wetland processes that could be managed as part of the creation of more valuable habitat.
- Land use within and around the site – land use within a site's catchment could affect conditions such as nutrient loads and hydrological inputs, and thus influence the viability of any works that could be undertaken as part of the compensation proposal. Other land use considerations might be relevant, such as the proximity of suitable grazing livestock that could be utilised for site management through landowner agreements.
- Site topography, geology, hydrology and hydrogeology – as the objectives of the compensation proposal are to create or enhance rich-fen habitat, the suitability of a site's physical properties to support such habitat had a strong bearing on the potential of the site to provide creation or enhancement opportunities. Each site was therefore evaluated for its suitability for the restoration or creation of the physical processes supportive of rich-fen habitat, as outlined in section 3.

6. Site descriptions and evaluations

The results of the desk study, field survey and evaluation of all 18 sites identified in section 4 are described below. The results are presented in a standardised form summarising information on site location, area, designation, number of owners, distance from Tre'r Gof SSSI, survey dates, land use, topography, geology and soils, hydrology and hydrogeology, water quality, ecology, management and condition. The result of the assessment of the suitability of each site to form part of the compensation proposal is presented following each site description.

The following supplementary information is provided in the appendices:

- Appendix A – hydroecological plans, showing main features of each site (habitats, water courses etc.), soil/water sample locations and positions of photographs;
- Appendix B – photographic plates;
- Appendix C – results of soil sample laboratory analyses;
- Appendix D – results of water sample laboratory analyses;
- Appendix E – lists of plants recorded at sites where botanical surveys were undertaken;
- Appendix F – full list of all plant communities recorded during the survey;
- Appendix G – vegetation plans for sites where botanical surveys were undertaken; and
- Appendix H – results of quadrat sampling from sites where botanical surveys were undertaken.

6.1 Burwen North

NGR: SH 4217 9312 **Area:** 6.3ha

Ownership: One owner **Designation:** None

Distance to Tre'r Gof SSSI: 6.3km

Survey date(s): 11 January 2016, 20 April 2016

Land use: Burwen North is used for pony / horse grazing and can be accessed from the surrounding more intensively grazed sheep pasture. The B5111 (Burwen Road) runs along the site's north eastern border, beyond which lie a number of residential properties associated with the hamlet of Burwen. A farm lies approximately 800m north of the site's northern border.

Topography: The site lies within a topographic basin formed of hills to the north, east and west (figure A-1). The elevation of the site ranges from 43m Above Ordnance Datum (AOD) in the north west to 38m AOD in the south east. Surrounding the basin is a number of hills with elevations of 58m AOD in the north, 53m AOD in the east and 57m AOD in the west. The basin is open to the south east, which forms a valley bottom between the hills to the east and west. Due to the nature of the topography, any streams and direct rainfall within the site would likely drain towards the south east and therefore the potential for water retention within the site could be slightly limited.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the site comprises the New Harbour Group, which contains schists, phyllite and pillow lavas. At this scale, no superficial deposits are shown to be present at the site.

Three soil cores were taken during the site walkover (figure A-1). The results of the coring showed that mineral soils were present in the south east of the site (BN.5 and BN.6), as well as in the far west of (BN.7). At location BN.5, 0.5m of clay soil was encountered, which had a grey hue at its base and evidence of iron oxide within the core. At BN.6 the clay soil (also 0.5m depth) was much darker, was saturated and contained gravel clasts at the base of the core. In the far west of the site, 20cm of very fibrous, dark, saturated clay was recovered with some minor gleying. Peat was not found at any of the three sampling locations.

Hydrology and hydrogeology: The main hydrological inputs to the site arose from the hill-slopes in the north. On the day of the site walkover, areas of seepage were found to the south of Burwen Road. OS mapping shows that at this location, a watercourse issues within the site boundary and flows southwards (plate 5) through the site before eventually turning west and flowing towards Burwen South. The surface water catchment area upstream of the outflow location, where the watercourse was found to exit the site, has been estimated at around 29ha. Water was found to pond adjacent to the outflow, creating very wet conditions (plate 2). The whole of the site is marked as a marsh on OS mapping. On the site walkover, a second drainage ditch was found to flow from the south of Burwen Road, mid-way through the site, eastwards towards the main drainage ditch identified on OS mapping. In addition to this, seepage zones were encountered in the north west of the site (plate 3), entering the site from

the surrounding hills. NRW online flood maps show that the site does not lie within a fluvial Flood Zone and is not considered to be at risk of surface water ponding.

BGS 1:625,000 hydrogeology mapping shows that the bedrock comprises a mildly productive aquifer and, given the absence of superficial deposits and peat at the site, recharge rates of surface water into the underlying bedrock are likely to be relatively high. Two wells are also shown to be located approximately 200m west of the site, although it is not known if water is currently abstracted from either of these wells and whether this could influence stream flow through the site.

The bedrock aquifer at the site forms part of the Ynys Môn Secondary Water Framework Directive (WFD) groundwater body that covers much of Anglesey (GB41002G204400). The overall status of this water body is poor due to poor chemical quality.

Water quality interpretation: Four surface water samples and three soil samples were collected during the site walkover, which was carried out in dry and sunny weather conditions (figure 5). The leachate from the soil samples had a slightly acidic pH and a low mineral and nutrient concentration. However, the concentration of nitrate in the leachate from the soil at BN.5 was slightly higher than at the other two locations, indicating a degree of nutrient enrichment in the far south east of the site in comparison to the other locations. Surface water samples had a broadly neutral to slightly acidic pH (6.4-7.3) and in general, concentrations of major ions were low and the site was relatively nutrient poor. The concentration of potassium was slightly higher in the far west of the site (BN6) and nitrate concentrations were slightly elevated at BN.1, BN.2 and BN.4, which could be indicative of nutrient enrichment from the surrounding agricultural land. Phosphorous and iron were also slightly higher west of the main drain (BN.3), which similar to BN.4 also receives runoff from the hills to the west where the pasture was found to be lush and more improved.

Ecology: The site supported rush mire in low-lying areas, and grassland and scrub on the raised ground (figure A-1). There were two main areas of botanically-rich rush mire, both referable to M23b *Juncus acutiflorus/effusus-Galium palustre* rush-pasture*, Juncus effusus* sub-community:

- The mire to the east (plate 2) was very wet at the time of survey with areas of shallow open water dominated by bog pondweed (*Potamogeton polygonifolius*) or a combination of fool's watercress (*Apium nodiflorum*) and water starwort (*Callitriche stagnalis*). Soft rush (*Juncus effusus*) was dominant, sharp-flowered rush (*Juncus acutiflorus*) frequent to abundant, and there was an understorey of frequent to abundant lesser spearwort (*Ranunculus flammula*), bog stitchwort (*Stellaria alsine*) and marsh bedstraw (*Galium palustre*), and frequent marsh thistle (*Cirsium palustre*). Purple moor-grass was occasional and marsh lousewort (*Pedicularis palustris*) was rare. There was occasional *Sphagnum denticulatum*, and locally abundant *Calliergonella cuspidata* and *Drepanocladus aduncus*.
- The main community constituents of the mire to the west were similar to the previous area. However, there was much less bog pondweed and more cover by a greater diversity of species, e.g. frequent to locally abundant water forget-me-nots (*Myosotis* spp.),

frequent brooklime (*Veronica beccabunga*), kingcup (*Caltha palustris*), square-stalked St John's wort (*Hypericum tetrapterum*) and water mint (*Mentha aquatica*), occasional star sedge (*Carex echinata*), and rare marsh ragwort (*Senecio jacobaea*).

The closely cropped mossy grassland along the northern edge of the site (plate 3) was diverse along the edges of the rush mire. Here, red fescue (*Festuca rubra*) and Yorkshire fog (*Holcus lanatus*) were dominant, sheep's fescue (*Festuca ovina*) was frequent, and heath grass (*Danthonia decumbens*) occasional. There was abundant devil's-bit scabious (*Succisa pratensis*).

Management and condition: The site was maintained by light pony grazing. The grazing and puddling of the mires maintained an open, species-rich community in which rushes could not become too dense. Algal blooms were frequent in surface water in the south eastern area, where sampling results suggest some nutrient enrichment.

Landscape context: Surrounded by pasture, the site is isolated from semi-natural habitat of similar quality. The main outflow drain eventually contributes to a tributary of the Afon Goch, by which are further candidate compensation sites.

Suitability as a compensation site: Given the topography of the site it seems likely that the extant mire vegetation already occupies a maximal area, and so the potential for further habitat creation is low. As much of this is itself in good condition and botanically interesting, the possibility of enhancing the existing habitat is also limited. Given the above, the overall suitability rating of the site has therefore been determined as None.

6.2 Burwen South and West

NGR: SH 4196 9277 **Area:** 9.7ha

Ownership: One owner **Designation:** None

Distance to Tre'r Gof SSSI: 6.1km

Survey date(s): 26 October 2015, 11 January 2016, 20 April 2016

Land use: Burwen South and West are fields within one farm. The farm is grazed by ponies and is extensively drained. Up gradient of this, aerial imagery shows that the land is used as sheep pasture. The 1889 OS survey shows that the vegetation and land use of the site and its surroundings are likely to have changed little.

Topography: Burwen West, along with the strip of land that lies between Burwen West and South, is situated on a hill-slope, which slopes eastwards towards the valley bottom to the south of Burwen North (section 6.1). The elevation of the site ranges from 47m AOD in the west to 43m AOD in the east. West and north of the site the land rises steeply to a maximum of around 55 to 60m AOD. Burwen South lies on a slightly gentler gradient which slopes southwards towards a tributary of the Afon Goch, bounding the site's southern border. The site drops 4m from north to south.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the site comprises the New Harbour Group, which consists of schists, phyllite and pillow lavas. In Burwen West and South, this is intruded by the Church Bay Tuffs and Skerries Grits (tuff and sandstone). The two sites are also covered in a layer of till, deposited during a period of glacial retreat, as is most of the area between the two sites. The exceptions are a small area to the south of Burwen West and north west of Burwen South.

Four soil cores were taken during the site walkover (figures A-1 and A-2). The results of the coring showed that mineral soils were present in the north east of Burwen West (BW.6 and BW.7), in the north of Burwen South (BS.2) and in the strip of land between the two (BW.5). At locations BW.5, BW.6 and BW.7, 0.2-0.3m of silty clay was recovered before hitting bedrock and was found to contain a thin upper horizon of organic matter, containing rootlets, and the remainder of the cores were a grey-blue clay with red mottles that were interpreted to be iron oxide. The soil at BS.2 was similar, but with gravely deposits at the core base.

Hydrology and hydrogeology: In Burwen West, a single drainage ditch runs north east to south west through the centre of the site. Discharging into this is another small drainage ditch, which flows north west to south east also through the centre of the site. Along the western boundary there is a large pond: the water level was very low in January but had risen substantially by April (plate 8). The pond appeared groundwater fed. There was also a small pond within the south west corner of the field (plate 11). A network of ditches drains the eastern part of site (plate 9), originating from a culvert beneath a farm track in the north east and which flushing the field to the east of Burwen South. Two small watercourses also issue to the west of Burwen south, the southernmost of which discharges into a tributary of the Afon Goch (plate 12), which runs along Burwen South's southern border. Given the nature of the

topography of the area, both sites and the surrounding area are likely to be freely draining, with limited potential for water retention. NRW online flood maps show that the site does not lie within a fluvial Flood Zone and the site is not considered to be at risk of surface water ponding.

Although the bedrock beneath the site contains mildly productive strata, the site is covered in a layer of glacial till, which would prevent recharge into the underlying bedrock. As a result, surface water would be retained at ground level which, due to the nature of the topography, is likely to be drained to the south east. Four wells are present within close proximity of the site, one along the southern border of Burwen South, one between the two sites and two to the east of Burwen West. It is not known if water is currently abstracted from any of these wells and whether this could influence stream flow through the site.

The bedrock aquifer at both sites forms part of the Ynys Môn Secondary WFD groundwater body that covers much of Anglesey (GB41002G204400). The overall status of this water body is poor due to poor chemical quality.

Water quality interpretation: Five surface water and four soil samples were collected during the site walkover, which was carried out in dry and sunny weather conditions (figures A-1 and A-2). The pH of the leachate from the soil samples was broadly neutral and alkalinity levels were low. Generally, concentrations of major ions and nutrients in the soil leachate were low, with the exception of the nitrate concentration at BW.5, which was slightly higher than the other sample locations. The pH of the water samples was moderately acidic (reaching a low of 5.4) and concentrations of major ions and nutrients were generally low. The exception was the concentration of ammonical nitrogen at BW.4 (which is adjacent to the farm buildings), which was very high and indicated contamination, potentially by farm slurry. The ionic balance at BW.4 was also anomalously high, suggesting that the sample was not stable and that there was an error in the results. Overall, there was a slight difference in water quality between samples taken from Burwen West and South. BS.1 had a slightly less acidic pH and a high nitrate concentration, which could be suggestive of nutrient enrichment from the surrounding agricultural land.

Ecology: The majority of the site comprised improved pasture, with patches of dense soft rush, extensive in the northern half of site. In the highest, northern-most field there were seepage tracks dominated by blinks (*Montia fontana*) (plate 7). The rush-dominated vegetation in this area was slightly richer than elsewhere, with abundant marsh bedstraw. The rushy vegetation was found to lie over heavily gleyed soil, a typical situation.

There was a pond at the western edge of the northern fields (plate 8). During the winter visit, there was little surface water and the area was largely bare earth dominated by common water crowfoot (*Ranunculus aquatilis*). In the spring the pond had grown into a sizable feature, inundating the surrounding pasture.

The pasture in the north eastern fields was similar to the others (plate 9). The ditches were more prominent, dominated by yellow flag (*Iris pseudacorus*) and bramble (*Rubus fruticosus* agg.) with abundant water mint and soft rush. Where open, the ditches were dominated by fool's watercress.

The lower, southern half of the site (plate 13) was mostly dry but graded into rushy vegetation in depressions, dominated by soft rush and Yorkshire fog. In the south west, carnation sedge (*Carex panicea*) and sharp-flowered rush were found along runnels.

Management and condition: The small areas of semi-natural rush mire though grazed were species-poor and in the condition one would expect to find them on a modern livestock farm. Nutrient enrichment of water courses was suggested by the vegetation, which was also borne out by results of the sampling.

Landscape context: Burwen South is part of an intensively managed pastoral landscape and is isolated from areas of semi-natural wetland vegetation.

Suitability as a compensation site: Restricting flows along the stream to the south of the site could create a large wetted area along the valley bottom but this would not include a significant part of the indicated site. Blocking ditches on the flatter fields in the north east would likely result only in the proliferation of the species-poor rush-dominated vegetation already present on site. Furthermore, water quality does not appear favourable to rich-fen, with elevated nutrient levels and low mineral content found in surface water samples. Given the above, the overall suitability rating of the site has therefore been determined as None.

6.3 Cae Adda

NGR: SH 3942 9432 **Area:** 1.6ha

Ownership: One owner **Designation:** Part of Tir Lleidiog Ty du WS

Distance to Tre'r Gof SSSI: 3.6km

Survey date(s): 26 October 2015, 21 April 2016, 27 June 2016, 24 July 2017

Land use: Most of the surrounding land is used as sheep pasture, having been improved, or is semi-improved. Access tracks border the site in the north and west and there are two residential properties that lie adjacent to the site's north western and south western boundaries. An east-west fence divides the site in two, with the northern half heavily grazed by sheep; the southern half did not appear to be in use.

Topography: The site lies within a topographic basin formed of hills to the north east, east, south and west (figure A-4). The elevation of the site ranges from 55m AOD to 56m AOD throughout. The land rises steeply to the north east and west, with the elevation of these hills rising to a maximum of 77m AOD and 68m AOD at their summits, respectively. Two small hills also lie to the south of the site at a slightly lower elevation of 62m AOD. Due to the presence of this high ground, the potential for water retention within the site is reasonably high.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the site comprises the Church Bay Tuffs and Skerries Grits (tuff and sandstone), produced as a result of explosive, pre-historic volcanic eruptions. At this scale, no superficial deposits are shown to be present at the site.

Two soil cores were taken during the site walkover (figure A-4). The results of the coring show that peat was present in the south of the site, immediately south of central drainage ditch (CA.5) and to the north of the footpath that runs along the site's southern border (CA.6). At location CA.5, peat was proven to a depth of 1m before hitting bedrock and was found to have a high moisture content and was moderately decomposed. At location CA.6, 0.3m of poorly decomposed peat was encountered at the base of the core, under 2m of clay soil, although the auger did not hit bedrock and the depth of the peat is therefore anticipated to be greater than 0.3m.

Hydrology and hydrogeology: A single drainage ditch runs west to east through the centre of the site (plate 14). In April 2016 the drain appeared to be stagnant, with no flow, and was not actively draining away (plate 15). In addition to this, seepage zones were encountered (plate 19), trending northwards towards the drainage ditch, particularly in the south west of the site, adjacent to the small hill that lies along the site's southern boundary. Since the site is located in a small topographic basin and sits on relatively high ground, the upstream surface water catchment is limited (approximately 5ha) and is likely to be rainwater fed with limited groundwater input. Given the nature of the topography and the inability of the drainage ditch to effectively discharge, the potential for water retention within the site is considered to be high.

Surface water was found to collect in a pool located at the far south western end of the site at a break in slope at the base of the southernmost hills. NRW online flood maps show that the site does not lie within a fluvial Flood Zone, but the flood maps do show that the site is at high risk of surface water flooding, with deep ponding likely to the south of the drainage ditch.

The bedrock comprises a mildly productive aquifer and, given the absence of superficial deposits at the site, recharge rates into the underlying bedrock is likely to be relatively high, meaning that the possibility of surface water ponding is reduced. The bedrock aquifer forms part of the Ynys Môn Secondary WFD groundwater body that covers much of Anglesey (GB41002G204400). The overall status of this water body is poor due to poor chemical quality.

Water quality interpretation: Three surface water and two soil samples were collected during the site walkover in April 2016, which was carried out in dry and sunny weather conditions (figure A-4). A further three surface water samples were collected in July 2017, two from the same locations (CA.1 and CA.3) as in April 2016, along with one additional location (CA.4). The surface water samples all had an acidic to slightly acidic pH and alkalinity levels were low. Concentrations of major ions and nutrients were also low in the water samples, as were electrical conductivity values and dissolved solid concentrations. The only exception was phosphorous, which was slightly elevated in April 2016 in the east of the site (CA.1) and could be indicative of a slight degree of nutrient enrichment in this part of the site from the surrounding agricultural land, However, the phosphorous analysis was on an unfiltered sample with a moderate quantity of suspended solids and so it could be related to sediment rather than dissolved phosphorous. The pH and alkalinity values were low in the leachate from the soil samples. In addition to this, soil leaching showed a very nutrient poor status with low concentrations of major ions.

Ecology: The site supported a small area of topogenous poor-fen habitat, separated into a northern and southern half by a fence; the former was not available for survey (figure G-1). The western end (plate 17) was swampy during the site visits, with water approximately 0.5m deep, and was dominated by soft rush with abundant fool's watercress, marsh bedstraw and water horsetail, and frequent marsh pennywort (*Hydrocotyle vulgaris*). This was referred to the non-NVC community M23b swampy variant.

A small swampy basin of peat lay to the east, circumscribed by a steep hill to the south and a gentle bracken-covered slope to the east. The vegetation here was a mosaic of S27a *Carex rostrata-Potentilla palustris* tall-herb fen, *Carex rostrata-Equisetum fluviatile* sub-community and M5 *Carex rostrata-Sphagnum squarrosum* mire, with M25b *Molinia caerulea-Potentilla erecta* mire, *Anthoxanthum odoratum* sub-community marking out peripheral and raised areas. Swathes of *Calliergon cordifolium* and water horsetail marked out S27, and *Sphagnum squarrosum* and cottongrass M5. No community was very species-rich. In the spring there was a large amount of surface water and dense webs of algae across the site.

The central drain was dominated by bog pondweed (plate 16) (M29 *Hypericum elodes-Potamogeton polygonifolius* soakway), and the remainder of the surveyed area was a mixture of rush pasture (M23b *Juncus acutiflorus/effusus-Galium palustre* rush pasture *Juncus effusus*

sub-community), semi-improved pasture, scrub, bracken and, along the hill to the south, small areas of acid grassland.

Management and condition: The northern half of site was very closely grazed by sheep (plate 14); the wetter southern half did not appear to be managed in any way and soft rush was abundant throughout. Algae across the southern half of the site indicate enrichment, though only potassium levels were found to be elevated, and conditions were generally oligotrophic.

Landscape context: The Tir Lleidiog Ty du WS also contains an area of mire to the south at Ty du (section 6.8), approximately 150m from Cae Adda. The Llanbadrig headland supports a cluster of fens: in addition to these two sites, Neuadd (section 6.6) is approximately 800m to the west, slightly beyond which is Cae Owen (section 6.4), and, to the north, Llanlleiana Pond (not surveyed) and the Tir Lleidiog Llanlleiana WS. The latter is 5ha of fen and reedbed at Porth Llanlleiana.

Cae Owen, Neuadd, Cae Adda and Ty du are connected by the hydrological system associated with the stream which rises around Ty du. The link between Cae Adda and Ty du is uncertain.

Suitability as a compensation site: Cae Adda is close to Tre'r Gof SSSI (3.6km) and supports vegetation which is uncommon in this area of Anglesey, including M6 *Carex rostrata-Sphagnum squarrosum* mire which falls under the 'Transition mires and quaking bogs' habitat listed on Annex I of the Habitats Directive. Existing mire vegetation occupies all of the topographic basin, with the surrounding land dry and rocky, so that the opportunity for habitat creation is low. However, as the site was found to be in quite poor condition, with the mire relatively species-poor, possibly a result of too little grazing and nutrient enrichment, the site could be enhanced as part of the compensation proposal. The site also forms part of an ecological network within the Llanbadrig headland.

In summary, although a small site, Cae Adda is close to Tre'r Gof SSSI and offers the opportunity to enhance a locally uncommon and Annex I mire habitat type. The overall suitability rating of the site has therefore been determined as Medium.

6.4 Cae Owen

NGR: SH 3821 9446 **Area:** 1.4ha

Ownership: One owner (also shares Neuadd) **Designation:** Cors Cae Owen WS

Distance to Tre'r Gof SSSI: 2.5km

Survey date(s): 11 January 2016, 19 April 2016, 27 June 2016

Land use: Cae Owen is adjacent to a residential site, with a track along the western boundary. The predominant land use in the catchment is sheep pasture, with minor use for viticulture to the north west and west. It is unclear how the site itself is used. The lower part of the site above the stream is planted with willows, presumably as a visual screen.

Topography: The site lies within an area of relatively flat ground, which forms a basin between hills to the north, east and west (figure A-5). The elevation of the site ranges from 25m AOD in the far east and west of the site to 22m AOD in the central and southern regions. The land rises steeply to the north, east and west and the elevation of the surrounding hills rises to a maximum of 45m AOD in the west, 55m AOD in the north and 35m AOD in the east. The basin is relatively open to the south where the drainage ditch that flows through Cae Owen enters the valley bottom where the watercourse flowing west from Neuadd is located. Although the site is naturally draining, due to the relatively flat gradient of the site, the potential for water retention is still reasonably high.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the site comprises the Gwna Group, which contains psammite, quartzite and pillow lavas. At this scale, no superficial deposits are shown to be present at the site.

Three soil cores were taken during the site walkover (figure A-5). The results of the coring show that mineral soils were present in the south of the site, to the east of the central drainage ditch (CO.3) and to the north of the stream that runs along the sites southern border (CO.4). These soils were clay based, with a low organic matter content and plant rootlets throughout. Gleying was observed in both soil cores, with some red mottled patches at the base of the cores, which was interpreted to be iron oxide. This could be suggestive of slightly reducing conditions.

Peat was found to be present in the north east of the site at location CO.5. It was proven to a depth of 0.5m before hitting gravel or bedrock, had a high moisture content and was found to be moderately decomposed.

Hydrology and hydrogeology: A single drainage ditch runs through the centre of the site from north to south (plates 20, 23), and discharges into a larger drainage channel (25), which runs along the site's southern border from Neuadd. The ditch that flows through the centre of the site has an estimated upstream surface water catchment area of approximately 15ha. During the site walkover, a culvert was found to pass underneath the road to the north of the site, providing inflow into this drainage ditch. During a site visit it was noted that runoff was exceeding the culvert capacity and overtopping the road, flowing into the site. However, the land being assessed is not shown on Welsh Government development advice maps as being

at risk from flooding or known to have been flooded in the past. There were also inputs from the west from a small a drainage pipe that was found to be discharging into the site from a caravan park immediately west of the access track that runs along the site's western boundary.

Immediately south of the road is a well, although it is not known whether it is currently used, nor whether it could affect the hydrology at the site. Given the isolated nature of the area and the nature of the aquifer (limited resources), it is unlikely that there would be any significant groundwater abstractions in the future that could affect the site. The absence of drift will mean that rainfall recharge will move to bedrock, although this could be limited where soils are clayey or peat rich such that a wet environment is maintained.

The bedrock aquifer beneath the site forms part of the Ynys Môn Secondary WFD groundwater body that covers much of Anglesey (GB41002G204400). The overall status of this water body is poor due to poor chemical quality.

Water quality interpretation: Two surface water samples were collected during the site walkover in dry and sunny weather conditions (figure A-5). The water samples had a relatively neutral pH, but electrical conductivity and total dissolved solids were slightly elevated suggesting elevated inorganics. However, concentrations of major ions were generally low, although they were much higher than those present in the soil suggesting that there was inflow of inorganics to the site, rather than leaching from soil. Concentrations of nitrates were low, but potassium and phosphorous were slightly elevated, which could be indicative of some minor nutrient enrichment from the surrounding agricultural land.

Three soil samples were subjected to laboratory leaching tests and indicated that neutral to acidic water could be leached by rainfall from the soil, although the leachate could have slightly elevated nutrients.

Ecology:

Notable Species

- Marsh fern

Vegetation

There were two distinct areas of fen vegetation (figure G-2) Most of the site was dominated by greater pond sedge (*Carex riparia*) swamp, which by nature are species-poor, with only larger forbs such as great willowherb (*Epilobium hirsutum*) and meadowsweet (*Filipendula ulmaria*) occasional. This community lay over strongly gleyed, heavy clay soil. The main interest feature of the site was the central area of blunt-flowered rush fen (M22a *Juncus subnodulosus-Cirsium palustre* fen-meadow, typical sub-community) (plate 26). The rush was codominant with lesser pond sedge (*Carex acutiformis*) across most of this area, and the rhizomatous marsh fern was abundant throughout. The vegetation was much consolidated and species-poor, dominated by rhizomatous monocots and with only bulky forbs frequent (e.g. meadowsweet, marsh thistle).

A small area of similar blunt-flowered rush fen was also to be found in the south western corner (plate 27). This was kept open by mowing to allow access to bee hives, and was somewhat richer but bramble was encroaching.

Management and condition: The state of the fencing, isolation from the surrounding farmland, and coarseness of the vegetation suggest that Cae Owen has been unmanaged for many years. Scrub encroachment was local, but the area under scrub was not insignificant for such a small site. The channel of the stream was evidently deepened long ago, and this likely contributes to the dryness of the bottom of the site, where there was little wetland vegetation and trees had been planted.

Landscape context: The Llanbadrig headland supports a cluster of fens. In addition to Cae Owen, Neuadd (section 6.6) is approximately 300m to the south east, Cae Adda (section 6.3) and Ty du (section 6.8) are 900m to the east; and to the north is the Tir Lleidiog Llanlleiana WS. The latter is 5ha of fen and reedbed at Porth Llanlleiana. The headland also supports heathland. Cae Owen, Neuadd, Cae Adda and Ty du are connected by the hydrological system associated with the stream rising at Ty du.

Suitability as a compensation site: Cae Owen supports rich-fen vegetation close to Tre'r Gof SSSI (2.5km). As rich-fen vegetation occupies most of the site, there is little opportunity to create new habitat within the small site boundary. However, the site offers potential for enhancement through management or other measures to make the site botanically more diverse as part of the compensation proposal. As Cae Adda supports a large colony of marsh fern, which based on available records is the only such site on Anglesey that is not a SSSI [RD12], inclusion in the compensation proposal would secure this feature for nature conservation. Moreover, Cae Owen is connected by a stream to Ty du and the nearby rich-fen Neuadd, and forms part of a wider ecological network within the Llanbadrig headland.

In summary, although a small site with no habitat creation opportunity, Cae Owen is suitable for enhancement, supports a locally rare and nationally scarce plant and forms part of a network of valuable ecological sites close to Tre'r Gof SSSI. The suitability rating of the site has therefore been determined as Medium.

6.5 Mynachdy

NGR: SH 3133 9219 **Area:** 13.5ha

Ownership: One owner **Designation:** Cors Mynachdy WS

Distance to Tre'r Gof SSSI: 4.8km

Survey date(s): 11 January 2016, 24 May 2016

Land use: Mynachdy is part of an intensively managed dairy farm. The farm buildings themselves are located to the west of the site, up-slope of the main drainage ditch. Land to the south east and east of the site appears to be used as sheep pasture. Upstream of the main inflow into the site lies a small urban area associated with the village of Llanfairyghornwy. To the north west of Mynachdy lie a number of residential properties. From the site walkover, it was clear that a programme of intensive drainage and improvement has been in place for some time. Most of the pasture has been recently stripped and drilled with rye-grass (*Lolium*).

Topography: The site lies within a topographic basin formed of hills to the north, east and west (figure A-6). The elevation of the site ranges from 18m AOD in the north east to 16m AOD in the south. The land rises steeply to the north, east and west, with the elevation of these hills rising to a maximum of 32m AOD at their summits in the north, 30m AOD in the east and 60m AOD in the west. The basin is open to the south and south east, which forms a valley for the main inflow to enter the site. The site is also partially open to in the far north, where a small valley allows the main drainage ditch to exit the site.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the site comprises the Gwna Group, which contains psammite, quartzite and pillow lavas. The majority of the site is also covered in a layer of alluvium (mixed clays, sands and gravels) which is likely to be underlain by glacial till.

Two soil cores were taken during the site walkover (figure A-6). The results of the coring showed that peat was present in the east of the site. At location MY.5, peat was proven to a depth of 2.5m and bedrock was not reached. The core was found to have two distinct layers; a thin 10cm layer at the top of the core, which was high in organic matter and contained plant rootlets, and a second layer of well-decomposed peat throughout the rest of the core, which had a high moisture content and gravel clasts at its base. At location MY.6, peat was also proven to a depth of 2.5m. The upper 0.3m of the core consisted of a clay soil with gravel clasts, underlain by 2.2m of dark brown, saturated peat which, when squeezed, retained its structure.

Hydrology and hydrogeology: The main inflow into the site is a large drainage ditch which enters the site from the south east and flows northwards, through the centre of the site, before exiting via a small valley in the north east (plate 28). A network of smaller drains discharges into this main watercourse, including a number of ditches from the west. Within the site lies a closed loop of interconnecting drains to the east of the main ditch, as well as a pond to the west (plate 34). The total surface water catchment area upstream of the site has been estimated at around 200ha. Given the presence of the surrounding hills, the potential for water

retention within the site is high. NRW online flood maps shows that the site does not lie within a fluvial Flood Zone but it is at high risk of surface water flooding, with a risk of deep ponding throughout the site, particularly at its centre.

Although the bedrock beneath the site contains mildly productive strata, the site is covered in a layer of alluvium and glacial till, which would prevent recharge into the underlying bedrock. As a result, surface water would be retained at ground level, which due to the nature of the topography is likely to be pond within the basin. OS mapping also identifies the presence of two springs within close proximity of the site, one immediately north west of the site and the other 250m east.

The bedrock aquifer beneath the site forms part of the Ynys Môn Secondary WFD groundwater body that covers much of Anglesey (GB41002G204400). The overall status of this water body is poor due to poor chemical quality.

Water quality interpretation: Four surface water and two soil samples were collected during the site walkover, which was carried out in dry and sunny weather conditions (figure A-6). The pH of both the soil and water samples was very slightly acidic, with the exception of the leachate from the soil at MY.5 which was neutral and also had a slightly higher alkalinity. Concentrations of major ions and nutrients in the soil leachate at MY.5 were also low, but MY.6 had slightly higher concentrations of ammoniacal nitrogen. In the water samples, concentrations of major ions were low and the majority of samples were relatively nutrient poor. The surface water samples had relatively high redox and dissolved oxygen values and low turbidity values, indicative of more aerated, flowing water. Concentrations of chloride and dissolved solids in all samples were very slightly elevated, as was the concentration of nitrate at all locations other than MY.3, which was south of the site. MY.3 had slightly different surface water quality characteristics to the other samples, with a higher calcium and bicarbonate concentration and lower levels of ammoniacal nitrogen. It also had a slightly higher concentration of iron.

Ecology: The only area of mire vegetation remaining on the site was a rectangular fragment of approximately 1.4ha surrounded by a ditch and overlying deep peat (figure A-6, plate 33). This fragment was species-poor owing to the thick vegetation, and dominated by common reed and bottle sedge. Cottongrass was locally abundant. There were areas where mosses were conspicuous, e.g. *Aulacomnium palustre*, and more herb rich, e.g. abundant bogbean (*Menyanthes trifoliata*) and marsh cinquefoil (*Comarum palustre*), frequent devil's-bit scabious and ragged robin (*Silene flos-cuculi*), and occasional northern marsh orchid (*Dactylorhiza purpurella*).

Management and condition: Given the attractions of the surrounding pasture and difficulty of access, the fragment of mire is unlikely to be grazed regularly. The ditch surrounding this fragment had recently been scoured and the peat placed onto the inside, damaging the vegetation (plate 31). The few less densely vegetated areas were associated with works to carry out this and similar maintenance. The flora of the ditches was consistent with eutrophic conditions, with frequent fool's watercress and watercress (*Nasturtium officinale* agg.).

Landscape context: Mynachdy is part of an intensively managed pastoral landscape. Although there are fragments of wetland in the area, the site is isolated from these. However, if a large area of the basin were to be converted to wetland, then its size would make its isolation less material.

Suitability as a compensation site: Peat was present under the fragment of mire vegetation and was found to underlie most of the surveyed area, albeit in places with a shallow cover of clay. As such, blocking the extensive network of ditches, turf stripping to expose more peat and remove any enriched topsoil, and planting might create a large wetland. However, whether such a wetland would develop into rich-fen is uncertain, with most surface water samples indicating low mineral content. The remnant mire vegetation within the site was also indicative of more acid or neutral chemistry, and there was no evidence of groundwater inputs to the site within the surveyed area that might be used in the creation of alkaline fen vegetation. Finally, as there was also some evidence of nutrient enrichment and the site has a large catchment much of which is farmed for dairy, nutrient enrichment would likely pose a significant problem were Mynachdy taken forward as part of the compensation proposal.

In summary, the site offers the opportunity for the creation of a large area of wetland habitat but conditions may not be suitable for the target rich-fen. The suitability rating of the site has therefore been determined as Medium.

6.6 Neuadd

NGR: SH 3852 9414 **Area:** 5.0ha

Ownership: Two owners **Designation:** Tir Gwlyb Teilia Neuadd WS

Distance to Tre'r Gof SSSI: 2.7km

Survey date(s): 11 January 2016, 19 April 2016, 22 May 2016, 28-30 June 2016, 25 July 2017

Land use: The land to the south, east and north is used for pasture. Sheep from the east can graze the part of the site on that side of the stream, but most of the site is inaccessible and unsuitable for sheep. Cattle grazing abuts the site to the west, but that boundary of site is fenced against stock. Both cattle and sheep are grazed to the south.

Topography: The site occupies an area of flat land in a basin formed of hills to the north, south east, east and west (figure A-7). The elevation of the site ranges from 26m AOD in the south to 24m AOD in the north. The land rises steeply to the north, south east, east and west and the elevation of the surrounding hills rises to a maximum of 50m AOD at their summits in the north and west and approximately 60 to 70m AOD in the east and south east, respectively. Streams flow along the valley bottoms and interfluve areas between the hills, but as the gradient of the site is relatively flat, the potential for water retention is relatively high. The basin is open to the north, with low ground extending along the stream towards Cae Owen (section 6.4).

Geology and soils: The BGS 1:50,000-scale geological map shows the bedrock beneath the site to comprise the Gwna Group (psammite, quartzite and pillow lavas), as well as a number of younger igneous intrusions. The site is also covered in a layer of alluvium (mixed clays, sands and gravels) deposited by rivers.

The BGS mapping also indicates that peat could be present in places. Four soil cores were taken during a site walkover carried out in April 2016 (figure A-7). The results of the coring showed that mineral soils (typically silty clays with thin organic horizons containing plant roots) were present at the south eastern edge of the site (NE.7) and in the south west corner, adjacent to an incoming drainage ditch (NE.10). Peat was found to be present in the centre of the southern portion of the site at locations NE.8 and NE.9. It was proven to a depth of 1m and was found to be saturated and poorly decomposed, with limited structure.

Hydrology and hydrogeology: Neuadd is a complex site dominated by a number of small watercourses, drainage ditches and groundwater seepage zones. The main watercourse, which has an upstream catchment area of approximately 90ha, enters the site from the east and turns sharply northwards in the centre of the site, before leaving the site in its north west corner and continuing to flow west towards Cemaes Bay (plates 35, 40, 45 and 46). The much reduced flow through the site creates an obvious wetland area, which is shown on Welsh Government development advice maps as having been flooded in the past and which has vegetation forming floating rafts.

A smaller, incised drainage ditch, approximately 150m in length, crosses the site's southern border (plate 57) and on the day of the site walkover was found to contain low flows. The ditch receives input from the south east from a small watercourse that originates from a 250mm diameter outfall pipe (plate 56), approximately 60m downstream of a pond that that lies on raised ground to the south of the site and appears to be runoff rather than groundwater fed (plate 55). A third drainage ditch enters the northern section of the site from the east, which issues immediately upstream of the site boundary and flows through the site before discharging into the main watercourse (plate 50). The overall surface water catchment area for the site including these influences is estimated to be around 107ha.

Other inputs into the site include groundwater seepage from the surrounding hills, which predominantly occurs in the west of the site, and has created a distinct pattern of vegetation. No abstraction wells were found on site or in its immediate vicinity during the site walkover.

The bedrock aquifer beneath the site forms part of the Ynys Môn Secondary WFD groundwater body that covers much of Anglesey (GB41002G204400). The overall status of this water body is poor due to poor chemical quality.

Water quality interpretation: Six surface water samples were collected during the April 2016 site walkover, with one sample collected in July 2017 (from NE.5). The weather conditions were dry and sunny on the day of sample collection (figure A-7). The pH was typically neutral, with very variable electrical conductivity, with slightly elevated concentrations at four of the sites (NE.1, NE.2, NE.4 and NE.5) suggesting slightly elevated inorganics. Total alkalinity (bicarbonate and carbonate) was low to moderate throughout the site, but the highest values occurred either side of the peat and in the locations shown to contain stagnant water. Nutrients were relatively low in all samples, although nitrate was slightly elevated in sample NE.1. There was only a small difference in water quality at sample point NE8 from April 2016 to July 2017.

Sample NE.4 was quite different to the other samples with negative redox, low dissolved oxygen and relatively high concentrations of iron, phosphorous and potassium. This was also the only sample taken from the south west of the site where dairy farming was located immediately upstream, which could be providing nutrient-rich surface water to the site as runoff from the adjacent farmland. High iron content at NE.4 was also observed which is above the EQS of 1 mg/l and is indicative of stagnant bog water, which matches the observations made on site.

NE.3 had the water with the lowest electrical conductivity, highest dissolved oxygen and generally had low concentrations of major ions and nutrients.

Four soil samples were taken and subjected to leaching tests to evaluate the likely leachate that could result from rainwater infiltration. The results indicate that the leachate would have a neutral pH with relatively low nutrients and low major ions, with the exception of sulphate which was slightly elevated in soil sample NE.9 (compared to the other locations).

Ecology:

Notable Species

- Black bog-rush
- Bog pimpernel (*Anagallis tenella*)
- Lesser tussock sedge (*Carex diandra*)
- Great fen-sedge
- Slender sedge (*Carex lasiocarpa*)

Vegetation

Neuadd supported a diverse assemblage of rich-fen plant communities, some areas showing zonation associated with hydrology (figure G-3). The most striking aspect of the vegetation was the contrast between the sheep-grazed area to the east of the stream and the ungrazed, fenced area to the west.

Western area:

- Great fen-sedge was present in four discrete colonies in low-lying parts of the western area, three of which were quite large (plate 36). Around one of these (plate 43) was a small area of open water, suggesting that the great fen-sedge formed a floating mat of rhizomes, as did neighbouring sedge and reed vegetation.
- Several areas of blunt-flowered rush fen were present. Most of this was very species-poor and swampy, with a thick thatch of blunt-flowered rush; the only frequent associates were common reed and bittersweet (*Solanum dulcamara*), both at low cover. These areas have been mapped as M22 swampy variant.
- A zonation with the above species-poor vegetation was seen toward the base of the steep hill dominating the site to the south west (plate 37). Here a species-poor community dominated by tussocky purple moor-grass and reed abruptly changed into blunt flowered rush fen, where there were several tussocks of black bog-rush, suggesting a degraded form of M13 *Schoenus nigricans-Juncus subnodulosus* mire. This was found to be associated with a sudden transition from a shallow peat deposit at the bottom of a gentle slope to a deep peat deposit underlying the blunt-flowered rush fen.
- A central area of blunt-flowered rush fen was slightly richer with tall-herb species, e.g. angelica, common reed, lesser pond sedge and meadowsweet. This graded into tall-herb vegetation referred to M27 *Filipendula ulmaria-Angelica sylvestris* mire and S26 *Phragmites australis-Urtica dioica* tall-herb fen.
- The central area of the fen was occupied by an expanse of reedbed. Reed canary-grass (*Phalaris arundinacea*) was mostly found along a slightly raised bank along the margin of the stream, this relief most pronounced in the east and north producing drier conditions suitable to this plant. Reed canary-grass was also mixed with common reed in the lower-lying area to the west in species-poor vegetation referred to S4 *Phragmites australis* swamp and reed-beds.
- There were some richer areas of reed-dominated vegetation to the south and west with prominent tall-herbs such as meadowsweet (S26a *Filipendula ulmaria* sub-community) and hemlock water-dropwort (S26c *Oenanthe crocata* sub-community).

Eastern area:

- Blunt-flowered rush dominated fen-meadow was the main vegetation type to the east of the stream (plate 53 and plate 54), which was much more species-rich than that found to the west, with frequent to abundant greater bird's-foot-trefoil and ragged robin. The northern end had frequent quaking grass (*Briza media*) and was very grassy and finely textured with a patchy rush cover (M22b *Trifolium* spp.-*Briza media* sub-community).
- Within a wetter area were small patches of M9 *Carex rostrata-Calliergon cuspidata/giganteum* mire, with abundant *Calliergonella cuspidata*, and lesser tussock sedge, marsh arrow-grass, marsh lousewort and northern marsh orchid (*Dactylorhiza purpurella*).
- Toward the stream on its eastern side, fen-meadow graded into swamp, supporting a floating raft of dense bog-bean and marsh cinquefoil, with abundant lesser tussock and slender sedges, frequent bottle sedge and water horsetail (S27 *Carex rostrata-Potentilla palustris* tall-herb fen).
- At the periphery of the fen in the surrounding pasture were a number of seepage zones. One in the cattle pasture to the south east was species-rich and supported bog pimpernel. That to the west partially overlay peat and was very open and swampy, in places markedly puddled by stock, with indicators of eutrophication with floating sweet-grass (*Glyceria fluitans*), fool's watercress and watercress. A further, more extensive zone was associated with springs below the road to the north of site (plate 47); this was not surveyed during the vegetation survey owing to access restrictions.

Management and condition: The western area of site appeared to be only infrequently accessed by sheep from the pasture to the south where the fencing was poorly maintained. The communities were not of the kind that can survive only under grazing and the very well-consolidated vegetation and high water table in the western half of site would make it slow to succeed to scrub. The communities were species-poor, and the rich communities associated with similar hydrological conditions were not present. The area to the east of the stream was much better grazed, as sheep can enter from the contiguous pasture, and the vegetation here was in good condition and botanically diverse.

Landscape context: The Llanbadrig headland supports a cluster of fens: in addition to these, Cae Owen (section 6.4) is approximately 300m to the north west; Cae Adda (section 6.3) and Ty du (section 6.8) are 900m to the east; to the north is Llanlleiana Pond (not surveyed) and the Tir Lleidiog Llanlleiana WS. The latter is 5ha of fen and reedbed at Porth Llanlleiana. The headland also supports heathland.

Cae Owen, Neuadd and Ty du are connected by the hydrological system associated with the stream which rises around Ty du.

Suitability as a compensation site: Neuadd is close to Tre'r Gof SSSI (2.7km), and supports botanically-rich rich-fen, including plant communities referable to 'Alkaline fen' listed on Annex I of the Habitats Directive, and is thus a site of nature conservation importance. The site also forms part of an ecological network within the Llanbadrig headland. Given the poor condition of much of the vegetation and the importance of this site, Neuadd offers good opportunity for enhancement as part of the compensation proposal.

Enhancement could involve the instigation of suitable management, which might be achieved by negotiation with surrounding cattle farmers and installation of appropriate infrastructure. More intensive restoration works could be undertaken to establish species-rich communities in the western part of site, cutting vegetation, and introducing green hay from species-rich fens. Restoration would be particularly desirable for the zone supporting black bog-rush.

Rich-fen vegetation presently occupies the entire site, so there is no opportunity to extend the area of fen within the site boundary. The proximity of Neuadd to other fens, and their connectivity via the main stream flowing through it, could offer potential for habitat creation to transform this cluster of fragments into a more coherent network, e.g. along the low-lying pasture along the stream between Neuadd and Cae Owen (plate 46). To date this has not been investigated as access to this connecting land has not been secured. Land along the valley between Neuadd and Ty du appeared to offer little opportunity for wetland creation; the valley was mostly dry with a shallow clay topsoil and with only the very bottom of the valley showing any indication of seepage (plate 78).

In summary, Neuadd offers the potential for enhancement of an important site, and forms part of a valuable ecological network close to Tre'r Gof SSSI, but appears to offer no potential for habitat creation. The suitability rating of the site has therefore been determined as Medium.

6.7 Tregynrig Fawr

NGR: SH 4085 9309 **Area:** 3.6ha

Ownership: Two owners **Designation:** None

Distance to Tre'r Gof SSSI: 5.0km

Survey date(s): 11 January 2016, 23 May 2016

Land use: Tregynrig Fawr and much of the surrounding land are used as sheep pasture. The site itself is used for cattle grazing. The 1889 OS mapping indicates that marshy vegetation was present across the basin. The latest 1:25,000 indicates marshy vegetation extends over only a part of the basin. The A5025 lies 700m north of the site and three farms are located to the north of the site in its upstream catchment.

Topography: The site lies within a topographic basin formed of hills to the north, east, west and south east (figure A-8). The elevation of the site ranges from 39m AOD in the east to 36m AOD in the south west. Tregynrig Fawr occupies a small area of land within the east of the topographic basin, with the closest high ground located to the east and south east of the site. Here the land rises steeply and the elevation of these hills rises to a maximum of 60m AOD in the east and 66m AOD in the south east. The land to the north and west is relatively flat, but eventually rises to a maximum elevation of 70m AOD and 63m AOD, respectively at the summits of the nearest hills. The basin is open to the south, which forms a valley for the main outflow from the site.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the site comprises the New Harbour Group, which contains schists, phyllite and pillow lavas. The majority of the site, with the exception of the far south, is also covered in a layer of alluvium, (mixed clays, sands and gravels) deposited by rivers, which in turn overlies glacial till.

One soil core was taken in the north west of the site (figure A-8). The results of the coring showed that the soil in this area comprised a dark brown organic clay, which was very stiff and friable and had a very low moisture content (based solely on a visual assessment). The core was taken from a depth of 0.4m. Bedrock was not reached but the stiffness of the clay made it difficult to core. Site observations concluded that peat was unlikely to be present at any location within the site. No further cores were taken.

Hydrology and hydrogeology: The site and the surrounding area are extensively drained, with drainage ditches running along the site's northern and western borders. A drainage ditch flows west through the centre of the site (plate 58) to join a drainage ditch that runs south along the western site boundary. The drainage ditch in the west is the main drain, into which the rest of the network connects. It has an estimated upstream surface water catchment area of approximately 115ha and flows southwards through the valley to the south of the site and towards the Afon Wygyr. Only the lowermost part of the basin was surveyed during the site walkover and this was found to be particularly wet. NRW online flood maps show that the site

does not lie within a fluvial Flood Zone, but the flood maps do show that the site has a high risk of deep surface water ponding, particularly in the central and south western sections.

BGS 1:625,000 hydrogeological mapping shows that the bedrock beneath the site comprises a low productivity aquifer with limited groundwater in the near-surface. The layer of alluvium that covers the majority of the site is likely to be relatively impermeable, such that recharge rates into the underlying bedrock is likely to be relatively low, which could explain the boggy conditions found on site. A spring is present on the eastern side of the site, 60m downstream of which lies a well. A second well is located 300m north west of the western side boundary and is associated with the western end of the drainage network. It is not known if water is currently abstracted from either of these wells and whether this could influence stream flow through the site.

The bedrock aquifer beneath the site forms part of the Ynys Môn Secondary WFD groundwater body that covers much of Anglesey (GB41002G204400). The overall status of this water body is poor due to poor chemical quality.

Water quality interpretation: One surface water and one soil sample were collected during the site walkover, which was carried out in dry and sunny weather conditions (figure A-8). Both the soil and water samples had a slightly acidic pH and alkalinity levels were low. Concentrations of minerals and nutrients were low in the leachate from the soil, with the exception of ammoniacal nitrogen, which was only slightly elevated. In the water sample, the concentrations of major ions were generally low, except iron, which was slightly elevated. The level of dissolved oxygen was also low, which together with the slightly raised iron concentration could suggest that the water was relatively stagnant and slow moving. Concentrations of nitrate and ammoniacal nitrogen were slightly elevated, which could be indicative of nutrient rich runoff entering the site from the surrounding agricultural land.

Ecology: The vegetation was species-poor and dominated by agriculturally improved pasture dominated by Yorkshire fog and soft rush (plate 58). Common sorrel (*Rumex acetosa*) and sharp-flowered rush were frequent and lesser spearwort abundant in particularly wet areas (figure A-8). The encircling ditches were well-vegetated, containing abundant fool's watercress and stands of common reed and reedmace (*Typha latifolia*).

Management and condition: The vegetation was in a similar condition to the surrounding pasture, and was intensively grazed. The southern half of the surveyed area had been spread with farmyard manure. The flora of the ditches was consistent with nutrient enrichment.

Landscape context: Tregynrig Fawr is part of an intensively managed pastoral landscape and is isolated from areas of wetland vegetation. However, if the basin were to be converted to wetland, then its size would potentially make its isolation less material.

Suitability as a compensation site: The entire site is level and located within a topographic basin making it likely that flow restrictions on the stream flowing south would result in wetting of most of the site in addition to a larger area to the north and west. However, the lack of evidence for past wetland vegetation of interest and probable widespread nutrient enrichment from the sizable catchment does not suggest the result would be of great value. The site is

also unlikely to support rich-fen vegetation based on investigations so far carried out. Given the above, the suitability rating of Tregynrig Fawr has been determined as None.

6.8 Ty du

NGR: SH 3958 9405 **Area:** 8.1ha

Ownership: Three owners **Designation:** Part of Tir Lleidiog Ty du WS

Distance to Tre'r Gof SSSI: 3.7km

Survey date(s): 26 October 2015, 21 April 2016, 30 June 2016, 25 July 2017

Land use: The site and its surroundings are used as pasture, with sheep to the north and cattle to the south, though cattle have limited access to site itself.

Topography: Ty du sits within a topographic basin formed of hills to the north, east and south west (figure A-9). The elevation of the site ranges from 53m AOD in the west to 50m AOD in the east. The land rises steeply to the north, east and south west of the site, with maximum elevations of 75m AOD in the north, 63m AOD in the east and 70m AOD in the south west.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the majority of the site is underlain by the Church Bay Tuffs and Skerries Grits (tuff and sandstone), produced as a result of explosive, pre-historic volcanic eruptions. The southernmost part of the site is underlain by the New Harbour Group, comprising schist, phyllite and pillow lava. Overlying the bedrock throughout most of the site is a layer of alluvium (mixed clays, sands and gravels) which may be underlain in places by glacial till.

Six soil cores were taken during the site walkover (figure A-9). The results of the coring showed that mineral soil was present in the east of the site, between two drainage ditches, but that peat was present in the north and south east of the site. The mineral soil in the east (TD.9) comprised <0.2m of dark brown silty clay with a low moisture content and gravel clasts at its base. In the north of the site (TD.7, TD.8 & TD.10), poorly decomposed peat was proven to a depth of >2.25m and was found to be saturated, with woody debris and rootlets present throughout the core as well as having a high concentration of organic matter. At location TD.6, peat was proven to a depth of 1.75m before hitting bedrock. It was more decomposed than the other samples, had a lower moisture content and had green and grey hues throughout. In the far south of the site the peat was found to be moderately saturated, very poorly decomposed and had red-orange staining throughout.

Hydrology and hydrogeology: A large, incised drainage ditch enters the site via its south east corner, flows west through the centre of the site and exits the site via its south western border (plate 63, and 74 to 77), before carrying on towards Neuadd. A network of smaller drains that originate within the site feed into this main channel from both the north and south (plates 68, 72 and 73)). The small drain to the south of the main channel was found to be more of a seepage zone rather than a well-defined or man-made channel. A pond is located adjacent to the site's north eastern corner. The total upstream surface water catchment area for the site is estimated to be around 48ha. The Welsh Government development advice map indicates that the area has been subject to flooding in the past.

A well or septic tank is located adjacent to the site's north eastern corner, although it is not known whether this is utilised. If glacial till is present across the site this will limit rainwater

infiltration to groundwater and will result in wet conditions being maintained across the site. The potential for groundwater flows into the site arises from a variety of sources, mostly where the topography flattens out on the outskirts of the basin.

The bedrock aquifer beneath the site forms part of the Ynys Môn Secondary WFD groundwater body that covers much of Anglesey (GB41002G204400). The overall status of this water body is poor due to poor chemical quality.

Water quality interpretation: Five surface water and six soil samples were collected during the site walkover in April 2016, which was carried out in dry and sunny weather conditions (figure A-9). Five water samples were then taken from the same locations in July 2017. The pH of the leachate from the soil samples was broadly neutral, except at TD.11 where the pH was very slightly acidic, and alkalinity levels were relatively low. Concentrations of major ions and nutrients in the soil leachate were generally low, but the concentration of ammoniacal nitrogen was very slightly elevated in the north of the site at location TD.6.

The pH of the surface water samples was acidic at location TD.4 (pH 4.8 and 5.1 in April 2016 and July 2017 respectively) and slightly acidic at the other locations and alkalinity levels were generally low, but were very low at TD.4 on both occasions. Concentrations of major ions were low and the samples also appeared to be nutrient poor, although phosphate was slightly elevated in samples TD.1 and TD.5. The characteristics of the water at TD.4 were different to the other locations with much lower calcium carbonate and as noted above, more acidic. Redox, dissolved oxygen and turbidity results for the samples indicate relatively well aerated, flowing water, although the dissolved oxygen at TD.2 was low in 2017 indicating that there could be some stagnation. The water samples in 2016 and 2017 generally had a similar quality, although in 2017, both ammoniacal nitrogen and iron were present at higher concentrations in TD.3 and TD.5 than they had been in 2016. In addition, phosphorous was higher in TD.5 in 2017 compared to 2016, although this may have been due to the very high sediment concentration in the sample.

Ecology:

Notable Species

- Bog pimpernel
- *Calliergon giganteum*
- Creeping willow (*Salix repens*)
- *Rhizomnium pseudopunctatum*
- Slender sedge
- *Sphagnum contortum*

Vegetation

Several areas of mire were present in and around the central block of grey willow (*Salix cinerea*) scrub which dominated most of the site (figure G-4).

- In the south was very species-poor, very tussocky purple moor-grass mire (plates 61 and 62), M25 *Molinia caerulea-Potentilla erecta* mire. Species diversity was slightly greater in

an area well marked out from a distance by cottongrass, but all species were at very low cover. Toward its northern edge, this vegetation passed into swampy rush mire (M23a swampy variant) along the main drainage ditch, and here the vegetation was more species-rich with abundant bog asphodel (*Narthecium ossifragum*) and slender sedge, and frequent heath spotted orchid (*Dactylorhiza maculata*).

The scrub enclosed a central area of swampy poor-fen (plate 69). Sphagna were conspicuous with the main constituent *S. squarrosum*, with frequent *Aulacomnium palustre*. The main vascular plants were bottle sedge, common cottongrass, marsh cinquefoil and soft rush (M5 *Carex rostrata-Sphagnum squarrosum* mire). The eastern edge of this area was drier, with coarse/shrubby vegetation of large purple moor-grass tussocks and heather (*Calluna vulgaris*) of various ages over a carpet of *S. palustre* or bare peat (M16b *Erica tetralix-Sphagnum compactum* wet heath, *Succisa pratensis-Carex panicea* sub-community; plate 70). Creeping willow was abundant through this heathy vegetation.

- A mosaic of mire vegetation occupied the field to the west (plates 65 and 66). The main community was M23a *Juncus acutiflorus/effusus-Galium palustre* rush pasture, *Juncus acutiflorus* sub-community. Within this ground were several large flow tracks (plate 64) supporting soligenous communities with bog pondweed and marsh St John's wort (*Hypericum elodes*) dominating (M29 *Hypericum elodes-Potamogeton polygonifolius* soakway), locally abundant floating club-rush (*Eleogiton fluitans*), and numerous forbs shared with the wider rush pasture. *Calliergon cordifolium* and *Calliergonella cuspidata* were abundant, and the uncommon mosses *Calliergon giganteum* and *Rhizomnium pseudopunctatum* were also found here and are indicative of base-enrichment. Within these soligenous areas were several prostrate plants of creeping willow.

  Between the tracks were four raised areas. The southern two were quite species-rich with a well-grazed sward of purple-moor grass, star sedge and sweet vernal-grass as the main components (M25b *Molinia caerulea-Potentilla erecta* mire, *Anthoxanthum odoratum* sub-community). The northern raised area was raised on hummocks of *S. papillosum* and *S. palustre*, soft rush was frequent and there was some low-growing heather; devil's-bit scabious, purple moor-grass and star sedge were frequent (M6c *Carex echinata-Sphagnum recurvum/auriculatum* mire, *Juncus effusus* sub-community). The smaller raised area to the south supported a much richer *Sphagnum* community, with *S. capillifolium* subsp. *rubellum, S. subnitens,* and the uncommon *S. contortum*, the latter indicating a more neutral water chemistry. This stand was referred to the non-NVC 'Species-rich *Sphagnum* mire' [RD8].

  A final community of note within this area, and contrasting with other mire communities here, was a small species-poor stand of blunt-flowered rush, referred to M22 swampy variant. This is indicative of local base-enrichment within the main base-poor or circum-neutral mire.

- To the east of the central poor-fen was a transitional rush mire, with blunt-flowered rush variably prominent, and very open compared with the scrubby central area (plate 71).

Much of the area was dominated by purple moor-grass, and tall-herb species such as angelica, marsh cinquefoil and marsh thistle were frequent. Most of this area was referred to M25c *Molinia caerulea-Potentilla erecta* mire, *Angelica sylvestris* sub-community swampy variant, but in places blunt-flowered rush succeeded in dominance, referred to M22a *Juncus subnodulosus-Cirsium palustre* fen-meadow, typical sub-community. Within the south of this area was a large colony of slender sedge.

- Finally, in the north-east of site was an extensive area of mire dominated by yellow flag with abundant fool's water-cress, to the north of which was a species-poor grass-dominated swamp of Yorkshire fog. Both of these communities are indicative of nutrient enrichment, and would suggest that the structure in the north-east is a leaky septic tank. Many of the drains within the basin also supported vegetation indicative of eutrophication.

The vegetation of Ty du was surveyed by NRW in 2014 as part of the Lowland Peatland Survey of Wales [RD20]. The mapped vegetation units of that survey correspond well with the results described above.

Management and condition: The current amount of grazing by sheep appeared to maintain the interest features in the western field. However, as the interior of the mire was fenced off, scrub was succeeding fen habitat across much of the site. The extent of scrub found by the present survey is very similar to that mapped by the Lowland Peatland Survey of Wales [RD20]. The purple moor-grass mire to the south was also not managed and has been drained and impoverished. The blunt-flowered rush and purple moor-grass mire to the east did not appear to be grazed but was open.

Nutrient enrichment was indicated especially in the north eastern area, where there is thought to be a leaky septic tank (water samples were not taken from this area), and this appeared also to enrich the drains through site. NRW inferred that the presence of these drains protected the species-rich mire communities to the west from eutrophication [RD20].

Landscape context: The Tir Lleidiog Ty du WS also contains the small mire at Cae Adda (section 6.3), approximately 150m from Ty du. The peninsula supports a cluster of fens: in addition to these, Neuadd (section 6.6) is approximately 800m to the west, slightly beyond which is Cae Owen (section 6.4), and, to the north, Llanlleiana Pond (not surveyed) and the Tir Lleidiog Llanlleiana WS. The latter is 5ha of fen and reedbed at Porth Llanlleiana. The headland also supports heathland.

Cae Owen, Neuadd and Ty du are connected by the hydrological system associated with the stream which rises around Ty du. The hydrological link between Ty du and Cae Adda is uncertain.

Suitability as a compensation site: Ty du is a botanically-rich mire complex close to Tre'r Gof SSSI (3.7km), supporting several notable species, and plant communities such as M6 *Carex rostrata-Sphagnum squarrosum* mire referable to the 'Transition mires and quaking bogs' habitat listed on Annex I of the Habitats Directive. The site also forms part of an ecological network within the Llanbadrig headland. Much of the site is unmanaged and a

significant area of mire (around 40% of site) is occupied by scrub. The compensation proposal could therefore provide an opportunity to significantly enhance this important site.

The simplest enhancement measure for Ty du would be to remove the scrub, opening up the site to grazing livestock and permitting regeneration of mire vegetation. It would also be desirable to improve the condition of the purple moor-grass mire to the south, which could be achieved by filling the deep drain running along its edge, thereby restoring a more natural headwater to the main stream, and by cutting of the hummocks of purple moor-grass. It would also be necessary to enable livestock to better access this area, which is part of an area of cattle pasture under separate ownership to the sheep-grazed land comprising the northern half of site. Finally, this survey and that of NRW [RD20] identified eutrophication thought to originate from a septic tank in the north east of site, and this could be removed as part of enhancement works.

Ty du appeared to be unsuitable for habitat creation as mire vegetation occupied the whole site. The surrounding area appeared also to be unsuitable due to topography and lack of groundwater influence.

In summary, Ty du offers the potential to significantly enhance important mire habitat, forms part of a valuable ecological network close to Tre'r Gof SSSI, but provides no potential for habitat creation. The suitability rating of the site has therefore been determined as Medium.

6.9 Tyddyn-y-Waun

NGR: SH 4189 9370 **Area:** 2.6ha

Ownership: One owner **Designation:** None

Distance to Tre'r Gof SSSI: 6.0km

Survey date(s): 11 January 2016, 23 May 2016

Land use: Tyddyn-y-Waun and its surroundings are used as sheep and cattle pasture. Only cattle have been observed using the site. The A5025 lies immediately adjacent to the site's eastern border and two residential properties lie within close proximity of the site, one 100m north east of the site and the other 200m south east. A single farm lies within the upstream catchment, 500m west of the site.

Topography: The site lies within a topographic basin that is formed of hills to the north west, south and south east (figure A-10). Tyddyn-y-Waun lies on a south west to north east slope with a moderate gradient. The elevation of the site ranges from 45m AOD in the south to 40m AOD in the north east. The land rises steeply to the north west, south west and south east, with the elevation of these hills rising to a maximum of 70m AOD at their summits in the north west, 52m AOD in the south west and 58m AOD in the south east. The basin is open to the north east, which forms a valley for the main outflow from the site. Due to the nature of the topography, the potential for water retention within the site could be limited.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the majority of the site is underlain by the Church Bay Tuffs and Skerries Grits (tuff and sandstone), produced as a result of explosive, pre-historic volcanic eruptions. The far south west corner of the site is underlain by the New Harbour Group, which is made up of schists, phyllite and pillow lavas. At this scale, no superficial deposits are shown to be present at the site.

One soil core was taken from Tyddyn-y-Waun from the south of the site (figure A-10). The coring found a homogenous clay soil, with low silt content, containing a high proportion of organic matter (rootlets, wood fragments, and rhizomes) and with low moisture content. Bedrock was reached at a depth of 0.5m. Site observations concluded that peat was unlikely to be present at any other location within the site. No further cores were taken.

Hydrology and hydrogeology: A drainage ditch originates within the north of the site and flows northwards towards Bull Bay. On the day of the site walkover the section of drainage ditch that lies within the site (plate 82) was found to be more of a ponded area with surface water collecting at a slight break in slope. Another stream issues to the north east of the site, flows east along the site's northern border and discharges into the northward flowing drainage ditch (plate 81). The estimated upstream surface water catchment area of both drains is 28.6ha. A seepage zone was also identified in the south of the site and was suspected to migrate towards the surface water collect in the north. NRW online flood mapping shows that the site does not lie within a fluvial Flood Zone, but the flood maps do show that the site is considered to be at high risk of surface water flooding, with a risk of deep ponding in the central and eastern sections.

The bedrock comprises a secondary aquifer and given the absence of superficial deposits and peat at the site, recharge rates of surface water into the underlying bedrock is likely to be relatively high. The bedrock aquifer also forms part of the Ynys Môn Secondary WFD groundwater body that covers much of Anglesey (GB41002G204400). The overall status of this water body is poor due to poor chemical quality.

In addition to this, two wells lie within close proximity of the site: the closest along the site's south eastern border, the second approximately 300m north east of the northern boundary.

Water quality interpretation: One surface water and one soil sample were collected during the site walkover, which was carried out in dry and sunny weather conditions (figure A-10). Both the soil and water samples had a slightly acidic pH and alkalinity levels were low. Concentrations of major ions and nutrients were low in the leachate from the soil. In the water sample, concentrations of major ions were very low as were nutrients, with the exception of nitrate, which was slightly elevated and could be indicative of nutrient enrichment from the surrounding agricultural land.

Ecology: Most of Tyddyn-y-Waun consisted of rushy pasture (figure A-10), dominated by dense tussocks of soft rush (plate 80). Yorkshire fog was abundant, and formed pure carpets over exceedingly wet, unconsolidated quaking areas. Lady's smock (*Cardamine pratensis*) was frequent to locally abundant and marsh thistle frequent, and in especially wet areas ivy-leaved water-crowfoot (*Ranunculus hederaceus*), fool's watercress and lesser spearwort were abundant, while water horsetail (*Equisetum fluviatile*) was locally dominant in the main drainage channel (plate 82). A shallow drainage channel along the northern boundary flowed into a collect vegetated by abundant ivy-leaved water-crowfoot and common water starwort.

Management and condition: The site was very wet and rushy and had probably been significantly modified and grazed to attain its present species-poor condition.

Landscape context: Tyddyn-y-Waun is part of an intensively managed pastoral landscape and is isolated from areas of wetland vegetation.

Suitability as a compensation site: The site was already very wet notwithstanding attempts to drain it. Any attempts to create wetland would be small in extent given the limitations of the site's topography, and would be isolated from any similar habitat. Moreover, given the soil type and water quality, the site would not develop into rich-fen. The suitability rating of the site has therefore been determined as None.

6.10 Site 3

NGR: SH 4710 8390 **Area:** 67.8ha

Ownership: Three owners **Designation:** None

Distance to Tre'r Gof SSSI: 14.8km

Survey date(s): 10 May 2016

Land use: The land immediately south of the site forms Cors Erddreiniog SSSI and Tyddyn-y-Waen SSSI lies immediately north west of the site. The remaining area consists of improved pasture used for sheep and cattle grazing. A minor road runs through the south of the site, providing access to the hamlet of Maenaddwyn to the west.

Topography: To the north and west of the site lie a series of hills, which reach a maximum elevation of 165m AOD. Generally, the topography within the site slopes steeply towards the south east. However, an area of high ground lies within the centre of the site, which reaches 86m AOD. This creates a topographic depression in the west of the site, between the topographic high and the hills to the north west. The base of the depression sits at 75m AOD. To the east of the site lies a valley bottom containing the Afon Lligwy, which reaches a low of 56m AOD. Beyond this, the topography rises again to a maximum of 130m AOD to the south east of the site. The site is open to the east, where a small valley allows the main drainage ditch to exit the site in its north eastern corner.

Geology and soils: The geology of Site 3 is complex. The bedrock underlying the site comprises two distinct sandstone formations; the Old Red Sandstone Supergroup and the Lligwy Sandstone Formation. At several locations in the north of the site, the Gwna Group intrudes into the surrounding sandstone formations. Across most of the site (with the exception of the intrusions) the bedrock is covered with a layer of till, deposited during a period of glacial retreat.

Two soil cores were taken during the site walkover (figure A-11). The results of the coring showed that mineral soils were present in both the north and east of the site. At sampling point 3.5, 0.4m of clay soil was recovered, with a 0.25m layer of brown, fibrous clay, containing rootlets and a 0.15m layer of marl. The marl was found to contain small pieces of black material, which when rubbed between fingers had a similar consistency to charcoal. At sampling point 3.6, the soil structure was similar, but with the marl layer containing orange staining throughout which was interpreted to be iron oxide. Small clasts of quartz-like minerals were also present.

Hydrology and hydrogeology: The Afon Lligwy enters the site from the south and flows north east through the east of the site before exiting mid-way along Site 3's eastern border. Along its course, a number of drainage ditches discharge into the river, including a drainage ditch from the north east from which two of the surface water samples were collected. A further drainage ditch originates in the north west of the site and flows into a tributary of the Afon Lligwy, which flows along the site's northern border. With the exception of the topographic depression in the west of the site, the potential for water retention within the site is likely to be

limited. NRW online flood mapping shows that the site does not lie within a fluvial Flood Zone and is also considered to be at low risk of surface water ponding.

A well is located between the topographic mound in the centre of the site and the Afon Lligwy. It is not known if water is currently abstracted from this well or whether this could influence the stream to the south of the site. A spring is also shown on OS mapping to be situated in the south east corner of the site, although any groundwater emanating at the surface would likely be routed towards the river and away from the site. Although the bedrock beneath the site contains mildly productive strata, the site is covered in a layer of glacial till, which would prevent recharge into the underlying bedrock. As a result, surface water would be retained at ground level, which due to the nature of the topography is likely to be drained to the south east.

The bedrock aquifer beneath the majority of the site forms part of the Ynys Môn Secondary WFD groundwater body that covers much of Anglesey (GB41002G204400). However, the bedrock aquifer underlying the east of the site forms part of the Ynys Môn Central Carboniferous Limestone WFD groundwater body (GB41001G204200). The overall status of both water bodies is poor due to poor chemical quality.

Water quality interpretation: Four surface water and two soil samples were collected during the site walkover, which was carried out in dry and sunny weather conditions (figure A-11). The pH of the leachate from the soil samples was broadly neutral and alkalinity levels were low. Concentrations of major ions and nutrients in the soil leachate were also low, with the exception of phosphate in the north of the site (sampling point 3.5) which was slightly elevated. The pH of the surface water samples was acidic (pH 5.2 to 5.6) and alkalinity levels were low. Generally speaking, concentrations of major ions and nutrients were low and the total dissolved solids/ electrical conductivity was low indicating little mineral enrichment, with the exception of iron, which was slightly elevated at sampling points 3.1, 3.3 and 3.4. The concentration of phosphate was slightly elevated in the north (sampling point 3.1) and potassium content was higher in the east (sampling point 3.4) than in the other samples. Redox, dissolved oxygen and turbidity levels were indicative of relatively well aerated, flowing water.

Ecology:

Notable Species

- Black bog-rush
- Bog myrtle (*Myrica gale*)

Vegetation

Most of the site comprised species-poor semi-improved or improved pasture. However, the slopes of the hill at the centre of the surveyed area support a system of circum-neutral flushes and wet heath along most of the western and eastern flanks.

The flush on the gentle western slope was largely soft rush-dominated and confined to a narrow band above a ditch at the western boundary of the survey area. Mosses were

conspicuous with *Sphagnum inundatum* and *S. contortum* locally abundant, and *Sarmentypnum exannulatum* occasional. Sedges were also abundant throughout, mostly carnation sedge, and lousewort (*Pedicularis sylvestris*) and marsh bedstraw were frequent (the non-NVC community 'neutral flush').

The steeper eastern slope supported wet heath (M15 *Scirpus cespitosus-Erica tetralix* wet heath). The northern end was markedly acid, with the slope dominated by tussocks of purple moor-grass, with abundant heather and frequent cottongrass and heath milkwort (*Polygala serpyllifolia*). The area at the base of this slope had abundant cottongrass.

A narrow flush at the southern end of the eastern face had a more basic influence with several bushes of bog myrtle (MG15a *Carex panicea* sub-community) and tussocks of black bog-rush. The mosses *Bryum pseudotriquetrum* and *Campylium stellatum* were present in small quantity among small sedges, such as flea and pill sedges (*Carex pulicaris* and *C. pilulifera*, respectively).

The low-lying pasture along the Afon Lligwy supported abundant soft rush, and was species-poor.

Management and condition: The flushes on the gentler slopes were quite diverse, a result of the maintenance of open conditions by grazing and trampling by livestock. The steeper slopes were of rather coarse vegetation.

Landscape context: The site is adjacent to Cors Erddreiniog SSSI/National Nature Reserve (NNR), part of the Anglesey Fens SAC, a site supporting alkaline and calcareous fen of international importance. Tyddyn y Waen SSSI is also immediately to the north of site.

Suitability as a compensation site: Semi-natural wetland habitat was found on the eastern slopes of the central hill, but this was wet heath indicating acid conditions. Any habitat creation work would focus on the low-lying ground along the Afon Lligwy, at least the lower area of which is underlain by a marl deposit. Marl would be valuable in the creation of rich-fen, but it lies at least 0.6m below clay and sampling indicates low mineral and alkalinity levels in soil and water. These results indicate that this area would be sub-optimal for creation of rich-fen habitat. Given the above the suitability rating of the site has been determined as None.

6.11 Site 8

NGR: SH 4751 7983 **Area:** 8.0ha

Ownership: One owner **Designation:** None

Distance to Tre'r Gof SSSI: 18.0km

Survey date(s): 3 November 2016

Land use: The site has been unused for decades according to a neighbour. Cors Erddreiniog SSSI occupies the area of land to the north of the site and the land surrounding Site 8 is used for grazing sheep and cattle. The B5110 lies 400m east of the site boundary along which are also a number of farm smallholdings. A slightly larger farm is situated in the site's upstream catchment, to the north of Cors Erddreiniog SSSI.

Topography: The site is centred within an area of gently sloping ground in the western portion of the valley of the Afon Clai (figure A-12). The site slopes from west to east, with the elevation of the site ranging from 69 m AOD in the west to 64m AOD in the east, where the Afon Clai runs along the site's eastern border. Along the route of the watercourse, the land within the site slopes very gently towards the south. The land rises to the south and west of the site, with the immediately adjacent hill reaching a maximum elevation of 74m AOD. The site is open to the east, and given the presence of the Afon Clai, the potential for water retention is low.

Geology and soils: The bedrock beneath the site comprises the Old Red Sandstone Supergroup, with the exception of the south west corner of the site, which is underlain by schist belonging to the Gwna Group. A layer of glacial till covers the bedrock across the whole of the site, with a layer of river alluvium lying over the till in the far north east, adjacent to Cors Erddreiniog SSSI.

Two soil cores were taken during the site walkover (figure A-12). The results of the coring showed that mineral soils were present in the west of the site (8.4) and in the east of the site, to the south of the drainage ditch that joins the Afon Clai (8.3). These soils were clay based, with some gleying observed in both soil cores, as well as yellow/orange staining throughout, which could be indicative of reducing conditions. Both samples contained white gravel clasts and sand at the base of the core, interpreted to be the top layer of the superficial deposits.

Hydrology and hydrogeology: The site is drained by two drainage ditches, one which originates in the north of the site and flows east towards the site's eastern border, and another which runs east, along the south of the site (plate 84). Both ditches discharge into the Afon Clai, a Main River, which flows southwards along the site's eastern border. The Afon Clai is the only surface water outflow from the site. NRW online flood mapping shows that the majority of the site lies within fluvial Flood Zones B and C2 and has more than a 1% chance of fluvial flooding in any one year. The flood maps also show that the site has a high risk of deep surface water ponding in the south east corner of the site, adjacent to the Afon Clai.

The layer of glacial till that covers the site is considered an unproductive stratum and is relatively impermeable, such that recharge rates into the underlying bedrock are likely to be low. This is considered a likely contributor to the boggy ground conditions encountered on site.

It should be noted that there are no wells shown on OS mapping within the site or its surrounds and none were found during the site walkover.

The bedrock aquifer beneath the site forms part of the Ynys Môn Secondary WFD groundwater body that covers much of Anglesey (GB41002G204400). The overall status of this water body is poor due to poor chemical quality.

Water quality interpretation: Two surface water (8.1 and 8.2) and two soil samples (8.3 and 8.4) were collected during the site walkover, which was carried out in dry weather conditions (figure A-12). The soil samples (8.3 and 8.4) were subjected to leaching tests and the pH of the leachate is slightly alkaline (pH 8.4) and calcium concentrations and alkalinity levels are high in comparison to samples taken from other sites. This was reflected in the surface water sample (8.1) from the Afon Clai (see below). Concentrations of major ions and nutrients in the soil leachate were generally low, with the exception of magnesium in the west of the site (8.4) which was very slightly elevated.

The pH of the surface water samples (8.1 and 8.2) was broadly neutral (pH 6.1-6.8) and alkalinity levels are moderate. Due to the very shallow nature of the water at location 8.2 it was difficult to obtain a water sample without disturbing the sediment and so this sample had a very high suspended sediment concentration and this will have influenced unfiltered concentrations of some substances. Concentrations of major ions and nutrients were generally low; however, the concentration of total unfiltered phosphorous was high in sample 8.1 from the Afon Clai. As this was an unfiltered sample the high phosphorous concentration could be due to material in suspension rather than having been dissolved, although either way, the data demonstrate that there was nutrient rich water flowing into the site. This could be the result of fertiliser input from upstream agricultural land, as the soil samples both had low total and leachable phosphate. Electrical conductivity readings were within the range for fresh surface water, with the sample from the Afon Clai being the more elevated of the two samples, likely due to elevated calcium carbonate, derived from the soil. Redox levels were also higher in the Afon Clai than in the drainage ditch, indicative of better aerated, fresh, flowing water in the river.

Ecology:

Notable Species

- Black bog-rush
- Bog myrtle
- Parsley water-dropwort (*Oenanthe lachenalii*)
- Great fen-sedge

Vegetation

Site 8 largely comprised rich-fen habitat dominated by very coarse purple moor-grass, with some small areas of grey sallow and birch (*Betula*) scrub scattered throughout and a central area of heath (figure A-12). Associates of the purple moor-grass were few, though blunt-flowered rush was constant across most of site but of varying cover. Heather and western

gorse (*Ulex gallii*) were abundant in the dry central area of the site, while to the west species-poor M22 *Juncus subnodulosus-Cirsium palustre* fen meadow lay over lower poorly-draining ground (plate 86). To the north, associated with ground hollows and other changes in topography, the vegetation again gave way to vegetation dominated by purple moor-grass but here with an abundance of black bog-rush and bog myrtle (M13 *Schoenus nigricans-Juncus subnodulosus* mire). To the north east the vegetation comprised very coarse tussocky vegetation dominated by purple moor-grass and bog myrtle with occasional black bog-rush (plate 85); some tussocks supported cross-leaved heath and heather and there were small scattered stands of great fen-sedge.

The vegetation of Site 8 was surveyed in 2009 by NRW as part of the Lowland Peatland Survey of Wales [RD21]. The mapped vegetation units of that survey correspond roughly with the results described above, with rich-fen dominated by purple-moor grass predominating, including areas of alkaline fen. Given the unfavourable season of the present survey and short amount of time on-site it was not possible to obtain more detailed information on the vegetation, as found by the NRW survey.

Management and condition: The site appeared to be long unmanaged and consequently in a very poor condition. Scrub was slowly colonising the drier areas.

Landscape context: A compartment of Cors Erddreiniog SSSI borders the site to the north. This site is part of the Anglesey Fens SSSI, supporting alkaline and calcareous fen habitats of international importance.

Suitability as a compensation site: The whole of Site 8 supports rich-fen vegetation, including 'Alkaline fen' habitat listed on Annex I of the Habitats Directive. The site has long been neglected, so that is the good potential to enhance this large site. With clearance of scrub and installation of appropriate infrastructure and management, the site could be incorporated into the management unit of the adjacent SSSI, thereby significantly extending the SSSI and enhancing the site. Enhancement works could also involve cutting of the purple moor-grass, allowing the vegetation to regenerate naturally, and rectifying nutrient enrichment of the Afon Clai.

In summary, Site 8 is not suitable for rich-fen creation but supports a significant area of this habitat that is in need of management and is therefore suitable for enhancement. The suitability rating of Site 8 has therefore been determined as Medium.

6.12 Site 18

NGR: SH 4959 8161 **Area:** 19.4ha

Ownership: Three owners **Designation:** None

Distance to Tre'r Gof SSSI: 18.2km

Survey date(s): 10 May 2016

Land use: Access was only available for the north east and south west sections of the site only): the land in the north east is used for horse grazing, with sheep pasture in the east. The area to the south forms part of Cors Goch SSSI. Parts of the south west had been improved for horse grazing. From aerial imagery, the catchment to the north of the site is improved pasture. A caravan park occupies the area of land to the north of the site's north eastern end and residential properties lie along the site's southern boundary.

Topography: The site occupies an area of relatively flat ground at the base of a series of hills to the north of the site (figure A-13). The hills to the north and north west reach a maximum elevation of 120m AOD, which drops steeply to 91m AOD at the site's northern border. A low-lying area of land exists immediately south of this, within the site, elevated at around 75m AOD where the Afon Marchogion lies. The south of the site is at a slightly higher elevation of 80m AOD. South of this are a series of small hills, which run along the northern border of Cors Goch South (section 6.12). The site is open to the north east, where the Afon Marchogion flows from the site.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the site comprises the Clwyd Limestone Group, i.e. limestone with interbedded sandstone. The centre of the site is also covered in a layer of alluvium (mixed clays, sands and gravels) deposited by rivers.

Two soil cores were taken during the site walkover (figure A-13). The results of the coring showed that in the far south west of the site (sampling point 18.2) there was a silty clay soil, with a low moisture content. Below this was a 0.2m layer of marl, with orange staining throughout, likely iron oxide. In the far east of the site (sampling point 18.3), 1.3m of peat was present, which had a low moisture content and was stiff and structured, with a significant amount of organic matter. Beneath the peat was a sharp transition into a 0.2m layer of marl, which was uniform in nature and contained calcite flakes and small shells throughout. The moisture content of the marl increased with depth and although bedrock was not reached, the stiffness of the marl made auger penetration difficult.

Hydrology and hydrogeology: The Afon Marchogion originates from a ponded area in the south west of the site and flows north east through the centre of the site towards Bwlch. The river receives a number of inputs from small drainage ditches, which also originate within the site. The Afon Marchogion does however receive a larger input from another watercourse, which flows through Cors Goch SSSI and enters the site via its southern boundary. In the topographic depression in the north of the site the potential for water retention could be high. Only the south western and north eastern parts of the site were surveyed during the site

walkover and these areas were found to be relatively dry. NRW online flood mapping shows that the site does not lie within a fluvial Flood Zone and the majority of the site is considered to be at low risk of surface water flooding. The only area shown to be prone to ponding is in the topographic low where the Afon Marchogion originates.

BGS 1:625,000 hydrogeological mapping shows that the bedrock beneath the site comprises a moderately productive aquifer with a rapid response to rainfall. Most of the site is free from superficial deposits and recharge to the aquifer in these areas is likely to be high. In the north of the site where the layer of alluvium is present, recharge into the underlying bedrock is likely to be more restricted, which could explain the increased risk of surface water ponding in this area. Although not marked on OS mapping, a private abstraction well lies in the far south east of the site, located within the edge of the SSSI. From discussions with the landowner (also the owner of the borehole), the well had been contaminated on numerous occasions in the past due to cattle grazing within the SSSI. It is not known how much water is abstracted from the well or how it is used.

The bedrock aquifer beneath the site forms part of the Ynys Môn Central Carboniferous Limestone WFD groundwater body (GB41001G204200). The overall status of the water body is poor due to poor chemical quality.

Water Quality: One surface water and two soil samples were collected during the site walkover, which was carried out in dry and sunny weather conditions (figure A-13). The pH of the leachate from the soil samples was broadly neutral, with the sample in the north east tending towards being slightly alkaline. The concentration of dissolved bicarbonate and calcium was also high in the soil and in the leachate in the north east, suggesting that it contained limestone. With the exception of nitrate, the concentrations of all other major ions and nutrients in the soil samples were low. The pH of the water sample is slightly acidic; however, the concentration of dissolved bicarbonate was high, as was the concentration of calcium, which suggested that the water had the limestone bedrock as its source. The concentration of iron was slightly elevated and the dissolved oxygen concentration was relatively low, which was indicative of slow moving, poorly aerated water. Concentrations of all other major ions and nutrients, including nitrate was low.

Ecology: The surveyed area was split between either end of the site and largely comprised semi-improved or unimproved grazing, for the most part dry except for a negligible area along the boundary with Cors Goch SSSI. The two accessible areas flanked a stretch of peatland along the Afon Marchogion. None of this mire was available for survey from the western end, but at the eastern end a small area extended into semi-improved grazing and was species-poor, dominated by purple moor-grass. A short scrape in this vegetation had been created at right angles to the stream in order to water stock, and supported abundant bottle sedge and water horsetail with frequent marsh bedstraw.

Management and condition: The small purple moor-grass-dominated mire in the eastern surveyed area was unmanaged as it flooded regularly. From what could be seen from without, the fen along the Afon Marchogion appeared completely neglected. The vegetation gave the impression of ponds, suggesting parts may have been dug out.

Landscape context: The site is adjacent to Cors Goch SSSI/NNR, part of the Anglesey Fens SAC, a site supporting alkaline and calcareous fen of international importance.

Suitability as a compensation site: Some of the grassland in the western surveyed area was underlain by marl. However, the dryness of these areas, the likely good quality of existing grassland vegetation, the depth of the marl below the surface, and the small area of calcareous fen which might be created by manipulating these conditions, make it unsuitable as a compensation site.

Most of the eastern surveyed area was also unsuitable, lying over dry raised ground. The small area of mire present here was not of itself of interest, but the significant deposit of marl underlying it indicates that the larger fen system along the Afon Marchogion may be suitable as part of the compensation proposal. This fen has not been accessed.

Given the above, the suitability rating of the area of Site 18 that has been surveyed is considered to be None. However, as there could be potential in the unsurveyed area along the Afon Marchogion, the overall rating has been determined as Low until this area can be accessed.

6.13 Site 19

NGR: SH 4990 8100 **Area:** 21.2ha

Ownership: One owner **Designation:** None

Distance to Tre'r Gof SSSI: 18.8km

Survey date(s): 9 May 2016

Land use: Access was only available to the far western section of the site, where the pasture appeared to have been impoverished by horse grazing. The area to the north and west of the site boundary forms part of the Cors Goch SSSI. From aerial imagery, the areas to the east and south of the site appear to be being used as sheep pasture.

Topography: The site occupies an area of relatively high ground, with hills in the north and south of the site and a topographic low in the site's mid-section (figure A-13). The hills in the north and south east of the site are elevated at 86m AOD and 84m AOD, respectively. A small, valley-like feature extends through the centre of the site, trending east to south west, with an elevation of approximately 75m AOD. Low ground continues south west of the site, giving rise to a number of water features to the south of the site boundary (see hydrology section below).

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the site comprises the Clwyd Limestone Group, i.e. limestone with interbedded sandstone layers. The majority of the site is also covered in a layer of glacial till. The exception is the far west of the site, which is shown to contain only bedrock deposits. This was the only section of the site accessible on the day of the site walkover.

From general observations made on site, outcrops of bedrock were present and cuttings into the soil made by livestock revealed shallow, mineral-based soils. Given the lushness of the pasture, it is likely that the soil in this area of the site is rich in agricultural nutrients. As a result, and given the location's unsuitability for wetland creation, no soil samples were taken at this location.

Hydrology and hydrogeology: Given the presence of the two hills in the north and south of the site, surface water inflows to the site are restricted and the surface water catchment to the site itself is small. A review of OS mapping shows that there are no surface water streams or drainage ditches that enter the site from the surrounding catchment. There are, however, two ponds located in the strip of low ground that runs through the centre of the site. In addition to this, a spring is shown to be present on OS mapping which arises along the site's south eastern border, from which a small watercourse originates and flows southwards away from the site. NRW online flood mapping shows that the site does not lie within a fluvial Flood Zone and the majority of the site is considered to be at low risk of surface water flooding. The only area shown to be prone to localised ponding is in the topographic low in the east of the site, although this was not surveyed on the day of the site walkover.

BGS 1:625,000 hydrogeological mapping the bedrock beneath the site comprises a moderately productive aquifer with a rapid response to rainfall. The site is also free from

superficial deposits and recharge to the aquifer is therefore likely to be high, meaning that standing water is unlikely to occur for prolonged periods of time.

The bedrock aquifer beneath the site forms part of the Ynys Môn Central Carboniferous Limestone WFD groundwater body (GB41001G204200). The overall status of the water body is poor due to poor chemical quality.

Water quality interpretation: Given the absence of surface water in the section of site visited, no surface water samples were taken during the site walkover. Site observations also deemed that peat was not present within the area surveyed and therefore no soil samples were taken.

Ecology: The surveyed area comprised dry species-poor semi-improved neutral grassland. The only wet areas were at the very edge of the site where it met heathy vegetation within Cors Goch SSSI.

Management and condition: The grassland gave no indication of agricultural improvement but was well-grazed by horses.

Landscape context: The site is adjacent to Cors Goch SSSI/NNR, part of the Anglesey Fen SAC, a site supporting alkaline and calcareous fen of international importance.

Suitability as a compensation site: The surveyed area was at the top of a hill above the spring line feeding Cors Goch SSSI and so is unsuitable for wetland creation or enhancement, and there was no indication of wetter areas in unsurveyed areas. The suitability rating of the surveyed area of Site 19 has therefore been determined as None.

6.14 Site 24

NGR: SH 4943 7671 **Area:** 27.8ha

Ownership: Five owners **Designation:** None

Distance to Tre'r Gof SSSI: 21.6km

Survey date(s): 28 September 2016, 9 November 2016, 15 March 2017, 25-28 July 2017

Land use: The majority of the site has been drained in order for it to be used as pasture. The northern portion of the site appears to have been improved for grazing cattle, with no evidence of cattle or sheep in the south. Cors Bodeilio SSSI occupies the area of land to the north east of the site boundary and to the west is Caeau Talwrn SSSI. The land surrounding the site is used for both sheep and cattle grazing, with minor roads lying along the southern and western boundaries. The village of Talwrn lies approximately 250m to the north west, with two residential properties in the north western corner of site and dairy farms on both its northern and western borders.

Topography: The site is formed in a basin that lies at the head of a shallow valley, enclosed by higher ground to the north, east, south and south west, with the valley sloping gently downwards towards the north east (figure A-15). The elevation of the site ranges from approximately 41m AOD in the south west, to 29m AOD in the north east. The elevation of the surrounding hills rises to a maximum of approximately 70m AOD in the north, 55m AOD in the east and 60m AOD in the south and south east. The high ground along the west is projected north east into the valley as two low elongated hills, creating three sub-valleys which extend towards the centre of site. The main watercourse flows along the valley bottom and given that the gradient of the site is relatively gentle, the potential for water retention is high. The basin is open to the north east, with low ground extending to Cors Bodeilio SSSI.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the majority of the site comprises the Clwyd Limestone Group, i.e. limestone with interbedded sandstone. The entire eastern portion of the site, however, is underlain by schist, quartzite and pillow lavas belonging to the Gwna Group. A layer of glacial till covers the bedrock across the whole of the site, with alluvium overlying the till in the north, where the drainage network merges with the main watercourse, which flows north east through the site. The thickness of the till is not known so it is uncertain as to how much groundwater / surface water interaction there is at this site.

Five soil cores were taken during the site walkover (figure A-15). The results of the coring showed that peat was present at two locations (24.10 and 24.11) in the north east of the site, adjacent to Cors Bodeilio SSSI. At both locations, peat was only present at the top of the cores, to a depth of only 0.2m, with the remainder of the sample comprising of a gleyed, clay soil, with a calcium-rich, coarse grained sand layer at the base of the cores, interpreted to be derived from the limestone bedrock underlying the site. The peat at the top of both cores was found to be stiff and well structured, very dark brown/black in colour, poorly decomposed, high in organic matter content and with relatively low moisture content.

Mineral soils were encountered at all other sample locations (24.12, 24.13 and 24.14). In the north of the site (24.12), 0.2m of fibrous loam topsoil was encountered, with 0.2m of stiff, gleyed clay below, comprising mottled orangey/red staining throughout (indicating reducing conditions). At the base of the core, a thin layer of white sandy soil was found, with visible calcite flakes. The cores taken at the north eastern boundary of the site, adjacent to Cors Bodeilio SSSI (24.13), and in the east of the site (24.14) exhibited similar compositions, with the core at 24.14 comprising a more distinct gravel layer at the base of the core.

Hydrology and hydrogeology: The main inflow into the site appears to be from surface water runoff from the surrounding catchment, from groundwater, and from direct rainfall. All drainage ditches, including the main watercourse which runs through the centre of the site, rise within the site boundary, as opposed to flowing into it (plates 89, 92, 93, 94, 100 and 103). The main watercourse rises along the site's western border, flows north east through the centre of the valley, and exits the site via its north eastern corner. A complex network of drainage ditches discharges into this watercourse from either side, which also flow in a north easterly direction. A spring was identified at the head of the drainage ditch from which sample TA2 was taken. Running water was audible, and could be seen flowing through the soil profile, into the drainage ditch. These features are shown in figure A-15.

A spring (close to where a well is denoted on the 1:25,000 OS map) was also identified within pasture at the head of the valley in the south of site, with an area of approximately $1m^2$ comprising a mounded springhead of calcite (plate 98). There were drains immediately to the south, north and north west of this spring, the former draining the up-gradient area of pasture via a pipe (figure A-15).

Given the presence of superficial deposits, restricting groundwater recharge into the underlying bedrock, the presence of the surrounding hills and the topographic low in the north east of the site, the potential for water retention is high. NRW online flood mapping shows the site does not lie within a fluvial Flood Zone but it is at high risk of surface water flooding, with a risk of deep ponding throughout the site, particularly in the north east.

Due to the impermeable layer of glacial till that covers the site, recharge rates into the underlying bedrock aquifer are likely to be low, resulting in wet and boggy ground conditions being maintained across the site. The potential for groundwater flows into the site arises from a variety of sources, but mostly where the topography flattens out within the valley bottom. There are two wells within the site boundary, and another seven within 200m of the site, although it is not known if water is abstracted from these wells or whether this could influence stream flow through the site.

The bedrock aquifer beneath the west of the site forms part of the Ynys Môn Central Carboniferous Limestone WFD groundwater body (GB41001G204200). However, the bedrock aquifer underlying the east of the site forms part of the Ynys Môn Secondary WFD groundwater body that covers much of Anglesey (GB41002G204400). The overall status of both water bodies is poor due to poor chemical quality.

Water quality interpretation: Four surface water (24.1, 24.4, 24.5, and 24.8), and five soil samples (24.12, 24.13, 24.14, 24.10 and 24.11) were collected during the September 2016

site walkovers, with a further two surface water samples (24.3 and 24.9) collected in November 2016 (figure A-15). Six water samples were collected in March 2017 and a further eight water samples were then taken in July 2017, mostly from the same locations as in 2016.

The pH of the leachate from the soil samples was slightly alkaline (pH 7.9-8.3) and calcium concentrations and bicarbonate concentrations were relatively high which is not unusual for an area underlain by limestone. Concentrations of major ions and nutrients in the soil leachate were low, with the exception of sodium concentrations at 24.14 and 24.10, and leachable sulphate concentrations, which were elevated in the east of the site (location 24.10).

The pH of the surface water samples was neutral to slightly alkaline (maximum of 8.3 which was in 2016), due to calcium and bicarbonate concentrations being high, likely due to leaching from the soil, or possibly from the limestone bedrock depending on the thickness and permeability of the till. The exception is location 24.10 which was only sampled in 2017 and which had distinctly lower calcium and bicarbonate concentrations than all of the other locations. In 2016 there was also some carbonate as well as bicarbonate alkalinity in samples 24.1 and 24.5, which is unusual, and this is the only location where this has been detected in surface water. This is likely due to the limestone bedrock, which suggests that the limestone plays a role in local water quality and that the till may not be acting as an impermeable layer across the site. However, there is a high degree of uncertainty associated with this and on site borehole drilling would be required to assess the likely degree of interaction. Concentrations of major ions and nutrients were generally low, but all surface water samples had relatively high concentrations of total dissolved solids in 2016 and 2017. During 2016 and 2017 nitrate and sulphate concentrations were slightly elevated at locations 24.1 and 24.3 in comparison to the other locations. In comparison to other locations sulphate was elevated in 24.4 in 2017 (it was not sampled in 2016) whilst nitrate was slightly elevated at 24.6 in 2017 (not sampled in 2016). In comparison to other locations, sample 24.1 was very high in total phosphorous (unfiltered); as this sampling location was immediately downstream of a dairy farm, contaminated runoff from the farm is a possible cause of these elevated concentrations. Through discussions held with a local landowner on site, it was identified that there is a septic tank in the Bron Haul farm area, which up until 2 years ago, had been leaking into the drainage ditch in the north of the site.

Electrical conductivity readings were relatively high for all surface water samples, but the samples in the north of the site (24.1 and 24.4) had the highest readings, indicative of a greater degree of mineral enrichment in this portion of the site. Redox levels were highest in the drainage ditches and watercourses with the highest flows (24.1, 24.4 and 24.5), indicative of more well aerated, flowing water, compared to other sample locations. This was also confirmed by the low turbidity readings and high dissolved oxygen readings for all surface water samples collected.

Ecology:

Notable Species

- Bog pimpernel
- Common butterwort (*Pinguicula vulgaris*)

- Dioecious sedge (*Carex dioica*)
- Fen fragrant orchid (*Gymnadenia densiflora*)
- Fen pondweed (*Potamogeton coloratus*)
- Few-flowered spike-rush (*Eleocharis quinqueflora*)
- Grass-of-Parnassus (*Parnassia palustris*)
- Greater spearwort (*Ranunculus lingua*)
- Lesser water-plantain (*Baldellia ranunculoides* subsp. *ranunculoides*)
- Long-stalked yellow sedge (*Carex lepidocarpa*)
- Marsh helleborine (*Epipactis palustris*)
- Parsley water-dropwort
- Great fen-sedge

Vegetation

The northern and southern parts of the valley contrasted markedly (figure G-5), the north comprising improved pasture and the south largely unimproved rich-fen. The vegetation of the northern and southern parts of Site 24 are described separately below and their floras are also listed separately in appendix E.

Northern area:

- The pastures of the northern part of site had been drained and improved, and the vegetation occupying the lower-lying areas was a species-poor wet pasture dominated by creeping bent (*Agrostis stolonifera*), with inundated areas with frequent marsh foxtail (*Alopecurus geniculatus*) and common spike-rush (*Eleocharis palustris*) locally dominant, and areas of hard rush (*Juncus inflexus*) (plates 87 and 88). The lowest-lying area adjacent to Cors Bodeilio SSSI consisted of swampy vegetation dominated by common sedge (*Carex nigra*) and common spike-rush. Here there was also a very small stand of great fen-sedge where plants had colonised from Cors Bodeilio SSSI (plate 92).
- The main ditch running through the middle of this area was shaded and species-poor, dominated by fool's watercress. Ditches to the north (plates 89 and 90) had been cleared in the last two years, were species-rich and supported a calcicolous aquatic flora: common stonewort (*Chara vulgaris*) and the nationally scarce fen pondweed were dominant, brookweed (*Samolus valerandi*), lesser water-parsnip (*Berula erecta*) and water horsetail were frequent to abundant and there were a few plants of lesser water plantain (*Baldellia ranunculoides* subsp. *ranunculoides*) and, in deeper water, bristly stonewort (*C. hispida*). Wefts of algae were also frequent and long-stalked yellow sedge was abundant along some banks.
- An area of land to the west of site was not surveyed due to access refusal but it also appeared to support only improved grassland with rushes in lower-lying area

Southern area:

- The majority of the pasture to the south comprised a mosaic of species-rich fen meadow (plates 94, 95 and 97). Grazing and hydrogeological variation manifested a mix of M22a

Juncus subnodulosus-Cirsium palustre, typical sub-community and M22b *Trifolium repens-Briza media* sub-community, transitional areas of M23a *J. acutiflorus/effusus – Galium palustre* rush pasture, *J. acutiflorus* sub-community and M24b *Molinia caerulea-Cirsium dissectum* fen meadow, typical sub-community. In one area the latter gave place on lower wetter ground to small, species-poor stands of MG8 *Cynosurus cristatus-Caltha palustris* grassland. Throughout were coarser stands of vegetation, such as M27 *Filipendula ulmaria-Angelica sylvestris* mire and rush-infested areas resulting from disturbance.

- In the west of site at the head of the valley was an area of M13 *Schoenus nigricans-Juncus subnodulosus* mire. This included a mounded spring head of very open vegetation, more extensive short lawns of byrophytes and sedges, and coarser black bog-rush vegetation. Numerous rich-fen vascular plant species were found here, e.g. common butterwort, dioecious sedge, fen fragrant orchid, few-flowered spike-rush, grass-of-Parnassus and marsh helleborine.
- Fen vegetation had been modified in a pair of fields in the eastern corner of the site (plates 104 and 105). The lower-lying halves of these fields were swampy and very species-poor, dominated by stands of brown sedge, common sedge, or blunt-flowered rush. Greater spearwort was found in this area at the boundary with Cors Bodeilio. The drier eastern halves of these fields were improved grassland or species-poor rush-pasture.
- The raised ground to the west of site extended east into areas of fen, and much of this drier ground had been converted to agricultural grassland. Some drier areas were recognisable as MG5 *Cynosurus cristatus-Centaurea nigra* grassland, but were relatively species-poor examples of this community. A large field of predominantly semi-improved neutral grassland had been cut for hay shortly before the vegetation survey and was not surveyed.
- The rich ditch flora seen in the northern pastures was repeated in some of the ditches draining the bottom of the southern part of site, with colonist species abundant, e.g. fen pondweed and stoneworts.

Management and condition: The southern side of the valley was largely unimproved and the fen grazing in good condition, presumed to be grazed by sheep. However, there were clearly ongoing attempts to drain the land and some areas have been impoverished by improvement and ditching operations. Fen vegetation in the two fields in the eastern corner of site was in a degraded state owing to neglect and attempts to improve them. Higher ground to the south and the whole of the northern part of site had been improved.

Landscape context: Cors Bodeilio SSSI lies along the eastern edge of site, downstream of site along the valley. Caeau Talwrn SSSI is located on the western side of the road which forms the western boundary of site; the higher ground at the western end of site forms the watershed between the two sites. Cors Bodeilio SSSI is part of the Anglesey Fens SAC, supporting alkaline and calcareous fen of international importance. Units of Caeau Talwrn SSSI further to the north west also form part of the Anglesey Fens SAC.

Suitability as a compensation site: Unimproved rich-fen habitat occupied approximately 40% of the surveyed area of Site 24, including a small area of habitat referable to 'Alkaline

fens' listed on Annex I of the Habitats Directive. The site is botanically-rich, with numerous species and plant communities characteristic of rich-fen habitats. Fen fragrant orchid, for instance, is listed in accordance with Section 7 of the Environment (Wales) Act 2016, and fen pondweed is nationally scarce.

The hydrology of the existing rich-fen appeared to be broadly replicated in improved areas of pasture in most of the remainder of site, with clay soils supplied by calcium-rich groundwater via seepage and springs. It therefore seems likely that fen vegetation can be created in areas of improved grassland in the fields to the north and east, estimated to be 7.2ha. The potential of improved fields to the south is less clear. Access was refused to approximately a quarter of the site and this land may also provide additional area suitable for rich-fen creation.

The work needed to achieve rich-fen creation within agriculturally improved areas would involve the filling, blocking or diversion of ditches, removal of improved turves and re-landscaping, and introduction of propagules from rich-fen vegetation to establish new habitat. Rich-fen could also be created by clearing approximately 0.9ha of scrub in the south-west of the site. Existing fen vegetation within the site could be used as a source of plant propagules and as a source for future dispersal around site by grazing animals. Fen creation would mirror vegetation of unimproved areas of site and within Cors Bodeilio SSSI [RD19] with fen meadow and alkaline fen created on the slopes and upper reaches of the valley, and swamp communities dominated by reed or great fen-sedge established in the valley bottom.

The site also offers the opportunity to secure approximately 8.2ha of existing rich-fen habitat, including a small area of alkaline fen at the head of the south western valley. This existing habitat is not appropriately managed and areas have been damaged by drainage or other agricultural works, including areas of alkaline fen, and there are extensive species-poor areas such as the lower parts of the fields in the east. This area would therefore be suitable for enhancement as part of the compensation proposal and, as this also has no designation, the compensation proposal would be an opportunity to secure this important site for nature conservation.

Finally, on a wider ecological and landscape scale, the site offers the potential to extend Cors Bodeilio SSSI (a constituent unit of the Anglesey Fens SAC) upstream into one of the site's natural headwater valleys. In addition to increased extent and landscape connectivity, this may have other benefits for the integrity of the SSSI, such as improvements in water quality and management.

In conclusion, Site 24 is suitable for a significant area of habitat creation and habitat enhancement, including of existing alkaline fen. The suitability rating of the site has therefore been determined as High.

6.15 Site 25

NGR: SH 4780 7821 **Area:** 3.8 ha

Ownership: One owner **Designation:** None

Distance to Tre'r Gof SSSI: 19.5km

Survey date(s): 3 - 4 November 2016, 16 March 2017, 10-14 July 2017

Land use: On the day of the site walkover surveyors had access to the north east of the site only. This part of the site is grazed lightly by cattle and is primarily maintained as cover for game. The surrounding land, including the catchments to the north east and north west, has been improved for grazing sheep and cattle. The B5110 lies approximately 150m west of the site and the road to Talwrn lies immediately to the north. A public right of way passes directly through the site. Four farm smallholdings lie within close proximity of the site, three of which lie within the site's surface water catchment. Site 26 lies immediately south of the site.

Topography: The site lies within a shallow basin at the head of a valley, which drains to the south west, with hills to the north, east and west (figure A-16). The elevation of the site ranges from 60m AOD in the north east to 53m AOD in the south west. The hills to the north, east and west reach maximum elevations of 78m AOD, 82m AOD and 64m AOD, respectively. The site is open to the south west, and a low-lying area of land exists beyond the site's southern border (extending into site 26).

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the majority of the site comprises the Lligwy Sandstone Formation. The eastern portion of the site, however, is underlain by the Clwyd Limestone Group, i.e. limestone interbedded with sandstone. A layer of glacial till covers the bedrock across the whole of the site, with alluvium overlying the till in the site's centre, where the drainage ditches flow south west through the site.

Two soil cores were taken during the site walkover (figure A-16). The results of the coring showed that mineral soils were present in the north east of the site (25.4) and in the north of the site, to the west of the drainage network (25.5). These soils were clay based, with the core taken at 25.4 comprising of some 0.2m of organic topsoil, overlying 0.8m of stiff, gleyed clay, containing a layer of white sandy soil and limestone gravel clasts at its base. The core taken at 25.5 exhibited a similar composition, but with a much higher moisture content in the topsoil (water table was at ground level) and with some iron staining present within the clay section of the core.

Hydrology and hydrogeology: An unnamed Ordinary Watercourse issues within the site boundary (plate 106), along the site's north western border, flows south east towards the site's eastern border, and then turns south west, before flowing through the centre of the site. To the south of site, this watercourse becomes the Afon Canol-dydd. The watercourse meets a drainage ditch in the centre of the site, trending north west to south east (plate 111). To the south west of this ditch, another channel flows south west, towards the site's southern border. At this location, a spring/seepage area was encountered. At this location Ordnance Survey

mapping shows a watercourse which flows through the valley and into the centre of site 26. NRW online flood mapping shows that the site does not lie within a fluvial Flood Zone but it is at high risk of surface water flooding, with a risk of deep ponding in the area surrounding the watercourse in the centre of the site.

Due to the impermeable layer of glacial till that covers the site, recharge rates into the underlying bedrock aquifer are likely to be low, resulting in wet and boggy ground conditions across the site. However, the thickness of the till is not known and so there is a degree of uncertainty regarding groundwater / surface water interactions. There is a well located within the site boundary, although this was not found during the site walkover, and a spring is present in the south of the site.

The bedrock aquifer beneath the site forms part of the Ynys Môn Central Carboniferous Limestone WFD groundwater body (GB41001G204200). The overall status of the water body is poor due to poor chemical quality.

Water quality interpretation: Three surface water (25.1, 25.2 and 25.3) and two soil samples (25.4 and 25.5) were collected during the November 2016 site walkover, which was carried out in dry weather conditions (figure A-16). All three water sample locations (25.1, 25.2 and 25.3) were also sampled in March 2017 and again in July 2017.

Laboratory analysis could only be undertaken on the soil sample taken at 25.4. The pH of the leachate from the soil at 25.4 was slightly alkaline (pH 8.4) and the concentration of calcium and levels of alkalinity were high. Concentrations of major ions and nutrients in the soil leachate from sample 25.4 were generally low, with the exception of sodium and sulphate which were very slightly elevated.

The pH of the surface water samples was broadly neutral (pH 7-8) and alkalinity levels and calcium concentrations were high, which suggest leaching from calcareous soils. Concentrations of major ions and nutrients were generally low, although in comparison to other locations nitrate was slightly elevated in 25.1 in 2016 and 2017. The concentration of iron in sample 25.3 in 2016 was elevated, as was the concentration of sulphate in sample 25.1 in both 2016 and 2017. Total unfiltered phosphorous concentrations were also slightly elevated in all three samples during all three rounds of sampling, although as the analysis was on unfiltered samples this could have been due to suspended sediment which was high in all samples. Electrical conductivity readings were high for all surface water samples, also indicative of mineral enrichment. Redox values were low in sample 25.3, indicative of slow moving, or stagnant water, but high in samples 25.1 and 25.2, where the water was faster flowing in the surface water drainage network.

Ecology:

Notable Species

- Black bog-rush
- Bog pimpernel
- Dioecious sedge
- Fen pondweed

- Long-stalked yellow sedge
- Parsley water-dropwort
- *Philonotis calcarea*

Vegetation

Rich-fen vegetation occupied almost the whole site (figure G-6) and was very rich, with zonation associated with topography and groundwater seepage. The stream which divided the site (plate 107) separated two distinct areas, the eastern lower-lying and flatter area being strongly influenced by groundwater seeping into site from below the low escarpment along the eastern boundary. The vegetation here was dominated by blunt-flowered rush, and in areas of accumulation of groundwater were areas of short open vegetation dominated by bryophytes and small sedges, e.g. long-stalked yellow sedge and *Campylium stellatum*, with frequent black bog-rush (M13 *Schoenus nigricans-Juncus subnodulosus* mire). The very wet upper reaches of these seepage areas were dominated by common cottongrass and *Calliergonella cuspidatum*, and a similar community occupied topographic depressions elsewhere.

The vegetation of the western half of site was more varied, largely owing to topography. Set within rank blunt-flowered rush and meadowsweet vegetation, the flat ground toward the north (plate 108) supported an area dominated by purple moor-grass with abundant blunt-flowered rush and carnation sedge, while devil's-bit scabious, tawny sedge (*Carex hostiana*) and tormentil (*Potentilla erecta*) were frequent (M24b *Molinia caerulea-Cirsium dissectum* fen meadow, typical sub-community). Where groundwater throughput accumulated between tussocks of the purple moor-grass, short bryophyte- and small sedge-dominated vegetation, was present with e.g. dioecious sedge, *Campylium stellatum* and *Philonotis calcarea* (M10 *Carex dioica-Pinguicula vulgaris* mire). There was also a small amount of black bog-rush here. At a similar elevation but on drier ground to the west was neutral grassland (MG5 *Cynosurus cristatus-Centaurea nigra* grassland). The sloping ground below these areas was dominated by blunt-flowered rush (M22 *Juncus subnodulosus-Cirsium palustre* fen meadow), which took on a particularly swampy and species-poor character toward the bottom of the slope with abundant water horsetail.

An area of pasture in a small field in the north east of site below the road (plate 106) had a different character to the fen vegetation within the main fen complex. This was associated with a shallow area of strong seepage above the stream, with drier ground above showing evidence of improvement. The vegetation was dominated by soft and hard rushes, while blunt-flowered rush was frequent albeit of low cover. Wetland herbs such as greater bird's-foot-trefoil, marsh thistle and ragged robin were frequent to abundant. This area had been heavily poached.

Through most of the site the stream was completely consolidated with aquatic plants forming a loose mat, dominated by water horsetail.

Management and condition: The fen vegetation over much of Site 25 was evidently not grazed regularly or at any intensity, the site being maintained as game cover. As such, the vegetation across much of the site was coarse, and areas of alkaline fen could likely be extended under appropriate management. Parts of the stream were dominated by fool's

watercress and there was a little watercress in one seepage area; these may indicate concentration of nutrients from the farmland. To the north west below the field gate, the vegetation had been mown short and heavily disturbed over autumn/winter 2016.

Landscape context: Site 25 is surrounded by improved pasture and lies at the head of a long valley. It therefore has no direct connectivity with similar areas of semi-natural vegetation. However, Site 26 extends southward from Site 25, connecting two compartments of Caeau Talwrn SSSI. The latter sites comprise pasture with vegetation similar to Site 25.

Suitability as a compensation site: Almost the whole of Site 25 comprised rich-fen, including alkaline fen, listed on Annex I of the Habitats Directive, and although the site is not suitable for habitat creation it has high nature conservation value. As the site is currently under or unmanaged, the site offers the opportunity for enhancement by the introduction of suitable management, and enhancement could also seek to extend existing areas of alkaline fen within Site 25. Moreover, as this important site is presently undesignated, securing it as part of the compensation proposal would also represent an enhancement.

Site 25 is part of an ecological network, comprising the two units of rich-fen within Caeau Talwrn SSSI to the south. If Site 25 were therefore combined with Site 26 (section 6.16), as part of the compensation proposal then this would establish an extensive and ecologically coherent valley fen system significantly enhancing an Anglesey Fens SAC site. This is further discussed in section 6.16.

In summary, Site 25 is not suitable for rich-fen habitat creation, but does support important rich-fen habitat that could be enhanced through management, and forms part of an important ecological network. The suitability rating of Site 25 has therefore been determined as High if it were taken forward as part of this larger network.

6.16 Site 26

NGR: SH 4741 7775 **Area:** 21.7ha

Ownership: Two owners **Designation:** None

Distance to Tre'r Gof SSSI: 19.6km

Survey date(s): 14 October 2016, 4 November 2016, 16 March 2017, 11 July 2017, 26 July 2017

Land use: The site lies adjacent to, and connects, compartments of Caeau Talwrn SSSI, which runs along part of the site's western and southern borders and comprises unimproved grassland and fen vegetation. Site 25 to the north is also unimproved fen. Site 26 consists of improved pasture, used for both sheep and cattle grazing, as is the surrounding land. The B5110 runs along part of the western boundary of the site and a number of farm smallholdings are located within the site's surface water catchment, mainly in the north.

Topography: As with Site 25, the site lies within a basin at the head of a valley, which drains to the south west, with low hills to the east and west (figure A-17). The elevation of the site ranges from 65m AOD in the north east to 38m AOD in the south. The hills to the east and west reach maximum elevations of 80m AOD and 65m AOD, respectively. Site 25 lies immediately north of the site, slightly further up the valley on higher ground. The site is open to the south and south west, and the Ordinary Watercourse exits the site via its southern border, flowing south west.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the majority of the site comprises the Lligwy Sandstone Formation, with interbedded sandstone and conglomerate. The far north east and south east portions of the site, however, are underlain by the Clwyd Limestone Group. A layer of glacial till covers the bedrock across the majority of the site (with the exception of the far east of the site where there is no drift cover), with alluvium overlying the till in the west, along the route of the Ordinary Watercourse.

Five soil cores were taken during the site walkover (figure A-17). The results of the coring showed that peat was present in the west of the site, approximately 30m east of Caeau Talwrn SSSI. The core at this location reached a depth of 0.6m and comprised 0.5m of gleyed, clay mineral soil, overlying a 0.05m layer of peat, which itself then overlays a 0.05m layer of white/grey sand, containing gravel clasts. The peat was found to be relatively well decomposed, with low moisture content. Being deeply buried and very local, the presence of peat is not relevant to current site processes.

Mineral soils were encountered at all other sample locations (26.6, 26.7, 26.9 and 26.10). In the south of the site (26.6), 0.2m of organic, sandy topsoil was encountered, overlying 0.3m of white/grey sand, with what was interpreted to be limestone clasts, and orange staining, likely caused by the presence of iron oxide. The core taken in the centre of the site (26.7) exhibited a similar composition, but with a core depth of 1.2m. The bottom 0.6m of the core comprised the same white/grey sandy soil, with larger gravel clasts and orange/yellow staining. The same white/grey soil was found in the soil core taken to the west of the Ordinary

Watercourse and 35m south of Caeau Talwrn SSSI. The only core to show a differing soil profile was that taken at 26.12, which comprised 0.4m of a brown silty clay soil.

No soil coring was undertaken in land to the north of the watercourse but the soil profile was exposed in the bank of a recently cut ditch running north west at a right angle to the watercourse. This showed a 0.1m thick band of marl, approximately 0.5m below the surface.

Hydrology and hydrogeology: An Ordinary Watercourse rises to the north east of the site, flows south west through the centre of site along the valley bottom and then exits the site via its southern boundary. Along its length, several drainage ditches, which originate within the site boundary, discharge into the watercourse from the east, one of which drains a spring (plate 114). In addition, another Ordinary Watercourse (plate115), which drains the high ground to the east and north east, enters the site via its eastern border and discharges into the Afon Canol-dydd. The landowner reported that there is also an extensive network of sub-surface drainage draining the site.

Downstream of the tributary, the Afon Canol-dydd gains Main River status. NRW online flood mapping shows that the site does not lie within a fluvial Flood Zone but it is at high risk of surface water flooding, with a risk of deep ponding throughout the site, although this is confined to the watercourse channels and their immediate surrounds.

Due to the impermeable layer of glacial till that covers the site, recharge rates into the underlying bedrock aquifer are likely to be low, resulting in wet and boggy ground conditions across the site. However, the thickness of the till is not known and so there is uncertainty regarding surface water / groundwater interactions at the site. A large area of groundwater seepage was identified during the site walkover, in the central portion of the site, and was found to be providing flow to the drainage ditches which trend west towards the Ordinary Watercourse. OS mapping shows a well located within the south east of the site, adjacent to Canol-dydd farm (ruins), although this could not be found on site. There is also a well shown to be located 150m south of the site boundary, although it is not known if water is abstracted from this well or if this could influence stream flow through the site.

The bedrock aquifer beneath the site forms part of the Ynys Môn Central Carboniferous Limestone WFD groundwater body (GB41001G204200). The overall status of the water body is poor due to poor chemical quality.

Water quality interpretation: Three surface water samples (26.1, 26.2 and 26.3) were collected in October 2016, with a further two surface water samples (26.4 and 26.5) and five soil samples (26.6, 26.7, 26.8, 26.9 and 26.10) collected during the site walkover in November 2016. A further five water samples were collected in March 2017 and an additional four samples (CAN1 was not sampled) in July 2017, all at the same locations as sampled in 2016 (figure A-17).

Laboratory analysis could only be undertaken on three of the five soil samples. The pH of the leachate from the soil was slightly alkaline (pH 8.2-8.4) and calcium concentrations and alkalinity levels (both carbonate and bicarbonate) were relatively high, suggesting that it contained limestone. Concentrations of major ions and nutrients in the soil leachate were

generally low, with the exception of nitrate concentrations at 26.5, and particularly at 26.7, which were slightly elevated. The concentration of sulphate at 26.9 was also slightly elevated.

The pH of the surface water samples was neutral (pH 7-8) during both sampling rounds, with elevated bicarbonate and calcium concentrations in comparison to many of the other sites sampled. The calcium carbonate was elevated in the soils and leaching is likely to have caused the elevated concentrations in the water. Concentrations of other major ions and nutrients in the surface water samples were generally low to moderate. Several locations had high concentrations of total phosphorous, but this is almost certainly as a result of the high suspended solids concentration in the water samples.

Ecology:

Notable Species

- Parsley water-dropwort

Vegetation

Site 26 comprised improved and semi-improved pasture (figure G-7). Two fields at the southern end of site had been reseeded with rye-grass and white clover (*Trifolium repens*) during the summer of 2016 (plate 119), and all of the higher ground was similarly improved. Rushy communities dominated by hard rush and/or soft rush (MG10 *Juncus effusus-Holcus lanatus* rush pasture) marked out areas of seepage along breaks in the valley slopes or occupied low-lying, flatter ground above the stream (plates 112, 113 and 117). In the north of site were two small areas of species-poor blunt-flowered rush-dominated vegetation (M22 *Juncus subnodulosus-Cirsium palustre* fen meadow) set within improved rushy pasture.

There were numerous ditches and these, with the two streams, were largely dominated by a species-poor eutrophic flora, with abundant fool's watercress, or overgrown with bramble. However, one ditch draining a spring within the pasture on the eastern valley slope (plate 114) supported a relict fen flora, with frequent blunt-flowered rush and occasional parsley water-dropwort. The spring had abundant marsh arrow-grass (*Triglochin palustre*) but was dominated by floating sweet-grass.

Management and condition: The vegetation was in a similar condition to the surrounding pasture and was well grazed. There had been some recent ditch maintenance works in the north, with arisings placed on the banks, damaging the vegetation.

Landscape context: Site 26 connects two compartments of Caeau Talwrn SSSI (section 6.18) which is part of the Anglesey Fens SAC, supporting alkaline fen habitat of international importance. One such compartment of the SSSI lies on the western valley slope opposite the main area of Site 26 (Caeau Talwrn SSSI (North), section 6.18), the other to the south where a second stream meets the stream draining Site 26. Site 25 (section 6.15) lies immediately to the north at the head of the valley and supports rich-fen.

Suitability as a compensation site: Given the few fen plants found along one of the ditches, small areas of relict fen vegetation within the northern area of site and the situation of the site to Caeau Talwrn SSSI (North), Site 26 clearly once supported fen vegetation but it has been

lost through drainage and other land improvement works. However, the underlying physical conditions are still conducive to rich-fen, with zones of seepage along the valley slope and water and soil samples demonstrating high pH and calcium content across site. Site 26 is therefore likely to be suitable for the creation of rich-fen habitat, estimated to be approximately 13.3ha, comprising land lying below the apparent seepage lines along the valley.

Within the area identified for creation of rich-fen habitat, habitat creation would aim to mirror the vegetation seen at Caeau Talwrn SSSI (North) (section 6.18) and Site 25 (section 6.15), with fen meadow established on the slopes and drier areas and alkaline fen around areas of strong seepage. Except for the spring described above, the valley was not found to be especially wet, likely owing to drainage, including subsurface drainage, and the influence of the main valley stream, which in places was over 1.5m deep. Habitat creation works would therefore aim to remove these drainage features, including subsurface drainage. The stream that enters site from the east offers potential to make the site wetter, providing a further source of calcium-rich water in the eastern part of site.

If creation of fen habitat were successful, Site 26 would link the two compartments of Caeau Talwrn SSSI (a constituent unit of the Anglesey Fens SAC) and Site 25. This combined unit would form an almost complete valley fen system and a continuous area of rich-fen habitat of approximately 18ha, and provide additional recilience to Caeau Talwrn SSSI through management of the headwaters.The site would form an island of semi-natural vegetation in an intensively farmed landscape so it would be necessary to control some of the surrounding land to regulate access, management, and contamination by nutrients and other pollutants.

In summary, Site 26 is suitable for a potentially significant area of rich-fen habitat creation which, if successful, would connect areas of the Anglesey Fens SAC and important rich-fen in the valley head at Site 25. Considered on its own or together with Site 25 and Caeau Talwrn SSSI (North), the suitability rating of Site 26 has therefore been determined as High.

6.17 Site 32

NGR: SH 4796 7925 **Area:** 26.4ha

Ownership: Six owners **Designation:** Prysan/Galchfaen/Fagwyr Fawr WS

Distance to Tre'r Gof SSSI: 18.7km

Survey date(s): 13 October 2016, 1 November 2016, 16 March 2017, 26 July 2017

Land use: On the day of the site walkover, surveyors had access to the north east and southernmost sections of the site only. The majority of the valley, of which Site 32 forms a part, is used for grazing sheep and cattle. The northern end of the site comprises an area of unimproved fen, occasionally grazed by cattle and used as cover for game. Grazing is more intensive to the north and east. In the centre of the north eastern portion of the site, along the valley floor, an area has been set aside from agricultural use and dug with ponds for amenity and wildlife conservation purposes. The B5110 runs approximately 200m to the west and there are three residential properties situated between the site's western border and the road, one of which is derelict. There are also a number of farm smallholdings located on the hillsides to the north and east, and three public rights of way cross the site.

Topography: The site occupies an area of relatively flat ground at the base of a series of hills to the north and east of the site (figure A-18). The hills to the north reach a maximum elevation of 110m AOD, which drops steeply to 80m AOD at the site's north eastern border. The hills to the east of the site reach a lower maximum elevation of around 85m AOD. A low-lying area of land exists immediately south of this, within the site, elevated at around 60m AOD where the Glan Gors Main River lies. The south of the site is at a slightly lower elevation of 55m AOD. The south of the site is open to the south west, where the Afon Glan Gors flows into the Afon Clai.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the majority of the site comprises the Lligwy Sandstone Formation, with interbedded sandstone and conglomerate. The far north east portion of the site, however, is underlain by the Clwyd Limestone Group. A layer of glacial till covers the bedrock across the whole of the site, with alluvium overlying the till in the site's centre, along the route of Afon Glan Gors.

Two soil cores were taken during the site walkover (figure A-18). The results of the coring show that mineral soils were encountered in the north of the site, to the east of the Afon Glan Gors (32.6) and in the far north of the site, west of the drainage network (32.7). At sampling location 32.6, 0.3m of soil was recovered, before the auger could not penetrate any further. The top 0.15m of the core comprised a light brown, fibrous topsoil with rootlets throughout and a lower 0.15m of a dark brown/black soil, containing iron staining. At location 32.7, a 0.05m layer of marl-like clay soil was encountered at the top of the 0.3m core, overlying the same dark brown/black fibrous soil found at 32.6. Both cores had a low moisture content throughout.

Hydrology and hydrogeology: The Afon Glan Gors originates in the north east of the site and flows south west through the centre of the site, before discharging into the Afon Clai immediately south west of the B5110 along the site's southern boundary. The Afon Glan Gors

receives inputs from small drainage ditches and watercourses, which also originate within the site, and drain surface water runoff entering the site from the hillsides to the east and west. In addition to drainage ditches and watercourses, 21 ponds are present within the northern portion of the site (plates 125 and 126), which have been artificially created as part of a wildlife conservation scheme. NRW online flood mapping shows that the site does not lie within a fluvial Flood Zone and the majority of the site is considered to be at low risk of surface water flooding. The only area shown to be prone to ponding is in the topographic low in the centre of the site, to the east of the Afon Glan Gors.

The site is covered in a layer of glacial till, and alluvium in places, and recharge to the underlying bedrock aquifer is therefore likely to be low. An area of groundwater seepage was identified in the far north east of the site during the site walkover, indicative of high groundwater levels in this location, or the result of heavy or prolonged rainfall in the catchment. In addition to this, several watercourses are shown to rise and sink within the site boundary, which could be indicative of a karst groundwater system in the limestone. OS mapping shows two wells lie within the site boundary, one in the north west, and the other in the south west corner of the site. A further five wells are shown to lie within close proximity of the site, although no wells were visited during the site walkover and it is therefore unknown whether they are indeed wells or springs, or whether they are used or not.

The bedrock aquifer beneath the site forms part of the Ynys Môn Central Carboniferous Limestone WFD groundwater body (GB41001G204200). The overall status of the water body is poor due to poor chemical quality.

Water quality interpretation: Two surface water (32.1 and 32.2) and two soil samples (32.6 and 32.7) were collected during the site walkover in October 2016, which was carried out in dry weather conditions (figure A-18). A further five surface water samples were collected in March 2017 with two samples collected in July 2017. Laboratory analysis could not be undertaken on the two soil samples: the laboratory considered the samples too wet to be processed and did not undertake the analysis.

The pH of all of the surface water samples was broadly neutral to very slightly alkaline (pH 7.4 to 8.2) and alkalinity levels and concentrations of calcium were moderate, except in the two samples collected in July 2017 which were slightly lower than the previous samples, although the locations were different. With the exception of calcium and bicarbonate, concentrations of major ions in all surface water samples were relatively low. The concentrations of nutrients were also relatively low, but very variable between sampling locations with nitrate ranging from <0.3 to 14mg/l, and potassium ranging between 1 and 3mg/l. Orthophosphate concentrations were very low whilst phosphorous concentrations varied depending on sediment concentration. Electrical conductivity readings were generally high for surface water, with the exception of the pond sampled in 2017 which was relatively low. Redox levels in all samples were indicative of well aerated, fresh, surface water.

Ecology:

Notable Species

- Bog pimpernel
- Black bog-rush
- Common butterwort
- Fen pondweed
- Grass-of-Parnassus
- Lesser water-plantain
- Long-stalked yellow sedge
- Parsley water-dropwort

Vegetation

The open basin of approximately 2.5ha at the northern head of the valley comprised rich-fen, mostly M13b *Schoenus nigricans-Juncus subnodulosus*, *Briza media-Pinguicula vulgaris* sub-community (figure A-18, plates 120 and 123). The nominate species of the community were abundant, as was purple moor-grass, and between the tussocks of this and black bog-rush were extensive areas of bare marl and wefts of mosses such as *Campylium stellatum*. There were numerous vascular plants typical of the sub-community, including frequent saw-wort (*Serratula tinctoria*). Butterwort was locally abundant and there was occasional grass-of-Parnassus.

The drainage channel running south from this area supported swampy fen vegetation with abundant bog-bean and bottle sedge, and frequent blunt-flowered rush, common reed and marsh cinquefoil (S27 *Carex rostrata-Potentilla palustris* tall-herb fen). The vegetation to the west of the channel was dominated by blunt-flowered rush with frequent common reed (M22 *Juncus subnodulosus-Cirsium palustre* fen meadow).

An artificial pond was seen on the eastern edge of the basin (plate 121), fed by a short stream arising from the spring on the slope above. The open water was dominated by broad-leaved pondweed (*Potamogeton natans*), and there was a fringing zone of floating vegetation comprising bog-bean, bottle sedge and water horsetail (S9 *Carex rostrata* swamp, *Menyanthes trifoliata-Equisetum fluviatile* sub-community). Most of the pond was also surrounded by a further zone of branched bur-reed and watercress (122), where watering cattle had poached and fouled the ground. Fouling by cattle was particularly conspicuous below the spring, where cattle also drank.

Fen vegetation terminated abruptly against formerly agricultural land to the south (plate 124). The valley bottom had recently been set aside by the owner, the area fenced, planted with trees such as alder (*Alnus glutinosa*) and a series of shallow ponds and scrapes dug (plate 125 and plate 126). Most of these supported an abundance of pioneer fen plants, aquatic and terrestrial, including fen pondweed and long-stalked yellow sedge. There were also some small areas of fen, dominated by blunt-flowered rush, in and around the stream draining the valleyhead (photo 126), but this vegetation became smaller and rougher downstream of this. These areas are not apparent on aerial photographs from *circa* 2009, and so are presumed to have become established following the setting aside of the land. The surrounding land was improved pasture (plate 129).

Management and condition: The light grazing by cattle of the valleyhead had maintained the vegetation in good condition. The relicts of fen in the set aside land to the south are likely to succeed to coarse vegetation or woodland in time as these areas are not managed to promote wetland vegetation.

Landscape context: The site is not directly connected to similar semi-natural vegetation, although there are numerous sites in the wider area, e.g. Cors Goch SSSI/NNR. The proposed WS comprises an extensive area of limestone grassland and heathland on the limestone escarpment to the north of Site 25.

Suitability as a compensation site: The valleyhead fen within Site 32 comprised rich-fen, including a significant area of alkaline fen, a habitat listed on Annex I of the Habitats Directive. This valleyhead area is therefore of high nature conservation value and, although direct enhancement opportunities are limited (such as filling the pond and removing nutrient enrichment by cattle), inclusion of this area within the compensation proposal would provide an enhancement by securing this important site.

Downstream of the fen, little of the site has been surveyed. Within this area, the valley slopes were steep and dry, and it is likely that only the bottom would be suitable for fen creation; around 3ha within the surveyed area. The works undertaken on set aside land by the owner have successfully allowed some rich-fen vegetation to become established already. Extending the site further to the south would involve negotiation with several landowners.

In summary, the area of Site 32 surveyed is of limited suitability for rich-fen habitat creation, but offers the opportunity to secure an important area of alkaline fen within the valleyhead as part of the compensation proposal. Given this, the suitability rating of the site has been determined as Medium.

6.18 Caeau Talwrn SSSI (North)

NGR: SH 4739 7788 **Area:** 2.1ha

Ownership: 1 owner **Designation:** SSSI, site within the Anglesey Fens SAC

Distance to Tre'r Gof SSSI: 18.7km

Survey date(s): 10 November 2017

Land use: The surveyed area comprises the northern-most unit of Caeau Talwrn SSSI, which connects the north and south of site 26. The site and surrounding land are grazed by sheep, and the SSSI itself is comprised entirely of unimproved fen pasture. The B5110 runs parallel to the western boundary of the site, approximately 200m to the west, and a number of farm smallholdings lie within close proximity of the site, to the north.

Topography: As with Site 26, the site lies within a basin at the head of a valley, which drains towards the southwest. The site lies on the western side of the valley, to the west of the Afon Canol-dydd Ordinary Watercourse, which flows southwest along the site's eastern border. The elevation of the site ranges from 51m AOD in the northwest to 42m AOD in the southeast, with the topography generally sloping from north west to south east.

Geology and soils: BGS 1:50,000-scale geological mapping shows that the bedrock beneath the site comprises the Lligwy Sandstone Formation, i.e. interbedded sandstone and conglomerate. The whole of the site is also shown as covered in a layer of glacial till and alluvium is shown to be present along the site's eastern border, along the bottom of the Afon Canol-dydd valley.

Five soil cores (CT.3 to CT.7) were taken during the site walkover (figure A-19). The results showed that, with the exception of CT.6, mineral soils with a similar core profile were found to be present throughout the site (CT.3, CT.4, CT.5 and CT.7), comprising 0.1-0.2m of dark, poorly decomposed and very organic topsoil, overlying approximately 0.2m of stiff brown silty clay, sometimes containing calcite flakes, overlying a basal layer of white/yellow sandy clay marl, which contained calcite flakes and 2-5mm clasts of unknown origin. In the southeast of the site at CT.6, adjacent to the Afon Canol-dydd, 0.45m of uniform brown silty clay was present, but the clastic sandy marl layer was not reached. These cores generally revealed similar soil profiles to those found throughout site 26. None of the soil samples were scheduled for laboratory analysis as the soil profiles were comparable to those taken from site 26.

Hydrology and hydrogeology: The Afon Canol-dydd flows southwest through the site and exits the site at its south-western corner to flow through site 26 (figure A-19). A secondary channel runs parallel to the Afon Canol-dydd, within the site, separated from the Afon Canol-dydd by an earth embankment, which appears to impound runoff and possibly a proportion of sub-surface seepage from the SSSI and its upslope catchment. This secondary channel is poorly defined (approximately 1.5-2m wide), with no channel bank on the SSSI side, and exhibited low flows during the site walkover on Friday 10 November 2017. This channel discharges into the Afon Canol-dydd approximately 40m upstream of the south west corner of

the site, via a 0.2m wide outflow channel, causing the water within the secondary channel to drop by half a meter into the Afon Canol-dydd.

Four drainage ditches discharge into the Afon Canol-dydd as it flows along the site boundary, including one which drains a spring to the northeast of the site and runs along the site's northern border. Two ditches discharge into the Afon Canol-dydd from the east and a larger drainage channel, that was relatively fast flowing on Friday 10 November 2017, flows southeast, along the southern border of the site.

Due to the relatively low permeability of the glacial till that covers the site, recharge rates into the underlying bedrock aquifer are likely to be low, resulting in wet and boggy ground conditions across the site. However, the thickness of the till is not known and so there is uncertainty over the degree of surface water / groundwater interaction. NRW online flood mapping shows that the site does not lie within a fluvial Flood Zone, although the fluvial flood maps only apply to Main River catchments that are more than 3km^2, and the site is not shown to be at risk of surface water flooding. Seepage areas were found in the valley bottom, with potential springs located at either end of the site, feeding into the two drainage ditches from the west. There are no wells shown on Ordnance Survey mapping within the SSSI or its immediate surrounds.

The bedrock aquifer beneath the site forms part of the Ynys Môn Central Carboniferous Limestone WFD groundwater body (GB41001G204200). The overall status of the water body is poor due to poor chemical quality.

Water quality interpretation: Two surface water samples were collected during the November 2017 site walkover (figure A-19). One sample was taken from the Afon Canol-dydd as it enters the site at its north-eastern corner (CT.1) and one from an area of seepage in the north of the site (CT.2), assumed to be fed by a spring, that drains into the Afon Canol-dydd at the point where sample CT.1 was taken.

The pH of the surface water samples was neutral to slightly alkaline (maximum of 8.1), due to high concentrations of calcium and bicarbonate, compared to other sites visited, possibly due to leaching from the soil, both within the site (CT.2) and in the upstream catchment (CT.1). Concentrations of other major ions and nutrients in both surface water samples were generally low. Electrical conductivity, redox and dissolved oxygen readings were very similar between the two samples, and all readings were comparable to values obtained from surface water samples collected during the multiple site walkovers of site 26.

Ecology:

Notable Species

- Bog pimpernel
- Black bog-rush
- Grass-of-Parnassus
- Long-stalked yellow sedge
- Parsley water-dropwort

Vegetation

The site comprised unimproved fen pasture dominated by two distinct vegetation types (figure G-8): in the north east was very rank vegetation dominated by tussocks of black bog-rush, referred to M13a *Schoenus nigricans-Juncus subnodulosus* mire, *Festuca rubra-Juncus acutiflorus* sub-community, and in the south west was vegetation dominated by blunt-flowered rush, referred to M22a *Juncus subnodulosus-Cirsium palustre* fen meadow, typical sub-community and M22b *Briza media-Trifolium* spp. sub-community. The transition between these fen communities and the improved pasture up-slope of site beyond the SSSI boundary was very marked (plate 130).

The black bog-rush vegetation was species-poor owing to dominance by black bog-rush and purple moor-grass (plate 132), but small areas toward the top of the valley slope were more open, supporting species such as grass-of-Parnassus and long-stalked yellow sedge, referred to M13b *Briza media-Pinguicula vulgaris* sub-community. Large tussocks of black bog-rush and purple moor-grass supported occasional calcifuge species such as heather and pale St John's wort (*Hypericum pulchrum*), while smaller tussocks supported bryophytes such as *Calliergonella cuspidata, Ctenidium molluscum* and *Lophocolea bidentata*. A watercourse running along the southern boundary of this area was dominated by fool's watercress (plate 133), and floating sweet-grass was locally dominant. The spring above the watercourse in the north eastern corner of site was dominated by the moss *Calliergonella cuspidata* with abundant long-stalked yellow sedge, while the presence of watercress suggested enrichment (plate 131).

The blunt-flowered rush vegetation to the south was more varied in character. The valley slope supported a well-grazed community characterised by small sedges such as glaucous sedge (*Carex flacca*) and other smaller herbs, with only patchy cover by blunt-flowered rush and hard rush. The wetter valley bottom supported rank vegetation in which blunt-flowered rush was dominant, with only taller forb species present, such as meadowsweet and water mint frequent.

The vegetation of Caeau Talwrn SSSI (North) was surveyed in 1991 by the Wales Lowland Grassland Survey [RD22]. This survey mapped the whole north eastern half of the site as M13b, and the south western half as M22b.

Management and condition: The north eastern half of site was very rank and is unsuitable for grazing by sheep, except in the small shorter areas toward the top of the valley slope. Bramble and gorse scrub was scattered around the edge of this area, and several bushes of the invasive non-native Himalayan cotoneaster (*Cotoneaster simonsii*), listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended), were found growing out of black bog-rush tussocks. The Wales Lowland Grassland Survey [RD22] assigned this area to M13b, describing it as tightly grazed by cattle with heavily poached runnels between tussocks; the condition of this field has evidently declined since then.

The south western half of site was grazed on the valley slope but the vegetation in the valley bottom was coarse and is unlikely to be frequently grazed. The latter area was assigned to

M22b by the 1991 Wales Lowland Grassland Survey [RD22], suggesting it has declined in condition since then.

The watercourse along the southern boundary of site and the spring in its north eastern corner supported species indicative of nutrient-enrichment.

Landscape context: There is rich-fen along the valley of the Afon Canol-dydd, with a further unit of Caeau Talwrn SSSI in the very south and Site 25 (section 6.15) in the very north. Site 26 (section 4.2.16), comprising improved pasture, connects these fragments.

Suitability as a compensation site: Caeau Talwrn SSSI (North) offers no potential for fen creation but the north eastern half of site (approximately 1.1ha) offers the potential for enhancement of unmanaged alkaline fen. Management measures that could diversify the vegetation and bring it into better condition include grazing with heavier stock such as cattle to graze down the coarse vegetation, or manual cutting of tussocks. The south western part of site would also benefit from regular management.

As part of the compensation proposal, Caeau Talwrn SSSI (North) could be integrated with Site 25 to the north and connecting land of Site 26, which would establish an extensive and ecologically coherent valley fen system, connecting also the unit of Caeau Talwrn SSSI to the south east of Site 26. This system would present a significant extension of the Anglesey Fens SAC, and is further discussed in section 6.16.

In summary, Caeau Talwrn SSSI (North) offers no potential for habitat creation but could be enhanced as part of the compensation proposal. Its inclusion within the larger valley system comprising Site 25 and Site 26 would present a significant ecological enhancement of the Anglesey Fens SAC, and the suitability rating of Caeau Talwrn SSSI (North) has therefore been determined as High if included within this larger system.

7. Summary of findings

A summary of the findings and of the site evaluations are given in table 7-1 below.

Table 7-1: Summary of site survey and evaluation. Total area is of the whole site; areas for fen creation or enhancement are within area surveyed

SITE NAME (TOTAL AREA)	SUMMARY OF SURVEY FINDINGS	POTENTIAL AREA FOR RICH-FEN HABITAT CREATION (HA)	POTENTIAL AREA FOR FEN HABITAT ENHANCEMENT (HA)	SUMMARY OF POTENTIAL TO FORM PART OF COMPENSATION PROPOSAL	POTENTIAL
Burwen North (6.3ha)	• 6.3km from Tre'r Gof SSSI • Scrub, semi-improved grassland, rush mire • Occupies a small basin on valley side	0	0	• Wetland habitat in good condition and occupying available area – no further improvement possible	None
Burwen South and West (9.7ha)	• 6.1km from Tre'r Gof SSSI • Rushy species-poor pasture on valley side • Extensive drainage network	0	0	• Blocking drains etc. would be very unlikely to result in rich-fen, of which there is no extant vegetation on site	None
Cae Adda (1.6ha)	• 3.6km from Tre'r Gof SSSI • Small topogenous poor-fen • The valuable poor-fen within the surveyed are is apparently unmanaged, while part of the basin (not accessed) is grazed	0	1.0	• Small area, close to Tre'r Gof SSSI • Habitat improvement only through management	Medium
Cae Owen (1.4ha)	• 2.5km from Tre'r Gof SSSI • Rich-fen associated with stream connecting to Ty du and Neuadd	0	1.1	• Habitat improvement only through management and scrub clearance	Medium

SITE NAME (TOTAL AREA)	SUMMARY OF SURVEY FINDINGS	POTENTIAL AREA FOR RICH-FEN HABITAT CREATION (HA)	POTENTIAL AREA FOR FEN HABITAT ENHANCEMENT (HA)	SUMMARY OF POTENTIAL TO FORM PART OF COMPENSATION PROPOSAL	POTENTIAL
	• Sedge swamp and blunt-flowered rush fen, with large population of marsh fern, but limited botanical diversity • Unmanaged, some scrub, and tree planting along stream				
Mynachdy (13.5ha)	• 4.8km from Tre'r Gof SSSI • Intensively managed dairy farm, with extensive drainage network • Extensive area of former wetland overlying largely intact peat • Small area of remnant mire (1.4ha)	12.1	1.4	• Close to Tre'r Gof SSSI • Blocking the network of ditches together with turf stripping, natural regeneration and planting/seeding may create a large wetland • Uncertain whether rich-fen would develop • Enrichment over large catchment area would need to be addressed	Medium
Neuadd (5.0ha)	• 2.7km from Tre'r Gof SSSI • Rich-fen associated with stream connecting to Ty du and Cae Owen • Fen meadow, reed bed, tall herb fen, great fen-sedge swamp,	0	4.0	• Moderate size, close to Tre'r • No potential for habitat creation • Habitat enhancement through establishment of management, removal of coarse vegetation, introduction of species-rich hay	Medium

SITE NAME (TOTAL AREA)	SUMMARY OF SURVEY FINDINGS	POTENTIAL AREA FOR RICH-FEN HABITAT CREATION (HA)	POTENTIAL AREA FOR FEN HABITAT ENHANCEMENT (HA)	SUMMARY OF POTENTIAL TO FORM PART OF COMPENSATION PROPOSAL	POTENTIAL
	small area of degraded alkaline fen • Western half un-managed, with some scrub • Eastern half well-managed and botanically rich				
Tregynrig Fawr (3.6ha)	• 5km from Tre'r Gof SSSI • Wet rushy species-poor pasture • Extensive drainage network • Large, shallow basin (up to 23 ha)	0	0	• Blocking the network of ditches and other works may create a large wetland, but underlying conditions are not suitable for rich-fen	None
Ty du (8.1ha)	• 3.7km from Tre'r Gof SSSI • Site heterogeneous, with mire communities of poor-fen and rich-fen • Large area succeeded to scrub or otherwise degraded due to drainage or lack of grazing • Possible nutrient enrichment from septic tank	0	7.0	• Moderate size, close to Tre'r Gof SSSI (3.7km) • No potential for fen creation within or beyond site boundary • Habitat enhancement through management, scrub clearance, drainage modifications and removal of septic tank, would enhance quality of mire habitats	Medium

SITE NAME (TOTAL AREA)	SUMMARY OF SURVEY FINDINGS	POTENTIAL AREA FOR RICH-FEN HABITAT CREATION (HA)	POTENTIAL AREA FOR FEN HABITAT ENHANCEMENT (HA)	SUMMARY OF POTENTIAL TO FORM PART OF COMPENSATION PROPOSAL	POTENTIAL
Tyddyn-y-Waun (2.6ha)	• 6km from Tre'r Gof SSSI • Wet rushy species-poor pasture • Occupies a small basin	0	0	• Site small and isolated, with no potential for creation of rich-fen vegetation	None
Site 3 (67.8ha)	• 14.8km from Tre'r Gof SSSI • Improved pasture with neutral flushes and wet heath on slopes • Marl deposit at 0.6m below surface along Afon Lligwy	0	0	• No rich-fen habitat • Sampling indicates low-lying ground unsuitable for fen creation despite marl deposits	None
Site 8 (8.0ha)	• 18km from Tre'r Gof SSSI • Site comprised abandoned rich-fen vegetation	0	8.0	• No potential for fen creation • Site in very poor condition: could be incorporated into management of adjacent Cors Erddreiniog SSSI and condition improved through vegetation clearance and management	Medium
Site 18 (19.4ha)	• 18.2km from Tre'r Gof SSSI • Surveyed area comprised dry grazing • Area includes unsurveyed degraded rich-fen	0	0	• Surveyed area not suitable for wetland creation • Remaining area of site comprising fen along the Afon Marchogion is likely to be	Low

SITE NAME (TOTAL AREA)	SUMMARY OF SURVEY FINDINGS	POTENTIAL AREA FOR RICH-FEN HABITAT CREATION (HA)	POTENTIAL AREA FOR FEN HABITAT ENHANCEMENT (HA)	SUMMARY OF POTENTIAL TO FORM PART OF COMPENSATION PROPOSAL	POTENTIAL
				suitable to restoration, but may not offer potential for creation	
Site 19 (21.2ha)	• 18.8km from Tre'r Gof SSSI • Surveyed area comprised dry grazing	0	0	• Surveyed area not suitable for wetland creation	None
Site 24 (27.8ha)	• 21.6km from Tre'r Gof SSSI • Half of surveyed area comprised improved grazing, and approx. 8.5ha rich-fen habitat • Some fen habitat degraded • Extensive drainage	7.2	8.2	• Potential for large area of fen creation and some enhancement • Potential to secure a significant area of existing fen • Compensation works may have benefits for the adjacent Cors Bodeilio SSSI (a constituent unit of the Anglesey Fens SAC), and the combined unit of fen would form a large and hydro-ecologically coherent wetland system	High
Site 25 (3.8ha)	• 19.5km from Tre'r Gof SSSI • Approx. 2.8ha of rich-fen in good condition within valleyhead	0	2.8	• No potential for rich-fen creation • Vegetation in good condition but enhancement potential by	High

SITE NAME (TOTAL AREA)	SUMMARY OF SURVEY FINDINGS	POTENTIAL AREA FOR RICH-FEN HABITAT CREATION (HA)	POTENTIAL AREA FOR FEN HABITAT ENHANCEMENT (HA)	SUMMARY OF POTENTIAL TO FORM PART OF COMPENSATION PROPOSAL	POTENTIAL
				securing a significant area of existing fen and connecting this to Caeau Talwrn SSSI (a constituent unit of the Anglesey Fens SAC) via Site 26 • Site 25 should be considered with Site 26 and Caeau Talwrn SSSI (North)	
Site 26 (21.7ha)	• 19.6km from Tre'r Gof SSSI • Improved pasture with some very small relict fen vegetation • Water supplied by seepage along the valley slopes and a calcareous stream from spring source to the east	13.3	0	• Potential for a large area of fen creation along the valley • Created habitat would connect compartments of Caeau Talwrn SSSI (a constituent unit of the Anglesey Fens SAC) and the valley fen at Site 25, establishing a continuous valley fen system of approximately 18 ha	High
Site 32 (26.4ha)	• 18.7m from Tre'r Gof SSSI • Approximately 2.5ha of rich-fen in good condition at valley head • Some habitat works have already taken place in areas of	3.0	2.5	• Existing rich fen (2.5ha) offers no opportunity for creation or enhancement • Surveyed area to the south offers some potential for	Medium

SITE NAME (TOTAL AREA)	SUMMARY OF SURVEY FINDINGS	POTENTIAL AREA FOR RICH-FEN HABITAT CREATION (HA)	POTENTIAL AREA FOR FEN HABITAT ENHANCEMENT (HA)	SUMMARY OF POTENTIAL TO FORM PART OF COMPENSATION PROPOSAL	POTENTIAL
	site adjacent to existing fen, resulting in small-scale incidental fen establishment			creation of up to 3ha of fen but the area is modest and some fen has been established through previous habitat works	
Caeau Talwrn SSSI (North) (2.1ha)	• 18.7km from Tre'r Gof SSSI • Rich-fen supplied by springs and seepage along valley slope • Part of Anglesey Fens SAC	0	2.1	• Enhancement potential through cutting of coarse vegetation and introduction of appropriate management • Ecological connectivity between Site 25, Site 26 and unit of Caeau Talwrn SSSI (a constituent unit of the Anglesey Fens SAC) to the south	High

8. Final site selection

8.1 Sites with potential to form part of the compensation proposal

The site survey and evaluation process identified 11 sites offering 'Medium' or 'High' potential to form part of the compensation proposal, in terms of offering opportunity for the creation of new habitat and/or enhancement of existing habitat, summarised in table 8.1. Of those investigated, these sites are considered to offer the best potential to form part of the compensation proposal.

SITE NAME	POTENTIAL AS PART OF COMPENSATION PROPOSAL
Cae Adda	Medium
Cae Owen	Medium
Mynachdy	Medium
Neuadd	Medium
Ty du	Medium
Site 8	Medium
Site 24	High
Site 25	High
Site 26	High
Site 32	Medium
Caeau Talwrn SSSI (North)	High

Table 8-1: Summary of sites of 'Medium' and 'High' potential to form part of compensation proposal.

8.2 Land purchase

The above 11 sites were pursued by Horizon in order to secure land under an option for purchase for the compensation proposal. Based on the negotiations with landowners, there was no potential for acquiring an interest in the following five sites or only fragmented ownership could be achieved such that it would not meaningfully contribute toward the objectives of the compensation proposal:

- Cae Adda;

- Cae Owen;
- Mynachdy;
- Neuadd;
- Site 8; and
- Site 32.

Horizon took the decision to pursue these sites no further as part of the compensation proposal. Of the remaining five sites Horizon is pursuing an option to purchase the whole or a significant area of these sites, with the objective of taking these forward to form the final compensation proposal.

8.3 The final compensation proposal

Horizon is pursuing an option for purchase of the whole or significant areas of five of the sites initially identified as offering 'Medium' or 'High' potential. As the areas of interest within Sites 25, 26 and Caeau Talwrn SSSI are contiguous, these three sites are considered as one. The final compensation proposal would therefore comprise three distinct areas:

- **Cae Canol-dydd** – This site will comprise land at Site 26 together with Site 25 and Caeau Talwrn SSSI (North). The site is named after the Afon Canol-dydd that runs along the valley, and is Welsh for 'midday pasture'.
- **Cors Gwawr** – This site will comprise land at Site 24. The site's name is Welsh for 'sunrise marsh'.
- **Ty du** – This site will comprise the whole area previously referred to as Ty du. 'Ty du' is Welsh for 'black house', the name of a building to the north east of site.

The potential contribution of each of these sites to the overall compensation proposal is summarised in table 8-2 and site boundaries are shown in figures 8-1, 8-2 and 8-3. The areas summarised in table 8-2 differ from those in table 7-1 in that they represent areas for habitat creation and enhancement lying within the new site boundaries.

SITE NAME	POTENTIAL AREA OF RICH-FEN/MIRE HABITAT PROPOSED TO BE CREATED (HA)	POTENTIAL AREA OF RICH-FEN/MIRE HABITAT PROPOSED TO BE ENHANCED (HA)	POTENTIAL TOTAL AREA OF RICH-FEN/MIRE WITHIN PROPOSAL (HA)	TOTAL SITE AREA (HA)
Cors Canol-dydd	7.7	4.8	12.5	20.9
Cors Gwawr	6.1	8.2	14.3	20.5
Ty du	0	7.0	7.0	8.1
TOTAL	13.8	20.0	33.9	49.5

Table 8-2: Summary of the final compensation proposal

The final compensation proposal would represent 49.5ha of land of which 13.8ha is suitable for rich-fen habitat creation and 20.0ha for the enhancement of existing but unmanaged or degraded fen and mire habitat. Furthermore, the proposed sites would provide landscape connectivity between sites within the Anglesey Fens SAC (figure 8-4). As this proposal provides more than 10ha of rich-fen habitat creation and a large area of enhancement, it is considered that this compensation proposal meets the objectives set out in section 2.3.

The specific proposals for each site included in the final compensation proposal are outlined in *Tre'r Gof SSSI Compensation Strategy Volume II* (Appendix D9-24. Application Reference Number: 6.4.57), and detailed designs will be produced in accordance with principles set out in the Landscape and Habitat Management Strategy (Application Reference Number: 8.16) and the Phasing Strategy (Application Reference Number: 8.29), and secured through a DCO requirement, Draft Development Consent Order (Application Reference Number: 3.1).

In February 2018, Horizon undertook a consultation on additional land that had not been consulted on previously, which included the sites which comprise this final compensation proposal. Details of this consultation are provided in chapter B9 Introduction to the topics (Application Reference Number: 6.2.9).

Figure 8-1: Compensation proposal - Cae Canol-dydd

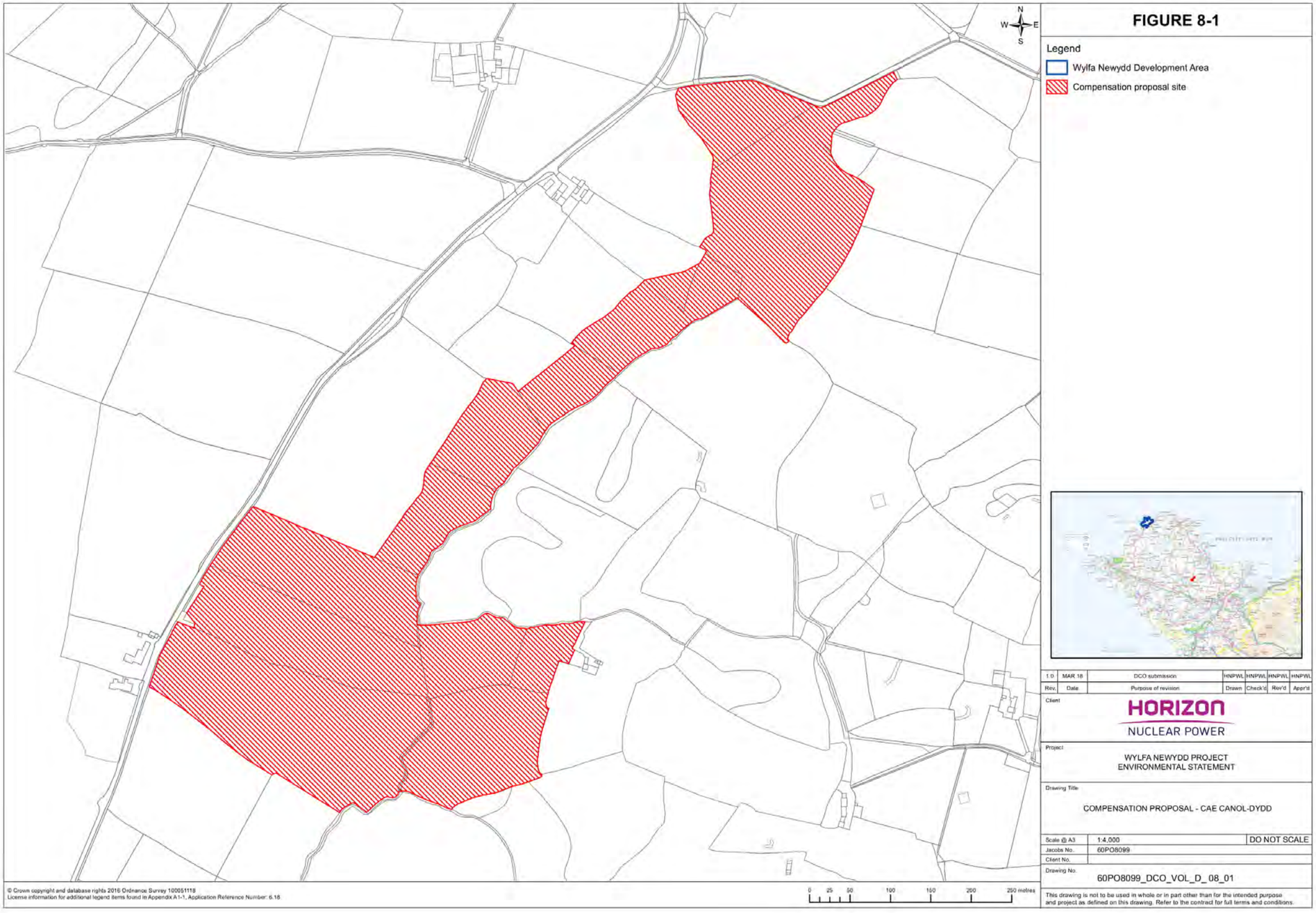


Figure 8-2: Compensation proposal - Cors Gwawr

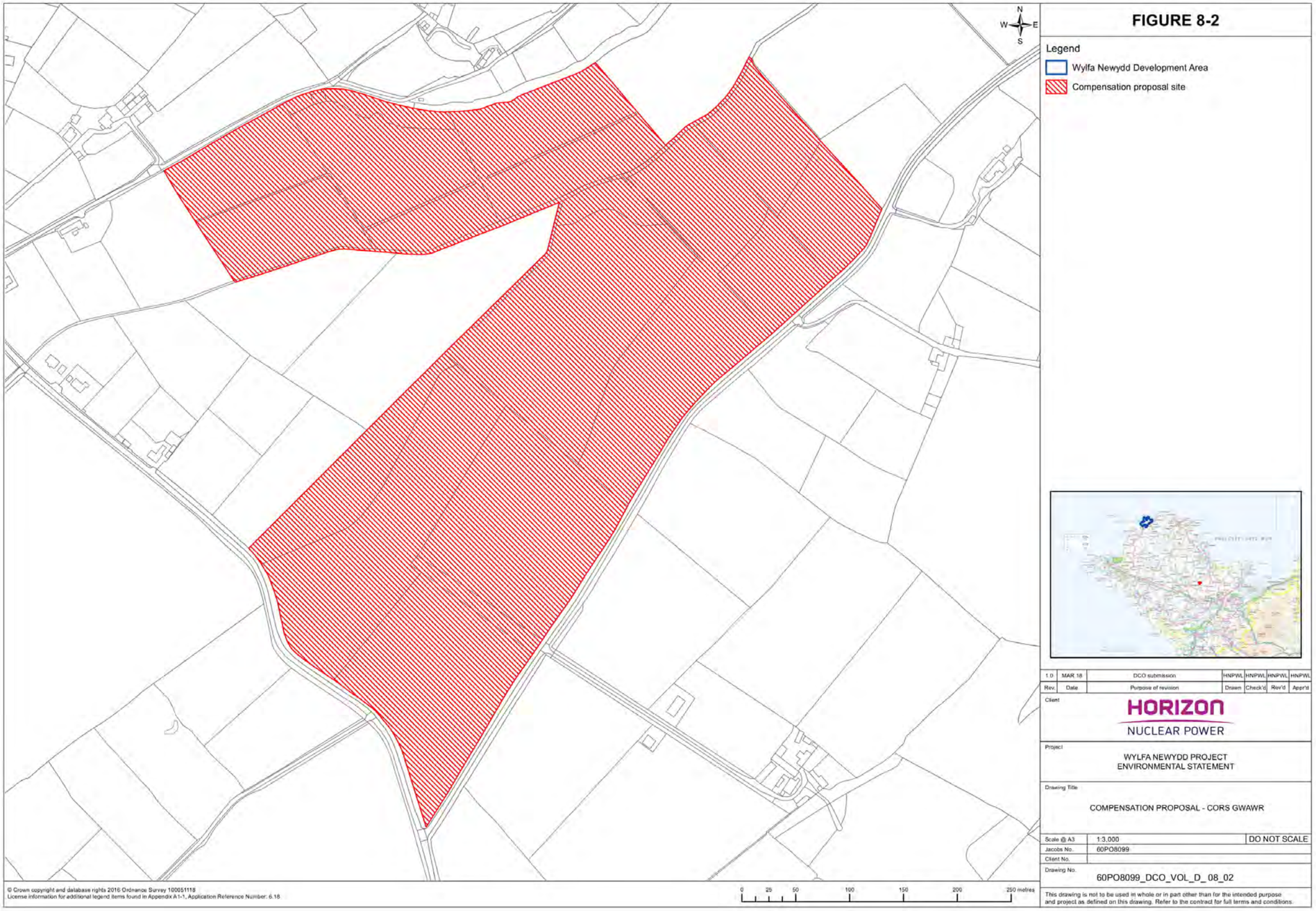


Figure 8-3: Compensation proposal – Ty du

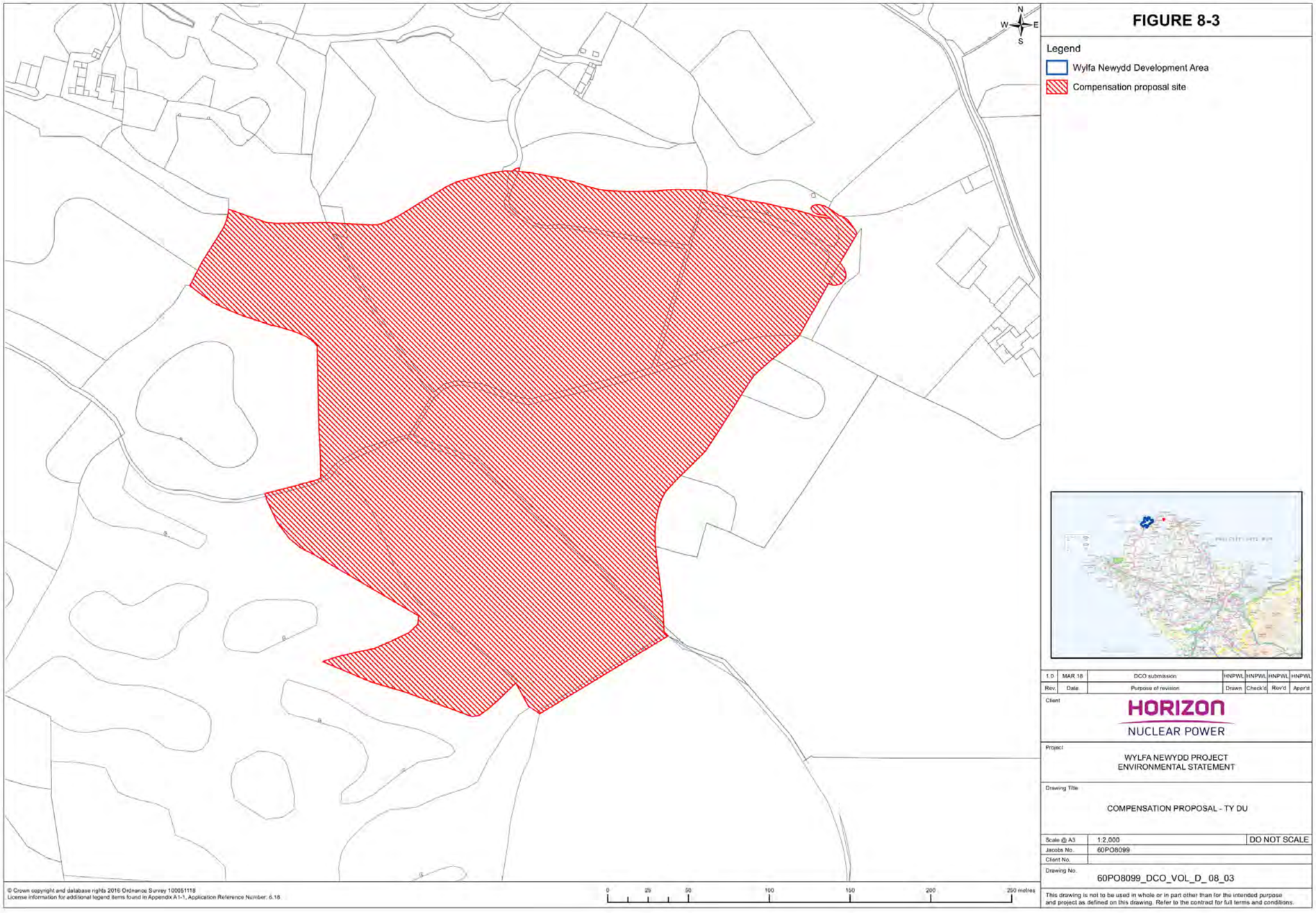
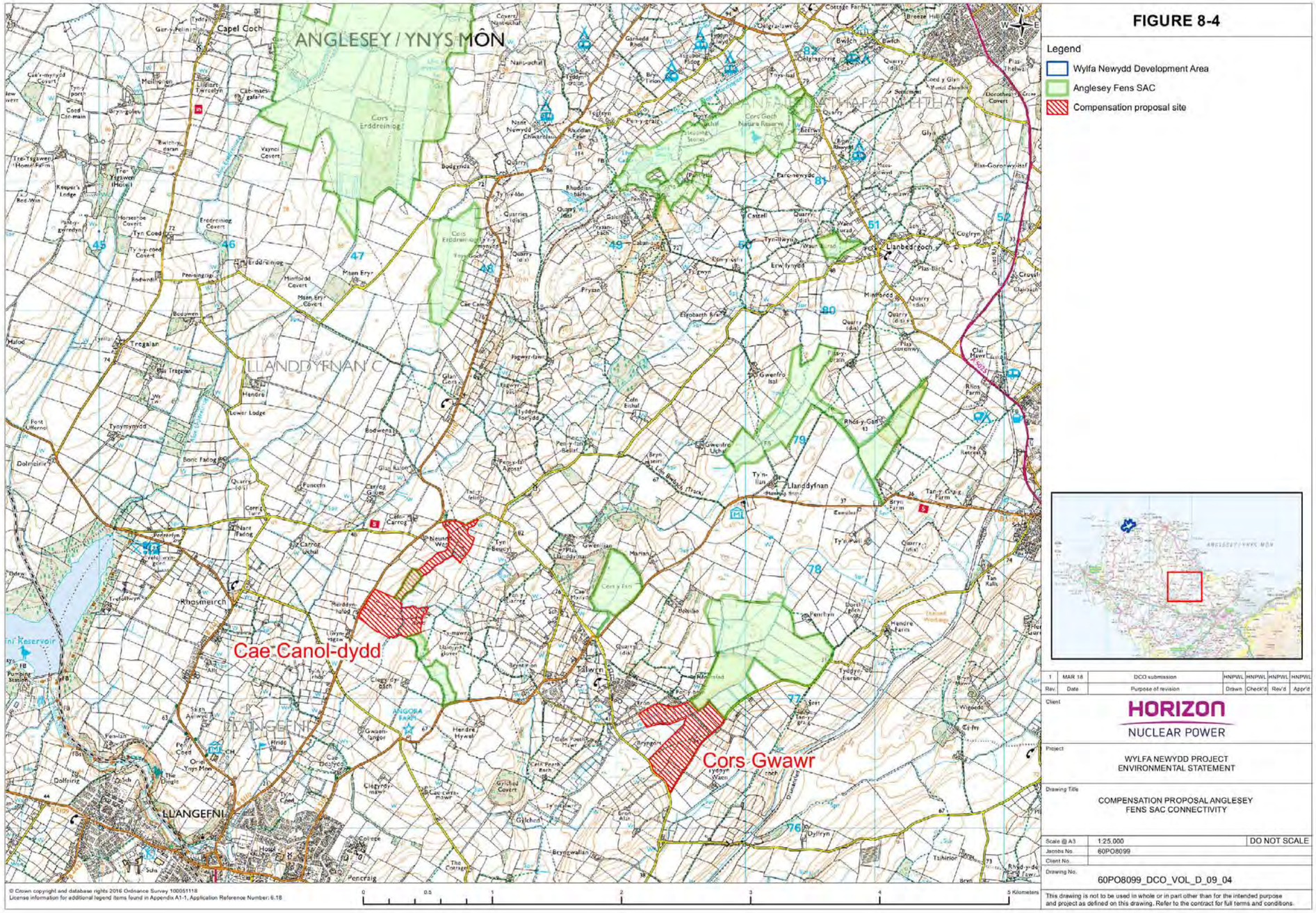


Figure 8-4: Compensation proposal – connectivity with Anglesey Fens SAC



9. References

Table 9-1: References

REF. NO.	TITLE
[RD1]	Department for Energy and Climate Change (2011). *National Policy Statement for Nuclear Power Generation (EN-6)*.
[RD2]	Department for Energy and Climate Change (2011). *National Policy Statement for Nuclear Power Generation (EN-6).*
[RD3]	Commission of the European Communities (1991). *CORINE biotopes manual – Habitats of the European Community*. Commission of the European Communities, Luxembourg.
[RD4]	NRW (2010). *Lowland Peatland Survey Site Report: Tre'r Gof SSSI.*
[RD5]	Jones, P.S., Hanson, J., Farr, G. (2013). *Proceedings of the Anglesey & Llyn Fens Technical Workshop: The rich-fens of Anglesey and Llŷn.* NRW
[RD6]	Joint Nature Conservation Committee (2007). *Guidelines for Selection of Biological SSSIs – Fens.*
[RD7]	Rodwell, J. (Ed.) (1991-2000). *British Plant Communities*. Cambridge University Press
[RD8]	Bosanquet, S. D. S. et al (2013). *Lowland Peatland Survey of Wales - Survey Manual*. NRW
[RD9]	Wheeler, B.D. (1980a*). Plant communities of rich-fen systems in England and Wales. I. Introduction. Tall sedge and reed communities.* Journal of Ecology 68; 365-395.
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[RD12]	National Biodiversity Network, 2017. NBN Atlas. [Online]. [Accessed: 04/01/2018]. Available from: https://nbnatlas.org/
[RD13]	British Geological Survey. 2016. Geological maps at 1:50,000 scale. [Online]. [Accessed: 04/01/2018]. Available from: www.bgs.ac.uk/products/digitalmaps/digmapgb_50.html.
[RD14]	Rodwell, J. S. (2006). *National Vegetation Classification: Users' Handbook*. Peterborough: Joint Nature Conservation Council.
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[RD17]	Stace, C. (2010). *New Flora of the British Isles* (3 ed.). Cambridge University Press
[RD18]	Hill, M. O., Blackstock, T. H., Long, D. G., Rothero, G. P. (2008). *A checklist and census catalogue of British and Irish bryophytes*. British Bryological Society
[RD19]	Bryant, J.A., Stewart, N.F. & Stace, C.A. 2002. *A checklist of Characeae of the British Isles*. Watsonia 24, 203-208
[RD20]	NRW (2014). *Lowland Peatland Survey Site Report: Ty du.*
[RD21]	NRW (2009). *Lowland Peatland Survey Site Report: Cors Cefn Uchaf.*
[RD22]	CCW (1991). *Wales Lowland Grassland Survey: Clegyrdy-bâch.*

Appendix A Hydroecology plans

Figure A-1: Hydroecological features – Burwen North

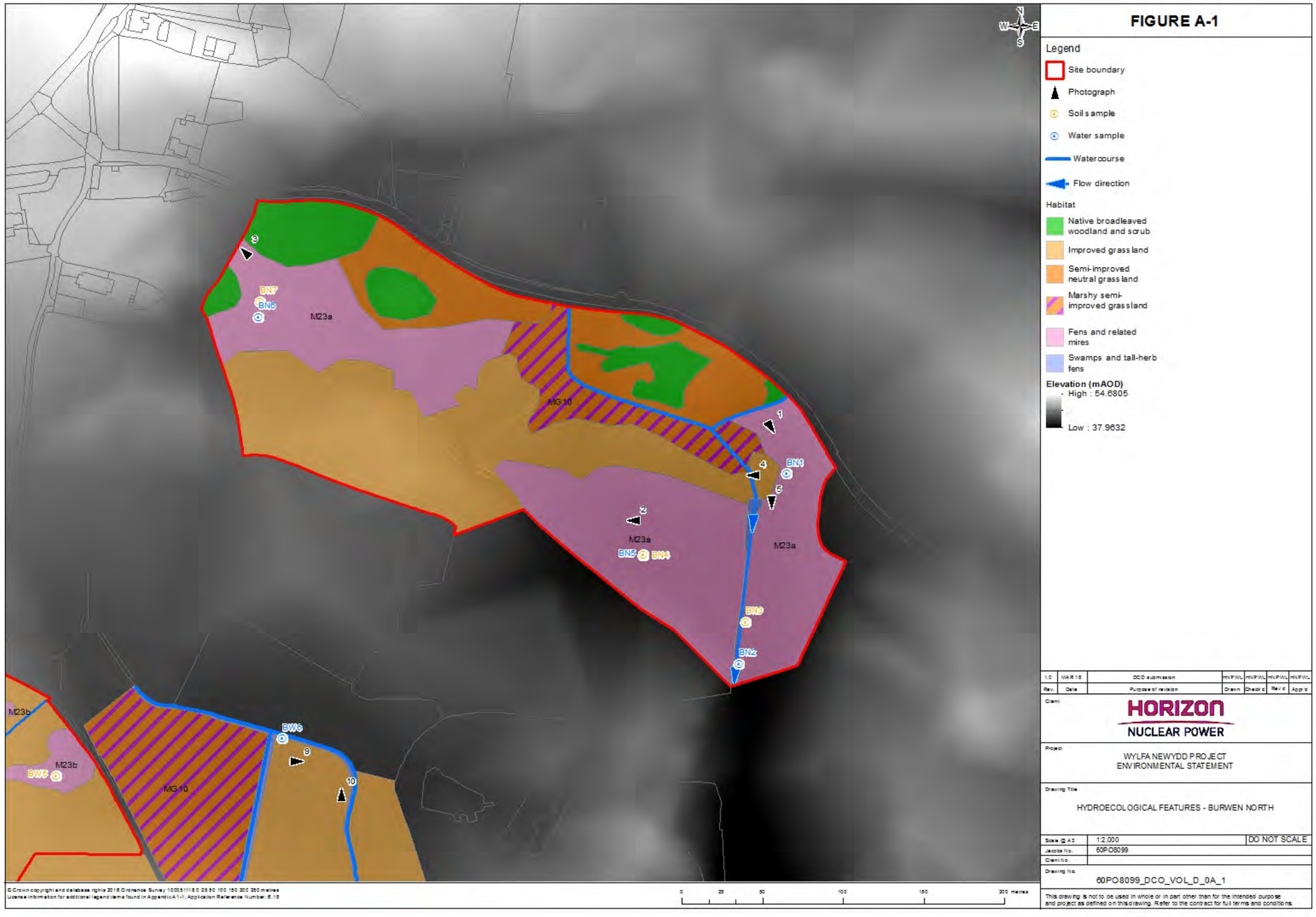


Figure A-2: Hydroecological features – Burwen South

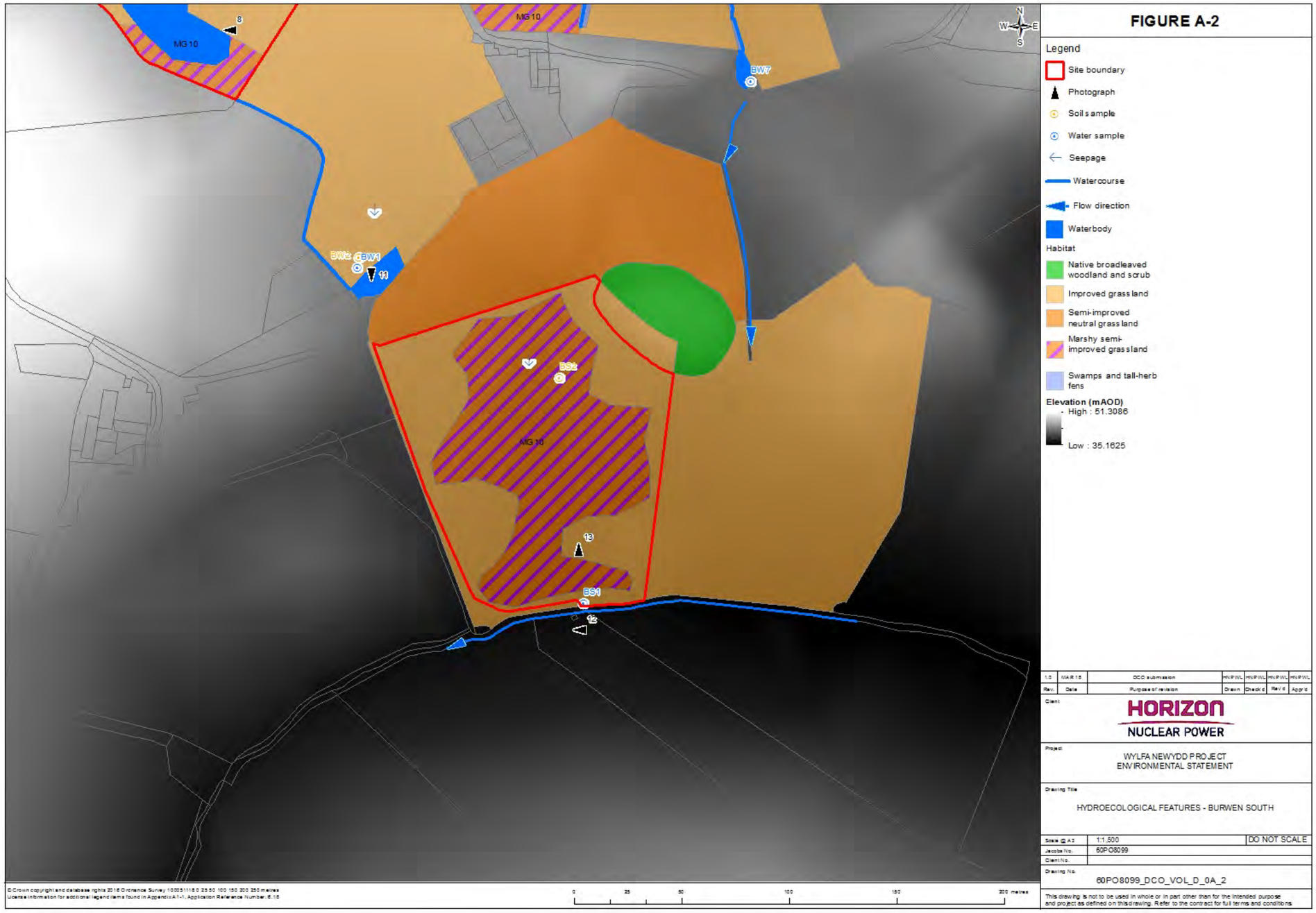


Figure A-3: Hydroecological features – Burwen West

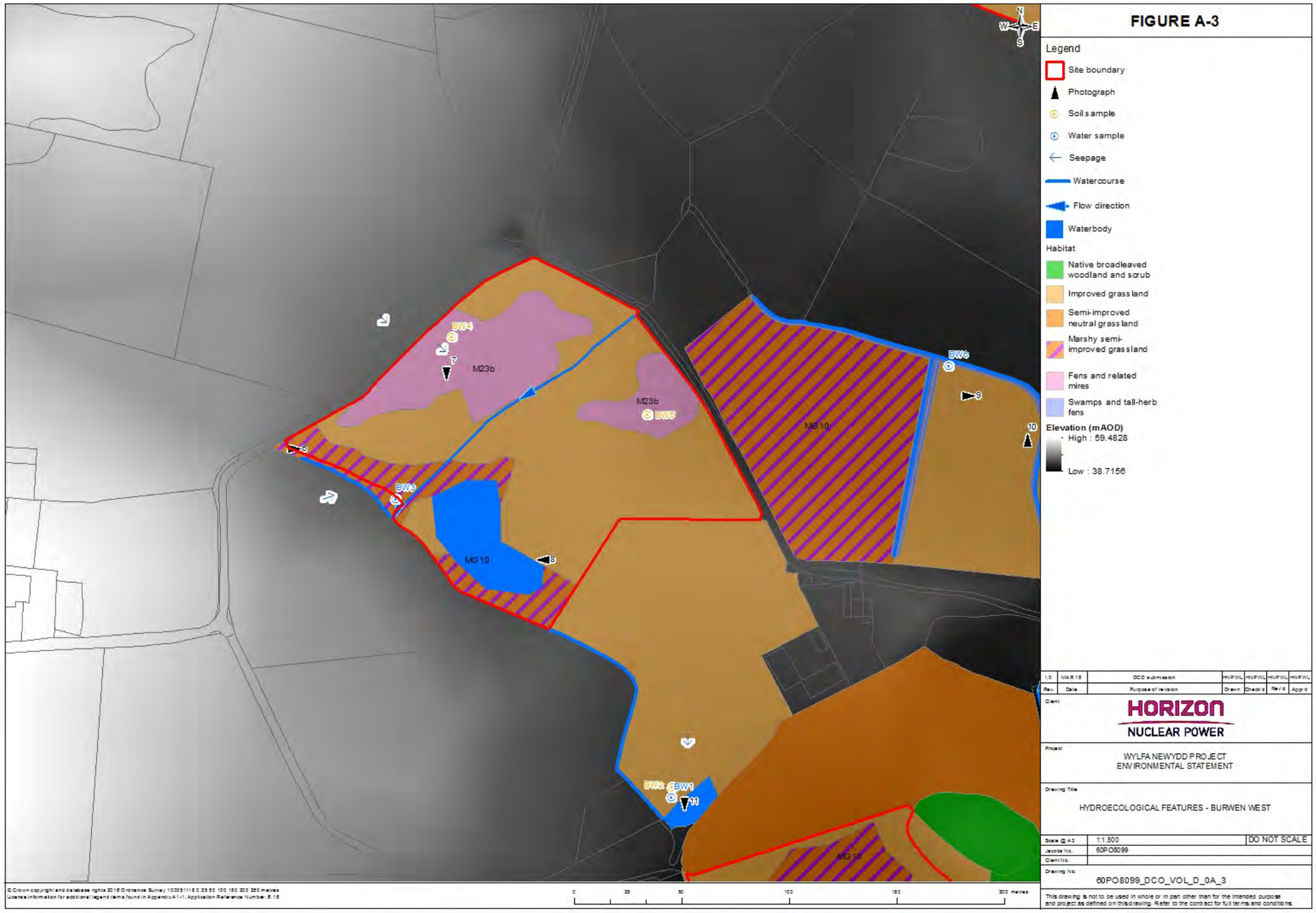


Figure A-4: Hydroecological features – Cae Adda

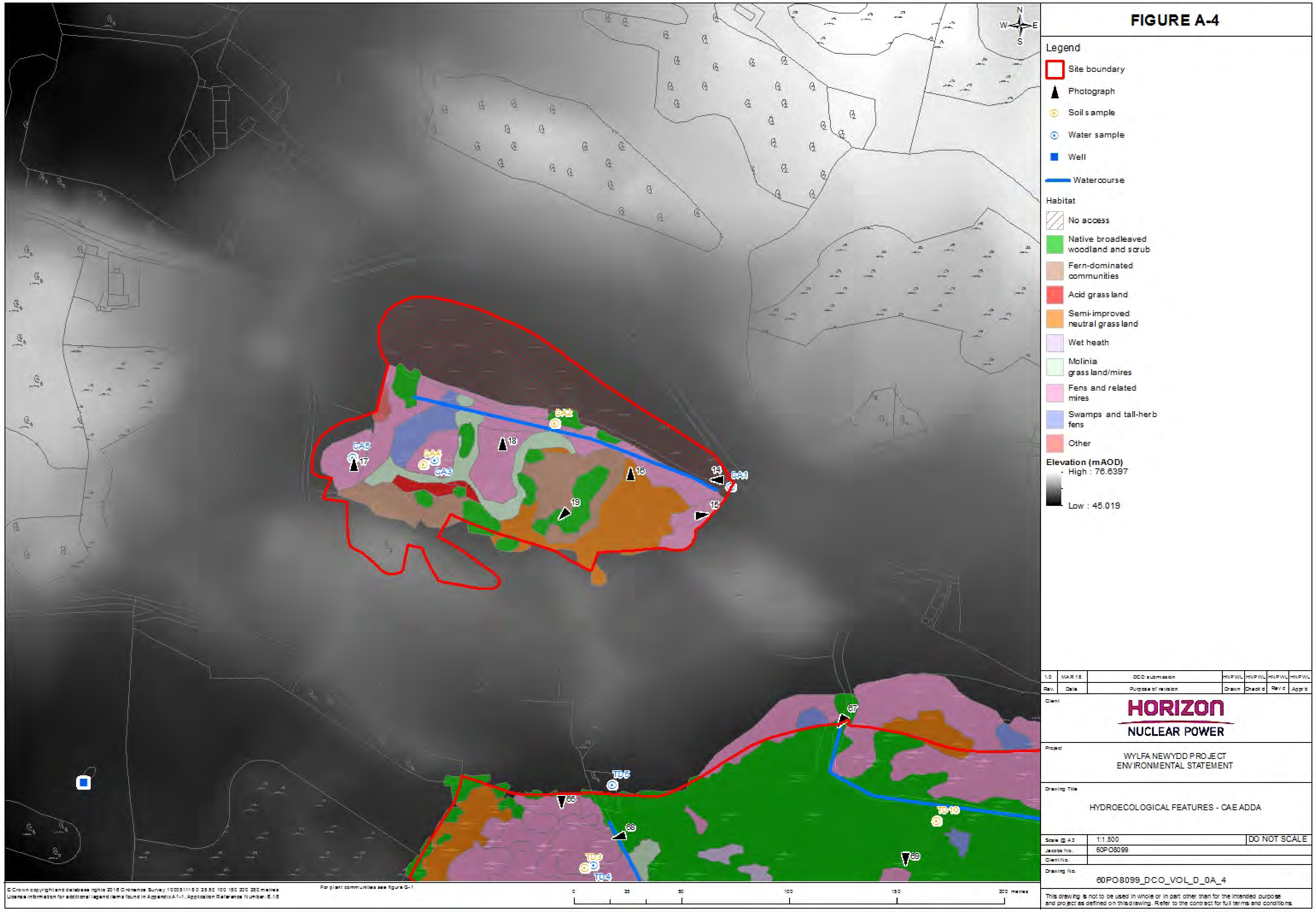


Figure A-5: Hydroecological features – Cae Owen

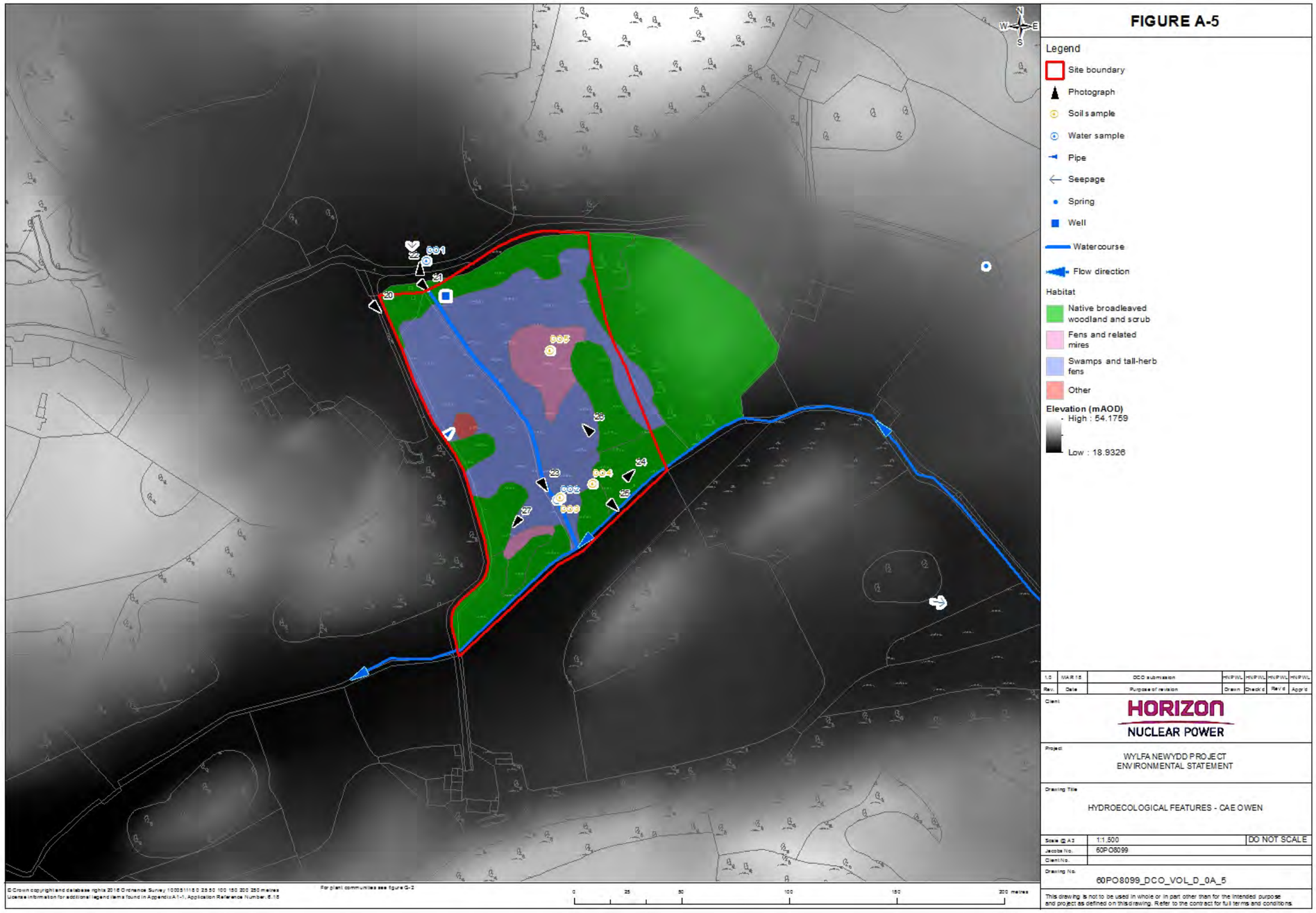


Figure A-6: Hydroecological features – Mynachdy

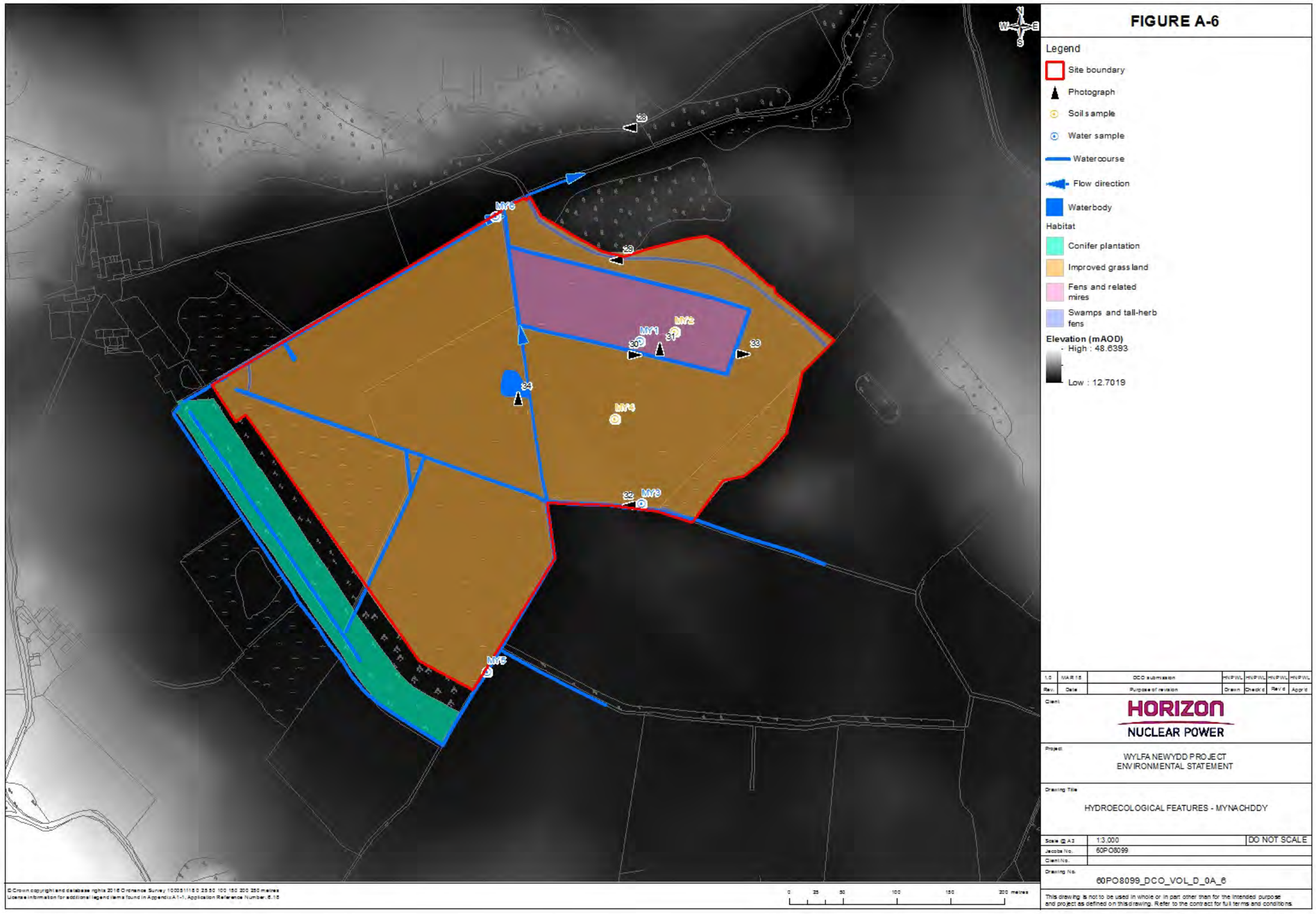


Figure A-7: Hydroecological features – Neuadd

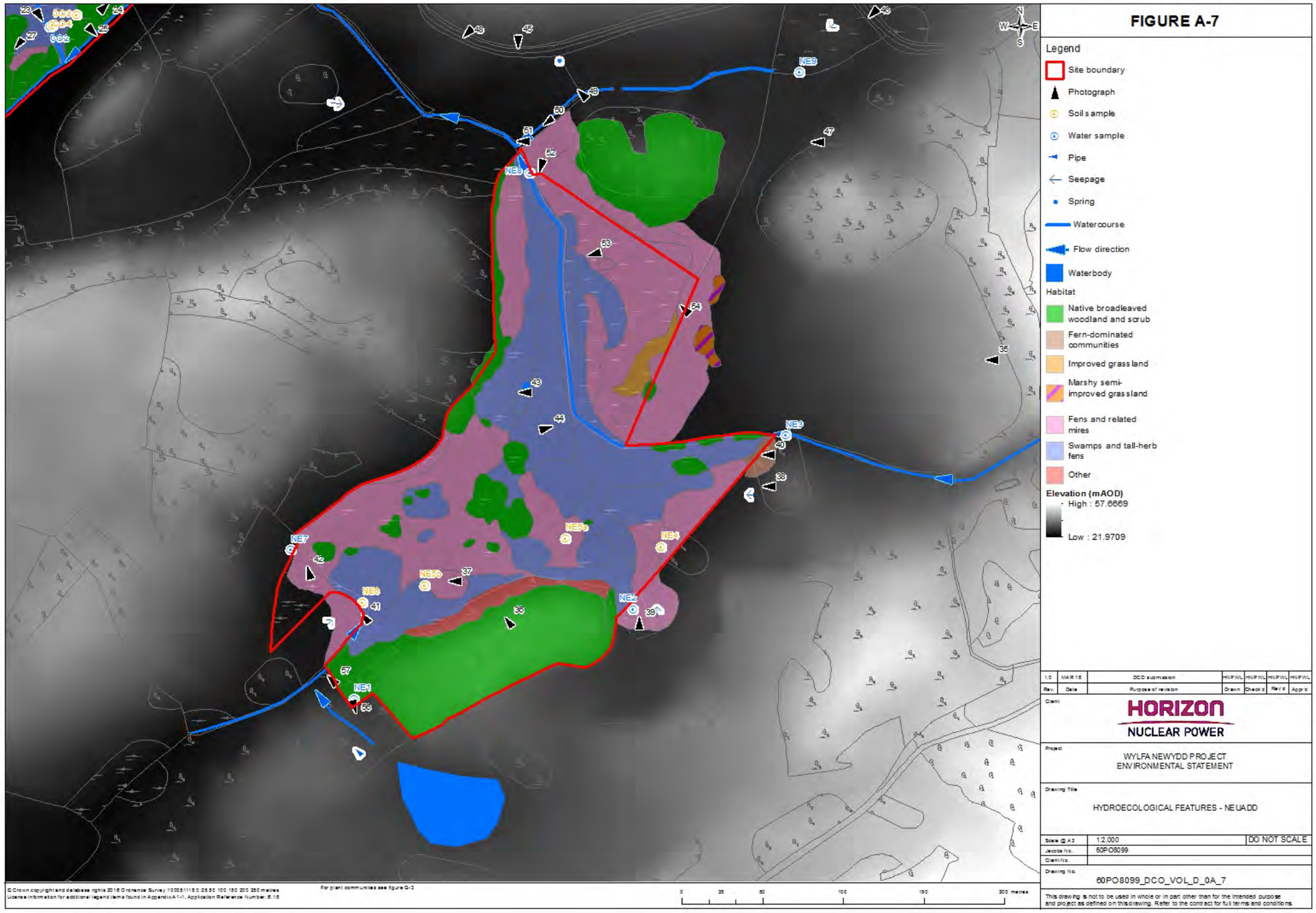


Figure A-8: Hydroecological features – Tregynrig Fawr

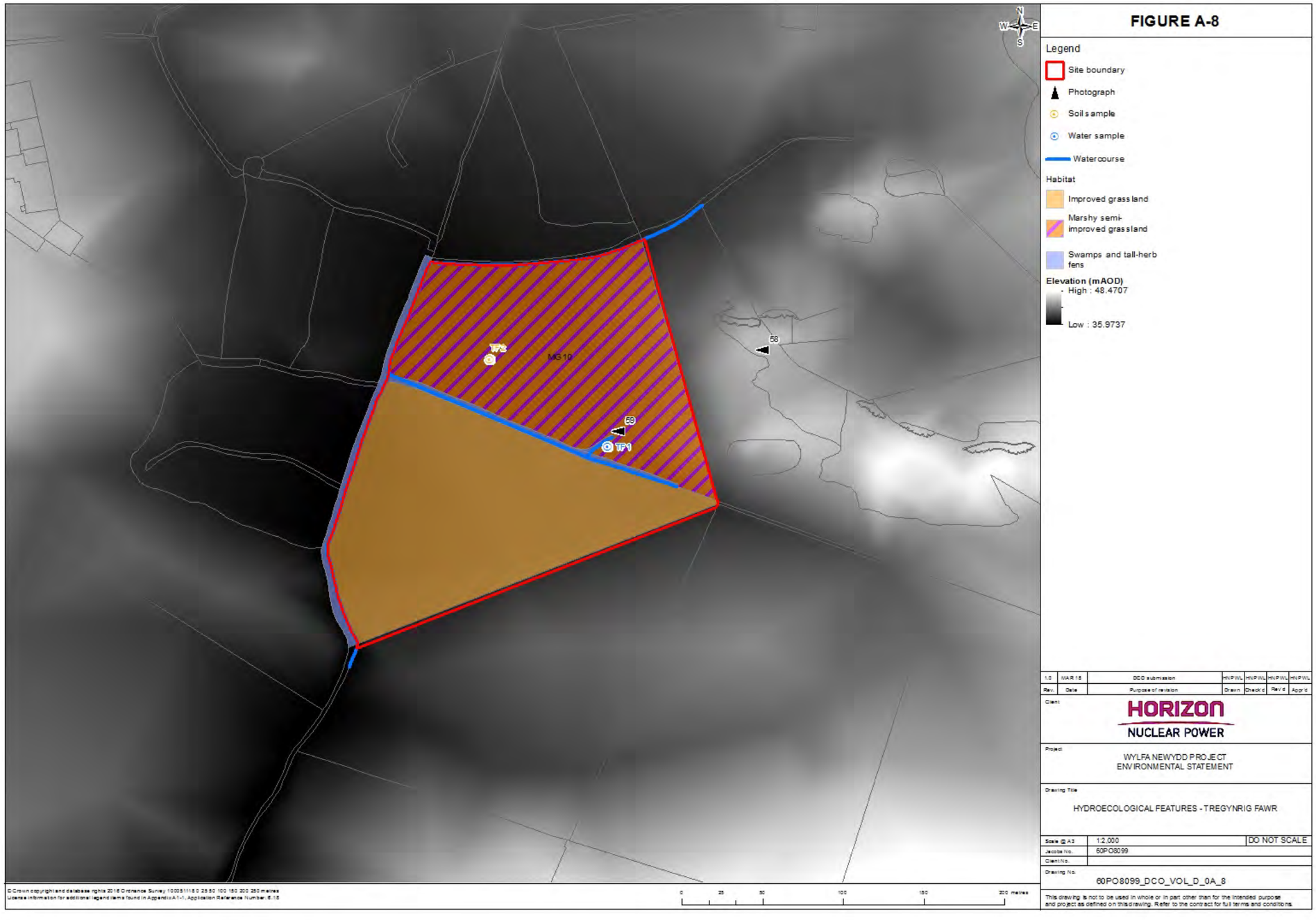


Figure A-9: Hydroecological features – Ty du

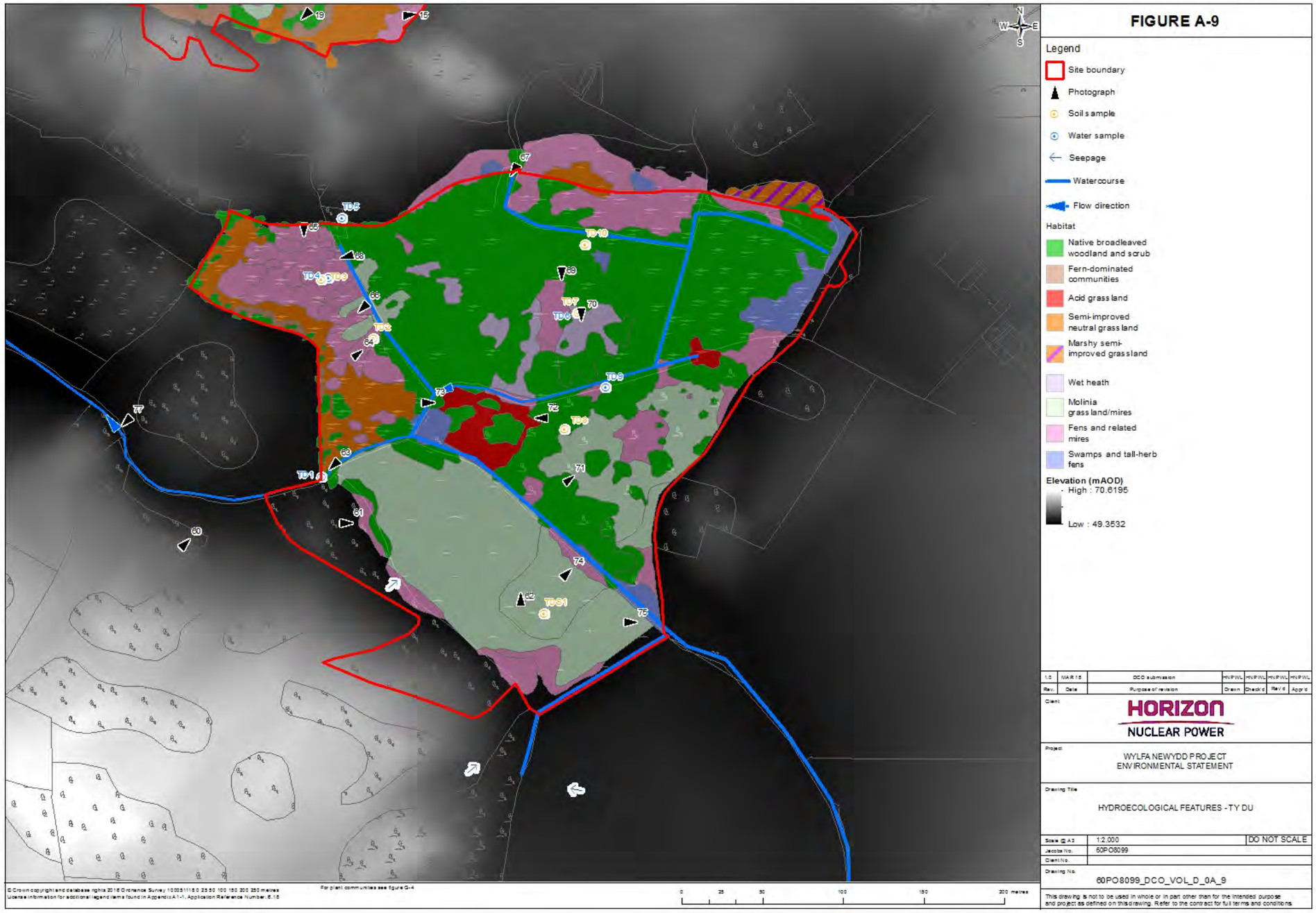


Figure A-10: Hydroecological features – Tyddyn Y Waun

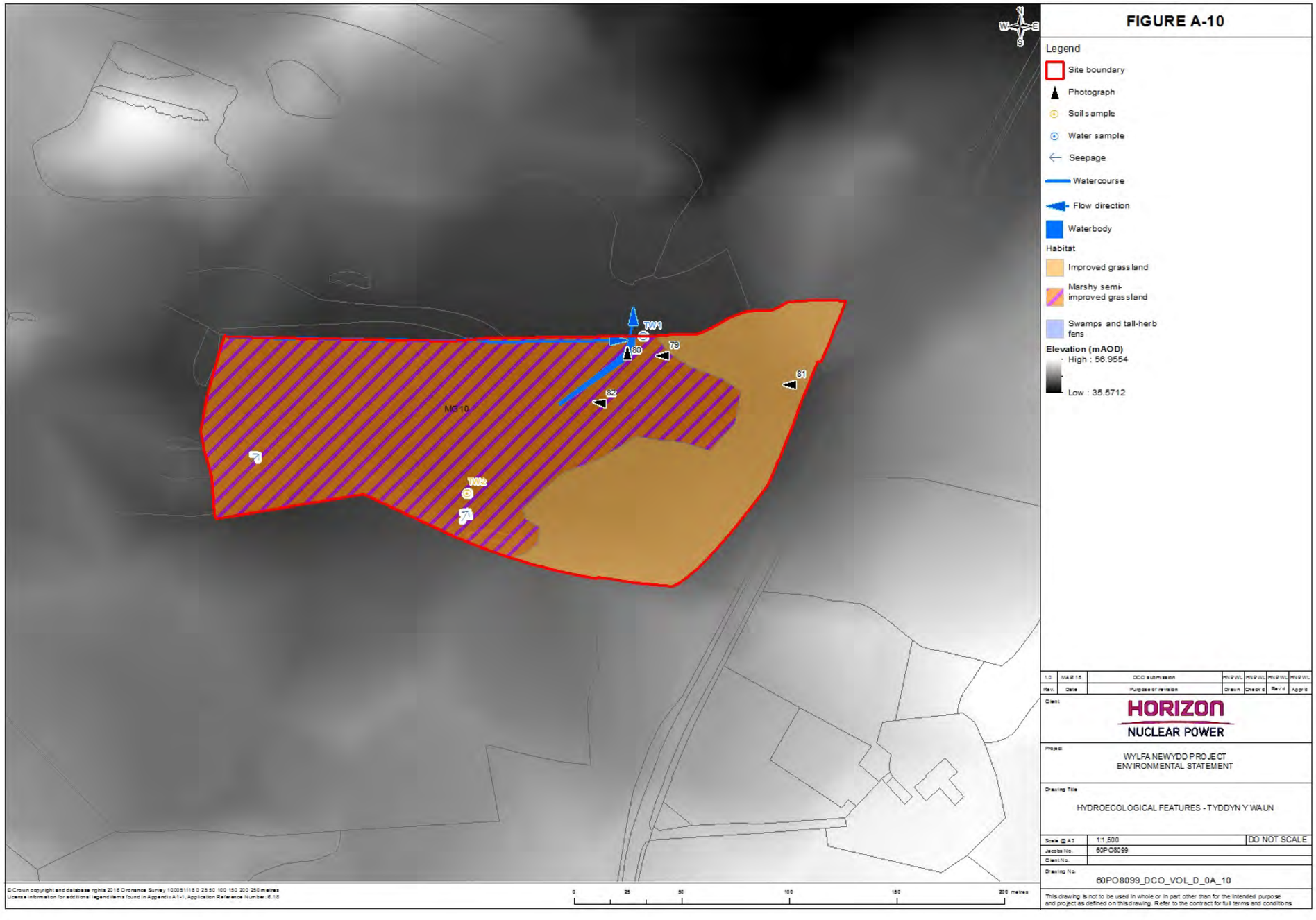


Figure A-11: Hydroecological features – Site 3

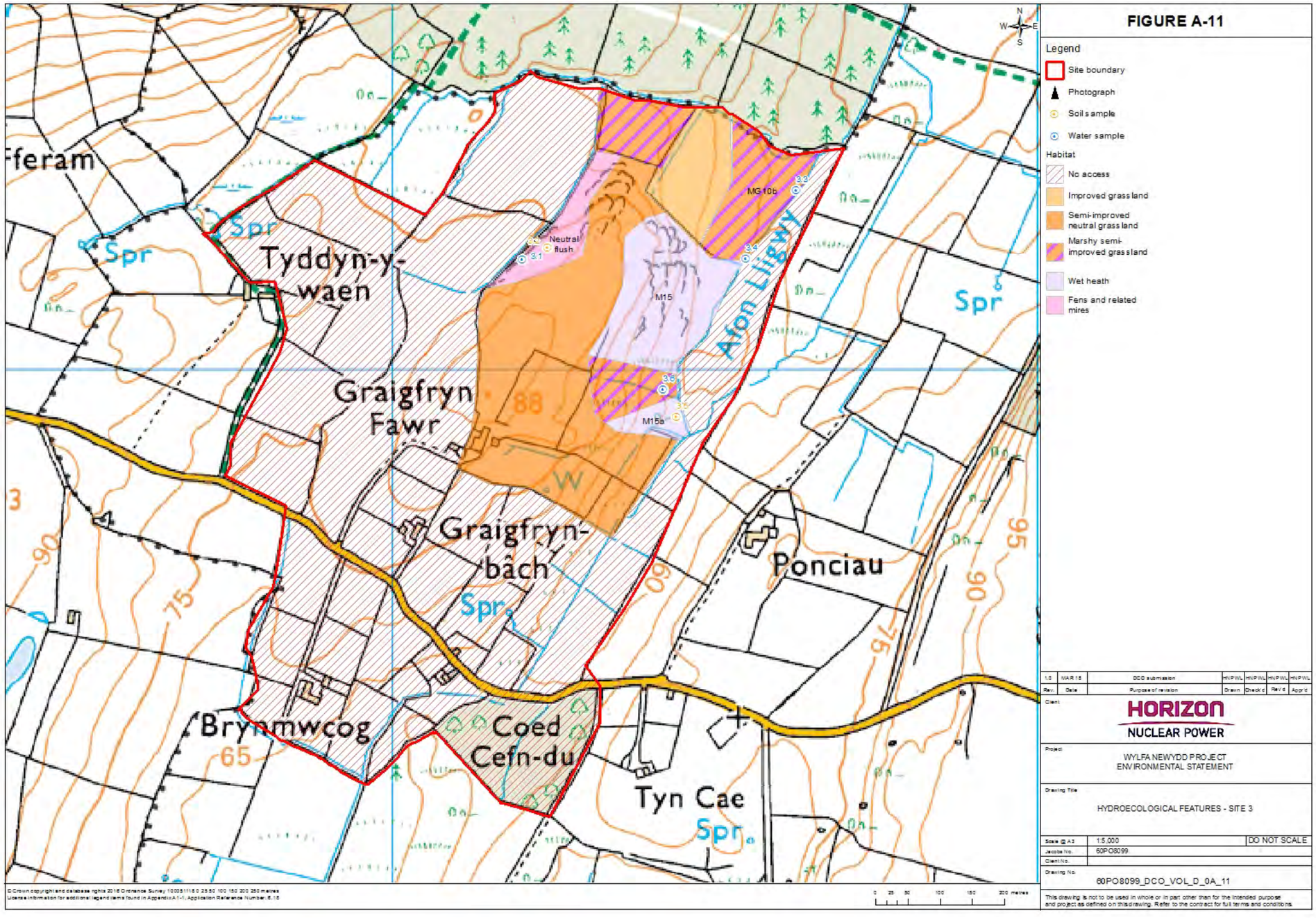


Figure A-12: Hydroecological features – Site 8

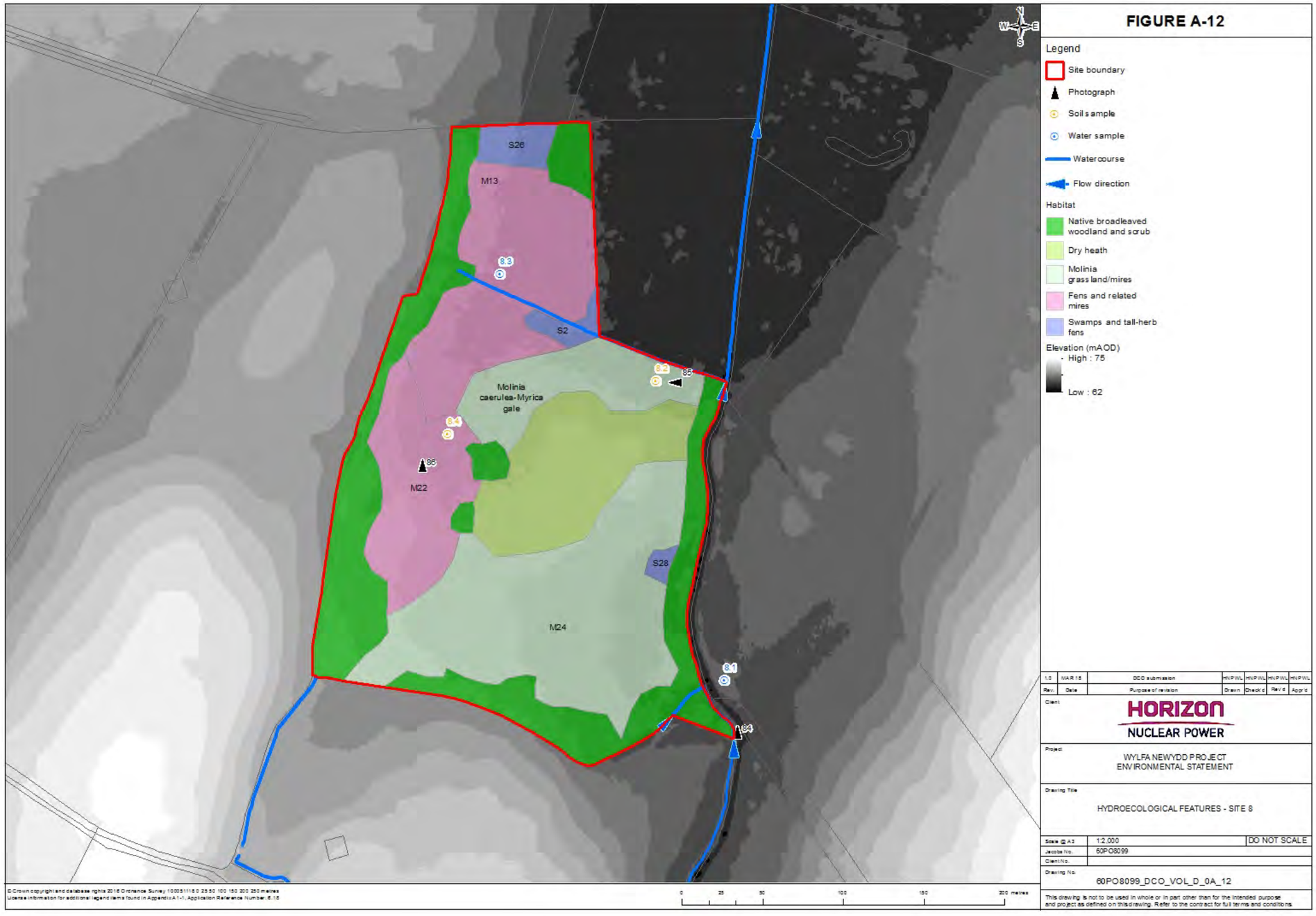


Figure A-13: Hydroecological features – Site 18

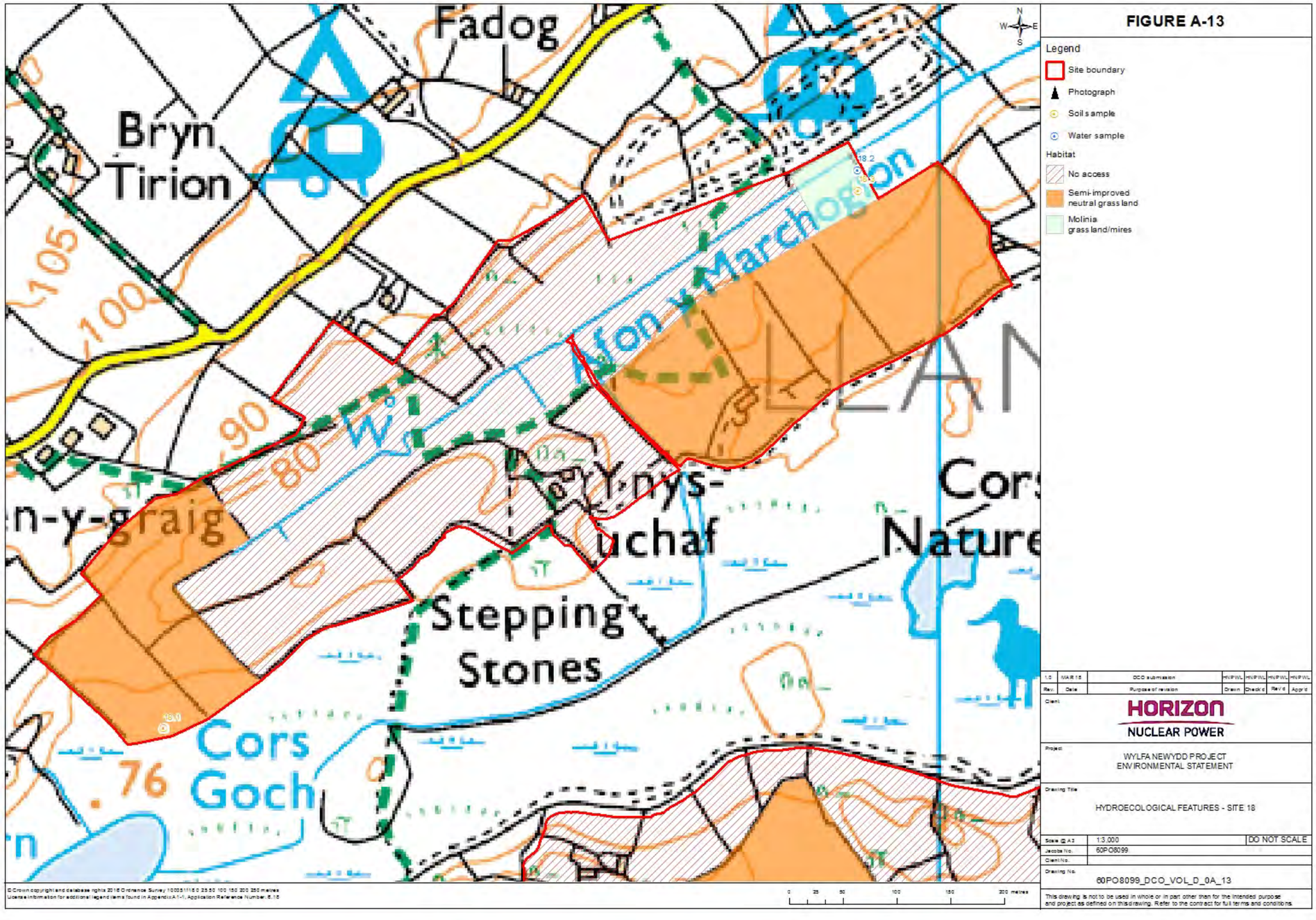


Figure A-14: Hydroecological features – Site 19

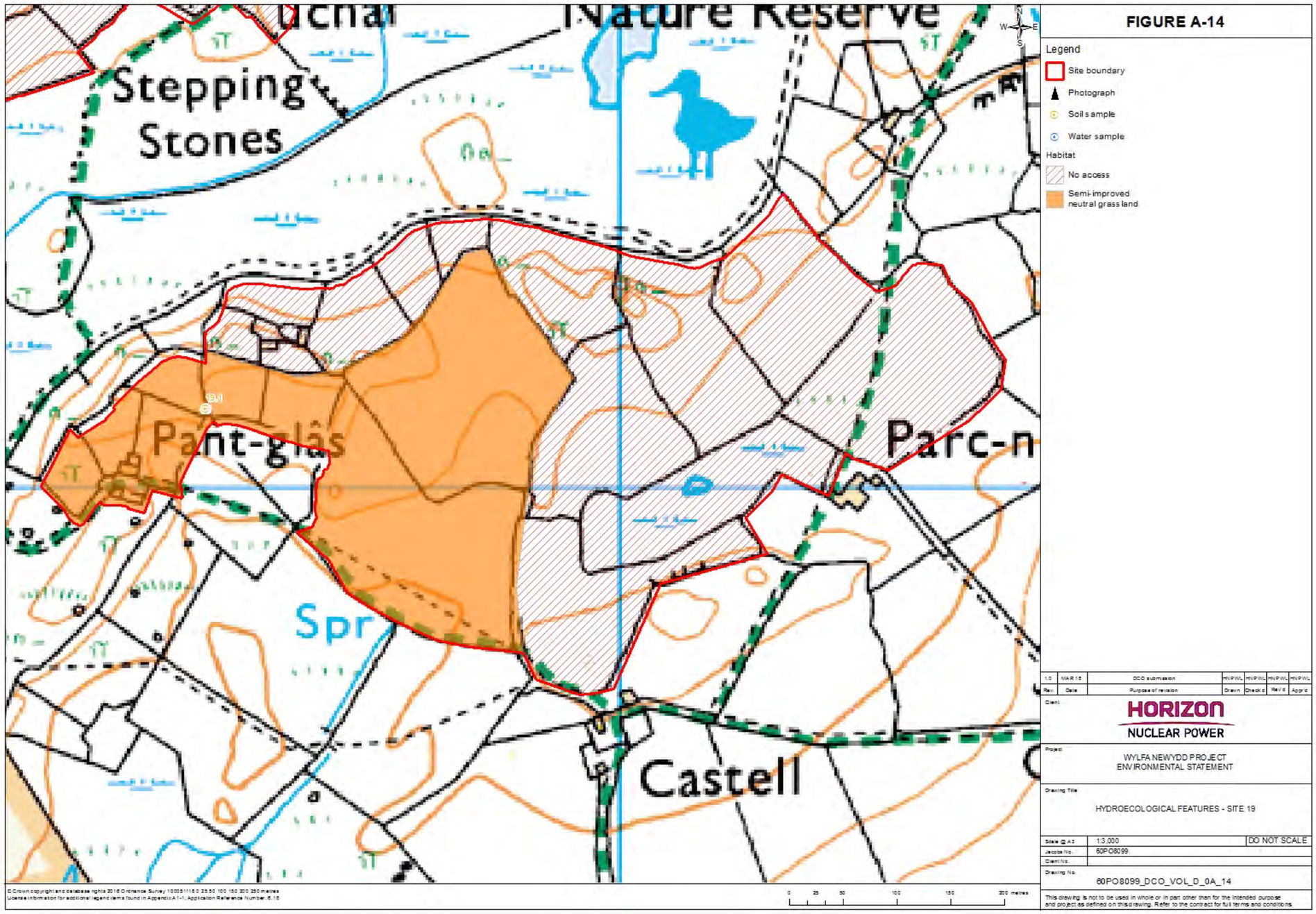


Figure A-15: Hydroecological features – Site 24

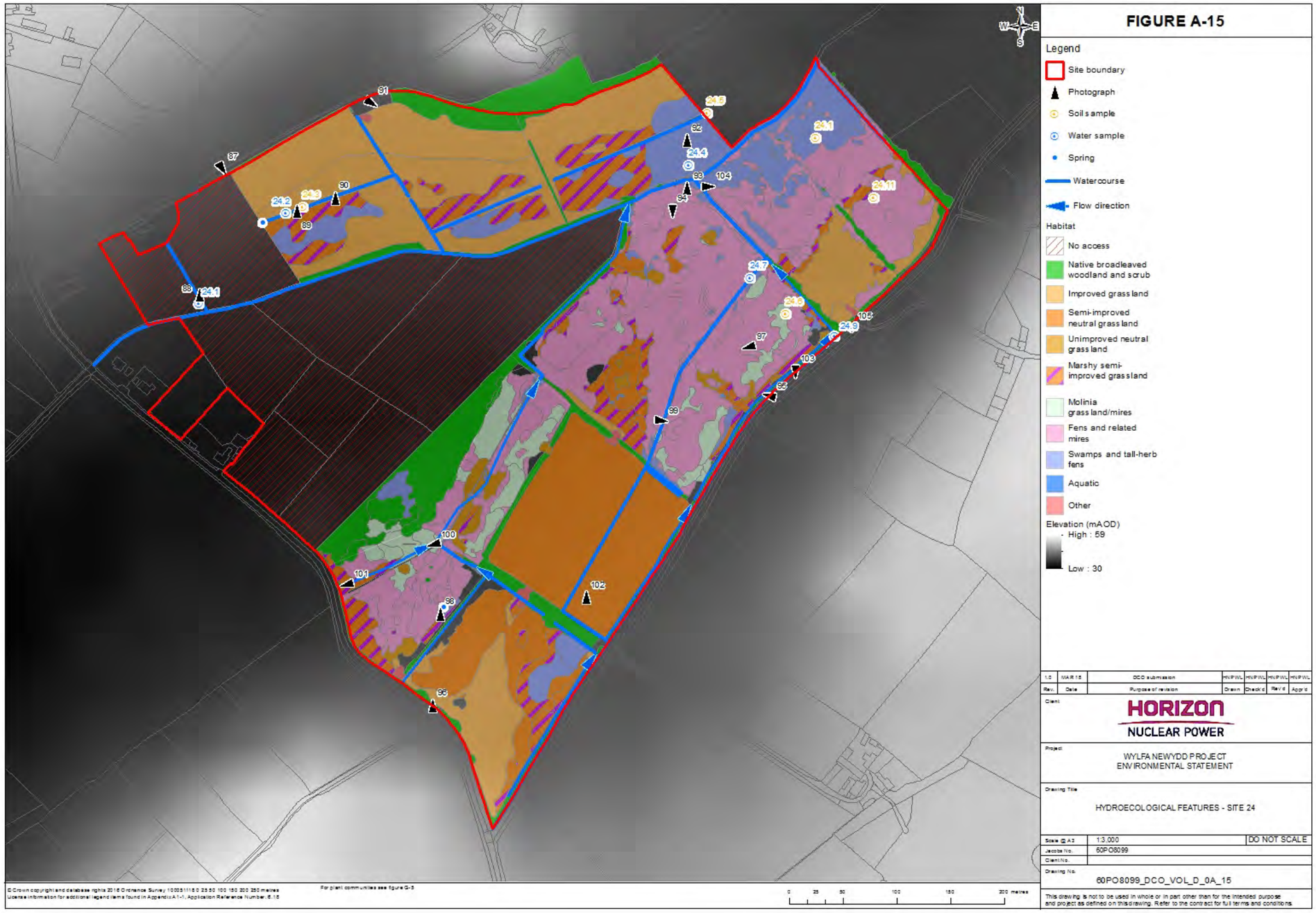


Figure A-16: Hydroecological features –Site 25

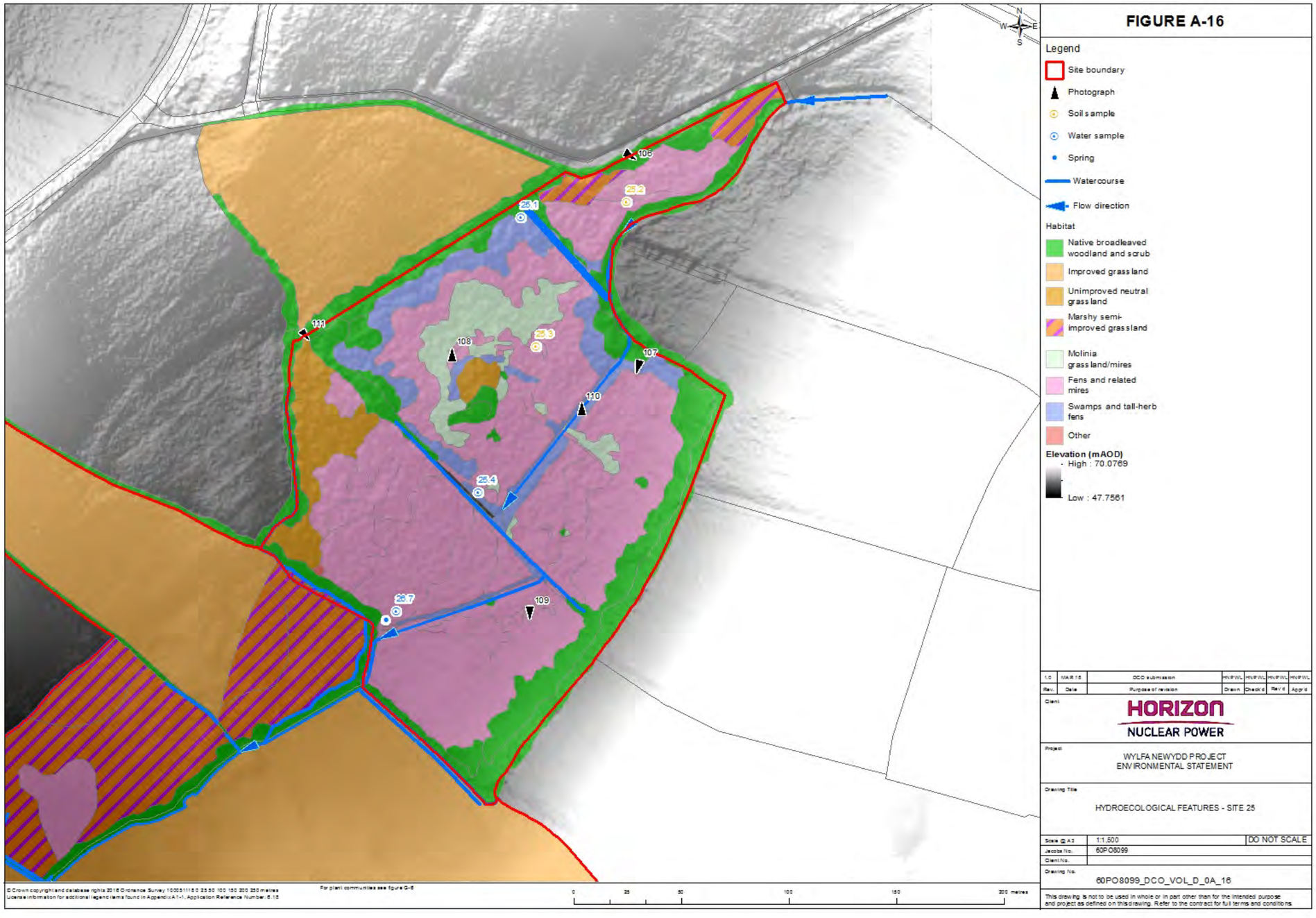


Figure A-17: Hydroecological features – Site 26

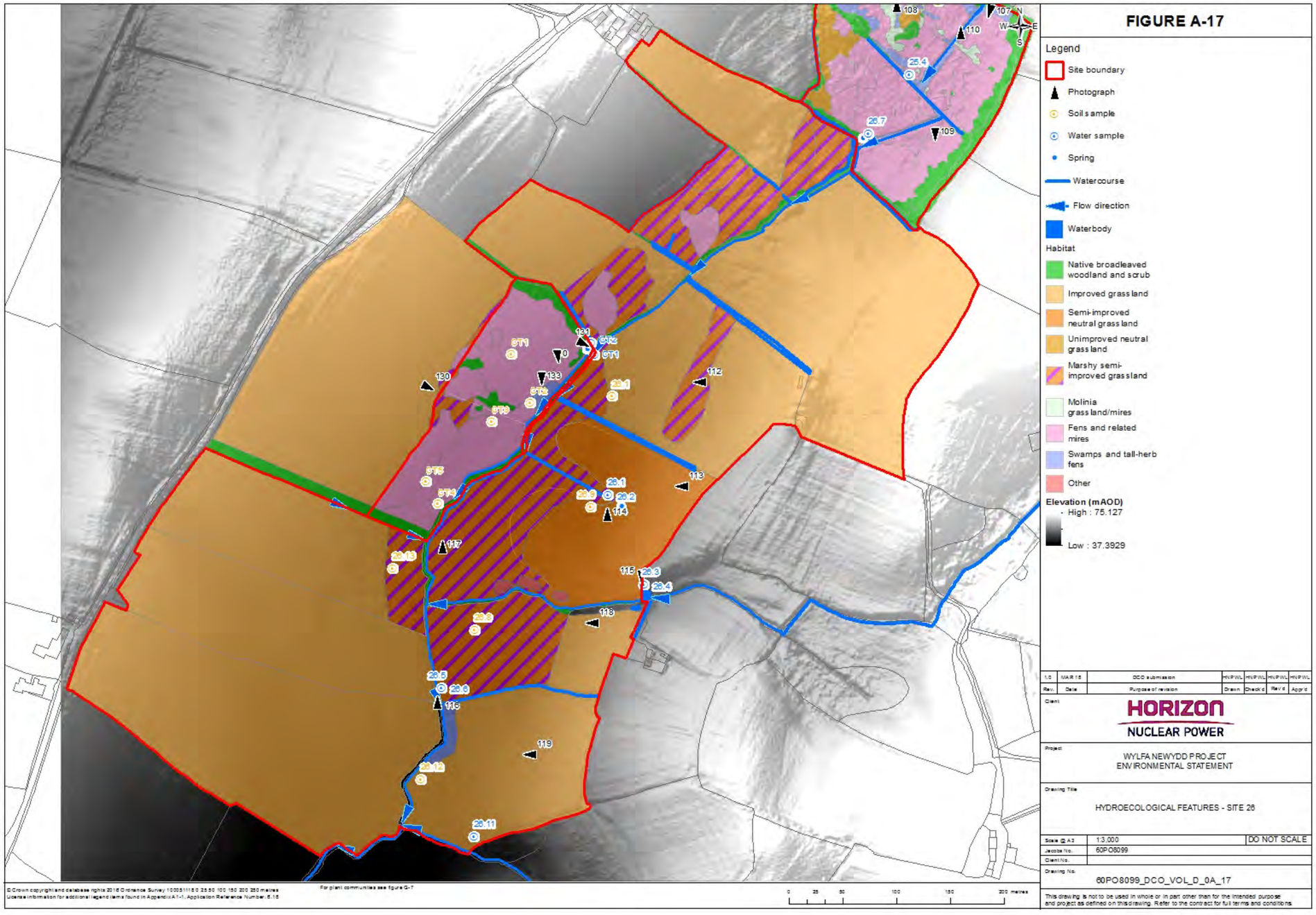


Figure A-18: Hydroecological features – Site 32

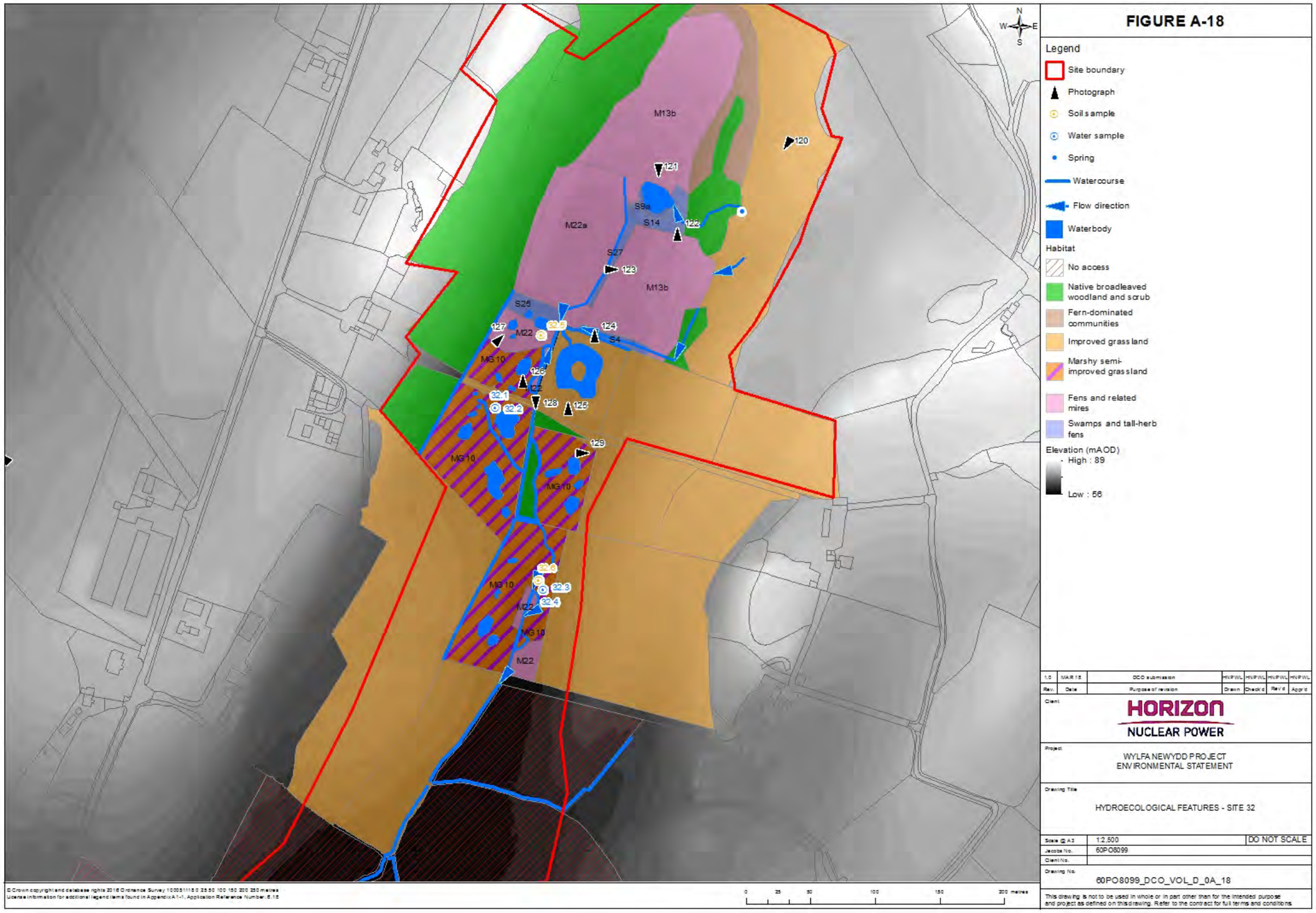
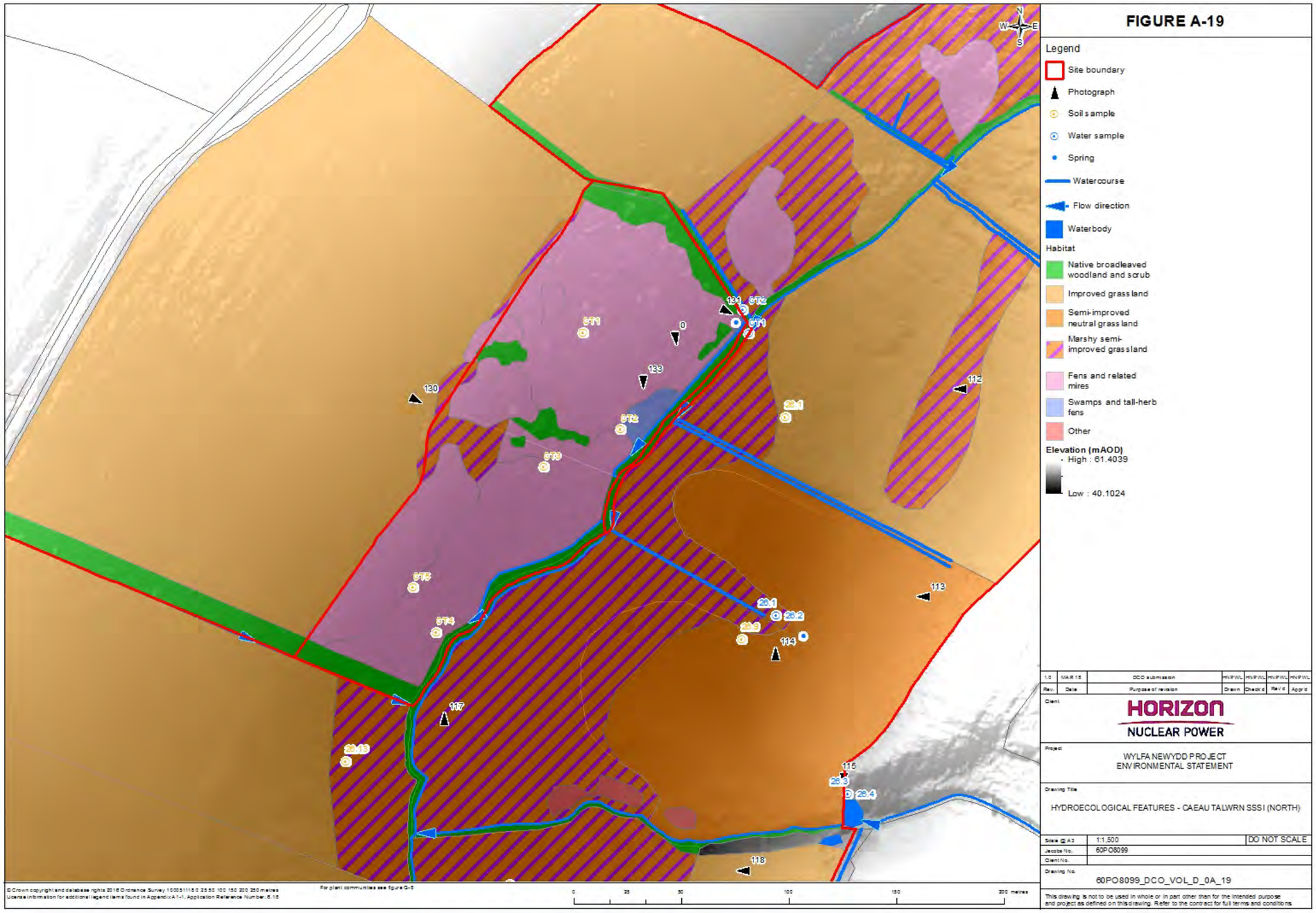


Figure A-19: Hydroecological features – Caeau Talwrn SSSI (North)



Appendix B Photographic plates

Plate 1: Looking from near the road toward the south-east corner of Burwen North. 20/04/2016

Plate 2: Flow tracks through the eastern area of rush mire. Burwen North, 20/04/2016

Plate 3: Western area of mire with transition to unimproved neutral grassland. Burwen North, 20/04/2016

Plate 4: The drain running west to east across site, looking west. Burwen North, 20/04/2016

Plate 5: The main site drain running north to south, looking south toward the outfall. Burwen North, 20/04/2016

Plate 6: Burwen West, viewed from the north-west corner of, looking across the top of the highest field toward the farm. 20/04/2016

Plate 7: Seepage tracks in the top-most field. Burwen West, 20/04/2016

Plate 8: The pond at the western edge of site. Burwen West, 20/04/2016

Plate 9: The fields to the east, looking east along the boundary drainage ditch with the surveyed area to the right. Burwen West, 20/04/2016

Plate 10: Vegetation of the boundary ditch in the eastern fields. Burwen West, 20/04/2016

Plate 11: Collect at western edge of site receiving drainagefrom the north. Burwen West, 20/04/2016

Plate 12: Looking west (upstream) along the stream running along the bottom of site. Burwen South, 20/04/2016

Plate 13: Looking north from the stream across the lower-most fields. Burwen South, 20/04/2016

Plate 14: Cae Adda, view from the north-eastern corner looking south-west from the road, showing sheep-grazed area to the right. 21/04/2016

Plate 15: The apparent outfall of the drain, at the eastern end of site. Cae Adda, 21/04/2016

Plate 16: The drain through site and dominated by bog pondweed. Cae Adda, 21/04/2016

Plate 17: The pond at the western end of site. Cae Adda, 21/04/2016

Plate 18: The rushy poor-fen community making up most of site with Sphagnum squarrosum and cotton sedge. Cae Adda, 21/04/2016

Plate 19: Looking south toward the hills which define southern edge of the Cae Adda basin: the abrupt change in vegetation shown here marks the transition to deep peat. 21/04/2016

Plate 20: Cae Owen, looking south into the fen. 19/04/2016

Plate 20: Drainage into Cae Owen, looking south from the road. 19/04/2016

Plate 22: Land to the north of Cae Owen above the road. 19/04/2016

Plate 23: Looking along the ditch south toward the stream. Cae Owen, 19/04/2016

Plate 24: The dry, raised area planted with trees. Cae Owen, 19/04/2016

Plate 25: Artificially deepened stream, choked with vegetation. Cae Owen, 19/04/2016

Plate 26: Looking north across Cae Owen from its centre. 19/04/2016

Plate 27: The south-west corner of the fen, mown for access to bee hives, and maintaining an area of fen. Cae Owen, 19/04/2016

Plate 28: View west across Mynachdy from the public right of way, with the hill Mynydd y Garn in the distance and the farm buildings on the right. The main drain follows the line of scrub into site, flowing toward the foreground. 24/05/2016

Plate 29: View across the main area of pasture with Mynydd y Garn centre, the remnant of mire vegetation left of centre. Mynachdy, 25/05/2016

Plate 30: A stretch of the drain encircling the remnant mire. Mynachdy, 24/05/2016

Plate 31: Peat removed from the drain, left on the remnant mire. Mynachdy, 24/05/2016

Plate 32: Deep drain at the periphery, away from the central area of peat. Mynachdy, 24/05/2016

Plate 33: View from within the remnant mire, much of it dominated by common reed. Mynachdy, 24/05/2016

Plate 34: The large ponded area and its vegetation. Mynachdy, 24/05/2016

Plate 35: Neuadd, looking from the hills to the east: the stream runs along the hedge in the middle distance, flowing away from the viewer, bends to the right at the centre of the view and leaves site behind the hill on the right. 19/04/2016

Plate 36: View from the hill at the southern end of Neuadd, looking north across the fen. Large areas of great fen-sedge are visible in the middle and near distance. Neuadd, 22/04/2016

Plate 37: Transition at base of slope between Molinia and reed dominated vegetation to blunt-flowered rush fen. Black bog-rush occurs along the intermediate zone visible right of centre. Neuadd, 22/04/2016

Plate 38: View from the eastern corner. The stream flows from the right along the hedge. Neuadd, 22/04/2016

Plate 39: View into site with seepage zone in foreground, the zig-zag of which extends into site as species poor rushy vegeation. Neuadd, 22/04/2016

Plate 40: The stream as it enters site. Neuadd, 22/04/2016

Plate 41: The western edge of Neuadd looking north into cattle grazed land. The ditch from the south flows in from the left along the fence, and there is seepage along the bottom of the slope in the centre of the view extending a short way outwards the fencing. 22/04/2016

Plate 42: Transitional close-grazed rush mire (see Plate 41) with abundant bottle sedge. Neuadd, 22/04/2016

Plate 43: A stand of great fen-sedge and floating Carex acutiformis raft. Neuadd, 22/04/2016

Plate 44: View approximately east from within the fen on the western side of the stream, showing zonation between wet reed swamp (green) and drier reed canary-grass vegetation on a raised baulk along the stream. Neuadd, 22/04/2016

Plate 45: View from the road around the headland north of Neuadd, looking south into site. The meander of the stream is visible from the vegetation, and the site boundary is visible as the post and wire fence running between the scattered shrubs in the middle distance. The stream continues right (west). Neuadd, 22/04/2016

Plate 46: North of Neuadd, on the road, here looking west up the valley toward Tyddyn Rhydderch (the two white buildings, opposite Cae Owen) and Magnox. Springs emanate from just to the right of view and seep down under the road into the rough area in the middle distance, then into the upper part of the fen and the valley. The stream flows from the sheep right, middle distance, around the right hand side of the low gorse-capped hill, following the fence line and passing under the white house just visible (Isallt). 22/04/2016

Plate 47: North of the main fen area, looking north toward the road across the seepage zone rising on the right and collecting as flow on the left where it enters the stream. Neuadd, 22/04/2016

Plate 48: View from the road of the northern end of site (fence posts visible on the left). The stream runs along the hedge/fence line in the middle distance, seepage vegetation continues beyond this up the valley. The seepage area pictured above enters from the left. Neuadd, 22/04/2016

Plate 49: A discrete spring source (within brambles/rubble) contributing to the seepage zone from the north of the fen. Neuadd, 22/04/2016

Plate 50: The seepage zone collects into a ditch before entering the stream, visible ahead in centre. Neuadd, 22/04/2016

Plate 51: Boundary of the fen (left), and between ungrazed and grazed land. The stream is choked with vegetation and runs along the post and wire fence. The seepage zone from the north enters from direclty behind this view. Neuadd, 22/04/2016

Plate 52: Same point as Plate 51, looking into the fen, showing vegetated outflow and transition to swamp vegetation. Neuadd, 22/04/2016

Plate 53: View south-west across the fen on the eastern side of the stream. Neuadd, 22/04/2016

Plate 54: Transition between dry and wet rush vegetation. Neuadd, 22/04/2016

Plate 55: View north of the pond to the south of Neuadd, which lies just over the gorse-covered hill in the distance. Neuadd, 22/04/2016

Plate 56: Pipe and ditch draining the pond. Neuadd, 22/04/2016

Plate 57: The outflow heads into a ditch along the line of scrub shown here and flows right into site. Neuadd, 22/04/2016

Plate 58: View west across Tregynrig Fawr: the main ditch is visible running away from the viewer, with the two wetter fields either side; the field on the left is paler having had manure spread on it; the field on the right was recently mown. 23/05/2016

Plate 59: Looking west over Tregynrig Fawr with a scrape cut into the field for cattle to drink from in the foreground. 23/05/2016

Plate 60: Ty du seen from the south looking north-east. The white house is Cae Adda. The central area of scrub is most visible here stretching across the centre of site, with the purple moor-grass mire stretching off to the right. 21/04/2016

Plate 61: The purple moor-grass mire showing the slopes enclosing it in the foreground and the more gently sloping land away to the south-east. Ty du, 21/04/2016

Plate 62: The vegetation of the purple moor-grass mire: dry, coarse and with scattered heather. The wetter areas hold cotton sedge and scrappy areas of bog moss. Ty du, 24/05/2016

Plate 63: The footbridge over the main drain as it leaves site. The channel is around three metres deep and is heavily vegetated. Ty du, 21/04/2016

Plate 64: Flow tracks within the mire to the west of site, dominated by bog pond weed, looking east toward the central area of scrub. Ty du, 21/04/2016

Plate 65: View south across the mire to the west of site. Ty du, 21/04/2016

Plate 66: Looking south-west from the the transition zone between the western mire, undergrazed mire to the left of the fence and central scrub. Ty du, 21/04/2016

Plate 67: View across the northern edge of site looking south. Ty du, 21/04/2016

Plate 68: Flow into the scrub area from the western mire, meeting a drain along the western boundary, rising just to the right of view as a seepage area below a derelict wall. Ty du, 21/04/2016

Plate 69: View north into the central area of poor-fen, with flow tracks. Ty du, 21/04/2016

Plate 70: The southern edge of the central mire shows a transition to drier vegetation with tussocks of purple moor-grass and scattered heather and gorse. Ty du, 21/04/2016

Plate 71: The eastern part of the mire system is kept much more open, and supports transitional rush mire. View looking north, with a ditch running through the scrub to the left and the central bog area beyond this. Ty du, 21/04/2016

Plate 72: Drain running east to west through the centre of site, to the south of the central area of mire. Ty du, 21/04/2016

Plate 73: The branch of the drainage system collecting water from the centre of the mire system, flowing toward the viewer, meeting the main drain several metres behind to the right. Ty du, 21/04/2016

Plate 74: Looking north across the zone between the purple moor-grass mire and the scrub, the lush vegetation in the middle ground is the main drainage channel, flowing in from the right. Ty du, 21/04/2016

Plate 75: The sedge vegetation of the main drainage channel, running in from the right (south). There is a clear seepage/inundation zone along the stream, visible on the right here as a zone of lusher vegetation between the fence and the pasture on the slopes above. Ty du, 21/04/2016

Plate 76: The culvert which drains the fields to the south of the A5025 down through the main drainage channel running by Ty du. No flow was visible. 24/05/2016

Plate 77: Very deep channel to the drain running along the valley, downstream of Ty du. 24/05/2016

Plate 78: The stream approximately half way along the valley between Ty du and Neuadd, here taking on a much more natural appearance, with a shallow channel. The fenced area to the right of view is a well. Above the stream, as shown here, there were small areas of yellow-flag dominated vegetation suggestive of intermittent seepage. 24/05/2016

Plate 79: Tyddyn y Waun, view north-west into site, showing extensive rushy vegetation occupying the lower lying land. The outfall for the drain is along the wall on the right. 23/05/2016

Plate 80: Vegetation at the outfall of the drain where water pools before flowing under the wall. Tyddyn y Waun, 23/05/2016

Plate 81: View north at the outfall of the drain through site. Tyddyn y Waun, 23/05/2016

Plate 82: Flow track through mire (above) dominated by water horsetail (below). Tyddyn y Waun, 23/05/2016

Plate 83: View north-west looking toward the valley in which Site 8 sits, showing surround intensive land use. 03/11/2016

Plate 84: The stream draining along the eastern boundary of Site 8 with access bridge. 03/11/2016

Plate 85: Rank purple moor-grass and bog myrtle vegetation with great fen-sedge in the north-east of Site 8 near the boundary with Cors Erddreiniog SSSI. 03/11/2016

Plate 86: Rank fen meadow dominated by blunt-flowered rush in the west of Site 8. 03/11/2016.

Plate 87: Site 24, view from track looking south into improved pasture with abundant hard rush. 27/09/2016

Plate 96: Looking east over Improved grassland on higher ground in the south-west of Site 24, with transition to fen (left). 02/11/2016

Plate 97: Well-grazed fen pasture in south of Site 24. 28/09/2016

Plate 98: Tufa-forming springhead within M13 in the valley head in the west of Site 24. 26/07/2017

Plate 99: Heavy calcite deposition on recently cleared ditch within unimproved fen pasture. Site 24, 28/09/2016

Plate 100: Steeply-inclined, new ditch draining the road through fen pasture. Site 24, 28/09/2016

Plate 101: Culvert draining road into Site 24 with abundant watercress suggesting nutrient enrichment. 28/09/2016

Plate 102: Field drain or former ditch within semi-improved grassland in south of Site 24. 02/11/2016

Plate 103: Ditch along the southern boundary of Site 24 with abundant sedges, stoneworts and bryophytes. 02/11/2016

Plate 104: View looking east into partially improved fen in the east of Site 24. 27/09/2016

Plate 105: View from the road looking north into eastern fields, showing improved pasture with transition to partially improved fen (Plate 103). Site 24, 02/11/2016

Plate 106: Site 25, view south-east over fen pasture above the stream (line of trees) in the north of site. 03/11/2016

Plate 107: View south-west over bottom of fen with stream running through the centre of view. Site 25, 03/11/2016

Plate 108: Fen vegetation in the north-west of Site 25, showing M25 Molinia caerulea-Cirsium dissectum fen meadow (left and foreground) and transition to M13b Schoenus nigricans-Juncus subnodulosus mire, Briza media-Pinguicula vulgaris sub-community (right). 04/11/2016

Plate 109: Black bog-rush within open M13b fen. Site 25, 03/11/2016

Plate 110: M9 Carex rostrata-Calliergon giganteum/cuspidata marking out areas of strong water seepage within M13. Site 25, 03/11/2016

Plate 111: Looking south-east in the west of Site 25: M22 in the middle distance and low escarpment marked by trees in distance supplying M13; the stream separates these two vegetation types, flowing away to the right (south) into Site 26. 03/11/2016

Plate 112: Site 26, looking west over improved pasture in the north of site with areas of rushes marking out seepage. 04/11/2016

Plate 113: View south-west over steeper slopes of valley within Site 26, with break in slope marking out seepage area in middle distance and flatter ground above stream (line of trees); the ditch right of centre drains a spring. 04/11/2016

Plate 114: Spring within pasture dominated by floating sweet-grass. Site 26, 13/10/2016

Plate 115: The stream entering site from the east supplies a pool where it has been dammed. Site 26, 13/10/2016

Plate 116: Deep channel of stream draining valley. Site 26, 13/10/2016

Plate 117: Rushy valley bottom looking north. Site 26, 13/10/2016

Plate 118: Looking west across improved pasture toward stream (line of trees in centre) with rushy valley bottom; the stream flowing into site from the east follows the line of trees on the right. Site 26, 13/10/2016

Plate 119: View west over recently re-sown pasture, Site 26. The southern unit of Caeau Talwrn SSSI to the left of view. 04/11/2016

Plate 120: Site 32 looking south from the slopes above Fagwyr Fawr with pond dug on set-aside land visible in the distance; the pond within the mire is below the group of trees to the right; the spring supplying the pond is within the trees. 13/10/2016

Plate 121: View south over artificial pond on the eastern edge of valleyhead fen – the spring supplying the pond discharges on the left of view. Site 32, 13/10/2016

Plate 122: Enriched vegetation of branched bur-reed and watercress around pond margin. Site 32, 13/10/2016

Plate 123: Black bog-rush within valleyhead fen. Site 32, 13/10/2016

Plate 124: Looking north into valleyhead fen from set-aside land to the south. Site 32, 13/10/2016

Plate 125: Large amenity pond in set-aside land – note boat and benches right of view. Site 32, 13/10/2016

Plate 126: One of several shallow fenny ponds within set aside land, looking north. Site 32, 13/10/2016

Plate 127: Fen vegetation established in set-aside land. Site 32, 13/10/2016

Plate 128: Pool formed along stream draining the valley. Site 32, 13/10/2016

Plate 129: Dry eastern valley slope with set-aside land in foreground. Site 32, 13/10/2016

Plate 130: Caeau Talwrn SSSI (North) looking east from improved pasture above SSSI. 10/11/2017

Plate 131: Nutrient-enriched spring. 10/11/2017

Plate 132: M13 dominated by large tussocks of black bog-rush. 10/11/2017

Plate 133: Flooded area at bottom of site dominated by fool's watercress. 10/11/2017

Appendix C Soil sample results

Table C-1: Soil sample results

Site Name	Sample ID	Sample Date	P/M	M	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L
			Peat or Mineral Soil	Sample Depth (Base of Core)	Alkalinity, Bicarbonate as CaCO3 (diss.filt)	Alkalinity, Carbonate as CaCO3 (diss.filt)	Ammoniacal Nitrogen as N	Calcium (diss.filt)	Chloride	Magnesium (diss.filt)	Nitrate as NO3	pH (diss.filt)	Phosphate (ortho) as PO4	Potassium (diss.filt)	Sodium (diss.filt)	Sulphate
Neuadd	NE.7	19/04/2016		0.4	5.5	<2	<0.2	0.73	2.1	0.239	0.517	7.31	<0.05	<1	2.75	<2
Neuadd	NE.8	19/04/2016		0.5	11.9	<2	<0.2	3.25	4.3	1.31	<0.3	7.31	<0.05	<1	2.92	<2
Neuadd	NE.9	19/04/2016		1	6	<2	<0.2	4.42	3.9	1.71	<0.3	7.21	<0.05	<1	3.07	17.7
Neuadd	NE.10	19/04/2016		0.25	9.5	<2	<0.2	2.34	<10	0.712	0.355	7.02	<0.05	<1	2.21	<2
Cae Owen	CO.3	19/04/2016		0.25	4	<2	<0.2	0.85	<2	0.287	4.09	6.94	0.091	2.01	2.27	<2
Cae Owen	CO.4	19/04/2016		0.25	<2	<2	<0.2	0.443	<2	0.235	3.14	5.21	0.217	2.14	2.29	<2
Cae Owen	CO.5	19/04/2016		0.5	4	<2	<0.2	3.67	6.9	1.84	<0.3	7.12	0.104	<1	6.21	21.9
Burwen West	BW.5	20/04/2016	M	0.2	3	<2	<0.2	1.15	<2	0.105	0.605	7.1	<0.05	<1	1.53	<2
Burwen West	BW.6	20/04/2016	M	0.2	7	<2	<0.2	1.74	2.4	0.313	<0.3	7.19	0.061	<1	2.9	9.7
Burwen West	BW.7	20/04/2016	M	0.3	6	<2	<0.2	1.39	<2	0.124	<0.3	7.48	<0.05	<1	1.92	<2
Burwen South	BS.2	20/04/2016	M	0.3	3.5	<2	<0.2	0.237	<2	0.0601	<0.3	6.69	<0.05	<1	2.01	<2
Burwen North	BN.5	20/04/2016		0.45	18.5	<2	<0.4	5.47	<2	0.2	0.937	8.39	<0.05	<1	3.17	<2
Burwen North	BN.6	20/04/2016		0.5	5	<2	<2	2.55	<10	0.604	<0.3	7.12	<0.05	<1	3.06	<2
Burwen North	BN.7	20/04/2016		0.2	3.5	<2	<0.4	0.57	2.8	0.184	<0.3	7.04	<0.05	<1	3.01	<2
Ty du	TD.6	21/04/2016	P	1.75	6	<2	0.813	2.46	<10	0.463	<0.3	6.98	0.066	<1	3.64	<2
Ty du	TD.7	21/04/2016	P	2.5	6	<2	<0.2	<0.012	<10	<0.036	<0.3	6.9	<0.05	<1	<0.076	<2
Ty du	TD.8	21/04/2016	P	2.5	4.5	<2	<0.2	1.19	6.9	0.519	<0.3	6.98	<0.05	<1	5.33	<2
Ty du	TD.9	21/04/2016	M	0.17	6	<2	<4	1.51	<10	0.511	1.11	6.73	<0.05	<1	4.14	<2
Ty du	TD.10	21/04/2016	P	2.25	7.5	<2	<1	1.92	5.9	0.506	<0.3	6.9	<0.05	<1	4.34	<2
Cae Adda	CA.5	21/04/2016		1	4	<2	<0.2	2.02	<10	0.849	<1.5	6.34	<0.05	<1	5.08	<2

Site Name	Sample ID	Sample Date	P/M	M	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pH units	mg/L	mg/L	mg/L	mg/L
			Peat or Mineral Soil	Sample Depth (Base of Core)	Alkalinity, Bicarbonate as CaCO3 (diss.filt)	Alkalinity, Carbonate as CaCO3 (diss.filt)	Ammoniacal Nitrogen as N	Calcium (diss.filt)	Chloride	Magnesium (diss.filt)	Nitrate as NO3	pH (diss.filt)	Phosphate (ortho) as PO4	Potassium (diss.filt)	Sodium (diss.filt)	Sulphate
Cae Adda	CA.6	21/04/2016		2.2	7.5	<2	<0.2	2.17	3.9	0.169	<0.3	7.23	<0.05	<1	4.07	<2
18	18.2	10/05/2016	M	0.5	12	<2	<0.2	3.35	<2	0.558	0.759	7.36	<0.05	<1	0.872	<2
18	18.3	11/05/2016	P	1.5	55	<2	<0.2	19.4	<2	0.372	1.35	8.14	0.126	<1	0.74	<2
3	3.5	10/05/2016	M	0.4	2.5	<2	<0.2	0.433	<2	0.169	<0.3	6.71	0.61	<1	1.68	6.3
3	3.6	10/05/2016	M	0.4	4	<2	<0.2	1.15	<2	0.22	0.421	6.8	<0.05	<1	1.7	<2
Mynachdy	MY.5	24/05/2016	P		12	<2	<0.2	6.74	<2	1.14	<0.3	7.05	<0.05	<1	2.28	8.6
Mynachdy	MY.6	24/05/2016	P		4.5	<2	0.51	4.67	<20	0.716	<3	5.91	<0.05	<1	4.79	<2
Ty du South	TD.11	24/05/2016	P	2.5	4	<2	<0.2	1.84	<20	0.422	<3	6.08	<0.05	<1	3.86	<10
Tregynrig Fawr	TF.2	23/05/2016			4	<2	0.309	2.82	<20	0.627	<1.5	6.2	<0.05	<1	2.35	<10
Tyddyn-y-Waun	TW.2	23/05/2016			3.5	<2	<0.2	2	2.4	0.352	<0.3	6.29	<0.05	<1	3.77	5.3
26	26.6	04/11/2016	M	0.5	170	30	<0.2	70.5	8.5	4.79	6.42	8.37	<0.05	<1	10.9	21.7
26	26.7	04/11/2016	M	1.2	215	20	<0.2	112	7.1	2.82	12.5	8.21	<0.05	<1	6.44	56.2
26	26.8	04/11/2016	P	0.6	230	30	0.517	106	5.9	2.74	4.31	8.33	<0.05	<1	4.68	25.8
26	26.9	04/11/2016	M	0.4												
26	26.10	04/11/2016	M	0.3												
8	8.3	03/11/2016	M	0.3	120	30	<0.2	56.3	7	3.7	2.63	8.36	<0.05	1.05	6.32	7.6
8	8.4	03/11/2016	M	0.7	205	40	<0.2	87.5	11.3	8.2	2.57	8.39	<0.05	<1	11	10.4
25	25.4	03/11/2016	M	1	210	50	<0.2	108	11.2	1.86	3.74	8.39	<0.05	<1	8.61	23.6
25	25.5	03/11/2016	M	0.6												
32	32.6	02/11/2016	M	0.3												
32	32.7	02/11/2016	M	0.3												
24	24.10	02/11/2016	P	0.6	230	40	<0.2	163	7.6	7.73	5.27	8.3	<0.05	<1	9.41	168

Site Name	Sample ID	Sample Date	P/M	M	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	pH UNITS	MG/L	MG/L	MG/L	MG/L
			Peat or Mineral Soil	Sample Depth (Base of Core)	Alkalinity, Bicarbonate as CaCO3 (diss.filt)	Alkalinity, Carbonate as CaCO3 (diss.filt)	Ammoniacal Nitrogen as N	Calcium (diss.filt)	Chloride	Magnesium (diss.filt)	Nitrate as NO3	pH (diss.filt)	Phosphate (ortho) as PO4	Potassium (diss.filt)	Sodium (diss.filt)	Sulphate
24	24.11	02/11/2016	P	0.5	140	40	<0.2	66.4	6.5	5.8	5.49	8.15	<0.05	<1	6.08	11.7
24	24.12	29/09/2016	M	0.4												
24	24.13	29/09/2016	M	0.4	320	<2	<0.2	117	4.1	4.2	4.38	7.87	<0.05	<1	5.1	19.5
24	24.14	29/09/2016	M	0.3	210	20	<0.2	89.2	8	1.8	1	8.25	<0.05	<1	7.21	<2

Appendix D Water sample results

Table D-1: In-situ water quality results

Site Name	Sample ID	Sample Date	pH units	•C	µS/cm	mV	%	NTU
			pH	Temperature	Electrical Conductivity	Redox	Dissolved Oxygen	Turbidity
Neuadd	NE.1	21/04/2016	6.5		450	25	74	<5
Neuadd	NE.2	21/04/2016	6.4		454	10	70	500
Neuadd	NE.3	21/04/2016	6.6		235	16	102	<5
Neuadd	NE.4	21/04/2016	6.4		427	-22	51	60
Neuadd	NE.5	21/04/2016	6.8		365	-13	97	-
Neuadd	NE.6	21/04/2016	7.3		294	22	75	<5
Cae Owen	CO.1	21/04/2016	6.8		448	8	73	6
Cae Owen	CO.2	21/04/2016	6.8		569	16	84	11
Burwen West	BW.1	21/04/2016	5.4		147	49	65	500
Burwen West	BW.2	21/04/2016	5.6		181	62	79	7
Burwen West	BW.3	21/04/2016	5.9		175	52	66	60
Burwen West	BW.4	21/04/2016	5.9		174	46	88	<5
Burwen South	BS11	21/04/2016	6.4		228	17	73	<5
Burwen North	BN11	21/04/2016	6.4		244	29	76	10
Burwen North	BN.2	21/04/2016	6.3		234	35	-	100
Burwen North	BN.3	21/04/2016	6.3		171	41	-	380
Burwen North	BN.4	21/04/2016	6.1		212	60	-	25
Ty du	TD.1	26/04/2016	6.6		243	76	54	-
Ty du	TD.2	26/04/2016	5.6		209	102	96	<5
Ty du	TD.3	26/04/2016	5.7		203	111	87	40
Ty du	TD.4	26/04/2016	4.8		135	105	68	30
Ty du	TD.5	26/04/2016	6		245	102	82	30
Cae Adda	CA.1	26/04/2016	5.7		177	81	24	280
Cae Adda	CA.2	26/04/2016	5		135	89	93	<5
Cae Adda	CA.3	26/04/2016	5.2		237	98	-	11
18	18.1	11/05/2016	6.3		610	70	48	<5
3	3.1	12/05/2016	5.6		77	127	97	19
3	3.2	13/05/2016	5.4		114	170	78	<5
3	3.3	14/05/2016	5.2		89	183	72	24
3	3.4	15/05/2016	5.5		149	119	67	49
Mynachdy	MY.1	16/05/2016	6.5		343	126	61	<5
Mynachdy	MY.2	17/05/2016	6.3		287	133	71	<5
Mynachdy	MY.3	18/05/2016	6.3		357	92	63	45
Mynachdy	MY.4	19/05/2016	6.4		297	117	77	<5
Tregynrig Fawr	TF.1	20/05/2016	5.9		242	103	49	70
Tyddyn-y-Waun	TW.1	21/05/2016	6		294	144	87	-
24	24.1	29/09/2016	6.3		622	594	113	90
24	24.4	29/09/2016	6.4		561	455	158	
24	24.5	29/09/2016	6.5		504	580	108	<5
24	24.8	29/09/2016	6.9		541	351	91	55
32	32.1	13/10/2016	6.9		463	212	93	<5
32	32.2	13/10/2016	7.5		598	181	84	<5
26	26.1	13/10/2016	6.4		704		27	200
26	26.2	13/10/2016	7.6		675		94	<5
26	26.3	13/10/2016	7.8		620		93	<5
26	26.4	04/11/2016	5.5		393	92		500
26	26.3	04/11/2016				122		
26	26.2	04/11/2016				128		
26	26.1	04/11/2016				-40		
26	26.5	04/11/2016	7		473	102		<5
8	8.1	03/11/2016	6.1		502	170		<5
8	8.2	03/11/2016	6.8		353	95		500
25	25.1	03/11/2016	6.7		598	166		<5
25	25.2	03/11/2016	6.7		512	104		200
25	25.3	03/11/2016	6.7		602	-47		250
32	32.1	01/11/2016				212	93	
32	32.2	01/11/2016				181	84	
24	24.3	02/11/2016	6.6		419	167		<5
24	24.9	02/11/2016	7.1		482	157		<5
24	24.1	15/03/2017	8.1	10.27	502	83.1	92.4	

Site Name	Sample ID	Sample Date	pH units	•C	µS/cm	mV	%	NTU
			pH	Temperature	Electrical Conductivity	Redox	Dissolved Oxygen	Turbidity
24	24.4	15/03/2017	8.05	14.21	509.5		190.4	
24	24.5	15/03/2017	8.37	12.58	396.7	88.3	183	
24	24.8	15/03/2017	8.02	10.87	410.7	66.9	92.1	
24	24.3	15/03/2017						
24	24.9	15/03/2017						
32	32.3	16/03/2017	8.1	12.05	429	96.5	156.3	
32	32.5	16/03/2017	7.55	11.1	484.2	126.6	71.6	
32	32.4	16/03/2017	7.42	10.95	493.1	97.5	79.7	
32	32.1	16/03/2017	8.41	11.5	313.9	94.8	121	
32	32.2	16/03/2017	8.13	11.32	375.4	95.6	98.6	
26	26.1	16/03/2017	7.63	9.89	337.7	59.4	116.3	
26	26.2	16/03/2017	8.25	9.56	464.8	86.5	103.4	
26	26.3	16/03/2017	8.14	9.84	431.5	88.1	98.2	
26	26.4	16/03/2017	8.09	9.47	395	81	94	
26	26.5	16/03/2017	8.27	10.07	463.6	93.6	103.4	
25	25.1	16/03/2017	7.94	13.17	504.4	97.5	94	
25	25.2	16/03/2017	7.8	9.7	388.2	73.9	77.6	
25	25.3	16/03/2017	7.9	9.24	349	82.3	82.3	
25	25.1	10/07/2017	8.02	16.42	544.41	16.8	95.82	
25	25.2	10/07/2017	6.94	17.1	559.76	-72.1	117.61	
25	25.3	10/07/2017	7.11	20.24	611.49	-113.4	10.51	
26	26.2	11/07/2017	8.17	16.01	497.75	400.6	101.53	
26	26.3	11/07/2017	8.21	15.65	444.22	379.5	96.79	
26	26.4	10/07/2017	7.73	18.62	448.95	144.4	79.68	
26	26.5	11/07/2017	8.29	15.1	457.52	392.6	101.88	
24	24.7	12/07/2017	7.74	22.63	333.65	510.8	72.08	
24	24.2	12/07/2017	8.29	14.53	465.95	418.3	97.79	
24	24.2	12/07/2017	7.49	19.84	636.67	159.2	162.32	
24	24.5	12/07/2017	7.71	24.72	624.68	411.5	151.11	
24	24.8	12/07/2017	7.33	25.45	418.1	15.1	56.47	
24	24.3	12/07/2017	7.89	20.64	563.42	428.5	97.86	
24	24.9	12/07/2017	7.89	21.38	456.5	528.8	91.93	
24	24.6	12/07/2017	7.38	15.99	571.46	524.9	67.64	
Cae Adda	CA.1	24/07/2017	5.91	21.76	208.87	140.1	70.57	
Cae Adda	CA.2	24/07/2017	4.87	20.65	158.44	281.5	35.1	
Cae Adda	CA.4	24/07/2017						
Cae Adda	CA.3	24/07/2017	5.67	18.64	255.8	81.8	30.13	
Ty du	TD.2	25/07/2017	6.01	17.68	194.01	143.6	12.35	
Ty du	TD.3	25/07/2017	6	15.87	145.49	81.3	57.33	
Ty du	TD.4	25/07/2017	4.92	17.04	170.06	201.1	118.97	
Ty du	TD.5	25/07/2017	6.51	17.44	325	-81	114.98	
Ty du	TD.1	25/07/2017	7.05	18.73	316.49	115	69.21	
Neuadd	NE.5	25/07/2017	7.38	19.8	302.25	284.5	105.98	
32	32.3	26/07/2017	8.19	19.3	251	237.7	114.89	
32	32.4	26/07/2017	7.84	17.25	392.09	269.3	83.96	
Caeau Talwrn	CT.1	10/11/2017	8.11	8.71	469.64	150.9	97.48	
Caeau Talwrn	CT.2	10/11/2017	7.77	9.23	472.74	170.7	96.91	

Table D-2: Laboratory water quality results

Site Name	Sample ID	Sample Date	pH Units	µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% Diff	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			pH	Electical Conductivity @ 20 deg.C	Turbidity	Alkalinity, Bicarbonate as CaCO3 (diss.filt)	Alkalinity, Carbonate as CaCO3	Alkalinity,Total as CaCO3 (diss.filt)	Ammoniacal Nitrogen as N	Calcium (diss.filt)	Calcium (tot.unfilt)	Chloride	Dissolved solids, Total (gravimetric)	Ionic Balance	Iron (diss.filt)	Iron (tot.unfilt)	Magnesium (diss.filt)	Magnesium (tot.unfilt)	Nitrate as NO3	Nitrite as NO2	Nitrogen, Total	Phosphate (ortho) as PO4	Phosphorus (tot.unfilt)	Potassium (diss.filt)	Potassium (tot.unfilt)	Sodium (diss.filt)	Sodium (tot.unfilt)	Sulphate	Suspended solids, Total
8	8.1	03/11/2016	7.91	490	5.22	240	<2	240	<0.2	95	100	25	351	2.63	0.194	0.431	5	6	2.83	<0.05	1.37	<0.05	31.6	1.89	2.1	16	16.6	<2	2
8	8.2	03/11/2016	7.36	424	7750	170	<2	170	0.593	64	476	26	588	-3.57	0.998	748	5	11	3.48	<0.25	1.93	<0.05	27500	1.91	11.9	11	12.5	12.9	13800
24	24.1	29/09/2016	8.2	537	631	300	10	320	<0.2	125	187	25	416	-1.79	<0.019	18	6	9	7.33	<0.05	2.72	0.082	930	2.37	4.2	16	17	24.5	8.5
24	24.1	15/03/2017	7.91	574	3.99	320	<2	320	<0.2	136	134	26.1	395	1.74	0.0388	0.915	5.76	5.47	11.5	<0.05	2.62	<0.05	103	3.33	3.13	16.4	16.0	22.5	14.2
24	24.7	13/07/2017	7.65	314	5.33	135	<2	135	<0.2	48.6	45.3	25.4	199	-0.622	0.191	0.868	6.59	6.49	3.42	0.062	1.14	<0.05	45	1.95	<2	14.9	14.9	9.1	20.7
24	24.2	12/07/2017	7.87	560	1.39	270	<2	270	<0.2	117	107	25.5	323	1.36	<0.019	0.12	6.16	5.94	12.3	<0.05	2.77	<0.05	61.4	2.06	<2	15.9	15.3	25.2	8.8
24	24.4	29/09/2016																											
24	24.4	15/03/2017	8.02	526	4.65	295	<2	295	<0.2	118	111	24	356	1.2	<0.019	0.178	7.04	6.46	3.08	<0.05	1.01	<0.05	29.5	4.16	4.02	16.3	15.1	22.3	17.2
24	24.4	12/07/2017	7.59	587	18.3	295	<2	295	<0.2	119	111	25.5	391	0.295	<0.019	0.0678	6.09	5.89	<0.3	<0.05	<1	<0.05	81.6	5.47	4.91	16.2	15.5	30.1	29.7
24	24.5	29/09/2016	8.28	474	10.8	255	10	265	<0.2	97	97.1	21	324	1.3	0.0913	0.0978	6	5	<0.3	<0.05	<1	<0.05	34.2	4.71	4.65	13	13.2	2	<2
24	24.5	15/03/2017	8.23	458	1.17	250	<2	250	<0.2	95.8	90.4	22	370	-0.331	0.0263	0.0561	5.87	5.42	1.23	<0.05	<1	<0.05	<20	2.07	2.06	14.1	13.3	13.2	<2
24	24.5	12/07/2017	7.76	586	2.04	305	<2	305	<0.2	117	107	23.4	362	1.1	0.0753	0.614	6.54	6.37	<0.3	<0.05	<1	<0.05	98.9	1.81	2.04	15.7	15	7.9	4.7
24	24.8	29/09/2016	7.99	508	106	275	<2	285	<0.2	101	127	20	333	-2.99	0.136	5.22	5	6	2.38	<0.05	1.27	<0.05	145	<1	4.26	12	13.7	<2	340
24	24.8	15/03/2017	7.96	487	375	270	<2	270	<0.2	104	153	18.5	412	2.05	0.122	25.9	5.63	4.23	4.86	<0.05	1.46	<0.05	447	<1	<2	13.6	12.7	<2	657
24	24.8	12/07/2017	7.53	407	32.6	205	<2	205	<0.2	87.7	100	21.4	262	5.36	2.27	7.56	4.18	3.89	1.02	<0.05	<1	<0.05	307	<1	<2	12.3	11.6	<2	284
24	24.3	02/11/2016	7.83	630	2.2	330	<2	330	<0.2	134	143	27	427	0.398	<0.019	0.376	6	7	8.99	<0.05	2.53	<0.05	26.9	5.84	7.56	19	20.5	29.3	18.5
24	24.3	12/07/2017	7.69	621	0.502	270	<2	270	<0.2	140	119	27.2	352	9.15	<0.019	0.408	6.31	5.89	13.3	<0.05		<0.05	33.4	5.27	4.35	17.7	16.6	28.9	36.5
24	24.9	02/11/2016	8.12	465	2.51	235	<2	235	<0.2	98	99.6	22	301	2.23	<0.019	0.0642	4	4	4.38	<0.05	1.51	<0.05	<20	<1	<2	12	12.9	6.1	6.5
24	24.9	15/03/2017	7.97	424	0.773	250	<2	250	<0.2	107	98.5	19.6	290	4.52	<0.019	<0.024	3.89	3.63	5.19	0.06	1.44	<0.05	64	<1	<2	12.3	11.2	<2	<2
24	24.9	12/07/2017	7.7	465	3.16	245	<2	245	<0.2	98.7	101	17.7	291	2.3	<0.019	0.802	3.87	3.75	2.48	<0.05	1.54	<0.05	198	<1	<2	10.4	9.98	<2	121
24	24.6	13/07/2017	7.52	665	0.546	355	<2	355	<0.2	145	125	25.8	430	1.02	<0.019	<0.024	8.92	8.72	21.4	<0.05	3.6	<0.05	<20	1.18	<2	14.5	13.8	11.9	<2
25	25.1	03/11/2016	7.99	571	25.9	285	<2	285	<0.2	124	153	27	429	-0.753	<0.019	2.6	4	5	1.75	<0.05	<1	<0.05	101	1.99	2.46	15	18	35.8	54.5
25	25.1	16/03/2017	8.03	594	3.34	315	<2	315	<0.2	132	136	23.2	388	0.625	0.0231	0.361	4.19	4.37	4.99	<0.05	1.16	<0.05	21.7	2.18	2.39	12.9	13.3	18.3	15
25	25.1	10/07/2017	7.87	623	97.3	340	<2	340	<0.2	137	174	22.2	400	-0.766	<0.019	23.2	4.19	4.08	2.41	<0.05	1.33	<0.05	858	1.89	<2	13.3	12.3	19.4	370
25	25.2	16/03/2017	7.82	493	67.2	275	<2	275	<0.2	112	121	17.9	331	2.45	0.0441	31	2.96	2.30	0.715	<0.05	<1	<0.05	113	<1	<2	11.1	11.3	<2	128
25	25.2	10/07/2017	7.05	594	324	360	<2	360	<0.2	133	155	8.8	370	-0.889	0.168	245	3.26	3	<0.3	<0.25	<1	<0.05	315	<1	<2	9.59	11.6	<2	629
25	25.2	03/11/2016	7.65	499	64.5	275	<2	275	<0.2	100	131	21	339	-0.499	<0.019	5.88	5	5	<0.3	<0.05	<1	<0.05	359	1.1	<2	14	16.1	<2	203
25	25.3	03/11/2016	7.27	531	1520	275	<2	275	<0.2	118	350	36	72	3.67	9.79	478	6	7	<0.3	<0.05	1.43	<0.05	780	1.12	<2	15	16.6	<2	1990
25	25.3	16/03/2017	7.64	440	339	230	<2	230	<0.2	93.4	168	24.2	288	2.67	<0.019	96.9	3.73	0.75	<0.3	<0.05	<1	<0.05	486	1.25	<2	13.9	13.5	<2	929
25	25.3	10/07/2017	7.06	554	80.3	340	<2	340	<0.2	124	578	14.9	360	-1.49	0.029	1230	5.04	4.72	<0.3	<0.05	1.48	<0.05	1280	<1	<2	9.69	9.78	<2	1930
26	26.1	13/10/2016	7.49	583	216	335	<2	335	<0.2	122	167	18	369	-2.58	<0.019	43	4	3	0.744	<0.05	<1	<0.05	1430	<1	<2	11	10.7	<2	578
26	26.1	16/03/2017	7.22	416	691	240	<2	240	0.539	90.5	563	14	278	0.191	0.0248	970	3.35	<0.05	<0.3	<0.05	<1	<0.05	19700	<1	2.81	8.9	9.5	<2	656
26	26.1	04/11/2016								112					4.42		4							<1		11			
26	26.2	13/10/2016	8.05	601	4.52	295	<2	295	<0.2	113	128	27	388	-2.04	<0.019	0.0889	5	6	10.2	<0.05	3.15	<0.05	20.8	4.48	4.88	15	16.5	15.4	5.5
26	26.2	16/03/2017	7.83	543	3.86	285	<2	285	<0.2	131	119	24.7	346	4.87	<0.019	0.0614	4.86	4.74	15.7	<0.05	3.43	<0.05	<20	3.83	3.61	13.7	13.2	14	8.9
26	26.2	11/07/2017	7.91	540	1.77	270	<2	270	<0.2	115	102	27.7	358	2.09	<0.019	0.059	5.46	5.23	9.32	<0.05	2.42	<0.05	<20	4.1	3.74	14.4	13.7	14.6	4.55
26	26.2	04/11/2016								122					<0.019		6							6.21		16			
26	26.3	13/10/2016	8.1	540	3.52	275	<2	275	<0.2	109	111	28	356	-0.264	<0.019	0.212	5	5	5.19	<0.05	1.56	<0.05	<20	2.58	2.38	17	15.9	14.7	3.5
26	26.3	16/03/2017	7.96	524	5.55	260	<2	260	<0.2	116	118	26.1	329	3.27	<0.019	0.251	4.51	4.67	10.8	<0.05	2.58	<0.05	<20	2.38	2.72	14.0	14.9	13.3	8
26	26.3	11/07/2017	7.97	506	5.3	235	<2	265	<0.2	106	100	26	345	0.433	0.0246	0.277	5.08	4.89	4.91	<0.05	1.53	<0.05	35.2	2.39	2.06	14.4	14.3	11.1	5.05
26	26.3	04/11/2016								116					0.04		5							4.25		17			
26	26.4	04/11/2016	7.43	510	336	265	<2	265	0.407	104	270	28		-3.15	0.213	363	4	6	<0.3	<0.05	<1	<0.05	6640	2	6.3	14	15.8	20.5	4080
26	26.4	16/03/2017	7.72	474	427	260	<2	260	<0.2	106	157	19.5	331	2.49	<0.019	56.3	3.35	1.74	1.94	<0.05	1.3	<0.05	1290	1.24	2.68	11.5	12.1	<2	3040
26	26.4	10/07/2017	7.47	500	135	275	<2	275	<0.2	107	115	13.1	321	1.66	0.0519	46	3.44	3.11	<0.3	<0.05	<1	<0.05	776	<1	<2	9.89	9.68	<2	419
26	26.5	04/11/2016	8.04	549	4.43	280	<2	280	<0.2	118	116	29		2.43	0.0316	0.213	5	5	3.21	<0.05	1.4	<0.05	<20	3.59	3.73	16	16.2	13.6	12.5

Site Name	Sample ID	Sample Date	pH Units	µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% Diff	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			pH	Electical Conductivity @ 20 deg.C	Turbidity	Alkalinity, Bicarbonate as CaCO3 (diss.filt)	Alkalinity, Carbonate as CaCO3	Alkalinity,Total as CaCO3 (diss.filt)	Ammoniacal Nitrogen as N	Calcium (diss.filt)	Calcium (tot.unfilt)	Chloride	Dissolved solids, Total (gravimetric)	Ionic Balance	Iron (diss.filt)	Iron (tot.unfilt)	Magnesium (diss.filt)	Magnesium (tot.unfilt)	Nitrate as NO3	Nitrite as NO2	Nitrogen, Total	Phosphate (ortho) as PO4	Phosphorus (tot.unfilt)	Potassium (diss.filt)	Potassium (tot.unfilt)	Sodium (diss.filt)	Sodium (tot.unfilt)	Sulphate	Suspended solids, Total
26	26.5	16/03/2017	7.88	549	6.07	290	<2	290	<0.2	124	124	27.2	374	1.64	0.0225	0.276	4.90	4.62	14	<0.05	3.38	<0.05	<20	2.84	2.94	14.9	14.5	14.1	19.9
26	26.5	11/07/2017	7.86	521	24	270	10	270	<0.2	111	107	26.3	341	0.711	<0.019	0.192	5.16	4.93	5.27	<0.05	1.54	<0.05	<20	2.08	<2	14.2	15.3	13.5	33.5
32	32.3	26/07/2017	8.13	275	34.4	125	<2	125	<0.2	37	37.3	20.9	180	-5.04	0.701	1.46	4.19	3.99	<0.3	<0.05	1.09	<0.05	22.5	2.68	2.73	12.3	12.6	<2	31.4
32	32.4	26/07/2017	7.77	424	4.59	215	<2	215	<0.2	82.2	81.8	19.4	287	0.364	0.146	0.542	3.92	3.5	0.784	<0.05	<1	<0.05	<20	1.79	<2	10.8	11.9	<2	4.75
32	32.3	16/03/2017	7.93	463	13.6	235	<2	235	<0.2	90.3	115	22.9	322	-4.67	0.0566	1.85	3.68	4.09	8.49	<0.05	2.24	<0.05	46.2	1.09	<2	11.4	12.2	16.2	128
32	32.4	16/03/2017	7.67	600	25	330	<2	330	<0.2	123	147	20.9	385	-5.04	<0.019	1.65	3.49	3.78	9.82	<0.05	2.27	0.069	28.7	1.28	<2	10.2	11.2	11.1	79.7
32	32.5	16/03/2017	7.41	594	3.23	310	<2	310	<0.2	130	126	23	388	0.281	<0.019	0.0376	4.12	3.84	14.3	<0.05	2.87	<0.05	<20	1.03	<2	12.8	12.2	11.6	6.3
32	32.1	13/10/2016	8.03	400	8.9	200	<2	200	<0.2	75	74.8	24	268	2.17	0.224	0.96	6	6	<0.3	<0.05	<1	<0.05	<20	1.96	2.09	15	15	<2	4.5
32	32.1	16/03/2017	7.98	365	5.71	170	<2	170	<0.2	69.9	65.3	26.8	255	2.51	0.107	0.35	4.23	3.80	<0.3	<0.05	<1	<0.05	<20	3.28	3.02	14.8	13.9	8.7	8.85
32	32.1	01/11/2016																											
32	32.2	13/10/2016	8.13	526	33.3	275	<2	275	<0.2	114	112	25	345	1.39	<0.019	2.16	5	5	5.6	<0.05	1.59	<0.05	38.9	1.13	<2	15	14.5	12.5	61.5
32	32.2	16/03/2017	8.2	491	1.46	255	<2	255	<0.2	96.1	101	24.2	327	-4.5	0.0472	0.242	3.95	4.03	8.53	<0.05	1.74	<0.05	81.4	1.11	<2	12.5	13.1	13.4	<2
32	32.2	01/11/2016																											
Burwen North	BN.1	21/04/2016	7.34	253	2.33	55	<2	55	<0.2	22	26	39	164	-8.32	0.038	0.17	5	6	11.40	<0.05	2.95	<0.05	37.5	1.76	<2	22	27	23.3	2.5
Burwen North	BN.2	21/04/2016	7.15	245	25.7	54	<2	54	<0.2	22	27	40	170	-5.8	0.0312	6.58	5	6	7.53	<0.05	2.09	<0.05	322	<1	<2	22	25	20.6	377
Burwen North	BN.3	21/04/2016	6.39	174	202	55	<2	55	<0.2	13	32	30	149	-9.9	0.233	30.00	3	5	<0.3	<0.05	1.44	0.059	1790	<1	2.32	16	18	<2	2470
Burwen North	BN.4	21/04/2016	6.86	231	84.3	25.9	<2	26	<0.2	15	19	39	150	-6.38	0.0794	4.02	4	5	13.60	<0.05	3.42	<0.05	334	3.58	3.94	21	24	26.3	277
Burwen South	BS.1	21/04/2016	7.23	241	53.2	75	<2	75	<0.2	22	29	27	146	-5.58	<0.019	5.76	6	8	4.41	<0.05	1.25	<0.05	662	<1	<2	19	24	17.9	193
Burwen West	BW.1	21/04/2016	6.72	164	342	60	<2	60	<0.2	18	55	23	141	-3.47	0.219	264.00	4	<5	0.41	<0.05	1.02	<0.05	3790	<1	<200	13	18	<2	2470
Burwen West	BW.2	21/04/2016	7.32	204	3.04	60	<2	60	<0.2	19	22	28	130	-4.89	0.123	1.16	4	5	<0.3	<0.05	<1	<0.05	51.8	<1	<2	17	19	12.8	10.5
Burwen West	BW.3	21/04/2016	6.76	194	91.1	50	<2	50	<0.2	18	26	29	123	-1.64	0.098	29.60	4	2	0.68	<0.05	<1	<0.05	1590	<1	<2	16	18	6.9	422
Burwen West	BW.4	21/04/2016	7.24	187	1.29	49	<2	49	23.5	18	18	29	121	30.7	0.0437	0.34	4	4	<0.3	<0.05	<1	<0.05	44.3	<1	<2	16	16	4.9	5
Cae Adda	CA.4	24/07/2017	4.95	147	13	4.5	<2	4.5	<0.2	4.8	5.31	42.8	168	4.18	0.331	0.608	2.93	3.02	<0.3	<0.05	1.89	0.076	465	1.19	<2	21.4	22.2	<2	31.6
Cae Adda	CA.1	26/04/2016	6.43	200	171	46	<2	46	<0.2	11	16	39	195	-6.02	0.56	34.30	3	3	<0.6	<0.5	1.73	0.29	3230	<1	4.29	22	23	<2	580
Cae Adda	CA.1	24/07/2017	5.86	184	2.24	9.5	<2	9.5	<0.2	9.26	10.5	50.4	222	5.82	0.945	1.64	3.45	3.89	<0.3	<0.05	2.02	0.064	200	<1	<2	24.5	26.4	<2	3.4
Cae Adda	CA.2	26/04/2016	5.94	147	1.61	7	<2	7	<0.2	4	5	36	150	4.17	0.469	0.46	2	2	<0.6	<0.5	1.6	0.259	65.2	<1	<2	20	20	<2	<6
Cae Adda	CA.2	24/07/2017																											
Cae Adda	CA.3	26/04/2016	6.36	259	24.3	16	<2	16	<0.2	10	10	65	182	-5.7	0.178	0.39	4	4	<0.3	<0.05	<1	0.05	105	<1	<2	32	32	13.6	13.5
Cae Adda	CA.3	24/07/2017	6.06	253	17.2	50	<2	50	<0.2	12.1	12.9	75.3	232	-10.8	0.86	1.23	4.59	4.84	<0.3	<0.05	1.87	0.281	360	1.35	<2	35.3	35.7	<2	98
Cae Owen	CO.1	21/04/2016	7.65	556	209	185	<2	185	<0.2	59	83	80	345	-5.07	0.722	41.80	13	17	<0.3	<0.05	<1	0.058	3420	<1	<2	40	47	20	268
Cae Owen	CO.2	21/04/2016	7.96	589	8.08	200	<2	200	<0.2	58	61	78	387	-5.78	<0.019	1.58	19	19	4.44	<0.05	1.43	0.057	122	2.82	2.85	39	41	32.9	19.5
Caeau Talwrn	CT.1	10/11/2017	8.15	608	1.61	315	<2	315	<0.2	126	129	24	397	-0.658	0.0257	0.08	4	4	4.99	<0.05	1.41	<0.05	<20	1.85	2.11	13	15	10.4	<2
Caeau Talwrn	CT.2	10/11/2017	8.12	615	49.6	310	<2	310	<0.2	125	222	24	391	-0.0976	<0.019	13.10	4	5	5.01	<0.05	1.44	<0.05	269	1.84	2.58	13	15	10.6	79.6
18	18.1	11/05/2016	8.26	659	5.75	400	<2	400	<0.2	144	170	14	458	-5.88	1.07	1.15	4	4	<0.3	<0.05	1.22	<0.05	74.2	<1	<2	8	10	18.5	5.5
3	3.1	12/05/2016	6.54	98	17.8	8.5	<2	9	<0.2	3	4	21	95	-9.75	1.74	5.98	1	2	<0.3	<0.05	1.81	0.285	960	<1	2.49	9	11	<2	77
3	3.2	13/05/2016	7.57	132	4.2	33	<2	33	<0.2	10	11	22	87	-1.82	0.0914	0.16	2	3	<0.3	<0.05	<1	<0.05	<20	<1	<2	12	13	<2	<2
3	3.3	14/05/2016	7.5	102	10.4	12	<2	12	<0.2	4	5	24	85	-4.73	1.01	2.91	2	2	0.54	<0.05	1.3	<0.05	57.3	<1	<2	12	13	<2	34
3	3.4	15/05/2016	7.28	160	272	55	<2	55	<0.2	17	21	20	108	-4.51	1.34	28.40	2	3	<0.3	<0.05	1.67	<0.05	416	1.75	2.23	12	13	<2	420
Mynachdy	MY.1	16/05/2016	7.22	396	0.973	90	<2	90	0.986	37	44	51	259	-7.02	0.0275	0.09	9	11	21.70	<0.05	5.56	<0.05	<20	1	<2	26	30	36.9	4
Mynachdy	MY.2	17/05/2016	7.24	314	0.867	70	<2	70	0.717	28	30	53	215	-6.3	0.0657	0.12	8	8	11.20	0.067	3.35	0.057	31.9	<1	<2	25	27	23.9	<2
Mynachdy	MY.3	18/05/2016	7.09	403	194	125	<2	125	<0.2	50	59	52	320	-5.16	0.524	15.10	10	12	<0.3	<0.05	<1	<0.05	980	<1	<2	22	24	34.9	622
Mynachdy	MY.4	19/05/2016	7.39	327	2.88	65	<2	65	0.279	25	28	56	217	-7.82	0.275	0.90	9	10	7.65	<0.05	2.85	<0.05	54.5	1.64	<2	26	30	32.1	7.5
Neuadd	NE.1	21/04/2016	7.77	417	2.7	165	<2	165	<0.2	43	49	43	305	-7.12	0.458	0.70	18	20	19.50	<0.05	4.75	<0.05	<20	<1	<2	21	24	16.7	<2
Neuadd	NE.2	21/04/2016	7.58	485	868	180	<2	180	<0.2	43	130	61	322	-8.54	<0.019	149.00	20	30	<0.3	<0.05	<1	<0.05	5400	<1	3.42	27	30	25.8	3760
Neuadd	NE.3	21/04/2016	7.91	236	8.77	65	<2	65	<0.2	20	22	40	164	-2.08	0.0773	1.06	6	6	4.76	<0.05	1.72	0.051	100	<1	<2	22	24	<2	28.5
Neuadd	NE.4	21/04/2016	7.39	387	156	220	<2	220	<0.2	53	66	30	291	-6.16	5.15	56.40	14	13	<0.3	<0.05	1.17	<0.05	1080	1.26	2.53	20	24	<2	368
Neuadd	NE.5	21/04/2016	7.83	405	2.32	155	<2	155	<0.2	37	38	44	264	-5.86	0.0315	0.44	17	16	4.34	<0.05	1.28	<0.05	143	<1	<2	21	21	14.4	10
Neuadd	NE.5	25/07/2017	7.48	351	33.8	130	<2	130	<0.2	34.6	42	48.7	249	-3.27	0.486	11.1	10.6	11.8	2.53	0.065	1.34	0.08	954	1.46	<2	26.6	29.2	<2	150
Neuadd	NE.6	21/04/2016	7.67	399	49.5	115	<2	115	<0.2	38	49	57	275	-7.2	<0.019	8.33	9	11	7.70	<0.05	1.89	0.09	289	<1	<2	27	30	17.8	97
Tregynrig Fawr	TF.1	20/05/2016	6.85	273	89.2	60	<2	60	0.372	24	27	36	196	-3.22	1.52	5.35	7	8	8.45	<0.25	2.9	<0.05	245	1.48	2.05	23	24	28.6	245
Ty du	TD.1	25/07/2017	7.5	333	6.17	120	<2	120	<0.2	35	41.3	48.4	260	-8.17	0.26	13.7	6.97	0.584	0.901	<0.05	1.32	0.169	1230	2.19	<2	32.4	28.5	29.3	67.4
Ty du	TD.2	25/07/2017	6.41	197	15.3	35.5	<2	35.5	<0.2	14.4	17.3	43.5	211	3.29	0.429	1.03	3.13	1.77	<0.3	<0.05	2.59	0.14	507	1.22	<2	25.1	26.9	<2	97.1

Site Name	Sample ID	Sample Date	pH Units	µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% Diff	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			pH	Electical Conductivity @ 20 deg.C	Turbidity	Alkalinity, Bicarbonate as CaCO3 (diss.filt)	Alkalinity, Carbonate as CaCO3	Alkalinity,Total as CaCO3 (diss.filt)	Ammoniacal Nitrogen as N	Calcium (diss.filt)	Calcium (tot.unfilt)	Chloride	Dissolved solids, Total (gravimetric)	Ionic Balance	Iron (diss.filt)	Iron (tot.unfilt)	Magnesium (diss.filt)	Magnesium (tot.unfilt)	Nitrate as NO3	Nitrite as NO2	Nitrogen, Total	Phosphate (ortho) as PO4	Phosphorus (tot.unfilt)	Potassium (diss.filt)	Potassium (tot.unfilt)	Sodium (diss.filt)	Sodium (tot.unfilt)	Sulphate	Suspended solids, Total
Ty du	TD.3	25/07/2017	6.35	228	8.87	<2	<2	50	0.35	17.2	19.6	63.5	318	-5.84	10.5	19.8	5.31	2.43	<1.5	<0.05	<1	0.271	607	1.62	<2	26.7	27.2	<2	88.8
Ty du	TD.4	25/07/2017	5.07	176	26.8	6	<2	6	<0.2	8.57	8.79	52.3	249	8.63	0.6	1.01	4.04	3.94	<1.5	<0.05	2.52	<0.05	286	<1	<2	26.6	24.7	<2	84.3
Ty du	TD.5	25/07/2017	6.73	331	95.4	120	<2	120	0.513	24.6	44.7	66.2	37.9	-20.3	16.2	124	1.54	<0.05	<1.5	<0.05	<5	3.35	14800	5.15	5.66	31.7	35.4	5	1400
Ty du	TD.1	26/04/2016	7.06	255	20.2	67	<2	67	<0.2	22	24	40	203	0.559	0.213	7.82	6	5	<0.6	<0.05	1.16	0.124	713	<1	<2	22	22	<2	177
Ty du	TD.2	26/04/2016	6.93	244	5.26	35	<2	35	<0.2	14	15	53	192	1.94	0.0277	0.06	4	4	<0.3	<0.25	1.31	0.067	167	<1	<2	28	27	<2	12
Ty du	TD.3	26/04/2016	6.69	209	157	38	<2	38	<0.2	12	17	46	150	-4.19	0.0705	7.29	4	5	0.86	<0.05	<1	0.087	545	<1	<2	23	25	<2	500
Ty du	TD.4	26/04/2016	5.86	155	3.27	7.5	<2	8	<0.2	5	6	39	192	6.86	0.248	0.33	3	3	<0.6	<0.5	2.03	<0.25	89.5	<1	<2	22	23	<10	11
Ty du	TD.5	26/04/2016	7.36	254	1.9	67	<2	67	<0.2	20	21	38	209	2.01	0.335	0.88	6	6	<0.6	<0.05	1.11	0.139	178	1.4	<2	24	24	<2	8
Tyddyn-y-Waun	TW.1	21/05/2016	7.14	337	8.48	90	<2	90	0.206	32	37	52	234	-6.75	0.245	1.09	7	8	7.02	<0.05	3.69	0.274	205	<1	<2	26	28	20.7	42

Appendix E Plant records

Table E-1: Records of stoneworts, bryophytes and vascular plants from selected sites surveyed

SCIENTIFIC NAME	ENGLISH NAME	CAE ADDA	CAE OWEN	NEUADD	TY DU	24 NORTH	24 SOUTH	25	26	32	CAEAU TALWRN SSSI (NORTH)
Stoneworts											
Chara virgata	delicate stonewort	-	-	-	-	-	-	R	-	-	-
Chara hispida	bristly stonewort	-	-	-	-	LA	-	-	-	LD	-
Chara vulgaris	common stonewort	-	-	-	-	LA	R	R	R	LA	-
Bryophytes											
Aneura pinguis	-	-	-	-	-	-	R	-	-	-	-
Aulacomnium palustre	-	-	-	-	LA	-	-	-	-	-	-
Barbula unguiculata	-	-	-	-	-	-	R	-	-	-	-
Brachythecium mildeanum	-	-	-	-	-	-	-	-	R	-	-
Brachythecium rivulare	-	-	-	-	-	-	-	-	LA	-	R
Brachythecium rutabulum	-	-	-	O	O	-	-	-	-	-	R
Bryum pseudotriquetrum	-	-	-	-	R	-	-	R	-	-	-
Calliergon cordifolium	-	A	-	O	LA	-	-	-	-	-	-
Calliergon giganteum	-	-	-	-	LF	-	-	-	-	-	-
Calliergonella cuspidata	-	-	-	O-LA	LA	LA	F	A	F	LA	LA
Campylium protensum	-	-	-	-	-	-	R	-	-	-	-
Campylium stellatum	-	-	-	-	-	-	LA	LF	-	-	-
Campylopus introflexus	-	-	-	-	O	-	-	-	-	-	-
Cololejeunea minutissima	-	-	-	-	R	-	-	-	-	-	-
Cratoneuron filicinum	-	-	-	R	-	O	R	-	R	O	R
Ctenidium molluscum	-	-	-	-	-	-	R	-	-	-	LF
Dicranella heteromalla	-	-	-	-	-	-	-	-	R	-	-

SCIENTIFIC NAME	ENGLISH NAME	CAE ADDA	CAE OWEN	NEUADD	TY DU	24 NORTH	24 SOUTH	25	26	32	CAEAU TALWRN SSSI (NORTH)
Dicranum scoparium	-	R	-	-	-	-	-	-	-	-	-
Didymodon tophaceus	-	-	-	-	-	-	-	-	R	-	-
Fissidens adianthoides	-	-	-	-	-	-	-	-	-	-	LF
Fissidens bryoides	-	-	-	-	-	-	-	-	LA	-	-
Frullania dilatata	-	-	-	-	LF	-	-	-	-	-	-
Hypnum cupressiforme	-	R	-	-	LF	-	-	-	-	-	-
Hypnum jutlandicum	-	-	-	-	LA	-	-	-	-	-	-
Kindbergia praelonga	-	-	-	O	O	-	-	-	R	-	-
Lophocolea bidentata	-	-	-	-	LF	-	-	-	-	-	F
Metzgeria furcata	-	-	-	-	LF	-	-	-	-	-	-
Mnium hornum	-	-	-	-	LA	-	-	-	-	-	-
Palustriella falcata	-	-	-	-	-	-	-	R	-	-	-
Pellia endiviifolia	-	-	-	-	-	R	-	O	LF	-	R
Philonotis calcarea	-	-	-	-	-	-	-	LA	-	-	-
Plagiochila asplenioides	-	-	-	-	-	-	-	-	-	-	R
Plagiomnium elatum	-	-	-	-	-	-	-	R	-	-	-
Plagiomnium ellipticum	-	-	-	-	-	-	-	-	-	-	R
Plagiomnium undulatum	-	-	-	-	-	-	-	O	-	-	O
Pleurozium schreberi	-	LF	-	-	-	-	-	-	-	-	-
Pohlia melanodon	-	-	-	-	-	-	-	-	R	-	-
Pohlia wahlenbergii	-	-	-	-	-	-	R	-	-	-	-
Polytrichum commune	-	O	-	-	LA	-	-	-	-	-	-
Pseudoscleropodium purum	-	-	-	-	R	-	-	R	R	-	F
Rhizomnium pseudopunctatum	-	-	-	-	R	-	-	-	-	-	-

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Rhytidiadelphus squarrosus	-	O	-	-	-	-	-	-	R	-	-
Scapania gracilis	-	R	-	-	-	-	-	-	-	-	-
Scorpidium cossonii	-	-	-	-	-	-	LA	-	-	-	-
Sphagnum capillifolium subsp. *rubellum*	-	-	-	-	R	-	-	-	-	-	-
Sphagnum compactum	-	-	-	-	R	-	-	-	-	-	-
Sphagnum contortum	-	-	-	-	R	-	-	-	-	-	-
Sphagnum fallax	-	F	-	-	-	-	-	-	-	-	-
Sphagnum fimbriatum	-	-	-	-	LF	-	-	-	-	-	-
Sphagnum palustre	-	R	-	-	LD	-	-	-	-	-	-
Sphagnum papillosum	-	-	-	-	LD	-	-	-	-	-	-
Sphagnum squarrosum	-	D	-	-	LA	-	-	-	-	-	-
Sphagnum subnitens	-	-	-	-	LA	-	-	-	-	-	-
Thuidium tamariscinum	-	-	-	-	-	-	-	-	-	-	R
Ulota bruchii	-	-	-	-	LF	-	-	-	-	-	-
Warnstorfia fluitans	-	-	-	-	-	R	-	-	-	-	-
Weissia sp.	-	-	-	-	-	-	-	-	R	-	-
Vascular Plants											
Acer pseudoplatanus	sycamore	-	-	-	-	LF	LF	LF	R	O	-
Achillea ptarmica	sneezewort	-	-	R	-	-	O	F	R	-	R
Agrostis canina	velvet bent	F	-	O	LF	-	-	O	-	-	-
Agrostis capillaris	common bent	LF	-	R	LF	-	LF	LF	F	-	-
Agrostis stolonifera	creeping bent	O	-	LF	-	F-LD	F-LD	F	LF	F	O
Ajuga reptans	bugle	-	-	-	-	-	-	O	R	-	F
Alchemilla filicaulis	hairy lady's-mantle	-	-	-	-	-	-	R	-	-	-

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Alisma plantago-aquatica	water-plantain	-	-	-	-	R	R	-	-	-	-
Alnus glutinosa	alder	-	-	-	-	-	-	-	-	O	-
Alopecurus geniculatus	marsh foxtail	-	-	-	R	F	LF	-	-	-	-
Alopecurus pratensis	meadow foxtail	-	-	-	R	O	-	-	-	-	-
Anagallis arvensis subsp. *arvensis* f. *arvensis*	scarlet pimpernel	-	-	-	-	R	R	-	-	-	-
Anagallis tenella	bog pimpernel	-	-	R	R	-	O	R	R	R	R
Angelica sylvestris	wild angelica	O	O	F-LA	F	R	F	F	O	F	O
Anthoxanthum odoratum	sweet vernal-grass	F	-	F	F	F	LF	LF	F	F	-
Anthriscus sylvestris	cow parsley	-	R	-	-	-	-	-	-	-	-
Apium nodiflorum	fool's-water-cress	LA	R	O-LA	LA	LA	LA	LA	LA	LF	LD
Arrhenatherum elatius	false oat-grass	-	R	O	LF	R	R	R	R	O	-
Asplenium scolopendrium	hart's-tongue	-	-	-	-	R	R	R	R	-	R
Athyrium filix-femina	lady fern	-	-	R	-	-	-	-	-	-	-
Baldellia ranunculoides subsp. *ranunculoides*	lesser water-plantain	-	-	-	-	LF	R	-	-	LF	-
Bellis perennis	daisy	-	-	-	-	R	R	R	-	-	-
Berula erecta	lesser water-parsnip	-	-	-	-	LF	-	-	-	-	-
Betula pubescens	downy birch	-	-	-	-	-	-	-	-	R	-
Betula x *aurata*	downy/silver birch hybrid	-	-	-	-	-	-	-	-	R	-
Brachypodium sylvaticum	false-brome	-	-	-	-	R	R	-	LF	R	R
Briza media	quaking-grass	-	-	R-LF	-	-	LF	LF	-	-	-
Bromus racemosus	smooth brome	-	-	-	-	O	LF	-	-	-	-
Bryonia dioica	white bryony	-	-	-	R	-	-	-	-	-	-
Callitriche agg.	water-starwort	-	-	-	LA	-	LA	-	-	-	-
Calluna vulgaris	heather	-	-	-	LF	-	-	-	-	-	R

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Caltha palustris	marsh-marigold	-	R	F	LF	-	LF	R	-	R	-
Calystegia sepium	hedge bindweed	-	-	-	-	-	-	R	-	-	-
Capsella bursa-pastoris	shepherd's-purse	-	-	-	-	R	-	-	-	-	-
Cardamine pratensis	cuckooflower	F	-	F	LF	O	-	R	R	R	O
Carex acutiformis	lesser pond-sedge	LF	-	LD	-	-	-	-	-	-	-
Carex binervis	green-ribbed sedge	-	-	-	R	-	-	-	-	-	-
Carex demissa	common yellow-sedge	-	-	R	LA	-	R	-	R	-	-
Carex diandra	lesser tussock-sedge	-	-	LA	-	-	-	-	-	-	-
Carex dioica	dioecious sedge	-	-	-	-	-	R	R	-	-	-
Carex disticha	brown sedge	-	-	-	-	-	LA	-	-	-	-
Carex echinata	star sedge	R	-	R	LA	-	R	R	-	-	-
Carex flacca	glaucous sedge	-	-	R-LF	-	R	LA	LF	R	F	LF
Carex hirta	hairy sedge	-	-	O	R	F	R	R	-	O	-
Carex hostiana	tawny sedge	-	-	-	-	-	LF	LF	-	-	-
Carex lasiocarpa	narrow-leaved sedge	-	-	LA	LA	-	-	-	-	-	-
Carex lepidocarpa	long-stalked yellow-sedge	-	-	-	-	LF	LF	F	-	LF	F
Carex leporina	oval sedge	R	-	R	O	O	LF	O	O	LF	-
Carex nigra	common sedge	F	-	O	F	R	F-LD	O	-	LD	-
Carex otrubae	false fox-sedge	-	-	-	-	R	-	-	-	-	-
Carex panicea	carnation sedge	O	-	O-LF	F	-	F	F	-	F	F
Carex pulicaris	flea sedge	-	-	-	-	-	R	-	-	-	-
Carex riparia	greater pond-sedge	-	D	-	LD	-	-	-	-	-	-
Carex rostrata	bottle sedge	F	-	O-LF	F	-	R	-	-	R	R
Centaurea nigra	common knapweed	-	R	O	O	-	F	-	R	-	LF

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Centaurium erythraea	common centaury	-	-	-	-	-	R	-	-	-	-
Cerastium fontanum	common mouse-ear	-	-	O	O	O	O	R	F	F	-
Ceratocapnos claviculata	climbing corydalis	R	R	-	O	-	-	-	-	-	-
Chamerion angustifolium	rosebay willowherb	-	F	O-LA	-	-	-	-	-	-	-
Chenopodium album	fat-hen	-	-	-	-	-	R	-	-	-	-
Cirsium arvense	creeping thistle	O	LF	O	O	O	R	R	LA	LA	R
Cirsium palustre	marsh thistle	O	O	F	F	F	F	F	F	F	F
Cirsium vulgare	spear thistle	-	-	-	-	R	R	-	R	R	-
Cladium mariscus	great fen-sedge	-	-	LD	-	R	R	-	-	-	-
Comarum palustre	marsh cinquefoil	F	O	F-LA	A	-	R	-	-	-	-
Conopodium majus	pignut	R	-	-	-	-	-	-	-	-	-
Corylus avellana	hazel	-	-	-	-	-	-	R	-	-	-
Cotoneaster simonsii	Himalayan cotoneaster	-	-	-	-	-	-	-	-	-	R
Crataegus monogyna	hawthorn	O	LD	-	F	LD	LD	LF	LD	LD	LD
Crepis capillaris	smooth hawk's-beard	-	R	-	-	R	-	-	-	O	-
Cynosurus cristatus	crested dog's-tail	LF	-	LF	F	F	LF	LF	F	F	-
Dactylis glomerata	cock's-foot	O	-	LF	R	R	-	R	O	O	-
Dactylorhiza fuchsii	common spotted-orchid	-	-	-	-	R	F	F	R	O	-
Dactylorhiza maculata	heath spotted-orchid	-	-	-	LF	-	-	-	-	-	-
Dactylorhiza purpurella	northern marsh-orchid	-	-	F	-	-	-	R	-	-	-
Dactylorhiza sp.	-	-	-	-	-	-	-	-	-	-	R
Danthonia decumbens	heath-grass	R	-	-	-	-	LF	-	-	-	-
Deschampsia cespitosa	tufted hair-grass	-	R	O	O	R	O	-	R	-	O
Digitalis purpurea	foxglove	R	LA	LF	O	-	-	-	R	-	-

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Dryopteris carthusiana	narrow buckler-fern	-	-	R	R	-	-	-	-	-	-
Dryopteris dilatata	broad buckler-fern	-	R	O	LF	-	R	-	-	-	-
Dryopteris filix-mas	male-fern	-	-	R	-	R	-	R	R	-	R
Eleocharis palustris	common spike-rush	-	-	R	-	LD	LD	LA	-	LD	-
Eleocharis multicaulis	many-stalked spike-rush	-	-	-	R	-	LF	-	-	-	-
Eleocharis quinqueflora	few-flowered spike-rush	R	-	-	-	-	LF	-	-	-	-
Eleogiton fluitans	floating club-rush	-	-	-	LA	-	-	-	-	-	-
Elytrigia repens	common couch	-	-	-	-	-	-	R	-	-	-
Epilobium ciliatum	American willowherb	-	-	-	-	R	R	-	-	-	-
Epilobium hirsutum	great willowherb	-	O-LD	F	O	O	R	LF	LF	O	LA
Epilobium montanum	broad-leaved willowherb	-	-	-	O	-	-	R	-	-	-
Epilobium palustre	marsh willowherb	F	O	F	F	-	O	O	R	O	-
Epilobium parviflorum	hoary willowherb	-	O	F	F	-	O	F	O	-	R
Epipactis palustris	marsh helleborine	-	-	-	-	-	LF	-	-	-	R
Equisetum arvense	field horsetail	-	-	R	-	R	R	R	R	-	-
Equisetum fluviatile	water horsetail	A	O-LF	F-LA	F	LA	LA	F-LD	-	-	-
Equisetum palustre	marsh horsetail	-	-	F	-	O	O	F	R	O	-
Erica tetralix	cross-leaved heath	-	-	-	O	-	-	-	-	-	-
Eriophorum angustifolium	common cottongrass	A	-	-	LF	-	LF	LA	-	-	-
Eupatorium cannabinum	hemp-agrimony	-	-	O	-	O	F	F	O	-	R
Euphrasia arctica	arctic eyebright	-	-	-	-	-	R	-	-	-	-
Euphrasia nemorosa	common eyebright	-	-	-	-	-	LF	-	-	-	-
Fallopia convolvulus	black bindweed	R	-	-	-	-	-	-	-	-	-
Festuca ovina	sheep's fescue	R	-	-	R	-	-	-	-	-	-

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Festuca rubra	red fescue	-	-	F	-	O	O	LF	F	F	F
Filipendula ulmaria	meadowsweet	-	O	F-LA	-	-	F-LD	F-LD	F	F	F
Fraxinus excelsior	ash	-	-	-	-	LF	LF	O	O	O	LF
Galeopsis tetrahit	hen-bit deadnettle	-	-	-	R	-	R	-	-	-	-
Galium aparine	cleavers	-	O	-	F	R	R	-	-	R	-
Galium palustre	marsh-bedstraw	A	O	F	A	LF	F	F	F	LF	R
Galium saxatile	heath-bedstraw	R	-	-	LF	-	-	-	-	-	-
Geranium robertianum	herb-robert	-	R	R	O	R	R	R	R	-	R
Geum urbanum	wood avens	-	-	-	-	-	-	R	-	-	-
Glechoma hederacea	ground-ivy	-	-	-	-	-	-	-	R	-	-
Glyceria fluitans	floating sweet-grass	-	-	R	-	R	R	-	-	-	LA
Glyceria notata	plicate sweet-grass	-	-	-	-	-	O	-	-	-	-
Gymnadenia densiflora	marsh fragrant-orchid	-	-	-	-	-	LF	-	-	-	-
Hedera helix	common ivy	-	R	R	LF	LF	R	LF	R	-	-
Heracleum sphondylium	hogweed	-	O	R	-	R	O	R	O	O	LA
Holcus lanatus	Yorkshire-fog	F	LD	F	F	F	F	F	F	F	-
Holcus mollis	creeping soft-grass	-	-	-	LA	-	-	-	-	-	-
Hyacinthoides non-scripta	bluebell	-	-	-	R	-	-	-	-	-	-
Hydrocotyle vulgaris	marsh pennywort	A	O	F	F-LA	-	LA	F-LA	-	LF	R
Hypericum elodes	marsh St John's-wort	-	-	-	LA	-	-	-	-	-	-
Hypericum pulchrum	slender St John's-wort	-	-	-	-	-	R	-	R	-	LF
Hypericum tetrapterum	square-stalked St John's-wort	-	-	O	-	O	O	F	R	F	R
Hypochaeris radicata	cat's-ear	-	-	-	-	R	-	R	-	-	-
Ilex aquifolium	holly	-	-	-	-	-	-	R	-	-	R

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Iris pseudacorus	yellow flag	-	LF	O	LA	-	-	-	-	-	-
Isolepis setacea	bristle club-rush	-	-	-	-	-	R	R	R	-	-
Juncus acutiflorus	sharp-flowered rush	A	-	O	F-LD	-	F-D	O	F	-	-
Juncus articulatus	jointed rush	-	R	F-LA	F	F	F-LA	F	LF	LF	-
Juncus bufonius	toad rush	-	-	-	-	-	-	-	R	-	-
Juncus bulbosus	bulbous rush	R	-	R	LF	-	-	-	-	-	-
Juncus conglomeratus	compact rush	-	-	R	R	-	F	O	O	O	-
Juncus effusus var. *effusus*	soft-rush	LD	O	F	F-LD	F	F-LD	LA	F-LA	F	R
Juncus effusus var. *subglomeratus*	soft-rush	-	-	-	-	R	-	-	-	-	-
Juncus inflexus	hard rush	-	-	R	-	LD	F-LD	LD	F	F	LF
Juncus subnodulosus	blunt-flowered rush	-	D	D	LD	R	F-D	A-LD	LD	LD	F-LD
Juncus x *diffusus*	hard/soft rush hybrid	-	-	-	-	-	R	-	-	-	-
Juncus x *surrejanus*	jointed/sharped-flowered rush hybrid	-	-	-	-	-	LA	-	-	-	-
Lapsana communis	nipplewort	-	-	-	-	-	R	R	-	-	-
Lathyrus pratensis	meadow vetchling	-	R	F	O	R	LF	R	F	F	R
Lemna minor	common duckweed	-	-	R	R	R	R	-	-	-	-
Leontodon saxatile	lesser hawkbit	-	-	-	R	-	-	-	-	-	-
Lepidium coronopus	swine-cress	-	-	-	-	-	R	-	-	-	-
Leucanthemum vulgare	oxeye daisy	-	-	-	-	-	R	-	-	-	-
Linum catharticum	fairy flax	-	-	-	-	-	R	-	-	-	-
Lolium perenne	perennial rye-grass	R	-	R	O-LD	LD	LD	R	F-LA	LA	-
Lonicera periclymenum	honeysuckle	-	O	O	-	R	R	R	R	-	R
Lotus corniculatus	common bird's-foot-trefoil	-	-	R	R	R	LF	-	-	-	-

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Lotus pedunculatus	greater bird's-foot-trefoil	A	O	F-LA	F-LA	LF	F	F	F	F	O
Luzula campestris	field wood-rush	O	-	LF	F	-	-	-	-	-	-
Luzula multiflora subsp. *congesta*	heath wood-rush	-	-	R	F	-	O	O	-	-	-
Luzula multiflora subsp. *multiflora*	heath wood-rush	-	-	-	-	-	R	R	-	-	-
Lythrum salicaria	purple-loosestrife	-	R	O	LF	O	F	F	-	F	R
Matricaria discoidea	pineappleweed	-	-	-	-	R	LF	-	-	-	-
Mentha aquatica	water mint	F	LF	F-LA	F	LF	F	F	F	F	O
Mentha x *verticillata*	corn/water mint hybrid	-	-	-	-	-	R	-	-	-	-
Menyanthes trifoliata	bogbean	-	-	F-LA	F-LA	-	LF	-	-	-	-
Molinia caerulea	purple moor-grass	F	-	O-LA	F-LD	-	F	LA	-	-	F
Myosotis laxa	tufted forget-me-not	F	-	F-LA	F	R	R	-	R	-	-
Myosotis scorpioides	water forget-me-not	R	-	R	-	-	R	-	-	-	-
Myosotis secunda	creeping forget-me-not	F	-	O	-	-	-	-	-	-	-
Nardus stricta	mat grass	LF	-	-	R	-	-	-	-	-	-
Narthecium ossifragum	bog asphodel	-	-	-	LF	-	-	-	-	-	-
Nasturtium microphyllum	narrow-fruited water-cress	-	-	R	R	LF	R	-	-	-	-
Nasturtium officinale agg.	water-cress	-	R	-	-	-	-	R	R	-	R
Odontites vernus	red bartsia	-	-	-	-	-	O	R	O	O	-
Oenanthe crocata	hemlock water-dropwort	-	O	-	LD	-	-	-	-	-	-
Oenanthe lachenalii	parsley water-dropwort	-	-	-	-	R	F	F	R	LF	R
Parnassia palustris	grass-of-Parnassus	-	-	-	-	-	LF	-	-	-	R
Pedicularis palustris	marsh lousewort	-	-	LA	-	-	LF	O	-	LF	-
Pedicularis sylvestris	heath lousewort	-	-	-	LF	-	-	-	-	-	-
Persicaria amphibia	amphibious bistort	R	-	R	O	-	-	-	-	-	-

SCIENTIFIC NAME	ENGLISH NAME	CAE ADDA	CAE OWEN	NEUADD	TY DU	24 NORTH	24 SOUTH	25	26	32	CAEAU TALWRN SSSI (NORTH)
Persicaria maculosa	redshank	-	-	-	-	-	R	R	-	-	-
Phalaris arundinacea	reed canary-grass	-	D	D	-	-	-	-	-	-	-
Phleum bertolonii	smaller cat's-tail	-	-	-	-	R	R	-	-	-	-
Phleum pratense	timothy	-	-	-	-	-	LA	R	O	O	-
Phragmites australis	common reed	-	-	D	-	R	LD	-	-	LD	-
Pinguicula vulgaris	common butterwort	-	-	-	-	-	R	-	-	-	-
Plantago lanceolata	ribwort plantain	-	-	LF	-	O	LF	LF	F	F	O
Plantago major	greater plantain	-	-	-	-	-	R	R	-	LF	-
Poa annua	annual meadow-grass	-	-	-	-	R	LF	-	-	-	-
Poa humilis	spreading meadow-grass	-	-	-	-	-	R	-	-	-	-
Poa trivialis	rough meadow-grass	O	LF	O-LF	F	O	O	O	-	O	-
Polygala serpyllifolia	heath milkwort	-	-	-	LF	-	-	-	-	-	-
Polygonum aviculare	common knotgrass	-	-	-	-	LA	-	-	-	-	-
Polypodium interjectum	intermediate polypody	-	-	-	-	R	-	-	-	-	-
Polystichum aculeatum	hard shield-fern	-	-	-	-	-	R	-	-	-	-
Polystichum setiferum	soft shield-fern	-	-	-	-	R	R	-	-	-	-
Populus x *canadensis*	hybrid poplar	-	-	-	-	-	-	-	-	O	-
Potamogeton coloratus	fen pondweed	-	-	-	-	LA	R	R	-	LA	-
Potamogeton natans	broad-leaved pondweed	-	-	-	-	LA	-	-	-	LA	-
Potamogeton polygonifolius	bog pondweed	LA	-	-	LA	-	-	-	-	-	-
Potamogeton pusillus	lesser pondweed	-	-	-	-	R	-	-	-	R	-
Potentilla anglica	trailing tormentil	-	-	-	R	-	-	-	-	-	-
Potentilla anserina	silverweed	-	-	F	O	F	F	LF	F	F	R
Potentilla erecta	tormentil	O	-	LF	F	-	LF	F	-	-	F

SCIENTIFIC NAME	ENGLISH NAME	CAE ADDA	CAE OWEN	NEUADD	TY DU	24 NORTH	24 SOUTH	25	26	32	CAEAU TALWRN SSSI (NORTH)
Potentilla reptans	creeping cinquefoil	-	-	O	O	O	O	O	O	O	R
Potentilla sterilis	barren strawberry	-	-	-	-	-	R	-	-	-	-
Potentilla x *mixta*	common cinquefoil/trailing tormentil hybrid	-	-	-	-	-	-	R	-	-	-
Primula veris	cowslip	-	-	-	-	-	-	-	R	-	-
Primula vulgaris	primrose	-	-	R	-	-	-	-	-	-	-
Prunella vulgaris	selfheal	-	-	LF	R	O	F	LF	O	F	R
Prunus spinosa	blackthorn	-	-	LD	-	LD	LD	LD	LD	LD	LA
Pteridium aquilinum	bracken	LD	LD	LD	LD	-	-	R	-	-	-
Pulicaria dysenterica	common fleabane	-	-	-	-	LF	F-LA	LA	O	-	LA
Quercus robur	pedunculate oak	-	R	-	-	-	-	-	-	-	-
Ranunculus acris	meadow buttercup	F	-	F	F	-	-	LF	O	F	F
Ranunculus flammula	lesser spearwort	F	-	F	F	LF	O	LF	R	LF	-
Ranunculus lingua	greater spearwort	-	-	-	-	-	LA	-	-	-	-
Ranunculus repens	creeping buttercup	F	-	F	F	F	F	F	F	F	F
Ranunculus trichophyllus	thread-leaved water-crowfoot	-	-	-	-	R	-	-	-	-	-
Rhinanthus minor	yellow-rattle	-	-	-	R	-	O	R	-	F	-
Ribes nigrum	black currant	-	-	-	LA	-	-	-	-	-	-
Rosa arvensis	field-rose	-	-	-	-	R	R	-	-	-	R
Rosa canina	dog-rose	-	-	-	-	-	R	-	-	-	-
Rosa canina agg.	a dog-rose	-	-	-	-	-	-	R	-	-	-
Rosa x *dumalis*	hybrid rose	-	-	-	-	-	-	-	-	-	-
Rubus fruticosus agg.	bramble	-	F	LD	LD	LF	LD	LD	LF	-	-
Rubus ulmifolius	elm-leaved bramble	-	-	-	-	-	-	-	-	-	LD

SCIENTIFIC NAME	ENGLISH NAME	CAE ADDA	CAE OWEN	NEUADD	TY DU	24 NORTH	24 SOUTH	25	26	32	CAEAU TALWRN SSSI (NORTH)
Rumex acetosa	common sorrel	F	O	F	F	-	LF	LF	F	F	LF
Rumex conglomeratus	clustered dock	R	-	O	-	R	R	O	-	O	-
Rumex crispus	curled dock	-	R	R	R	R	-	R	-	O	-
Rumex obtusifolius	broad-leaved dock	-	-	-	-	-	-	R	R	-	-
Rumex sanguineus	wood dock	-	R	-	-	-	-	-	-	-	-
Sagina procumbens	procumbent pearlwort	-	-	R	-	-	-	-	-	-	-
Salix aurita	eared willow	-	-	-	-	-	-	R	-	-	-
Salix caprea	goat willow	-	-	-	-	-	-	-	-	R	-
Salix cinerea	grey willow	R	D	LD	D	O	LD	O-LD	F	-	O
Salix cinerea subsp. *cinerea*	grey sallow	-	-	-	-	-	-	-	-	R	-
Salix repens	creeping willow	-	-	-	F	-	-	-	-	-	-
Salix viminalis	osier	-	R	-	-	-	-	-	-	-	-
Salix x *reichardtii*	goat/grey sallow hybrid	-	-	-	-	-	R	-	-	-	-
Sambucus nigra	elder	-	R	-	-	-	-	-	-	-	-
Samolus valerandi	brookweed	-	-	-	-	LF	O	R	-	LF	-
Schedonorus giganteus	giant fescue	-	-	-	-	-	-	R	-	-	-
Schedonorus pratensis	meadow fescue	-	-	R	-	-	F	O	F	-	-
Schoenoplectus tabernaemontani	grey club-rush	-	-	-	-	-	R	-	-	-	-
Schoenus nigricans	black bog-rush	-	-	R	-	-	LF	LF	-	-	-
Scorzoneroides autumnalis	autumn hawkbit	-	-	-	-	-	R	-	-	-	-
Sedum anglicum	English stonecrop	R	-	-	LA	-	-	-	-	-	-
Senecio erucifolius	hoary ragwort	-	-	-	-	-	O	-	-	-	-
Senecio jacobaea	common ragwort	-	-	R	-	R	R	R	R	O	-
Serratula tinctoria	saw-wort	-	-	-	-	-	R	-	-	-	LF

SCIENTIFIC NAME	ENGLISH NAME	CAE ADDA	CAE OWEN	NEUADD	TY DU	24 NORTH	24 SOUTH	25	26	32	CAEAU TALWRN SSSI (NORTH)
Silene dioica	red campion	-	F-LD	F-LA	-	-	R	R	R	R	-
Silene flos-cuculi	ragged-robin	F	O	F	F	-	O	LF	-	-	-
Solanum dulcamara	bittersweet	-	O	F	LF	R	O	R	O	O	-
Sonchus arvensis	field sow-thistle	-	-	-	-	-	R	R	-	-	-
Sonchus asper	prickly sow-thistle	-	R	-	-	R	R	-	R	O	-
Sparganium erectum	branched bur-reed	-	LF	O	LF	LF	LF	-	R	R	R
Spergula arvensis	corn spurrey	-	-	-	-	-	R	-	-	-	-
Stachys palustris	marsh woundwort	-	-	-	-	-	R	-	-	-	-
Stachys sylvatica	hedge woundwort	-	-	-	-	-	R	R	R	-	-
Stellaria alsine	bog stitchwort	-	R	F	-	-	R	-	-	-	-
Stellaria graminea	lesser stitchwort	-	-	R	-	-	R	R	R	R	R
Stellaria media	common chickweed	-	-	-	-	R	-	R	-	-	-
Succisa pratensis	devil's-bit scabious	-	R	R	F-LA	-	LF	LA	-	-	O
Tamus communis	black bryony	-	-	-	-	R	R	R	-	R	R
Taraxacum agg.	dandelion	-	-	R	-	O	LF	-	O	-	O
Taraxacum cf. palustre	fen dandelion	-	-	-	-	-	LF	-	-	-	-
Teucrium scorodonia	wood sage	-	-	-	R	-	-	-	R	-	-
Thelypteris palustris	marsh fern	-	A	-	-	-	-	-	-	-	-
Torilis japonica	upright hedge-parsley	-	-	-	-	-	R	-	R	R	-
Trifolium dubium	lesser trefoil	-	-	-	-	R	R	-	-	LF	-
Trifolium medium	zigzag clover	-	-	-	-	-	F	LF	-	-	-
Trifolium pratense	red clover	-	-	LF	-	-	F-LA	LF	-	R	-
Trifolium repens	white clover	-	-	LF	R	LF	F	R	F-LA	-	-
Triglochin palustris	marsh arrowgrass	-	-	O	-	R	O	R	-	-	-

SCIENTIFIC NAME	ENGLISH NAME	CAE ADDA	CAE OWEN	NEUADD	TY DU	24 NORTH	24 SOUTH	25	26	32	CAEAU TALWRN SSSI (NORTH)
Tripleurospermum inodorum	scentless mayweed	-	-	-	-	-	R	-	-	-	-
Tussilago farfara	coltsfoot	-	-	-	-	-	-	-	R	-	R
Typha latifolia	bulrush	-	-	-	LF	R	LA	-	-	LD	-
Ulex europaeus	gorse	LD	LD	LD	-	O	LD	LD	O	-	LD
Umbilicus rupestris	navelwort	-	-	-	R	-	-	-	-	-	-
Urtica dioica	common nettle	-	-	O	R	R	-	R	O	O	-
Valeriana officinalis subsp. *sambucifolia*	common valerian	-	-	-	-	R	F	R	-	-	R
Veronica beccabunga	brooklime	-	-	R	-	-	R	R	-	R	R
Veronica catenata	pink water-speedwell	-	-	-	-	-	R	-	-	-	-
Veronica chamaedrys	germander speedwell	-	-	-	R	-	-	-	R	R	-
Veronica officinalis	heath speedwell	-	-	R	-	-	-	-	-	-	-
Veronica scutellata	marsh speedwell	-	-	-	R	-	-	-	-	-	-
Veronica serpyllifolia subsp. *serpyllifolia*	thyme-leaved speedwell	-	-	-	-	-	-	-	-	-	-
Vicia cracca	tufted vetch	-	-	O-LF	R	R	O	F	O	O	-
Vicia sepium	bush vetch	-	-	-	-	-	R	R	-	R	-
Viola palustris subsp. *palustris*	marsh violet	-	-	-	-	-	-	-	-	-	-
Viola riviniana	common dog-violet	-	-	-	-	R	R	-	-	-	R
	TOTAL TAXA:	69	60	127	144	118	192	143	108	99	86

Appendix F Plant communities recorded

Plant communities with the following affinities were encountered during field surveys. Non-NVC communities are marked by an asterisk and references to phytosociological descriptions are provided where relevant. Plant communities are referred to by community code only in the hydroecology and vegetation plans (appendices A and G).

Acid grassland

- U4 *Festuca ovina- Agrostis capillaris-Galium saxatile* grassland

  U4b *Holcus lanatus-Trifolium repens* sub-community
- U5 *Nardus stricta-Galium saxatile* grassland
- U20 *Pteridium aquilinum-Galium saxatile* community

  U20a *Anthoxanthum odoratum* sub-community

Unimproved and Semi-improved neutral grassland

- MG5 *Cynosurus cristatus-Centaurea nigra* grassland

  MG5a *Lathyrus pratensis* sub-community

  MG5b *Galium verum* sub-community

  MG5c *Danthonia decumbens* sub-community
- MG6 *Lolium perenne-Cynosurus cristatus* grassland

  MG6a typical sub-community

  MG6b *Anthoxanthum odoratum* sub-community
- MG8 *Cynosurus cristatus-Caltha palustris* grassland

Damp semi-improved grassland

- MG10 *Holcus lanatus-Juncus effusus* rush pasture

  MG10a typical subcommunity

  MG10b *Juncus inflexus* sub-community
- MG11 *Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland
- MG13 *Agrostis stolonifera-Alopecurus geniculatus* grassland

Molinia grassland/mires

- M24 *Molinia caerulea-Cirsium dissectum* fen meadow

  M24b typical sub-community
- M25 *Molinia caerulea-Potentilla erecta* mire

  M25a *Erica tetralix* sub-community

M25b *Anthoxanthum odoratum* sub-community

M25c *Angelica sylvestris* sub-community

- **Molinia caerulea-Myrica gale* [RD8]

Wet heaths

- M15 *Scirpus cespitosus-Erica tetralix* wet heath

  M15a *Carex panicea* sub-community
- M16 *Erica tetralix-Sphagnum compactum* wet heath

  M16b *Succisa pratensis-Carex panicea* sub-community

Fens and related mires

- M5 *Carex rostrata-Sphagnum squarrosum* mire
- M6 *Carex echinata-Sphagnum recurvum/auriculatum* mire

  M6c *Juncus effusus* sub-community
- M9 *Carex rostrata-Calliergon cuspidatum/giganteum* mire

  M9b *Carex diandra Calliergon giganteum* sub-community
- M10 *Carex dioica-Pinguicula vulgaris* mire

  M10b *Briza media-Primula farinosa* sub-community
- M13 *Schoenus nigricans-Juncus subnodulosus* mire

  M13b *Briza media-Pinguicula vulgaris* sub-community

  M13c *Caltha palustris-Galium uliginosum* sub-community
- M22 *Juncus subnodulosus-Cirsium palustre* fen meadow

  M22a typical sub-community

  M22b *Briza media-Trifolium* spp. sub-community
- *M22 swampy variant [RD8]
- **Carex disticha* vegetation [RD8]
- **Juncus inflexus*-dominated vegetation [RD8]
- M23 *Juncus acutiflorus/effusus-Gallium palustre* rush pasture

  M23a *J. acutiflorus* sub-community

  M23b *J. effusus* sub-community
- *M23a/b swampy variant [RD8]
- **Juncus acutiflorus*-dominated vegetation [RD8]
- M27 *Filipendula ulmaria-Angelica sylvestris* mire

M27a *Valeriana officinalis-Rumex acetosa* sub-community

- M27c *Juncus effusus-Holcus lanatus* sub-community
- M28 *Iris pseudacorus-Filipendula ulmaria* mire
- M28a *Juncus effusus* sub-community
- M29 *Hypericum elodes-Potamogeton polygonifolius* soakway
- *Neutral flush [RD10]
- *Species-rich *Sphagnum* mire [RD8]

Swamps and tall-herb fens

- S2 *Cladium mariscus* swamp and sedge-beds

  S2a *Cladium mariscus* sub-community
- S4 *Phragmites australis* swamp and reed-beds

  S4a *Phragmites australis* sub-community
- S6 *Carex riparia* swamp
- S7 *Carex acutiformis* swamp
- S9 *Carex rostrata* swamp

  S9b *Menyanthes trifoliata-Equisetum fluviatile* sub-community
- S10 *Equisetum fluviatile* swamp

  S10a *Equisetum fluviatile* sub-community

  S10b *Carex rostrata* sub-community
- S14 *Sparganium erectum* swamp

  S14a *Sparganium erectum* sub-community

  S14b *Alisma plantago-aquatica* sub-community
- S19 *Eleocharis palustris* swamp
- S22 *Glyceria fluitans* water-margin vegetation

  S22a *Glyceria fluitans* sub-community
- S23 Other water-margin vegetation
- S26 *Phragmites australis-Urtica dioica* tall herb fen

  S26a *Filipendula ulmaria* sub-community

  S26c *Oenanthe crocata* sub-community

  S26d *Epilobium hirsutum* sub-community
- S27 *Carex rostrata-Potentilla palustris* tall-herb fen

S27a *Carex rostrata-Equisetum fluviatile* sub-community

- S28 *Phalaris arundinacea* tall herb fen

  S28a *Phalaris arundinacea* sub-community

  S28b *Epilobium hirsutum* sub-community

- **Holcus* swamp [RD8]
- **Iris*-dominated vegetation [RD8]

Aquatic communities

- A9 *Potamogeton natans* community

The following NVC communities were also encountered but are of only peripheral interest to the project and are mapped under broad habitat type.

Improved grassland

- MG7 *Lolium perenne* leys and related grasslands

Native broadleaved woodland and scrub

- W1 *Salix cinerea-Galium palustre* woodland
- W21 *Crataegus monogyna-Hedera helix* woodland
- W22 *Prunus spinosa-Rubus fruticosus* scrub
- W23 *Ulex europaeus-Rubus fruticosus* scrub
- W23c *Teucrium scorodonia* sub-community
- W24 *Rubus fruticosus-Holcus lanatus* underscrub
- W25 *Pteridium aquilinum-Rubus fruticosus* underscrub
- W25a *Hyacinthoides non-scripta* sub-community
- W24 *Rubus fruticosus-Holcus lanatus* underscrub

Other vegetation types

- OV24 *Urtica dioica-Galium aparine* community
- OV25 *Urtica dioica-Cirsium arvense* community
- OV26 *Epilobium hirsutum* community
- OV27 *Epilobium angustifolium* community
- OV28 *Agrostis stolonifera-Ranunculus repens* community

Appendix G Vegetation plans

Figure G-1: Vegetation plan – Cae Adda

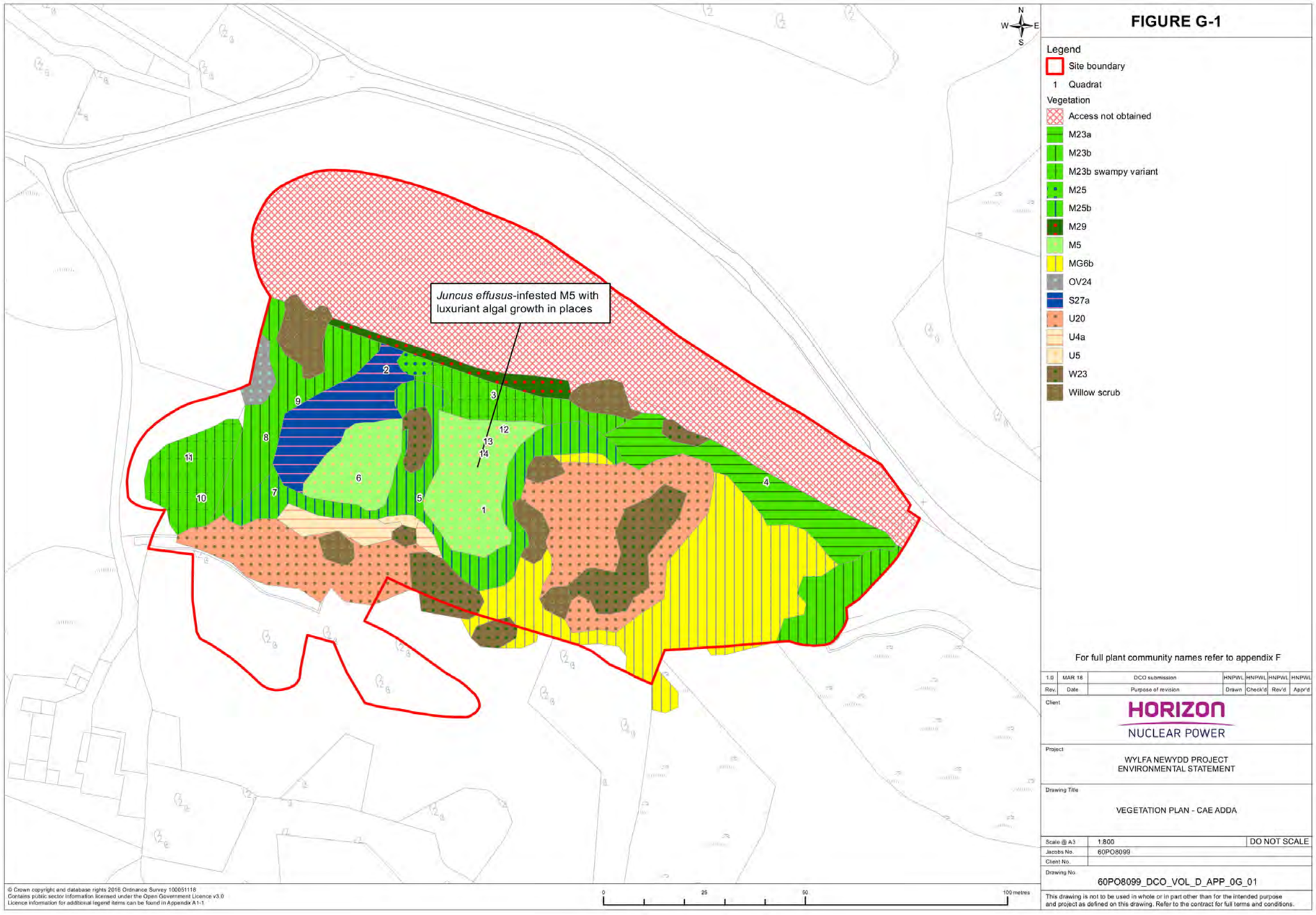


Figure G-2: Vegetation plan – Cae Owen

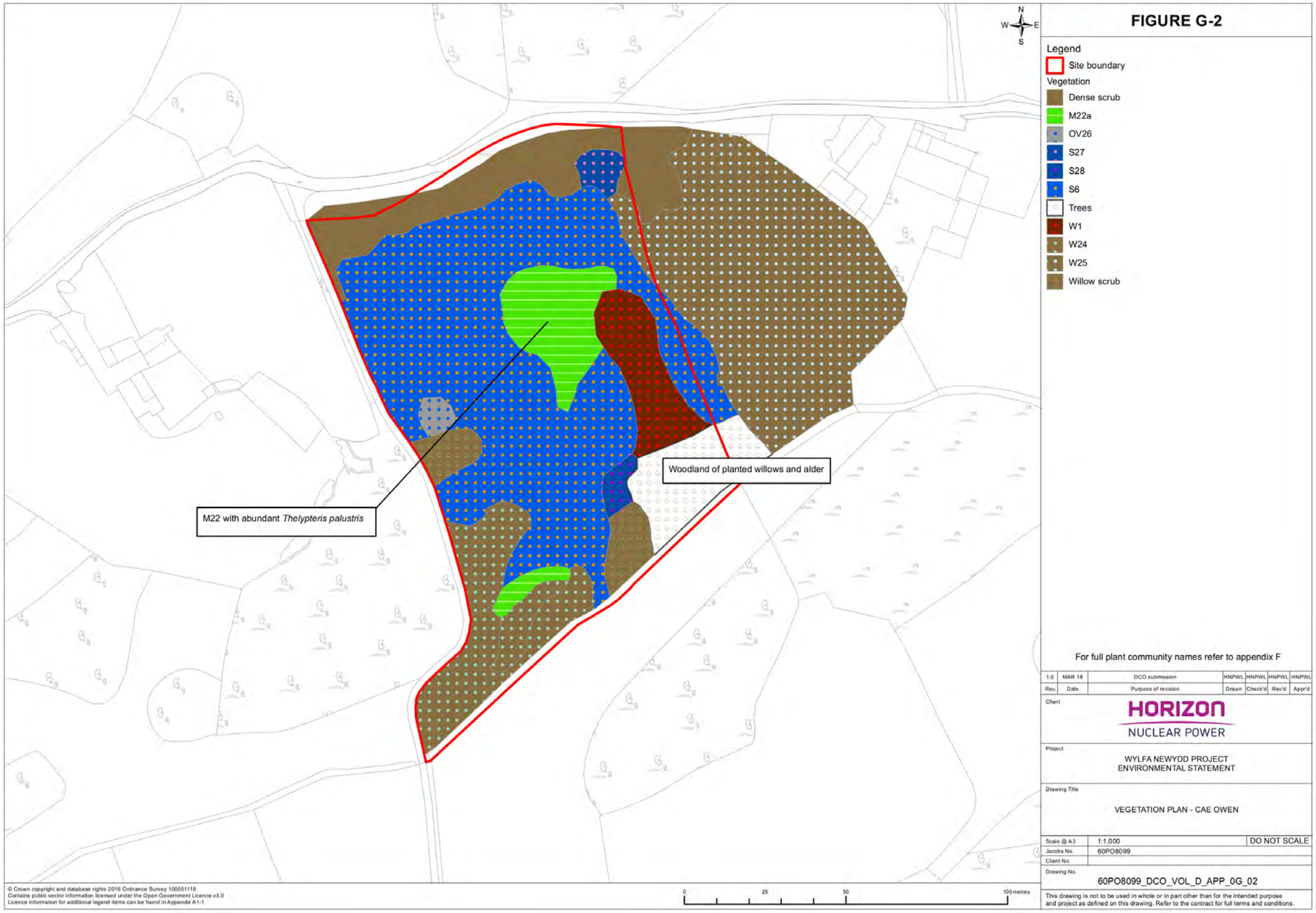


Figure G-3: Vegetation plan – Neuadd

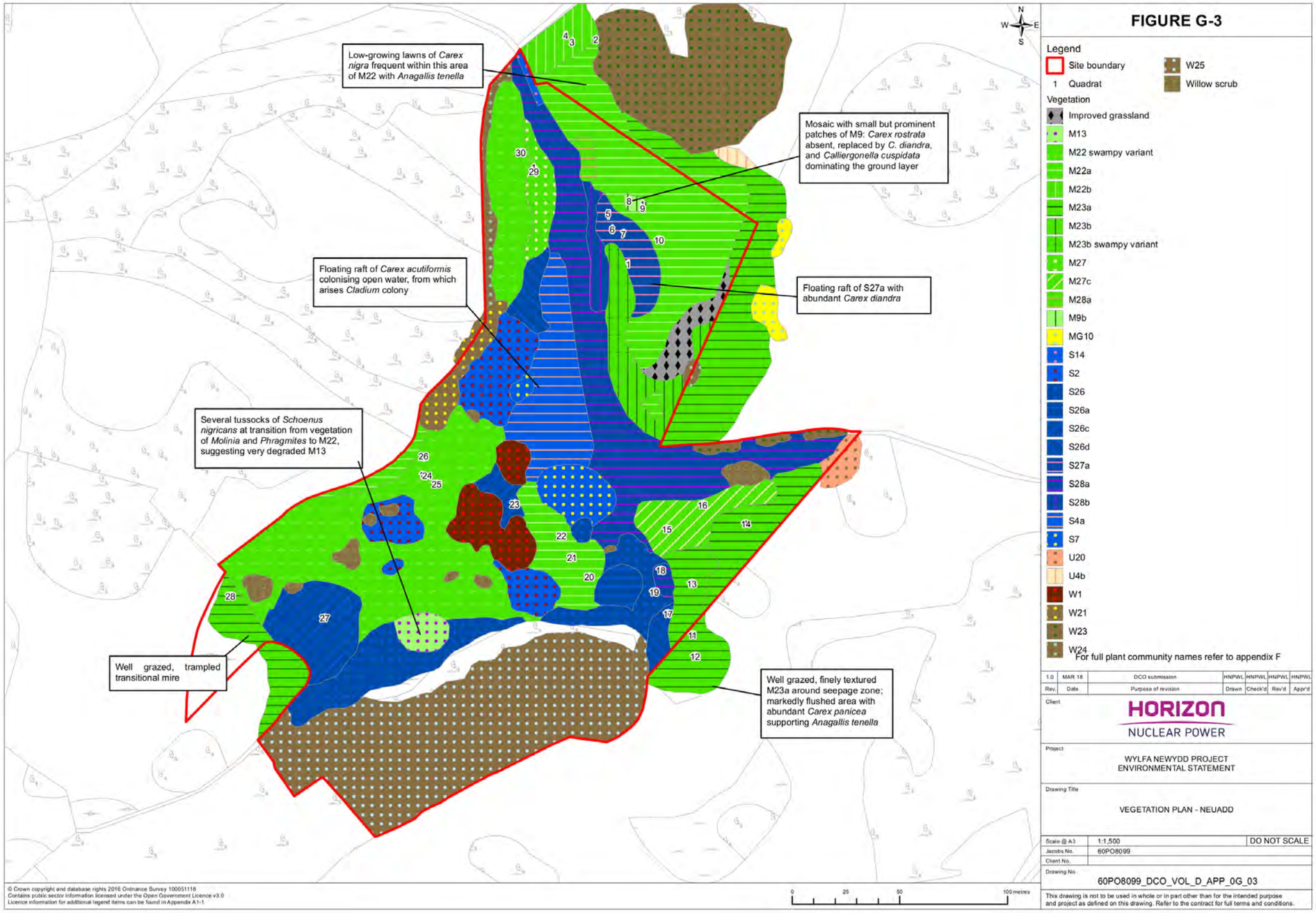


Figure G-4: Vegetation plan – Ty du

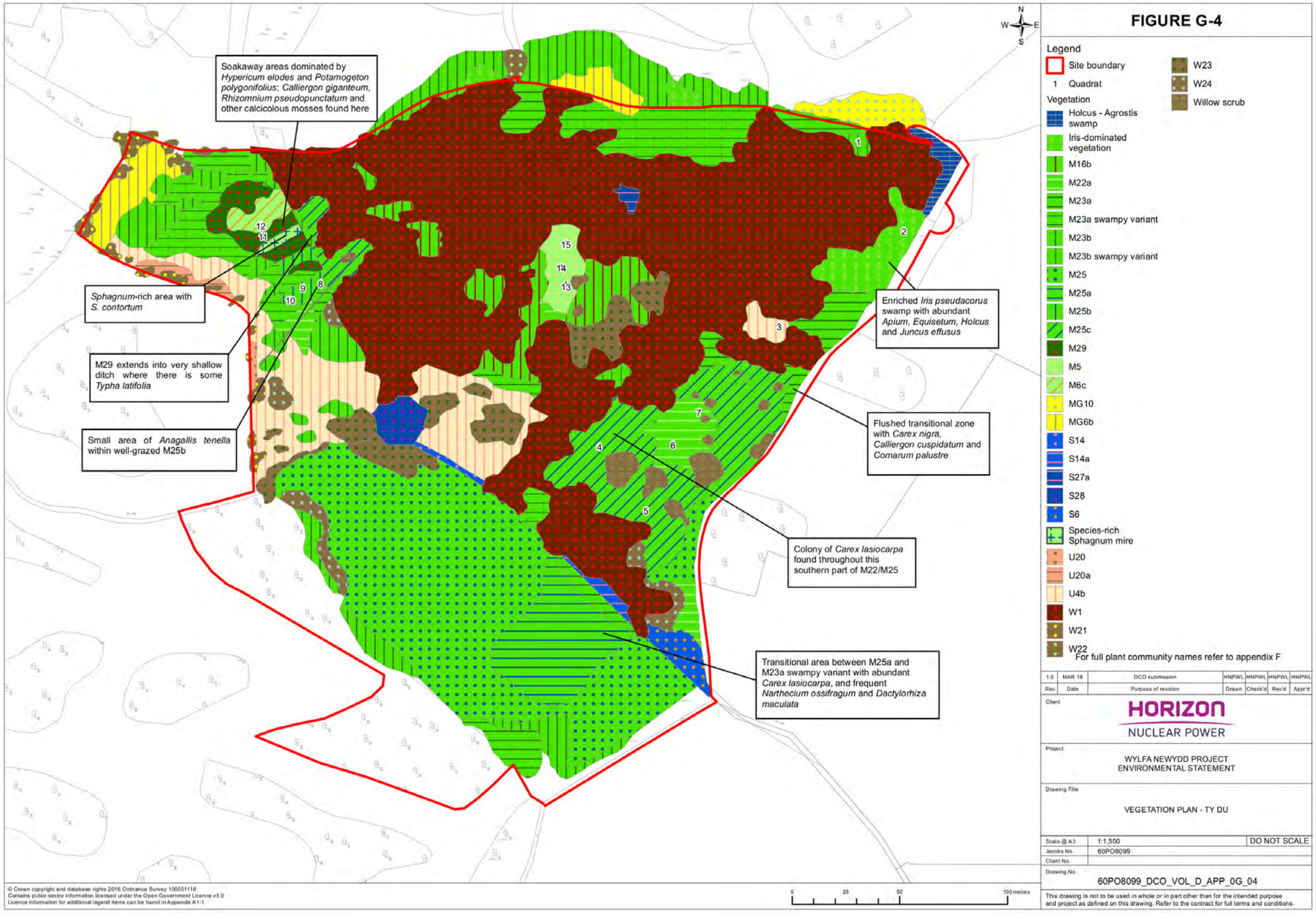


Figure G-5: Vegetation plan – Site 24

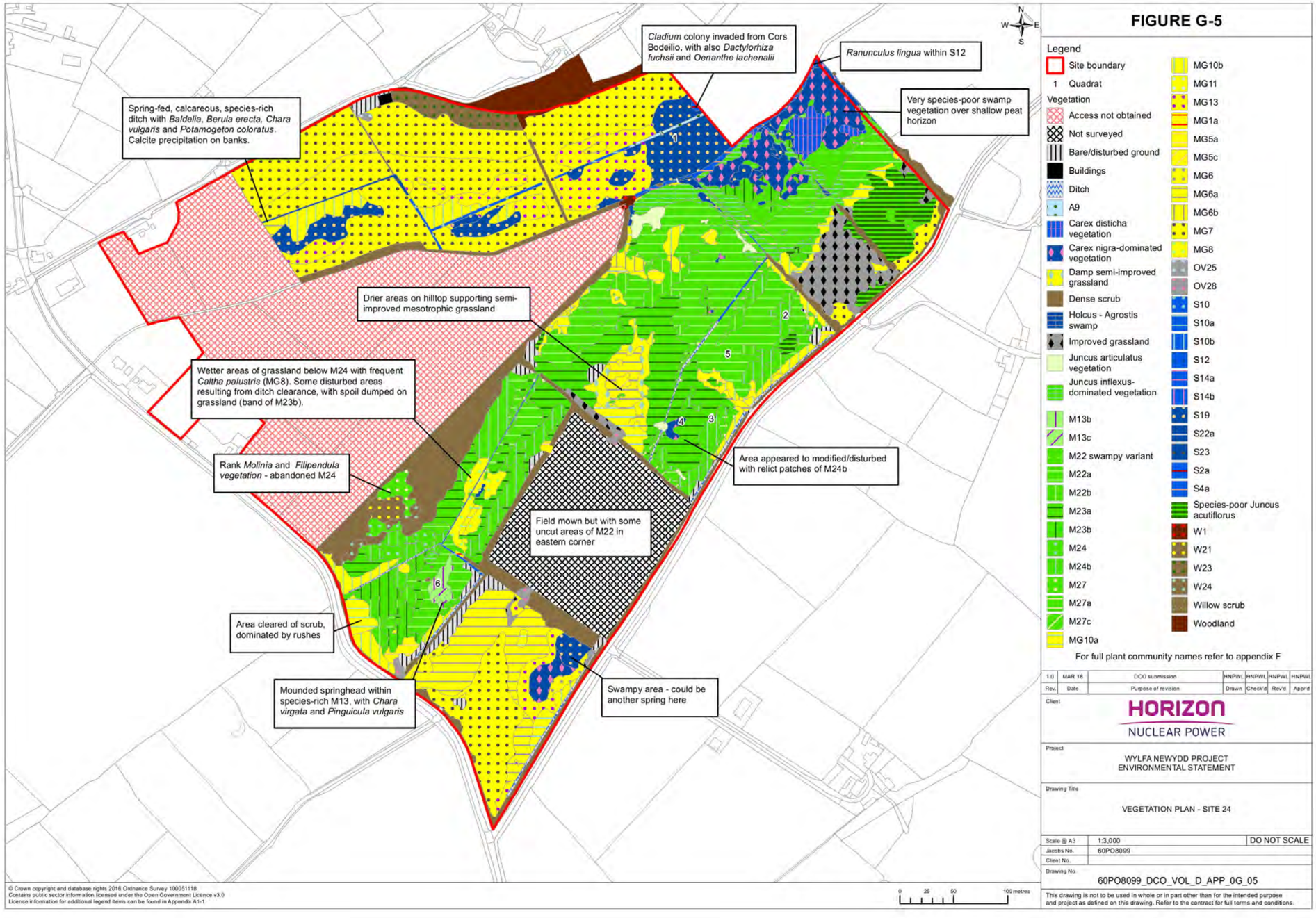


Figure G-6: Vegetation plan – Site 25

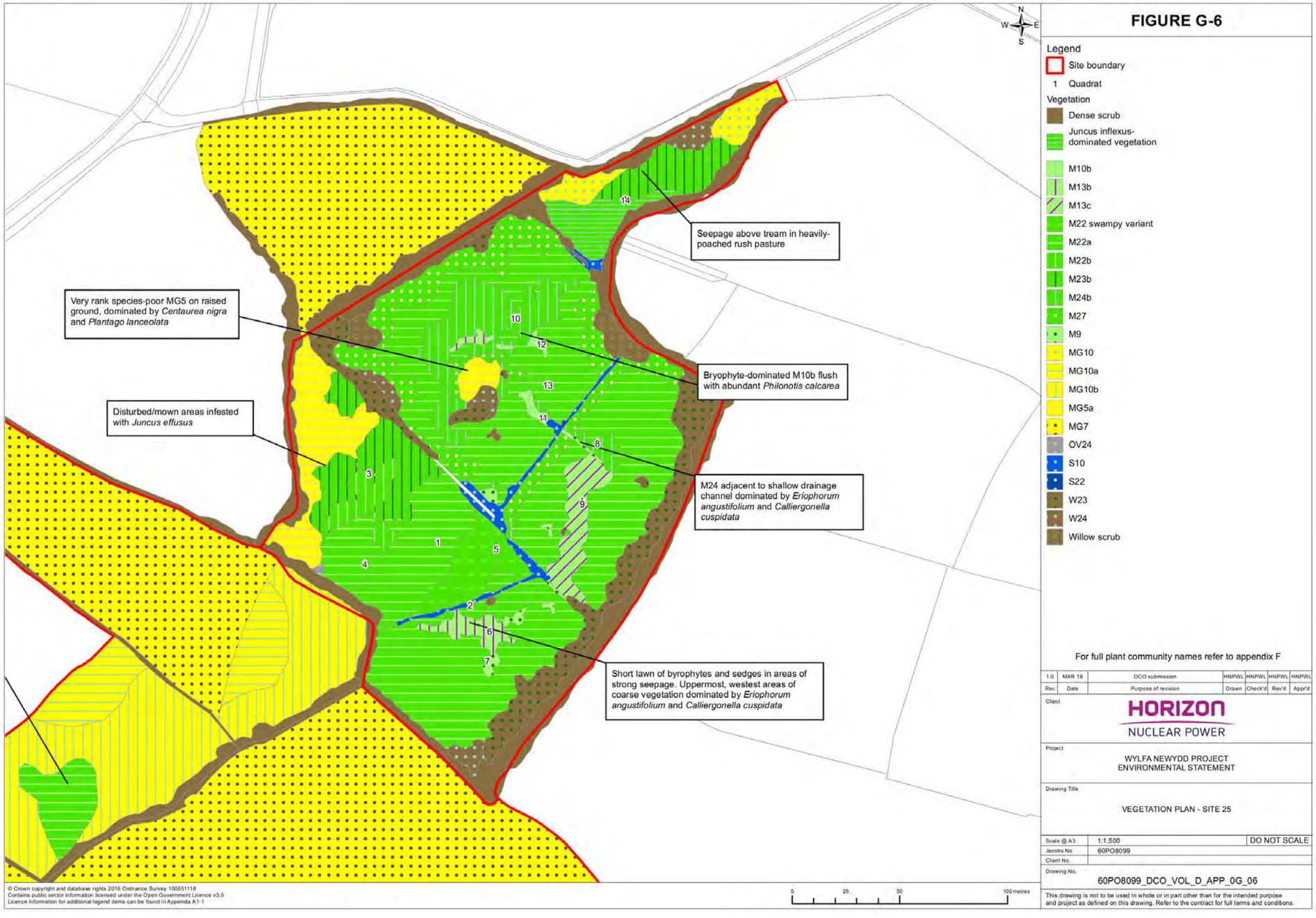


Figure G-7: Vegetation plan – Site 26

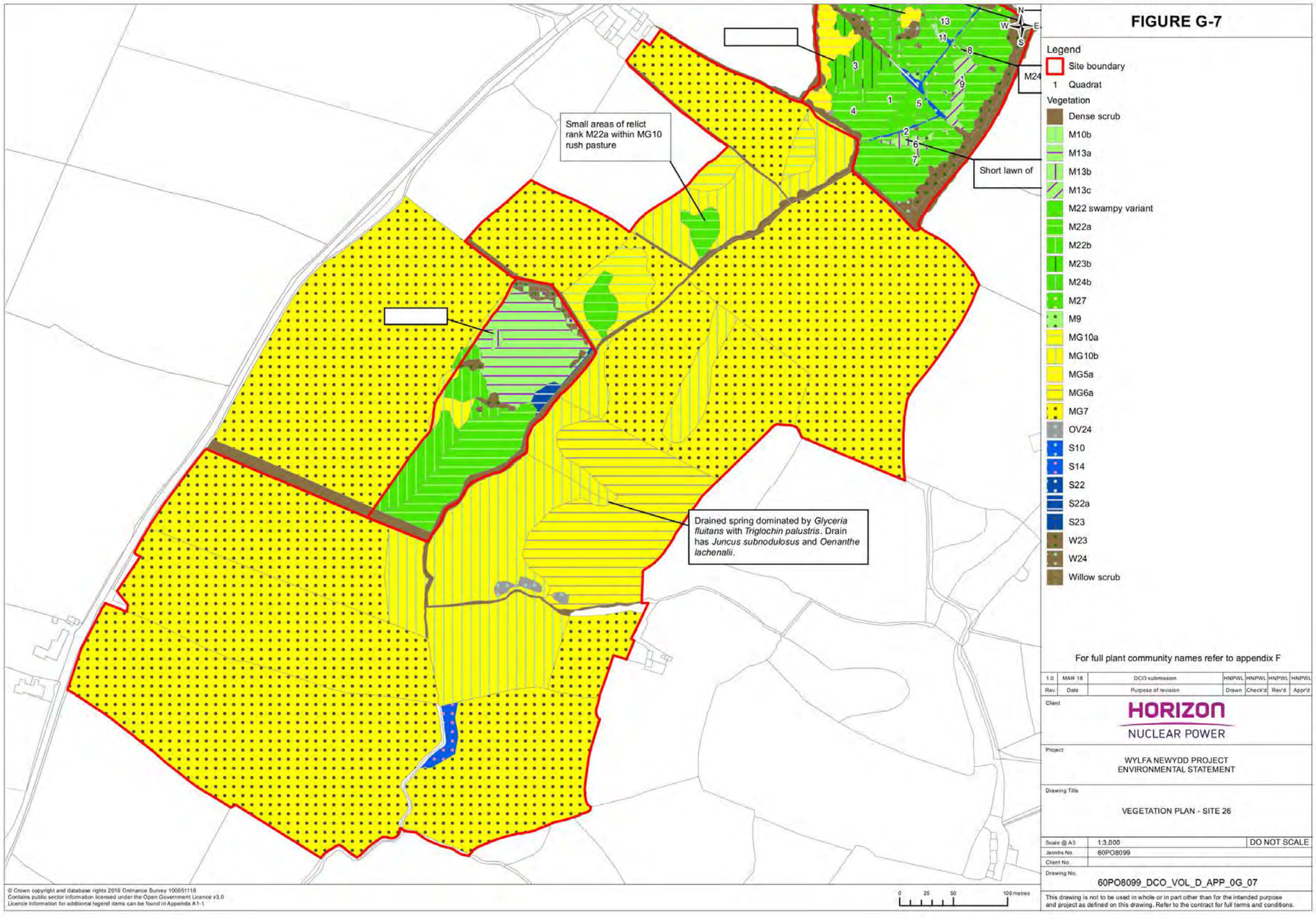
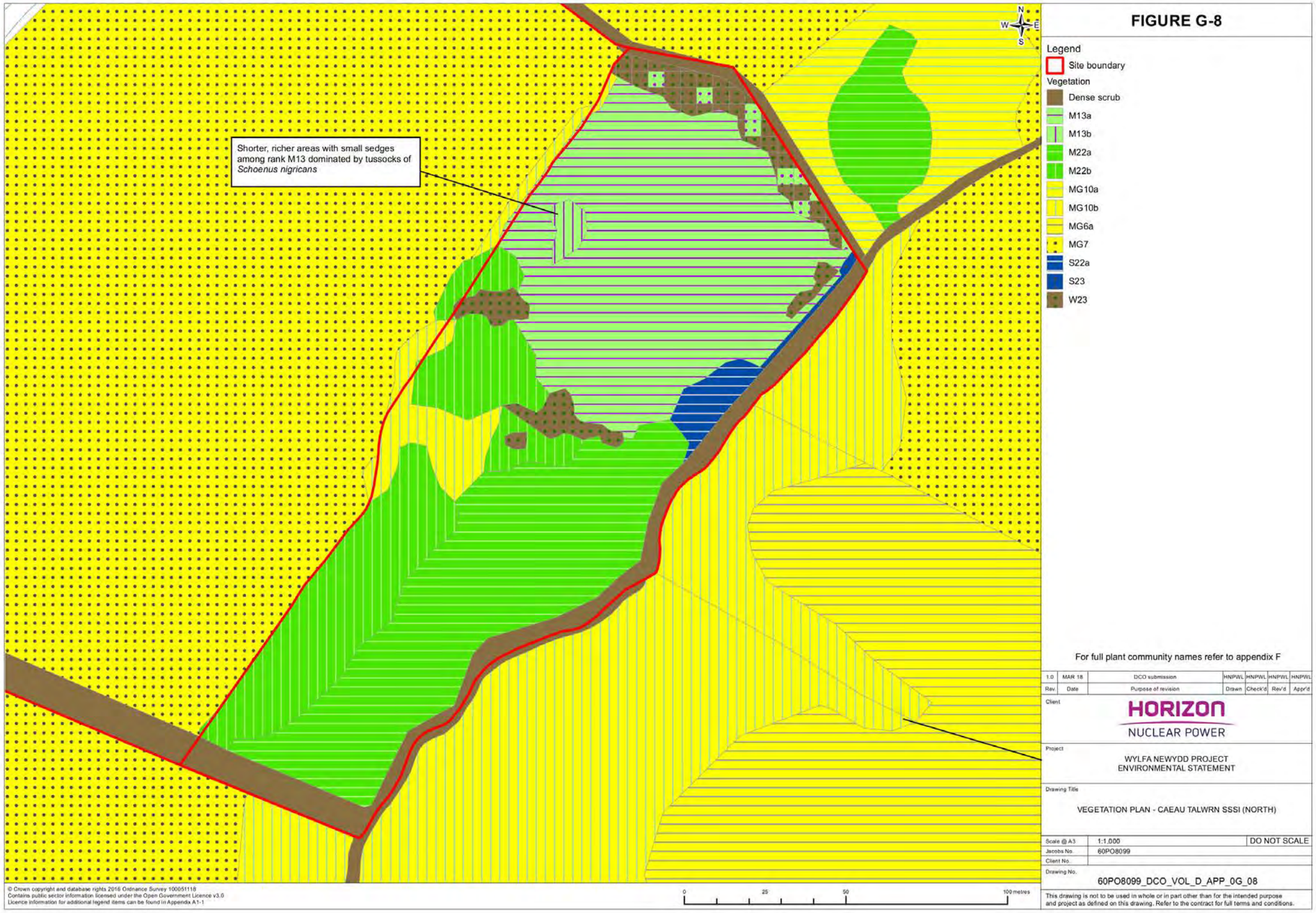


Figure G-8: Vegetation plan – Caeau Talwrn SSSI (North)



Appendix H Quadrat results

Table H-1: Quadrat locations, dates, notes and determinations. Locations are shown on the vegetation plans in appendix G (corrected where recorded grid references were incorrect).

SITE	QUADRAT	DATE	GRID REFERENCE	NOTE	TYPE
Cae Adda	1	27/06/2016	SH 39423 94311	Molinia-Carex rostrata dominated area transitional to main M5 mire, some C. echinata	M5
Cae Adda	2	27/06/2016	SH 39402 94348	-	S27a
Cae Adda	3	27/06/2016	SH 39426 94343	Transitional to M5 by fence	M23b swampy variant
Cae Adda	4	27/06/2016	SH 39493 94318	-	M23b
Cae Adda	5	27/06/2016	SH 39407 94314	Abundant eriophorum angustifolium with mesotrophic herbs	M25b
Cae Adda	6	27/06/2016	SH 39392 94319	-	M5
Cae Adda	7	27/06/2017	SH 39385 94325	Grassy raised area between M5 and M23 dominated by big Molinia tussocks	M25b
Cae Adda	8	27/06/2016	SH 39369 94329	-	M23b
Cae Adda	9	27/06/2016	SH 39377 94338	-	M23b
Cae Adda	10	27/06/2016	SH 39353 94314	Tall Juncus effusus with abundant Equisetum fluviatile in swampy area marked as pond on map lying in depression	M23b swampy variant
Cae Adda	11	27/06/2016	SH 39350 94324	-	M23b swampy variant
Cae Adda	12	27/06/2016	SH 39428 94331	Sphagnum squarrosum abundant with tussocks of Juncus effusus, Eriophorum frequent but low cover, edge of quaking mire by rise to scrub, water below surface	M5
Cae Adda	13	27/06/2016	SH 39424 94328	-	M5
Cae Adda	14	27/06/2016	SH 39423 94325	-	M5
Neuadd	1	30/06/2016	SH 38570 94248	-	M23b swampy variant
Neuadd	2	29/06/2016	SH 38555 94352	Grassy m22 area with frequent Briza and Trifolium repens, Juncus subnodulosus frequent but of reduced cover	M22b
Neuadd	3	29/06/2016	SH 38544 94351	-	M22b
Neuadd	4	29/06/2016	SH 38541 94354	-	M22b
Neuadd	5	29/06/2016	SH 38564 94280	Quaking raft of vegetation between M22 and swampy Phragmites; very colourful	S27a
Neuadd	6	29/06/2016	SH 38566 94274	Similar to 5, more Carex diandra and Juncus subnodulosus cover much reduced; water above surface	S27a
Neuadd	7	29/06/2016	SH 38571 94272	Similar to 6	S27a
Neuadd	8	29/06/2016	SH 38576 94283	Short vegetation transitional between tall M22 and M22/S27/M9; swampy, short and mossy	M9b
Neuadd	9	29/06/2016	SH 38584 94273	More open than 8 and richer; very spongey substrate, water oozes but not above surface	M9b
Neuadd	10	29/06/2016	SH 38580 94255	Quaking raft of grassy vegetation between M22 and M23 swampy variant, Juncus effusus frequent and Caltha occasional in stand	M22a

SITE	QUADRAT	DATE	GRID REFERENCE	NOTE	TYPE
Neuadd	11	29/06/2016	SH 38600 94076	Seepage area on slope at periphery of fen	M23a
Neuadd	12	28/06/2016	SH 38601 94066	Flushed M23a	M23a
Neuadd	13	28/06/2016	SH 38609 94097	Ungrazed rush pasture; rush/Filipendula-dominated veg on seepage area at edge of fen below fence line	M23a
Neuadd	14	28/06/2016	SH 38958 94120	Similar to 13 but Filipendula of reduced cover, transitional to area in which Holcus is much more prevalent	M23a
Neuadd	15	28/06/2016	SH 38588 94125	-	M27b
Neuadd	16	28/06/2016	SH 38604 94140	Similar to 16, very herby tall-herb with Filipendula and Dactylis	M27b
Neuadd	17	28/06/2016	SH 38596 94085	Epilobium hirsutum abundant with invading Phragmites, adjacent to zone with roles reversed	S26d
Neuadd	18	28/06/2016	SH 38585 94106	Between S26 and S26/28, with frequent Caltha and Angelica	S26b
Neuadd	19	28/06/2016	SH 38582 94096	Less eutrophic conditions than 18, quite herby, Dactylorhiza purpurella elsewhere in stand	S26b
Neuadd	20	28/06/2016	SH 38552 94103	Very species-poor	M22a
Neuadd	21	28/06/2016	SH 38544 94112	-	M22a
Neuadd	22	28/06/2016	SH 38539 94122	Similar to 21 but more Comarum and abundant Carex acutiformis and Angelica	M22a
Neuadd	23	28/06/2016	SH 38527 94138	Quaking peat; cover of Juncus subnodulosus much reduced but constant as is Carex acutiformis and Filipendula, Angelica and Comarum but addition of Epilobium hirsutum and Oenanthe crocata	S26c
Neuadd	24	28/06/2016	SH 38474 94150	-	M22 swampy variant
Neuadd	25	28/06/2016	SH 38481 94146	Very species-poor stand in wet bottom of fen; Solanum dulcamara frequent, Hydrocotyle and Menyanthes abundant in places	M22 swampy variant
Neuadd	26	28/06/2016	SH 38475 94158	Periphery of fen adjacent to very species-poor M22, mixed with Pteridium	M22 swampy variant
Neuadd	27	28/06/2016	SH 38429 94084	Species-poor S26c, with Oenanthe crocata frequent through stand, with Solanum dulcamara and Nasturtium	S26c
Neuadd	28	28/06/2016	SH 38390 94105	Transitional very unstable rush mire with Carex rostrata some Cratoneuron, heavily grazed and poached	M23a
Neuadd	29	28/06/2016	SH 38532 94293	Edge of species-poor M22, with abundant Filipendula of high cover, with high cover of Epilobium hirsutum	M27
Neuadd	30	28/06/2016	SH 38526 94300	Very wet zone abundant Menyanthes	M22 swampy variant
Ty du	1	30/06/2016	SH 39742 94174	Swampy transition from M23b	M23b swampy variant
Ty du	2	30/06/2016	SH 39777 94138	Very species-poor swampy eutrophic vegetation	Iris-dominated vegetation
Ty du	3	30/06/2016	SH 39712 94087	Ungrazed acid grassland, Nardus present in stand at very low cover	U4b
Ty du	4	30/06/2016	SH 39622 94027	Very grassy with Arrhenatherum, with Carex lasiocarpa locally abundant in stand	M25c
Ty du	5	30/06/2016	SH 39657 94001	Similar to 4 but more open	M25c
Ty du	6	30/06/2016	SH 39656 94028	Grassier than 5 with small amount of Carex lasiocarpa	M22a

SITE	QUADRAT	DATE	GRID REFERENCE	NOTE	TYPE
Ty du	7	30/06/2016	SH 39668 94043	-	M22a
Ty du	8	30/06/2016	SH 39499 94107	Baulk between M22 at edge of mire and M29 track; other baulks in area, with Sphagna, this rather grassy with Anagallis tenella	M25b
Ty du	9	30/06/2016	SH 39494 94107	-	M25b
Ty du	10	30/06/2016	SH 39495 94105	-	M25b
Ty du	11	30/06/2016	SH 39482 94125	M29 soakway	M29
Ty du	12	30/06/2016	SH 39481 94130	Raised sphagnum baulk between flow tracks	M6c
Ty du	13	30/06/2016	SH 39612 94102	-	M5
Ty du	14	30/06/2016	SH 39610 94110	-	M5
Ty du	15	30/06/2016	SH 39612 94121	-	M5
Site 24	1	12/07/2017	SH 49585 76913	Improved area of wet ground	S19
Site 24	2	12/07/2017	SH 49688 76749	Very sedgey M24b sward	M24b
Site 24	3	12/07/2017	SH 49619 76653	Short with more Molinia than nearby, well grazed and fairly uniform	M24b
Site 24	4	12/07/2017	SH 49591 76650	Disturbed area of fen pasture, partially modified?	Carex nigra-dominated vegetation
Site 24	5	12/07/2017	SH 49634 76713	-	M22a
Site 24	6	13/07/2017	SH 49365 76500	Very short open springhead mire m13b with bryophyte and small sedge lawn	M13b
Site 25	1	10/07/2017	SH 47770 78171	-	M22a
Site 25	2	10/07/2017	SH 47785 78142	S10 in stream with a lot of rushes from fen, forming floating raft in places	S10
Site 25	3	11/07/2017	SH 47738 78203	-	M22b
Site 25	4	11/07/2017	SH 47736 78161	Tall disturbed Juncus inflexus pasture infested with Juncus effusus	M22a
Site 25	5	11/07/2017	SH 47797 78168	S10/M22 mosaic (M22 swampy variant) very wet and swampy underfoot	M22 swampy variant
Site 25	6	11/07/2017	SH 47794 78130	Short open flow rack through M22 (or degraded M13?) with abundant Equisetum fluviatile. A few big tussocks of Schoenus with numerous smaller plants. Patches of water with Chara and hummocks of Campylium stellatum	M13b
Site 25	7	11/07/2017	SH 47793 78116	Species-poor M9 toward top of flow track. Spring?	M9
Site 25	8	11/07/2017	SH 47844 78217	M24 on drier area next to shallow drainage channel	M24b
Site 25	9	11/07/2017	SH 47837 78190	Rather little Schoenus, only big old tussocks and quite grassy. Wider area once M13 but lost to M22?	M13c
Site 25	10	14/07/2017	SH 47806 78275	-	M24b
Site 25	11	14/07/2017	SH 47819 78229	Very short open M10 bryophyte flush	M10b
Site 25	12	14/07/2017	SH 47818 78263	Patchy bryophyte flush with large patches of Philonotis calcarea	M10b
Site 25	13	14/07/2017	SH 47821 78244	Tall strongly flushed area through M22	M22a
Site 25	14	14/07/2017	SH 47857 78330	Very heavily poached area infested with Junci and Equisetum fluviatile	Juncus inflexus-dominated vegetation

Table H-2: Results of quadrat samples from Cae Adda

	QUADRAT													
SCIENTIFIC NAME	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Agrostis canina	-	4	-	6	6	7	5	7	5	-	-	1	3	3
Agrostis sp.	-	-	5	-	-	-	-	-	-	-	-	-	-	-
Agrostis stolonifera	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthoxanthum odoratum	-	-	-	-	2	-	1	-	-	-	-	-	-	-
Apium nodiflorum	-	-	-	-	-	-	-	-	-	-	5	-	-	-
Calliergon cordifolium	-	8	9	8	-	-	2	7	8	9	2	-	1	3
Calliergonella cuspidata	-	-	-	-	2	-	-	-	-	-	-	-	-	-
Cardamine pratensis	1	-	1	-	-	-	1	-	3	-	1	-	-	-
Carex nigra	-	-	-	-	1	-	1	-	-	-	-	-	-	-
Carex rostrata	10	3	2	-	4	7	2	2	-	1	1	3	6	6
Comarum palustre	3	4	4	3	2	5	2	3	5	2	-	5	5	4
Dactylis glomerata	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Epilobium palustre	-	2	3	-	-	-	1	-	-	-	-	-	1	2
Equisetum fluviatile	5	3	3	-	1	1	1	1	2	6	4	2	3	3
Eriophorum angustifolium	5	-	-	-	-	4	-	-	-	-	-	6	-	4
Galium palustre	2	4	3	-	3	3	3	5	6	3	3	4	2	5
Hydrocotyle vulgaris	5	5	5	4	3	8	3	6	4	6	5	6	6	5
Juncus acutiflorus	-	-	-	-	-	-	4	-	-	-	-	-	-	-
Juncus articulatus	2	-	-	3	-	-	-	-	-	-	-	8	-	-
Juncus bulbosus	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Juncus effusus	-	9	9	10	9	5	5	8	9	10	10	9	8	8
Lotus pedunculatus	-	2	3	-	6	-	5	2	4	-	-	-	-	-
Mentha aquatica	-	-	-	-	-	-	-	1	2	2	-	-	-	-
Molinia caerulea	4	-	-	-	4	-	9	-	-	-	-	-	-	-
Myosotis laxa	-	-	1	-	-	-	-	-	-	-	2	-	-	-
Myosotis secunda	-	3	-	-	-	-	-	2	3	3	-	-	-	-
Polytrichum commune	-	-	-	-	3	-	-	-	-	-	-	-	-	-
Ranunculus flammula	3	-	-	3	-	-	-	1	3	-	-	-	1	-
Rhytidiadelphus squarrosus	-	-	-	-	-	-	3	-	-	-	-	-	-	-
Rumex acetosa	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Rumex conglomeratus	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Silene flos-cuculi	-	3	-	1	-	-	2	3	4	-	-	-	-	-
Sphagnum fallax	3	-	-	-	-	-	-	-	-	-	-	4	4	-
Sphagnum palustre	-	-	-	-	6	-	-	-	-	-	-	-	-	-
Sphagnum squarrosum	-	1	5	-	2	10	1	-	-	-	-	4	9	9
Viola palustris	-	-	-	-	5	-	4	3	-	-	-	-	-	-
TOTAL TAXA	**13**	**13**	**13**	**8**	**16**	**9**	**20**	**15**	**13**	**10**	**9**	**11**	**12**	**11**

Table H-3: Results of quadrat samples from Neuadd

	QUADRAT																													
SCIENTIFIC NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Agrostis canina	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agrostis stolonifera	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anagallis tenella	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Angelica sylvestris	-	-	-	-	-	-	-	-	-	-	2	1	1	1	2	-	-	4	4	-	-	4	4	3	-	-	-	-	-	-
Anthoxanthum odoratum	-	7	5	4	-	-	-	-	2	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Apium nodiflorum	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-
Arrhenatherum elatius	4	-	-	-	-	-	-	-	-	-	-	-	2	-	5	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brachythecium rutabulum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-
Briza media	-	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliergonella cuspidata	-	-	-	-	-	-	-	8	8	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caltha palustris	-	-	-	-	-	5	2	-	-	-	-	-	-	-	-	-	-	5	4	-	-	-	-	-	-	-	-	-	-	-
Cardamine pratensis	-	-	1	1	-	2	-	-	3	-	-	1	-	-	-	-	-	3	1	-	-	-	-	-	-	-	-	-	-	-
Carex acutiformis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-
Carex demissa	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex diandra	-	-	-	-	3	6	7	5	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex flacca	-	4	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex hirta	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex lasiocarpa	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex nigra	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex panicea	-	-	5	-	-	-	-	-	4	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex rostrata	-	-	-	-	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Cerastium fontanum	-	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cirsium arvense	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	QUADRAT																													
SCIENTIFIC NAME	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Cirsium palustre	-	5	1	2	-	-	-	-	2	-	-	-	-	-	6	5	-	2	2	-	-	-	-	-	-	-	-	-	-	-
Comarum palustre	-	-	-	-	-	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	1
Cratoneuron filicinum	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cynosurus cristatus	-	3	3	3	-	-	-	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Dactylis glomerata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dactylorhiza purpurella	-	-	-	-	-	-	-	1	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deschampsia cespitosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dryopteris dilatata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Dryopteris filix-mas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epilobium hirsutum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	5	-	-	-	-	-	7	-
Epilobium palustre	-	-	-	-	-	1	3	-	-	1	2	-	-	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-	-	-
Epilobium parviflorum	-	-	-	-	1	-	1	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-
Epilobium tetragonum	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equisetum arvense	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Equisetum fluviatile	6	-	-	-	5	3	5	1	2	6	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equisetum palustre	-	-	-	1	-	1	-	1	1	-	1	2	2	4	5	4	3	-	3	2	-	-	-	1	-	-	-	1	-	1
Festuca rubra	-	8	9	8	-	-	-	6	5	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Filipendula ulmaria	-	2	2	4	-	-	-	5	5	1	2	1	8	1	3	4	4	8	7	8	8	8	6	5	-	9	6	-	9	4
Galium aparine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	3	3	-	-	1	2	2	-	-	-	-	-	1	-
Galium palustre	3	2	2	3	5	4	6	3	3	3	3	1	-	3	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-
Glyceria fluitans	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Holcus lanatus	5	5	4	4	3	4	4	1	2	8	3	-	-	6	6	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
Hydrocotyle vulgaris	-	-	-	-	-	-	1	7	7	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Hypericum tetrapterum	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	QUADRAT																													
SCIENTIFIC NAME	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Juncus acutiflorus	5	5	7	-	-	-	-	-	-	-	9	8	10	10	-	-	-	-	5	-	-	-	-	-	-	-	-	5	-	-
Juncus articulatus	-	-	-	-	-	4	7	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juncus bulbosus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-
Juncus conglomeratus	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juncus effusus	6	-	-	-	-	-	-	-	-	-	-	-	-	-	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juncus subnodulosus	-	5	-	8	6	-	-	3	3	-	-	-	-	-	-	-	-	-	-	10	10	8	5	10	10	9	-	-	6	8
Kindbergia praelonga	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-
Lathyrus pratensis	-	3	3	3	-	-	-	3	-	-	3	-	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lolium perenne	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lotus corniculatus	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lotus pedunculatus	-	-	4	4	-	-	-	4	4	5	4	-	-	2	-	7	-	-	-	-	4	1	-	2	-	-	-	-	-	-
Luzula campestris	-	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mentha aquatica	-	-	-	-	7	4	6	-	-	1	2	3	-	3	-	-	-	4	2	2	1	2	-	-	-	-	-	2	-	-
Menyanthes trifoliata	-	-	-	-	9	9	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	9
Molinia caerulea	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Myosotis laxa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Myosotis scorpioides	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Myosotis secunda	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nasturtium microphyllum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-
Nasturtium officinale agg.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
Oenanthe crocata	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	6	-	-	-
Pedicularis palustris	-	-	-	-	-	-	-	7	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phalaris arundinacea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Phragmites australis	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	-	5	9	9	5	5	4	8	4	7	1	10	-	2	-

	QUADRAT																													
SCIENTIFIC NAME	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Plantago lanceolata	-	5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poa trivialis	2	3	2	-	6	4	-	2	-	4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potentilla anserina	-	3	-	4	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potentilla erecta	-	4	4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potentilla reptans	-	-	1	1	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prunella vulgaris	-	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pteridium aquilinum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
Ranunculus acris	-	-	3	3	-	-	-	2	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus flammula	3	-	-	-	3	3	3	-	-	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus repens	4	3	5	1	2	-	-	-	-	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Rumex acetosa	-	-	2	-	-	-	-	-	-	-	3	1	5	3	-	3	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Rumex conglomeratus	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Schedonorus pratensis	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silene dioica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silene flos-cuculi	-	1	-	3	-	-	-	-	4	2	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Solanum dulcamara	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
Stellaria alsine	3	-	-	-	3	3	-	-	-	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Succisa pratensis	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taraxacum agg.	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium pratense	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium repens	-	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triglochin palustris	-	-	-	-	-	-	-	-	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vicia cracca	-	3	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL TAXA	**13**	**26**	**26**	**26**	**14**	**18**	**16**	**18**	**22**	**15**	**25**	**22**	**8**	**12**	**13**	**14**	**5**	**14**	**10**	**5**	**6**	**9**	**8**	**8**	**4**	**4**	**6**	**16**	**5**	**6**

Table H-4: Results of quadrat samples from Ty du

	Quadrat														
Scientific name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Agrostis canina	-	-	-	4	-	-	-	7	-	3	3	-	7	6	6
Agrostis capillaris	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Angelica sylvestris	-	-	-	5	1	1	1	-	-	-	-	-	-	-	-
Anthoxanthum odoratum	-	-	6	-	-	-	-	5	3	4	-	3	-	-	-
Apium nodiflorum	4	7	-	-	-	-	-	-	-	-	-	-	-	-	-
Arrhenatherum elatius	-	-	1	5	-	6	6	-	-	-	-	-	-	-	-
Aulacomnium palustre	-	-	-	-	-	-	-	4	2	5	-	-	4	-	4
Calliergon cordifolium	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
Calliergon giganteum	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
Calliergonella cuspidata	-	-	-	-	-	-	-	4	7	6	-	-	-	-	-
Callitriche agg.	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calluna vulgaris	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-
Caltha palustris	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex demissa	-	-	-	-	-	-	-	2	8	7	-	-	-	-	-
Carex echinata	-	-	-	-	-	-	-	7	5	4	-	4	-	-	-
Carex lasiocarpa	-	-	-	3	3	1	3	-	-	-	-	-	-	-	-
Carex nigra	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-
Carex panicea	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-
Carex rostrata	-	-	-	-	-	-	-	-	-	-	3	-	5	5	7
Cirsium palustre	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Comarum palustre	-	-	-	4	5	3	5	3	5	3	4	-	6	7	8
Cynosurus cristatus	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Danthonia decumbens	-	-	-	-	-	-	-	9	4	1	-	5	-	-	-
Eleogiton fluitans	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-
Epilobium montanum	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Epilobium palustre	-	-	-	1	4	-	2	-	-	2	-	-	-	-	1
Equisetum fluviatile	8	3	-	-	-	-	2	3	4	3	3	2	2	2	-
Eriophorum angustifolium	-	-	-	-	-	-	-	-	2	-	-	3	5	5	3
Festuca rubra	-	-	8	-	-	-	-	-	5	5	-	-	-	-	-
Galium palustre	4	-	-	3	1	-	-	-	2	-	3	-	-	3	3
Galium saxatile	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Holcus lanatus	3	8	6	3	3	8	8	2	3	3	-	-	-	-	-
Hydrocotyle vulgaris	-	-	-	4	5	4	4	-	-	-	-	-	-	-	-
Hypericum elodes	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-
Iris pseudacorus	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Juncus articulatus	-	-	1	4	7	6	-	3	1	1	-	-	-	-	5
Juncus bulbosus	-	-	-	-	-	-	-	-	3	1	-	-	-	-	-
Juncus effusus	-	1	-	-	-	-	-	-	-	-	3	1	1	2	-

	Quadrat														
Scientific name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Juncus subnodulosus	-	-	-	8	4	7	7	-	-	-	-	-	-	-	-
Lotus pedunculatus	-	-	-	-	-	-	3	4	4	4	-	3	1	4	3
Luzula campestris	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Luzula multiflora	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-
Luzula multiflora subsp. *congesta*	-	-	-	-	-	-	-	-	1	-	-	-	3	-	-
Mentha aquatica	3	5	-	1	-	-	-	-	-	-	-	-	-	-	-
Menyanthes trifoliata	-	-	-	-	-	-	-	-	6	2	4	-	-	-	-
Molinia caerulea	-	-	-	5	-	-	-	2	8	7	-	-	3	-	-
Myosotis secunda	4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
Pedicularis sylvatica	-	-	-	-	-	-	-	3	-	2	-	-	-	-	-
Plantago lanceolata	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
Poa trivialis	3	1	3	-	4	-	-	-	-	-	-	-	-	-	-
Potamogeton polygonifolius	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-
Potentilla anserina	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Potentilla erecta	-	-	6	-	-	-	-	3	-	-	-	-	-	-	-
Ranunculus flammula	5	-	-	-	8	-	-	-	1	-	1	-	-	-	-
Ranunculus repens	3	-	-	-	-	4	3	-	-	-	-	-	-	-	-
Rhytidiadelphus squarrosus	-	-	3	-	-	-	-	4	-	4	-	-	-	-	-
Rumex acetosa	-	-	3	5	2	-	3	-	-	1	-	-	4	2	-
Rumex conglomeratus	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salix cinerea	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Salix repens	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Silene flos-cuculi	-	-	-	-	-	-	-	-	3	-	-	-	-	1	-
Sphagnum fimbriatum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
Sphagnum palustre	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-
Sphagnum squarrosum	-	-	-	-	-	-	-	-	-	-	-	-	8	8	7
Succisa pratensis	-	-	-	-	-	-	-	-	-	1	-	-	4	-	-
Veronica chamaedrys	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Veronica scutellata	-	-	-	-	-	-	-	-	-	-	1	-	1	1	-
Viola palustris	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
TOTAL TAXA	**12**	**8**	**14**	**14**	**14**	**10**	**12**	**17**	**22**	**22**	**15**	**10**	**16**	**12**	**12**

Table H-5: Results of quadrat samples from Site 24

	QUADRAT					
SCIENTIFIC NAME	**1**	**2**	**3**	**4**	**5**	**6**
Agrostis stolonifera	7	-	-	4	1	-
Anagallis tenella	-	-	4	-	-	5
Aneura pinguis	-	-	-	-	-	2
Angelica sylvestris	-	-	-	-	2	3
Anthoxanthum odoratum	-	1	-	3	3	-
Briza media	-	3	2	1	-	1
Bromus racemosus	-	-	-	-	1	-
Calliergonella cuspidata	9	7	5	4	7	5
Campylium protensum	-	-	-	-	-	1
Campylium stellatum	-	-	-	-	-	6
Cardamine pratensis	1	-	-	-	-	-
Carex demissa	-	-	-	3	-	-
Carex echinata	-	-	-	-	-	1
Carex flacca	-	8	6	6	-	-
Carex hirta	-	-	-	4	-	-
Carex hostiana	-	4	-	-	-	-
Carex lepidocarpa	-	-	-	-	-	4
Carex nigra	5	3	-	-	1	-
Carex panicea	6	6	5	-	1	6
Centaurea nigra	-	3	2	-	-	-
Cerastium fontanum	-	-	-	1	-	-
Cirsium palustre	-	1	2	-	1	1
Ctenidium molluscum	-	-	-	-	-	2
Cynosurus cristatus	-	1	1	4	-	-
Dactylorhiza fuchsii	-	-	1	2	2	1
Danthonia decumbens	-	1	-	-	-	-
Eleocharis palustris	9	-	-	-	-	-
Eleocharis quinqueflora	-	-	-	3	-	8
Equisetum fluviatile	-	-	1	1	1	1
Equisetum palustre	1	-	-	1	1	2
Eriophorum angustifolium	-	-	-	-	-	2
Festuca rubra	-	4	3	7	5	-
Galium palustre	4	-	-	-	-	-
Holcus lanatus	-	-	-	5	2	-
Hydrocotyle vulgaris	-	-	-	-	-	4
Hypericum tetrapterum	-	-	-	-	1	-
Isolepis setacea	-	-	-	1	-	-
Juncus articulatus	3	5	7	4	-	-

	QUADRAT					
SCIENTIFIC NAME	**1**	**2**	**3**	**4**	**5**	**6**
Juncus inflexus	-	-	1	1	-	-
Juncus subnodulosus	-	-	-	-	10	3
Lathyrus pratensis	-	-	-	-	1	-
Lotus corniculatus	-	2	1	2	-	-
Lotus pedunculatus	-	-	-	1	5	-
Luzula multiflora subsp. *congesta*	-	-	-	2	-	-
Mentha aquatica	-	2	1	-	-	-
Menyanthes trifoliata	-	-	-	-	-	8
Molinia caerulea	-	5	7	-	-	2
Odontites vernus	-	-	-	-	1	-
Oenanthe lachenalii	-	-	-	-	-	2
Parnassia palustris	-	-	-	-	-	1
Pedicularis palustris	-	-	-	-	-	3
Pellia endiviifolia	-	-	3	-	-	-
Phleum bertolonii	-	-	-	2	-	-
Phleum pratense	-	-	-	2	1	-
Pinguicula vulgaris	-	-	-	-	-	1
Plantago lanceolata	-	2	2	1	3	-
Poa trivialis	3	-	-	-	-	-
Potentilla anserina	1	1	1	-	-	-
Potentilla erecta	-	4	3	2	-	1
Potentilla reptans	-	1	-	2	4	-
Prunella vulgaris	-	4	3	-	-	-
Pulicaria dysenterica	-	4	2	-	-	-
Ranunculus acris	-	2	-	-	2	-
Ranunculus flammula	3	-	1	-	-	-
Ranunculus repens	2	-	-	-	-	-
Rhinanthus minor	-	-	-	-	2	-
Rhytidiadelphus squarrosus	-	1	-	-	-	-
Schedonorus pratensis	-	1	1	-	-	-
Schoenus nigricans	-	-	-	-	-	5
Scorpidium cossonii	-	-	-	-	-	5
Succisa pratensis	-	-	-	-	-	4
Taraxacum agg.	-	1	3	2	-	-
Trifolium dubium	-	1	-	-	-	-
Trifolium pratense	-	3	3	2	4	-
Trifolium repens	-	3	2	2	-	-
Triglochin palustris	-	-	-	-	-	1
TOTAL TAXA	**13**	**29**	**27**	**29**	**24**	**30**

Table H-6: Results of quadrat samples from Site 25

	QUADRAT													
SCIENTIFIC NAME	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Achillea ptarmica	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Agrostis canina	-	-	-	-	-	1	-	1	-	-	-	-	-	-
Agrostis stolonifera	-	-	3	-	-	-	-	-	-	1	-	-	1	-
Anagallis tenella	-	-	-	-	-	3	2	-	3	-	3	3	-	-
Angelica sylvestris	3	2	-	1	-	-	1	4	3	-	2	2	4	4
Anthoxanthum odoratum	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Apium nodiflorum	-	5	-	-	-	-	-	-	-	-	-	-	-	-
Brachythecium rutabulum	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Briza media	-	-	-	-	-	-	-	-	-	2	3	-	-	-
Bryum pseudotriquetrum	-	-	-	-	-	3	-	-	-	-	1	-	-	-
Calliergonella cuspidata	9	-	7	9	7	4	9	4	6	4	-	2	2	6
Caltha palustris	-	5	-	-	-	-	-	-	-	-	-	-	-	-
Campylium stellatum	-	-	-	-	-	7	2	-	-	-	7	-	-	-
Cardamine pratensis	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Carex dioica	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Carex echinata	-	-	-	-	-	-	-	3	-	-	-	-	-	-
Carex hirta	1	-	-	2	-	-	-	-	-	-	-	-	-	-
Carex hostiana	-	-	-	-	-	-	-	-	-	3	2	-	-	-
Carex lepidocarpa	-	-	-	-	-	4	4	3	6	3	4	3	4	-
Carex nigra	-	-	-	-	-	4	1	4	3	-	4	2	7	-
Carex panicea	-	-	6	1	-	4	5	5	6	6	3	5	4	-
Centaurea nigra	-	-	4	2	-	-	-	-	-	-	-	-	1	-
Cerastium fontanum	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Chara vulgaris	-	-	-	-	-	4	-	-	-	-	-	-	-	-
Cirsium palustre	4	1	4	2	-	-	2	2	1	1	1	4	5	4
Cratoneuron filicinum	-	-	-	-	-	-	-	-	-	-	-	2	-	-
Cynosurus cristatus	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Dactylorhiza fuchsii	1	1	1	-	-	1	1	1	-	3	-	2	-	-
Eleocharis palustris	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Epilobium palustre	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Epilobium parviflorum	-	-	1	-	-	-	-	-	-	-	-	-	-	5
Equisetum fluviatile	2	6	-	-	6	6	2	4	2	3	4	4	5	5
Equisetum palustre	3	3	3	3	3	2	-	2	2	1	1	1	1	4
Eriophorum angustifolium	-	-	-	-	-	1	5	-	3	-	4	-	4	-
Eupatorium cannabinum	-	-	-	2	-	2	3	4	-	-	-	2	4	-
Festuca rubra	-	-	8	-	-	3	-	7	-	2	3	3	-	-
Filipendula ulmaria	6	3	4	3	4	-	-	-	-	-	3	4	1	-
Galium palustre	-	-	2	2	3	-	-	-	-	-	-	-	-	3
Holcus lanatus	-	-	3	-	-	-	-	-	-	-	-	-	-	3

	QUADRAT													
SCIENTIFIC NAME	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Hydrocotyle vulgaris	-	-	-	-	-	3	4	5	4	-	4	4	7	-
Juncus articulatus	-	-	4	-	-	3	-	1	2	2	1	-	-	1
Juncus conglomeratus	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Juncus effusus	-	-	4	7	-	-	-	-	-	-	-	-	-	3
Juncus inflexus	-	4	5	6	9	-	-	-	-	-	-	-	2	8
Juncus subnodulosus	8	6	3	-	3	4	7	6	4	-	-	4	5	-
Lathyrus pratensis	-	-	3	3	-	-	-	-	-	-	-	-	-	-
Lotus pedunculatus	4	1	4	7	-	-	-	-	-	-	2	-	1	4
Lythrum salicaria	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Mentha aquatica	5	1	1	5	8	-	1	2	1	-	1	1	2	7
Molinia caerulea	-	-	-	-	-	3	3	9	8	9	6	5	-	-
Odontites vernus	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Oenanthe lachenalii	-	-	-	-	1	1	2	1	1	1	-	2	2	-
Palustriella falcata	-	-	-	-	-	-	-	-	2	-	3	-	-	-
Pedicularis palustris	-	-	-	-	-	-	4	-	-	-	1	-	-	-
Pellia endiviifolia	-	-	-	-	-	1	-	-	1	-	-	-	-	-
Pellia neesiana	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Philonotis calcarea	-	-	-	-	-	-	-	-	-	-	-	7	-	-
Phleum pratense	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Plagiomnium elatum	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Plagiomnium undulatum	-	-	-	1	-	-	2	-	1	-	-	-	-	-
Plantago lanceolata	-	-	5	2	-	-	-	-	-	-	-	-	-	-
Poa trivialis	-	-	3	3	-	-	-	-	-	-	-	-	-	3
Potentilla anserina	-	-	3	-	-	-	-	-	-	-	-	-	-	1
Potentilla erecta	-	-	-	-	-	4	3	5	3	5	4	4	-	-
Potentilla reptans	-	-	3	4	-	-	-	-	-	-	-	-	-	-
Potentilla x mixta	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Prunella vulgaris	-	-	3	3	-	-	-	-	-	-	1	-	-	-
Pseudoscleropodium purum	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Pulicaria dysenterica	-	-	3	8	-	-	-	-	-	-	-	-	-	-
Ranunculus acris	-	-	2	-	-	-	-	-	-	-	-	-	-	2
Ranunculus flammula	-	-	-	-	-	-	-	1	-	-	-	-	-	1
Ranunculus repens	-	1	-	-	-	-	-	-	-	-	-	-	-	1
Rumex acetosa	1	-	1	-	-	-	-	-	-	-	-	-	-	-
Rumex conglomeratus	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Schoenus nigricans	-	-	-	-	-	5	-	-	1	-	-	-	-	-
Silene flos-cuculi	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Succisa pratensis	-	-	-	-	-	1	1	-	-	7	1	5	-	-
Taraxacum agg.	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Vicia cracca	-	-	1	-	-	-	-	-	-	-	-	-	-	-

	QUADRAT													
SCIENTIFIC NAME	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
TOTAL TAXA	**14**	**14**	**37**	**23**	**9**	**25**	**22**	**22**	**22**	**17**	**26**	**22**	**19**	**18**