Electrical Connection Environmental Report

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Appendix 1

EIA Screening Request and Matrix

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Electrical Connection Request for Screening Opinion – Supporting Information Report

Abergelli Power Limited

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Abbreviations

AOD	above ordnance datum	$L_{Aeq, T}$ dB	equivalent continuous level decibels
APL	Abergelli Power Limited	LEMS	Landscape and Ecology Mitigation Strategy
BICC	British Insulated Callender's Cables	LOAEL	lowest observable adverse effect level
BS	British Standard	LVIA	landscape and visual impact assessment
CCS	City and County of Swansea Council	M	metre
CEMP	Construction Environment Management Plan	M^2	Meters squared
CSTP	Construction Staff Travel Plan	NETS	National Grid Electricity Transmission System
CTMP	Construction Traffic Management Plan	NSR	noise sensitive receptors
Drax	Drax Group plc	OCGT	Open Cycle Gas Turbine
EIA	Environmental Impact Assessment	PROW	Public Right of Way
EMF	electromagnetic fields	SAC	Special Area of Conservation
ES	Environmental Statement	SINC	Site of Nature Conservation Interest
GIS	gas-insulated switchgear	SPA	Special Protection Area
GVA	Gross value added	SSSI	Site of Special Scientific Interest
Ha	Hectares	Substation	Swansea North Substation
HDD	Horizontal Directional Drill	SWMP	Site Waste Management Plan
HGV	Heavy Goods Vehicle	UPD	Unitary Development Plan
IAQM	Institute of Air Quality Management	µT	micro Tesla
ICNIRP	International Commission on Non-Ionizing Radiation Protection	WSI	Written Scheme of Investigation
kV	Kilovolt		

Glossary

Associated Development	Development for which Development Consent can be granted under Section 115 of the Planning Act, 2008.
EIA Development	Development listed in schedule 1 of the EIA Regulations or listed in schedule 2 either exceeding threshold requirements or located in a sensitive area.
EIA Regulations	Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017.
Electrical Connection	The proposed development - an electrical connection from the proposed Abergelli Power Station to the existing Swansea North substation.
Water Main	An underground water pipeline that crosses the Project Site, directly south of the Generating Equipment Site.
Oil Pipeline	A decommissioned underground oil pipeline that crosses the Project Site, directly south of the Generating Equipment Site.

1. Introduction

1.1 Screening the Need for EIA

1.1.1 This Supporting Information Report has been prepared on the behalf of Abergelli Power Limited (APL). This Report sets out detailed information in relation to a to a forthcoming planning application for an Electrical Connection from the proposed Abergelli Power Station to the existing Swansea North substation (hereafter referred to as the "Electrical Connection"). The location of the Electrical Connection can be viewed on Figure 1: Site Location and Layout Plan.

1.1.2 A screening opinion is requested pursuant to Regulation 6(1) of the *Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017* (the 'EIA Regulations') (1) from the City and County of Swansea Council (CCS) regarding the need for an Environmental Impact Assessment (EIA) for the Electrical Connection.

1.2 Background

1.2.1 APL proposes to construct and operate an Open Cycle Gas Turbine ("OCGT") peaking power generating station (the "Power Generation Plant") and new connections to the gas and electricity networks on land adjacent to the Felindre Gas Compressor Station at Abergelli Farm, Felindre, Swansea SA5 7NN (the "Project").

1.2.2 APL's project is split into three different elements which are described below, which together form the "Abergelli Power Project". These elements are referred to as the Power Generation Plant, the Gas Connection, and the Electrical Connection.

1.2.3 The three main elements of the Project comprise:

- An Open Cycle Gas Turbine (OCGT) peaking power generating station, fuelled by natural gas and capable of providing a rated electrical output of up to 299 Megawatts (MW). The Power Generation Plant comprises:
  - Generating Equipment including one Gas Turbine Generator with one exhaust gas flue stack and Balance of Plant (BOP) (together referred to as the "Generating Equipment") which are located within the "Generating Equipment Site";
  - An Access Road to the Project Site from the B4489 which lies to the west, formed by upgrading an existing access road between the B4489 junction and the Swansea North Substation (the "Substation") and constructing a new section of access road from the Substation to the Generating Equipment Site; and
  - A temporary construction compound for the storage of materials, plant and equipment as well as containing site accommodation and welfare facilities, temporary car parking and temporary fencing (the "Laydown Area"). A small area within the Laydown Area will be retained permanently (the "Maintenance Compound").
  - Ecological Mitigation Area – area for ecological enhancement within the Project Site Boundary
  - Permanent parking and drainage to include: a site foul, oily water and surface water drainage system.

- A Gas Connection in the form of a new Above Ground Installation (AGI) and underground gas connection (the "Gas Pipeline") to bring natural gas to the Generating Equipment from the National Gas Transmission System; and

- An Electrical Connection in the form of a new underground electrical cable to export power from the Generating Equipment to the National Grid Electricity Transmission System (NETS).

1.2.4 The Electrical Connection is the focus of this Request for Screening Opinion.

1.3 Development Consent under the Planning Act 2008

1.3.1 Power Generation Plant

1.3.2 The Power Generation Plant described above would have a rated electrical output of up to 299 MW of electricity and is therefore classified as a Nationally Significant Infrastructure Project ("NSIP") under section 15 of the Planning Act 2008 (as amended) ("PA 2008").

1.3.3 As such, APL is applying to the Secretary of State ("SoS") for Business, Energy and Industrial Strategy under section 31 of the PA 2008 for a Development Consent Order ("DCO") for powers to construct, operate and maintain the Power Generation Plant. The DCO Application was submitted on 25th May, 2018.

1.3.4 Associated Development

1.3.5 The Gas Connection and Electrical Connection comprise development associated with the NSIP ("associated development").

1.3.6 The PA 2008 restricts associated development for which consent can be sought under a DCO in Wales to development that is associated with a generating station with a capacity in excess of 350 MW. As the Power Generation Plant would have rated electrical output of up to 299 MW, associated development to the Power Generation Plant cannot be included in any application for DCO under the PA 2008. The application for a DCO therefore only includes the Power Generation Plant and related mitigation as "authorised development" and does not seek development consent for the Gas Connection or the Electrical Connection.

1.4 Town and Country Planning Act 1990

1.4.1 APL is seeking for planning permission for the Gas Connection under the Town and Country Planning Act 1990 ("TCPA 1990").

a) Abergelli Power Project Environmental Statement

1.4.2 The Abergelli Power Project is a Schedule 1 development as it is a thermal generating station with a heat output of 300 MW or more as listed in Schedule 1, paragraph 2(1) of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009. As such, an EIA has been carried out in respect of the development.

1.4.3 Therefore, although the Electrical Connection has not previously been screened to determine the need for an EIA, the environmental impacts associated with the Electrical Connection have been assessed within the Abergelli Power Project Environmental

Statement (ES). Though the Gas and Electrical Connections are not included in the DCO Application, the Connections were included within the EIA to avoid the risk of overlooking potentially significant environmental impacts through segregating the Abergelli Power Project into component parts, often referred to as 'salami-slicing'.

1.4.4 Mitigation has been identified within the EIA carried out for the Abergelli Power Project which is applicable to the Electrical Connection. This mitigation includes both embedded mitigation (mitigation inherent in to the design of the Project and also specifically to the Electrical Connection), or additional mitigation (which is required to mitigate any residual adverse effects of the Project). This has been identified in this request for Screening Opinion for clarity where appropriate.

1.5 The Developer

1.5.1 The Applicant is APL, an energy development company established for the Abergelli Power Project and owned by Drax Group plc (Drax).

1.5.2 Drax is responsible for generating 6% of the UKs electricity, predominantly via Drax power station in Selby. Drax is one of the UK's largest energy producers and is committed to helping to reduce carbon emissions, displacing more coal off the system and providing additional system support to plug the gaps created by intermittent renewables and boost security of supply.

1.5.3 Drax acquired APL from Watt Power Limited (Watt Power) in 2016. Stag Energy Development Company Ltd (Stag Energy) previously provided management services to Watt Power in relation to APL. Stag Energy continues to provide resources to APL through a management services agreement. Stag Energy was founded in 2002 and the company draws on a depth of experience within a team that has created and delivered over 10,000 MW of power generation and related infrastructure projects across the globe, of which 2,500 MW has been delivered in the UK.

1.5.4 APL is committed to the development of assets to support the UK Government's drive to a low carbon economy. APL recognises the need to balance commercial issues with the environmental benefits and concerns relating to energy projects and believes this balance can be responsibly delivered. The Electrical Connection as part of the Abergelli Power Project will be designed and developed to high quality, safety and environmental standards.

1.5.5 Further information on the companies referred to above is provided at www.abergellipower.co.uk or www.drax.com.

1.6 Structure of Report

1.6.1 The remainder of this report is structured as follows:

- Section 2 presents a detailed description of the Electrical Connection;
- Section 3 presents an overview of the screening process and relates the Electrical Connection to the EIA Regulations;
- Section 4 presents a description of the current land use at the Electrical Connection and surrounding area;
- Section 5 provides an overview of the potential environmental effects associated with the Electrical Connection;

- Section 6 presents the Report conclusions.

1.6.2 An EIA Screening Matrix has been completed for the Electrical Connection and is included in Appendix 1 of this Report. A Mitigation Register has been prepared that outlines all the embedded and additional mitigation which has been identified to avoid, reduce or remedy any significant residual effects from the Project as a whole, but specifically for the Electrical Connection. The Mitigation Register is included in Appendix 2 of this Report and has been abbreviated from the wider Abergelli Power Project Mitigation Register for the mitigation required for the Electrical Connection. This is cross-referenced throughout this Report for consistency and ease of reference.

1.6.3 The Report summarises the environmental assessments conducted as part of the Abergelli Power Project ES and provides technical conclusions based on those assessments in relation to the likely significant effects of the Electrical Connection.

2. Project Description

2.1.1 The Electrical Connection will enable power to be exported from the Abergelli Power Station to the National Grid Electricity Transmission System (NETS). The connection will be approximately 900 metre (m) in length. It will consist of a 400 kilovolt (kV) underground cable to the Substation and associated works inside the Substation to connect to a gas-insulated switchgear (GIS) bay. The GIS bay will be consented and owned by National Grid with APL providing and installing a 400 kV cable for termination into the GIS bay as well as installing feeder protection and settlement metering for the GIS Bay.

2.1.2 The Substation is proposed to be extended by National Grid at the eastern end of the building to house the GIS bay. National Grid is responsible for securing any necessary planning permissions for this work and therefore this is not considered as part of this project description or application.

2.1.3 The Electrical Connection route (see Figure 1: Site Location and Layout Plan) will run immediately adjacent to the alignment of the new section of Access Road for the Abergelli Power Project. At the eastern extent, the Electrical Connection leaves the Abergelli Power Project Generating Equipment Site, passing underground through open land to the east and southeast of the National Grid Gas Transmission System. The route crosses into National Grid's land to the east of tower 4YW251 heading towards the Sub-station. Once within National Grid's land the Electrical Connection turns to the north-west to run outside the Substation and parallel with the Substation fence line. The Electrical Connection then turns into the Substation close to the northern corner.

2.1.4 The Electrical Connection passes twice under one 400 kV overhead lattice tower mounted transmission line and once under one wooden pole mounted 11 kV overhead distribution line. The route crosses two ditches and a Local Transmission System pipeline within the field to the east of tower 4YW251. The Electrical Connection will be drilled (for example using drilling techniques such as Horizontal Directional Drill (HDD)) under the Water Main and Oil Pipeline with at least 2 m clearance from the underside of the Water Main.

a) Construction

2.1.5 The Electrical Connection will be constructed within the curtilage of the new section of Access Road within a 5 m working width adjacent to the road. A cable duct will be installed adjacent to the new section of Access Road to allow the cable to be pulled through at a

later date. Short sections of open cut trench will be required at either end of the cable route where it does not coincide with the Access Road. The installation of the cable within the Substation is anticipated to be in cable ducts, although National Grid has recently started using direct buried cables within the Substation.

2.1.6 The Electrical Connection will require temporary bridges (for example a temporary bailey bridge) over the Water Main and Oil Pipeline during the construction phase to enable access from the new section of Access Road and Laydown Area. The temporary bailey bridge will approximately 5 m in height from the anchor points on the existing ground level.

b) Operation and Maintenance

2.1.7 No regular maintenance is anticipated to be carried out on the underground electrical cable. Maintenance of the electrical cable will be limited to repair in the event of a fault in the cable, in which case the cable will be isolated for repair in line with industry good practice.

2.1.8 The electrical equipment would be subject to periodic inspection. To perform such inspections, pedestrian access is adequate.

2.1.9 The route would be regularly checked to ensure that there are no excavation or construction works in the direct vicinity of the cables, that mounds of soil are not deposited above the cables and that trees are not planted above the cables; this should normally require little more than a drive past.

2.1.10 In addition, periodic inspection of any above ground equipment associated with the cable system would be required. The above ground equipment would include cable terminations, and structures, and bonding system link housings; this would require access to the equipment. In some case dirt and debris can deposit on cable termination insulators which may therefore require cleaning. It is also recommended that the integrity of the cable oversheath be tested at least once every two to three years; this would require access to the cable terminations and the bonding system link housings. In the event that the oversheath is found degraded or damaged then a repair may be required which would necessitate some excavation along the cable route (in most cases, oversheath damage results from the actions of third parties).

c) Decommissioning

2.1.11 It is assumed that the Electrical Connection would be decommissioned after 25 years, which is the design life of the Power Generation Plant. However, it is important to note that elements of the Connection (such as the GIS bay) would be owned and operated by National Grid. In accordance with its statutory duties, National Grid may use these assets in the future as part of its wider network.

2.1.12 As such, though the date of decommissioning of some elements of the Electrical Connection cannot be certain, a 25 year working assumption has been used to allow for a reasonable assessment of decommissioning effects in this Report.

2.1.13 Finally, it is assumed that elements of the Electrical Connection may be left in situ at the point of decommissioning, as this approach is likely to cause less environmental effects than removal.

d) Embedded Mitigation

2.1.14 Mitigation which is either implicit in the design of the Electrical Connection or its construction and operation through standard control measures routinely used, such as working within best practice guidance during construction, is known as embedded mitigation. The embedded mitigation implemented on the Electrical Connection is summarised as follows but is outlined in greater detail within the Mitigation Register in Appendix 2 (using the notation for ease of reference):

- Production of an Outline Construction Environment Management Plan (CEMP) (ref GEN01) which includes waste management (OE01);
- Production of an Outline Landscape & Ecology Mitigation Strategy (LEMS) (GEN02);
- Management of dust and air quality mitigation (AQ01 – AQ04);
- Management of noise, noise generation and vibration management (N01 – N08);
- Protection of sensitive habitats, sensitive ecological features, protected species and designated sites (E01 – E03);
- Production of an Outline Surface Water Management Plan (WQ01), surface water management (WQ04) and drainage (WQ06 and WQ09);
- Protection of groundwater and hydrogeology features, peat management, identification and management of unexpected contamination(G01 – G03);
- Landscape and visual mitigation from Public Rights of Way (PRoW) and other amenity viewpoints (LV01);
- Production of a Construction Traffic Management Plan (CTMP) (including safety, severance and traffic management such as speed restrictions) in addition to a Construction Staff Travel Plan (CSTP) (T03 – T05); and
- Archaeological investigation including a Written Scheme of Investigation (WSI) (CH01 and CH02)

2.1.15 This embedded mitigation applies to the Electrical Connection and has been assumed for this Supporting Information Report to be in place from the outset. The assessments included in this Report therefore consider the likely significant effects of the Electrical Connection including embedded mitigation.

2.1.16 Any required additional mitigation is set out within the relevant assessment in Section 5 of this Report and cross referenced within the Mitigation Register in Appendix 2. The management plans committed to as embedded mitigation are also referenced where relevant.

3. Determining the Need for EIA

3.1 EIA Regulations

3.1.1 All development in Schedule 1 of the EIA Regulations requires an EIA. Development in column 1 of the table in schedule 2, which is either to be carried out in a sensitive area or satisfies a threshold or criterion in Column 2 of that table ('Schedule 2 development') requires EIA if it is likely to have significant effects on the environment.

3.1.2 The Electrical Connection does not constitute an EIA Development as underground cables are not listed in either Schedule 1 or 2 of the EIA Regulations. Therefore in isolation the Electrical Connection would not require an EIA.

3.1.3 The Electrical Connection is a constituent part of the Abergelli Power Project, which is an EIA Development, and its effects (including those from the Electrical Connection) are fully assessed in the Environmental Statement that accompanies the DCO Application. However, whilst the laying of electrical cable is not listed in Schedule 1 or Schedule 2 of the EIA Regulations, for completeness and to ensure a robust approach, the potential environmental impacts of the Electrical Connection have been assessed in this Report.

3.1.3 The existing site conditions of the Electrical Connection and surrounding area are discussed in Section 4.

3.1.4 The potential environmental effects relating to the Electrical Connection, as identified in the Abergelli Power Project ES are summarised in Section 5 with an overview in Section 5.13. A Screening Matrix has also been completed and is included in Appendix 1 of this Report.

4. Site Description

4.1 Electrical Connection Location

4.1.1 The Electrical Connection (see Figure 1) is located on open agricultural land approximately 2 kilometres (km) north of Junction 46 on the M4, approximately 3 km to the north of the city of Swansea, 1 km southeast of Felindre and 1.4 km north of Llangyfelach. The current land use is improved grazing for sheep and horses on poor quality agricultural land (Agricultural Land Classification Grade 4).

4.1.2 The western extent of the Electrical Connection encompasses parts of the Swansea North Substation ('Substation') (comprising a 400 kilovolt (kV) and 132 kV substation) and the existing access road leading to the Substation and Felindre Gas Compressor Station from the B4489. There are no residential dwellings located along the Electrical Connection.

4.1.3 Ground levels vary from approximately 85 m above ordnance datum (AOD) at the highest point to the east and approximately 80 m AOD along the southern extent, with ground levels generally falling in a southerly and south easterly direction. The CCS Unitary Development Plan (UDP) Proposals Map (Ref.4.1) identifies mineral deposits within the Site including coal and sand and aggregates. There is a groundwater body below the Electrical Connection of poor current and projected *Water Framework Directive* (Ref.4.2) status.

4.1.4 The Electrical Connection coincides with an area classified as Ancient Woodland as the route enters the Substation. This is part of a wider area of Ancient Woodland surrounding the Substation and Felindre Gas Compressor Station, and the existing access road leading to these facilities from the B4489. The woodland is also partially within the Lletty-Morfil Site of Nature Conservation Interest (SINC) (no. 106), which is adjacent to the Site to the north.

4.1.5 The Electrical Connection crosses two drainage ditches that discharge into the Afon Llan. The Afon Llan links with the Afon Lliw and the River Loughor, which discharges into Carmarthen Bay through Bury Inlet, 7 km west of the Abergelli Power Station Site. Carmarthen bay and estuaries is designated as a Special Area for Conservation (SAC) and Bury Inlet is designated as a Special Protection Area (SPA), Site of Special Scientific Interest (SSSI) and as a wetland of international importance under the Ramsar Convention. There are no Main Rivers within the boundary of the Electrical Connection.

4.2 Surrounding Area

4.2.1 The area surrounding the Electrical Connection is, at present, predominantly rural in character, although there is the Felindre Park and Ride facility to the south and a substantial amount of utility infrastructure in the area, some of which the Electrical Connection will cross.

4.2.2 The National Gas Transmission System, a Water Main and the Oil Pipeline cross the Electrical Connection and there is also a network of electricity pylons, underground utilities and overhead lines which lead to and from the Substation. The Felindre Water Treatment Works is located to the northwest, while the Cefn Betingau Solar Park and Abergelli Solar Farm are located to the east of the Electrical Connection. A further three solar parks are built in the vicinity; Lletty-Morfil Solar Farm, Brynwhilach Solar Park and Gelliwern Isaf Solar Park.

4.2.3 Other features of the area include public footpaths, bridleways and tracks that link the Electrical Connection to the wider area. Of particular note is the LC117 which crosses the Electrical Connection at its western end. There are a number of residential properties between 600 m and 875 m from the Electrical Connection. These include Cefn-betingau to the east, Feline Wen Farm and Llwynhelig to the south east, Maes-eglwys to the south, and Lletty-Morfil Farm to the west and Abergelli Farm to the north west.

4.2.4 There is a paintball activity centre located to the west of the Electrical Connection off the B4889. Other tourist attractions and resources include the Cwm Clydach Nature Reserve woodland and nature reserve at Clydach, 3 km east of the Electrical Connection and the National Cycle Route 43, which passes through Clydach on route to Swansea from Builth Wells.

4.2.5 In addition to the Lletty-Morfil SINC, there is another SINC, Rhos Fawr (no.316), 1 km north of the Electrical Connection across the Rhyd-Y-Pandy road. The Rhyd-Y-Pandy SINC (no. 315) is 850 m to the north east and Waun Garn Wen SINC (no. 105) 400 m to the north. There is also a Wildlife Trust Reserve (Coed Barcud) to the north east and an area of Ancient Woodland 150 m to the north. The Mawr Uplands Special Landscape Area (SLA) is located within 5 km of the Electrical Connection, extending from the north-west round to the east.

4.2.6 The remains of Abergelli Colliery are located north of Abergelli Farmhouse. The environmental features and designations along the Electrical Connection and in the surrounding area are set out on the attached Figure 2: Constraints Plan.

4.3 Area Sensitivity

4.3.1 In summary, the Electrical Connection is currently low value agricultural land. Although there are some mineral deposits within the Electrical Connection, these are not in high demand or of especially high quality. There are ancient woodlands around the Electrical Connection and some locally designated habitat. As such the Electrical Connection is classified as having low environmental sensitivity based on the criteria contained in Schedule 3 of the EIA Regulations (Ref.4.1).

5. Assessment of the Electrical Connection

5.1.1 The following sections set out a summary of the environmental impact assessment of the Electrical Connection which has been undertaken for the Abergelli Power Project and informs this request for Screening Opinion. The results are summarised by environmental technical topic and phase of the development. Section 5.13 provides an overview of the anticipated effects, proposed mitigation and significance.

5.1.2 The operational lifetime of the Electrical Connection is assumed to be 25 years for the purpose of the assessments. As it is likely that the Electrical Connection will be partially or fully left in place at the end of the operational period, few effects are anticipated during the decommissioning phase. The sections below discuss decommissioning only when effects are anticipated from the Electrical Connection being left in situ.

5.2 Air Quality

a) Construction

5.2.1 The sensitivity of the human receptors to the Electrical Connection is classed as low in terms of both nuisance and health impacts as the closest residential receptors are 600 m from activities onsite. In relation to ecology the sensitivity is classed as low as the only ecological sites close to dust generating activities, Lletty-Morfil SINC and an area of Ancient Woodland, are locally designated and not considered to be sensitive to dust deposition.

5.2.2 The dust emission potential for construction of the Electrical Connection is assessed as being small during earthworks and construction considering that the earthworks are confined to small area and construction emissions will be moderated by the largely prefabricated nature of the installation. Emissions from trackout have a small dust potential due to the number of vehicles operating and the fact there will be minimal amount of excavation/trenching needed. There is no demolition associated with this phase of the works.

5.2.3 Table 5.1 sets out the assessment of dust emission class from demolition activities, earthworks, construction and trackout as a function of the works associated with the Electrical Connection.

Table 5.1: Summary Assessment of Dust Emissions Class

Phase	Magnitude	Dust Risk		
		Nuisance (Low Receptor Sensitivity)	Human Health (Low Receptor Sensitivity)	Ecology (Low Receptor Sensitivity)
Demolition	N/A	N/A	N/A	N/A
Earthworks	Small	Negligible	Negligible	Negligible
Construction	Small	Negligible	Negligible	Negligible
Trackout	Small	Negligible	Negligible	Negligible

5.2.4 Using the Institute of Air Quality Management (IAQM) construction dust assessment criteria (Ref.5.1) the dust emission magnitude is combined with the distance to and sensitivity of

the nearest receptors to assess the risk of effects associated with the construction phase of the Electrical Connection with no embedded or additional mitigation. Table 5.1 shows the risk of effects with no mitigation is **Negligible** in terms of human health, nuisance and ecological impacts. Impacts are therefore anticipated to be **Not Significant**.

5.2.5 Although no significant effects are anticipated, even without mitigation, good practice dust management will be set out within the Outline CEMP, GEN01 of the Mitigation Register (Appendix 2).

b) Operational

5.2.6 No impacts on air quality are anticipated from the operation of the Electrical Connection.

5.3 Noise & Vibration

5.3.1 A worst case assessment of the potential noise and vibration effects from the Electrical Connection has been undertaken for identified noise sensitive receptors (NSRs). The NSRs for the Electrical Connection are listed in Table 5.3 and are comprised of the residential properties surrounding the Electrical Connection as detailed in Section 4.2.

a) Baseline

5.3.2 The baseline sound levels summarised in Table 5.2 were measured by AECOM in February 2018. The monitoring method used was in line with the requirements of BS 4142:2014 (Ref.5.2). Access could only be obtained to four of the six NSRs. Unattended loggers were installed at NSRs 1, 4, 5 and 6 over a period of six days and were located within the property boundary of each NSR following prior agreement with the residents.

5.3.3 It was not possible to place loggers at NSRs 2 and 3, even though attempts were made to locate and contact the residents both prior to and during the monitoring period. However the four locations that were used cover the major compass directions from the Electrical Connection and include the two closest receptors (1 and 6). Therefore the lack of monitoring data from NSRs 2 and 3 does not impact the comprehensiveness or validity of the assessments and conclusions on the impacts and effects on NSRs 2 and 3 can be drawn from application of professional judgement to the results for the other four NSRs.

Table 5.2: Representative Background and Ambient Sound Levels

NSR	Observations of baseline sound environment	Day time *background sound level* L_{AF90}	Day time ambient (residual) sound level L_{Aeq}	Night time *background sound level* L_{AF90}	Night time ambient (residual) sound level L_{Aeq}
NSR1	Distant rotary engine noise and M4 motorway traffic noise, low but audible. Bird noise and cattle noises heard from the nearby area. On collection there was additional noise from farm activities as well as a low frequency plant hum which started up around 10:00. At night, low level plant hum heard, road traffic was audible to both the south and east. Very quiet site.	40	46	34	40
NSR4	M4 motorway traffic noise and rotary engine noise low but audible. On collection dogs were barking at the nearby property. At night, low level plant hum and distant M4 traffic noise, low but audible. Very quiet site.	36	43	35	38
NSR5	On site hen noise and dogs barking. Wind rustle in the trees. Distant M4 traffic and rotary engine noises heard, low but audible. On collection a low level plant hum could be heard. At night, low level plant hum and distant M4 traffic noise, low but audible. Very quiet site.	43	54	38	40

NSR	Observations of baseline sound environment	Day time *background sound level* L_{AF90}	Day time ambient (residual) sound level L_{Aeq}	Night time *background sound level* L_{AF90}	Night time ambient (residual) sound level L_{Aeq}
NSR6	Wind rustle and birds heard in nearby trees, dogs barking in the distance. Distant M4 traffic and rotary engine noises heard, low but audible. Rotary engine noise, advised to be a drone, low but audible. At night, low level plant hum and distant road traffic noise heard. Very quiet site.	40	47	36	39

a) Construction

5.3.4 The predicted indicative construction noise levels for the Electrical Connection are given in Table 5.3 below.

Table 5.3: Predicted Construction Sound Levels ($L_{Aeq,T}$ dB)

Location		Electrical Connection
Cefn-betingau	NSR1	33
Felin Wen Farm	NSR2	31
Llwynhelig	NSR3	33
Maes-eglwys	NSR4	40
Lletty Morfil Farm	NSR5	46
Abergelli Farm	NSR6	35

5.3.5 The predicted indicative construction noise levels range between 31 and 46 equivalent continuous level decibels ($L_{Aeq,\ T}$ dB). This is lower than the lowest observable adverse effect level (LOAEL) as derived from British Standard (BS) 5228:2009 of 65 $L_{Aeq,T}$ dB for day time, 55 $L_{Aeq,T}$ dB for evenings and weekends and 45 $L_{Aeq,T}$ dB for night time.

5.3.6 Therefore the magnitude of impact is assessed to be very low at all of the NSRs. The sensitivity of all residential receptors is assessed to be high as they are susceptible to noise and vibration. Therefore the significance of effects, is predicted to be **Negligible** at all NSRs, and is therefore considered **Not Significant**.

5.3.7 No additional mitigation is proposed however good practice noise management is considered within the Outline CEMP, GEN01 of the Mitigation Register (Appendix 2).

b) Operational

5.3.8 Once operational the Electrical Connection will not generate any noise or vibration impacts.

5.4 Ecology

a) Construction

i. Habitat Loss

5.4.1 The construction in the Electricity Connection will result in the temporary loss of:

- 0.36 metres squared (m^2) (<0.01%) of Lletty-Morfil SINC comprising broadleaved semi-natural woodland;
- 54 m^2 of dense/continuous scrub;
- Up to 15 m of the row of trees habitat designated as ancient woodland;
- 0.07 hectares (ha) of semi-improved neutral grassland; and
- 0.15 ha of marshy grassland.

5.4.2 There may also potential be the loss of up to one standalone tree.

5.4.3 The significance of the effect on these habitats is considered **Negligible** and therefore **Not Significant** given the small areas affected.

ii. Species

5.4.4 The impact on the species present at the Electrical Connection has been assessed and is summarised as follows:

- The loss or temporary removal of habitat has the potential for **Minor Adverse** impacts on invertebrates, amphibians, reptiles and bats;
- Construction activities relating to the Electrical Connection also have the potential to disrupt breeding birds, the significance of which would also be **Minor Adverse**;
- Construction works in or near water courses could have an impact of **Minor Adverse** significance on otter through direct harm;
- Additional, species specific, mitigation has been identified where required as set out in E04 and E09 – E20 of the Mitigation Register (Appendix 2);
- Mitigation will also be set out within the Outline CEMP and the Outline LEMS GEN01 and GEN02 of the Mitigation Register (Appendix 2); including measures relating to lighting, habitat protection and habitat reinstatement;

5.4.5 Therefore impacts are considered **Not Significant**.

b) Operational

5.4.6 No operational effect on Ecology has been identified.

5.5 Water Quality and Resources

a) Construction

i. Water Quality and Resources

5.5.1 The principal risks of the construction works to water quality and resources comprise:

- Pollution impacts on surface watercourses and groundwater associated with:
  - Increased sediment loads in site runoff containing elevated suspended sediment levels disturbed during site clearance;
  - The release of hydrocarbons and oils due to a large number of vehicles accessing the site, leakages from temporary oil/fuel storage tanks and accidental spillages; and
  - Accidental leaks of hazardous materials, such as concrete and cement products, which can be contained in uncontrolled wash-down water and surface water runoff;
  - Dewatering of excavations and the discharge of potentially polluted/high sediment loading water to the water receptors; and
  - Pollution from dust and debris.

5.5.2 Good practice management measures for the reduction and control of water pollution including works near water will be set out in the Surface Water Management Plan and Drainage Strategy, WQ01 of the Mitigation Register (Appendix 2). No additional mitigation measures have been proposed.

5.5.3 Surface water runoff from the Electrical Connection will be conveyed to the tributaries of the Afon Llan River to the east. There is potential for hydraulic connectivity (most likely

through shallow groundwater) and therefore for some runoff to migrate to the Lletty-Morfil, Waun Garn Wen and Rhos Fawr SINCs. Surface water runoff from the Electrical Connection may also infiltrate and migrate further afield via groundwater. The tributary to the Afon Llan, the SINCs and the groundwater at the Electrical Connection are all classified as having medium sensitivity.

5.5.4 Given the limited scope of the Electrical Connection works and the measures to be implemented through the Outline CEMP (GEN01) and the Outline Surface Water Management Plan (WQ01 of the Mitigation Register, Appendix 2), the magnitude of the potential construction water quality and resources effects are Negligible. Accordingly, the significance of effects is assessed to be **Negligible** and **Not Significant**.

ii. Flooding

Watercourse Crossings

5.5.5 The Electrical Connection crosses two field drains. One of the drains will be culverted or bridged for a short length for the new section of Access Road. This would be designed to allow flow up to the 1 in 100 year return period. The Electrical Connection will be laid within the curtilage of the new section of Access Road across the bridge or culvert.

5.5.6 The crossing method for the second drain will be informed by post-consent ground investigation surveys. Trenchless techniques such as horizontal direction drilling (HDD) will be considered.

5.5.7 The sensitivity of the watercourse crossings as a flood risk receptor is considered to be Negligible since the Electrical Connection is in a very low flood risk area. The magnitude of the impact is considered to be **Low**. The significance of the permanent effect is therefore considered to be **Negligible,** and **Not significant**.

b) Operational

5.5.8 For water quality and resources and flooding, no impact is expected to arise from the Electrical Connection location during the operational phase.

5.6 Geology, Ground Conditions and Hydrogeology

a) Construction

i. Geology and Soils: Sand and Gravel Reserves

5.6.1 Sand and gravel reserves were identified within the Electrical Connection area on the UDP Proposals Map (Ref.4.1).

5.6.2 The Electrical Connection will be routed adjacent to the Felindre Gas Compressor Station and the Substation, and adjacent to the new section of Access Road. Therefore the land is already sterilised in this area. The sand and gravels reserves are considered to be of low sensitivity due to minimal economic use. The magnitude of the impact is assessed as low, as while there will be permanent sterilisation of the reserves, a relatively small area of the reserves will be affected compared to the full extent. The significance of the effects is therefore considered to be **Minor adverse**, which is **Not Significant**. No additional mitigation is proposed.

ii. Geology and Soils: Coal Reserves

5.6.3 The UDP Proposals Map indicates that coal reserves are present underlying the Electrical Connection (Ref.4.1). These coal reserves are considered to be of low sensitivity due to minimal economic use. Given that the majority of the Electrical Connection route is already sterilised and a relatively small area of the coal reserves will be affected compared to the full extent, the magnitude of the impact is assessed as low. The significance of the effects is therefore considered to be **Minor adverse**, which is **Not Significant**. No additional mitigation is proposed.

iii. Agricultural Land

5.6.4 The construction works associated with the Electrical Connection will result in the direct, local and permanent sterilisation of approximately 0.33 ha of Grade 4 agricultural land. Grade 4 land is defined as land with severe limitations that significantly restrict the range of crops and / or level of yield. Therefore the sensitivity of the agricultural land is considered to be Negligible and the magnitude also Negligible due to the limited extent of the impact. The significance of effect is therefore considered to be **Negligible**, which is **Not Significant**. No additional mitigation is proposed.

b) Operational

i. Geology and Soil

5.6.5 The geology and soils are considered to be of low sensitivity and the magnitude of the impact is therefore considered to be low. Operation and maintenance is anticipated to have a **Minor adverse** effect on the geology and soils present at the Electrical Connection as the potential impact will have occurred during the construction phase, which is **Not Significant**. No additional mitigation is proposed.

ii. Structures

5.6.6 There is potential for long term chemical attack on the underground cable ducts during the operational and decommissioning phase. Chemical compounds such as sulphate and pH levels in natural ground or polluted ground can cause damage to sub surface structures. The sensitivity of the structures is assessed as high as the receptor has low ability to absorb change without fundamentally altering its character. Pre-construction ground investigation has been committed to as embedded mitigation to identify ground conditions and potential contaminants (G03 of the Mitigation Register Appendix 2). The Electrical Connection will be built to industry safety standards and meet legislative requirements for safe operation to protect the installed equipment from chemical attack. Therefore the magnitude of effect is considered to be Negligible. The significance of the effects has therefore been assessed as **Minor adverse**, which is **Not Significant**. No additional mitigation is proposed.

5.7 Landscape and Visual Effects

5.7.1 The landscape and visual effects have been assessed for the Electrical Connection as a component part of the Abergelli Power Project.

a) Construction

Landscape

5.7.2 The Electrical Connection route will run immediately adjacent to the alignment of the new section of Access Road. The construction activity and plant associated with the Electrical Connection alone will only result in localised and limited effects to the landscape character resulting in a small loss of woodland and hedgerow planting, which will not affect the integrity or key characteristics of the landscape. Magnitude of change will be Low, which combined with the Medium sensitivity will result in a **Minor adverse** effect on the landscape character, which is **Not Significant**. No additional mitigation is proposed, but good practice landscape and visual management measures will be included within the Outline CEMP and LEMS, GEN01 and GEN02 of the Mitigation Register (Appendix 2).

Visual

5.7.3 There will be no significant effects on views as a result of construction of the Electrical Connection.

b) Operational

5.7.4 Once operational there will be no significant visual effects or effects on the landscape character as a result of the Electrical Connection.

5.8 Traffic, Transport and Access

a) Construction

i. Traffic Generation

5.8.1 The construction of the Electrical Connection is estimated to take place alongside and within the period of construction of the Abergelli Power Project Generating Equipment. The peaks in construction staff traffic and Heavy Good Vehicle (HGV) traffic for the Electrical Connection are shown for the weekday AM and PM peak hours and 24-hour period in Table 5.4.

Table 5.4: Electrical Connection Peak Traffic Generation

Time Period	Vehicle Type	Arrivals	Departures	Total
Weekday AM Peak Hour (07:45-08:45)	Light Vehicles (Staff)	2	0	2
	HGVs	2	0	2
	Total	**4**	**0**	**4**
Weekday PM Peak Hour (16:30-17:30)	Light Vehicles (Staff)	0	2	2
	HGVs	0	2	2

Time Period	Vehicle Type	Arrivals	Departures	Total
	Total	**0**	**4**	**4**
Weekday 24-Hour	Light Vehicles (Staff)	2	2	4
	HGVs	3	3	6
	Total	**5**	**5**	**10**

ii. Traffic Flows

5.8.2 The impact of the predicted traffic arising from the construction of the Electrical Connection on the traffic flows of local traffic links has been assessed.

5.8.3 The links assessed included sections of the Pant Lasau Road, the B4489, the A48 and the M4. The links were assed to range from very low to high sensitivity. The percentage change between 2020 predicted baseline traffic flows and the baseline plus all predicted Electrical Connection construction traffic was between 0 and 4%, with a Negligible to Low magnitude of change. Accordingly the significance is **Negligible** and therefore **Not Significant**. No additional mitigation is proposed however traffic management will be covered within a CTMP and CSTP, T03 – T05 of the Mitigation Register (Appendix 2).

iii. Driver Delay

5.8.4 An assessment of the Electrical Connection construction traffic on driver delay was also conducted. The assessment found that the Electrical Connection will, at worst, have a **Minor adverse** effect in terms of driver delay, which is **Not Significant**. This effect will be temporary in nature, and only experienced during the peak of construction traffic movements.

5.8.5 No additional mitigation is proposed, but management measures to minimise driver delay will be included within a CTMP and CSTP, T03 – T05 of the Mitigation Register (Appendix 2).

iv. Severance

5.8.6 Only one footpath will be affected by the construction of the Electrical Connection, this is the LC117, which routes adjacent to the perimeter of the Felindre Gas Compressor Station. The proposed management of the PROW will be set out in the Outline CEMP (GEN01) and CTMP T03 of the Mitigation Register (Appendix 2) and will be developed further in consultation with the PROW Officer at CCS.

5.8.7 It is not proposed to permanently divert the LC117, although measures will be implemented to ensure the safety of users. Given the scale and nature of the works associated with the Electrical Connection it is likely that there will be little or no hindrance to pedestrian movements along the LC117 and therefore effects are anticipated to be **Not Significant.**

b) Operational

5.8.8 No operational effects on traffic, transport and access have been identified.

5.9 Historic Environment

5.9.1 Construction and operation of the Electrical Connection will not impact on any known historic asset. No known historic assets exist within its footprint.

5.9.2 A WSI will be prepared and a watching brief will be implemented during construction. In the event that any archaeology be discovered during construction it will be excavated, recorded and reported in line with the WSI as set out in CH02 of the Mitigation register (Appendix 2).

5.10 Socio-Economics

a) Construction

i. Socio-economics

5.10.1 The socio-economic assessment of effects considers the Abergelli Power Project as a whole as impacts cannot be disaggregated into elements, i.e. Power Generation Plant, Gas Connection, and Electrical Connection. The assessment reviewed employment, gross added value, skill requirements, accommodation capacity and labour market absorption capacity.

5.10.2 At peak construction the estimated number of workers onsite is 122 with a median of 69.5 (monthly). This constitutes a Low beneficial impact on local construction employment. The demand for construction labour arising from the Abergelli Power Project's development will not result in any pressure on labour market capacity as it will require less than 15%[1] of existing capacity. These jobs will also be predominantly moderate – high skilled with relatively high value and high paid positions that required a high degree of training and qualifications.

5.10.3 Although likely unnecessary due to the high potential for local workers; 100% of the workers could be accommodated without causing pressure or shortages on the local accommodation supply.

5.10.4 Gross value added (GVA) is a measure of the value of goods and services produced in an area, industry or sector of an economy. Annual construction GVA per head in Wales is £76,725. The construction phase could therefore deliver up to £7.1 million GVA[2] to the wider economy.

5.10.5 The impact on the labour market for the Abergelli Power Project as a whole was assessed to be Negligible Beneficial and therefore not significant. As a minor contributing part of the Project, the impact of the Electrical Connection can also be assumed to be **Not Significant.**

ii. Tourism, Recreation and Community

5.10.6 No significant effects on tourism, recreation or community infrastructure were identified as part of the assessment.

[1] 15% threshold based on professional judgement
[2] £76,725 x 92 person years= £7,058,745 (note this is the same as 9.2 FTEs x 10 years continuous employment x £76,725 = £7.1m)

b) Operational

5.10.7 Best practice principles outlined in HM Treasury Green Book Appraisal Guidance (Ref.5.4) were applied to assess the effect of permanent operational employment. An Economic Impact Model was developed to measure net additional employment and GVA. Labour market capacity, accommodation capacity and skill requirements were again considered.

5.10.8 Similar to the construction phase a Negligible effect on the labour market was identified for the Abergelli Power Project as a whole. As a minor contributing part of the Project, the impact of the Electrical Connection can also be assumed to be **Not Significant**.

5.10.9 No operational impacts were identified for community infrastructure or tourism and recreation.

5.11 Other Effects

a) Waste

5.11.1 The laying of the Electrical Connection will involve the excavation of a trench or drilling, temporary placement of the excavated soil and then backfilling with soil. No surplus waste materials are expected to arise from this activity if excavated material is reused onsite, which is normal practice. In the event that material is not suitable for re-use onsite it will be managed in accordance with the Site Waste Management Plan (SWMP),which will be contained within the Outline CEMP, GEN01 of the Mitigation Register (Appendix 2).

5.11.2 No waste is anticipated from the operation of the Electrical Connection.

b) Electromagnetic Fields

5.11.3 An electromagnetic fields (EMF) assessment has been undertaken and an overview of the likely significant effects is provided below:

- Underground cables, as proposed, do not give rise to electric fields above ground due to the shielding effect of the cable sheath. This is explained in the British Insulated Callender's Cables (BICC) Electric Cables Handbook (Ref.5.5).
- In 1998, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) issued guidelines reference level of 360 micro Tesla (μT) for public exposure (basic restriction) to magnetic fields (Ref.5.5). At 1 m above ground The EMF assessment an additional 3.1 μT is predicted from the underground cable, which is considerably lower than the ICNIRP guidelines.
- The intensity of both electric fields and magnetic fields also diminishes with increasing distance from the source.
- The above-ground components of the Electrical Connection will also lie within the Substation where there are already EMFs present that were considered as part of the application for the Substation; they will not make a significant difference to the EMFs already present. It should also be noted that the general public will not spend any prolonged time in close proximity to the Electrical Connection or to the Substation.

5.11.4 The general public will thus not be exposed to any increase in EMFs from the Electrical Connection and there will be no significant effects arising from EMFs.

c) Public Health

5.11.5 Public health impacts as a result of noise, air quality and pollution or contamination have been assessed to be **Negligible** and therefore **Not Significant** during construction and decommissioning given the Negligible impacts identified for these technical topics individually.

5.11.6 No operational effects on public health were identified.

d) Climate Change

5.11.7 Climate change impacts have been considered throughout each of the individual technical topic impact assessments, where relevant. Climate resilience has therefore been built into the design to reduce effects from climate change.

5.12 Cumulative

a) Intra-project Effects

5.12.1 For the purpose of this section, consideration will be given to the additive or amplified effects resulting from environmental effects on 'shared receptors' and also where sources of effect from different components of the Abergelli Power Project may combine to be of greater significance than when the Electrical Connection considered alone.

i. Shared Receptors

5.12.2 Shared receptors from individual elements of the Abergelli Power Project (e.g. construction of Power Generation Plant, Gas Connection and Electrical Connection) are likely to be limited to nearby residential dwellings.

5.12.3 Potential effects at these shared receptors may comprise of the following:

- Noise effects;
- Views from residential dwellings;
- Potential effects on waterbodies and water based receptors from increased risk of sediment runoff and polluted discharges during the construction phase;
- Traffic effects from increased vehicle numbers during the construction phase; and
- Production of dust during the construction phase.

5.12.4 Due to the application of embedded and additional mitigation measures (such as the avoidance of habitats, the proposed Outline CEMP and topic specific management plans) which ensure that likely significant effects on shared receptors are unlikely, or the absence of any effects on shared receptors, the following technical topics are scoped out from the intra-cumulative assessment:

- *Ecology* - due to the embedded and additional mitigation, there is unlikely to be any cumulative effects from multiple components of the Abergelli Power Project working simultaneously affecting several species.
- *Socio-economic* - Absence of effects on shared receptors.
- *Historic Environment* – Absence of effects on shared receptors.
- *Geology, Ground Conditions and Hydrogeology* - Absence of effects on shared receptors.

ii. Assessment of Potential Intra-project effects

5.12.5 Table 5.5 outlines the potential intra-project cumulative effects from the Abergelli Power Project. It is considered unlikely that there will be any intra-project effects during operation or decommissioning, and so the assessment only considers construction stage effects.

Table 5.5: Intra-Project Cumulative Effects

Receptor with potential for multiple effects	Potential Intra-Project Effects	Comments
Residential	Dust, Noise, Traffic, Landscape	Construction of the whole Abergelli Power Project will result in construction activity not previously present and additional vehicles along access routes. This creates an increase in traffic flows for all Abergelli Power Project components, disruption of views and potential production of noise, dust and air pollutants from the Abergelli Power Project as a whole during the construction period. This may have an effect on local communities and nearby residential dwellings. As embedded and additional mitigation is proposed (such as a CTMP and Outline CEMP), this will result in a **Minor Adverse** in-combination effect, which is **Not Significant.**

b) Inter-project Effects

5.12.6 The Electrical Connection is considered within the assessment of inter-project effects in the Abergelli Power Project ES. Given the integral nature of the Electrical Connection to the Abergelli Power Project, it is not considered appropriate to assess the inter-project effects of the Electrical Connection in isolation. Segmenting the development has the potential to distort the assessment of effects. Therefore inter-project effects are not assessed for the Electrical Connection within this Supporting Information Report.

5.13 Overview

5.13.1 The likely effects, mitigation and significance for each of the technical topics are set out in Table 5.6 below.

Table 5.6: Summary of Likely Effects

Technical Topic	Likely Effect(s)	Additional Mitigation and Proposed Management Plans	Significance
Air Quality	Negligible human health, nuisance and ecological impacts during construction. No operational impacts identified.	Outline CEMP	Not significant
Noise and Vibration	The predicted indicative construction noise levels are Negligible at all NSRs. No operational impacts identified.	Outline CEMP	Not significant
Ecology	Negligible impact on habitats and species through loss and temporary loss of habitat during construction. No operational impacts identified.	E04 and E09 –E20 Mitigation Register (Appendix 2) Outline CEMP Outline LEMS	Not significant
Water Quality and Resources	Negligible impact on water quality from construction activities. No flooding impacts identified. No operational impacts identified.	Outline Surface Water Management Plan Drainage Strategy.	Not significant

Technical Topic	Likely Effect(s)	Additional Mitigation and Proposed Management Plans	Significance
Geology, Ground Conditions and Hydrogeology	Minor adverse sterilisation effects on mineral and coal reserves resulting from construction Negligible impact on agricultural land during construction/ decommissioning. During operation, minor adverse structural effects from chemical attack.	None	Not significant
Landscape and Visual	Minor adverse impact on landscape character during construction. No operational impacts identified.	Outline CEMP Outline LEMS	Not significant
Traffic, Transport and Access	During construction, Negligible effects on traffic generation, minor adverse effects on driver delay and on PRoW users due to severance. No operational impacts identified.	CTMP CSTP	Not significant.
Historic Environment	None	CH01 and CH02 Mitigation Register (Appendix 2)	N/A

Technical Topic	Likely Effect(s)	Additional Mitigation and Proposed Management Plans	Significance
Socio-Economic	During construction, Negligible beneficial impacts on the labour market and Negligible to Minor adverse impacts on nearby tourist attractions. No greater than minor adverse impacts on community infrastructure. Negligible beneficial impacts on the labour market during operation.	None	Not significant
Other Effects	No significant waste, public health, EMF or climate change impacts anticipated.	Outline CEMP	Not significant
Cumulative	Minor adverse Dust, Noise, Traffic and Landscape intra-project effects during construction. Major adverse inter-project effects on traffic during construction.	Outline CEMP CTMP	Significant inter-project effects on traffic, all others not significant.

6. Conclusion

6.1.1 The proposed development does not fall within 'Schedule 1' of the 2017 Regulations.

6.1.2 'Schedule 2 development' means development, other than exempt development, of a description mentioned in Column 1 of the table in Schedule 2 of the 2017 Regulations where:

6.1.3 any part of that development is to be carried out in a sensitive area; or

6.1.4 any applicable threshold or criterion in the corresponding part of Column 2 of that table is respectively met or exceeded in relation to that development.

Sensitive Area

6.1.5 The site is not located within, or partly within, a sensitive area as defined by Regulation 2(1) of the 2017 Regulations.

Applicable Threshold and Criterion

6.1.6 The proposed development does not fall within Schedule 2

6.1.7 As the proposal is not located within a 'sensitive area' as defined by Regulation 2(1) and does not have significant adverse effects, the proposal does not constitute 'Schedule 2 development' within the meaning of the 2017 Regulations by virtue of its size, location and nature.

6.1.8 In conclusion, an EIA is not required.

7. Further Supporting Information

7.1.1 The planning application for the Electrical Connection under the Town & Country Planning Act 1990 will be accompanied by the following Management Plans and other supporting documents. These supporting documents will include:

- Management Plans:
  - Outline CEMP;
  - Outline CTMP;
  - Outline CSTP;
  - Outline LEMS; and
  - Outline Surface Water Management Plan.
- Supporting Documents / Baseline Reports:
  - Drainage Strategy
  - Preliminary Ecology Appraisal Report
  - National Vegetation Classification Report
  - Bat Baseline Report
  - Invertebrate Baseline Report
  - Reptile Baseline Report
  - Amphibian Baseline Report
  - Breeding Bird Baseline Report
  - Otter & Water Vole Report
  - Noise Baseline Report

- Badger Report (confidential)
- Dormice Baseline Report
- Preliminary Geo-environmental Assessment (Envirocheck)
- Landscape Assessment & LANDMAP Aspect Data
- EMF Report

8. References

Ref.4.1 CCS. Unitary Development Plan (UDP) Proposals Map. http://swansea.devplan.org.uk/map.aspx?map=41&layers=all [Accessed 02/05/18]

Ref.4.2 Directive 2000/60/EC Water Framework Directive. L 327/1

Ref.5.1 IAQM (2014) Guidance on the assessment of dust from demolition and construction, February 2014, Institute of Air Quality Management.

Ref.5.2 British Standards Institute (2014) BS 4142 – Methods for rating and assessing industrial and commercial sound.

Ref.5.3 BS 5228:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites*'.

Ref.5.4 HM Treasury. 2011. The Green Book: Appraisal and Evaluation in Central Government. (Online) Available at: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

Ref.5.5 BICC Cables (1997). Electric Cables Handbook. Blackwell Science Ltd., Padstow, UK.

Ref.5.6 ICNIRP (1998). *ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (up to 300 Ghz).* Health Physics 74 (4):494-522.

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Gas Connection Boundary
- Electrical Connection Boundary
- Order Limits Boundary
- Generating Equipment Slte
- Above Ground Installation (AGI)
- Gas Connection
- Electrical Connection (400kV Cable)
- Access Track

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SITE LOCATION AND LAYOUT PLAN

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Electrical Connection Boundary
- Order Limits Boundary
- Grade II* - Listed Building
- Grade II - Listed Building
- Site of Special Scientific Interest
- Tree Preservation Order (TPO)
- Ancient Woodland (AWI)
- SINCs
- Conservation Area
- Parks and Gardens
- Scheduled Monument
- Flood Zone 3
- Flood Zone 2

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Appendix 1. Screening Matrix

1. CASE DETAILS			
Case Reference	Abergelli Power Project - Electricity Connection	**Brief description of the project / development**	The Electricity Connection will enable power to be exported from Abergelli Power Station to the National Grid Electricity Transmission System. The connection will be approximately 900 metres (m) in length and consist of a 400 kilovolt (kV) underground cable to the Substation and associated works inside the Substation to connect to a gas-insulated switchgear (GIS) bay. The GIS bay will be consented and owned by National Grid with APL providing and installing a 400 kV cable for termination into the GIS bay as well as installing feeder protection and settlement metering for the GIS Bay. National Grid will extend the existing Substation building at the eastern end of the Substation to house the GIS bay.
Appellant	Abergelli Power Limited		
LPA	City of Swansea Council		

2. EIA DETAILS	
Is the project Schedule 1 development according to Schedule 1 of the EIA Regulations?	No
If YES, which description of development (THEN GO TO Q4)	N/A
Is the project Schedule 2 development under the EIA Regulations?	No
If YES, under which description of development in Column 1 and Column 2?	N/A
Is the development within, partly within, or near a 'sensitive area' as defined by Regulation 2 of the EIA Regulations?	No
If YES, which area?	N/A
Are the applicable thresholds/criteria in Column 2 exceeded/met?	N/A

If yes, which applicable threshold/criteria?	N/A
3. LPA/SOS SCREENING	
Has the LPA or SoS issued a Screening Opinion (SO) or Screening Direction (SD)? (In the case of Enforcement appeals, has a Regulation 37 notice been issued)	No
If yes, is a copy of the SO/SD on the file?	N/A
If yes, is the SO/SD positive?	N/A
4. ENVIRONMENTAL STATEMENT	
Has the appellant supplied an ES for the current or previous (if reserved matters or conditions) application?	Yes – the Electrical Connection is considered within the application for Development Consent for the Abergelli Power Project. This is consented under a different legislative regime (Planning Act 2008 (as amended)).

Question	(Part 2a) / (Part 2b) – Answer to the question and explanation of reasons (Yes/No or Not Known (?) or N/A)		(Part 3a) / (Part 3b) (only if Yes in part 2a) – Is a Significant Effect Likely? (Yes/No or Not Known (?) or N/A)	
	Briefly explain answer to Part 2a and, if applicable and/or known, include name of feature and proximity to site (If answer in Part 2a / 2b is 'No', the answer to Part 3a / 3b is 'N/A')		Is a significant effect likely, having regard particularly to the magnitude and spatial extent (including population size affected), nature, intensity and complexity, probability, expected onset, duration, frequency and reversibility of the impact and the possibility to effectively reduce the impact? If the finding of no significant effect is reliant on specific features or measures of the project envisaged to avoid, or prevent what might otherwise have been, significant adverse effects on the environment these should be identified in bold.	
1. NATURAL RESOURCES				
1.1 Will construction, operation or decommissioning of the project involve actions which will cause physical changes in the topography of the area?	No	The excavated material and topsoil for the Electrical Connection trench will be returned to its original position and re-seeded to return to current condition. Therefore no physical changes to the topography of the area are anticipated. Any excess waste generated will be controlled via the Construction Environment Management Plan for the Project.	N/A	-
1.2 Will construction or operation of the project use natural resources above or below ground such as land, soil, water, materials/minerals or energy which are non-renewable or in short supply?	No	The Electrical Connection construction and operation will not use natural resources.	N/A	-

Question	(Part 2a) / (Part 2b) – Answer to the question and explanation of reasons (Yes/No or Not Known (?) or N/A)		(Part 3a) / (Part 3b) (only if Yes in part 2a) – Is a Significant Effect Likely? (Yes/No or Not Known (?) or N/A)	
1.3 Are there any areas on/around the location which contain important, **high quality or scarce resources** which could be affected by the project, e.g. forestry, agriculture, water/coastal, fisheries, minerals?	Yes	The current land use is improved grazing for sheep and horses on poor quality agricultural land (Agricultural Land Classification Grade 4). There are mineral deposits including coal and sand and aggregates.	No	The agricultural land is not of high quality. In addition, the working width will be reinstated. As the Electrical Connection will be routed adjacent to the Felindre Gas Compressor Station, the Substation and adjacent to the new road, sterilisation or constraint of mineral deposits would be to a very local spatial extent. Therefore the effects are not anticipated to be significant.
2. WASTE				
2.1 Will the project produce solid wastes during construction or operation or decommissioning?	Yes	There is likely to be some waste associated with construction such as pipe and cable cuttings and packaging. This is expected to be minor.	No	Due to the scale and nature of the activities and implementation of a Site Waste Management Plan (SWMP) within an Outline CEMP, no significant effects from waste generation are anticipated. The measures within the SWMP will align with the EU Waste Framework Directive, together with the Environmental Permitting (England and Wales) Regulations 2016 and the Hazardous Waste (England and Wales) Regulations 2005 (as amended by the Hazardous Waste (England and Wales) Amendment Regulations 2016) (OE01 in the Mitigation Register).

Question	(Part 2a) / (Part 2b) – Answer to the question and explanation of reasons (Yes/No or Not Known (?) or N/A)		(Part 3a) / (Part 3b) (only if Yes in part 2a) – Is a Significant Effect Likely? (Yes/No or Not Known (?) or N/A)	
3. POLLUTION AND NUISANCES				
3.1 Will the project release pollutants or any hazardous, toxic or noxious substances to air?	No	Emissions to air associated with the Electrical Connection is associated with construction vehicles bringing materials, workers and equipment to site which is expected to be minor and localised. Dust is likely to be elevated during the construction phase. This will be controlled via a CEMP.	N/A	-
3.2 Will the project cause noise and vibration or release of light, heat, energy or electromagnetic radiation?	Yes	Construction of the Electrical Connection will generate noise and vibration, which will be controlled via a CEMP. No noise or vibration will be caused during operation. Underneath power lines, magnetic fields can be around 20 μT, which is considerably lower than the ICNIRP guidelines. The Electrical Connection will also be underground and will not be accessible to the public. No risk from electromagnetic radiation has therefore been identified.	No	Given the nature of the excavation and installation activities, the length of the connection and the distance to any noise sensitive receptors, no significant effect is anticipated. Construction noise will be controlled through a CEMP, which will also contain a protocol for acknowledging and taking action on nuisance complaints from the general public. Given the low level of magnetic fields expected from the Electrical Connection, no significant effects are likely.
3.3 Will the project lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater, coastal waters or the sea?	No	With good construction practice, implementation of a pollution prevention plan within a CEMP (WQ01 in the Mitigation Register) and standard operation, no risk of contamination has been identified.	N/A	-

Question	(Part 2a) / (Part 2b) – Answer to the question and explanation of reasons (Yes/No or Not Known (?) or N/A)		(Part 3a) / (Part 3b) (only if Yes in part 2a) – Is a Significant Effect Likely? (Yes/No or Not Known (?) or N/A)	
3.4 Are there any areas on or around the location which are already subject to pollution or environmental damage, e.g. where existing legal environmental standards are exceeded, which could be affected by the project?	No	There are areas adjacent, to the north, and outside of the Electrical Connection, at Abergelli Farm, including a reinstated and historical landfill, a disused colliery and adit and an old gravel pit that could potentially be subject to contamination. However, the Electrical Connection infrastructure is on previously undeveloped, agricultural land, so pre-existing contamination and pollution risk is low. APL have committed to pre-construction ground investigations that would identify ground conditions and potential contaminants (G03 in the Mitigation Register). A protocol for the event that unexpected contaminated land is identified during construction is also included within a CEMP.	N/A	-
4. POPULATION AND HUMAN HEALTH				
4.1 Will there be any risk of major accidents (including those caused by climate change, in accordance with scientific knowledge) during construction, operation or decommissioning?	No	The Project has been designed to comply with industry safety standards and to meet legislative requirements for safe operation.	N/A	-
4.2 Will the project present a risk to the population (having regard to population density) and their human health during construction, operation or decommissioning? (for example due to water contamination or air pollution)	No	The Electrical Connection is sited at an appropriate standoff distance from other infrastructure and population. There are risks associated with any construction, which will be managed in compliance with the most current HSE legislation at the time of construction.	N/A	-
5. WATER RESOURCES				

Question		(Part 2a) / (Part 2b) – Answer to the question and explanation of reasons (Yes/No or Not Known (?) or N/A)		(Part 3a) / (Part 3b) (only if Yes in part 2a) – Is a Significant Effect Likely? (Yes/No or Not Known (?) or N/A)	
5.1	Are there any water resources including surface waters, e.g. rivers, lakes/ponds, coastal or underground waters on or around the location which could be affected by the project, particularly in terms of their volume and flood risk?	Yes	The Electrical Connection will cross two field drains.	No	No significant effect on flooding or runoff volume is anticipated. An Outline Surface Water Management Plan will outline the mitigation measures required during the construction phase.

Question	(Part 2a) / (Part 2b) – Answer to the question and explanation of reasons (Yes/No or Not Known (?) or N/A)		(Part 3a) / (Part 3b) (only if Yes in part 2a) – Is a Significant Effect Likely? (Yes/No or Not Known (?) or N/A)	
6. BIODIVERSITY (SPECIES AND HABITATS)				
6.1 Are there any protected areas which are designated or classified for their terrestrial, avian and marine ecological value, or any non-designated / non-classified areas which are important or sensitive for reasons of their terrestrial, avian and marine ecological value, located on or around the location and which could be affected by the project? (e.g. wetlands, watercourses or other water-bodies, the coastal zone, mountains, forests or woodlands, undesignated nature reserves or parks. (Where designated indicate level of designation (international, national, regional or local)).	Yes	There are a number of Sites of Nature Conservation Interest in the area surrounding the Electrical Connection. This includes Lletty-Morfil (no. 106) adjacent to the west, Rhos Fawr (no.316), 1 km to the north across the Rhyd-Y-Pandy Road, Rhyd-Y-Pandy (no. 315) 130 m to the east and Waun Garn Wen (no. 105) 250 m to the west. There is a Wildlife Trust Reserve (Coed Barcud) to the north east. There are also areas of ancient woodland adjacent to the east and west.	No	Temporary loss of 0.36 m^2 of the Lletty-Morfil SINC is not considered significant.

Question	(Part 2a) / (Part 2b) – Answer to the question and explanation of reasons (Yes/No or Not Known (?) or N/A)		(Part 3a) / (Part 3b) (only if Yes in part 2a) – Is a Significant Effect Likely? (Yes/No or Not Known (?) or N/A)	
6.2 Could any protected, important or sensitive species of flora or fauna which use areas on or around the site, e.g. for breeding, nesting, foraging, resting, over-wintering, or migration, be affected by the project?	Yes	A Phase 1 survey has confirmed the presence of scrub, rows of and standalone trees, semi-improved grassland, hedgerows, standing water and marshy grassland. The habitats present are suitable to support badgers, water vole, breeding birds, otters, bats, reptiles and amphibians.	No	With the implementation of embedded mitigation no significant effects on these ecological receptors are anticipated. Embedded mitigation measures include: • Pre-construction surveys for bats, water voles, otters and badgers; • Trapping and translocating of reptiles; • The inclusion of ecological management measures within the CEMP such as the management of excavations to prevent trapping mammals; and • Reinstatement of habitats and the creation of replacement habitats including hedgerows. These measures are set out in E09-E16 and E20-E26 of the Mitigation Register.
7. LANDSCAPE AND VISUAL				
7.1 Are there any areas or features on or around the location which are protected for their landscape and scenic value, and/or any non-designated / non-classified areas or features of high landscape or scenic value on or around the location which could be affected by the project?[3] Where designated indicate level of designation (international, national, regional or local).	Yes	The Mawr Uplands Scenic Landscape Area (SLA) is within 5 km of the Electrical Connection.	No	The visual effect of the Electrical Connection is limited in extent due to the underground nature of the cables. Visual amenity effects associated with construction will be temporary. In addition, the distance is great enough between the Electrical Connection and the SLA that there is unlikely to be an effect on visual amenity during construction.

[3] See question 8.1 for consideration of impacts on heritage designations and receptors, including on views to, within and from designated areas.

Question	(Part 2a) / (Part 2b) – Answer to the question and explanation of reasons (Yes/No or Not Known (?) or N/A)		(Part 3a) / (Part 3b) (only if Yes in part 2a) – Is a Significant Effect Likely? (Yes/No or Not Known (?) or N/A)	
7.2 Is the project in a location where it is likely to be highly visible to many people? (If so, from where, what direction, and what distance?)	Yes	The Electrical Connection is predominantly underground, but construction plant will be visible.	No	Visual effects associated with the Electrical Connection will be limited to the construction period only due to the underground nature of the cables. Construction effects will be minimised through the implementation of a CEMP as set out in LV01 in the Mitigation Register.
8. CULTURAL HERITAGE/ARCHAEOLOGY				
8.1 Are there any areas or features which are protected for their cultural heritage or archaeological value, or any non-designated / classified areas and/or features of cultural heritage or archaeological importance on or around the location which could be affected by the project (including potential impacts on setting, and views to, from and within)? Where designated indicate level of designation (international, national, regional or local).	No	No known historic assets exist within the Electrical Connection footprint.	N/A	-
9. TRANSPORT AND ACCESS				
9.1 Are there any routes on or around the location which are used by the public for access to recreation or other facilities, which could be affected by the project?	Yes	The Electrical Connection will cross a Public Rights of Way (PRoW), the LC117.	No	Effects will be localised and temporary and it is not intended to divert or close this PROW.

Question	(Part 2a) / (Part 2b) – Answer to the question and explanation of reasons (Yes/No or Not Known (?) or N/A)		(Part 3a) / (Part 3b) (only if Yes in part 2a) – Is a Significant Effect Likely? (Yes/No or Not Known (?) or N/A)	
9.2 Are there any transport routes on or around the location which are susceptible to congestion or which cause environmental problems, which could be affected by the project?	Yes	The Electrical Connection is accessible from the Rhyd-y-pandy road off junction 46 of the M4.	No	There will likely be an increase in traffic flow over the construction period, 10 traffic movements are anticipated per day for the Electrical Connection. There is the potential for congestion and traffic delay. This effect will be temporary and minor. A construction traffic management plan (CTMP) will include details of the management of construction traffic (T04 in the Mitigation Register).
10. LAND USE				
10.1 Are there existing land uses or community facilities on or around the location which could be affected by the project? E.g. housing, densely populated areas, industry / commerce, farm/agricultural holdings, forestry, tourism, mining, quarrying, facilities relating to health, education, places of worship, leisure /sports / recreation.	No	The land is currently poor value agricultural land.	N/A	-
10.2 Are there any plans for future land uses on or around the location which could be affected by the project?	No	There are no current planning applications on the Electrical Connection. A planning application for an *emergency standby electricity generation facility* was submitted in 2015 for land just north of Abergelli Farm adjacent to the west of the Electrical Connection, but this was refused.	N/A	-
Question	**(Part 2a) / (Part 2b) – Answer to the question and explanation of reasons (Yes/No or Not Known (?) or N/A)**		**(Part 3a) / (Part 3b) (only if Yes in part 2a) – Is a Significant Effect Likely? (Yes/No or Not Known (?) or N/A)**	
11. LAND STABILITY AND CLIMATE				

11.1 Is the location susceptible to earthquakes, subsidence, landslides, erosion, or extreme /adverse climatic conditions, e.g. temperature inversions, fogs, severe winds, which could cause the project to present environmental problems?	No	The Electrical Connection will be required to be built to industry safety standards and meet legislative requirements for safe operation to protect the installed equipment from extreme weather and other geological induced conditions.	N/A	-
12. cumulative effects				
12.1 Could this project together with existing and/or approved development result in cumulation of impacts together during the construction/operation phase?	Yes	**Intra-Project** Only nearby residential dwellings have been identified as shared receptors between the other components of the Abergelli Power Project and the Electrical Connection. Construction of the Abergelli Power Project will result in construction activity not previously present and additional vehicles along access routes. This creates an increase in traffic flows, disruption of views and potential production of noise, dust and air pollutants from construction activities.	No	**Intra-Project** No operational cumulative effects are anticipated, but there may be dust, noise, traffic and landscape effects during construction. These effects will be mitigated through embedded mitigation in the form of a CTMP and CEMP (T04 and GEN01 in the Mitigation Register). No significant effects are anticipated.

Question	(Part 2a) / (Part 2b) – Answer to the question and explanation of reasons (Yes/No or Not Known (?) or N/A)		(Part 3a) / (Part 3b) (only if Yes in part 2a) – Is a Significant Effect Likely? (Yes/No or Not Known (?) or N/A)	
12.1 (cont.)	Yes	**Inter-Project** The proposed Felindre Business Park and existing Park and Ride are located just north of Junction 46 of the M4, approximately 900 m south west of the Electrical Connection. Whilst the Electrical Connection will not have adverse cumulative effects with the proposed Felindre Business Park, the Business Park will have cumulative landscape and traffic effects with the Abergelli Power Project overall.	No	**Inter-Project** There may be effects on pedestrian experience and driver delay along the B4489. The Electrical Connection will constitute less than 10% of the traffic from the Abergelli Power Project and the effects will be temporary. Construction traffic will be managed through a CTMP (T04 in the Mitigation Register). Effects are not anticipated to be significant.
13. Transboundary effects				
13.1 Is the project likely to lead to transboundary effects?	No	None	N/A	-

CONCLUSIONS – ACCORDING TO EIA REGULATIONS SCHEDULE 3
The characteristics of the Electrical Connection are such to be unlikely to incur significant adverse environmental effects. The Electrical Connection is located on land that will have the capacity to absorb the development without stressing the availability and quality of resources. Any impacts are likely to be localised and in most instances, temporary.

SCREENING DECISION		
If a SO/SD has been provided do you agree with it?	N/A	
Is it necessary to issue a SD?	Yes	
Is an ES required?	No	
ASSESSMENT (EIA REGS SCHEDULE 2 DEVELOPMENT)	OUTCOME	
Is likely to have significant effects on the environment	ES required	
Not likely to have significant effects on the environment	ES not required	
More information is required to inform direction	Request further info	

NAME	Click here to enter text.
DATE	Click here to enter a date.

Appendix 2. Mitigation Register

Table A.1 Construction Mitigation Register

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
General Environmental Management Principles and Responsibility							
GEN01	Embedded	A CEMP will be prepared and then implemented during construction to mitigate any adverse environmental effects. An Outline CEMP for the Project is provided in Appendix 3.1 of the ES. It includes measures relating to the environmental topics assessed in this ES which will mitigate the effects of construction. The CEMP will be finalised and followed by the Contractor on site, once the content has been agreed with CCS. The Outline CEMP includes the following information: • Community liaison; • Complaints procedures; • Nuisance management including measures to avoid or minimise the impacts of construction works (covering dust, noise, vibration and lighting); • Dust management measures; • Site waste and materials management measures; • Surface and ground water protection measures; • Pollution control measures; • Security measures and use of artificial lighting; and A protocol in the event that unexpected contaminated land is identified during ground investigation or construction.	3.11.3	CEMP	APL/ Main contractor	CCS	Main contractor
GEN02	Embedded	Water courses and ditches will be diverted around the Generating Equipment Site in line with the Landscape and Ecology Mitigation Strategy (Appendix 3.4). These diversions will be undertaken using silt traps, straw bale filters / sedimats and an attenuation pond formed for any surface water outlet from the Generating Equipment Site. Water from the attenuation pond will be discharged in a controlled manner to the Afon Llan.	3.7.8	CEMP	APL/ Main contractor	CCS	Main contractor
GEN03	Embedded	Piling will be carried out using rotary driven piles in high load areas of the Generating Equipment Site such as plant and building column foundations. This technique will minimise disturbance of nearby sensitive ecological receptors. Shallow foundations for lighter buildings	3.7.17	CEMP	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		will be excavated.					
Air Quality							
AQ01	Embedded	The CEMP will include the standard good practice dust mitigation measures, as set out in the Outline CEMP in Appendix 3.1 of the ES.	3.11.14	CEMP	APL/ Main contractor	CCS	Main contractor
AQ02	Embedded	Daily visual inspections of dust emissions will be made in conjunction with dust emissions monitoring at locations to be agreed with NRW. If plumes of dust are visible, behind moving vehicles for example, or dust was visibly deposited on roads outside of the Project Site, additional control measures may be required.	3.11.15	CEMP	APL/ Main contractor	CCS	Main contractor
AQ03	Embedded	Institute of Air Quality Managers (IAQM) guidance on monitoring air quality at construction sites (Ref A.1) recommends that, in addition to visual inspections, ambient air monitoring is undertaken in the vicinity of high risk sites. This data is required for two reasons: the first relates to ensuring that mitigation measures are appropriate and being applied rigorously; the second is to provide early warning of increased dust emissions which allows for the cessation or modification of activities prior to impacts occurring.	3.11.16	CEMP	APL/ Main contractor	CCS	Main contractor
AQ04	Embedded	Monitoring will be undertaken in the vicinity of the Lletty-Morfil SINC. Since the risk for ecosystems relates to dust deposition, a real time monitor for total suspended particulate matter will be installed but this needs to be an 'indicative instrument' only. Trigger levels for the instrument, which would suggest increasing risk/emissions, should be agreed with NRW prior to the commencement of construction. The monitoring stations will be mobile and would be moved around the Project Site as the principal activities move.	3.11.17	CEMP	APL/ Main contractor	CCS	Main contractor
Noise							
N01	Embedded	It is anticipated that core working hours and boundary noise will be limited during construction by a Requirement in the DCO. Working hours are likely to be between 08.00 and 18.00 on weekdays, and between 08.00 and 13.00 hours on Saturdays and public holidays. Some works may be allowed to take place outside of normal working hours provided they do not cause any noise disturbance. Should it be necessary to conduct work with the potential to generate noise, outside	3.11.21	CEMP	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		these core hours, this would be with the prior written agreement of CCS. These limits will not apply during commissioning and testing of the Project.					
N02	Embedded	Measures to mitigate noise and ensure compliance with any imposed maximum boundary noise limits will be implemented during the construction phase of the Project in order to minimise impacts at local residential Noise Sensitive Receptors (NSRs), particularly with respect to activities required outside of normal working hours.	3.11.22	CEMP	APL/ Main contractor	CCS	Main contractor
N03	Embedded	Construction noise mitigation measures are included in the Outline CEMP (Appendix 3.1 of the ES). In order to keep noise effects from the construction phase to a minimum, all construction activities relating to the Power Generation Plant, Gas Connection, and Electrical Connection would be carried out in accordance with the recommendations of British Standard (BS) 5228 'Noise and Vibration Control on Construction and Open Sites' (Ref A.2) as explained in **Chapter 7: Noise and Vibration** of the ES.	3.11.23	CEMP	APL/ Main contractor	CCS	Main contractor
N05	Embedded	Method statements regarding construction management, traffic management, and overall site management would be prepared in accordance with best practice and relevant British Standards, to help to minimise impacts of construction works. One of the key aims of such method statements would be to minimise noise disruption to local residents during the construction period.	3.11.25	CEMP	APL/ Main contractor	CCS	Main contractor
N06	Embedded	Consultation and communication with the local community throughout the construction period would also serve to publicise the works schedule, giving notification to residents regarding periods when higher levels of noise may occur during specific operations, and providing lines of communication where complaints can be addressed.	3.11.26	CEMP	APL/ Main contractor	CCS	Main contractor
N07	Embedded	A detailed noise assessment would be carried out once the contractor is appointed and further details of construction methods are known, in order to identify specific mitigation measures for the Project.	3.11.27	CEMP	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
N08	Embedded	In addition, it is proposed that the contractor would be a member of the 'Considerate Constructors Scheme' which is an initiative open to all contractors undertaking building work.	3.11.28	CEMP	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
N04	Embedded	Mitigation measures for inclusion within the CEMP may contain, but are not limited to: • Abiding by any construction noise limits at nearby NSRs; • Ensuring that all processes are in place to minimise noise before works begin and ensuring that best practicable measures (BPM) are being achieved throughout the construction programme, including the use of localised screening around significant noise producing plant and activities; • Ensuring that modern plant is used, complying with the latest European noise emission requirements. Selection of inherently quiet plant where possible; • Hydraulic techniques for breaking to be used in preference to percussive techniques where practical; • Use of lower noise piling (such as rotary bored or hydraulic jacking) rather the driven piling techniques (if required), where possible; • Off-site pre-fabrication, where practical; • All plant and equipment being used for the works to be properly maintained, silenced where appropriate, operated to prevent excessive noise, and switched off when not in use; • All contractors to be made familiar with current legislation and the guidance in BS 5228 (Parts 1 and 2), which should form a prerequisite of their appointment; • Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials around the Project Site, to be conducted in such a manner as to minimise noise generation; • Appropriate routing of construction traffic on public roads and along access tracks; • Consultation with CCC and local residents to advise of potential noisy works that are due to take place; and • Monitoring of noise complaints, and reporting to the main contractor for immediate investigation.	3.11.24	CEMP	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
N09	Additional	The preferred approach for controlling construction noise and vibration is to reduce levels at source where possible, but with due regard to practicality. Sometimes a greater noise or vibration level may be acceptable if the overall construction time, and therefore length of disruption, is reduced.	7.6.3	CEMP	APL/ Main contractor	CCS	Main contractor
N10	Additional – Monitoring	During operation, monitoring is considered appropriate in order to track the success of delivery of proposed mitigation. Ideally this monitoring would be based on regular or fixed measurements close to the Project Site boundary to give consistency by minimising the impact of weather and extraneous sources. The measured levels at these locations must be calibrated against the levels at the receptors as part of the plant commissioning sound test procedure. Any change in Project Site boundary levels can then be related directly to changes at the receptors.	7.6.4	CEMP	APL/ Main contractor	CCS	Main contractor/ Environmental Manager/ ECoW
Ecology							
E01	Embedded	Local habitats and protected species would be protected during the construction works through measures included within the Outline CEMP (Appendix 3.1 of the ES) such as fencing to prevent access of species to working areas and translocation of protected species (e.g. reptiles).	3.11.35	CEMP	APL/ Main contractor	CCS	Main contractor
E02	Embedded	Sensitive ecology features such as the Ancient Woodland, trees and habitats have been avoided during the Project design development.	3.11.36	CEMP	APL/ Main contractor	CCS	Main contractor
E03	Embedded	An area has been allocated within the Project Site Boundary as mitigation for any habitat loss from permanent land take resulting from the construction and operation of the Project. This Ecological Mitigation Area is commensurate with the extent of mitigation required and the Landscape and Ecology Mitigation Strategy (Appendix 3.4) outlines the methods to be employed in enhancing its natural capital. The Landscape and Ecology Mitigation Plan illustrates the mitigation proposed (Figure 3.6).	3.4.27	Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan	APL/ Main contractor	CCS and NRW	Main contractor
E04	Additional	*Lletty-Morfil SINC* Mitigation for the loss of SINC habitat (broadleaved semi-natural woodland, dense/continuous scrub and marshy grassland) will include	8.8.5	Landscape and Ecology Mitigation Strategy and	APL/ Main contractor	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		the provision of replacement habitats. Indicative areas, based on the previous layout are as follows: Indicative areas, based on the plan are as follows: • 1.07 ha of woodland/scrub; • 2.50 ha of grassland (acid grassland/marshy grassland mosaic); • 900 m of hedgerow; and, • Two wildlife ponds and 180 m^2 of attenuation pond.		Landscape and Ecology Mitigation Plan			
E06	Additional	*Row of Trees – Broadleaved and Hedgerows – Species-Poor* Loss of rows of trees and hedgerows utilised by wildlife such as commuting and foraging bats, and commuting badgers will be mitigated for through the introduction of hedgerows and linear woodland features as shown on the LEMP and Strategy presented in Figure 3.6 and Appendix 3.4. Mitigation measures include that habitats temporarily removed will be reinstated and that mature trees removed may be replaced by standards of the same species or transplanted to a suitable location elsewhere within the Project Site Boundary	8.8.7	Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan	APL/ Main contractor	CCS and NRW	Main contractor
E07	Additional	*Marshy Grassland* Temporarily removed habitats will be reinstated. Mitigation for the loss of marshy grassland habitat will include the provision of replacement habitat, as shown on the LEMP and Strategy, presented in Figure 3.6 and Appendix 3.4. The indicative area, based on the previous layout of the landscaping plans is 2.5 ha of grassland (acid grassland/marshy grassland mosaic); however, this area is subject to change.	8.8.9	Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan	APL/ Main contractor	CCS and NRW	Main contractor
E08	Additional	*Standing Water* Mitigation for the loss of standing water habitat will include the provision of replacement habitat, as shown on the LEMP and Strategy, presented in Figure 3.6 and Appendix 3.4. Provisionally, it has been suggested that two attenuation ponds will be provided and function as wildlife ponds as well as two wildlife ponds within the acid grassland/marshy grassland mosaic replacement habitat. . The attenuation ponds will be planted with native wetland species and where possible maintained as	8.8.10	Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan	APL/ Main contractor	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		wetland features. The wildlife ponds will be planted with native wetland species and maintained as wetland features.					
E09	Additional	*Amphibians* Recommendations for reptiles will help to limit the injury or killing of amphibians.	8.8.11	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor
E10	Additional	*Reptiles* Mitigation for the loss of habitat suitable for supporting reptiles (dense/continuous scrub and grassland) will include the provision of replacement habitats, as shown on the LEMP and Strategy, presented in Figure 3.6 and Appendix 3.4.	8.8.12	Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan	APL/ Main contractor	CCS and NRW	Main contractor
E13	Additional	To reduce the risk of individual reptiles being injured or killed, all works will proceed under a Method Statement agreed with the Local Biodiversity Officer/Council Ecologist prior to works commencing. The risk of reptiles and the mitigation measures will be included in the Project Site induction package and prior to any site clearance and construction tasks. Full details are provided in the LEMP and Strategy in Figure 3.6 and Appendix 3.4.	8.8.19	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor
E14	Additional	The risk of reptiles and the mitigation measures will be included in the site induction package and prior to any site clearance and construction tasks.	8.8.20	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E11	Additional	Due to the 'Good' population of common lizard and the presence of low numbers of grass snakes within the survey area it is recommended that a trapping and translocation programme is undertaken to help protect any reptiles from being injured or killed. Due to the presence of suitable habitat for adder, the programme will include measures for this species. The actions involved in the proposed trapping and translocation are outlined below: • Any construction areas suitable or known to support reptiles, including any routes in and out, areas for site compounds, offices or storage of materials/waste, will be fenced off using suitable fencing	8.8.16	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		(drift or semi-permanent) to limit individuals attempting to enter the Project Site from the adjacent land; • No construction activities, including pedestrian access will be allowed outside of the fencing in areas of habitat suitable for supporting reptiles. • A number of refugia (at a density of 50/ha) will be placed within the fenced area to attract reptiles; • Each day, up to twice a day for a minimum of 60 days an ecologist will check the refugia for the presence of reptiles; • Any reptiles or amphibians found will be captured for relocation to suitable habitat outside of the fenced areas. • After 60 days the trapping can cease once there have been five consecutive days where no reptiles have been found; • After the fenced area has been cleared of reptiles and prior to soil stripping the vegetation can undergo a process of habitat management and hand searches for reptiles; • Supervision of the soil strip during construction work by a suitably qualified ecologist will be required to help protect injury or killing of reptiles; and, • Any litter or rubble piles will be removed by hand under the supervision of an ecologist to avoid injuring or killing any reptiles. If the material is too heavy to be removed by hand it can be done so using a mini excavator carefully and slowly removing the material, under the supervision of an ecologist.					
E15	Additional	*Breeding Birds* Habitat creation measures relating to the loss of the SINC, broadleaved woodland, marshy grassland, hedgerows and lines of trees will provide additional areas for breeding birds post construction. Embedded landscape planting will also provide additional habitat for the species assemblage recorded.	8.8.22	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor
E16	Additional	*Bats* To allow the most appropriate and effective mitigation measures to be determined and to be included in a subsequent CEMP or LEMP, the	8.8.23	Landscape and Ecology Mitigation	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		following surveys will be undertaken: • Building assessments and further bat surveys on Buildings 7 and 8 within the Abergelli Farm between May and July 2018; and • Pre-construction checks on trees scheduled for removal for their current bat roost potential with consideration of the seasonal survey timings (May-September).		Strategy			
E17	Additional	Based on the current Project design a European Protected Species Licence (EPSL) is not a requirement. However, should the scope of the Project change and/or if further bat roosts are identified an EPSL may be required.	8.8.24	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E18	Additional	Maintain connectivity of foraging and commuting habitats by the retention of trees and hedgerows wherever possible and utilising 'brown hedgerows' of brash, to maintain connectivity during construction. For linear features identified as key forging or commuting habitat, where possible the Gas Connection should be installed using drilling to retain feature and connectivity across the Project Site. Embedded mitigation includes the provision of replacement habitats that will benefit foraging and commuting bats.	8.8.26	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E19	Additional	Night time working with its associated need for additional lighting should be avoided as far as possible within areas near to known roosts. There should be no night time illumination of the hedgerows, woodland or mature tree lines.	8.8.27	Landscape and Ecology Mitigation Strategy / Lighting Strategy	APL/ Main contractor	CCS	Main contractor
E20	Additional	*Water Vole and Otter* A pre-construction check for water vole burrows, otter holts/couches and activity of both species will be undertaken where construction is present within 100 m of watercourses as identified as suitable for supporting the species during the 2017 field surveys. The check should be undertaken the year before works are due to commence and if the area declared clear, habitat management undertaken to help reduce the quality of the habitats for burrow and holt/couch creation for the period leading up to and for the duration of construction in that area. Additional mitigation may be required as a result of the survey.	8.8.28	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
E21	Additional	*Badger* A pre-construction check for badger setts and activity will be undertaken where construction works are within 30 m of suitable habitats for badger sett creation.	8.8.29	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E22	Additional	Works likely to damage or destroy a badger sett will require a license to close the sett prior to works commencing. The terms of the license may stipulate the requirement for compensatory setts to be created should any main setts be destroyed and/or temporarily closed.	8.8.30	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E23	Additional	Excavations, if left unfilled overnight, should be covered to avoid badgers and other animals becoming trapped. Sloping escape ramps for badgers should be created by edge profiling trenches/excavations and/or excavations should be fitted with a scaffolding board ramp to allow any trapped animals to exit. Crossing places will be provided across open excavations for the duration of the works on the sections where known badger paths have been identified. Open pipework greater than 150 mm diameter that is left over night will be made secure by either filling in the end of the pipe or covering the end with a solid timber panel or similar.	8.8.31	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E24	Additional	Night time working with its associated need for additional lighting should be avoided as far as possible within areas near to setts and areas of known activity to reduce disturbance to badger when they are out of their setts and foraging. There should be no night time illumination of the hedgerows, woodland or setts.	8.8.32	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E25	Additional	The introduction of new woodland, scrub, species-rich grassland and hedgerows will increase opportunities for resting, breeding and foraging badger.	8.8.33	Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan	APL/ Main contractor	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
E26	Additional	*Invasive Species* An invasive species management plan will be produced to control and eradicate the invasive species within the Project Site Boundary. An updated invasive species survey should be undertaken to accurately assess invasive species and extents within the Project Site Boundary prior to the implementation of control measures.	8.8.34	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor
Water Quality and Resources							
WQ01	Embedded	Hydrological protection measures have been included in the Outline Surface Water Management Plan (Appendix 3.2) to prevent pollution events, with particular reference to the Gas Connection and section of new Access Road. The Surface Water Management Plan includes details of silt traps and / or sedimats to reduce flow of suspended solids, suitable phasing to reduce the need for unprotected slopes and avoidance of stockpiled materials.	3.11.39	Surface Water Management Plan	APL/ Main contractor	CCS	Main contractor
WQ02	Embedded	The Project incorporates welfare facilities which will require a site foul water drainage system. The Project Site is remote and it is believed it will be unfeasible to connect to a public sewer. Therefore, a foul water drainage system will either drain to a septic tank or a package treatment plant within the Project Site but outside any area at risk of flooding. It is likely that the latter would be the preferred option for ease of maintenance and environmental criteria. The processed water would then discharge on site or to a nearby watercourse in accordance with Environmental Permit conditions, if required.	3.11.5	Drainage Strategy	APL	CCS and NRW	Main contractor
WQ03	Embedded	An oily water drainage system will be required to receive surface water from potentially contaminated oil retaining areas and prevent contaminated water discharging from site. Oily water drainage shall be designed in accordance with National Grid Technical Specification 2.20 'Oil Containment at Electricity Substations and Other Operational Sites' or similar approved guidelines.	3.11.6	Drainage Strategy	APL	CCS and NRW	Main contractor
WQ04	Embedded	The surface water drainage system will be required to adequately drain the site and prevent ponding. The surface water drainage system will adopt the principles of the SuDS Manual – Ciria C753. – Updated SuDS Manual reference 2015.	3.11.7	Drainage Strategy	APL	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
WQ05	Embedded	To prevent inundation of the Project Site from surface runoff cut off drainage ditches will be placed around the uphill site perimeter. These new drainage ditches will be designed to carry the surface runoff around the Project Site and downstream back to the original drainage ditches/watercourses. This is detailed in the Outline Surface Water Management Plan (Appendix 3.2).	3.11.8	Surface Water Management Plan	APL	CCS and NRW	Main contractor
WQ06	Embedded	Where possible, the new levels and surfacing will be designed so they naturally drain by infiltration into the surrounding ground. Where this is not economically possible or presents an unsatisfactory risk of flooding, infiltration drains will be installed. All infiltration drains will connect to the surface water drainage system.	3.11.9	Drainage Strategy	APL	CCS and NRW	Main contractor
WQ07	Embedded	It is not expected that it will be possible to connect the surface water drainage system to an infiltration basin due to the presumed predominantly clayey ground and high groundwater level in places. This will be confirmed when the Ground Investigation surveys are carried out post-consent. Instead the discharged flow of water at the Generating Equipment Site boundary from the surface water drainage system will be attenuated in order to maintain the equivalent greenfield runoff flow for a range of events up to the 1 in 100 year event (with climate change allowance). The flow will be attenuated using suitably sized attenuation ponds with restricted discharge pipes to the existing greenfield runoff rates. An emergency overflow will be provided to the attenuation ponds to prevent site flooding in the event of an extreme rainfall event with suitable pollution prevention measures installed if possible to avoid a pollution event, although priority must be given to site security and resilience.	3.11.10	Drainage Strategy	APL	CCS and NRW	Main contractor
WQ08	Embedded	Where possible, roadside swales and infiltration drains will be used to remove and convey any standing water into the surface water drainage system from internal roads within the Project Site including the new Access Road. Where there are space constraints, or there is an elevated risk of contamination, the new site roads will be kerbed and drain via road gullies with pollution control measures. It is expected that roadside swales will discharge to nearby local watercourses at the existing greenfield runoff rate.	3.11.11	Drainage Strategy	APL	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
WQ09	Embedded	Existing field drainage that will cross the new Access Road will be culverted or bridged for a short length to allow flow up to the 1 in 100 year return period.	3.11.12	Drainage Strategy	APL	CCS and NRW	Main contractor
Geology, Ground Conditions and Hydrogeology							
G01	Embedded	The CEMP will be implemented during construction to mitigate any adverse environmental effects and includes working in accordance with best practices, such as the completion of all necessary ground investigation and risk assessments, maintaining safe working practices and the use of correct and appropriate Personal Protective Equipment (PPE).	3.11.47	CEMP	APL/ Main contractor	CCS	Main contractor
G02	Embedded	The following information which relates specifically to geology, ground conditions and hydrogeology will be included within the CEMP: • Surface and groundwater protection measures; • Peat management measures as required; and • Security measures; a protocol in the event that unexpected contaminated land is identified during ground investigation or construction.	3.11.48	CEMP	APL/ Main contractor	CCS	Main contractor
G03	Embedded	Intrusive ground investigation will be conducted to identify ground conditions and potential contaminants, as will risk assessments including gas, control waters and human health.	3.11.49	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor
G04	Embedded	A detailed mining risk assessment will be required to establish the risk of untreated shallow underground workings beneath the Project Site. There is potential for mine workings and entries requiring stabilisation treatment so ground stability will be improved.	3.11.50	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor
G05	Embedded	A mineral resources survey will be undertaken to establish the value of the sand, gravel and coal reserves.	3.11.51	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor
G06	Embedded	A foundations risk assessment is likely to be required to assess the risk of piling foundations to controlled waters; however this will be confirmed by the ground investigation.	3.11.52	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
Landscape and Visual							
LV01	Embedded	Mitigation measures will be implemented during the construction phase as set out in the Outline CEMP (Appendix 3.1 of the ES) in order to limit impacts on the landscape and visual resource. These measures will include: • The use of tall hoardings to screen views of ground level construction activities in relation to sensitive receptors such as residential views and views from nearby PRoW; • Materials and machinery will be stored tidily during the construction works in order to minimise impacts on views; • Lighting of compounds and work sites will be restricted to agreed working hours and those which are necessary for security in accordance with the Institution of Lighting Professionals guidelines. • The unnecessary removal of vegetation will be avoided; • The retention and protection of existing trees in accordance with BS5837:2012 Trees in Design, Demolition and Construction, Recommendations; • Public roads providing access to construction site will be maintained fee of dust and mud; • The Contractor will clear and clean all working areas and accesses as work proceeds and when no longer required for the works; • On completion of construction works, all structures, equipment, surplus materials, waste, notice boards and temporary fences used during construction will be removed from the Project Site with minimum damage to the surrounding area; and • Prompt reinstatement of areas that are no longer required following construction.	3.11.53	CEMP / Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
Traffic, Transport and Access							
T01	Embedded	Modifications to the B4489/Access Road junction to facilitate movements by abnormal loads;	3.11.60	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor
T02	Embedded	Widening and extension of the Access Road to facilitate access by	3.11.60	*Secured*	APL	CCS and	Main

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		construction traffic;		*through DCO Requirement*		NRW	contractor
T03	Embedded	Physical management of the Access Road to ensure the security and safety of all staff;	3.11.60	CEMP	APL/ Main contractor	CCS	Main contractor
T04	Embedded	A Construction Traffic Management Plan (CTMP) including details of the management of construction traffic and Public Right of Way (PROW); and	3.11.60	CTMP	APL	Highway Authority, CCS and NRW	Main contractor
T05	Embedded	A Construction Staff Travel Plan (CSTP) to minimise the level of single occupancy car use by construction staff travelling to/from the site.	3.11.60	CSTP	APL	Highway Authority, CCS and NRW	Main contractor
Historic Environment							
CH01	Embedded	A Written Scheme of Investigation (WSI) will be prepared in advance of construction commencing. A watching brief will then be implemented in accordance with WSI during construction for any works associated with ground disturbance.	3.11.61	WSI	APL	CCS and NRW	Main contractor
CH02	Additional	In the event that the watching brief reveals archaeological remains, sufficient time and resources will be allowed to ensure that these are adequately excavated, recorded and removed, and for samples to be taken if appropriate. Provision will also be made for post-excavation analysis and, if appropriate, publication of the results.	13.8.10	WSI	APL	CCS and NRW	Main contractor
Other Effects Considered							
OE01	Embedded	The Outline CEMP includes a section on Site Waste Management, which will encourage reuse and recycling of waste before disposal in accordance with the waste hierarchy.	3.11.62	CEMP	APL/ Main contractor	CCS	Main contractor

Table A. 2 Operation Mitigation Register

Ref No	Is Measure Embedded or Additional?	Operational Mitigation Measure	ES Reference	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
Air Quality							
AQ05	Embedded	The Generating Equipment will be designed to comply with Industrial Emissions Directive (IED) emission limits. In addition the stack sensitivity assessment (Appendix 6.2 of the ES) has demonstrated that a minimum stack height of 35 m is appropriate to ensure the adequate dispersal of pollutants to ensure that no harm is caused.	3.11.18	*Secured through Environmental Permit*	APL	CCS and NRW	Main contractor
AQ06	Embedded	The Project will require an Environmental Permit to operate, and monitoring the performance of the Generating Equipment against the permit conditions will be the responsibility of NRW. The performance of the emissions control will require monitoring by stack emissions testing throughout operation and the Generating Equipment will be 'fine-tuned' so as to ensure that limits are not exceeded.	3.11.19	Environmental Management System (EMS)	The operator	NRW	The operator
Noise							
N11	Embedded	The selection of the Project Site and development of the indicative concept layout have already included consideration of potential noise effects and proximity to NSRs, with Generating Equipment being located as close to the existing electrical infrastructure as possible and as far from the NSRs as practicable.	3.11.29	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Operational Mitigation Measure	ES Reference	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
N12	Embedded	Other measures with regards to noise and vibration during operation, to be incorporated into the design include: • The Gas Turbine Generator and major compressors are to be housed in acoustic enclosures. In addition, these will be housed within secondary acoustic enclosures specified at 75 dB(A) Sound Pressure Level at 1 m. • Gas turbine air inlet filter and ventilation apertures are to be fitted with silencers, and designed such that all sensitive noise receptors benefit from screening and/or directivity corrections. • Silencers are to be fitted in the exhaust stack. Due to the impracticality of screening stack noise, discharge noise will be controlled using these silencers, which will be tuned to attenuate low frequencies from the Gas Turbine Generator exhausts. • All plant items will be controlled to minimise noise of an impulsive or tonal nature. • Noise breakout from the stack will be controlled using silencers. To achieve the predicted noise levels used in this assessment, noise from the top of the stacks should not exceed the maximum octave band sound power levels identified in Table 7-8 of Chapter 7 of ES.	3.11.30	*Secured through Environmental Permit*	APL	CCS and NRW	Main contractor
N13	Embedded	During the detailed design stage, options to mitigate potential significant residual noise effects by design will be further explored.	3.11.31	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor
N14	Embedded	Several options for configuration and suppliers of the Generation Equipment are under consideration. Preliminary modelling has shown that options are available that are capable of meeting the threshold noise levels.	3.11.32	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Operational Mitigation Measure	ES Reference	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
N15	Embedded	The Project would operate in accordance with an Environmental Permit issued and regulated by the NRW. This would require operational noise from the Generating Equipment to be controlled through the use of BAT, which would be determined through the Environmental Permit application.	3.11.33	EMS	The operator	Relevant certification bodies	The operator
N16	Embedded	If any non-normal and/or emergency operations were to lead to noise levels in excess of the agreed limits specified in the DCO Requirements, the operator will inform the local authority and local residents of the reasons for these operations, the anticipated emergency period and the steps to be taken to bring it back to compliance.	3.11.34	EMS	The operator	Relevant certification bodies	The operator
Ecology							
E27	Embedded	The stack has been designed to minimise impacts from emissions during operation, which includes minimising deposition which that could affect ecological receptors.	3.11.38	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor
E28	Additional	*Protected Species* The mitigation for partial underground cable or pipework replacement or repairs will follow best practice and any intrusive works will only commence after consultation with an ecologist to assess whether there are any impacts associated with the work. Management of newly created habitats or compensatory features will be detailed in the Landscape and Ecology Mitigation Strategy (Appendix 3.4) and will be designed to minimise disturbance or adverse effects on protected and/or priority species, such as avoiding vegetation management during nesting bird season, and cutting grass and scrub within the reptile receptor area to a height of no less than 150 mm.	8.8.36	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Operational Mitigation Measure	ES Reference	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
E29	Additional	*Bats* The lighting should utilise warm light luminaire such as yellow or amber LED. White LED lamps have a broad spectrum of light with whilst yellow and amber LED lamps each have a specific, narrower spectrum and have peak wavelengths between 590 and 660 nm, which is less attractive to invertebrates. This in turn will reduce the number of bats that will be attracted to feed and be open to predation through increased visibility.	8.8.38	Lighting Strategy	APL	CCS and NRW	Main contractor
Water Quality and Resources							
WQ10	Embedded	Adaptation of different platform levels at the locations of key elements of the Project development. In line with this, the ground level of the Welsh Water main easement area will be retained at the existing level in order to provide a path for any flood water to pass through the Project Site, thereby avoiding the elevated Power Generation Plant (PGP) areas – with the PGP finished floor level to be raised by approximately 150 millimetres (mm) above the site road crown level while keeping the plant plinths at 300 mm above the site level.	3.11.41	*Secured through DCO Requirement*	APL	-	Main contractor
WQ11	Embedded	Provision for all process water (i.e. gas turbine compressor wash water) to be collected in a drain tank removed by road tanker and disposed by an accredited company to a designated treatment facility off-site.	3.11.42	Drainage Strategy	APL	-	Main contractor
WQ12	Embedded	Rainwater will be removed from oil retaining areas by an automatic pump to the oily water drainage system. The automatic pumps will be designed to shut down in the event that a major oil spillage is detected. This will help prevent large quantities of oil entering the oily water drainage system.	3.11.43	Drainage Strategy	APL	CCS and NRW	Main contractor
WQ13	Embedded	The oily water drainage system will ultimately pass through a Class 1 Full Retention Oil Separator (As defined in BS EN 858) before discharging into surface water bodies or drainage systems.	3.11.44	Drainage Strategy	APL	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Operational Mitigation Measure	ES Reference	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
WQ14	Embedded	All oil unloading areas on site have been designed to include containment for accidental spillage of fuel during unloading with the loading system equipped such that drainage is isolated during filling and any spillage goes to the dedicated interceptor.	3.11.45	Drainage Strategy	APL	CCS and NRW	Main contractor
WQ15	Embedded	The oil separator will be fitted with an alarm to indicate when the oil coalesce requires emptying. All oil separators will be sized to suit the oily water catchment area.	3.11.46	Drainage Strategy	APL	CCS and NRW	Main contractor
Landscape and Visual							
LV02	Embedded	Utilising technology (OCGT) will allow a significant reduction in stack height compared to other technology types. As a result of selecting OCGT technology, there will be no visible plume arising from the stack. The high temperature of the exhaust gases means that water vapour is well above the condensation point which would give rise to a visible plume.	3.11.55	*Secured through DCO Requirement*	APL	-	Main contractor
LV03	Embedded	The architectural design of the buildings and structures on the Project Site has been designed to reduce glare and to assimilate the Project into the surrounding landscape as much as possible by using neutral recessive colours to lessen the contrast with the surrounding landscape and break up the overall massing of the large scale structures.	3.11.56	*Secured through DCO Requirement*	APL	-	Main contractor
LV04	Embedded	External lighting has been designed to reduce trespass and configured to avoid glare and spillage. Details will be provided in the Outline Lighting Strategy to be submitted as part of the DCO Application and undertaken in accordance with the Institution of Lighting Professionals Guidelines (Ref. A.9).	3.11.57	Lighting Strategy	APL	-	Main contractor
LV05	Embedded	The Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan (LEMP) has been developed to both provide reinstatement planting as well as to integrate the Project into the landscape and its wider setting. The planting proposals will be developed in accordance with the various utility and service constraints within the site.	3.11.58	Lighting Strategy	APL	-	Main contractor

Ref No	Is Measure Embedded or Additional?	Operational Mitigation Measure	ES Reference	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
LV05	Embedded	The landscape proposals will cover a minimum period of five years of monitoring, management and maintenance to ensure the landscape objectives are successfully achieved.	3.11.59	Lighting Strategy	APL	-	Main contractor

Appendix 2.1

Mitigation Register

Appendix 2.1: Mitigation Register

Table A.1 Construction Mitigation Register

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
General Environmental Management Principles and Responsibility							
GEN01	Embedded	A CEMP will be prepared and then implemented during construction to mitigate any adverse environmental effects. An Outline CEMP for the Project is provided in Appendix 2.2. It includes measures relating to the environmental topics assessed in this ES which will mitigate the effects of construction. The CEMP will be finalised and followed by the Contractor on site, once the content has been agreed with CCS. The Outline CEMP includes the following information: • Community liaison; • Complaints procedures; • Nuisance management including measures to avoid or minimise the impacts of construction works (covering dust, noise, vibration and lighting); • Dust management measures; • Site waste and materials management measures; • Surface and ground water protection measures; • Pollution control measures; • Security measures and use of artificial lighting; and A protocol in the event that unexpected contaminated land is identified during ground investigation or construction.	3.11.3	CEMP	APL/ Main contractor	CCS	Main contractor
GEN02	Embedded	A Landscape and Ecology Mitigation Strategy (LEMS) will be prepared and then implemented during construction to mitigate any adverse environmental effects. An Outline LEMS for the Project is provided in Appendix 2.3. It includes measures relating to the landscape and ecological topics which will mitigate the effects of construction.	N/A	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
Air Quality							
AQ01	Embedded	The CEMP will include the standard good practice dust mitigation	3.11.14	CEMP	APL/ Main	CCS	Main

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		measures, as set out in the Outline CEMP in Appendix 2.2.			contractor		contractor
AQ02	Embedded	Daily visual inspections of dust emissions will be made in conjunction with dust emissions monitoring at locations to be agreed with NRW. If plumes of dust are visible, behind moving vehicles for example, or dust was visibly deposited on roads outside of the Project Site, additional control measures may be required.	3.11.15	CEMP	APL/ Main contractor	CCS	Main contractor
AQ03	Embedded	Institute of Air Quality Managers (IAQM) guidance on monitoring air quality at construction sites (Ref A.1) recommends that, in addition to visual inspections, ambient air monitoring is undertaken in the vicinity of high risk sites. This data is required for two reasons: the first relates to ensuring that mitigation measures are appropriate and being applied rigorously; the second is to provide early warning of increased dust emissions which allows for the cessation or modification of activities prior to impacts occurring.	3.11.16	CEMP	APL/ Main contractor	CCS	Main contractor
AQ04	Embedded	Monitoring will be undertaken in the vicinity of the Lletty-Morfil SINC. Since the risk for ecosystems relates to dust deposition, a real time monitor for total suspended particulate matter will be installed but this needs to be an 'indicative instrument' only. Trigger levels for the instrument, which would suggest increasing risk/emissions, should be agreed with NRW prior to the commencement of construction. The monitoring stations will be mobile and would be moved around the Project Site as the principal activities move.	3.11.17	CEMP	APL/ Main contractor	CCS	Main contractor
Noise							
N01	Embedded	It is anticipated that core working hours and boundary noise will be limited during construction by a Requirement in the DCO. Working hours are likely to be between 08.00 and 18.00 on weekdays, and between 08.00 and 13.00 hours on Saturdays and public holidays. Some works may be allowed to take place outside of normal working hours provided they do not cause any noise disturbance. Should it be necessary to conduct work with the potential to generate noise, outside these core hours, this would be with the prior written agreement of CCS. These limits will not apply during commissioning and testing of the Project.	3.11.21	CEMP	APL/ Main contractor	CCS	Main contractor
N02	Embedded	Measures to mitigate noise and ensure compliance with any imposed	3.11.22	CEMP	APL/ Main	CCS	Main

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		maximum boundary noise limits will be implemented during the construction phase of the Project in order to minimise impacts at local residential Noise Sensitive Receptors (NSRs), particularly with respect to activities required outside of normal working hours.			contractor		contractor
N03	Embedded	Construction noise mitigation measures are included in the Outline CEMP (Appendix 2.2). In order to keep noise effects from the construction phase to a minimum, all construction activities would be carried out in accordance with the recommendations of British Standard (BS) 5228 'Noise and Vibration Control on Construction and Open Sites' (Ref A.2).	3.11.23	CEMP	APL/ Main contractor	CCS	Main contractor
N04	Embedded	Mitigation measures for inclusion within the CEMP may contain, but are not limited to: • Abiding by any construction noise limits at nearby NSRs; • Ensuring that all processes are in place to minimise noise before works begin and ensuring that best practicable measures (BPM) are being achieved throughout the construction programme, including the use of localised screening around significant noise producing plant and activities; • Ensuring that modern plant is used, complying with the latest European noise emission requirements. Selection of inherently quiet plant where possible; • Hydraulic techniques for breaking to be used in preference to percussive techniques where practical; • Off-site pre-fabrication, where practical; • All plant and equipment being used for the works to be properly maintained, silenced where appropriate, operated to prevent excessive noise, and switched off when not in use; • All contractors to be made familiar with current legislation and the guidance in BS 5228 (Parts 1 and 2), which should form a prerequisite of their appointment; • Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials around the Project Site, to be conducted in such a manner as to minimise	3.11.24	CEMP	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		noise generation; • Appropriate routing of construction traffic on public roads and along access tracks; • Consultation with CCC and local residents to advise of potential noisy works that are due to take place; and Monitoring of noise complaints, and reporting to the main contractor for immediate investigation.					
N05	Embedded	Method statements regarding construction management, traffic management, and overall site management would be prepared in accordance with best practice and relevant British Standards, to help to minimise impacts of construction works. One of the key aims of such method statements would be to minimise noise disruption to local residents during the construction period.	3.11.25	CEMP	APL/ Main contractor	CCS	Main contractor
N06	Embedded	Consultation and communication with the local community throughout the construction period would also serve to publicise the works schedule, giving notification to residents regarding periods when higher levels of noise may occur during specific operations, and providing lines of communication where complaints can be addressed.	3.11.26	CEMP	APL/ Main contractor	CCS	Main contractor
N07	Embedded	A detailed noise assessment would be carried out once the contractor is appointed and further details of construction methods are known, in order to identify specific mitigation measures for the Project.	3.11.27	CEMP	APL/ Main contractor	CCS	Main contractor
N08	Embedded	In addition, it is proposed that the contractor would be a member of the 'Considerate Constructors Scheme' which is an initiative open to all contractors undertaking building work.	3.11.28	CEMP	APL/ Main contractor	CCS	Main contractor
N09	Additional	The preferred approach for controlling construction noise and vibration is to reduce levels at source where possible, but with due regard to practicality. Sometimes a greater noise or vibration level may be acceptable if the overall construction time, and therefore length of disruption, is reduced.	7.6.3	CEMP	APL/ Main contractor	CCS	Main contractor
Ecology							
E01	Embedded	Local habitats and protected species would be protected during the construction works through measures included within the Outline CEMP (Appendix 2.2) such as fencing to prevent access of species to	3.11.35	CEMP	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		working areas and translocation of protected species (e.g. reptiles).					
E02	Embedded	Sensitive ecology features such as the Ancient Woodland, trees and habitats have been avoided during the Project design development.	3.11.36	CEMP	APL/ Main contractor	CCS	Main contractor
E06	Additional	*Row of Trees – Broadleaved and Hedgerows – Species-Poor* Loss of rows of trees and hedgerows utilised by wildlife such as commuting and foraging bats, and commuting badgers will be mitigated for through the introduction of hedgerows and linear woodland features as shown on the LEMP and Strategy. Mitigation measures include that habitats temporarily removed will be reinstated and that mature trees removed may be replaced by standards of the same species or transplanted to a suitable location.	8.8.7	Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan	APL/ Main contractor	CCS and NRW	Main contractor
E07	Additional	*Marshy Grassland* Temporarily removed habitats will be reinstated. Mitigation for the loss of marshy grassland habitat will include the provision of replacement habitat, as shown on the LEMP and Strategy.	8.8.9	Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan	APL/ Main contractor	CCS and NRW	Main contractor
E09	Additional	*Amphibians* Recommendations for reptiles will help to limit the injury or killing of amphibians.	8.8.11	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor
E10	Additional	*Reptiles* Mitigation for the loss of habitat suitable for supporting reptiles (dense/continuous scrub and grassland) will include the provision of replacement habitats, as shown on the LEMP and Strategy.	8.8.12	Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan	APL/ Main contractor	CCS and NRW	Main contractor
E13	Additional	To reduce the risk of individual reptiles being injured or killed, all works will proceed under a Method Statement agreed with the Local Biodiversity Officer/Council Ecologist prior to works commencing. The risk of reptiles and the mitigation measures will be included in the	8.8.19	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		Project Site induction package and prior to any site clearance and construction tasks. Full details are provided in the LEMP and Strategy.					
E14	Additional	The risk of reptiles and the mitigation measures will be included in the site induction package and prior to any site clearance and construction tasks.	8.8.20	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E11	Additional	Due to the 'Good' population of common lizard and the presence of low numbers of grass snakes within the survey area it is recommended that a trapping and translocation programme is undertaken to help protect any reptiles from being injured or killed. Due to the presence of suitable habitat for adder, the programme will include measures for this species. The actions involved in the proposed trapping and translocation are outlined below: • Any construction areas suitable or known to support reptiles, including any routes in and out, areas for site compounds, offices or storage of materials/waste, will be fenced off using suitable fencing (drift or semi-permanent) to limit individuals attempting to enter the Project Site from the adjacent land; • No construction activities, including pedestrian access will be allowed outside of the fencing in areas of habitat suitable for supporting reptiles. • A number of refugia (at a density of 50/ha) will be placed within the fenced area to attract reptiles; • Each day, up to twice a day for a minimum of 60 days an ecologist will check the refugia for the presence of reptiles; • Any reptiles or amphibians found will be captured for relocation to suitable habitat outside of the fenced areas. • After 60 days the trapping can cease once there have been five consecutive days where no reptiles have been found; • After the fenced area has been cleared of reptiles and prior to soil stripping the vegetation can undergo a process of habitat management and hand searches for reptiles; • Supervision of the soil strip during construction work by a suitably qualified ecologist will be required to help protect injury or killing of	8.8.16	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		reptiles; and, • Any litter or rubble piles will be removed by hand under the supervision of an ecologist to avoid injuring or killing any reptiles. If the material is too heavy to be removed by hand it can be done so using a mini excavator carefully and slowly removing the material, under the supervision of an ecologist.					
E15	Additional	*Breeding Birds* Habitat creation measures relating to the loss of the SINC, broadleaved woodland, marshy grassland, hedgerows and lines of trees will provide additional areas for breeding birds post construction. Embedded landscape planting will also provide additional habitat for the species assemblage recorded.	8.8.22	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor
E16	Additional	*Bats* To allow the most appropriate and effective mitigation measures to be determined and to be included in a subsequent CEMP or LEMP, the following surveys will be undertaken: • Pre-construction checks on trees scheduled for removal for their current bat roost potential with consideration of the seasonal survey timings (May-September).	8.8.23	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E17	Additional	Based on the current Project design a European Protected Species Licence (EPSL) is not a requirement. However, should the scope of the Project change and/or if further bat roosts are identified an EPSL may be required.	8.8.24	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E18	Additional	Maintain connectivity of foraging and commuting habitats by the retention of trees and hedgerows wherever possible and utilising 'brown hedgerows' of brash, to maintain connectivity during construction. Embedded mitigation includes the provision of replacement habitats that will benefit foraging and commuting bats.	8.8.26	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E19	Additional	Night time working with its associated need for additional lighting should be avoided as far as possible within areas near to known roosts. There should be no night time illumination of the hedgerows, woodland or mature tree lines.	8.8.27	Landscape and Ecology Mitigation Strategy / Lighting	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
				Strategy			
E20	Additional	*Water Vole and Otter* A pre-construction check for water vole burrows, otter holts/couches and activity of both species will be undertaken where construction is present within 100 m of watercourses as identified as suitable for supporting the species during the 2017 field surveys. The check should be undertaken the year before works are due to commence and if the area declared clear, habitat management undertaken to help reduce the quality of the habitats for burrow and holt/couch creation for the period leading up to and for the duration of construction in that area. Additional mitigation may be required as a result of the survey.	8.8.28	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E21	Additional	*Badger* A pre-construction check for badger setts and activity will be undertaken where construction works are within 30 m of suitable habitats for badger sett creation.	8.8.29	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E22	Additional	Works likely to damage or destroy a badger sett will require a license to close the sett prior to works commencing. The terms of the license may stipulate the requirement for compensatory setts to be created should any main setts be destroyed and/or temporarily closed.	8.8.30	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E23	Additional	Excavations, if left unfilled overnight, should be covered to avoid badgers and other animals becoming trapped. Sloping escape ramps for badgers should be created by edge profiling trenches/excavations and/or excavations should be fitted with a scaffolding board ramp to allow any trapped animals to exit. Crossing places will be provided across open excavations for the duration of the works on the sections where known badger paths have been identified. Open pipework greater than 150 mm diameter that is left over night will be made secure by either filling in the end of the pipe or covering the end with a solid timber panel or similar.	8.8.31	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor
E24	Additional	Night time working with its associated need for additional lighting should be avoided as far as possible within areas near to setts and areas of known activity to reduce disturbance to badger when they are out of their setts and foraging. There should be no night time illumination of the hedgerows, woodland or setts.	8.8.32	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
E25	Additional	The introduction of new woodland, scrub, species-rich grassland and hedgerows will increase opportunities for resting, breeding and foraging badger.	8.8.33	Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan	APL/ Main contractor	CCS and NRW	Main contractor
E26	Additional	*Invasive Species* An invasive species management plan will be produced to control and eradicate the invasive species within the Project Site Boundary. An updated invasive species survey should be undertaken to accurately assess invasive species and extents within the Project Site Boundary prior to the implementation of control measures.	8.8.34	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor
Water Quality and Resources							
WQ01	Embedded	Hydrological protection measures have been included in the Outline Surface Water Management Plan (Appendix 2.4) to prevent pollution events. The Surface Water Management Plan includes details of silt traps and / or sedimats to reduce flow of suspended solids, suitable phasing to reduce the need for unprotected slopes and avoidance of stockpiled materials.	3.11.39	Surface Water Management Plan	APL/ Main contractor	CCS	Main contractor
WQ02	Embedded	The Project incorporates welfare facilities which will require a site foul water drainage system. The Project Site is remote and it is believed it will be unfeasible to connect to a public sewer. Therefore, a foul water drainage system will either drain to a septic tank or a package treatment plant within the Project Site but outside any area at risk of flooding. It is likely that the latter would be the preferred option for ease of maintenance and environmental criteria. The processed water would then discharge on site or to a nearby watercourse in accordance with Environmental Permit conditions, if required.	3.11.5	Drainage Strategy	APL	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
WQ03	Embedded	An oily water drainage system will be required to receive surface water from potentially contaminated oil retaining areas and prevent contaminated water discharging from site. Oily water drainage shall be designed in accordance with National Grid Technical Specification 2.20 'Oil Containment at Electricity Substations and Other Operational Sites' or similar approved guidelines.	3.11.6	Drainage Strategy	APL	CCS and NRW	Main contractor
WQ08	Embedded	Where possible, roadside swales and infiltration drains will be used to remove and convey any standing water into the surface water drainage system from internal roads within the Project Site including the new Access Road. Where there are space constraints, or there is an elevated risk of contamination, the new site roads will be kerbed and drain via road gullies with pollution control measures. It is expected that roadside swales will discharge to nearby local watercourses at the existing greenfield runoff rate.	3.11.11	Drainage Strategy	APL	CCS and NRW	Main contractor
WQ09	Embedded	Existing field drainage that will cross the new Access Road will be culverted or bridged for a short length to allow flow up to the 1 in 100 year return period.	3.11.12	Drainage Strategy	APL	CCS and NRW	Main contractor
Geology, Ground Conditions and Hydrogeology							
G01	Embedded	The CEMP will be implemented during construction to mitigate any adverse environmental effects and includes working in accordance with best practices, such as the completion of all necessary ground investigation and risk assessments, maintaining safe working practices and the use of correct and appropriate Personal Protective Equipment (PPE) (Appendix 2.2).	3.11.47	CEMP	APL/ Main contractor	CCS	Main contractor
G02	Embedded	The following information which relates specifically to geology, ground conditions and hydrogeology will be included within the CEMP: • Surface and groundwater protection measures; • Peat management measures as required; and • Security measures; a protocol in the event that unexpected contaminated land is identified during ground investigation or	3.11.48	CEMP	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		construction.					
G03	Embedded	Intrusive ground investigation will be conducted to identify ground conditions and potential contaminants, as will risk assessments including gas, control waters and human health.	3.11.49	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor
G04	Embedded	A detailed mining risk assessment will be required to establish the risk of untreated shallow underground workings beneath the Project Site. There is potential for mine workings and entries requiring stabilisation treatment so ground stability will be improved.	3.11.50	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor
G05	Embedded	A mineral resources survey will be undertaken to establish the value of the sand, gravel and coal reserves.	3.11.51	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor
Landscape and Visual							
LV01	Embedded	Mitigation measures will be implemented during the construction phase as set out in the Outline CEMP (Appendix 2.2) in order to limit impacts on the landscape and visual resource. These measures will include: • The use of tall hoardings to screen views of ground level construction activities in relation to sensitive receptors such as residential views and views from nearby PRoW; • Materials and machinery will be stored tidily during the construction works in order to minimise impacts on views; • Lighting of compounds and work sites will be restricted to agreed working hours and those which are necessary for security in accordance with the Institution of Lighting Professionals guidelines. • The unnecessary removal of vegetation will be avoided; • The retention and protection of existing trees in accordance with BS5837:2012 Trees in Design, Demolition and Construction, Recommendations; • Public roads providing access to construction site will be maintained fee of dust and mud; • The Contractor will clear and clean all working areas and accesses as work proceeds and when no longer required for the works; • On completion of construction works, all structures, equipment,	3.11.53	CEMP / Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		surplus materials, waste, notice boards and temporary fences used during construction will be removed from the Project Site with minimum damage to the surrounding area; and • Prompt reinstatement of areas that are no longer required following construction.					
Traffic, Transport and Access							
T01	Embedded	Modifications to the B4489/Access Road junction to facilitate movements by abnormal loads;	3.11.60	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor
T02	Embedded	Widening and extension of the Access Road to facilitate access by construction traffic;	3.11.60	*Secured through DCO Requirement*	APL	CCS and NRW	Main contractor
T03	Embedded	Physical management of the Access Road to ensure the security and safety of all staff;	3.11.60	CEMP	APL/ Main contractor	CCS	Main contractor
T04	Embedded	A Construction Traffic Management Plan (CTMP) including details of the management of construction traffic and Public Right of Way (PROW) (Appendix 2.5).	3.11.60	CTMP	APL	Highway Authority, CCS and NRW	Main contractor
T05	Embedded	A Construction Staff Travel Plan (CSTP) to minimise the level of single occupancy car use by construction staff travelling to/from the site (Appendix 2.6).	3.11.60	CSTP	APL	Highway Authority, CCS and NRW	Main contractor
Historic Environment							
CH01	Embedded	A Written Scheme of Investigation (WSI) will be prepared in advance of construction commencing. A watching brief will then be implemented in accordance with WSI during construction for any works associated with ground disturbance.	3.11.61	WSI	APL	CCS and NRW	Main contractor
CH02	Additional	In the event that the watching brief reveals archaeological remains, sufficient time and resources will be allowed to ensure that these are adequately excavated, recorded and removed, and for samples to be taken if appropriate. Provision will also be made for post-excavation	13.8.10	WSI	APL	CCS and NRW	Main contractor

Ref No	Is Measure Embedded or Additional?	Construction Mitigation Measure	ES Ref	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
		analysis and, if appropriate, publication of the results.					
Other Effects Considered							
OE01	Embedded	The Outline CEMP (Appendix 2.2) includes a section on Site Waste Management, which will encourage reuse and recycling of waste before disposal in accordance with the waste hierarchy.	3.11.62	CEMP	APL/ Main contractor	CCS	Main contractor

Table A. 2 Operation Mitigation Register

Ref No	Is Measure Embedded or Additional?	Operational Mitigation Measure	ES Reference	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
Ecology							
E28	Additional	*Protected Species* The mitigation for partial underground cable or pipework replacement or repairs will follow best practice and any intrusive works will only commence after consultation with an ecologist to assess whether there are any impacts associated with the work. Management of newly created habitats or compensatory features will be detailed in the Landscape and Ecology Mitigation Strategy (Appendix X.X) and will be designed to minimise disturbance or adverse effects on protected and/or priority species, such as avoiding vegetation management during nesting bird season, and cutting grass and scrub within the reptile receptor area to a height of no less than 150 mm.	8.8.36	Landscape and Ecology Mitigation Strategy	APL/ Main contractor	CCS and NRW	Main contractor
Landscape and Visual							
LV03	Embedded	The architectural design of the buildings and structures on the Project Site has been designed to reduce glare and to assimilate the Project into the surrounding landscape as much as possible by using neutral recessive colours to lessen the contrast with the surrounding landscape and break up the overall massing of the large scale structures.	3.11.56	*Secured through DCO Requirement*	APL	-	Main contractor
LV04	Embedded	External lighting has been designed to reduce trespass and configured to avoid glare and spillage. Details will be provided in the Outline Lighting Strategy to be submitted as part of the DCO Application and undertaken in accordance with the Institution of Lighting Professionals Guidelines (Ref. A.9).	3.11.57	Lighting Strategy	APL	-	Main contractor

Ref No	Is Measure Embedded or Additional?	Operational Mitigation Measure	ES Reference	Relevant Management Plan	Responsibility		
					Preparation	Approval	Delivery
LV05	Embedded	The Landscape and Ecology Mitigation Strategy and Landscape and Ecology Mitigation Plan (LEMP) has been developed to both provide reinstatement planting as well as to integrate the Project into the landscape and its wider setting. The planting proposals will be developed in accordance with the various utility and service constraints within the site.	3.11.58	Lighting Strategy	APL	-	Main contractor
LV06	Embedded	The landscape proposals will cover a minimum period of five years of monitoring, management and maintenance to ensure the landscape objectives are successfully achieved.	3.11.59	Lighting Strategy	APL	-	Main contractor

A.1 References

Ref A.1 IAQM. (2012). Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites. [Online]. Available: http://www.iaqm.co.uk/wp-content/uploads/guidance/monitoring_construction_sites_2012.pdf [Accessed: 30/11/17]

Ref A.2 British Standards Institute (BSI). (2014). BS 5228 -1: 2009+ A1:2014. Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise.

Ref A.3 Herpetofauna Groups of Britain and Ireland (HGBI) (1998). Evaluating local mitigation/translocation programmes: Maintaining Best Practice and lawful standards. HGBI advisory notes for Amphibian and Reptile Groups (ARGs). HGBI, c/o Froglife, Halesworth. Unpubl.

Ref A.4 National Grid. (2014). NGTS 2.20: Oil Containment at Electricity Substations and Other Operational Sites.

Ref A.5 CIRIA. (2015). C753: The SUDS [Sustainable Urban Drainage] Manual.BSI. (2012). BS 5837. Trees in Relation to Design, Demolition and Construction – Recommendations.

Ref A.6 ILP. (2011). Guidance Notes for the Reduction of Obtrusive Light. [Online]. Available: https://www.theilp.org.uk/resources/free-resources/ilp-guidance-notes/ [Accessed: 30/11/17]

Appendix 2.2

Outline Construction Environment Management Plan (CEMP)

AECOM Imagine it. Delivered.

Outline Construction Environment Management Plan

Abergelli Power Project
Abergelli Power Limited

May 2018

Document Control				
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List of Outstanding Issues and Information				
Ref.	**Outstanding issue/info.**	**Section/Paragraph**	**Responsibility**	**Action**

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Appendix A 1

Abbreviations

APL	Abergelli Power Limited, the Applicant
BPM	Best Practicable Means
CCS	City and County of Swansea
CEMP	Construction Environment Management Plan
CLG	Community Liaison Group
COSHH	Control of Substances Hazardous to Health
DEFRA	Department for Environment, Food and Rural Affair's
DCO	Development Consent Order
ECoW	Ecological Clerk of Works
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
EMS	Environmental Management System
ES	Environmental Statement
HGV	Heavy Goods Vehicles
HSE	Health and Safety Executive
IAQM	Institute of Air Quality Management
M	Metre
MW	Megawatt
NETS	National Grid Electricity Transmission System
NRW	Natural Resource Wales
OGCT	Open Gas Cycle Turbine
PPE	Personal Protection Equipment
PRoW	Public Right of Way
RAMS	Risk Assessment / Method Statement
SINC	Site of Importance for Nature Conservation
SWCN	Special Waste Consignment Note
SWTRA	South Wales Trunk Road Agency
WFD	Waste Framework Directive
WTN	Waste Transfer Note

1. Introduction

1.1 Overview

1.1.1 This Outline Construction Environment Management Plan (CEMP) has been prepared as part of the Environmental Statement (ES) for Abergelli Power Station (hereafter referred to as the 'Project'). This Outline CEMP has been prepared by AECOM on behalf of the applicant, Abergelli Power Limited (APL).

1.1.2 The Project comprises of an Open Gas Cycle Turbine (OGCT) peaking power generating station and supporting infrastructure. The Project is described in detail in **Chapter 3: Project and Site Description** and its location provided in Figure 1.1 and Figure 1.2 of the ES.

1.2 Purpose of this Document

1.2.1 The purpose of this Outline CEMP is to set out the approach towards, and framework for, environmental management during the construction phase (including site preparation) and to provide mitigation against potentially adverse construction impacts on environmental resources, local residents and businesses. The Outline CEMP will provide assurance to the decision maker and stakeholders that appropriate measures for preventing and reducing environmental effects will be adopted during the construction of the Project and secured via this document. Both standard environmental good practice and project specific mitigation, as committed to within the ES are included within this Outline CEMP.

1.2.2 This Outline CEMP covers all elements of the Project as described in **Chapter 3: Project and Site Description** of the ES, although some measures will only be relevant to particular project elements or specific works, and this will be made clear in the text of the document. The principles of this Outline CEMP set out the standards, environmental management and good practice that will also be consistently applied to the construction of the Gas and Electrical Connections.

1.2.3 Post-consent, this CEMP will require updating in accordance with a Development Consent Order (DCO) Requirement and will be approved by CCS (in consultation with Natural Resources Wales) prior to any construction commencing on the Project Site. The approved CEMP will be used as an environmental management and monitoring tool for the duration of the construction phase. The CEMP will be kept on site as a live document, being updated as and when required (for example to recognise changes in regulations, good practice guidance, actions from on site audits or a change in situation onsite).

1.2.4 The approved CEMP will fall within the scope of the main contractor's externally certified environmental management systems, and as such will be subject to independent audits by the relevant certification bodies.

1.2.5 Measures set out in this document and the approved CEMP will have regard to the Welsh Government document '*Construction and Demolition Sector Plan*' (Ref. 1.1)

which seeks to move towards zero waste by detailing outcomes, policies and delivery actions for organisations, companies and individuals involved with the construction and demolition sector in Wales.

a) Decommissioning

1.2.6 It is anticipated that the environmental effects of the decommissioning of the Project will be similar in size and nature to those associated with construction. A detailed decommissioning methodology cannot be finalised until immediately prior to decommissioning. However the measures and procedures are anticipated to be similar to those set out within this Outline CEMP and updated to align with industry good practice guidance at the time of writing.

1.3 Content and Structure

1.3.1 This Outline CEMP includes the following topics:

- Community liaison;
- Complaints procedures;
- Nuisance management including measures to avoid or minimise the impacts of construction activities (covering dust, noise, vibration and lighting);
- Dust management measures;
- Site waste and materials management measures;
- Pollution control measures;
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- Security measures and use of artificial lighting;
- A protocol in the event that unexpected contaminated land is identified during ground investigation or construction; and
- Environmental training requirements.

1.3.2 In considering these environmental matters, information is provided on:

- A register of environmental aspects (Section 2.3);
- Roles and responsibilities (Section 2.1);
- Communication and co-ordination (Section 2.2);
- Training and awareness (Section 2.2);
- Checking, monitoring, auditing and corrective action (Sections 2.5 and 3);
- Good practice environmental control measures (Section 3); and
- Where embedded mitigation and additional mitigation has been incorporated and secured (Section 3).

1.3.3 This document should be read in conjunction to other mitigation places such at:

- ES Appendix 3.2: Surface Water Management Plan;
- ES Appendix 3.3a Contraction Traffic Management Plan;
- ES Appendix 3.3b Construction Staff Travel Plan; and
- ES Appendix 3.4: Landscape and Ecology Mitigation Strategy.

1.4 Construction Phase

1.4.1 The construction phase of the Project is anticipated to take approximately 22 months with an anticipated starting date in 2020. A detailed description of the site preparation and construction phase is available **in Chapter 3: Project and Site Description** of the ES.

1.4.2 Site preparation will entail:

- Creating temporary bridges over the Water Main and Oil Pipeline for the Access Road;
- Diverting watercourses and ditches around the Generating Equipment Site and Access Road:
- Creating attenuation ponds;
- Excavation of material of the new Access Road;
- Site clearance including vegetation clearance and topsoil stripping/ excavations;
- Establishing Laydown Area, site compounds and installing welfare facilities;
- Ecological mitigation works which may be required pre-construction; and
- Conducting geotechnical investigations and any other pre-construction surveys.

1.4.3 The main activities associated with the construction phase will be:

- Excavation and site levelling for new foundations and piling if required. The need for piling will be determined through pre-construction ground investigations;
- Access Road paving;
- Creation of drainage features (not including the attenuation pond);
- Heavy Goods Vehicles (HGVs) Deliveries of materials and equipment;
- Erection and fitting out of buildings;
- Installation of the generating plant on completed foundations including auxiliary equipment such as electrical switchgear and fuel handling equipment;
- Excavation and laying of the Electrical Connection, which will include going under the Oil Pipeline and Water Main and reinstating the excavated material once the Electrical Connection has been laid; and
- Excavation and laying of the Gas Connection; and
- The construction of cable ducts alongside the Access Road.

1.5 References

Ref. 1.1 Welsh Government. (2012). Construction and Demolition Sector Plan. Towards Zero Waste One Wales: One Planet. [Online]. Available: *http://gov.wales/docs/desh/publications/130301construction-demolition-waste-plan-en.pdf* [Accessed: 25/10/17].

2. Environmental Management Framework

2.1 Roles and Responsibilities

2.1.1 The following sections outline the responsibilities for those parties involved in the construction phase of the Project. These roles and responsibilities are indicative and may interchange between APL and the main contractor(s), and are not exhaustive.

a) APL

2.1.2 In terms of environmental management, APL is responsible for the overall delivery of the Project in compliance with relevant environmental legislation, the mitigation set out in this Outline CEMP and any Requirements to be implemented as part of the DCO.

2.1.3 APL will ensure that there is a dedicated Environmental Manager who will either be employed by APL or a nominated member of the main contractor's staff. The proposed role and responsibilities of the Environmental Manager are described below, starting in paragraph 2.1.8.

2.1.4 APL's role will include (but is not limited to):

- Ensuring the CEMP is finalised, implemented and monitored by the main contractor(s);
- Ensuring all the following factors are considered and appropriately actioned;
  - The most appropriate order and method of working;
  - Allocation of responsibilities between personnel, and other organisations on the Project Site; and
  - The approved CEMP is prepared and issued in a controlled way.
- Communications and Training (Section 2.2):
  - Ensuring that environmental meetings are held regularly and that environmental issues are covered as appropriate;
  - Regular liaison between all parties on the Project Site to ensure adequate precautions are taken to minimise the impact on the environment;
- Monitoring and Auditing (Section 2.5):
  - Ensuring that the main contractor(s) comply with the good practice, mitigation measures, set out in the CEMP and DCO Requirements through review of an Audit Close-Out Schedule;
  - Ensuring that all environmental incidents are reported and investigated where appropriate; and
  - Ensuring environmental inspections of the Project Site are performed and all issues raised are addressed promptly.

b) Main Contractor(s)

2.1.5 The main contractor(s) will be appointed by APL to undertake the construction of the Project. The main contractor(s) are required to comply with the mitigation and provisions within the Outline CEMP along with any Requirements imposed in the

DCO and/or licences and secondary consents associated with the Project. This also applies to any sub-contractors engaged on the Project. The main contractor(s) would also be a member of the Considerate Constructors Scheme.

2.1.6 If not already implemented by APL, the main contractor(s) will have a nominated environmental contact to perform the role of Environmental Manager, a description and list of responsibilities for the role are set out in the section below starting in paragraph 2.1.8.

2.1.7 The responsibilities of the main contractor(s) will also include (but are not limited to):

- Ensuring employees and sub-contractors implement the controls outlined in the finalised and approved CEMP;
- Communications and Training (Section 2.2):
  - Liaising with statutory authorities and APL as required and ensuring records of communication (including verbal communication) are kept;
  - Ensuring employees and sub-contractors receive Site Inductions (that include environmental issues) and toolbox talks, as appropriate;
  - Ensuring environmental management and emergency response training is provided and recorded.
- Monitoring and Auditing (Section 2.5):
  - Ensuring personnel needed for audits are available when required;
  - Verifying actions resulting from Corrective Action Requests (procedure used to originate a corrective action), Non-Conformance notices (notice issued to the main contractor(s) for conflicts with the contract documents) and Observations raised during audits are completed by the deadlines;
  - Verifying actions resulting from Corrective Action Requests, Non-Conformance notices and Observations raised during audits are completed by the deadlines and recorded appropriately.

c) Environmental Manager

2.1.8 APL or the main contractor(s) will appoint a suitably qualified Environmental Manager for the duration of the construction of the Project and during any restoration works. The purpose of this appointment is to ensure that the environmental interests of the Project Site are safeguarded. The Environmental Manager will have the authority to review method statements, oversee works and recommend action as appropriate. This includes having the authority to temporarily stop works if required, for example, where poor practices are being applied or mitigation is not being appropriately implemented or adhered to.

2.1.9 The Environmental Manager will work with the main contractor(s) to ensure the implementation of, and compliance with, the provisions of the approved CEMP and licences, consents or other conditions imposed on the Project.

2.1.10 A detailed description of the Environmental Manager's responsibilities will be included in the finalised version of the CEMP however, in summary the Environmental Manager will be responsible for:

- Ensuring any pre-construction environmental surveys are scheduled into the construction programme and conducted prior to works commencing;
- Inspections of works to ensure that environmental mitigation measures and other commitments have been and/or are being implemented;
- Implementation of additional mitigation other than those committed to where unforeseen circumstances arise that could result in a breach of environmental legislation;
- Monitoring and Auditing (Section 2.5):
  - Conducting weekly site inspections and record keeping of environmental sensitivities and requirements;
  - Conducting or coordinating monthly routine audits of the main contractor's compliance with the approved CEMP including construction activities and record keeping;
  - Coordinating and organising any regular monitoring requirement or commitment;
  - Regular reporting to CCS summarising the works undertaken on the Project; and
  - Monitoring or inspection of onsite activities in response to incidents, breaches of the approved CEMP or complaints received from a third party.

d) ECoW

2.1.11 The Environmental Manager may be assisted by an Environmental Clerk of Works (ECoW). The ECoW will perform specific specialist tasks that require expert knowledge, such as observations and watching briefs. The ECoW role may be performed by a suitably qualified individual or a team of individuals with differing expertise.

2.1.12 The responsibilities of the ECoW will be finalised in the approved CEMP, but may include:

- Any pre-construction surveys requiring specialised skills;
- Watching briefs or observations of specific construction activities i.e. vegetation clearance;
- Any auditing or monitoring requiring specialised skills; and
- Input into topic specific toolbox talks and training.

e) All Site Personnel

2.1.13 All site personnel have a responsibility to the environment, which includes, but is not limited to:

- In the case of an incident, stopping work, implementing control procedures and reporting it to the appropriate personnel as identified by the main contractor(s) in the finalised CEMP;
- Reporting when waste needs collecting;
- Passing any queries or correspondence on environmental issues to the appropriate personnel as identified by the main contractor(s) in the finalised CEMP; and
- Working in accordance with the finalised and approved CEMP and associated management plans. Protocol to support adherence is set out in the Communication and Training section (starting paragraph 2.2.2) of this Outline CEMP.

2.2 Communications and Training

a) Community Liaison

2.2.1 The following steps will be taken by APL/the main contactor to make the public aware of the activities onsite and the available lines of communication with the Project:

- Neighbouring residents and occupiers will be notified of the start of construction activities, the likely duration of the construction phase, of any changes to the working hours as agreed with CCS and of periods when higher levels of noise may be expected;
- There will be a community liaison group (CLG) established for facilitation two-way communication between the public and the Project, which will meet on a regular basis.
- A telephone number for environmental complaints will be published local to the Project Site. There will be a dedicated person responsible for dealing with any complaints, which could be the Environmental Manager. This person will have the appropriate authority to resolve complaints. An 'out of hours' telephone number will be made available if required. A Welsh speaker can be available at request;
- Liaison will be maintained with CCS's Environmental Health Officer (EHO) for the duration of the construction phase;
- Should any complaints regarding dust or noise be received the details will be passed to the EHO for verification purposes; and
- Should any unforeseen event occur on the Project Site that has the potential to cause pollution then the relevant regulatory bodies will be notified immediately. As far as possible, notice will be issued to the EHO for dealing with an unforeseen activity that may give rise to a particular nuisance problem.

b) Environmental Site Meetings

2.2.2 To ensure dissemination of environmental information, environmental meetings will be held throughout the duration of the Project construction. The frequency of meetings will be determined by the main contractor(s), but will not be less than

once per month. These meetings will be held for all site personnel and will be attended by the ECoW or similar environmental expert (if required).

2.2.3 Any environmental issues or lessons learnt will be reported at these meetings along with any updates or changes to environmental management plans. A “Look Ahead” at relevant environmental management or special requirements linked to specific upcoming tasks or seasonality will also be provided.

c) Site Signage and Notice Boards

2.2.4 Working areas will be clearly marked with appropriate signage and warnings to ensure that they are avoided by members of the public.

2.2.5 Site notice boards for disseminating information to Site personnel will be positioned either within individual work stations or in a centralised location. Site notice boards will display method statements, emergency contacts, and relevant statutory and non-statutory advice and guidance.

d) Site Inductions

2.2.6 The main contractor(s) will ensure all employees, sub-contractors, suppliers, and other visitors to the Project Site receive induction training. The Site Induction will include a summary of environmental risks associated with the Project and the onsite environmental methods and standards. Any environmental methods and standards specifically relevant to the inductee’s role or task will be highlighted.

2.2.7 Topics that will be covered in the Site Induction include, but are not limited to;

- Pertinent areas of environmental sensitivity, such as ecological, archaeological, hydrological or geological sensitive areas;
- Pollution prevention and protection of the water environment (including concrete washout);
- Waste management; and
- Environmental incident and near miss reporting.

e) Training in Environmental Requirements

2.2.8 The main contractor(s) will ensure all personnel are suitably trained in general site good practice and environmental emergency response procedures, including the use of spill kits, silt mitigation and concrete washing out. Good practice and emergency response training will be provided by a suitably qualified person on a regular basis. The main contractor(s) will keep a record of this training.

2.2.9 Toolbox talks will be provided as part of briefings on specific tasks, based on method statements and environmental standards. The will provide on-going reinforcement and awareness of environmental sensitivities and issues on the Project Site. Toolbox talks will be task specific and will identify the sensitive receptors and provide advice on any specific procedures that need to be followed and the mitigation measures that should be implemented. For specialist topics,

toolbox talks may be presented by an ECoW (or equivalent suitably trained specialist).

2.2.10 A programme of relevant toolbox talks will be drawn up by the Environmental Manager or main contractor(s) based on upcoming construction activities. Additional toolbox talks may be required outside of this based on circumstances such as unforeseen risks, repeated observation of bad practices, perceived lack of awareness, or a pollution event. A record of all toolbox talks reporting highlights of the meeting and attendees will be maintained.

2.3 Register of Mitigation

2.3.1 A register of embedded and additional mitigation measures committed to within the ES has been attached in Appendix A: Mitigation Register to this Outline CEMP. The Register has been updated in response to consultee comments and updated EIA technical assessments. This Register will be used to inform the onsite environmental management and provide a tool for aiding the preparation of method statements or environmental standards. The register covers several environmental topic areas and will be regularly updated to reflect any additional risks resulting from the main contractors selected methods of working, changing site conditions etc. Mitigation measures have been identified under the following general headings:

- General;
- Air Quality;
- Noise and Vibration;
- Ecology;
- Water Quality and Resources;
- Geology, Ground Conditions and Hydrogeology;
- Landscape and Visual;
- Traffic, Transport and Access; and
- Historic Environment.

2.4 Method Statements and Site Environmental Standards

2.4.1 The main contractor(s) will prepare Method Statements for specific construction activities and Site Environmental Standards for day-to-day Project Site operations such as housekeeping, material storage and waste management. These will be based on standard good practice measures (as set out within relevant management plans in Section 3 of this Outline CEMP), statutory requirements, environmental sensitivities and any Requirements of the DCO.

2.4.2 Site Environmental Standards will be printed on A3 posters, placed on site notice boards and used as a briefing tool onsite. They will also form the basis of toolbox talks on the relevant Project Site operations.

2.4.3 The method statement will be communicated to all or task specific personnel ahead of the commencement of the relevant activities using an agreed instruction format (e.g. toolbox talks).

2.5 Monitoring and Auditing

a) Inspections

2.5.1 The Project Site will be inspected at regular intervals to ensure implementation of good practice and compliance with measures set out within the approved CEMP. The inspection and auditing schedule for the Project will be agreed by the main contractor(s) in consultation with the Environmental Manager and ECoW if required prior to commencement of construction. It is anticipated that there will be a programme of:

- Daily inspections;
- Weekly inspections;
- Monthly Audits;
- Monthly Complaint Reporting; and
- Ongoing Environmental Monitoring.

2.5.2 Particular notice will be taken during and following extreme weather events (high rainfall, high winds, snowfall etc.), when working in areas of known contamination, and when particularly hazardous activities are being carried out. Additional Method Statements or Site Environmental Standards will be produced where significant risk to the environment is identified.

2.5.3 An Audit Close-out Schedule will be maintained by the main contractor(s). This is a document to record any observations, corrective action requests or non-compliance notices identified through inspections. Progress against corrective and preventative actions logged in the Schedule will be reported to APL on a regular basis.

i. Daily Inspections

2.5.4 The nominated site personnel or the Environmental Manager will conduct daily checks against environmental requirements. This could be done against a pro forma or similar, based on the measures outlined within method statements and Environmental Standards relevant to activities being conducted on that day.

2.5.5 Daily inspections will include visual inspections of dust emissions as described in Section 4.3.

ii. Weekly Inspections

2.5.6 Weekly Project Site inspections will be carried out by the Environmental Manager, which will assess the effectiveness of the implemented mitigation on the Project Site.

iii. Monthly Audits

2.5.7 Compliance with the approved CEMP, environmental legislation and good practice will be audited on a monthly basis by the Environmental Manager or ECoW. The audit will include details on who is responsible for implementing any action required and the associated timescales.

iv. Monthly Complaints Reporting

2.5.8 The main contractor(s) will report to APL regarding any nuisance complaints from the general public and actions on how these have been addressed. The process for receiving and taking action on complaints is set out in the Community Liaison (paragraph 2.2.1).

v. Environmental Monitoring

2.5.9 Any requirements for specific monitoring programmes as determined through the DCO or pre-construction surveys (i.e. ground investigations) will be conducted at appropriate intervals by a suitably qualified individual.

b) Incidents and Near Misses

2.5.10 An indicative environmental Emergency Response Plan is detailed in Section **Error! Reference source not found.** of this Outline CEMP. This will be finalised by the main contractor(s). The plan in the approved CEMP will follow the stop – contain – notify protocol and will detail responsible personnel and contacts for reporting. All personnel will be briefed on the notification protocol for alerting the main contractor(s) and Environmental Manager of an environmental emergency as part of their Site Induction. Environmental emergency response training and toolbox talks will also be conducted at regular intervals by a suitably qualified person.

2.5.11 The main contractor(s) will maintain a register of all environmental incidents, dangerous occurrences and/or near misses, each supported by an Environmental Incident Report Form. This will document the nature, date and time of the incident, corrective action(s) taken, and details of any contact with regulatory agencies. All incidents will be reported to the appropriate regulatory body and APL on the day that they occur or within 24 hours.

2.5.12 All environmental incidents, dangerous occurrences and near misses will be reviewed by the Environmental Manager and where necessary changes to working practices/procedures will be implemented. Lessons learnt, along with any updates to method statements, sections of the approved CEMP and toolbox talk will be communicated to all personnel at Environmental Site Meetings.

3. General Environmental Management Measures during Construction Phase

3.1 Safety

3.1.1 The main contractor(s) will have the day to day responsibility for maintaining Health and Safety throughout the construction phase. A risk assessment and method statement (RAMS) will be produced and detail how risk will be minimised through an approved procedure, which will:

- Identify the significant Health and Safety impacts that can be anticipated;
- Assess the risks from these impacts;
- Identify the control measures to be taken and re-calculate the risk; and
- Report where an inappropriate level of residual risk is identified so that action can be taken.

3.1.2 There will be no access to construction areas by the general public. The Project Site will be secured to avoid unauthorised access including where permissive routes cross the construction areas.

3.1.3 Traffic safety should be promoted by all project personnel to prevention and control traffic related injuries. Speed restrictions will be imposed onsite. This will also minimise disturbance of bare surfaces.

3.1.4 The following good practice measures will be implemented by the main contractor(s) to ensure the safety of site personnel:

- The provision of appropriate Personal Protective Equipment (PPE), including footwear, masks, protective clothing and goggles where required;
- Eating, drinking and smoking will be limited to a designated ‘clean’ area of the Project Site;
- Welfare facilities will be made available;
- All site personnel will be required to wash their hands and remove overalls/boots when moving from ‘dirty’ to ‘clean’ areas of the Project Site;
- Any soils excavated that are considered by the main contractor(s) to be potentially contaminated will be reported, left in situ and fenced off until their appropriate treatment (in line with Section **Error! Reference source not found.**: Emergency Response Plan); and
- Water inflows to excavated areas will be minimised by the use of lining materials, good housekeeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water.

3.1.5 The main contractor(s) will ensure that qualified first-aid can be provided at all times. Appropriately equipped first-aid stations will be easily accessible throughout the Project Site.

3.2 Security

3.2.1 During site preparation the perimeter of the Generating Equipment Site will be cleared of undergrowth and a permanent or temporary security fence placed with

locked gates for main and emergency exits (capable of being opened in an emergency).

3.3 Construction Site Housekeeping

3.3.1 Good construction site housekeeping practice will be applied at all times. As far as reasonably practicable the construction working areas for the Project Site will be designed using the following principles:

- All work areas will be secured;
- Any fuels or liquid materials will be stored and bunded in compliance with the relevant regulation;
- Signage and boundary fences will be regularly inspected, repaired and replaced as necessary;
- All working areas will be kept in a clean and tidy condition;
- Wheel washing and dust suppression facilities will be provided when and where required;
- Waste will be removed at frequent intervals; and
- Construction waste susceptible to spreading by wind or liable to cause litter will be stored in secure containers.

3.4 Storage of Fuels and Chemicals

3.4.1 The main contractor(s) will ensure that fuels and chemicals are stored appropriately and the measures are in place to prevent pollution of ground and water. Fuel will be stored:

- In areas where potential for contamination of water bodies is low i.e. outside 50 m of a spring, well or borehole and 10 m of an open watercourse;
- In areas that are low risk of flooding;
- In tanks that meet the manufacturing standards appropriate for the type of oil stored and comply with BS EN ISO 9001;
- With contents clearly marked on the storage containers;
- With secure and appropriately sized bunds being suitable to contain 110% of the contents (single tank). If there is more than one storage container, the bund will be capable of containing 110% of the largest tank, or 25% of the total aggregate capacity, whichever is the greatest;
- Tanks/ storage containers will be protected against vehicle collision; and
- All deliveries will be overseen by site personnel with emergency response training.

3.4.2 A Control of Substances Hazardous to Health (COSHH) store will be set up in the site compound. COSHH assessments and Material Safety Data Sheets will be held with the COSHH materials. A COSHH register will be created and maintained onsite.

3.4.3 All site personnel and sub-contractors will be made aware of the COSHH requirements through site inductions and specific toolbox talks. Daily site inspections will be used to review and monitor the storage and issue of COSHH materials.

3.5 Welfare Facilities

3.5.1 Welfare cabins, toilets and drying facilities, in line with The Construction (Design and Management) Regulations 2015 (Ref. 3.1) will be provided within the Project Site for the use of site personnel. Grey and foul water from welfare facilities will not be discharged directly into ditches or watercourse, but will be collected through a foul water drainage system that will either drain to a septic tank or a package treatment plant within the Project Site. It is likely that the latter will be the preferred option for ease of maintenance and environmental criteria. The processed water will then discharge onsite or to a nearby watercourse.

3.5.2 Where portable generators are used, industry good practice will be followed to minimise noise and pollution from such generators.

3.5.3 The risk of infestation by pests or vermin will be minimised by the appropriate collection, storage and regular collection of waste, the prompt treatment of any pest infestation and effective preventative pest control measures.

3.6 Public Right of Ways

3.6.1 There are three Public Right of Ways (PRoW) that cross the Project Site. Specific mitigation measures for the management of these PRoWs is contained within the Outline Construction Traffic Management Plan, which will be finalised post-consent, in consultation with the PRoW officer at CCS.

3.6.2 It is not proposed to permanently divert any PRoWs although measures will be implemented during the construction phase to maintain safety to users from construction traffic and also from any excavations which may be present. Any temporary closures, required for public safety, will be advertised in advance and diversions or directions to alternate routes will be provided where practicable.

3.6.3 Appropriate signage will be placed prior to the construction area to ensure users are aware of the works prior to arriving. Should works be undertaken in the immediate location of the crossing, banksman will be employed to avoid any potential adverse effects from construction traffic. In addition, suitable fencing will be implemented to ensure users of the permissive routes are segregated from construction traffic appropriately and safely if required.

3.7 Timing of Works

3.7.1 Construction will be programmed in such a way as to ensure that construction activities are undertaken in a timely manner while minimising environmental risk as far as possible, e.g. seasonal sensitivities or inclement weather will be considered. Construction activities may be undertaken simultaneously at more than one area of the Project Site. The work programme will be agreed with CCS prior to construction commencing onsite. In the event that the programme changes significantly, the changes will be communicated to CCS.

3.7.2 Construction activities will be scheduled so that works that have the potential to impact upon ecological receptors are conducted outside key periods of seasonal

activity, for instance, vegetation clearance will be conducted outside of the breeding bird season.

3.7.3 Construction activities will also be scheduled, where possible to reduce the risk of pollution. Measures include:

- Minimising the periods for which soils are exposed and stockpiled thereby reducing the risk of generating silt laden runoff;
- Avoiding, where possible, undertaking specific activities such as earthworks during prolonged and heavy rainfall thereby reducing the risk of sediment or pollutants becoming entrained in excess runoff; and
- Avoiding, where possible, undertaking activities in closer proximity to watercourses when water levels are higher and adjacent land is at risk of flooding.

3.8 Working Hours

3.8.1 Construction activities will not take place outside the hours of 08:00-18:00 Monday to Friday and 08.00-13.00 on Saturday and public holidays, unless otherwise agreed with CCS. These limits will not apply during commissioning and completion of the Project, as defined in **Chapter 3: Project and Site Description** of the ES. Local residents will be notified, as detailed in Section 2.2 Community Liaison, of any agreed changes to the working hours. Lighting

3.8.2 The Project Site will require artificial lighting during construction to provide a safe working environment during hours of darkness. Artificial lighting can be a nuisance to any nearby residence and can disrupt nocturnal species.

3.8.3 All artificial lighting used at the Project Site will be in accordance with the Institute of Lighting Professionals (ILP) Guidelines (Ref. 3.2) and the Bat Conservation Trust's (BCT) interim guidance on artificial lighting and wildlife (Ref. 3.3).

3.8.4 In order to minimise light disturbance to ecological receptors:

- There will be no more than 1 lux beyond the boundary of the proposed Project Site, particularly within the Lletty-Morfil Site of Importance for Nature Conservation (SINC) to the north and east of the Generating Equipment Site, which is a habitat that supports bats; and

3.8.5 The general design objectives that will be used to ensure that adverse effects of lighting (through adding light to a darker rural landscape) associated with construction of the Project are minimised are listed below:

- Luminaires will be appropriately designed for the required task;
- Louvres and shields will be used to prevent undesirable light break-out;
- Construction lighting will be directed away from all sensitive receptors;
- For the illumination of large areas, in order to limit light trespass, glare and sky glow from the plant, preference will be given to several, lower lighting units rather than tall, wide beam lighting units;
- Vehicle lights will be properly directed (conforming to MOT requirements) and lenses will be intact to prevent un-necessary glare and light intrusion;

- Lighting will be reduced or switched off when not required for safety purposes;
- Security lighting will be kept at the minimum level needed for visual and security protection;
- Dark corridors will be maintained along hedgerows and watercourses and any other linear features by avoiding light encroaching on these areas. This will avoid the fragmentation of habitat used by species such as bats and also otters that use these features to move at night-time; and
- If appropriate, the use of infra-red floodlighting and CCTV systems will be considered for security to reduce the need for visible lighting outside working hours.

3.9 References

Ref. 3.1 The Construction (Design and Management) Regulations 2015. S.I. 2015/51.

Ref. 3.2 ILP. (2011). Guidance Notes for the Reduction of Obtrusive Light. [Online]. Available: https://www.theilp.org.uk/resources/free-resources/ilp-guidance-notes/ [Accessed: 30/11/17]

Ref. 3.3 BCT. (2014). Artificial Lighting and Wildlife. Interim Guidance: Recommendations to Help Minimise the Impact Artificial Lighting. [Online]. Available: http://www.bats.org.uk/pages/bats_and_lighting.html [Accessed 07/12/17].

4. Environmental Management Plans

4.1 Overview

4.1.1 The following sections outline the likely contents of the topic specific Management Plans that will be developed to be submitted to discharge a DCO Requirement post-consent.

4.1.2 Other than the Emergency Response Plan which is integral to the CEMP, these plans will be subject to their own separate Requirement in the DCO and finalised as required via standalone documents.

4.2 Emergency Response Plan

4.2.1 This plan provides response measures for potential environmental emergencies that could arise during the construction of the Project. These include; discovery of unknown contaminated 'hotspots'; spills of contaminants such as chemicals, fuels or waste materials; and entry of contaminants into watercourses during flood events.

4.2.2 This Emergency Response Plan will be reviewed by the main contractor(s) and finalised in the approved CEMP. The main contractor(s) will also supply emergency contact details for nominated site personnel, relevant regulatory bodies and emergency services. These details will be available on site notice boards (paragraph 2.2.5) and will be displayed along with a plan of the Project Site that displays safe storage areas and the location of response equipment, such as spill kits.

4.2.3 The emergency plan and contact details will be shown to all site personnel as part of the Site Induction. Nominated site personnel will be provided with emergency response training. There will be regular toolbox talks on emergency response procedures and all site personnel will be informed of the notification procedure in the event of discovering contamination or a spill as part of the Site Induction.

4.2.4 All incidents where the Emergency Response Plan is implemented will be reported in line with the Incident Response Procedure detailed in Section 2.5: Monitoring and Auditing (starting paragraph 2.5.10).

a) Contaminated Hotspots Plan

4.2.5 Ground investigations will be conducted to identify any potentially existing contaminated land within the Project Site. In the case where a contaminant is identified, a contaminant specific management plan will be produced.

4.2.6 As such, the procedure below is proposed to be followed in the eventuality that an unidentified contaminant "hotspot" showing visual or olfactory evidence of contamination is discovered during construction:

- Relevant construction activities will be stopped immediately;

- The discovery will be reported to the Environmental Manager or appropriate personnel as identified by the main contractor(s);
- The area will be sealed off in order to contain the spread of contaminants;
- The area will be cleared to ensure there is nothing that could cause fire or explosion;
- The relevant regulator and/or CCS will be contacted once it is confirmed that contamination has been found;
- Testing will be arranged; and
- Details of the incident will be recorded, including photos and relevant information on the Environmental Incident Report Form.

b) Emergency Spill Response Plan

4.2.7 Appropriate spill response materials for the chemicals, fuels and oils stored onsite will be provided throughout the Project Site. Spill kits will be made available at fuel storage and refuelling locations and in individual plant and vehicles. Use of plant and hazardous materials will be done in the presence of at least one operative trained in emergency response.

4.2.8 The main contractor(s) will produce an emergency response plan that will follow the STOP – CONTAIN – NOTIFY – CLEAN UP – REPORT procedure. An indicative procedure is set out below:

- STOP
  - Relevant Construction activities will be stopped immediately;
  - Spilt substance will be identified and any information available (i.e. COSHH material sheet) obtained along with the correct PPE;
  - If safe to do so, the spill will be stopped to prevent more material spilling, e.g. oil drums will be righted or valves closed; and
  - Sources of ignition will be switched off.
- CONTAIN
  - The spillage will be immediately contained using bunds of earth or sand, drip trays, boom and or spill materials;
  - Drains and watercourses will be checked to see if the spill has reached them. Where possible, spills will be diverted and drains will be bunded to stop the spill entering the drainage network;
  - Spillage and runoff will not be washed into the drainage system.
- NOTIFY
  - The Environmental Manager will be notified;
  - The Environmental manger will then notify the relevant regulator, CCS and APL.
- CLEAN UP
  - The spill will be cleaned up using appropriate spill materials OR by an expert/ specialist clean-up contractor;
  - Contaminated soil, ground and water will be disposed of as hazardous waste (Section 4.5.11).
- REPORT
  - An Environmental Incident Report will be completed in line with the Incident Response Procedure (Section 2.5.10).

c) Flood Risk Management Plan

4.2.9 The following provides an outline of the measures to be implemented to minimise flood risk:

- The main contractor(s) will sign up to receive NRW flood warnings or flood alerts for the Afon Llan and Afon Lliw;
- The main contractor(s) will sign up to receive high rainfall alerts provided by the MET office as flood warning for the Project Site;
- Weather forecasts will be checked regularly;
- Plant, machinery and stockpiles will be stored away from watercourses, ditches and low lying areas that could flood;
- If flooding of the Project Site is expected, vehicles and plant machinery that pose a hazard will be moved to higher ground or off-site if appropriate;
- If flooding of the Project Site occurs, plant machinery and vehicles will be checked to ensure they are safe before use; and

4.2.10 Where possible, temporary works (including stockpiles and drains) will be set to direct overland flows away from the main Project Site and access routes.

4.3 Dust Management Plan

4.3.1 This plan contains a proposed dust monitoring plan and standard good practice measures for reducing dust and emissions from vehicles.

4.3.2 Guidance relevant to the implementation of air quality measures include;

- BS 6031: 2009: Code of Practice for Earth Works (Ref. 4.1);
- HSE Vehicle at Work Guidance (Ref. 4.2); and
- Institute of Air Quality Management (IAQM) Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites (Ref. 4.3).

a) Contents of Plan

4.3.3 In line with IAQM guidance (Ref. 4.3) on monitoring air quality at construction sites; daily visual inspections of dust emissions (and weekly recording) will be made in conjunction with dust emissions monitoring at locations to be agreed with NRW. This data will be used to ensure that mitigation measures are appropriate and being applied rigorously and to provide early warning of increased dust emissions to inform the cessation or modification of activities prior to impacts occurring.

4.3.4 Monitoring will be undertaken in the vicinity of the Lletty-Morfil SINC. Since the risk for ecosystems relates to dust deposition, a real time monitor for total suspended particulate matter will be installed. Trigger levels for the instrument, which would suggest increasing risk/emissions, will be agreed with NRW prior to the commencement of construction. The monitoring stations will be mobile and will be moved around the Project Site as the principal activities move.

4.3.5 The following are general good practice measures that will be implemented onsite to control dust and vehicle emissions. If inspections and monitoring find that plumes

of dust are visible, behind moving vehicles for example, or dust was visibly deposited on roads outside of the Project Site, more vigorous control measures may be required.

i. Site Management

- All personnel will be made aware of nuisance dust and will be trained in dust management; and
- Project Site plant will be maintained so as to reduce emissions.

ii. Earthworks

- Disturbance of the ground will be kept to a minimum wherever possible;
- Necessary vegetation/ topsoil removal will be carried out in discrete sections with progressive restoration of exposed areas to minimise wind erosion;
- Earthworks and excavation areas will be kept damp, and will be avoided during periods of exceptionally dry weather; and
- Earthworks will be undertaken following BS 6031:2009 (Ref. 4.1).

iii. Material Handling

- The number of handling operations will be kept to a minimum to ensure that dusty material isn't moved or handled unnecessarily;
- Soil handling will be restricted during adverse weather conditions such as high winds or exceptionally dry spells;
- Drop heights will be kept to a minimum and will be enclosed where possible;
- Transportation of aggregates and fine materials will be conducted in enclosed or sheeted vehicles;
- Dampening methods will be used where necessary; and
- Methods and equipment will be in place for immediate clean-up of spillages of dusty or potentially dusty materials.

iv. Stockpiles

- Stockpiles will be located away from sensitive receptors where dust nuisance is likely to result;
- During exceptionally dry and windy periods stockpiles will be kept damp;
- Soils will, where appropriate be landscaped into suitable shapes for secondary functions e.g. visual screening; and
- Appropriate shrouding/ wind shielding measures dependent on particulate size will be put in place to prevent dust generation from stockpiled materials. Long-term stockpiles may be capped or grassed over.

v. Traffic Measures

- Unsurfaced roads will be graded regularly to remove loose gravel and kept in a clean and compacted condition;
- A mechanical road sweeper will be made available if required for the cleaning of public roads (in agreement with CCS and South Wales Trunk Road Agent (SWTRA));
- Wheel/ vehicle wash facilities will be provided at Project Site entrance/exit; and

vi. Emissions Management

- Plant and equipment will be operated as far as possible away from residential areas or sensitive receptors near to the Project Site;
- An onsite speed limit will be implemented by the main contractor(s) that will be appropriate to the types of construction plant utilised and the Project Site hazards in line with Vehicles at Work guidance from the Health and Safety Executive (HSE) (Ref. 4.2);
- Onsite vehicle movement will be kept to a minimum and restricted to adequately compacted internal roads;
- All plant utilised on Project Site should be regularly inspected. Monitoring of plant will include:
  - Ensuring no black smoke is emitted other than during ignition;
  - Ensuring exhaust emissions are maintained to comply with the appropriate limits;
- Vehicle exhausts will be directed away from the ground and other surfaces and preferably upwards to avoid road dust being re-suspended to the air; and
- Exhausts will be positioned at a sufficient height to ensure adequate dispersal of emissions.

4.4 Pollution Prevention Management Plan

4.4.1 This plan covers measures to minimise the risk of pollution to ground and water from the storage and use of potentially polluting materials onsite. The sections below detail the storage of fuels and oil, management of non-oil chemicals, potential pollution from construction vehicles, plant and machinery and the use of cement and concrete.

4.4.2 An Emergency Spill Response Plan is set out within Section **Error! Reference source not found.**.

4.4.3 All fuel storage will comply with the Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016 (Ref. 4.4).

4.4.4 Further water specific management measures can be found in ES Appendix 3.2: Surface Water Management Plan.

a) Contents of Plan

i. Movement, Parking and Re-fuelling of Vehicles and Plant

4.4.5 Vehicles and plant will comply with the following:

- In order to prevent compaction and erosion of undeveloped ground, movement of construction plant and vehicles will be limited to clearly defined access tracks and construction areas only.
- Where possible, all construction plant and vehicles will be parked/stored at least 50 m away from surface waterbodies and springs.
- All construction plant and vehicles will be checked daily for oil and fuel leaks and record of such checks kept by the Environmental Manager (or ECoW).

- Mobile plant will be in good working order, kept clean and fitted with drip trays where appropriate.
- Refuelling of construction plant and vehicles will be undertaken on an impermeable surface at a temporary construction compound only.
- All refuelling activities will be supervised by site personnel with emergency response training.

ii. Cement and Concrete

4.4.6 Concrete and cement are alkaline and corrosive, and can have a highly polluting impact in water and on land and are harmful to human flesh.

4.4.7 Due to the size of the Project Site it is likely that concrete batching will occur onsite. The equipment used for concrete batching should be operated in accordance with Process Guidance Note 3/01(12) (Ref. 4.5).

4.4.8 Mixing and washing of concrete will not take place within 10 m of any watercourse or swale and waste waters will not be discharged into the water environment. All site personnel will receive training on concrete washout as part of their Site Induction.

4.5 Waste and Material Management Plan

4.5.1 To ensure efficiency of resource use, prevention of litter nuisance and compliance with waste legislation, this sections sets out good practice waste and material management measures.

4.5.2 Construction activities associated with materials and/or waste generation include:

- Site clearance will remove vegetation and undergrowth in work areas generating organic materials and waste;
- Excavation; it is estimated that the overall quantity of excavated material (solid) from the construction is to be approximately 19,000 m^3m^3. This figure is a measure of excavated material in the ground and bulk material. The worst case scenario assessed in **Chapter 12: Traffic, Transport and Access** of the ES assumes that none of this excavated material can be reused within the Project Site. However the worst case is not anticipated; and
- General day-to-day construction operations such as use of welfare facilities and deliveries generating packaging, domestic waste and sewage.

4.5.3 Waste likely to be generated during construction includes:

- Topsoil and subsoil;
- Excess concrete, mortar and grout;
- Wood off cuts and used wood (crates and concrete formwork);
- Bricks, pavers and concrete block off cuts;
- Roofing materials;
- Metal including steel reinforcement off cuts;
- Plastic wrapping and packaging;

- Paper;
- Delivered material bags, wrappings and coverings; and
- Miscellaneous materials

4.5.4 The EU Waste Framework Directive (WFD) (Ref. 4.6) provides the overarching legislative framework for the collection, transport, recovery and disposal of waste, and includes a common definition of waste. The Project will operate in accordance with the WFD, together with the Environmental Permitting (England and Wales) Regulations 2016 (Ref.4.7) and the Hazardous Waste (England and Wales) Regulations 2005 (as amended by the Hazardous Waste (England and Wales) Amendment Regulations 2009 and 2016) (Ref. 4.8).

4.5.5 Other guidance referred to within the CEMP includes:

- The Waste Classification Technical Guidance WM3 (Ref. 4.9), which sets out a standardised classification of waste based on material properties;
- Welsh Government Guidance on Applying the Waste Hierarchy (Ref. 4.10); and
- The Department for Environment, Food and Rural Affair's (DEFRA) Waste Duty of Care Code of Practice (Ref. 4.11).

a) Contents of Plan

i. Waste Hierarchy

4.5.6 Onsite waste management will align with the Waste Hierarchy, which promotes efficient resource use and minimisation of waste through the priority ordering of the following measures:

- Prevention;
- Preparing for re-use;
- Recycle;
- Other recovery; and
- Dispose (Ref. 4.11).

4.5.7 The priority order may be deviated from if a better overall environmental outcome is recognised for a particular resource or waste.

ii. Waste Prevention

4.5.8 The following preventative measures will be adopted:

- Building materials ordered will be the correct size so as not to be wasted due to being obsolete;
- The appropriate volume of material will be ordered to avoid excess;
- Ordering of new materials will be avoided if there are existing materials available or able to be adapted to the task within the Project Site;
- Deliveries will be timely and directly placed in secure storage areas, double handling will be kept to a minimum;
- Re-usable materials will be identified onsite and removed for storage and re-sale;
- Excess materials will be returned to the supplier if possible; and

- General information on site waste management will be provided in Site Inductions and toolbox talks with feedback welcomed.

iii. Classification of Waste

4.5.9 APL and/ or the main contractor(s) will identify and classify all Project Site waste streams in line with the categories and methods set out in the Waste Classification Technical Guidance WM3 (Ref. 4.9).

iv. Storing Waste

4.5.10 Where resources are earmarked for recycling, recovery or disposal the following method of storage will be implemented to minimise the risk of waste escaping, litter and/ or pollution:

- All waste will be stored at the location in which it is generated, or within a designated central waste storage area;
- These designated waste storage areas will be isolated from surface water drains and areas that discharge directly to the water environment;
- Waste will be stored in suitable containers of sufficient capacity to avoid loss, overflow or spillage;
- Storage of liquid wastes will be on impermeable bunds that hold the capacity of the container;
- Waste will be segregated by waste stream and storage containers will be clearly signed with the waste that they will hold e.g. wood, metal, plastics or other appropriate waste stream;
- Storage containers will be secure, covered or enclosed;
- There will be separate containers for hazardous waste (see Paragraph 4.5.11);
- Skips will be monitored and action taken if waste levels are too high; and
- Burning of waste is prohibited.

v. Hazardous Waste

4.5.11 “Hazardous waste” is any waste which contains properties that might make it harmful to human health or the environment (Ref. 4.8).

4.5.12 Hazardous waste could arise during construction from the following sources:

- Maintenance of plant and machinery;
- Oily water waste;
- Oily rags;
- Oil absorbent pads etc.; and
- Environmental Spill recovery (small amounts only; larger volumes taken away directly for disposal).

4.5.13 All Hazardous waste will be segregated by type and from other waste streams. All waste oil will be stored in a bunded facility until such times that it is collected. Used filters, rags and absorbents will be stowed in the hazardous waste container in drums or waste oil bags.

vi. Organic Matter

4.5.14 The waste wood and foliage material resulting from site clearance will be managed in-line with the Waste Hierarchy (as detailed within paragraph 4.5.6), thus helping to minimise potential environmental issues pertaining to this process.

4.5.15 Wherever feasible, the generation of tree and foliage waste will be prevented and these features will be retained in-situ. However, the retention of trees and foliage will not always be possible; therefore the reuse of material onsite will be explored wherever practicable, with wood material either reused in construction, or within landscaping aspects such as the use of wood chippings, or as mulch to enhance soil quality to aid the reinstatement of the Project Site.

4.5.16 Should this not prove to be a viable option for all generated material, then excess wood waste will be stored under cover, such as tarpaulin, to protect wood from the weather so that it may be re-used wherever possible off-site e.g. as carpentry material or offered to the local community for fire wood and biomass.

4.5.17 Attention will also be paid to the proximity principle, with local uses for waste materials considered where this represents the best practicable environmental option. For all material that cannot be re-used on- or off- site, or recycled, then elements of the wood and foliage material can be converted into wood-chip. By following this process, it will be possible to limit the volume of tree and foliage waste sent for disposal as far as practicably possible.

4.5.18 Any topsoil or subsoil generated will remain onsite to be reused for any landscaping.

vii. Transporting Waste

- Waste contractors will be checked periodically (bi-annually) to ensure they have valid licences; and
- All waste leaving the Project Site will be accompanied by a Waste Transfer Note (WTN) for non-hazardous waste or a Special Waste Consignment Note (SWCN) for hazardous waste. A copy of which will be retained for 2 (WTN) or 3 years (SWCN).

4.6 References

Ref. 4.1 BSI. (2009). BS 6031:2009 Code of Practice for Earthworks.

Ref. 4.2 HSE. (n.d.) Speed Limits. [Online]. Available: *http://www.hse.gov.uk/workplacetransport/factsheets/speed.htm* [Accessed 20/11/17].

Ref. 4.3 IAQM. (2012). Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites. [Online]. Available: *http://www.iaqm.co.uk/wp-content/uploads/guidance/monitoring_construction_sites_2012.pdf* [Accessed: 30/11/17]

Ref. 4.4 Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016. W.S.I. 206/359/W112.

Ref. 4.5 DEFRA. (2012). Process Guidance Note 3/01(12): Statutory Guidance for Blending, Packing, Loading, Unloading and Use of Cement. [Online]. Available: *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/573004/blending-packing-loading-unloading-and-use-of-cement-process-guidance-note-3-01_12_.pdf* [Accessed 21/11/17].

Ref. 4.6 Directive 2008/98/EC The Waste Framework Directive L312/3.

Ref. 4.7 The Environmental Permitting (England and Wales) Regulations 2016. S.I. 2016/1154. Environmental Protection, England and Wales.

Ref. 4.8 HSE. (n.d). Hazardous Waste. Available: *http://www.hse.gov.uk/waste/hazardouswaste.htm*. [Accessed 20/11/17].BSI. (2012). BS 5837. Trees in Relation to Design, Demolition and Construction – Recommendations.

Ref. 4.9 NRW, SEPA, NIEA and EA. (2015). Waste Classification. Guidance on the Classification and Assessment of Waste (1st Edition 2015). Technical Guidance WM3. [Online]. Available: *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf*The Waste (England and Wales) Regulations 2011. S.I. 2011/988. Environmental Protection, England and Wales. [Accessed 20/11/17].

Ref. 4.10 Welsh Government. (2012). Guidance on Applying the Waste Hierarchy. [Online]. Available: *http://gov.wales/docs/desh/publications/120119wastehierarchyguideen.pdf* [Accessed 01/12/17].

Ref. 4.11 DEFRA. (2016). Waste Duty of Care Code of Practice. [Online]. Available: *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/506917/waste-duty-care-code-practice-2016.pdf* [Accessed 01/12/17].

Appendix 2.3

Outline Landscape & Ecology Mitigation Strategy (LEMS)

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1. Introduction

1.1 Overview

1.1.1 This document describes the landscape and biodiversity impact mitigation measures that will be implemented prior to and during the construction phase of the Project, as well as the mitigation, management and monitoring measures to be implemented once the Project is operational.

1.1.2 This document should be read in conjunction with ES **Chapter 8: Ecology, Chapter 11: Landscape and Visual Assessment** and the Landscape and Ecology Mitigation Plan (LEMP) (ES Figure 3.6a-e). This strategy also refers to the following plans: Construction Environmental Management Plan (CEMP), Surface Water Management Plan (SWMP) and an Outline Lighting Strategy to demonstrate a holistic approach.

1.1.3 The proposed landscape and biodiversity mitigation measures are summarised below. These proposals have been designed to be delivered within the Project Site Boundary, as well as to retain where possible the existing planting within the Project Site Boundary. New habitat creation and landscaping have been accommodated, alongside the protection and enhancement of existing habitats where feasible.

1.1.4 The key measures proposed are:

- biodiversity mitigation by the provision of newly created replacement habitats;
- woodland structure planting within the Project Site Boundary to partially screen structures; and
- management of newly created replacement habitats.

1.1.5 The proposed landscape and ecological mitigation measures are illustrated in ES Figures 3.6a-e which graphically demonstrate the primary mitigation measures embedded into the project design as well as the new habitat creation. Combined with this document they outline the proposed mitigation measures for the Project in relation to landscape and ecology using a holistic and integrated approach, and have been produced to support the DCO Application.

1.1.6 The landscape and ecological mitigation measures described in this document will be subject to a 25 year management period running concurrently with the operational design lifetime of the Project. The execution of these works will be the responsibility of the operator of the Site. The planting operations in association with the Above Ground Installation (AGI) will be undertaken by National Grid.

1.2 The Purpose and Structure of this Document

1.2.1 The purpose of this document is to set out the proposed strategy to mitigate potentially adverse effects of the Project on the biodiversity features within the Project Site Boundary and on the landscape and visual resource. It provides a

clear landscape and ecological rationale, which responds to the Project Site and the assessments prepared in **ES Chapter 8: Ecology** and **Chapter 11: Landscape and Visual.**

1.2.2 The Project has been designed, as far as is practicable, to avoid or reduce effects on landscape and biodiversity features through design development and impact avoidance. Opportunities to secure net gains for landscape and biodiversity as a consequence of the Project have also been considered.

1.2.3 The document has been structured as follows:

- Baseline Conditions;
- Construction Mitigation;
- Landscape and Ecological mitigation proposals; and
- Management and Maintenance.

1.2.4 Outline species specific method statements are provided in Appendices A-G.

2. Baseline Conditions

2.1.1 The Project Site is located within a valley with ground rising to the north, east and west which provides visual containment. Ground levels vary across the Project Site from approximately 146 m Above Ordinance Datum (AOD) in the north-west corner to 80 m AOD along the southern perimeter. Ground levels generally fall in a southerly and south easterly direction.

2.1.2 The Project Site is predominantly covered with pasture which is currently used for sheep and horse grazing as well as a band of broadleaf woodland to the east. A soft surface horse training track, known as 'The Gallops', crosses the Project Site and runs diagonally north-west to south-east. Broadleaf woodland which is classified in part as Ancient Woodland lies to the east of the Project Site as well as around the Access Road to the Substation and Felindre Gas Compressor Station. Fields across the Project Site support a mix of improved grassland, semi-improved grassland (acid/neutral) and wet grassland (marshy grassland) which are subdivided by ditches, post and wire fencing, remnant hedgerows (forming rows of mature trees) and are interspersed with scrub vegetation. The habitats are heavily grazed and as such support a limited range of floristic species.

2.1.3 The western part of the Project Site encompasses part of the Substation, adjacent to the Felindre Gas Compressor Station. Both the Substation and the Felindre Gas Compressor Station comprise large scale power infrastructure facilities characterised by tall industrial structures enclosed by security fencing and set within woodland planting. Pylons are prominent across the landscape and converge at the Substation.

Generating Equipment Site

2.1.4 Pre-construction, the Generating Equipment Site is dominated by an area of marshy grassland surrounded by broadleaf woodland and semi-improved neutral

grassland. There are five ditches running through the centre of the Generating Equipment Site of which two pairs run parallel to each other and are wooded. Part of the broadleaf woodland and marshy grassland is designated as a Site of Importance for Nature Conservation (SINC) (Lletty-Morfil SINC), the boundary of which extends beyond the Project Site Boundary.

2.1.5 The construction of the Generating Equipment Site will require the creation of a temporary construction compound for the storage of materials, plant and equipment as well as containing site accommodation and welfare facilities, temporary car parking and temporary fencing (the Laydown Area). A small area within the Laydown Area will be retained permanently (the Maintenance Compound). The area is dominated by marshy grassland and a small area of improved grassland and semi-improved neutral grassland.

2.1.6 Habitats within the Generating Equipment Site are known to support or are suitable for supporting the following protected and priority species:

- Priority species of butterfly and moth;
- Common toad (priority species);
- Common lizard and grass snake (protected species);
- Breeding birds (protected species);
- Bats (protected species);
- Water vole (protected species);
- Otter (protected species);
- Brown hare (priority species); and,
- Badger (protected species).

2.1.7 The Generating Equipment Site also supports invasive non-native species (INNS) of plants – Japanese knotweed, Himalayan balsam and floating pennywort.

Access Road

2.1.8 The Access Road runs from the B4489, which lies to the west, to the Generating Equipment Site. The Access Road will be formed by upgrading an existing access road between the B4489 junction and the Substation and constructing a new section of Access Road from the Substation to the Generating Equipment Site.

2.1.9 Pre-construction, the Access Road comprises hard standing, improved grassland, semi-improved neutral grassland, row of trees and marshy grassland. The new section of Access Road crosses two watercourses, and has been rerouted to avoid an area of Ancient Woodland.

2.1.10 Habitats within the Access Road are known to support or are suitable for supporting the following protected and priority species:

- Common toad (priority species);
- Common lizard and grass snake (protected species);
- Breeding birds (protected species);

- Bats (protected species);
- Otter (protected species);
- Brown hare (priority species); and,
- Badger (protected species).

2.1.11 The Access Road also supports INNS plants, namely Japanese knotweed.

Electrical Connection

2.1.12 The Electrical Connection is an underground electrical cable to export power from the Generating Equipment to the National Grid Electricity Transmission System (NETS). For the first 160 m (approx.) the route runs from the NETS through an area of semi-improved neutral grassland, a ditch and row of trees, after which it runs alongside the Access Road.

Gas Connection

2.1.13 The Gas Connection will be in the form of a new AGI and underground Gas Pipeline. This is to bring natural gas to the Generating Equipment from the National Gas Transmission System. The Gas Pipeline will follow an approximate north-south route corridor, between the National Gas Transmission System south of Rhyd-y-pandy Road and the Generating Equipment Site.

2.1.14 The Gas Connection is dominated by improved grassland, with boundary features including one hedgerow, two rows of trees and post and wire fences.

2.1.15 Habitats within the Gas Connection are known to support or are suitable for supporting the following protected and priority species:

- Priority species of butterfly and moth;
- Common toad (priority species);
- Common lizard and grass snake (protected species);
- Breeding birds (protected species);
- Bats (protected species);
- Otter (protected species);
- Brown hare (priority species); and,
- Badger (protected species).

2.1.16 The Gas Connection also supports INNS plants.

3. Construction Mitigation

3.1 Landscape Working Methods

3.1.1 Mitigation measures will be implemented during the construction in order to limit impacts on the landscape and visual resource. These are summarised below:

- Land and vegetation clearance and occupation will be limited to the minimum area necessary for the works;

- Good housekeeping measures will minimise unsightly waste and secure storage will be provided for materials at risk from displacement by wind;
- Temporary stockpiles will be located in defined storage areas, away from sensitive visual receptors;
- No advertisements or fly posting will be permitted on any fence and all graffiti will be removed and made good as soon as reasonably practicable;
- All boundary fences will be maintained in a neat and tidy condition;
- Any temporary fencing will be removed as soon as reasonably practicable after completion of the works; and
- Temporary lighting will be selected and sited so as to minimise visual intrusion to residents, whilst maintaining the safe and efficient operation of the work site. At night and during periods of darkness, directional security lighting will be used where required.

3.1.2 The following good practice measures will be adopted and implemented for the protection of trees retained onsite:

- A Root Protection Area (RPA) will be set up around trees to be retained onsite prior to commencement of construction;
- The RPA will be demarcated by 'Netlon' fluorescent mesh fencing or similar physical barrier. The protective fencing will be maintained for the duration of the construction phase and checked on a regular basis;
- In the event that an RPA cannot be maintained at 12 times the diameter at breast height (DBH) mitigation such as bog matting, flotation tyres and hand digging will be utilised;
- No machinery or material will be stored within the RPA;
- To ensure retained trees do not become hazardous, the condition of trees will be checked by the Environmental Manager or Ecological Clerk of Works (ECoW) at an appropriate frequency and following storm events where there may be damage from wind throw;
- Where a tree is damaged or diseased advice will be sought from an Arboriculturalist (unless the ECoW is appropriately qualified) for appropriate treatment measures;
- Where hazardous branches or trees require to be felled this will be done by a qualified tree surgeon in line with BS 3998: 2010;
- Before felling trees, surveys for potential bird nest or bat roosts will be undertaken by the ECoW; and

4. Landscape and Ecological Mitigation Proposals

4.1 Overview

4.1.1 The primary focus of the landscape and ecology mitigation is habitat creation and landscape planting which will be accommodated within the Project Site Boundary alongside the protection and enhancement of existing habitats. It is anticipated that existing planting within the Project Site would be retained and protected where

possible. ES Figure 3.6 identifies the woodland and trees to be retained and the areas of new habitat and planting.

4.1.2 The overall construction working methods to be implemented during the construction phase are outlined in the outline CEMP (Appendix 3.1), outline SWMP (Appendix 3.2) and Outline Lighting Strategy (Appendix 3.5) and are secured via corresponding Requirements in schedule 2 of the DCO (Document Reference 3.1). Therefore these are not repeated here but are referred to where necessary for completeness.

4.2 Habitats and Protection

4.2.1 Existing habitats will be retained where possible. Where this is not possible those habitats removed with conservation value will be compensated for through the provision of newly created habitats or enhancement of existing habitats. Mitigation to help avoid injury or killing of protected and priority species will be implemented.

4.2.2 Newly created habitats will be designed to be of value to those protected and priority species known to be present within the Project Site Boundary.

4.2.3 Lighting has been designed to limit the effects on wildlife (refer to outline Lighting Strategy (Appendix 3.5).

4.3 Habitat Replacement

4.3.1 The total area of habitat with conservation value (i.e. not improved grassland or hard standing) permanently removed during construction is estimated to be 2.9 ha. An area of land approximately 3 ha in size within the Project Site boundary has been identified as suitable for habitat enhancement and will mitigate for the loss of habitats including a proportion of Lletty-Morfil SINC. The habitat enhancement measures will also provide valuable habitats for a range of species including invertebrates, amphibians, reptiles, breeding and foraging birds, brown hare and badger, commuting and foraging bats and, once trees mature, roosting bats. This area is known as the Ecological Mitigation Area and will be implemented by the end of construction (ES Figure 3.6c).

4.3.2 During construction there will be no night time illumination of hedgerows, woodland or mature tree lines. Operational external lighting has been designed to reduce trespass and configured to avoid glare and spillage, and otherwise in accordance with the Outline Lighting Strategy undertaken in accordance with the Institution of Lighting Professionals guidelines. The strategy will seek to limit effects of lighting on habitats (and therefore species) adjacent to the Project Site. During the hours of darkness, only critical light sources will remain in operation,

4.3.3 The sensitivity of the infrared motion detectors will be set so as not to be activated by the movement of large mammals such as badgers and otters. The lighting strategy will ensure that all lighting columns will be fitted with cowls to reduce light spill and will be directed away from boundary features. A ‘dark corridor’ (as shown

in ES Figure 3.6) has been designed to keep lighting to no more than 1 lux along adjacent woodland edges and watercourses that are likely to be used by nocturnal species such as bats, badgers, water vole and otters. The Gas Connection and Electrical Connection will not be lit.

4.4 Tree Management and Root Protection

4.4.1 The following good practice measures will be adopted and implemented as part of this Strategy for the protection of trees retained onsite, including Ancient Woodland:

- A Root Protection Area (RPA) will be set up around trees to be retained onsite prior to commencement of construction;
- The RPA will be demarcated by 'Netlon' fluorescent mesh fencing or similar physical barrier. The protective fencing will be maintained for the duration of the construction phase and checked on a regular basis;
- In the event that an RPA cannot be maintained at 12 times the diameter at breast height (DBH) mitigation such as bog matting, flotation tyres and hand digging will be utilised;
- No machinery or material will be stored within the RPA;
- To ensure retained trees do not become hazardous, the condition of trees will be checked by the Environmental Manager or Ecological Clerk of Works (ECoW) at an appropriate frequency and following storm events where there may be damage from wind throw;
- Where a tree is damaged or diseased advice will be sought from an Arboriculturalist (unless the ECoW is appropriately qualified) for appropriate treatment measures;
- Where hazardous branches or trees require to be felled this will be done by a qualified tree surgeon in line with BS 3998: 2010;
- Before felling trees, surveys for potential bird nest or bat roosts will be undertaken by the ECoW; and
- The waste hierarchy will be applied to vegetation and biomass arisings and alternate onsite uses will be sought before disposal is considered.

4.5 Species-Specific Measures

4.5.1 Measures have been specified to help avoid injury or killing of protected and priority species, and control the spread of INNS plants and have been incorporated into the management strategy. These are outlined in Appendices A-G.

- Reptile (Appendix A);
- Breeding Birds (Appendix B);
- Bats (Appendix C);
- Otter and Water Vole (Appendix D);
- Badger (Appendix E);
- Invasive Non-Native Species (Appendix F); and
- Hedgerows (Appendix G).

4.6 Planting Proposals

i. Overview

4.6.1 A palette of native tree and shrub planting has been compiled to meet the various planting proposals identified below. The function of the planting is primarily to help integrate the various components of the Project into the local landscape and views whilst providing biodiversity value by enhancing existing habitats and creating new habitats.

ii. Woodland Planting

4.6.2 Woodland structure planting is proposed adjacent to the Generating Equipment Site to assist in screening lower level structures from view and to assist in integrating the Project Site within the immediate landscape (refer to ES Figure 3.6c). Woodland planting is also proposed along the western edge of the Ecological Mitigation Area (refer to ES Figure 3.6c).

4.6.3 The western edge of the Ecological Mitigation Area will be planted with a row of trees native to the local area. The trees will be allowed to mature and will create a linkage between a row of trees in the north and the watercourse in the south (Afon Llan). A mixture of standards and feathered will be used. This area compensates for the loss of the woodland habitat within Lletty-Morfil SINC.

4.6.4 Indicative typical species will include the following:

- *Betula pendula* (silver birch);
- *Betula pubescens* (downy birch);
- *Quercus robur* (pedunculate oak);
- *Salix alba* (white willow);
- *Alnus glutinosa* (Alder)
- *Ilex aquifolium* (holly); and
- *Corylus avellana* (hazel).

iii. Woodland Edge Scrub Planting

4.6.5 The Woodland Planting above will grade into an area of scrub habitat within the Ecological Mitigation Area refer to ES Figure 3.6c). Species will comprise those native to the local area and include species capable of thriving in a wetter environment. The scrub will be allowed to mature and be managed to have a scalloped edge. This area compensates for the loss of the scrub habitat.

4.6.6 Indicative typical species will include the following:

- *Crataegus monogyna* (hawthorn);
- *Prunus spinosa* (blackthorn) and,
- *Sorbus aucuparia* (rowan); and,
- *Eupatorium cannabinum* (hemp agrimony; and
- *Filipendula ulmaria* (meadowsweet).

4.6.7 It is anticipated that willow species and bramble will develop naturally and will not require planting.

iv. Hedgerow and Hedgerow Trees

4.6.8 Hedgerow and hedgerow tree planting is proposed along the Access Road (refer to ES Figure 3.6e) and to the west of the AGI as well as to reinstate any hedgerow planting removed during construction of the Gas Connection (refer to ES Figure 3.6d).

4.6.9 Mixed hedgerow and tree planting will provide vegetation structure and commuting corridors for bats as well as integrating the new Access Road into the immediate landscape structure. Reinstatement hedgerow planting is also proposed along the Gas Connection corridor where hedgerows are removed and also to the west of the AGI along an existing field boundary to provide partial screening of the AGI and local landscape enhancement, providing continuity of hedgerow boundary planting.

4.6.10 Indicative typical species will include the *following*:

- *Acer campestre* (field maple) *Corylus avellana* (hazel);
- *Crataegus monogyna* (hawthorn);
- *Rosa canina* (dog rose);
- *Viburnum opulu*s (guelder rose);
- *Prunus spinosa* (blackthorn);
- *Sorbus aucuparia* (rowan);
- *Ilex aquifolium* (holly); and,
- *Lonicera periclymenum* (honeysuckle)

v. Wet Meadow and Acid Grassland

4.6.11 Wet meadow and acid grassland is proposed to the south of the Generating Equipment Site within the Ecological Mitigation Area (refer to **ES Figure 3.6c**).

4.6.12 The Woodland Edge Planting will grade into a mosaic of marshy grassland and acid grassland within the . Ecological Mitigation Area. The area currently supports degraded versions of these habitat types, and a relaxation of the grazing regime (grazed less intensively) and therefore reduction in nutrient inputs will allow a greater botanical species diversity to develop without the need for seeding or plant plugs. The enhancements in this area compensate for the loss of the marshy grassland habitat within Lletty-Morfil SINC within the Generating Equipment Site.

vi. Wetland Habitat and New Drainage Routes

4.6.13 Two new ponds will be created within the Wet Meadow and Acid Grassland of the Ecological Mitigation Area to the south of the Generating Equipment Site. The ponds will be at least 2 m x 2 m and have shallow sides to allow animals to enter/exit the pond freely and should taper to a depth of at least 0.5 m in the centre. The pond will be planted with native plant species and will not be stocked with fish.

This will give native amphibians and invertebrates the best chance of colonising the pond. The creation of two ponds for wildlife compensates for the loss of the ponds within the Project Site.

4.6.14 Within the Generating Equipment Site (ES Figure 3.6c), adjacent to the Access Road (ES Figure 3.6c) and AGI (ES Figure 3.6d) the attenuation ponds will be planted with emergent native wetland species and where possible maintained as wetland features.

4.6.15 New ditches and rerouted ditches (Generating Equipment Site – ES Figure 3.6b) will be planted with emergent native wetland species and where possible maintained as wetland features.

4.6.16 Typical species will be determined at detailed design stage, as the species proposed will likely differ between waterbodies, depending on the aspect of the waterbody, substrate, the profile of the water body and potential water depth.

4.7 Management and Maintenance

vii. Management Aims

4.7.1 This section sets out the management and maintenance objectives for the protection and enhancement of the landscape and biodiversity fabric of the Project Site. A detailed landscape management and maintenance plan will be developed alongside the detailed landscape and ecological design. The maintenance and management plan will cover a 25 year period covering the operational design lifetime of the Project. Within the first five years after planting, all plants found to be dead or dying will be replaced within the first available planting season.

4.7.2 In general terms the landscape and ecological management aims for the Project Site are to:

- Secure the long-term future of the landscape;
- Enhance local landscape character;
- Integrate the Site into the surrounding landscape and local views;
- Retain and manage existing woodland/hedgerow and scrub planting and provide additional supplementary planting to provide links for wildlife across the site;
- Create, maintain and enhance habitats of value to wildlife to provide benefits for the local environment and biodiversity;
- Create marshy habitats in conjunction with the attenuation areas for amphibians and aquatic invertebrates; and,
- Establish a flexible management and maintenance regime able to respond to changing needs or objectives.

i. New Tree and Shrub Planting

4.7.3 Tree and shrub planting shall be subject to routine maintenance operations that include pruning, litter picking, prevention of weeds and invasive species. The maintenance regime will seek to:

- To create and maintain a vegetation structure, horticultural interest and to partially screen the built structures and movement within the Project Site; and
- To extend and enhance habitat diversity in a variety of different areas, including corridors for commuter bats.

ii. Management Aims – Grassland

4.7.4 Both wet meadow grassland and acid grassland areas will be subject to a similar maintenance regime. Both areas shall ensure a healthy sward of native wildflowers and grasses which will increase biodiversity as well as create visual interest. The maintenance regime will seek to:

- Maintain the quality and integrity of the ditches, such that they are free of litter, tree roots and invasive species;
- To establish and maintain species-rich swards of wet meadow and species rich swards, including wildflowers that support invertebrate larvae and flowers that attract pollinating bees, butterflies, moths and other invertebrates; and
- Sward management to ensure the sward is longest in the summer and shorter in the spring and autumn will allow flowering species to set seed and germinate.

4.8 Roles and Responsibilities

4.8.1 Roles and responsibilities for implementation of the landscape and ecological mitigation measures during the construction phase are identified in the outline CEMP (Appendix 3.1).

4.8.2 Management of habitat enhancement measures during the operational phase will be secured via landowner agreements. . [APL is currently investigating securing the involvement of the current landowners in the management of ecological areas including via grazing and management agreements].

4.9 Reinstatement

4.9.1 Reinstatement of temporary construction areas and working widths will be undertaken as soon as reasonably practical once construction has ceased. Prompt implementation of reinstatement and restoration measures aim to reduce the effects of:

- Compaction of subsoil, which can lead to inhibited drainage and root growth;
- Exposed ground, which can cause loss of topsoil, dust and water pollution through wind blow and erosion; and
- Visual intrusion.

4.9.2 Planned reinstatement at the Project Site includes the following considerations and measures:

- Land reinstatement should normally take place in the autumn following the construction phase. The length of the Gas Pipeline route will be reinstated to its original condition and returned to its previous use;
- Where compaction may have occurred a 'sub-soiler', which lifts and shatters the subsoil will be used before the topsoil is reinstated;
- Topsoil that has been stored in the Laydown Area will be spread and levelled across the width of the strip, using hydraulic excavators or bulldozers. In areas where stones have been brought to the surface, stone picking will be carried out mechanically;
- The finish in which the soil is left will be agreed with the relevant land occupier. Land to be reinstated as grassland will either be reseeded in the autumn or the following spring. Reptile fences will remain in place until the grass crop is established;
- Temporary construction fences will be removed once agreement has been reached with the landowners that the land over which temporary possession powers have been exercised has been reinstated and can be handed back to the landowner, and no later than three months from completion of construction and
- Hedgerows will be reinstated in the first planting season following the completion of construction and land reinstatement work.

4.9.3 The following general reinstatement good practice measures that will be adopted:

- Reinstatement will be carried out as soon as possible following any vegetation stripping to ensure integrity is maintained;
- The reinstatement of the construction areas will be undertaken to the standard to be agreed with CCS, using the existing soil and vegetation wherever possible;
- Stripped soil will be reinstated as close to where it was removed as possible;
- Subsoil, topsoil and turf will be replaced in the same order as removed;
- Restoration works will be carried out in suitable weather conditions noting that wet ground conditions can be difficult, as can hot, dry and windy spells; and
- Natural regeneration of habitats will be promoted in all appropriate areas as advised by the Environmental Manager or ECoW.

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Appendix A Reptiles

1. These measures will be applicable to the following Project components:

   - Generating Equipment Site;
   - Access Road;
   - Electrical Connection; and
   - Gas Connection.

2. The risk of reptiles and the mitigation measures discussed below will be included in the site induction package and prior to any site clearance and construction tasks.

3. The trapping and translocation programme has been designed following the guidance set out in Herpetofauna Groups of Britain and Ireland 1998 publication (HGBI, 1998).

4. Due to the 'Good' population of common lizard and the presence of low numbers of grass snakes within the survey area a trapping and translocation programme will be undertaken to help protect any reptiles from being injured or killed. Due to the presence of suitable habitat for adder, the programme includes measures for this species. The actions involved in the proposed trapping and translocation are detailed below.

   Fencing

5. Any construction areas suitable or known to support reptiles, including any routes in and out, areas for site compounds, offices or storage of materials/waste, will be fenced off using suitable fencing to limit reptiles attempting to enter the site from the adjacent land.

6. Fencing should remain in situ for the duration of construction to help limit the re-colonisation of the Project Site by reptiles. Depending on the construction duration it may be suitable to use recycled HDPE plastic semi-permanent, rigid reptile fencing with a 50 mm return folded and welded into the top edge forming an overlap to comply with EN guidelines and 100 mm underground return. It provides a reptile barrier that is highly resistant to vandalism and general site damage. Drift fencing can be used for construction duration lasting 18 months or less.

7. Fencing will be installed by a suitable contractor under the supervision of an ecologist. Contractors will be given a toolbox talk prior to works commencing, and advised on the identification of reptiles, what reptiles were expected on site, the legal protection afforded by reptiles, and how to safely move reptiles to avoid injury or killing.

8. Any areas subject to machines tracking over or repeated foot traffic, as well as the route of the fence line, will be hand searched by an ecologist for the presence of reptiles. Reptiles encountered will be captured by hand and moved out of the way into suitable habitat (see 'Translocation Area' below). The routes will then be mown

to a height of less than 150 mm and maintained as such for the duration of the fencing installation.

9. No vehicles, machinery or materials will be stored in areas suitable for supporting reptiles without first being checked by an ecologist; preference will be given to those areas not suitable for supporting reptiles.

10. No construction activities, including pedestrian access will be allowed outside of the fenced areas in habitat suitable for supporting reptiles.

Trapping and Translocation

11. Artificial refugia comprising approximately 1 m x 0.5 m square sheets of heavy-duty mineral roofing felt, corrugated iron and carpet tiles will be placed at a density of 50/ha in suitable habitat within the fenced area to attract reptiles.

12. The refugia will be left to 'bed-in' and will remain undisturbed for a period of at least fourteen days. After the 'bedding-in' period, each day, up to twice a day for a minimum of 60 days, an ecologist will check the refugia for the presence of reptiles. Any reptiles or amphibians found will be captured for relocation into suitable habitat outside of the fenced areas. After 60 days, the trapping can cease once there have been five consecutive days where no reptiles have been found.

13. After the fenced area has been cleared of reptiles and prior to soil stripping the vegetation can undergo a process of habitat management and hand searches for reptiles. Supervision of the soil strip during construction work by a suitably qualified ecologist will be required to help protect injury or killing of reptiles.

14. Any litter or rubble piles will be removed by hand under the supervision of an ecologist to avoid injuring or killing any reptiles. If the material is too heavy to be removed by hand it will be done so using a mini excavator carefully and slowly removing the material, under the supervision of an ecologist.

15. Any amphibians captured during the reptile trapping programme will be moved to a suitable location within the Project Site Boundary.

Translocation Area

16. During the reptile survey, very few numbers of reptiles were found within the footprint of the Project; the majority of reptiles were found along the Gallops. Due to the relatively low numbers of reptiles likely to be present within the fenced area it is considered appropriate to move any captured reptiles to the areas of habitat suitable for supporting reptiles that are to be retained outside of the fenced area.

Habitat Manipulation and Destructive Search

17. Once capture rates decrease significantly habitat manipulation will be used to enhance the process. This involves reducing the amount of suitable vegetation cover by strimming the vegetation between the refugia mats (leaving a 10cm buffer around the edge of each refugia mat) to a height of no less than 100mm, after 48

hours the cut will be repeated to ground level, concentrating the remaining reptiles to the retained vegetation and refugia. Naturally occurring refugia (stones, rocks, litter etc) will be hand searched by and ecologist before being removed and located within the receptor area. After which the final remaining areas of vegetation and refugia will be cut to ground level and removed following a final check for reptiles by an ecologist; any reptiles found will be removed and located within the receptor area.

18. Contractors will be given a toolbox talk prior to habitat manipulation works commencing, and will be advised on the identification of reptiles, what reptiles are expected on site, the legal protection afforded by reptiles, and how to safely move reptiles to avoid injury or killing. Any that reptiles identified during the strimming works will be moved by hand into suitable habitat outside of the fenced area. An ecologist will provide ecological support and advice during the works.

Timing

19. A method statement detailing the location and specification of fencing, timing and methodology for the management of reptiles will be submitted to CCS (in conjunction with NRW) for approval.

Appendix B Breeding Birds

1. These measures will be applicable to the following Project components:

   - Generating Equipment Site;
   - Access Road;
   - Electrical Connection; and
   - Gas Connection.

2. To avoid destruction of active bird nests or eggs, vegetation clearance works should be undertaken between September – February inclusive. Should works be required from 1 March – end August then an ecologist should inspect the area to be cleared no more than 48 hours prior to works. Should any active nests be found, works will have to halt in this area until the chicks have fledged and no longer return to the nest, which can take up to eight weeks. Should a nest be found a species-specific buffer should be implemented.

Appendix C Bats

1. These measures will be applicable to the following Project components:

   - Generating Equipment Site;
   - Access Road;
   - Electrical Connection; and
   - Gas Connection.

   Roosting Bats

2. Pre-construction checks will be undertaken on trees and any hedgerows prior to their removal for their current suitability for supporting roosting bats.

3. Checks will be undertaken to allow time for any follow up (emergence and re-entry) surveys to be undertaken and an application for a European Protected Species License (EPSL) should any works require a confirmed roost to be destroyed.

4. The survey results will be used to inform any further mitigation to seek to avoid impacts on roosting bats.

   Commuting and Foraging Bats

5. New planting will include wooded linear features to create new commuting and foraging routes linking existing rows of trees to the Afon Llan.

6. To allow bats to continue to use commuting and foraging routes during construction, the connectivity of tree lines and hedgerows along the Gas Connection, Access Road and Electrical Connection routes will be maintained utilising ‘brown hedgerows’ of brash. At least one hour before sunset key linear features as identified in ES Figure 3.6e will be reinstated utilising brash.

   Access Road

7. To maintain connectivity post-construction, replacement planting of trees removed to facilitate the construction of the Access Road (including the new section of Access Road) should be undertaken. Using standards of the same species as those trees removed, trees will be planted along the existing boundary tree lines up to the edge of the Access Road. Over time the canopies will grow closer together thereby creating a linear feature than can be used by bats to cross the new section of Access Road.

Appendix D Otter and Water Vole

1. These measures will be applicable to the following Project components:

    - Generating Equipment Site;
    - Access Road; and
    - Electrical Connection.

Water Vole

2. A pre-construction check for water vole burrows and activity will be undertaken where construction is present within 100 m of watercourses identified as suitable for supporting the species during the 2017 field surveys, as identified in ES Appendix 8.10 Figure 1.

3. Should the pre-construction check return a negative result, habitat management will be undertaken to help reduce the quality of the habitats for burrow creation in the period leading up to, and for the duration of construction in that area.

4. Should water vole be confirmed as present on watercourses within 100 m of construction works during the pre-construction check, a Water Vole Conservation License from Natural Resources Wales (NRW) may be required to allow works to proceed and additional mitigation may be required.

Otter

5.1.1 A pre-construction check for otter holts/couches and activity will be undertaken where construction is present within 100 m of watercourses identified as suitable for supporting the species during the 2017 field surveys, as identified in ES Appendix 8.10 Figure 1. A pre-construction check for otter holts/couches and activity will be undertaken where construction is present within 100 m of watercourses identified as suitable for supporting the species during the 2017 field surveys, as identified in ES Appendix 8.10 Figure 1.

5.1.2 Should the pre-construction check return a negative result, habitat management will be undertaken to help reduce the quality of the habitats for holt/couch creation for the period leading up to, and for the duration of construction in that area. Should otter be confirmed as present on watercourses within 100 m of construction works during the pre-construction check, a European Protected Species License from NRW may be required to allow works to proceed and additional mitigation may be required.

Appendix E Badger

1. These measures will be applicable to the following Project components:

   - Generating Equipment Site;
   - Access Road;
   - Electrical Connection; and
   - Gas Connection.

2. A pre-construction check for badger setts and activity will be undertaken where construction is present within 30 m of habitats identified as suitable for supporting the sett creation.

3. Should badger setts be confirmed as present in habitat within 30 m of construction works during the pre-construction check, a licence from Natural Resources Wales (NRW) may be required to for the temporary/permanent closure of the sett to allow works to proceed, and additional mitigation may be required.

Appendix F Invasive Non Native Species

1. These measures will be applicable to the following Project components:

   - Generating Equipment Site;
   - Access Road;
   - Electrical Connection; and
   - Gas Connection.

2. An updated INNS survey (Invasive Species Assessment – ISA) will be undertaken to accurately assess INNS and extents within the Project Site boundary prior to the implementation of control measures and a site specific Invasive Non Native Species Protocol will be produced that elaborates on the outline recommendations provided below.

3. Many remediation options are available for the management of invasive species. All control options will be considered to identify appropriate management actions relevant in the context of controlling Schedule 9 species on land impacted by the proposed works.

4. The optimal control measures for the proposed works will involve a combination of biosecurity precautions (i.e. good site hygiene) and mechanical and/or chemical treatment.

   Biosecurity Precautions

5. At a minimum, the following biosecurity measures will be implemented when working within the Project Site:

   - All appropriate staff members will be made aware of the locations of INNS and will be informed of the necessary precautions required to prevent spread. This will include informing personnel who might come into contact with any of the species of the requirements to prevent spread (e.g. during vegetation clearance, and vegetation management).
   - A toolbox talk will be provided by a suitably qualified Ecological Clerk of Works (ECoW) at the onset of works, providing details on identification and the required biosecurity precautions. An ECoW will be present during all works to help implement biosecurity measures.
   - Clearance works should avoid the period when Himalayan balsam has ripe seeds. When seeds ripen is dependent on the weather that year, but typically the period is from July until the end of October.
   - Vegetation clearance works will be undertaken methodically; commencing in areas with no presence of INNS, then working through areas with increasing levels of infestation. This will help prevent works spreading seeds and contaminated soils to areas onsite that are not currently infested.
   - Clearance works will avoid the area with INNS if the infestation is outside the treatment area or until treatment on the species has been completed. Before any treatment commences, if there is risk of vehicular or pedestrian incursion

into the area where INNS are growing then the plant stems will be fenced with temporary orange mesh fencing. Default stand-off distances are provided below. It may be possible to reduce these distances following the ISA, based on the data collected.

- Vehicular and people movements will be restricted to specific routes within the Project Site thereby helping to limit the spread of seeds and contaminated soils around Site.
- Cleaning stations will be set up at designated entry/exit points to demarcated areas. A jet wash should be available for vehicles and brushes and buckets of water should be available for clothing and equipment.
- No plant, equipment or personnel should leave a demarcated area without ensuring that all mud and/or plant material has been removed from vehicles, equipment and clothing/footwear.
- Any soil within demarcated areas will be considered to potentially contain INNS material (seeds etc.). When soils potentially containing viable INNS material seeds are taken off Site, such soils are classified as controlled waste and there is a duty of care for their proper disposal, i.e. the soil must be transported by an appropriately licensed carrier and disposed of at an appropriately licensed waste disposal facility.
- Personnel will be reminded of biosecurity requirements at the start of each work day and should be updated on any changes to management plans, i.e. information on the locations of any newly identified stands.
- Following the ISA, where additional biosecurity hazards are identified, they will be incorporated into the Invasive and Non Native Species Protocol.

Control

6. Potential control measures have been provided for each species identified within the Project Site Boundary below. Following the ISA a single actionable option will be specified for each stand, based on the recommendations below, in combination with a review of site development plans and activities.

Himalayan Balsam

7. Away from watercourses, depending on development plans, stands within working areas or stands within 6 m of a working area will be controlled by a combination of:

- Herbicide treatment (potentially followed by hand removal once the quantity of plants has been reduced):
- excavation and (i) burial or (ii) offsite disposal; and
- raising the soil profile above existing stands, thus preventing future growth

8. Any herbicide treatments will use appropriate herbicide, which will be applied by an appropriately qualified contractor.

9. Seeds from Himalayan balsam typically remain viable for 18 months in soil. Follow-up monitoring of the treated stands will confirm treatment has been successful when no new seeds have germinated; after which the soil is considered inert

(assuming no other contaminates are present). Typical treatment periods are for 2 years of control action followed by at least a 1 year monitoring period. Herbicide should be applied three times in the year.

10. Where excavation is required, the recommended excavation area is 6 m radius to a 30 cm depth, although through the commissioning of soil core analysis it may be possible to reduce the depth at which soil needs to be removed. The excavated material will need to be disposed of as controlled waste or buried within the Project Site.

11. Where the soil profile is raised, 30 cm soil is sufficient to prevent regrowth.

12. Where Himalayan balsam is growing next to a watercourse control will not be effective in the long term, since new seeds will travel from further up the catchment (where Himalayan balsam is abundant) and re-colonise the area. In such areas, management will focus on containment (i.e. implementation of biosecurity protocols).

Japanese Knotweed

13. In areas where there is a risk of spreading Japanese knotweed (stands within 7 m of access routes and storage compounds – following the ISA and through risk assessment is may be possible to reduce this distance to 4 m), the stands will be managed appropriately. A single actionable option for each stand will be determined for each stand with takes account of development plans. Options include:

- Herbicide treatment;
- Rhizome fragmentation and cultivation (e.g. soil rotation) to stimulate growth and reduce herbicide treatment time requirements;
- excavation and (i) stockpiling, (ii) burial or (ii) offsite disposal; and
- raising the soil profile above existing stands, thus preventing future growth.

14. Any soil containing Japanese knotweed material will be removed from the Project Site following the appropriate duty of care, or buried within the Project Site.

15. To reduce the risk of spread and future growth, a herbicide treatment programme will commence as far in advance of construction works as is practical. Typical treatment periods are for 3 years followed by a 2 year monitoring period. However, mature stands can take significantly longer to successfully treat. The presence of mature stands will be identified as part of the ISA. Herbicide should be applied once in the year.

16. Where herbicide treatment is used in isolation there is a risk that dormant but viable rhizomatous material remains underground after treatment appears successful above ground, and as such the soil in such areas should not be disturbed and if it is subsequently removed, it remains classified as controlled waste moving forward.

17. Where the soil profile is to be raised above Japanese knotweed, the plants should first be treated with herbicide in advance for as long as possible. Depending of

maturity and time scales, it may be beneficial to lay a geomembrane in the area prior to raising the soil level.

Floating Pennywort

18. There is one pond recorded as supporting floating pennywort in 2014. The pond is under the footprint of the proposed Power Generation Plant and is not hydrologically connected to any other waterbodies or watercourses. As such, the pond can be infilled with inert soil and then built on. No material or water will be removed from the pond.

Rhododendron and Montbretia

19. The ISA will be used to confirm locations and extents.

20. Montbretia is located on the edge of the Access Road, and should be treated by herbicide at the same time as the other species. The corms react well to herbicide treatment, and since the plant does not produce viable seed, this course of action will be effective at controlling the plant.

21. Rhododendron is present within the woodland which is not being disturbed during the construction of the Project. As such, there is no risk of causing the spread of rhododendron as the seeds produced by rhododendron will not establish in the disturbed soils of a development site (such seeds require very specific conditions to germinate AND establish).

Appendix G Hedgerows

1. These measures will be applicable to the following Project components:

   - Access Road;
   - Electrical Connection; and
   - Gas Connection.

2. To allow bats to continue to use commuting and foraging routes during construction, the connectivity of tree lines and hedgerows along the Gas Connection, Access Road and Electrical Connection routes will be maintained utilising ‘brown hedgerows’ of brash. At least one hour before sunset key linear features as identified in ES Figure 3.6 will be reinstated utilising brash.

3. On completion of construction works the hedgerow gaps will be reinstated by planting species typical of the hedgerow as whips of four per metre in a double staggered row. Shrubs will be bare rooted and comprise 1.5 m size class. Spiral guards will be used to help prevent damage from rabbits. Some brash can be left in situ to help maintain the linear feature whilst the whips are establishing.

4. In the two winters following planting, any dead shrubs should be replaced with the same species mix as the original planted.

5. The grass around the base of the trees/shrubs (0.5 m diameter) should be killed at least once annually using an approved non residual herbicide for three years following planting.

6. Additional hedgerow planting is covered in Planting Proposals Section 4.6.

Appendix 2.4

Outline Surface Water Management Plan

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1. Outline Surface Water Management Plan

1.1 Introduction

1.1.1 The objective of the Surface Water Management Plan (STMP) is to detail the water management principles and procedures to be implemented throughout the construction period of the Abergelli Power Project (the 'Project'). The SWMP is designed to ensure compliance with surface water protection legislative requirements, Environmental Statement (ES) commitments and environmental permits conditions during construction.

1.1.2 This Outline SWMP has been developed by the applicant, Abergelli Power Limited (APL), and will be adopted and implemented by the main contractor upon appointment. It will be the responsibility of APL to ensure the Project is executed in a manner that demonstrates commitment to the care and protection of the aquatic environment.

1.1.3 After appointment of the main contractor, this Outline SWMP will be reviewed to include any additional requirements of the main contractor's own environmental policies. The measures and procedures set out in the SWMP will feed-in to the detailed design process and the development of Construction Method Statements (CMS). This will include the selection and design of surface water drainage for the construction phase. The CMS will be submitted to the City and County of Swansea Council (CCS) and Natural Resource Wales (NRW) for approval as part of applications for temporary works environmental permits. On approval of the CMS, the SWMP will then be updated to include the finalised details for the construction surface water drainage.

1.1.4 The SWMP will be a 'live' document, which will be kept under continuous review by the main contractor. This is to take into account any additional environmental information obtained during the detailed design and construction phases, changes in legislation, policy and best practice, and any lessons learned on the Project. It will also allow for the inclusion of any further conditions and amendments that arise from the granting of any temporary works environmental permits, a review of environmental monitoring results or the legitimate concerns of Third Parties.

1.1.5 In implementing this plan, the main contractor will ensure that the measures and procedures are followed in accordance with the Outline Construction Environment Management Plan (CEMP) (Appendix 3.1).

1.2 Project Site Surface Water Features

1.2.1 The Project Site lies within the Afon Llan River catchment. The Afon Llan flows in a south-westerly direction past the southern boundary of the Project Site and links with the Afon Lliw and the River Loughor, before discharging into Carmarthen Bay.

1.2.2 Within the Project Site itself, there are a number of small drainage ditches and land drains, as well as springs and spring-drainage rivulets that drain into the Afon Llan. There are two heavily vegetated ponds located within the Generating Equipment Site. These are of unverified extent owing to vegetation cover but are thought to have a radius of approximately 5 m.

1.3 Guidance

1.3.1 Guidance relevant to this plan includes:

- The BS '*Code of Practice for Earthworks*' BS 6031:2009 (Ref 1.1);
- The BS '*Code of Practice for Foundations*' BS 8004:2015 (Ref 1.2);
- National Grid (NG) Technical Specification (TS) 2.20 '*Oil Containment at Electricity Substations and Other Operational Sites'* (Ref 1.3);
- C753: '*The SUDS [Sustainable Urban Drainage] Manual'* (Ref 1.4);
- SP156: '*Control of Water Pollution from Construction Sites – Guide to Good Practice'* (Ref 1.5); and
- C532: '*Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors'* (Ref 1.6).

1.4 Water Management Measures

a) Drainage Management

1.4.1 Information on the proposed design of the drainage system for the Project Site during the construction phase is available in **Chapter 3: Project and Site Description** of the ES and the Flood Consequence Assessment in Appendix 9.1 of the ES. Surface water, foul water and water potentially contaminated with oil (oily water) will have separated drainage systems on the Project Site. Foul water and oily water will not be directly discharged into drains or watercourse, but collected and treated. These details will be finalised by the main contractor as part of the detailed design.

1.4.2 Details of the proposed permanent drainage system to be implemented through the operational phase are available in the Outline Drainage Strategy (Appendix E of the Flood Consequences Assessment).

1.4.3 The following measures will be implemented within the design of the construction drainage to safeguard water quality:

- All Project Site drainage measures will be developed in consultation with NRW prior to the commencement of construction;
- Sequencing of work will be such that proposed drainage measures, including flow controls and attenuation storage will be in place prior to erection of buildings and hardstanding;
- The construction oily water drainage will be designed in accordance with NGTS 2.20 '*Oil Containment at Electricity Substations and Other Operational Sites'* (Ref 1.3) Oil Storage Regulations 2016 (Ref 1.7) and Pollution Prevention

Guidance 3: Use and Design of Oil Separators in Surface Water Drainage Systems (Ref 1.8) or similar approved guidelines;

- The construction surface water drainage system will adopt the principles of the SuDs Manual (Ref 1.4) to adequately drain the Project Site and prevent ponding; and
- Any artificial drainage will only be installed where necessary. The individual lengths, depths and gradients of these drains will be minimised to avoid intercepting large volumes of diffuse overland flow and generating high velocity flows during storm events.

b) Control of Runoff

1.4.4 During construction and site preparation, there will be a requirement for temporary measures to ensure controlled management of runoff draining from the Project Site. Runoff from the Project Site will not be allowed to drain directly into any water bodies untreated and will be collected, treated and attenuated using a range of control measures. These will include combinations of:

- Cut off drainage ditches;
- Infiltration drains;
- Suitably sized attenuation ponds with restricted discharge pipes;
- Road side swales; and
- Pollution control measures such as silt fencing, straw bales, sedimats and sediment traps.

1.4.5 The arrangements of such drainage infrastructure will be set out in the detailed design and, where appropriate, agreed with NRW prior to construction in accordance with the requirements of any temporary works discharge environmental permits.

1.4.6 The above measures will ensure that any sediment or other pollutants dissolved or carried in suspension in the surface water runoff from the Project Site will have been treated, filtered or settled out to an acceptable level before being discharged to a water body. Limits on the concentration of relevant physico-chemical parameters will be agreed with NRW as part of the process of determining a temporary works environmental permit from NRW.

1.4.7 All earthworks will be undertaken in accordance with BS6031:1981 Code of Practice for Earth Works (Ref 1.1). Land disturbance will be kept to a minimum and disturbed areas will be stabilised as soon as possible after construction.

c) Proximity to Water

1.4.8 The following good practice measures will be implemented to minimise the potential of direct pollution to water:

- A 10 m buffer will be applied to all Project Site watercourses. Where possible, this buffer will not be entered by plant and machinery;

- Stockpiles of excavated soils/peat will be located away from surface watercourses and away from known surface drainage pathways as much as possible;
- Laydown areas and plant and machinery will be stored at least 10 m from watercourses and where possible, in low flood risk areas; and
- Oil storage will comply with the measures set out in the Pollution Prevention Plan within the Outline CEMP (Appendix 3.1) including, where possible being located at least 50 m from an open watercourse.

d) Silt and Sediment

1.4.9 The following measures will be implemented in order to reduce the potential generation of silt laden runoff:

- The Project Site will be laid out to prevent runoff from stockpiles entering watercourses. Stockpiles of soils and excavated solid material will be surrounded at their bases by silt fencing that will be implemented as per manufacturer guidelines to prevent contaminated run-off being generated during inclement weather and where damping is used to prohibit dust;
- Bare ground exposure will be minimised by only removing vegetation from areas that require to be exposed in the near future and completing reinstatement as soon as practicably possible;
- Project Site roads will be regularly maintained and kept free from sediment deposits in order to reduce the volume of silt becoming entrained in surface runoff and entering any watercourse or drain;
- Mitigation will be implemented as required (silt fencing, placement of straw bales into ditches, sedimats or similar commercially available products and sediment traps) to intercept and collect silt, reduce runoff velocity and encourage deposition of suspended sediment; and
- Care will be taken during felling operations to reduce the risk of sedimentation and erosion into the watercourses.

e) Control of Pumped Water

1.4.10 Water pumped from excavations may contain a moderate level of suspended solids, which if left to drain untreated, could carry sediment into Afon Llan. As noted above, runoff from the Project Site will not be allowed to drain directly into any watercourse and will be filtered and attenuated using a variety of methods including silt traps and settlement lagoons.

1.4.11 If pumping is required, disposal of water pumped from excavations will be in accordance with the following requirements:

- APL and the main contractor will ensure that all necessary consents, permits and licences will be obtained from NRW prior to any pumping; and
- No discharges will be made directly to watercourses or land unless agreed with NRW and a discharge licence will be sought.

1.5 Protection of Private Water Supplies

1.5.1 Recent (received on 9 October 2017) data on private groundwater and abstraction licences received from CCS and NRW respectively did not identify any licences within 4 km of the Project Site.

1.6 References

Ref 1.1 BSI. (2009). BS 6031:2009 Code of Practice for Earthworks.

Ref 1.2 BSI. (2015). BS 8004:2015. Code of Practice for Foundations.

Ref 1.3 National Grid. (2014). NGTS 2.20: Oil Containment at Electricity Substations and Other Operational Sites.

Ref 1.4 CIRIA. (2015). C753: The SUDS [Sustainable Urban Drainage] Manual.

Ref 1.5 CIRIA. (2002). SP156: Control of Water Pollution from Construction Sites – Guide to Good Practice.

Ref 1.6 CIRIA. (2001). C532: Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors.

Ref 1.7 Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016. W.S.I. 206/359/W112.

Ref 1.8 Environment Agency. (withdrawn).Pollution Prevention Guidance 3: Use and Design of Oil Separators in Surface Water Drainage Systems.

Appendix 2.5

Construction Traffic Management Plan

Abergelli Power Project

Outline Construction Traffic Management Plan

Abergelli Power Limited

Project number: 60542910

May 2018

Quality information

Prepared by	Checked by	Approved by
		
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Revision History

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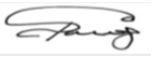
V1	23/02/2018	For discussion with National Grid.		Spiro Panagi	Principal Consultant
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1. Introduction

1.1 Overview

1.1.1 This Outline Construction Traffic Management Plan (CTMP) has been prepared by AECOM on behalf of Abergelli Power Limited (APL) in respect of the Abergelli Power Project (referred to as 'the Project' from herein).

1.1.2 This document supports the Environmental Statement (ES) which is submitted as part of the DCO Application. A Transport Assessment (TA) has also been undertaken and can be found in **ES Chapter 12: Traffic, Transport and Access**.

1.2 The Project

1.2.1 The Project is situated on open agricultural land located approximately 2 km north of Junction 46 of the M4 within the administrative area of the City and County of Swansea Council (CCS), approximately 1 km southeast of Felindre and 1.4 km north of Llangyfelach.

1.2.2 The land upon which the Project would be developed, or which is required for construction of the Project, is referred to as the 'Project Site'. The approximate centre of the Project Site lies at grid reference 265284, 201431. The Project Site covers an area of up to approximately 30 ha.

1.2.3 The current land use is predominantly agricultural, with sheep and horse grazing. The western extent of the Project Site encompasses the existing Access Road leading to the Substation and Felindre Gas Compressor Station from the B4489.

1.2.4 The components of the Project are summarised in **Table 1.1**.

Table 1.1: Project Components

Project Component	Description
Power Generation Plant	• An Open Cycle Gas Turbine (OCGT) peaking power generating station, fuelled by natural gas and capable of providing a rated electrical output of up to 299 Megawatts (MW). The Power Generation Plant comprises: • Generating equipment including one Gas Turbine Generator with one exhaust gas flue stack and Balance of Plant (BOP) (together referred to as the 'Generating Equipment') which are located within the 'Generating Equipment Site'; • An Access Road to the Project Site from the B4489 which lies to the west, formed by an existing access road between the B4489 junction and the Swansea North Substation (the Substation) and constructing a new section of Access Road from the Substation to the Generating

Project Component	Description
	Equipment Site; • A temporary construction compound for the storage of materials, plant and equipment as well as containing site accommodation and welfare facilities, temporary car parking and temporary fencing. A small area within the Laydown Area will be retained permanently (the Maintenance Compound); • Ecological Mitigation Area; and • Permanent parking and drainage.
Gas Connection	• The Gas Connection will be in the form of a new above ground installation (AGI) and underground gas pipeline connection (the Pipeline). This is to bring natural gas to the Generating Equipment from the National Gas Transmission System. The Pipeline will follow an approximate north-south route corridor, between the National Gas Transmission System south of Rhyd-y-Pandy Road and the Generating Equipment Site.
Electrical Connection	• This is an underground electrical cable to export power from the Generating Equipment to the National Grid Electricity Transmission System (NETS).

1.3 Structure of Construction Traffic Management Plan

1.3.1 The CTMP provides a framework for addressing the transport issues associated with the movement of construction traffic to serve the construction of the Project, including movements to/from the local and strategic highway network, along the existing Access Road (that serves the National Grid premises), the new section of Access Road that will be constructed to serve the Power Generation Plant and the new access to the proposed AGI. These will be considered with regard to routeing, signage, HGVs and Abnormal Indivisible Loads (AILs).

1.3.2 The purpose of this document is to set out the principles that APL and the contractor will follow to manage construction traffic during the construction of the Project.

1.3.3 The CTMP is structured as follows:

- Section 2 - Existing Conditions and Site Accessibility: Sets out the local transport conditions in the vicinity of the site and access to non-car modes of transport;
- Section 3 - Access Arrangements and Management Measures: Details the access arrangements to the Project Site during construction of the Project and the management measures to minimise the disruption on the highway network and internal access roads; and

- Section 4 - Traffic Generation: Sets out the forecast traffic generation during the construction and operational phases of the Project and summarises the impacts on the existing highway network.

2. Existing Conditions and Site Accessibility

2.1 Local Highway Network

2.1.1 The Project Site is served by a privately maintained Access Road from the B4489. The Access Road is unlit. The width of the Access Road varies along its length between 3.5 m and 7.5 m, and is generally bordered by trees and intermittent hedgerows. The Access Road connects to the B4489 via a simple priority junction. This is characterised by large radii on the minor arm (the Access Road) to accommodate HGV movements.

2.1.2 The B4489 routes between the village of Felindre to the north (approximately 2.3 km from the Access Road) and the M4 Junction 46 to the south (approximately 1.8 km from the Access Road). The B4489 is subject to a 40 mph speed limit at its junction with the Access Road. At this location, the road has a 5.5 m wide carriageway and is unlit. Approximately 330 m to the north of the Access Road, the B4489 becomes subject to the national speed limit. The B4489 continues a further 1.7 km north where it connects to Rhyd-y-Pandy Road at a priority junction. This section of the B4489 is unlit and ranges in width between 4.5 m and 5.5 m, with numerous passing places. The junction with Rhyd-y-Pandy Road and its approaches are subject to a 30 mph speed limit. Rhyd-y-Pandy Road routes east for 1.6 km where it passes the northern extent of the Project Boundary. This section of Rhyd-y-Pandy Road is unlit and ranges in width between 4.5 m and 5.5 m, with numerous passing places. It is subject to a 30 mph speed limit, increasing to the national speed limit around 900 m east of its junction with the B4489. It also serves the Felindre Water Treatment Works.

2.1.3 Approximately 475 m to the south of the Access Road, the B4489 is street lit. A further 75 m south from this point, the B4489 forms a three-arm roundabout with the access to the Felindre Park and Share.

2.1.4 On an average weekday, the B4489 carries approximately 130 vehicles during the AM peak hour, 90 vehicles during the PM peak hour, and 1,000 vehicles over the 24-hour period. HGVs account for no more than 2% of total traffic.

2.1.5 The B4489 forms a dumbbell roundabout with the M4 Junction 46. The northern dumbbell roundabout junction comprises three arms; the B4489 and the eastbound on/off-slips of the M4. The southern dumbbell roundabout junction comprises six arms; the A48 (three arms), the B4489 Swansea Road, and the westbound on/off-slips of the M4. The south-eastern arm of the A48 forms a mini-roundabout junction with Pant Lasau Road approximately 90 m southeast of the southern dumbbell roundabout. These junctions are subject to a 40 mph speed limit and are lit.

2.2 Walking and Cycling

2.2.1 The walking and cycling facilities and Public Rights of Way (PROW) are shown on **Figure 2.1**.

2.2.2 There are no footways that serve the Project Site. The nearest footways are on the B4489, approximately 475m south of the Access Road (on the approach to the junction with the Felindre Park and Share). This footway continues to the M4 Junction 46. The 500 m section of the footway to the north of the M4 Junction 46 is separated from the carriageway edge by a barrier. At the M4 Junction 46 the footways continues south along the east side of the carriageway, serving the southern arms of the southern dumbbell roundabout, with dropped kerbs and tactile paving to facilitate crossing movements across entry arms.

2.2.3 There are no formal cycling routes in the vicinity of the Project Site. Part of the B4489 is identified as an ‘advisory cycling route’ on the CCS’s cycle map. This covers the section of the B4489 that routes north from the Access Road to Felindre and to a point approximately 475 m south of the Access Road.

2.2.4 There are numerous PROW crossing/in the vicinity of the Project Site. Footpaths LC34 and LC117 cross the Access Road (and the new section of Access Road) at points approximately 350 m and 1.3 km from the B4489. Footpath LC35B passes through the northern part of the Project Site, connecting to Rhyd-y-Pandy Road in the vicinity of the AGI Access.

2.3 Public Transport

2.3.1 The nearest bus stop to the Project Site is the 'Lliw Reservoirs' stop located on Rhyd-y-Pandy Road. This is situated to the east of Felindre and approximately 500 m to the northwest of the northern extent of the Project Site boundary. There is no footway between the Project Site and this bus stop. It provides access to Service 142, which routes between Morriston and Garnswllt. This service is operated by DANSA, a community transport organisation. There are three to four services per day in each direction, although these can generally only be pre-booked.

2.3.2 Service 141 passes to the south of the Project Site, routeing between Gorseinon and Morriston. The nearest stop that provides access to this service is the 'Pant Lasau Cross' stop located on Mynydd Gelli Wastad Road. It is situated approximately 750 m to the southeast of the southern extent of the Project Site boundary and can be accessed via Footpath LC117.

2.3.3 There are no railway stations in the vicinity of the Project Site. Llansamlet railway station is situated approximately 5.5 km southeast of the Project Site, accessible by car via the A48 (from M4 Junction 44 and 46). Swansea railway station is a further 7 km from the Project Site; this is a key local transport hub and is more easily accessible by public transport. Swansea railway station is managed by Arriva Trains Wales. There are four services daily from Swansea to Shrewsbury; an hourly service from Swansea to Manchester Piccadilly, which calls at Cardiff Central; and a total of two to three services hourly from Swansea to Cardiff Central. Great Western Railway also provides services from Swansea to London Paddington, calling at Bristol Parkway.

2.3.4 Overall, the opportunities to access the Project Site by public transport are limited, and it is therefore considered that, for the purposes of this assessment, no trips by construction, maintenance and permanent staff will be undertaken by these modes.

2.4 Parking

2.4.1 Felindre Park and Share is accessed from the B4489, approximately 550 m south of the Access Road. It is located on the site of the proposed Felindre Business Park. It has capacity for 480 spaces and its use is encouraged for employees of the DVLA HQ in Clase. A shuttle bus service runs between the Felindre Park and Share and the DVLA. The Felindre Park and Share is understood to be managed by the DVLA and will not be available for use by the Project.

2.4.2 A layby is located adjacent to the northbound carriageway of the B4489, approximately 800 m from the M4 Junction 46, and 950 m from the Access Road. The layby measures approximately 50 m in length.

3. Access Arrangements and Management Measures

3.1 Construction Access Routes

3.1.1 The access route to the Project Site comprises four parts. These and the associated management measures along the route are set out under the following sub-headings and shown on **Figure 3.1**.

Local/Strategic Highway Network to Existing Access Road

3.1.2 Access to the Project Site (from the public highway) will be from the B4489. Construction traffic will route to/from the M4 Junction 46, located approximately 1.8 km from the Access Road. This section of the route is approximately 2 km in length. This route would be used during both the construction and operational phases of the Project.

3.1.3 A layby is located adjacent to the northbound carriageway of the B4489, approximately 950 m from the Access Road. The layby measures approximately 50 m in length, which is sufficient storage capacity for two HGVs, as shown on **Figure 3.2**. HGVs travelling to the Project Site will be instructed to enter the layby before proceeding to the Access Road. On arrival at the layby, HGVs will contact a Site Representative (Site Representative A) to be stationed at a holding area located approximately 40 m along the Access Road (east of the gates to the Access Road). Site Representative A will advise whether the holding area has capacity to accommodate HGVs, instructing HGVs to wait at the layby/proceed to the site as appropriate. The layby will be subject to a Temporary Traffic Regulation Order (TTRO) for closure to non-construction traffic during the construction phase to ensure that the layby has capacity to accommodate HGVs.

Existing Access Road (B4489 to National Grid)

3.1.4 The second part of the construction access route is along the existing Access Road which currently serves the National Grid premises. This is approximately 1 km in length between the B4489 at the western extent and the National Grid car park in the east. There are also additional adjoining accesses to National Grid areas along this route. A new section of Access Road will be constructed to serve the Project Site off the existing Access Road (discussed at Paragraph 3.1.6).

3.1.5 HGV movements along the existing Access Road will be managed by construction staff so that no two-way traffic movements are undertaken along the affected section of Access Road while an HGV is routeing along the Access Road. This will be managed by Site Representative A and a site representative (Site Representative B) located near the access to the new section of Access Road and in close proximity to the bend immediately after the existing height restricting frame, who will be in contact via radio. Traffic associated with the construction activities will be held at these locations and priority will be given to all National Grid vehicles and employees.

New Section of Access Road

3.1.6 A new section of Access Road will be constructed between the existing Access Road and the Laydown Area within the Project Site. This will commence at a point around 850 m along the existing Access Road.

3.1.7 HGV movements along the new section of Access Road will be managed by construction staff so that no resultant two-way traffic movements are experienced along the existing Access Road or at the junction of the two routes. This will be managed by Site Representative B and, if found to be required, a further site representative (Site Representative C) will be located within the Project Site (at the Laydown Area), who will be in contact via radio. Any HGV movements will be managed out of the new section of Access Road as appropriate. This will ensure priority is given to National Grid vehicles and employees on the existing Access Road.

AGI Access

3.1.8 The construction route to the AGI will result in the use of a section of the B4489 to the north of the existing Access Road. This continues approximately 2.1 km north before continuing east along Rhyd-y-Pandy Road for approximately 1.5 km. Much of the AGI access route is constrained in terms of two-way movement. Construction activities associated with the AGI will be undertaken over two quarterly periods, with up to 30 HGV movements per day.

3.1.9 The HGVs associated with the AGI will continue to the site without the need for being held. The AGI access will be managed by the construction team and will not be in use by third parties, as is the case for the existing National Grid access.

3.1.10 An alternative route via Rhyd-y-Pandy Road has been considered. This suffers from similar constraints to the route proposed, but would involve routeing via Pant-Lasau. Experience of this route gives us knowledge of the Local Highway Authority's (LHA's) concerns of the local roads being beyond theoretical vehicular capacity in the peak hour periods. In addition to this, the route passes through more residential areas and there could be issues with Morriston Hospital traffic. On this basis, it is considered more appropriate for the AGI construction traffic to access the north of the site using the B4489.

3.2 AIL Routeing

3.2.1 An AIL is a vehicle that has any of the following:

- A weight of more than 44 tonnes;
- An axle load of more than 10 tonnes for a single non-driving axle and 11.5 tonnes for a single driving axle;
- A width of more than 2.9m; and
- A length of more than 18.65m.

3.2.2 The shape and scale of these loads will be refined as the construction process develops in more detail. At this stage, we have taken instruction from the current design and from previous experience from within the Applicant team. There are expected to be two AILs; these are likely to be around 5 m in width, potentially 6.5 m in height and up to around 50 m in length. The total vehicle weight could be up to 400 tonnes per vehicle. The new section of Access Road has been designed to accommodate these vehicles, and provision will made along the Access Road through widening as appropriate. These loads will be travelling with a full complement of technical operators, mobile safety entourage and police escort. It is assumed that the heavy and large equipment will arrive via water transport to either Swansea or Port Talbot Docks. The route to the Project Site will be confined to the strategic highway network wherever possible and will take as direct a route as available given the local circumstances. The pre-planning and lead up time required for the transportation of such loads will ensure that all appropriate measures are in place and relevant authorities are notified.

3.2.3 Once the Contractor has been appointed, and prior to transportation of the first AIL, an access route survey report will be produced by the haulage company to identify any pinch-points requiring mitigation (such as temporary removal of road traffic signs). The access route survey report will detail:

- Preferred ports of entry;
- Delivery routes;
- Potential pinch-points and any street furniture removal/temporary highway alterations required; and
- Delivery vehicles.

3.3 Haulage Responsibilities for AILs

3.3.1 The following requirements will be the responsibility of the haulage companies during the delivery of AIL components:

- The tendering process for the construction of the site will ensure that AIL drivers and their convoy are fully aware of the access route and do not deviate from this;

- Deliveries should only take place during the hours agreed with the Police, LHA (CCS) and South Wales Trunk Road Agent (SWTRA);
- Peak traffic periods and school run periods will be avoided when timing deliveries to and from the Project Site;
- Deliveries on a Saturday between 08.00 and 13.00 may be undertaken if this is acceptable to the Police, LHA and SWTRA;
- Written notification of the commencement of the delivery period(s) should be given to the Police, LHA and SWTRA, within an agreed timescale, to allow for the safe coordination of the work; and
- Further temporary warning signs may be provided on the AIL delivery route in accordance with the requirements of the various Highway Authorities along the route.

3.3.2 For the delivery of AIL, it will be the responsibility of the haulage company to contact and inform the following stakeholders to inform them of delivery dates and likely impact of delivery.

Emergency Services

3.3.3 The Police, Fire and Ambulance service will be given written notice of the AIL deliveries.

Highway Authorities

3.3.4 The Highway Authorities will be given written notice of the AIL deliveries. The relevant authorities will include the LHA (CCS) and SWTRA.

3.3.5 Authorities can be notified using the Highways England Electronic Service Delivery for Abnormal Loads (ESDAL) system.

3.3.6 Any request for an AIL movement must include an indemnity to ensure that the cost of repairing any damage to the highway causing by transporting the AIL can be recovered.

Local Residents

3.3.7 Local residents affected by AIL deliveries will be notified prior to commencement of the deliveries. The method of communicating information will be agreed with the LHA (CCS), but could include the use of leaflet drops and information in the local media. The timing of the notification will be subject to the appointment of the AIL operator and handler who will be able to provide more information on the time and duration of the expected load delivery. Notification will be made in advance and as part of the consultation process and once the necessary agreements are obtained from the Highway Authorities detailed above. The communication should include the following information:

- Name and number of the Construction Site Manager;
- Commencement date for deliveries;

- Duration of delivery period;
- Estimated time of deliveries;
- Request to keep the highway clear of parked cars during the delivery period; and
- Emergency number of Local Police and LHA Helpdesk.

Local Business

3.3.8 Local businesses should be approached directly to ensure the effect on their businesses is minimised. This will be carried out in a similar timeframe and manner to that set out for local residents, detailed above.

Local Services

3.3.9 The contractor and haulage company will make all reasonable efforts to work with local service providers to ensure disruption caused by deliveries is avoided. Services of particular relevance include but are not limited to:

- Royal Mail for postal delivery services and distribution vehicles;
- Local buses;
- Refuse collection; and
- Regular good deliveries.

Planned Engineering Works

3.3.10 The contractor and haulage company will work with CCS to identify any planned engineering works that could cause conflict with the proposed delivery route times. Discussions will then be made to minimise disruption to the local community and the planned engineering works.

Local Community Events

3.3.11 The contractor and haulage company will work with CCS to identify any conflicts with school and nursery drop off and pick up locations and times. Where possible, construction deliveries will be scheduled to avoid these busy periods. The chosen routes have also been selected ensuring that the journey of construction traffic is direct and contained, using higher classification of roads, wherever possible.

3.3.12 Planned and notified community events will also be considered by the contractor and haulage company when scheduling deliveries. The Construction Site Manager will contact event organisers to ensure any issues are considered.

Highway Conditions Survey

3.3.13 A highway condition survey of the public highway along the access route will be undertaken by the haulage company prior to the first AIL and following the final AIL. Any road maintenance issues directly caused by the AIL will be notified and approved through the normal process by CCS Highway Inspectors.

3.4 Construction Signage

3.4.1 Signage will be provided along the construction routes to direct construction traffic to/from the Project Site and to warn other road users construction traffic movements in key locations, e.g. the B4489/Access Road junction. The location and form of signage will be agreed with the LHA. Signage will also be provided within the Project Site to guide construction traffic in and out of the Laydown Area and the Generating Equipment Site, and to the construction parking bays. The location of the signage will be developed as the Project progresses and in discussion with the LHA and National Grid.

3.5 Monitoring of Construction Traffic

3.5.1 AIL and HGV deliveries to site will be monitored to check compliance with the proposed routeing strategy. The final measures will be agreed with the LHA and the contractor, as either the use of one or a number of measures could be utilised to achieve compliance. An example of a possible monitoring measure is a sticker system thereby all HGVs delivering to the Project Site would be required to display a sticker in the front window. This would allow HGVs to be visually assessed for compliance with the proposed routes.

3.5.2 The haulage companies may be able to offer more advanced compliance measures depending on the type of tracking/monitoring system they employ on their vehicles.

3.6 Construction Laydown Area

3.6.1 A temporary Laydown Area during construction will be provided for the storage of materials, plant and equipment as well as containing site accommodation and welfare facilities, temporary car parking and temporary fencing. The Laydown Area will be provided adjacent to the Generating Equipment Site. A small permanent area within the Laydown Area is required for maintenance during the operational phase of the Project.

3.6.2 Sufficient car parking will be provided within the Laydown Area. During operation car parking for operational and maintenance staff would be provided within the Generating Equipment Site. The Project will take into account CCS's policy on parking standards during the operational phase of the Project and implement sustainable transport methods through travel planning measures, where possible.

3.7 Scheduling of Deliveries

3.7.1 A booking system will be used to log vehicles entering and leaving the Project Site. Where possible, deliveries will be spread across the day to minimise the impact of HGV traffic during the peak periods.

3.7.2 The transport of AILs will be timed to be undertaken at night or outside of the peak hours on the highway network to minimise disruption. These deliveries will be pre-arranged with local authorities and the police.

3.8 Cleansing of Vehicles Prior to Exiting the Site

3.8.1 All vehicles exiting the Project Site will be required to undertake effective vehicle cleaning and wheel-washing to minimise the amount of debris which is transferred to the Access Road and the local highway network. There will be specialised water tanks, hosing equipment, water collection and treatment tanks to undertake the cleaning process. The location of the wheel cleaning facility within the Project Site would be determined by the contractor in agreement with National Grid.

3.9 Highway Conditions Survey

3.9.1 A pre-construction condition survey, including road and verge condition at the junction of the Access Road and the B4489 and PROW (where directly affected) within the boundary of the Project Site would be undertaken prior to the commencement of the construction programme.

3.9.2 Three PROWs crossing the Project Site will be reinstated to their pre-construction condition upon completion of works (where any damage is attributable to contractors working on behalf of APL) or permanently diverted as appropriate. These PROW will be stopped up or diverted temporarily during construction to ensure public safety.

3.10 PROW

3.10.1 Footpaths LC34 and LC117 cross the Access Road (and the new section of Access Road) at points approximately 350 m and 1.3 km from the B4489. Footpath LC35B passes through the northern part of the Project Site. There will be further consultation to develop measures in respect of the PROW. Where possible, connectivity will be maintained by the use of temporary diversions and working methods to allow the PROWs to remain open for the majority of the construction period. Potential measures include fencing to ensure separation between movements along the PROW and construction activities (for PROW within the Project Site), and signage/management of movements where PROW cross construction traffic routes.

3.11 Construction Staff Travel Plan

3.11.1 Staff will be encouraged, where possible, to car share to the Project Site. It is recognised that using sustainable modes of transport may not be suitable due to working hours or the site location. However, car sharing would reduce the total number of trips to the Project Site. The Contractor will also be encouraged to lay on crew vehicles.

3.12 Measures relating to National Grid

3.12.1 The measures set out in this plan largely relate to the public highway network. In this case the Access Road to the construction site will, in part, require use of the existing Access Road which is currently operated by National Grid. Therefore, there will be a number of measures which will relate to National Grid as a business and as a provider of utilities. The measures below have been developed following ongoing discussions with and input from National Grid representatives.

- Works planned by National Grid in relation to the Felindre Gas Compressor Station and the Substation will be taken into consideration when finalising the Project construction plan. At the time of this report it has been determined that any future works planned by National Grid would not occur within the Project's construction period. Liaison will continue prior and during construction with appropriate management measures implemented if needed;
- National Grid operational staff at Felindre currently comprises four site-based staff in attendance 0800 hours to 1600 hours. The site entrance gate is locked outside of these times. There are also instances where weekend work is required. The contractor appointed for the Project construction will manage the gate security if working outside of these hours and ensure the National Grid access is not obstructed;
- To assist with the above and also with the construction communication process, National Grid will be provided with a named APL contact, the construction site manager or an appropriate project manager. Either the nominated construction manager will ensure that key communication is continually fed to National Grid operatives and will be the point of contact for all queries;
- Height clearance for overhead cables has been discussed with National Grid and the project team will ensure that all available information is considered and that HGV loads are able to safely pass below the cable lines;
- The existing height restriction gate will be temporarily removed to accommodate the width of any AILs, and only for these loads, it will be fully reinstated immediately after this work. In the interim period a height safety bunting gateway will be erected to ensure height limits are in place;
- There are a number of cable burials beneath the existing Access Road. The location of these is the subject of discussion at the time of writing this document. Location plans will be provided by National Grid and the

APL construction team will record and manage these appropriately. Liaison will continue through the planning and pre-construction period to understand if further works are required to protect or reroute cables;

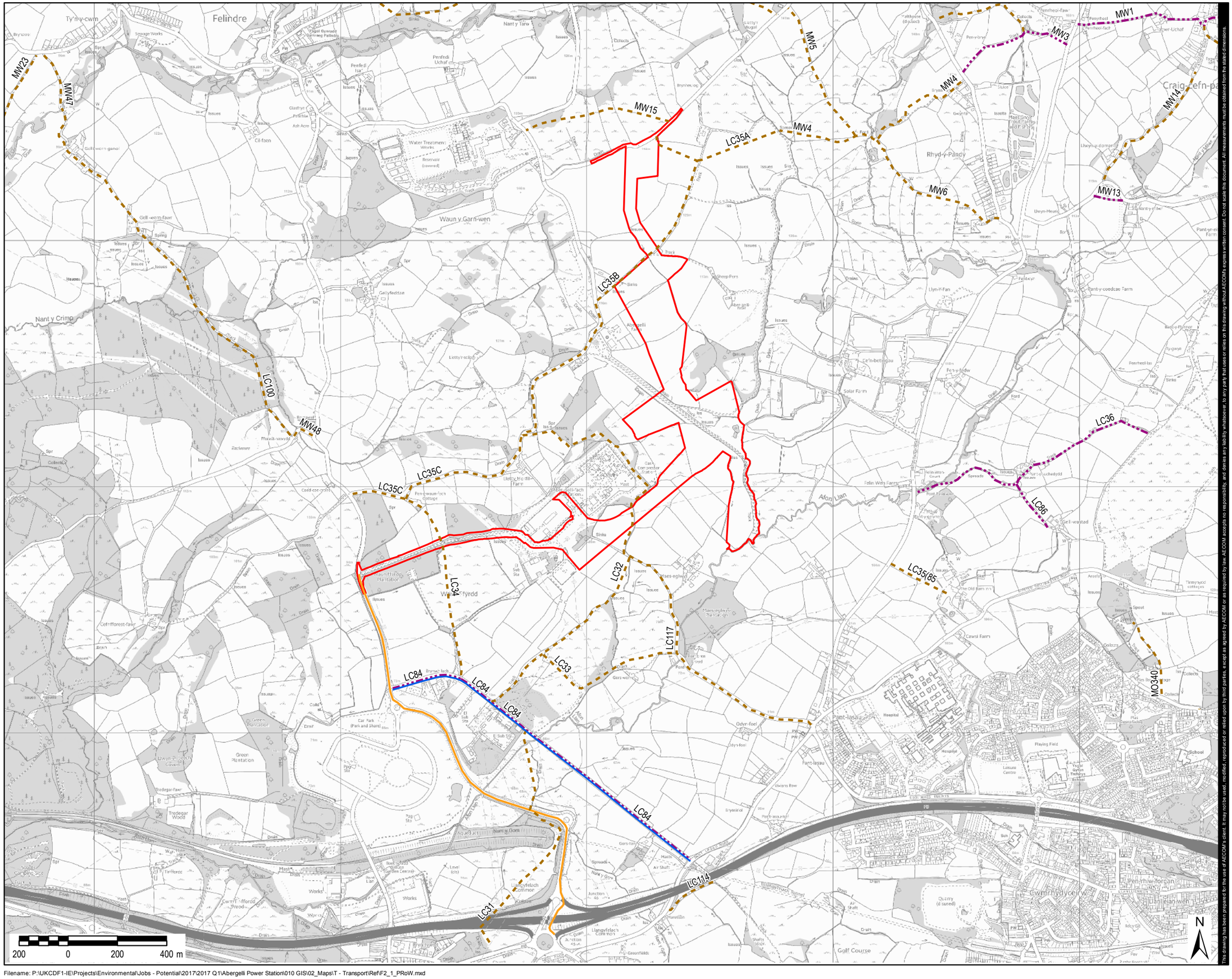
- National Grid will be kept informed of the planning for AILs with measures put into place to use the existing access outside of National Grid's key required access times.
- A highway condition survey of the existing Access Road will be undertaken by the APL construction team and National Grid, recording the condition of the route prior to work commencement. Following completion of the construction period, a final inspection will be carried out and any defects which have occurred since the first inspection will be recorded; and
- A highway condition survey of the existing Access Road will be undertaken by the haulage company prior to the first AIL and following the final AIL as a separate measure and in conjunction with the wider highway inspection.

4. Traffic Generation and Impacts

4.1.1 The TA sets out the level of traffic generation of the Project and considered the impacts on the highway network.

4.1.2 The peak traffic during construction is expected to result in approximately 270 car or van trips per day and around 130 HGV deliveries per day. This assumes a 22-month construction period, with the peak of HGV deliveries occurring during the first three months of the period and the peak of car and van trips occurring during months 13 to 15. The car or van trips would be limited to the start and end of the working day whilst HGV trips would be spread across the day.

4.1.3 Construction traffic generated by both staff and deliveries would arrive at the site from 08:00 and depart the site by 18:00 Mondays to Fridays. On Saturday and public holidays staff and deliveries would arrive at the site from 08:00 and depart the site by 13:00. AILs will be transported outside peak hours.



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Project Site Boundary
- Bridleway
- Footpath
- Traffic Free Cycle Route
- Footway

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AECOM Internal Project No:

60542910

Drawing Title:

PEDESTRIAN AND CYCLE ROUTES AND PUBLIC RIGHTS OF WAY

Scale at A3: 1:14,000

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FIGURE 2.1			001
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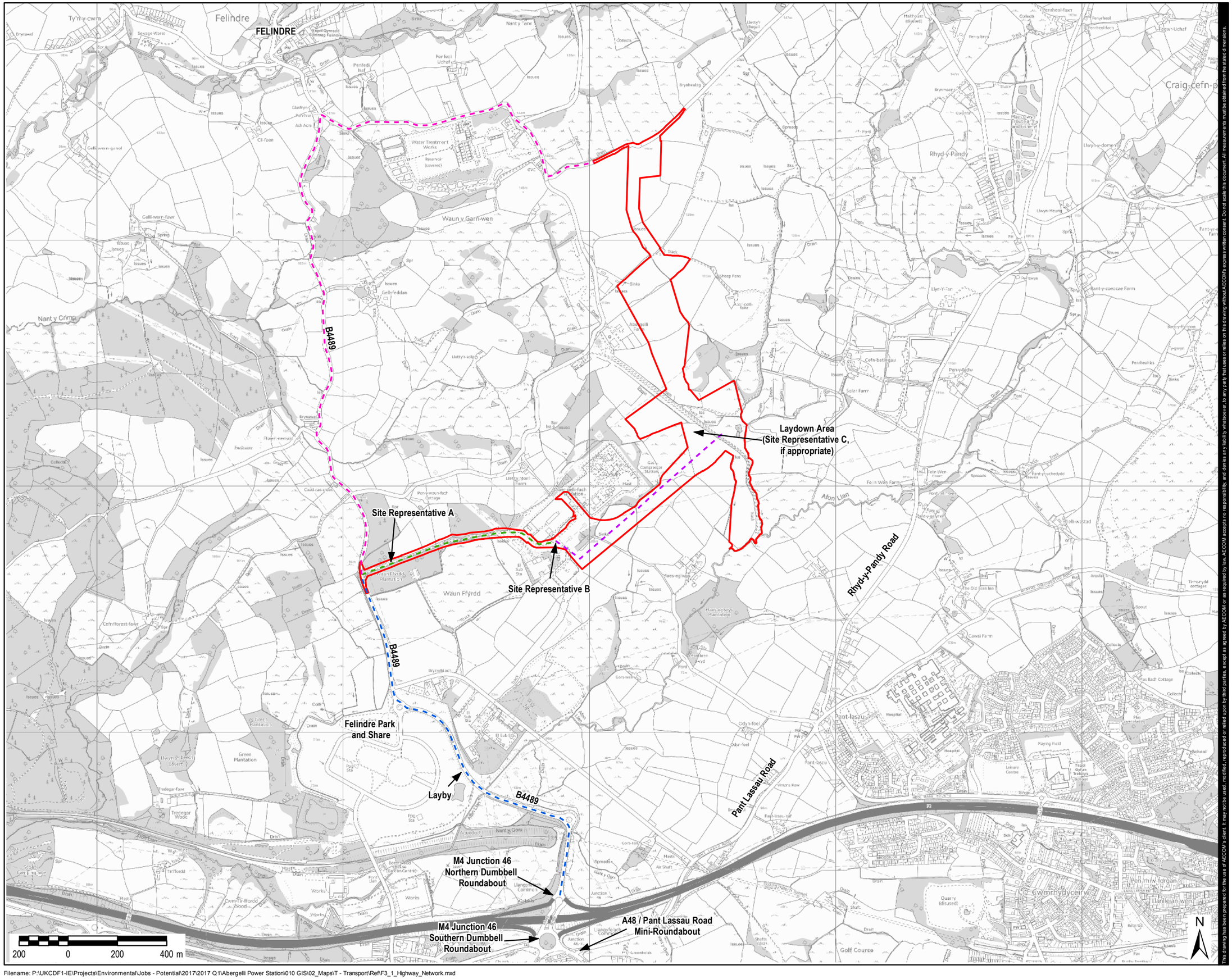
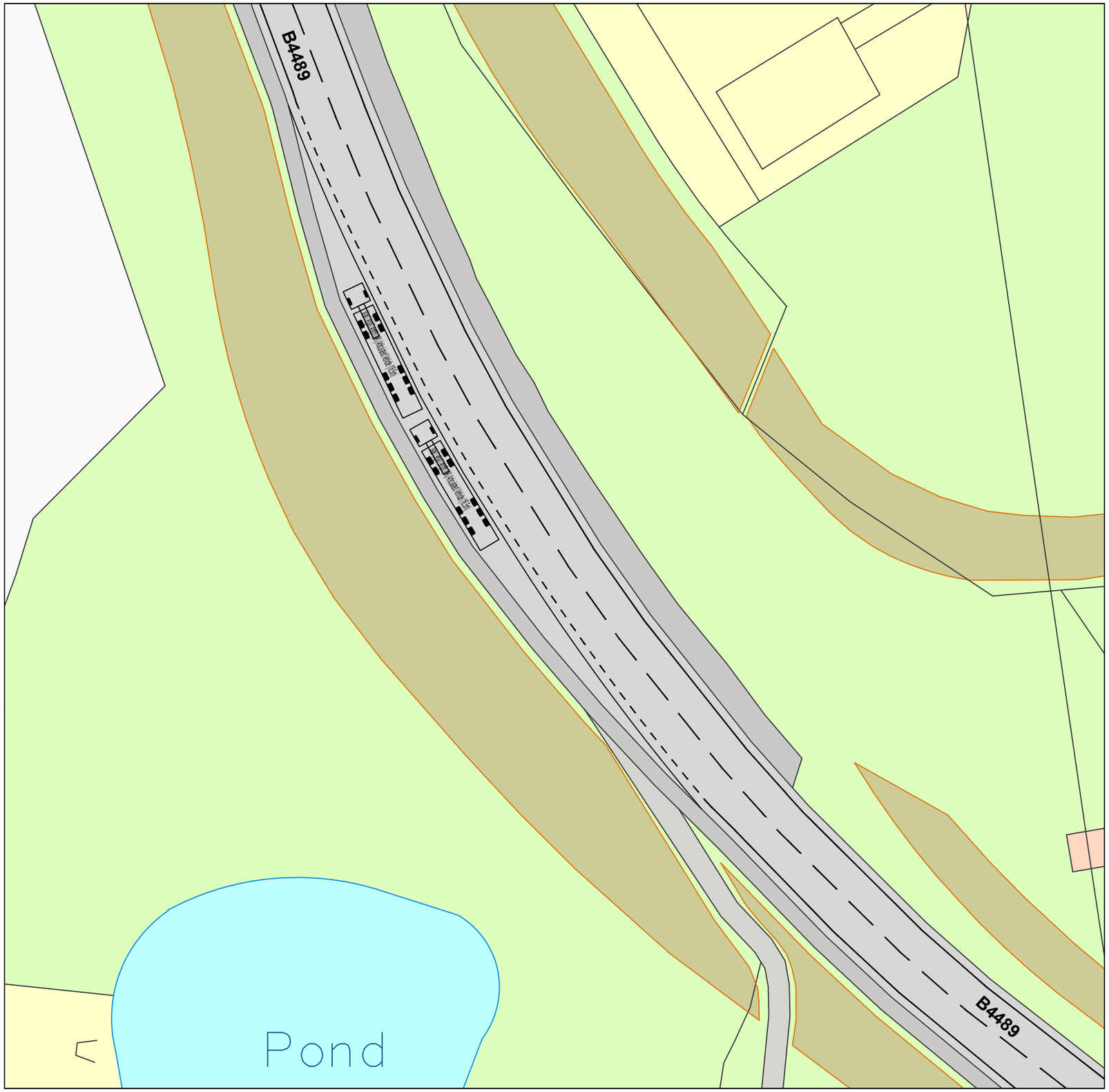

FELINDRE
Felindre
Ty'n-y-cwm
Nant y Crimp
Waun y Garn-wen
Water Treatment Works
Reservoir (covered)
Gelli-wern-fawr
Gelli-wern-genol
Gelly'reddan
Llettyr-ysgaw
Abergelli Farm
Sheep Pens
Rhyd-y-Pandy
Llwyn-meurig
Llwyn-y-domen
Craig-cefn-p
Llwyn-y-gaer
Rant-y-coeccae Farm
Penrhiwlas
Cefn-betingau
Pen-y-fedw
Solar Farm
Llwyn-y-bedw
Llettyr-isaf
Llettyr-uchaf
Penfedi Isaf
Penfedi Uchaf
Ash Acre
Cil-fden
Nant y-ar-w
Brynheulog
Perfedd Uchaf
Penrheol-fawr
Penrheol-isaf
Penrhiwlas
Pen-y-bryn
Matthouse (disused)
Collects
Sluice
Spreads
Sinks
Track
Drain
Issues
Spr
Ffynnon Gelli-wern-fawr
Spring
Brynawel
Sewage Works
Ysgol Gymraeg Rhydywaun Felindre
Glasfryn
Pen-rhiw
Ffynnon Gelli-wern-genol
Ffynnon Gelly'reddan
Ffynnon Llettyr-isaf
Ffynnon Llettyr-uchaf
Ffynnon Penfedi Isaf
Ffynnon Penfedi Uchaf
Ffynnon Penrhiwlas
Ffynnon Penrheol-fawr
Ffynnon Penrheol-isaf
Ffynnon Rhyd-y-Pandy
Ffynnon Waun y Garn-wen
Ffynnon Ty'n-y-cwm
Ffynnon Llwyn-y-gaer
Ffynnon Llwyn-y-domen
Ffynnon Llwyn-meurig
Ffynnon Pen-y-fedw
Ffynnon Pen-rhiw
Ffynnon Penrhiwlas
Ffynnon Cefn-betingau
Ffynnon Rant-y-coeccae Farm
Ffynnon Brynheulog
Ffynnon Nant y-ar-w
Ffynnon Nant y Crimp
Ffynnon Llettyr-ysgaw
Ffynnon Sheep Pens
Ffynnon Abergelli Farm
Ffynnon Water Treatment Works
Ffynnon Reservoir (covered)
Ffynnon Sewage Works
Ffynnon Ysgol Gymraeg Rhydywaun Felindre
B4489
Laydown Area
(Site Representative C, if appropriate)
Site Representative A
Site Representative B
Felindre Park and Share
Layby
B4489
M4 Junction 46
Northern Dumbbell
Roundabout
M4 Junction 46
Southern Dumbbell
Roundabout
A48 / Pant Lassau Road
Mini-Roundabout
Rhyd-y-Pandy Road
Pant Lassau Road
Afon Llan
Waun Ffyrdd
Maes-eglwys
Maes-eglwys Plantation
Green Plantation
Llwyn-y-brecci Covert
Tredegar Wood
Cefn/forest-fawr
Cwm-Tir-Morfydd Wood
Trafforddd
Pant-lasau
Cawsi Farm
Golf Course
Gwmnhydyceirw
Pen-rhiw-forgan
Llanllean-wen
Hospital
Playing Field
Leisure Centre
School
Chapel
Quarry (disused)
Pant-prysgau
Pant-prysgau-isaf
Pant-prysgau-uchaf
Pant-prysgau-fach
Pant-prysgau-fawr
Pant-prysgau-ganol

Towards Project Site



Towards M4 Junction 46

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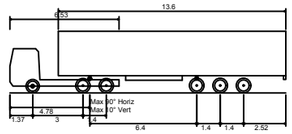
Project Title:

ABERGELLI POWER PROJECT

Client:

LEGEND



Max Legal Length (UK) Articulated Vehicle (16.5m)

Overall Length	16.500m
Overall Width	2.550m
Overall Body Height	3.681m
Min Body Ground Clearance	0.411m
Max Track Width	2.500m
Lock to lock time	6.00s
Kerb to Kerb Turning Radius	6.530m

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AECOM Internal Project No:

60542910

Drawing Title:

B4489 Layby - HGV Parking Area

Scale at A3: 1:500

Drawing No:	Rev:
FIGURE 3.2	-

Drawn:	Chk'd:	App'd:	Date:
MS	MD	SP	24/04/2018

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Appendix 2.6

Construction Staff Travel Plan (CSTP)

Abergelli Power Project

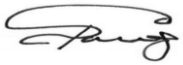
Construction Staff Travel Plan

Abergelli Power Limited

Project number: 60542910

April 2018

Quality information

Prepared by	Checked by	Approved by
		
Matt Davies Senior Consultant	Spiro Panagi Principal Consultant	Jeremy Douch Regional Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
V1	23/04/2018	For Client Review		Spiro Panagi	Principal Consultant

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4. Travel Plan Measures 8

Figures

Figure 2.1 Pedestrian and Cycle Routes and Public Rights of Way

1. Introduction

1.1 Overview

1.1.1 This Construction Staff Travel Plan (CSTP) has been prepared by AECOM on behalf of Abergelli Power Limited (APL) in respect of the Abergelli Power Project (hereafter referred to as 'the Project').

1.1.2 This document supports the Environmental Statement (ES) which is submitted as part of the DCO Application.

1.2 The Project

1.2.1 The Project is situated on open agricultural land located approximately 2 km north of Junction 46 of the M4 within the administrative area of the City and County of Swansea Council (CCS), approximately 1 km southeast of Felindre and 1.4 km north of Llangyfelach.

1.2.2 The land upon which the Project would be developed, or which is required for construction of the Project, is referred to as the 'Project Site'. The approximate centre of the Project Site lies at grid reference 265284, 201431. The Project Site covers an area of up to approximately 30 ha.

1.2.3 The current land use is predominantly agricultural, with sheep and horse grazing. The western extent of the Project Site encompasses the existing Access Road leading to the Substation and Felindre Gas Compressor Station from the B4489.

1.2.4 A detailed description of the Project and Project components are summarised in **Chapter 3: Project and Site Description.**

1.2.5 The core working hours during construction are between 08:00 and 18:00hrs (Monday to Friday) and 08:00 to 13:00hrs (Saturdays and Bank Holidays). For the assessment in the ES, it has been assumed that all construction staff will arrive between 07:45 and 08:45hrs, and depart between 16:30 and 17:30hrs. Temporary parking spaces for staff will be made available within the Laydown Area during construction.

1.2.6 The construction of the Power Generation Plant is estimated to take 22 months. The new section of Access Road will be constructed as part of the Power Generation Plant and is expected to take around six months. The construction of the Gas Connection and Electrical Connection is expected to take place alongside and within the period of construction of the Power Generation Plant.

1.3 Purpose and Scope of Construction Staff Travel Plan

1.3.1 Travel Plans (TPs) are a way of promoting sustainable travel behaviour through a range of mechanisms, initiatives and targets that when combined can help to reduce unnecessary travel and encourage journeys to be undertaken in a more environmentally sustainable way. For new developments, it is important that sustainable travel measures are in place prior to occupation of a new development as travel habits in favour of walking, cycling and public transport are more readily established from the outset.

1.3.2 Benefits of implementing a TP can include:

- Increased travel choice: TPs can increase personal travel choice by promoting existing and providing additional sustainable travel options;
- Health benefits: Many alternative forms of travel involve an element of physical activity that can help improve the physical health and mental wellbeing of users of a development. For employers, this can also reduce the number of days lost to staff illness;
- Public/environmental responsibility: A decrease in the number of vehicle trips results in cleaner air and eases congestion both in the development and on the local highway network;
- Positive publicity: TPs can generate positive publicity and improve the environmental image of an organisation, an area or a development. It demonstrates to residents living in the surrounding areas that the organisation is committed to limiting single occupancy car trips and promoting sustainable travel options; and
- Financial savings: Users of a development can make savings by switching to or encouraging travel by non-car modes. For staff employed on a site, this is primarily related to reduced fuel consumption and vehicle depreciation.

1.3.3 It is recognised that construction staff will exhibit travel behaviours and have certain requirements that differ from staff that would be traditionally targeted by a workplace TP. Factors can include:

- Requirement to carry and transfer of specialist equipment, tools and personal protective equipment;
- Start and finish times that are generally outside of periods when public transport is available or in periods when services are not as frequent;
- Requirement to undertake physically demanding tasks during the working day which makes the use of active modes such as walking/cycling for commuting purposes less attractive;
- Working on sites that are in remote locations where provision for non-car modes is limited; and
- Variation in the workforce due to the construction schedule, making the establishment of standard travel routines more difficult.

1.3.4 These factors have been taken into consideration in identifying measures in this CSTP.

1.4 Policy and Guidance

1.4.1 This CSTP has been prepared with reference to *Technical Advice Note (TAN) 18: Transport*, published by the Welsh Government (WG). TAN 18 sets out technical guidance for the transport related elements of development and also confirms the WG's commitment to sustainable travel via the implementation of TPs for new developments.

1.4.2 TAN 18 states that the WG "wishes to promote the widespread adoption of travel plans by businesses, schools, hospitals, tourist attractions and other significant travel-generating uses". It is also acknowledged that "travel plans may be prepared, individually or jointly, by the owners and operators of existing or proposed developments".

1.5 Report Structure

1.5.1 The TP is structured as follows:

- Section 2 – Existing Conditions and Site Accessibility: Sets out the local transport conditions in the vicinity of the site and access to non-car modes of transport
- Section 3 – Trip Generation: Provides details of the trip generation of staff associated with each of the Project components; and
- Section 4 – Travel Plan Measures: Sets out the key measures and initiatives relating to the reduction in single-occupancy car trips to/from the site.

2. Existing Conditions and Site Accessibility

2.1 Local Highway Network

2.1.1 The Project Site is served by a privately maintained Access Road from the B4489. The Access Road is unlit. The width of the Access Road varies along its length between 3.5 m and 7.5 m, and is generally bordered by trees and intermittent hedgerows. The Access Road connects to the B4489 via a simple priority junction. This is characterised by large radii on the minor arm (the Access Road) to accommodate HGV movements.

2.1.2 The B4489 routes between the village of Felindre to the north (approximately 2.3 km from the Access Road) and the M4 Junction 46 to the south (approximately 1.8 km from the Access Road). The B4489 is subject to a 40 mph speed limit at its junction with the Access Road. At this location, the road has a 5.5 m wide carriageway and is unlit. Approximately 330 m to the north of the Access Road, the B4489 becomes subject to the national speed limit. The B4489 continues a further 1.7 km north where it connects to Rhyd-y-Pandy Road at a priority junction. This section of the B4489 is unlit and ranges in width between 4.5 m and 5.5 m, with numerous passing places.

2.1.3 The junction with Rhyd-y-Pandy Road and its approaches are subject to a 30 mph speed limit. Rhyd-y-Pandy Road routes east for 1.6 km where it passes the northern extent of the Project Boundary. This section of Rhyd-y-Pandy Road is unlit and ranges in width between 4.5 m and 5.5 m, with numerous passing places. It is subject to a 30 mph speed limit, increasing to the national speed limit around 900 m east of its junction with the B4489. It also serves the Felindre Water Treatment Works.

2.1.4 Approximately 475 m to the south of the Access Road, the B4489 is street lit. A further 75 m south from this point, the B4489 forms a three-arm roundabout with the access to the Felindre Park and Share.

2.1.5 On an average weekday, the B4489 carries approximately 130 vehicles during the AM peak hour, 90 vehicles during the PM peak hour, and 1,000 vehicles over the 24-hour period. HGVs account for no more than 2% of total traffic.

2.1.6 The B4489 forms a dumbbell roundabout with the M4 Junction 46. The northern dumbbell roundabout junction comprises three arms; the B4489 and the eastbound on/off-slips of the M4. The southern dumbbell roundabout junction comprises six arms; the A48 (three arms), the B4489 Swansea Road, and the westbound on/off-slips of the M4. The south-eastern arm of the A48 forms a mini-roundabout junction with Pant Lasau Road approximately 90 m southeast of the southern dumbbell roundabout. These junctions are subject to a 40 mph speed limit and are lit.

2.1.7 The walking and cycling facilities and Public Rights of Way (PROW) are shown on **Figure 2.1**.

2.1.8 There are no footways that serve the Project Site. The nearest footways are on the B4489, approximately 475 m south of the Access Road (on the approach to the junction with the Felindre Park and Share). This footway continues to the M4 Junction 46. The 500 m section of the footway to the north of the M4 Junction 46 is separated from the carriageway edge by a barrier. At the M4 Junction 46 the footways continues south along the east side of the carriageway, serving the southern arms of the southern dumbbell roundabout, with dropped kerbs and tactile paving to facilitate crossing movements across entry arms.

2.1.9 There are no formal cycling routes in the vicinity of the Project Site. Part of the B4489 is identified as an ‘advisory cycling route’ on the CCS’s cycle map. This covers the section of the B4489 that routes north from the Access Road to Felindre and to a point approximately 475 m south of the Access Road.

2.1.10 There are numerous PRoW crossing/in the vicinity of the Project Site. Footpaths LC34 and LC117 cross the Access Road (and the new section of Access Road) at points approximately 350 m and 1.3 km from the B4489. Footpath LC35B passes through the northern part of the Project Site, connecting to Rhyd-y-Pandy Road in the vicinity of the AGI Access.

2.2 Public Transport

2.2.1 The nearest bus stop to the Project Site is the 'Lliw Reservoirs' stop located on Rhyd-y-Pandy Road. This is situated to the east of Felindre and approximately 500 m to the northwest of the northern extent of the Project Site boundary. There is no footway between the Project Site and this bus stop. It provides access to Service 142, which routes between Morriston and Garnswllt. This service is operated by DANSA, a community transport organisation. There are three to four services per day in each direction, although these can generally only be pre-booked.

2.2.2 Service 141 passes to the south of the Project Site, routeing between Gorseinon and Morriston. The nearest stop that provides access to this service is the 'Pant Lasau Cross' stop located on Mynydd Gelli Wastad Road. It is situated approximately 750 m to the southeast of the southern extent of the Project Site boundary and can be accessed via Footpath LC117.

2.2.3 There are no railway stations in the vicinity of the Project Site. Llansamlet railway station is situated approximately 5.5 km southeast of the Project Site, accessible by car via the A48 (from M4 Junction 44 and 46). Swansea railway station is a further 7 km from the Project Site; this is a key local transport hub and is more easily accessible by public transport. Swansea railway station is managed by Arriva Trains Wales. There are four services daily from Swansea to Shrewsbury; an hourly service from Swansea to Manchester Piccadilly, which calls at Cardiff Central; and a total of two to three services hourly from Swansea to Cardiff Central. Great Western Railway also provides services from Swansea to London Paddington, calling at Bristol Parkway.

2.2.4 Overall, the opportunities to access the Project Site by public transport are limited, and it is therefore considered that, for the purposes of this assessment, no trips by construction staff will be undertaken by these modes.

2.3 Parking

2.3.1 Felindre Park and Share is accessed from the B4489, approximately 550 m south of the Access Road. It is located on the site of the proposed Felindre Business Park. It has capacity for 480 spaces and its use is encouraged for employees of the DVLA HQ in Clase. A shuttle bus service runs between the Felindre Park and Share and the DVLA. The Felindre Park and Share is understood to be managed by the DVLA and will not be available for use by the Project.

2.3.2 A layby is located adjacent to the northbound carriageway of the B4489, approximately 800 m from the M4 Junction 46, and 950 m from the Access Road. The layby measures approximately 50 m in length.

3. Trip Generation

3.1.1 The traffic generated by staff associated with the Project during the construction period has been quantified using a first principles approach. This assumes that all construction staff will arrive at and depart the Project Site in private cars or vans at average vehicle occupancy of 1.6. Due to the limitations of public transport provision, no staff are expected to arrive or depart by public transport.

3.1.2 The forecast vehicle trip generation associated with staff is set out for the individual Project components and full Project in **Table 3.1**.

Table 3.1: Weekday Vehicle Trip Generation – Construction Staff

Project Component	Time Period	Arrivals	Departures	Total
Power Generation Plant	AM Peak Hour	64	0	64
	PM Peak Hour	0	64	64
	24-Hour	123	123	246
Gas Connection	AM Peak Hour	5	0	5
	PM Peak Hour	0	5	5
	24-Hour	10	10	20
Electrical Connection	AM Peak Hour	2	0	2
	PM Peak Hour	0	2	2
	24-Hour	2	2	4
Project	AM Peak Hour	71	0	71
	PM Peak Hour	0	71	71
	24-Hour	135	135	270

4. Travel Plan Measures

4.1 Aims and Objectives

4.1.1 The principal aim of this CSTP is to reduce the impact associated with the vehicle trip generation of the Project during the construction phases. In view of the development type, location and limited potential for non-car modes, it is considered appropriate and realistic for efforts to be focused on increasing occupancy levels of vehicles travelling to/from the site.

4.2 Travel Plan Implementation and Monitoring

4.2.1 The construction of the Project will be carried out by a contractor who will be responsible for complying with the selected measures described in the CSTP. The contractor will also be responsible for ensuring that all sub-contractors are both aware of, and comply with, the requirements of the CSTP.

4.2.2 A member of staff, typically the Site Manager, will be identified to perform the role of Travel Plan Coordinator (TPC). The TPC will be responsible for the management and delivery of the CSTP for the duration of the construction phase, working with senior site management and stakeholders.

4.2.3 The TPC will be required to monitor travel on a regular basis (e.g. every six months) throughout the construction period. This will involve car occupancy surveys at the accesses to the Project Site.

4.3 Car Sharing

4.3.1 The key measure to increase the occupancy levels of vehicles will be to increase car sharing. This will be achieved through the establishment of a staff car sharing database, which will contain the home postcodes of staff and details of their shift patterns so that staff can be 'matched'. This could be a bespoke database or could make use of online resources such as 'Share Cymru'.

4.3.2 Where practically possible, the contractor will lay on crew transport such as minibuses, between their place of business and the Project Site.

4.4 Marketing and Communication

4.4.1 This CSTP is exclusively focused on car sharing and all staff will be provided with:

- Details of and access to the car sharing database. As staff will work shift patterns, these timings will be reviewed to see where the optimum opportunities for car sharing can be achieved;
- Car sharing/site routeing policies;

- Information on local traffic-related congestion concerns for the purposes of raising awareness; and
- A map showing the location of the Project in relation to the local area, highlighting the designated routes to use to access the Project Site to reduce congestion/conflict.

4.4.2 Sustained and specific marketing of car sharing will be undertaken during the construction phase to ensure staff are aware of and understand the CSTP. This will include the provision of information to staff during the induction process, and regular communication through staff briefings and the staff notice board. As part of the induction process, all construction staff will be required to register on a car sharing database and encouraged to participate in car sharing to site with other staff members.

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Project Title:

ABERGELLI POWER STATION

Client:

Abergelli power
A Drax Group company

LEGEND

- Project Site Boundary
- Bridleway
- Footpath
- Traffic Free Cycle Route
- Footway

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Appendix 3.1

Preliminary Ecological Appraisal Report – Non-Confidential

Abergelli Power Project Preliminary Ecological Appraisal – NON-CONFIDENTIAL

Abergelli Power Limited
May 2018

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1. Executive Summary

1.1.1 AECOM was instructed by Abergelli Power Limited to carry out a Preliminary Ecological Appraisal (PEA) of the Abergelli site, hereafter referred to as 'the Project Site'. The central grid reference for the Project Site is SN 6528 0143 and the boundary of the Project Site is shown on Figure 1.

1.1.2 The Project Site supports woodland, rows of trees, standalone trees, dense and scattered scrub, improved, semi-improved and marshy grassland, tall ruderal vegetation, running water, fences and bare ground (hard standing).

1.1.3 The Project will require the partial removal of hedgerows, semi-natural broadleaved woodland, rows of trees, scrub, running water, ponds, hardstanding, marshy semi-improved and improved grassland and trees with potential for roosting bats.

1.1.4 The Project Site has potential to support the following protected species; marshy fritillary butterfly, great crested newt, reptiles, breeding birds, bats, hazel dormouse, badger, polecat, otter and water vole. The site may support important hedgerows.

1.1.5 In order to inform the production of an Ecological Impact Assessment as part of a wider Environmental Impact Assessment the following surveys are recommended:

Feature/Species	Details	Survey Timing
Important Hedgerows	Hedgerows proposed to be removed as part of the development should be assessed by a suitably qualified ecologist to determine if they are classified as an important hedgerow under the hedgerow regulations, 1997 (Ref. 1).	April to early-June
Tree Preservation Orders (TPO)	A survey to identify TPO trees outside of the Project Site boundary which will be affected by the works should be undertaken.	Anytime
Invertebrates (including marsh fritillary butterfly)	Consultation with NRW and the local planning authority required to determine the need for further surveys.	To be confirmed.
Great Crested Newt	Surveys for great crested newts to be undertaken on suitable ponds within the Project Site boundary, and within 500 m of the Project Site boundary to determine if they are present in the area.	Manual surveys: Between mid-March and mid-June; two of which should be between mid-April and mid-May. eDNA sampling surveys: Water samples must be taken between the 15th

Feature/Species	Details	Survey Timing
		April and 30th June.
Reptiles	Presence absence surveys in suitable areas of habitat using artificial refugia	Seven surveys to be undertaken between April and September, avoiding the summer months of July and August if possible.
Breeding Birds	Breeding bird surveys to be undertaken within suitable areas of habitat within the site to assess presence, population and activity of birds. Particular focus will be paid to protected/priority species breeding in woodland, hedgerows and scrub and ground nesting birds in particular lapwing in areas of marshy and semi-improved grassland.	Breeding birds - four visits between March and July.
Bats – Tree Assessments	If trees or broadleaved semi-natural woodland within the Project Site are to be removed or illuminated by external lighting a preliminary ground level roost assessment should be undertaken on all trees.	Anytime, ideally in winter
Bats – Building and Structure Assessments	Buildings and/or structures within the vicinity of the Project Site should be assessed for their potential to support summer roosting and winter hibernating bats.	Anytime
Bats – Tree Roost Survey	Any trees to be removed which have been assessed as having low potential to support roosting bats will not be subject to further surveys, but precautionary measures may be appropriate during felling or pruning activities. Any trees to be removed which have been assessed as having moderate or high potential to support roosting bats may require a further Potential Roost Feature (PRF) climbed inspection survey and/or will require presence/absence surveys to be undertaken	May - September
Bats – Buildings and Structures Survey	Any buildings or structures assessed as having potential to support roosting bats may require an internal inspection,	Summer Roosts: May - September. Up to

Feature/Species	Details	Survey Timing
	winter hibernations survey, and/or will require presence/absence surveys to be undertaken. To establish roost presence or likely absence up to three manual surveys (dusk/dawn) are to be completed following the Bat Survey Guidelines (Ref. 2).	three visits. Winter Roosts: October - April
Bats – Activity Survey	*Transect Surveys:* Two site visits a month, for each month between April and October inclusive for walked transects. Two people must be present on each transect. Transects will incorporate all areas of suitable habitat. Particular focus will be on commuting bats using the hedgerows and tree lines. The transect route will depend on suitable and safe access. *Automated/Static Activity Surveys:* Three locations per transect with data to be collected on five consecutive nights per month, for each month between April and October inclusive for remote detector surveys. The devices will placed out and retrieved after each session. Recordings are then analysed in the office.	April - October. Two site visits per month.
Hazel Dormouse	A consultation with NRW and the local planning authority will be required to determine if further surveys for hazel dormouse are required.	If surveys are required. Dormouse tubes must be deployed within suitable areas of habitat and surveys must be undertaken once per month between April and November.
Badger	[redacted]	October - April

Feature/Species	Details	Survey Timing
Otter	An otter survey should be undertaken along watercourses and ditches and at least 100 m from the Project Site to ascertain presence and distribution. Otters have previously been identified within the local area (see Table 4-1)	Anytime
Water Vole	A water vole survey should be undertaken.	Two surveys required: one mid-April – June, and another July – September, at least 2 months apart.
Invasive Non-Native Plants	An INNS survey is required within areas that could not be accessed during the PEA.	May - September

1.1.6 The Executive Summary is not a substitute for the full report. Refer to the full text for further detail.

2. Introduction

2.1 Introduction

2.1.1 AECOM was instructed by Abergelli Power Limited (APL) to carry out a Preliminary Ecological Appraisal (PEA) of the Abergelli site, hereafter referred to as 'the Project Site'. The central grid reference for the Project Site is SN 6528 0143 and the boundary of the Project Site is shown on Figure 1.

2.1.2 This PEA was commissioned to identify whether there are known or potential ecological receptors (nature conservation designations, and protected and notable habitats and species) that may constrain or influence the design and implementation of the Project. The approach applied when undertaking this PEA pays due regard to the *Guidelines for Preliminary Ecological Appraisal* published by the Chartered Institute of Ecology and Environmental Management (Ref. 3). The PEA addresses relevant wildlife legislation and planning policy as summarised in Section 2 of this report.

2.1.3 In order to deliver the PEA, a desk study and an extended Phase 1 Habitat Survey were undertaken by an appropriately experienced ecologist, to identify ecological features within the Project Site and the wider potential zone of influence of the Project. The potential zone of influence was defined with reference to the project description provided by APL as shown as the habitats surveyed on Figure 1. Additional details are provided in Section 3: Methodology.

2.2 Proposed Development

2.2.1 The Project Site is located near to the village of Felindre, Swansea, as shown in Figure 1.1 of the ES, and the central grid reference for the Project Site is SN65280143. The Project Site is approximately 30.66 ha. A full description of the development is provided in Chapter 3: Project and Site Description) of the ES.

2.2.2 The development will require the removal of hedgerows, semi-natural broadleaved woodland, rows of trees, scrub, running water, ponds, hardstanding, marshy grassland, semi-improved grassland, improved grassland, and trees with potential for roosting bats.

2.2.3 It is understood that construction is programmed to commence no sooner than 2020/2021.

2.3 Objectives

2.3.1 The objectives of the PEA were:

- Identify designated nature conservation sites on or within proximity to the Project Site;
- Identify known records of protected or notable species within proximity to the Project Site;

- Identify and categorise the main habitats and features of ecological interest present within the Project Site ;
- Appraise the potential for protected or notable species of fauna and flora;
- Provide advice on potential ecological constraints and opportunities on or within proximity to the Project Site;
- Identify the requirement for further habitat and species surveys;
- Make recommendations for requirements to avoid and mitigate ecological impacts as well as opportunities for biodiversity enhancements; and,
- Provide a map showing the Phase 1 habitats on the Project Site and features of ecological interest.

2.3.2 The purpose of this report is to support the submission of a Development Consent Order (DCO) application. The report identifies the scope of further work (where necessary) that would be required to support a DCO application. High level recommendations are made on potential options for the avoidance, mitigation or compensation of the potential impacts of the Project (where known) on the identified ecological receptors, and of potential enhancements to the biodiversity and ecosystem services. A full assessment of potential effects and mitigation will be made during the Ecological Impact Assessment (EcIA).

2.4 Wildlife Legislation and Planning Policy

Wildlife Legislation

2.4.1 There are several different acts of legislation and regulations which refer to the protection of wildlife. These are summarised in Appendix A. In particular, the legislation relating to possible protected species on the Project Site is outlined. This is a brief summary of the legislation and is not to be regarded as a definitive legal opinion. When dealing with individual cases, the client is advised to consult the full texts of the relevant legislation and obtain further legal advice.

2.4.2 The following wildlife legislation is potentially relevant to the Project:

- The Wildlife and Countryside Act (WCA) 1981 (as amended);
- The Countryside and Rights of Way (CRoW) Act 2000;
- The Conservation of Habitats & Species Regulations 2010 (as amended);
- Environment (Wales) Act 2016;
- The Hedgerow Regulations 1997; and,
- The Protection of Badgers Act 1992.

2.4.3 The above legislation has been considered when planning and undertaking this PEA using the methods described in Section 3, when identifying potential constraints to the Project, and when making recommendations for further survey, design options and mitigation, as discussed in Section 5. Compliance with legislation may require the attainment of relevant protected species licences prior to the implementation of the Project.

National Planning Policy

Planning Policy Wales (8th Ed. January 2016)

2.4.4 Planning Policy Wales (PPW) sets out the land use planning policies of Welsh Government. It provides the policy framework for the preparation of Local Development Plans. Chapter 5, Conserving and Improving the Natural Heritage and Coast, outlines Welsh Government's objectives for the conservation and improvement of natural heritage.

Technical Advice Note 5 (TAN5) Nature Conservation and Planning (2009)

2.4.5 The Planning Policy Wales (PPW) is supplemented by a series of Technical Advice Notes. TAN 5 provides guidance on how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation. It provides advice on areas including the key principles of positive planning for nature conservation, nature conservation in Local Development Plans and development management procedures. It also provides advice on development affecting designated sites and habitats, in addition to protected or priority habitats and species.

2.4.6 Key Principles include that the town and country planning system in Wales should integrate nature conservation into all planning decisions; that the town and country planning system should look for development to provide a net benefit for biodiversity conservation with no significant loss of habitats or populations of species, locally or nationally and that they should ensure that the UK's international and national obligations for site, species and habitat protection are fully met in all planning decisions.

Local Planning Policy

2.4.7 Local Development Plans (LDPs) must be produced by every Local Planning Authority in Wales. Any development proposal will be tested against the policies within the LDP. The LDPs follow the planning guidance provide in PPW, including biodiversity and natural heritage policies. These include protecting designated sites and other areas of importance for biodiversity conservation; safeguarding protected species and priority species, including those listed in local biodiversity action plans and retaining, creating and enhancing features of importance for biodiversity conservation where appropriate.

2.4.8 Relevant local planning policies for City and County of Swansea (CCS) are detailed in the adopted City and County of Swansea Unitary Development Plan.

2.4.9 CCS has also submitted the Swansea Local Development Plan 2010 – 2025 to the Secretary of State for Examination in public. This is an emerging development plan, and is not part of the statutory development plan. However, its policies are a material consideration. :

2.4.10 Appendix A provides a summary of relevant local planning policies. For the precise wording of each specific policy please refer back to the source document. This planning policy has been considered when assessing potential ecological constraints and opportunities identified by the desk study and field surveys; and, when assessing requirements for further survey, design options and ecological mitigation, as described in Section 6.

2.5 Quality Assurance

2.5.1 This survey and subsequent report was undertaken in line with AECOM's Integrated Management System (IMS). Our IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the international standards BS EN ISO 9001:2008 and 14001:2004 and BS OHSAS 18001:2007. In addition our IMS requires careful selection and monitoring of the performance of all sub consultants and contractors.

2.5.2 All AECOM Ecologists who worked on this project are members of (at the appropriate level) the Chartered Institute of Ecology and Environmental Management (CIEEM) and follow their code of professional conduct (Ref. 4) when undertaking ecological work.

3. Methodology

3.1 Desk Study

3.1.1 The objectives of the desk study are to review the existing information available in the public domain concerning species and habitats to identify the following:

- Internationally, nationally and locally designated sites, up to 2 km from the Project Site using the Multi Agency Geographic Information for the Countryside (MAGIC) website (www.magic.gov.uk);
- Protected and Priority species records and records of locally designated sites up to 2 km from the Project Site, using the South East Wales Biodiversity Records Centre (SEWBReC);
- Special Areas of Conservation (SACs) and Sites of Special Scientific Interest (SSSIs) designated for bats within a 10 km radius of the Site in accordance with Bat Conservation Trust (Collins, 2016) recommendations;
- Section 7 list of Species and Habitats of Principal Importance for Conservation of Biological Diversity in Wales;
- Ancient Semi-Natural Woodland (ASNW), Plantation on Ancient Woodland Site (PAWS), Restored Ancient Woodland Site (RAWS) or Ancient Woodland Site of Unknown category (AWSU) within or adjacent to the Project Site boundary using LLE dataset (http://lle.gov.wales/home);
- Tree Protection Orders (TPO's) from Swansea Council; and,
- Aerial photographs and Ordnance Survey (OS) maps were reviewed to identify features of ecological interest surrounding the Project Site including ponds within 500 m, nearby areas of ecological interest and features connecting these habitats (hedgerows, watercourses, railway lines).

3.1.2 The reports of previous surveys undertaken by BSG Ecology and WSP/Parsons Brinckerhoff (WSP/PB) were provided by the client and were reviewed (Ref. 5).

3.2 Extended Phase 1 Habitat Survey

3.2.1 A Phase 1 Habitat Survey (Ref. 6) of the Project Site was undertaken by two suitably experienced ecologists of AECOM on the 18th and 19th May 2017.

3.2.2 The survey involved a site walkover and preliminary assessment of key habitats, land use and ecological features. The main habitats present were recorded using standard Phase 1 Habitat Survey methodology as described in the Handbook for Phase 1 Habitat Survey: A technique for Environmental Audit (JNCC, 2010). The plant species defining the habitat types on the Project Site were recorded. Evidence of any invasive plant species subject to legal controls was recorded. The Project Site was assessed for its potential to support protected or notable species in order to identify potential ecological constraints and to guide recommendations for further surveys.

3.3 Assessment of Bat Potential

3.3.1 During the Phase 1 Habitat Survey, where access allowed, trees and buildings throughout the Project Site were classified into categories dependent on the presence of features suitable as bat roost habitat.

3.3.2 Due to the size of the Project Site and the number of trees present within the Project Site boundary, it was not possible to make an assessment of every tree. However a number of trees were assessed during the Phase 1 Habitat Survey and the details of these are provided in Table 3-1 below. Trees within area of woodland present within or close to the Project Site boundary were not individually assessed but the woodlands were given an overall rating, based on species composition and age, of their likelihood to support roosting bats and/or the need for further assessment.

3.3.3 The assessment was conducted via an external appraisal from the ground using binoculars where necessary. Table 3-1 provides descriptions of the categories for buildings and trees.

3.3.4 Habitats on-site were classified into categories dependent on the presence of features suitable for bats to commute and forage. Table 3-2 provides descriptions for commuting and foraging habitats.

Table 3-1: Building and Tree Bat Roost Potential Categories

Roost Potential	Descriptions for Buildings	Descriptions for Trees
Known or Confirmed	Confirmed signs of bat presence/occupation (droppings, oily staining around entry points, insect remains, odour, scratching) and actual bat presence.	Confirmed signs of bat presence/occupation (droppings, oily staining around entry points, insect

Roost Potential	Descriptions for Buildings	Descriptions for Trees
		remains, odour, scratching) and actual bat presence.
High	A structure with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions (e.g. temperature, humidity, height above ground level, light levels or levels of disturbance) and surrounding habitat. Can include structures with points of access to the interior of the building and poorly maintained fabric providing ready access points for bats into structures, but at the same time not draughty. Structures of traditional stone, brick or timber construction. Structures with large (>20 cm) roof timbers with mortice joints, cracks and holes. Structures of pre or early 20th century construction. Structures with large complicated and/or uncluttered roof spaces providing unobstructed flying spaces. Structures with weather boarding and/or hanging tiles with gaps. Structures with accessible south facing roofs. Structures with proximity to good foraging habitat such as woodland, wetland, water and /or good hedgerows.	A tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions (e.g. temperature, humidity, height above ground level, light levels or levels of disturbance) and surrounding habitat.
Moderate	A structure with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions (e.g. temperature, humidity, height above ground level, light levels or levels of disturbance) and surrounding habitat but unlikely to support a roost of high conservation status. Can include structures with some potential to support roosting bats, but fewer features than a high risk building. Features may include areas suitable for crevice dwelling and/or access points into structures. Some proximity to foraging habitat.	A tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However these potential roost sites do not provide enough space, shelter protection,	Tree of sufficient size and age to contain potential roost features but with none seen from the ground or features seen have only very limited

Roost Potential	Descriptions for Buildings	Descriptions for Trees
	appropriate conditions and/or suitable habitat to be used on a regular basis or by large numbers of bats (i.e. unlikely to be suitable for maternity or hibernation).	roosting potential.
Negligible	No features suitable for roosting bats. Can include structures constructed from unsuitable materials e.g. prefabricated with steel and sheet material. Structure is draughty, light and cool buildings with no roosting opportunities. High levels of regular disturbance including external and/or internal lighting. Building is isolated from areas of foraging habitat.	Trees with no potential to support bats.

(Source: Category descriptions drawn from Ref. 2 and Ref. 7, to be applied using professional judgement)

Table 3-2: Commuting and Foraging Habitat Potential Categories

Commuting and Foraging Potential	Descriptions
High	Continuous high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Project Site is close to and connected to known roosts.
Moderate	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
Low	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or un-vegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small number of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Negligible	Negligible habitat features on site likely to be used by commuting or foraging bats.

(Source: Category descriptions drawn from Ref. 2 and Ref. 7, to be applied using professional judgement)

3.4 Limitations

3.4.1 Biological records can be received from a wide variety of sources and may or may not be comprehensive and accurate. However, if assessed in conjunction with a Phase 1 Habitat survey, they can contribute to a robust ecological assessment of a site.

3.4.2 Due to the size of the Project Site, it was not possible to assess every tree or building for its potential to support bats.

3.4.3 Some areas adjacent to but outside of the Project Site boundary were not accessible at the time of survey and as such these habitats were surveyed from the road at a distance.

3.4.4 Some areas within the Project Site boundary were not accessible due to the presence of horses; these habitats were surveyed at a distance.

3.4.5 There is potential for trees and/or buildings with the potential to support roosting bats to have gone unrecorded due to time and access restrictions. It is possible that some species, including invasive non-native plant species may not have been recorded due to access limitations.

3.4.6 Despite the limitations described, there are deemed to be no significant limitations to this PEA.

4. Baseline Conditions

4.1 Desk Study Results

4.1.1 The designated habitats, sites and features within proximity to the Project Site are listed in Table 4-1 below and shown on Figure 2.

Table 4-1: Desk Study Results

Designation /Feature	Description
Designated Sites within 2 km	**Nant Y Crimp SSSI** **Distance and Direction**: Approximately 1.3 km west **Description**: Nant y Crimp is of special interest for its wet pastures, species-rich neutral grasslands and semi-natural woodland as well as associated scrub, which are host to several uncommon plant species. Notable plant species recorded at the Site include petty whin *Genista anglica*, cranberry *Vaccinium oxycoccos*, narrow buckler fern *Dryopteris carthusiana* and whorled caraway *Carum verticillatum*, the latter an Atlantic species characteristic of unimproved pastures in the South Wales coalfield. In addition, there is also a colony of the marsh fritillary butterfly *Euphydryas aurinia* at the Site. This is a declining species confined in South Wales to wet agriculturally unimproved pastures where its food plant, devil's bit scabious *Succisa pratensis*, grows in profusion.
Locally Designated Sites within 2 km	**Llety-Morfil SNCI** **Distance and Direction:** Within the Project Site boundary **Description:** Supporting the habitats: native wet woodland, ancient woodland, structurally-diverse and species-rich scrub, and purple moor-grass and rush pasture; and the Section 7 listed moth, wall *Lasiommata megera*. **Coed Barcud Wildlife Trust Reserve** **Distance and Direction**: Adjacent to the north east of the Project Site. **Description**: A previously improved grassland field, planted up to become a future woodland. Within the boundary of Rhos Fawr SNCI. **Rhos Fawr SNCI** **Distance and Direction:** Adjacent to the northern Project Site boundary **Description:** Supporting the habitats: woodland containing ancient woodland indicator species, structurally-diverse and species-rich scrub, species-rich neutral grassland, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species.

Designation /Feature	Description
	Felindre Grasslands SNCI **Distance and Direction:** Adjacent to the west of the Project Site boundary. **Description:** Native wet woodland, lowland mixed deciduous woodland, structurally-diverse and species-rich gorse scrub, and purple moor-grass and rush pasture; and a number of Section 7 listed invertebrate and bird species, and the Schedule 1 listed birds barn owl *Tyto alba* and Northern goshawk *Accipiter gentilis*. **Middle Llan SNCI** **Distance and Direction:** Adjacent to the southern Project Site boundary **Description:** Supporting the habitats: Continuous semi-natural linear vegetation and watercourse with exposure/erosion features. **Rhyd-Y-Pandy Valley and Grasslands SNCI** **Distance and Direction:** Approximately 70 m east **Description:** Supporting the habitats: native wet woodland, woodland containing ancient woodland indicator species, gorse stands, lowland meadow, species-rich neutral grassland, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, reedbeds, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species, and the Schedule 1 listed birds barn owl and red kite *Milvus milvus*. **Waun Garn Wen SNCI** **Distance and Direction:** Approximately 130 m west **Description:** Supporting the habitats: native wet woodland, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species. **Pant Lasau SNCI** **Distance and Direction:** Approximately 120 m south **Description:** Supporting the habitats: native wet woodland, lowland mixed deciduous woodland, gorse stands, lowland fen, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species. **Cefn Forest Stream SNCI** **Distance and Direction:** Approximately 230 m south west **Description:** Supporting the habitats: woodland containing ancient woodland indicator species, upland mixed ash woodland, native wet woodland, lowland mixed deciduous woodland, lowland meadow, species-rich neutral grassland, structurally-diverse and species-rich scrub, degraded lowland heath, lowland fen, purple moor-grass and rush pasture, ponds, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species, and

Designation /Feature	Description
	the Schedule 1 listed bird barn owl. **<u>Lower Lliw Resivoir SNCI</u>** **Distance and Direction:** Approximately 460 m north **Description:** Supporting the habitats: woodland containing ancient woodland indicator species, gorse stands, species-rich bracken, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species, and the Schedule 1 listed birds kingfisher *Alcedo atthis*, merlin *Falco columbarius* and red kite. **<u>Middle Lliw SNCI</u>** **Distance and Direction:** Approximately 670 m north west **Description:** Supporting the habitats: ancient semi-natural woodland, woodland containing ancient woodland indicator species, structurally-diverse and species-rich scrub, gorse stands, species-rich neutral grassland, semi-improved lowland dry acid grassland, acid grassland with anthills, purple moor-grass and rush pasture, watercourse with exposure/erosion features, and species-rich bracken; and a number of Section 7 listed invertebrate species. **<u>Cilfaen SNCI</u>** **Distance and Direction:** Approximately 760 m north west **Description:** Supporting the habitats: wet woodland, woodland containing ancient woodland indicator species, and purple moor-grass and rush pasture.
Designated Sites within 10 km designated for bats	There are no sites designated for bats within 10 km of the Project Site.
Protected and Priority Species Records from the last 10 years within 2 km	The following species have been recorded within 2 km of the Project Site in the last 10 years: **Plants**: Cornflower *Centaurea cyanus*, bluebell *Hyacinthoides non-scripta.* **Invertebrates**: Dusky brocade *Apamea remissa*, minor shoulder-knot *Brachylomia viminalis*, broom moth *Ceramica pisi*, small phoenix *Ecliptopera silaceata,* dingy skipper *Erynnis tages*, marsh fritillary *Euphydryas aurinia*, rustic *Hoplodrina blanda*, shoulder-striped wainscot *Leucania comma*, buff ermine *Spilosoma lutea*, blood-vein *Timandra comae*. **Amphibians:** Common toad *Bufo bufo*, palmate newt *Lissotriton helveticus*, common frog *Rana temporaria*. **Reptiles**: Slow-worm *Anguis fragilis*, grass snake *Natrix natrix*, adder *Vipera berus*, common lizard *Zootoca vivipara.* **Birds**: Lesser redpoll *Acanthis cabaret*, goshawk *Accipiter gentilis*, skylark *Alauda arvensis*, kingfisher *Alcedo atthis*, tree pipit *Anthus trivialis*, little ringed plover *Charadrius dubius*, ringed plover *Charadrius hiaticula*, black-headed gull *Chroicocephalus ridibundus*,

Designation /Feature	Description
	cuckoo *Cuculus canorus*, lesser spotted woodpecker *Dendrocopos minor*, yellowhammer *Emberiza citronella*, reed bunting *Emberiza schoeniclus*, merlin *Falco columbarius*, peregrine *Falco peregrinus*, hobby *Falco Subbuteo*, kestrel *Falco tinnunculus*, pied flycatcher *Ficedula hypoleuca*, linnet *Linaria cannabina*, grasshopper warbler *Locustella naevia*, common crossbill *Loxia curvirostra*, common scoter *Melanitta nigra*, red kite *Milvus milvus*, spotted flycatcher *Muscicapa striata*, curlew *Numenius arquata*, osprey *Pandion haliaetus*, house sparrow *Passer domesticus*, wood warbler *Phylloscopus sibilatrix*, willow tit *Poecile montana*, marsh tit *Poecile palustris*, dunnock *Prunella modularis*, bullfinch *Pyrrhula pyrrhula*, starling *Sturnus vulgaris*, redwing *Turdus iliacus*, song thrush *Turdus philomelos*, fieldfare *Turdus pilaris*, barn owl *Tyto alba*, lapwing *Vanellus vanellus*. **Bats**: Bat species *Chiroptera*, unidentified bat *Myotis*, Daubenton's *Myotis daubentonii*, Natterer's *Myotis nattereri*, Noctule *Nyctalus noctule*, pipistrelle species *Pipistrellus,* common pipistrelle *Pipistrellus pipistrelles*, soprano pipistrelle *Pipistrellus pygmaeus*, long-eared species *Plecotus*, brown long-eared *Plecotus auritus*. **Mammals (excluding bats):** West European hedgehog *Erinaceus europaeus*, European otter *Lutra lutra*, Eurasian badger *Meles meles*, polecat *Mustela putorius.*
Priority Habitats and Species – Section 7 List	The full list of Section 7 Habitats and Species of Principle Importance in Wales has been reviewed. Those priority habitats present on site and priority species with potential to be on site are listed in Table 4-2 and Table 4-3 respectively.
Surrounding Land Use	The Project Site is located to the north of Junction 46 of the M4 Motorway close to the village of Felindre, Swansea. The Project Site has agricultural fields to the east, south and north. Areas of woodland are located to the south, east and west of the Project Site. Areas of the Felindre Gas Compressor Station with associated roads and buildings are partially within and adjacent to the Project Site boundary. A waste water treatment works is located in the north west outside of the Project Site boundary.
Ancient Woodland	The following five areas have been identified: • An 8.1ha area of RAWS within and adjacent to the Project Site boundary towards the south west; • A 15.1 ha area of ASWU within and adjacent to the Project Site boundary in the south west. Part of this ASWU area covers the Felindre Gas Compressor Station; • A 0.9 ha area of PAWS adjacent to the Project Site boundary towards to the south west; • An 4.3 ha area of RAWS adjacent to the Project Site boundary; and, • A 1.6 ha ASNW adjacent to the Project Site boundary in the east. This area is also subject to TPOs.

Designation /Feature	Description
Tree Protection Orders (TPOs)	Swansea County Council advised that there is a small area of ASNW woodland covered by TPOs which is adjacent to the Project Site boundary to the east.
Ponds within 500m	OS mapping shows 25 Ponds within 500 m of the Project Site boundary, three of these (Ponds 16,22 and 23) are within the Project Site boundary: • Ponds 1 – 8: Located near to a waste water treatment works approximately 350m west. Connected to the Site via woodland and grassland; • Ponds 9, 10 and 21: Located approximately 350m east and connected to the north-east tip of the road boundary via grassland; • Pond 11: Approximately 210 m west of the Project Site boundary and connected to the Site via grassland and scrub; • Ponds 12 – 14 and 18: Located approximately 450 m east and connected to the Site via woodland and grassland; • Pond 15: Located approximately 130 m north and connected to the Site via woodland and grassland; • Pond 16: Within the Project Site boundary, dry during the Phase 1 Habitat Survey; • Pond 17: Located approximately 200 m west and connected to the Site via woodland, grassland and scrub; • Ponds 19a and 19b: Approximately 400 m north and connected to the Site via grassland; • Pond 20: Approximately 450 m north, connected to the Site via grassland. This pond was identified as dry dry during the Phase 1 Habitat Survey; • Pond 22: Within the Project Site boundary; • Pond 23: Within the Project Site boundary and identified during the Phase 1 Habitat Survey (Appendix B: Target Note 28). This pond was not accessible due to the presence of horses; and, • Pond 24: Approximately 150 m north within the garden of Pen-y-Waun Fach Cottage. The pond is connected to the Site via grassland and woodland.
Previous Surveys	The client provided AECOM with the reports of previous surveys undertaken by BSG Ecology and WSP/PB within the Site (Ref. 5, and Appendices 8.3 and 8.8 of the ES). It was noted that the current red line boundary of the Site is now smaller than the red line boundary used by BSG Ecology and WSP/PB. However, the current red line boundary is within the same area as the previous red line boundary provided to BSG Ecology and WSP/PB and therefore the surveys undertaken would have captured the current Project Site boundary. A summary of the previous protected and priority species surveys are detailed below:

Designation /Feature	Description			
	Species	**Year**	**Summary Results**	**Company**
	Invertebrates (moths, marsh fritillary (adult and larval stages), terrestrial *Coleoptera*, and aquatic macroinvertebrates (in ponds and watercourses)	2014	No protected species identified. A total of 384 species were recorded from the Survey Site. One species is Red Data Book. Two are nationally scarce and fourteen are Section 7species.	BSG Ecology
	Great Crested Newts (GCN) *Triturus cristatus*	2014	No GCN Identified within five ponds surveyed. Palmate newts and smooth newts *Lissotriton vulgaris* were found.	BSG Ecology
	Reptiles	2014	A peak count of 50 common lizard and a peak count of five grass snake were identified within the Site.	BSG Ecology
	Breeding Birds (including barn owl)	2014	Nine Section 42 (now Section 7) bird species considered likely to breed on Site. Two Schedule 1 species, red kite and peregrine falcon recorded. No evidence of schedule 1 species breeding within the Project Site. No evidence of barn owl within the Project Site.	BSG Ecology
	Hazel Dormouse *Muscardinus avellanarius*	2014	No dormice recorded from targeted surveys between June and November 2014.	BSG Ecology
	[redacted]	[redacted]	[redacted]	[redacted]

Designation /Feature	Description			
	Otter	2014	Otter spraint identified within the Project Site.	BSG Ecology
	Water vole *Arvicola amphibius*	2014	Holes that were likely to be mammal burrows were observed. The holes have the right dimensions to allow use by water voles, but did not show signs of current occupation. No latrines, footprints or grazing lawns were observed during the survey.	BSG Ecology
	Bats	2014	At least seven species of bats were recorded during transect surveys; common pipistrelle, soprano pipistrelle, Myotis sp., long-eared bat., noctule, Leisler's bat, and lesser horseshoe bat. All of these species and an additional three were recorded during automated bat detector surveys; Nathusius' pipistrelle, serotine, and greater horseshoe bat. Roost surveys of buildings within the survey Site confirmed that at least three buildings contained bat droppings and were used as bat roosts. Droppings from at least three species of bats (pipistrelle sp., long-eared bat sp. and lesser horseshoe bat) were found. Thirty three trees were located within the survey Site that were considered to have potential to support roosting bats. Emergence and /or re-entry surveys were carried out on eight trees all of which would potentially be directly affected by the Project. No bats were recorded emerging from or entering these potential tree roosts.	BSG Ecology
	Invasive Species	2014	Japanese knotweed *Fallopia japonica*, Himalayan balsam	BSG Ecology

Designation /Feature	Description			
			Impatiens glandulifera, rhododendron *Ericaceae species*, floating pennywort *Hydrocotyle ranunculoide* and montbretia *Crocosmia x crocosmifolia* identified within the Project Site boundary.	
	Invasive Species	2017	Himalayan balsam, Japanese knotweed, montbretia, Japanese rose *Rosa rugosa* and rhododendron. Identified within the Project Site boundary.	WSP/PB

4.2 Extended Phase 1 Habitat Survey

4.2.1 The habitats present within the Project Site boundary and their descriptions are shown in Table 4-2. A plan of the Site showing the location and distribution of these habitats is shown in Figure 1.

Table 4-2: Phase 1 Habitats and Descriptions

Habitat	Description	Section 7 Habitat
Broadleaved Woodland – Semi-Natural	There are areas of semi-natural broadleaved woodland, including areas of RAWS and ASWU, within the Project Site. There is an areas of wet woodland. Species include; oak species *Quercus*, silver birch *Betula pendula*, rowan *Sorbus* sp., honeysuckle *Lonicera periclymenum.*, holly *Ilex aquifolium*, alder *Alnus glutinosa*, hazel *Corylus avellana*, goat willow *Salix caprea,* willow species *Salix* sp. and bramble *Rubus fruticosus* with a ground flora including broad buckler fern *Dryopteris dilatata*, hard fern *Blechnum spicant*, male fern *Dryopteris filix-mas*, pignut Conopodium majus, lesser celandine *Ficaria verna* and native bluebell, herb Robert *Geranium robertianum* and wild strawberry *Fragaria vesca.*	Yes
Broadleaved Woodland – Plantation	There is one small area of broadleaved plantation woodland located within National Grid Compound in the south of the Project Site. Species include; silver birch, alder, willow species, and bramble. Trees with the potential to support roosting bats are described in Table 4-5	Yes
Scrub – Dense/Continuous	There are several areas of dense scrub, predominantly found in the south of the Project Site, but with one area in the north and one in the centre of the Project Site. Species include; bramble, willow species, gorse *Ulex europaeus*	No

Habitat	Description	Section 7 Habitat
	and bracken *Pteridium aquilinum* (Appendix C: Photographs 19 and 23 – 34).	
Scrub – Scattered	Several areas of scattered scrub are found within the south of the Project Site. Species include; gorse, silver birch, willow species, hawthorn *Crataegus monogyna* and bramble.	No
Rows of Trees – Broadleaved	Rows of trees are predominantly located in between grassland fields and along road edges. The majority of these are located on top of earth banks constructed with stone and earth and covered in grass. Species include silver birch, oak species, hawthorn and holly, with a ground flora including native bluebell, dog violet *Viola riviniana*, herb Robert, cleavers *Galium aparine* and sweet vernal grass *Anthoxanthum odoratum* (Appendix C: Photographs 19 and 26)	No
Standalone Trees	There are 13 standalone trees within the Site: • A pedunculate oak Quercus robur, 12 m in height with a diameter at breast height (DBH) of 0.7 m; • An oak species, 13 m in height with a DBH of 0.6 m; • A holly 10 m in height with a DBH of 0.3 m; • A holly 10 m in height with a DBH of 0.3 m; • An oak species 14 m in height with a DBH of 0.7 m; • An oak species 11 m in height with a DBH of 0.4 m; • An ash 8 m in height with a DBH of 0.3 m; • An oak species 12 m in height with a DBH of 0.5 m; • An oak species 9 m in height with a DBH of 0.3 m; • An oak species 11 m in height with a DBH of 0.5 m; • A pedunculate oak 12 m in height with a DBH of 1 m; • A pedunculate oak 12 m in height with a DBH of 1 m; and, • An oak species 9 m in height with a DBH of 0.6 m. Trees with the potential to support roosting bats are described in Table 4-5.	No
Ruderal – Tall Herb and Fern	There are two areas of tall ruderal vegetation. Species include bracken and nettle *Urtica dioica*.	No
Semi-Improved Neutral Grassland	There is semi-improved neutral grassland present on road and track sides both within and adjacent to the Project Site boundary. There are several semi-improved grassland fields within the centre of the Project Site. Semi-improved grassland species include; red fescue *Festuca rubra*, common vetch *Vicia sativa*, ribwort plantain *Plantago lanceolata*, sweet vernal grass, coltsfoot	Yes

Habitat	Description	Section 7 Habitat
	Tussilago farfara, marsh thistle *Cirsium palustre*, hard rush *Juncus inflexus*, compact rush *Juncus conglomeratus*, bird's foot trefoil *Lotus corniculatus*, black medic *Medicago lupulina*, perennial rye grass *Lolium perenne*, red clover *Trifolium pratense*, common mouse-ear *Cerastium fontanum*, Yorkshire fog *Holcus lanatus* and common bent *Agrostis capillaris* (Appendix C: Photographs 19, 21 and 24 – 25).	
Marshy Grassland	There are frequent areas of marshy grassland dominated by soft rush *Juncus effusus* and purple moor grass *Molinia caerulea* both within the Project Site boundary. Marshy grassland areas are predominantly located towards the south of the Project Site.	Yes
Improved Grassland	Areas of improved grassland are dominant throughout the Project Site. The majority of these are sheep and horse grazed. Species include; perennial rye grass, annual meadow grass *Poa annua*, sweet vernal grass and clover species (Appendix C: Photographs 19 – 20 and 26).	No
Running Water	There are several wet ditches (watercourses) across the Project Site (Appendix C: Photograph 26).	No
Standing Water	There are three ponds within the Project Site boundary (Appendix B: Target Notes 28, 40 and 44).	Yes
Hedgerow with Trees – Species – Rich	There is one native species-rich hedgerow alongside the access road to the National Grid site. Species include oak species, ash *Fraxinus excelsior,* hazel, honeysuckle, dog rose *Rosa canina*, field maple *Acer campestre*, holly and goat willow (Appendix C: Photograph 22).	Yes
Hedgerow with Trees – Species – Poor	There is one species-poor hedgerow within the Project Site boundary. Species include oak, ash, rowan, hawthorn, bramble and dog rose with a ground flora which includes native bluebell.	Yes
Intact Hedgerow – Species – Poor	There are two intact species-poor hedgerows. Species include hawthorn, blackthorn *Prunus spinosa*, bramble, hazel, willow species, holly, rose species, oak species, and ash.	Yes
Earth Bank	There are several grass covered raised earth banks within the Project Site. The earth banks comprise earth and stone. Some of these have scattered hawthorn and holly bushes with native bluebells on top of them. The earth banks with rows of trees on top are captured under the row of trees category.	No
Buildings	There are two buildings within the National Grid Compound within the south of the Project Site boundary; these buildings were not assessed for bats due to restricted	No

Habitat	Description	Section 7 Habitat
	access. Four buildings (outside of the Project Site boundary) were identified as having the potential to support roosting bats. Further detail is given in Section 4.5 (Appendix C: Photographs 7 – 17).	
Fences	There is frequent fencing including security and barbed wire fencing throughout the Project Site. The fences have no ecological value.	No
Bare Ground (Hard Standing)	Areas of gravel, asphalt road and pedestrian pavements are located across the Project Site. These have no ecological value.	No

4.3 Protected and Priority Species

4.3.1 Details of protected and priority species recorded on Project Site are shown in Table 4-3. A plan of the Project Site showing the location and distribution of features with potential for protected or priority species is shown in Figure 1. Target notes of protected species evidence or features that have potential to support protected species are shown in Figure 1 and Appendix B.

Table 4-3: Protected and Priority Species Potential

Species/ Species Group	Associated habitat	Description	Section 7 Species
Invertebrates	All natural habitats	All of the natural habitats on Project Site have the potential to support generalist aquatic and terrestrial invertebrates as well as some scarce invertebrates as previously identified in 2014 (see Table 4-1). Records of marsh fritillary were returned from the local records centre. The NVC survey undertaken by BSG Ecology in 2014 identified devil's bit scabious (the marsh fritillary larvae's main food source) within an area which now lies outside of the Project Site boundary and there is no reference to this plant growing anywhere else within the Project Site (Appendix 8.3 of the ES). Subsequent targeted surveys for marsh fritillary butterfly within the area where devils bit scabious was identified were undertaken by BSG Ecology in 2014. BSG Ecology did not find any evidence of marsh fritillary butterfly (Appendix 8.3 of the ES). The WSP/PB updated PEA report did not find any evidence of devil's bit scabious within the Project Site, however it was noted that the PEA was	Yes

Species/ Species Group	Associated habitat	Description	Section 7 Species
		conducted outside of this plants flowering period of July to October and may have gone unrecorded. It stated that there may still be suitable areas within the Project Site in which devil's bit scabious may be found (Ref. 5). Devil's bit scabious typically grows in damp meadows and marshes and along woodland rides and riverbanks. Areas of semi-improved neutral grassland and marshy grassland are present within the Project Site. Therefore there is the potential for devil's bit scabious to be present, however it is considered that even if this plant is now present within the Project Site it is unlikely to be in any great number and therefore it is considered unlikely that marsh fritillary butterfly will be present.	
Amphibians (including GCN)	Running water and ponds, marshy grassland and woodland.	These habitats are suitable for supporting generalist amphibians, including frogs, toads and smooth and palmate newts. Areas of slow running water and ponds have the potential to support breeding GCN. Areas of marshy grassland and woodland have the potential to support GCN using these areas to commute to ponds as well as providing suitable habitat for foraging and hibernation during the terrestrial phase of their life cycle. No GCN have been recorded previously at the Project Site (see Table 4-1) and no records of GCN were identified from the local records centre.	Yes
Reptiles	Semi-improved and marshy grassland, dense and scattered scrub, row of trees, earth banks, wood piles, gabion cage semi-natural broadleaved woodland, running	Semi-improved and marshy grassland, dense and scattered scrub has the potential to support foraging reptiles (Appendix B: Target Notes 7, 12, 14, 18, 20, 31, 32, 36 – 38) Row of trees on earth banks which occur near to woodland or semi-improved grassland may support foraging reptiles and the earth banks with stones have the potential to provide areas for basking as well as shelter and hibernation opportunities (Appendix B: Target Note 39). Wood piles have the potential to provide shelter, hibernation and basking opportunities (Appendix B: Target Notes 8 and 30). The gabion cage has the potential to provide shelter, and hibernation opportunities (Appendix B: Target Note 19). Semi-natural broadleaved woodland, hedgerows	Yes

Species/ Species Group	Associated habitat	Description	Section 7 Species
	water and ponds.	and scrub have the potential to support foraging reptiles as well as providing suitable habitat for shelter and hibernation (Appendix B: Target Notes 12 and 13) Clearings within the semi-natural broadleaved woodland have the potential to support basking reptiles. Running water, ponds and marshy grassland have the potential to provide foraging opportunities for grass snake. The surveys carried out by BSG Ecology in 2014 identified populations of common lizard and grass snake within the Project Site (see Table 4-1).	
Breeding Birds	Semi-natural and plantation woodland, rows of trees, standalone trees, species –rich and species - poor hedgerows, dense and scattered scrub and marshy and semi-improved grassland.	Semi-natural and plantation woodland, rows of trees, standalone trees, species –rich and species-poor hedgerows, dense and scattered scrub and grassland have the potential to support breeding birds. Redpoll, goldcrest *Regulus regulus*, blackcap *Sylvia atricapilla*, robin *Erithacus rubecula,* blue tit *Cyanistes caeruleus*, wren *Troglodytes troglodytes,* blackbird *Turdus merula*, cuckoo and bullfinch were heard during the Phase 1 Habitat Survey (Appendix B: Target Notes 2 and 5). Marshy and semi-improved grassland has the potential to support ground nesting birds, such as lapwing (Appendix B: Target Note 22) and snipe *Gallinago gallinago*. Records of barn owl, goshawk, red kite and peregrine were returned by the local records centre. The breeding bird survey undertaken in 2014 by BSG Ecology did not find any evidence of these species breeding within the Project Site boundary (see Table 4-1). However, it is possible that these species may now be breeding on Project Site.	Yes
Bats	Semi-natural and plantation woodland, rows of trees, standalone trees, species –rich and species	Trees in semi-natural and plantation woodland and rows of trees, and standalone trees have the potential to support roosting, foraging and commuting bats (Appendix B: Target Notes 29, 35 and 36). Species-rich and species-poor hedgerows, dense and scattered scrub, and running water have the potential to support foraging and commuting bats. Marshy and semi-improved grassland and ponds have the potential to support foraging bats. The Project Site was assessed as having High	Yes

Species/ Species Group	Associated habitat	Description	Section 7 Species
	poor hedgerows, dense and scattered scrub and marshy and semi-improved grassland, running water and ponds. Buildings.	commuting and foraging potential (see Table 3-2). Eleven trees were assessed as having the potential to support roosting bats (see Table 4-5). Not all trees close to the Project Site boundary were assessed for their potential to support roosting bats. The majority of trees within the woodlands close to or adjacent to the Project Site boundary were not assessed for their potential to support roosting bats. However, it was noted that the trees within area of woodland are of a suitable age and size to support bat roost potential features. Four buildings (outside of the Project Site boundary) were assessed as having the potential to support roosting bats (see Table 4-5), **Bat surveys undertaken by BSG Ecology in 2014 identified the following (Appendix 8.8 of the ES):** *Internal and External Building Inspection* • Building 4 (not assessed during the AECOM PEA due to landowner access refusal) – Confirmed roost. Long-eared, pipistrelle and lesser horseshoe bat droppings identified in the store room; • Building 8 (AECOM Building 2) – Confirmed bat roost. Long-eared and pipistrelle bat droppings identified in both the first and second storey at the north of the building; • Building 10 (not assessed during the AECOM PEA, outside of the Project Site boundary). Pipistrelle bat droppings identified on the floor; • Buildings 1, 2, 5 and 11 (not assessed during the AECOM PEA, outside of the Project Site boundary) were assessed as having Moderate potential; • Building 7 (AECOM Building 3) was assessed as having Low potential; and, • Building 3, 6 and 9 (not assessed during the AECOM PEA, outside of the Project Site boundary) were assessed as having negligible potential. No further bat surveys were undertaken on buildings as BSG Ecology stated that they would not be affected by the development proposals.	

Species/ Species Group	Associated habitat	Description	Section 7 Species
		Foraging and Commuting Common and soprano pipistrelle, myotis species, noctule, Leisler's and long-eared bat species were identified during the walked transects and static bat detector surveys: One record of lesser horseshoe bat in the south of the Project Site was recorded during the walked transect. In addition to the species listed above Serotine, Nathusius' pipistrelle and greater horseshoe were identified during the static bat detector surveys. The most frequently occurring species across the Project Site were common and soprano pipistrelle. The majority of the bat activity was recorded along hedgerows and treelines within the Project Site. The areas identified during the static detector bat surveys with the highest levels of bat activity were located in the south of the Project Site.	
Brown Hare *Lepus europaeus*	Semi-improved and marshy grassland and woodland	Semi-improved and marshy grassland and woodland habitats have the potential to support breeding, foraging and commuting brown hares. A brown hare was observed within semi-improved grassland by AECOM Ecologists when undertaking GCN surveys (Appendix B: Target Note 43).	Yes
Hazel Dormouse	Semi-natural and plantation woodland, rows of trees, dense and scattered scrub, species-poor and species-rich hedgerows.	Semi-natural and plantation woodland, rows of trees, dense and scattered scrub, species-poor and species-rich hedgerows have the potential to support breeding and foraging dormice (Appendix B: Target Notes 9 and 34 – 35). The dormouse surveys carried out by BSG Ecology in 2014 did not find any evidence of dormice (see Table 4-1).	Yes
European Hedgehog	Semi-natural and plantation woodland, species-rich and species-poor	Semi-natural and plantation woodland, species-rich and species-poor hedgerows dense and scattered scrub has the potential to support hibernating, foraging and commuting hedgehogs. Woodpiles have the potential to support hibernating hedgehogs. Marshy grassland and semi-improved grassland	Yes

Species/ Species Group	Associated habitat	Description	Section 7 Species
	hedgerows, dense and scattered scrub, marshy grassland and semi-improved grassland and woodpiles.	has the potential to support foraging and commuting hedgehogs.	
Badger	Semi-natural and plantation woodland, rows of trees, species-rich and species-poor hedgerows, dense and scattered scrub, marshy grassland and semi-improved and improved grassland.	[redacted]	No
Polecat	Semi-natural and plantation woodland, rows of trees, species-rich and species-poor hedgerows, dense and scattered scrub and semi-	These habitats have the potential to support foraging polecats. Polecat's food sources include rabbits, rats, birds and frogs which are likely to be present within the Project Site boundary. Six records of polecat were returned within 2 km of the Project Site from the local records centre. Piles of wood (Appendix B: Target Notes 8 and 30), woodland and any areas where rabbit burrows are present have the potential to support breeding polecat.	Yes

Species/ Species Group	Associated habitat	Description	Section 7 Species
	improved and improved grassland. Wood Piles.		
Otter	Semi-natural broad-leaved woodland, marshy grassland and running water.	Semi-natural broadleaved woodland which contains or is close to running water has the potential to support breeding as well as foraging and commuting otter. Running water and marshy grassland have the potential to support foraging and commuting otter. Otters are known to be in the area as spraints have been identified outside of the Project Site boundary during protected species surveys carried out by AECOM in 2017. One otter spraint was identified during the BSG Ecology surveys in 2014 (See Table 4-1).	Yes
Water Vole	Running water, marshy grassland and semi-improved grassland.	Running water, marshy grassland and semi-improved grassland provides suitable habitat for water vole. Previous surveys undertaken by BSG Ecology have identified mammal burrows that could be water vole burrows (see Table 4-1).	Yes

4.4 Invasive Species Subject to Legal Controls

4.4.1 Invasive species subject to legal controls were identified on the Project Site at the time of survey and are and are shown in Table 4-4 and on Figure 1. Not all areas of the Site were assessed for invasive species during the Phase 1 Habitat Survey due to access limitations. There is the potential for invasive species to have gone unrecorded in these areas.

Table 4-4: Invasive Species Subject to Legal Controls

Invasive Species Point	Species	Description
1	Rhododendron	5 x 6 m in size.
2	Japanese knotweed	Within hedgerow 5 m long by 1 m wide and 2 m high.
3	Japanese knotweed	On the edge of the road 2x1x2 m in size.
4	Japanese knotweed	Along the edge of a small area of woodland. 10x1x2 m in size (Appendix C: Photograph 18).
5	Rhododendron	Within woodland. 2x2x1 m in size.

Invasive Species Point	Species	Description
6	Rhododendron	1x1x1 m in size.
7	Japanese knotweed	On bank 1x1x2 m in size.
8	Japanese knotweed	Outside of the Project Site boundary. Roots could be inside the Project Site boundary.
9	Japanese knotweed	Occurring throughout the row of trees.
10	Japanese knotweed	Located in the centre of the field which is outside of the Project Site boundary and had no access. Viewed from the road.
11	Japanese knotweed	Within an area of improved grassland. 15x4m in size.
12	Japanese knotweed	4x5 m in size.
13	Himalayan balsam	Large extent of stands along woodland edge and within grassland. There are some scattered stands within the woodland.
14	Himalayan balsam	Young plants throughout scrub/tree line.

4.5 Bat Roost Assessment

4.5.1 Features suitable for supporting roosting bats were assessed during the site visit and are shown in Table 4-5. The locations of potential roosts are shown on Figure 1. Due to time and access constraints during the Phase 1 Habitat Survey, not all trees within the Project Site boundary, not all trees within woodland parcels in close proximity to the Project Site boundary and not all buildings in close proximity to the Project Site boundary were assessed for their potential to support roosting bats.

Table 4-5: Features Assessed as Having Potential to Support Roosting Bats

Feature	Description	Bat Roost Potential Category
Building 1	Approximately 120 m outside of the Project Site boundary to the north east. This was not fully assessed due to time constraints of the PEA survey. This is a modern building with a tiled roof. There were no obvious gaps. House sparrows were observed using spaces in the roof.	Low
Building 2	Approximately 75 m outside of the Project Site boundary to the west. A brick built building with a tower and asbestos pitched roof. There are fly-in access and crevice points (Appendix C: Photographs 7 – 11).	High BSG Ecology confirmed this as a roost in 2014 (Appendix 8.8 of the ES).
Building 3	Approximately 5 m outside of the Project Site boundary to the west. A brick built building with a pitched asbestos roof. There	Moderate

Feature	Description	Bat Roost Potential Category
	are gaps in the mortar and brick work and behind the wooden facia boards (Appendix C: Photographs 12 – 15).	
Building 4	Approximately 10 m outside of the Project Site boundary to the west. A single story brick built building with gaps leading to a cavity wall. Gaps are present on the east and south face of this building (Appendix C: Photographs 16 – 17).	Moderate
Tree 1	Within the Project Site boundary. An oak species, 14 m in height with a DBH of 0.7 m. This tree has south facing split at 6 m (Appendix C: Photograph 1).	Low
Tree 2	Within the Project Site boundary. An oak species, 12 m in height with a DBH of 0.6 m. This tree had dense ivy cover which could be obscuring potential bat features. The ivy itself did not appear to be a suitable feature for use by bats.	Low
Tree 3	Within the Project Site boundary. An oak species, 17 m in height with a DBH of 1.1 m. There is a knothole at 3 m facing north west and a crack in the limb at 5 m facing west.	Moderate
Tree 4	Approximately 55 m outside of the Project Site boundary to the south east. An oak species, 10 m in height with a DBH of 0.7 m. There is a hollow that extends for approximately 30 cm which could be used by a roost for a small number of bats.	Low
Tree 5	Approximately 20 m outside of the Project Site boundary to the south. An oak species, 14 m in height with a DBH of 0.8 m. A hollow at 0.5 m within the base of the tree (Appendix C: Photograph 2).	Low
Tree 6	Within the Project Site boundary. A pedunculate oak, 12 m in height with a DBH of 0.7 m. There is a spilt in the stem facing south towards the road and a woodpecker hole (Appendix C: Photograph 3).	Moderate
Tree 7	Within the Project Site boundary. A pedunculate oak, 8 m in height with a DBH of 1 m. There are splits in the stem facing west (Appendix C: Photograph 4).	Low
Tree 8	Within the Project Site boundary. An oak species, 12 m in height with a DBH of 0.6 m. There is a trunk cavity at 1.5 m, viewed from the road. The tree is located within an area of no access and the other side could not be viewed (Appendix C: Photograph 5).	Moderate
Tree 9	Within the Project Site boundary. An oak species 8 m in height with a DBH of 0.5 m. There are thick stems of ivy on the east face (Appendix C: Photograph 6).	Moderate
Tree 10	Approximately 25 m outside of the Project Site boundary to the east. A rowan 12 m in height with a DBH of 0.4 m. There is cavity approximately 1m from the ground which appears to	Moderate

Feature	Description	Bat Roost Potential Category
	extend upwards. There is currently an active wasp nest in the cavity which may deter bats from using it.	
Tree 11	Within the Project Site boundary. A multi-stem oak species 14 m in height with a DBH of 0.6 m. There is some loose bark and a gap in the base.	Low

5. Ecological Constraints and Indicative Potential Impacts

5.1.1 The constraints and potential impacts listed here do not include consideration of further surveys which have been recommended in Section 6. The results of further surveys may change the likely potential impacts.

5.1.2 The indicative potential impacts of the Project on habitats and protected species are outlined below; potential impacts will be assessed fully during the Ecological Impact Assessment (EcIA).

5.1.3 The development proposals are for proposed 299 MW Open Cycle Gas Turbine power station. The development will require the removal of vegetated habitats including hedgerows, semi-natural broadleaved woodland, rows of trees, scrub, hardstanding, marshy grassland, improved grassland, and trees.

5.2 Indicative Potential Impacts

5.2.1 Without mitigation, during construction and operation the following indicative potential impacts are anticipated:

- Habitat loss, severance and fragmentation;
- Loss and/or disturbance of breeding and resting sites of protected species;
- Disturbance, injury or killing of protected and priority species during site clearance and construction works;
- Disturbance, injury or killing of protected and priority species during operation where protected species are retained within the Project Site;
- Disturbance from noise and vibration (if piling is required);
- Pollution to land and/or water as a result of run off of sediments, chemicals, fuel or oil;
- Degradation of habitats and designated site habitats due to increases in nutrients from operational emissions;
- Spread of invasive species; and,
- External lighting disturbance.

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6. Further Surveys and Recommendations

6.1 Further Surveys

6.1.1 Further surveys for protected species are recommended so that the baseline data can be used to inform the EcIA. Surveys will be programmed and completed with sufficient time ahead of DCO application submission and the results can be used to inform the Project design. Certain species can only be surveyed for at certain times of year and without consideration this has potential to cause project delays.

6.1.2 Recommendations for further surveys are based on the current information available and will be subject to consultation with relevant consultees and local authority officers. Further surveys are recommended for the following species:

a) Hedgerows

6.1.3 Hedgerows proposed to be removed as part of the development should be assessed by a suitably qualified ecologist to determine if they are classified as an Important hedgerow under the Hedgerow Regulations, 1997 (Ref. 1). The optimal times for hedgerow surveys are April – early-June, whilst the woodland ground flora is still present.

b) Tree Preservation Orders

6.1.4 No TPOs are to be removed as part of the Project. However the TPOs may be impacted by the works. TPO trees that may be impacted by the Project should be identified and the appropriate Root Protection Zones should be set up during construction.

c) Invertebrates

6.1.5 As the habitats on the Project Site have not changed significantly since the invertebrate survey conducted in 2014 it is recommended that the consultation is undertaken with Natural Resources Wales (NRW) and the local planning authority to discuss the requirement for additional invertebrate surveys.

6.1.6 Should an update to the 2014 survey data be required by the NRW and the local planning authority it should be undertaken by a suitably qualified ecologist/entomologist to determine if the habitats proposed to be removed as part of the development support any protected and/or priority invertebrate species, including the marsh fritillary butterfly.

d) Great Crested Newts

6.1.7 It is recommended that surveys for great crested newts are undertaken on suitable ponds within the Project Site boundary, and within 500 m of the Project Site boundary to determine if they are present in the area.

e) Reptiles

6.1.8 It is recommended that presence/absence surveys for reptiles should be undertaken in areas of suitable habitat using artificial refugia.

6.1.9 Grass snake and common lizard have previously been identified on Project Site (see Table 4-1).

f) Breeding Birds

6.1.10 It is recommended that breeding bird surveys should be undertaken within suitable areas of habitat within the Site to assess presence, population and activity of birds. Particular focus will be paid to protected and/or priority species breeding in areas of suitable habitat and will include ground nesting birds, in particular lapwing, in areas of marshy and semi-improved grassland.

g) Bats

6.1.11 The Bat Survey Guidelines (Ref. 2) requires surveys to consider potential roosts (trees, buildings and structures) within the Zone of Influence (ZoI) of a project. For the Generating Equipment Site in consideration of construction noise and vibration, and operational lighting to COMAH regulations the ZoI has been set to a 50m radius from the Project Site boundary, and for the rest of the Site set to potential roosts within and adjacent to the Project Site boundary.

Tree Assessments

6.1.12 If broadleaved semi-natural woodland, rows of trees and /or individual trees within the ZoI and Project Site are to be removed or illuminated by external lighting a preliminary ground level roost assessment should be undertaken on all trees within the area which will be affected.

Building and Structure Assessments

6.1.13 Buildings and/or structures within the vicinity of the Project Site should be assessed for their potential to support summer roosting and winter hibernating bats.

Bat Roost Survey

Trees

6.1.14 Any trees to be removed or disturbed (disturbance can include lighting, crown lifting, limb removal, noise and vibration) which have been assessed as having low potential to support roosting bats will not be subject to further surveys, but precautionary measures may be appropriate during felling or pruning activities.

6.1.15 Any trees to be removed or disturbed which have been assessed as having moderate or high potential to support roosting bats may require a further Potential Roost Feature (PRF) climbed inspection survey and/or will require presence/absence surveys to be undertaken.

6.1.16 To establish roost presence or likely absence up to three manual surveys (dusk/dawn) are to be completed following the Bat Survey Guidelines (Collins, 2016). The climbed inspection can count towards one of the three manual surveys.

Buildings and Structures

6.1.17 Any buildings or structures assessed as having potential to support roosting bats may require an internal inspection, winter hibernations survey, and/or will require presence/absence surveys to be undertaken if they are to be disturbed as part of the Project (disturbance can include lighting, renovation works, noise and vibration).

6.1.18 To establish roost presence or likely absence up to three manual surveys (dusk/dawn) are to be completed following the Bat Survey Guidelines (Ref. 2).

6.1.19 At least three surveys are needed to support a European Protected Species License application if a roost is to be destroyed or disturbed.

Activity Survey

6.1.20 To ascertain the presence and/or level of bat activity on the Project Site, activity surveys (including walked transects and automated/static activity surveys) are recommended to be completed following the Bat Survey Guidelines (Ref. 2).

Transect Surveys

6.1.21 This comprises two site visits a month, for each month between April and October inclusive for walked transects. Transects will incorporate all areas of suitable habitat. Particular focus will be on commuting bats using the hedgerows and tree lines. The transect route will depend on suitable and safe access. Due to the size of the Project Site it is anticipated that the Project Site will be covered by two walked transect routes.

Automated/Static Activity Surveys

6.1.22 This comprises three remote detector locations per transect with data to be collected on five consecutive nights per month, for each month between April and October inclusive. The devices will be placed out and retrieved after each session. Recordings are then analysed in the office.

h) Hazel Dormouse

6.1.23 Suitable habitat for supporting dormice was recorded within woodland, hedgerows and dense scrub. No records of dormice were returned from the local records centre. Surveys for dormice were undertaken by BSG Ecology in 2014 (Appendix 8.8 of the ES) and no evidence of dormice was found.

6.1.24 The habitats on-site with the potential to support dormice are not considered to have changed since 2014, Therefore AECOM consider that no further surveys for dormice are necessary. However, a consultation with NRW and the local planning authority will be required to determine if this approach is appropriate. There may be a requirement to undertake further surveys for dormice in areas of suitable habitat on-site.

6.1.25 Should a dormouse survey need to be completed to ascertain presence or likely absence at the Project Site, the survey will follow the guidelines set out in the Dormouse Conservation Handbook Second Edition (Ref. 10).

6.1.26 Nest tubes will be positioned within areas of scrub woodland and along hedgerows suitable to support dormouse. The tubes will be checked monthly using a surveyor possessing a NRW dormouse handling licence for the presence of dormice and also for signs of recently constructed dormouse nests.

6.1.27 Based on survey methodologies provided in Ref. 10, it is recommended that surveys commence in May and are undertaken on a monthly basis until September. As shown in Table 6-1 below, each survey month is given an Index of Probability based on the likelihood of dormouse being present and active in each month. A minimum score of 20 is required to assume absence from the Site.

Table 6-1: Index of probability of finding dormice present in nest tubes in any one month

Month	Index of Probability (based on 50 tubes)
April	1
May	4
June	2
July	2
August	5
September	7
October	2
November	2

6.1.28 If dormice are confirmed present within the woodland on site then an application for a European Protected Species License (EPSL) will need to be made from NRW to allow works to be undertaken that would otherwise be in breach of legislation. The EPSL will contain a Method Statement describing how the works will proceed (likely to include timing of works, working methods and hand searching by a licensed ecologist) and mitigation measures. If an EPSL is required then the survey must include a survey in May to inform a population size class assessment, due to the timing of this PEA this would need to be undertaken in May 2018.

i) Badger

[redacted]

j) Otter and Water Vole

6.1.33 An otter and water vole survey should be undertaken along watercourses and ditches at least 100 m from the Project Site boundary (where access allows) to ascertain presence and distribution.

k) Invasive Non-Native Plant Species

6.1.34 Invasive non-native plant species were identified during the Phase 1 Habitat Survey. A survey for invasive non-native species should be undertaken in areas that could not be accessed during the Phase 1 Habitat Survey.

6.2 Recommendations for Further Work

a) Habitat Regulations Assessment – Screening

6.2.1 A search should be undertaken for any Natura 2000 sites situated within the 10 km study area. A Habitat Regulations Assessment (HRA) screening assessment should be undertaken to ascertain if the development proposals would have a Likely Significant Effects (LSE) on any Natura 2000 sites alone or in-combination with other projects, and therefore identifying whether an Appropriate Assessment (AA) is required. Consultation with NRW is recommended at early stages to discuss the proposals and suitable mitigation measures should these be required.

6.2.2 A HRA screening assessment was undertaken in 2015 by Parsons Brinckerhoff and concluded no LSE. It is recommended that the report is reviewed and, if deemed appropriate, consultation undertaken with NRW to ascertain whether the report can be used to support the DCO application. However, a new in-combination assessment will be required as there is a likelihood that new projects have been planned or built since the 2015 report was written.

6.3 Recommendations for Consultation

6.3.1 Development plans are likely to require the removal of SINC habitats and TPO trees, and may impact upon a number of protected and/or priority species, and designated sites. The following is a list of bodies that should be consulted:

- CCS Ecologist;
- CCS Officer;
- Natural Resources Wales; and,
- Local wildlife groups.

6.4 Recommendations for Mitigation and Enhancement

6.4.1 A detailed list of recommendations has not been completed. Further recommendations will be made as a result of the further surveys and as part of the EcIA.

6.4.2 The mitigation hierarchy should be considered and implemented when designing a new development.

a) Mitigation Hierarchy

1. Enhance positive impacts and opportunities;
2. Avoidance – Alternative site or technology, or timing to eliminate impact;
3. Minimise – Actions during design construction and operation to minimise or eliminate impacts; and
4. Compensation – Used as last resort to offset impacts.

b) Habitat Loss, Severance and Fragmentation

6.4.3 Avoid removal of habitats where possible. The following are of particular importance as they are listed as priority habitats under the Section 7 of the Environment (Wales) Act 2016. The Act places a duty on public authorities to 'seek to maintain and enhance biodiversity' of types of habitat included in on the Section 7 list, and encourage others to take such steps:

- Woodland;
- Semi-improved grassland;
- Marshy grassland;
- Standing water; and,
- Hedgerows.

c) Loss and/or Disturbance of Breeding and Resting sites of Protected Species

6.4.4 Further surveys will confirm the presence of any breeding or resting sites. Disturbance, destruction, or obstruction of breeding or resting sites for European Protected Species (EPS) and certain nationally protected species, such as badger, will require a licence from NRW. Compensatory habitat/sites, mitigation, supervision of works and post construction monitoring would likely be required.

d) Disturbance, Injury and Killing during Construction

- To reduce the risk of killing and injury to individual reptiles when vegetation is cleared it is recommended that a programme of translocation and mitigation based on a high population is undertaken prior to any site clearance.
- Removal or maintenance of habitats that have the potential to support breeding birds should take place outside of the breeding bird season (removal between the 1st September and end of February). There is a potential for a clash between the removal of vegetation to avoid impacts on birds and impacts on reptiles. This will need to be managed and planned once timings are known.

The provision of bird boxes, such as swift boxes, typical garden bird boxes, sparrow terraces and barn owl boxes will provide supplementary nesting sites.

- Any new lighting design should avoid lighting of habitats with the potential to support wildlife (such as vegetated habitats or buildings) and/or adjacent habitats. Suggestions for mitigating external lighting and achieving the lighting recommendations above are outlined in the best practice guidance by the Bat Conservation Trust (Ref. 11 and Ref. 12) and are applicable to several other nocturnal species.
- A vehicle traffic assessment should be completed to understand the likely impacts on habitats and species.
- A noise and vibration assessment as a result of piling should be completed to understand the likely impacts on species.
- Excavations, if left unfilled overnight, should be covered to avoid animals becoming trapped or excavations fitted with a scaffolding board ramp to allow any trapped animals to exit.

e) Pollution to Land and/or Water

- Appropriate measures should be in place to: control pollution and disturbance during construction and adhere to applicable published guidelines. These measures should be detailed and implemented via a Construction Management Plan (CMP) and appropriate Toolbox Talks.

f) Disturbance during Operation including Litter and Predation by Pets

- Areas set aside for wildlife (for example reptile receptor areas, woodland, diverse grassland planting) should be protected for the lifetime of the Project Site and should have management plans in place which are followed to protect and maintain the areas. For example, without active management through successional change grassland will turn to dense scrub which would make an area less suitable for reptiles.
- A Habitat Management Plan should be created for operation of the Project Site.

g) Spread of Invasive Species

- Invasive plants should be treated and removed from the Project Site as part of the Project. The removal of the plants from the Project Site will be of benefit to the biodiversity within the Project Site and the local area.
- Prevent the tracking of vehicles over or otherwise disturbing areas of invasive plant growth or areas of soil contaminated with the remains (roots, seeds, and rhizomes).
- Have an appropriate management plan in place during construction and operation to help prevent/limit any re-growth or re-introduction of invasive species that could be spread by works or invasive grounds maintenance activities, such as flailing and use of tractors or frequent trampling by people.

h) Biodiversity Enhancements

6.4.5 The National Planning Policy Framework (March, 2012) and the Environment (Wales) Act 2016, requires that developments enhance biodiversity, as well as just mitigating impacts.

6.4.6 A detailed list of recommendations has not been completed. Further recommendations can be made as a result of the further surveys and at EcIA stage.

6.4.7 Suggested potential enhancement measures for the Project Site are provided below.

- Implement a sympathetic management regime for the vegetation within the Project Site to increase the conservation value and biodiversity of the Project Site;
- Use locally native species within the planting and landscaping deign, and species that are of a benefit to invertebrates; and,
- Include the provision of bird nesting features within the landscaping design.

7. References

Ref. 1 Defra (2007). Hedgerow Survey Handbook. A standard procedure for local surveys in the UK. Defra. London

Ref. 2 Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London

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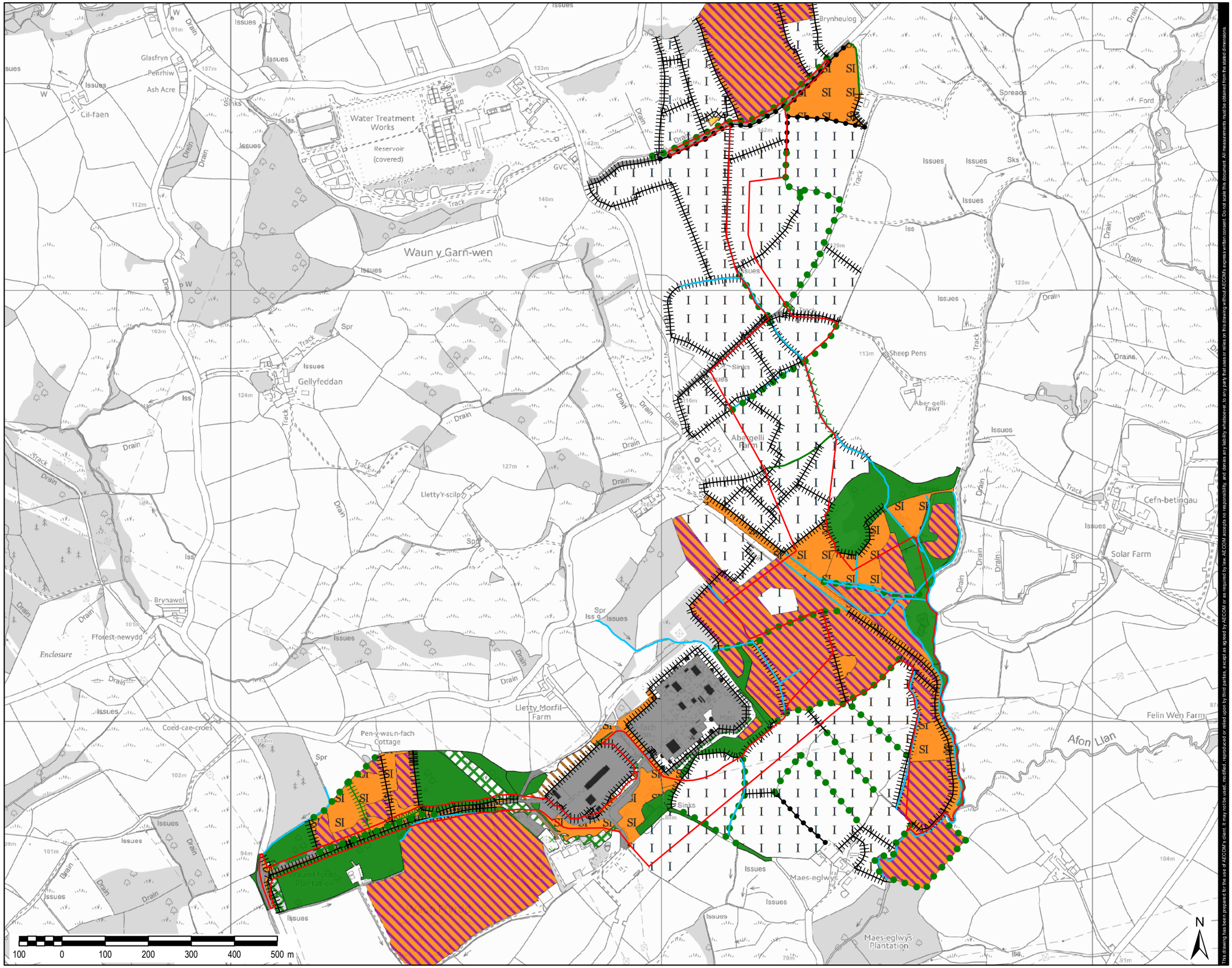
8. Appendices

Figure 1: Phase 1 Habitat Map



AECOM

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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Project Site Boundary

Phase 1 Habitat Linear Features

- Scrub - Scattered
- Row of trees - broadleaved
- Running Water
- Intact Hedge - Species-Poor
- Defunct Hedge - Species-Poor
- Hedge with Trees - Native Species-Rich
- Hedge with Trees - Species-Poor
- Fence
- Earth Bank

Phase 1 Habitat Areas

- Broadleaved woodland - semi-natural
- Broadleaved woodland - plantation
- Dense/Continuous scrub
- Scattered scrub
- Semi-improved - neutral grassland
- Improved grassland
- Marsh/marshy grassland
- Tall ruderal - herb and fern
- Dry heath/acid grassland mosaic
- Buildings
- Bare ground
- Hard standing

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PHASE 1 HABITAT MAP

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GM	CC	CA	15/05/18

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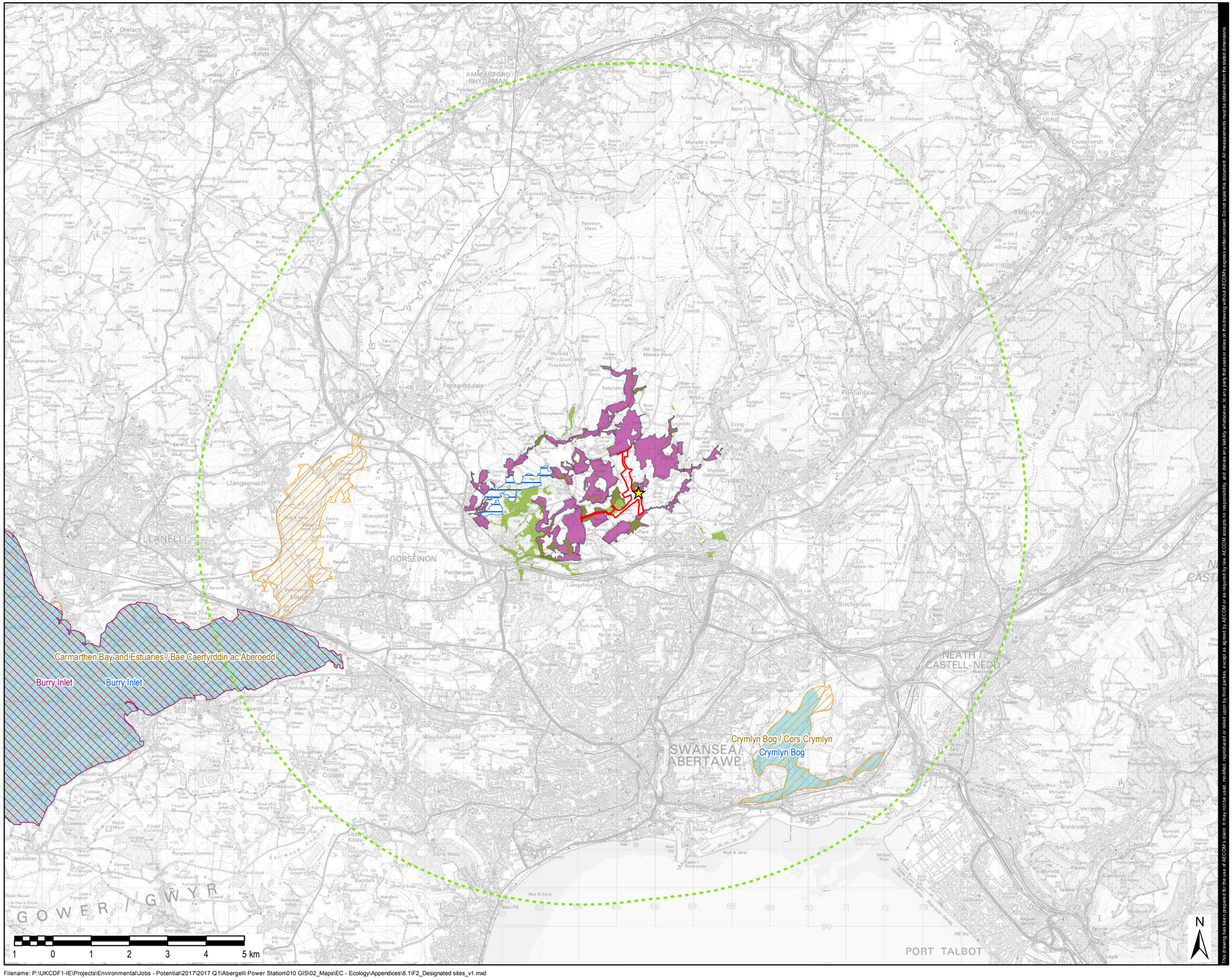
Figure 2: Designated Sites



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Proposed Stack Location
- Project Site Boundary
- 10km Study Area
- Special Protection Area
- Special Area of Conservation
- Site of Special Scientific Interest
- Ancient Woodlands
- Ramsar Site
- SINCs

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DESIGNATED SITES 1

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FIGURE A8.1.2			005
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GM	CC	CA	02/05/18

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Appendix A Wildlife Legislation and Local Planning Policy

8.2 Legislation – Habitats

8.2.1 A variety of sites are designated in the UK, under Conventions, Directives and Regulations for their nature conservation importance and interest. The general aim of these designations is to conserve and protect ecological resources, as well as raising awareness and understanding. Other non-statutory sites are afforded some protection through local plans. The following outlines the most common statutory and non-statutory designations:

Designation	Brief Description
Special Areas of Conservation (SAC)	SACs are sites selected to conserve the natural habitat types and species of wild flora and fauna listed in the Annexes of the Habitats Directive (further information regarding the Habitats Directive is set out in more detail in Table 8.3 below). They are the best areas to represent the range and variety of habitats and species within the European Union (EU).
Special Protection Area (SPA)	SPAs are strictly protected sites for the most important habitats for rare and migratory birds within the EU classified in accordance with Article 4 of the Birds Directive information regarding the Birds Directive is set out in more detail in Table 8.3 below).
Ramsar Sites	Ramsar Sites are wetlands of international importance. Ramsar Sites are protected, through the planning system, under the Wildlife and Countryside Act 1981 (as amended), and the Countryside and Rights of Way Act 2000 through their notification as SSSIs and through other regulatory systems addressing water, soil and air quality.
National Nature Reserve (NNR)	NNRs are nationally important areas of wildlife habitat and geological formations in Britain. NNRs are designated and protected under the National Parks and Access to the Countryside Act 1949 and the Wildlife and Countryside Act 1981 (as amended). They receive additional protection under the Countryside and Rights of Way Act 2000. They are managed for the benefit of nature conservation.
Site of Special Scientific Interest (SSSI)	A SSSI is a site of at least national importance for nature conservation designated under the Wildlife and Countryside Act 1981 (as amended) due to its special interest in terms of flora, fauna or geological or physiographical features. Protection afforded to SSSI's was strengthened by the Countryside and Rights of Way Act 2000. It should be noted that under the Countryside and Rights of Way Act 2000 owners of SSSIs must give Natural Resources Wales (NRW) written notice before they begin any of the operations listed in the notification as likely to damage the special interest features, or if they allow others to carry out these activities. None of the listed operations can be carried out without NRW's consent.
County Wildlife Site (Local site)	A County Wildlife Site is a non-statutory site designated by a local authority as being of local nature conservation value.
Ancient Woodland	Ancient Woodland is a term applied to woodlands which have existed from at least Medieval times to the present without ever having been

Designation	Brief Description
Inventory	cleared for uses other than wood or timber production. A convenient date used to separate ancient and secondary woodland is about the year 1600. In special circumstances semi-natural woods of post-1600 but pre-1900 origin are also included.
Wildlife Trust Reserve	These non-statutory sites are managed by the Wildlife Trusts with the purpose of conserving wildlife.

8.3 Legislation – Protected Species

8.3.1 In addition to habitats, a number of species have been afforded protection through international/European and national law. Other species are considered to contribute to our 'quality of life'. Although these species do not benefit from legal protection, they can be material considerations in the planning process. The table below outlines the key forms of protection afforded to species. The Countryside and Rights of Way Act, the Wildlife and Countryside Act 1981 (as amended), The Protection of Badgers Act 1992 and the Conservation of Habitats and Species Regulations 2017 are the main legislative framework for protection of wild animals in the UK. Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) covers birds, Schedule 5 covers other animals and Schedule 8 covers plants.

8.3.2 Species including bats, otters and great crested newts are listed under Schedule 2 of the Conservation of Habitats and Species Regulations 2017. Badgers are protected under their own Act: The Protection of Badgers Act 1992. Activities affecting protected species must usually be conducted under licence obtained from the appropriate body (in Wales, this is Natural Resources Wales).

8.3.1 Developers must be able to show that all reasonable measures have been taken to ensure that protected species are not subject to disturbance. The habitats which regularly support the Conservation of Habitats and Species Regulations 2017Schedule 2 species, the Wildlife and Countryside Act 1981 (as amended) Schedule 1 species and some Wildlife and Countryside Act 1981 (as amended) Schedule 5 species are also protected from disturbance and destruction. Again, all reasonable precautions should be taken to ensure that this does not happen. The Countryside and Rights of Way Act 2000 has strengthened enforcement powers and introduced a new offence of "reckless disturbance" that applies to both protected sites and species. **Error! Reference source not found.** below provides a summary of the relevant legislation with regards to protected and priority species.

8.3.2

Legislation	Brief Description
The Habitats Directive	The Habitats Directive 1992 (Directive 92/43/EEC sets out the legal framework requiring EU member states to protect habitat sites supporting vulnerable and protected species, as listed within the Directive. The need for an assessment of impacts on Natura 2000 sites (the collective name for European designated sites, including SPAs and SACs) is set out within Article 6 of the

Legislation	Brief Description
	Directive. The Directive is transposed into UK law through the Conservation of Habitats and Species Regulations 2017) (the "Habitats Regulations") and the Wildlife & Countryside Act 1981 (as amended).
The Birds Directive	The Directive on the Conservation of Wild Birds (Directive 2009/147/EC (the codified version of Council Directive 79/409/EEC as amended)) provides a framework for the protection, management and control of all species of naturally occurring wild birds in the European territory of Member States, including the UK. The provisions of the Birds Directive are transposed into UK law by the Conservation of Habitats and Species Regulations, 2017 and the Wildlife & Countryside Act 1981 (as amended).
Wildlife and Countryside Act (1981) (as amended)	The Wildlife and Countryside Act 1981 (as amended) is the principal mechanism for the legislative protection of wildlife in Great Britain. This legislation is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and (partially) the Birds Directive and the Habitats Directive are implemented in the UK. The Countryside and Rights of Way Act 2000 has strengthened this legal protection (see below). A small number of plant species are listed under Schedule 9 of the Wildlife and Countryside Act 1981, as amended, which includes species such as Japanese knotweed (*Fallopia japonica*), Himalayan balsam (*Impatiens glandulifera*), montbretia (*Crocosmia x crocosmiiflora*), giant hogweed (*Heracleum mantegazzianum*) and some cotoneaster species (Cotoneaster sp.). It is illegal to plant or to cause these plants to grow in the wild, and legal disposal methods for vegetation and soil subject to disturbance or clearance from a site must be used.
Convention on Biological Diversity and the Countryside and Rights of Way Act 2000	The Countryside and Rights of Way Act 2000 provides a statutory framework for biodiversity conservation. The Act places a duty on Government Departments and the National Assembly for Wales to have regard for the conservation of biodiversity and maintain lists of species and habitats for which conservation steps should be taken or promoted, in accordance with the Convention on Biological Diversity. Schedule 9 of the Act amends SSSI provisions of the Wildlife and Countryside Act 1981, including provisions to change SSSIs and providing increased powers for their protection and management. The provisions extend powers for entering into management agreements; place a duty on public bodies to further the conservation and enhancement of SSSIs; increases penalties on conviction where the provisions are breached; and introduce a new offence whereby third parties can be convicted

Legislation	Brief Description
	for damaging SSSIs. Schedule 12 of the Act amends the species provisions of the Wildlife and Countryside Act 1981, strengthening the legal protection for threatened species. The provisions make certain offences 'arrestable' and create a new offence of reckless disturbance. The UK Biodiversity Action Plan (BAP) was published in 1994, and was the UK Government's response to the Convention on Biological Diversity (CBD), which the UK signed up to in 1992. It provides the framework for fulfilling the UK's responsibilities towards the Convention on Biological Diversity. Conservation of biodiversity (the variety of life on earth) is an essential element of sustainable development.
Environment (Wales) Act 2016	The Environment (Wales) Act puts in place the legislation needed to plan and manage Wales' natural resources in a more proactive, sustainable and joined-up way. Part 1 relates to the sustainable management of natural resources. This ensures that the way in which the use of and the impacts on natural resources do not result in long term decline. The aim is to sustainably manage natural resources in a way and rate that meets the needs of present and current generations without compromising the needs of future generations. The Act also contains at section 7, a duty for the Welsh Ministers prepare and publish a list of the living organisms and types of habitat which in their opinion are of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales. This section replaces the duty in section 42 of the NERC Act 2006.
Protection of Badgers Act 1992	The Protection of Badgers Act 1992 makes it an offence to wilfully take, kill, injure or ill-treat a badger, possess a dead badger or any part of a badger. Sett interference includes damaging or destroying a sett, obstructing access to a sett, and disturbing a badger whilst it is occupying a sett. The Act defines a badger sett as 'any structure or place, which displays signs indicating the current use by a badger' and Natural England takes this definition to include seasonally used setts. Work that may disturb badgers or their setts is illegal without a development licence from the relevant statutory body (in this case Natural Resources Wales).
The Hedgerow Regulations 1997	The Hedgerow Regulations (1997) make provision for the protection of important hedgerows in England and Wales. The regulations affect hedgerows which are 20m or more in length, or connected at both ends to another hedgerow of any length. They relate to hedgerows which are on, or adjoining land used for the following purposes: agriculture or forestry; the breeding or

Legislation	Brief Description
	keeping of horses, ponies or donkeys; common land; village greens; and SSSIs (They do not include hedges that are attached to, or marking the boundaries of a private house. It is an offence to intentionally or recklessly remove or cause or permit another person to remove a hedgerow or intentionally or recklessly remove, or cause or permit another person to remove, a hedgerow which is the subject of a hedgerow retention notice.

8.4 Local Planning Policy

8.4.1 The table below provides a summary of relevant local planning policies found in the Swansea Unitary Development Plan. For the precise wording of each specific policy please refer back to the source document.

Planning Policy	Purpose /Relevant Sections
SP1 Creating a Quality Environment	Sustainable development will be pursued as an integral principle of the planning and development process. Development proposals designed to a high quality and standard, which enhance townscape, landscape, sense of place, and strengthen Swansea Waterfront identity, will be favoured.
SP2 - Creating a Quality Environment	The countryside will be protected and conserved, with green wedges shaping the urban form and safeguarding the distinctive interplay of town and country. Village character will be protected.
SP3 - Creating a Quality Environment	The natural, built, and cultural heritage of the County will be protected and enhanced to safeguard from materially harmful development.
Siting and Location - EV2	The siting of new development should give preference to the use of previously developed land over greenfield sites, and must have regard to the physical character and topography of the site and its surroundings by: i. Avoiding locations that would have a significant adverse impact on prominent buildings, landscapes, open spaces and the general locality, including loss of visual amenity, ii. Effectively integrating with the landscape, seascape or coastline by utilising topography to integrate into the contours of the site and avoiding conspicuous locations on prominent skylines and ridges, iii. Retaining important views into and out of the site, iv. Taking into account and where possible retaining site features including existing buildings, topography, landscape, archaeological and water features, trees and hedgerows, and, where appropriate: v. Undertaking, at the earliest opportunity, an assessment of species and habitats on site and, where planning permission is granted, implementing any necessary mitigation measures, ix. Determining whether the proposal would be at risk from flooding,

Planning Policy	Purpose /Relevant Sections
	increase flood risk off-site, or create additional water run-off, xiii. Having full regard to existing adjacent developments and the possible impact of environmental pollution from those developments, as well as the creation of any environmental pollution to the detriment of neighbouring occupiers (including light, air and noise).
Rural Development - EV21	In the countryside non residential development will only be permitted where it can be demonstrated that: iii. It is an appropriate development associated with farm diversification, sustainable tourism and recreation, or nature conservation and does not adversely affect the viability of an established farm unit.
Rural Development - EV22	The countryside throughout the County will be conserved and enhanced for the sake of its natural heritage, natural resources, historic and cultural environment and agricultural and recreational value through: i. The control of development, and ii. Practical management and improvement measures.
Sites of International Importance - EV25	Development, alone or in combination with other plans or projects, which is likely to adversely affect the integrity of a European protected site (SAC, Marine SAC, SPA and Ramsar Sites) and is not directly connected with or necessary to the management of the site, will not be permitted unless: i. There are imperative reasons of over-riding public interest, including those of a social or economic nature, which are sufficient to override the reasons for designation, and ii. There is no alternative solution. Where such development is permitted, planning conditions and/or obligations will be used to secure all compensatory measures necessary to ensure that the overall coherence of the European Site is protected.
SSSIs and National Nature Reserves - EV27	Development that significantly adversely affects the special interests of sites designated as SSSIs and NNRs will not be permitted unless the need for the development is of such significance that it outweighs the national importance of the designation. Where development is permitted, planning conditions and/or obligations will be used to protect and enhance those interests and where necessary provide effective mitigation and compensatory measures.
Sites of Local Importance - EV28	Within locally designated areas the natural heritage will be preserved and enhanced wherever possible. Development that would significantly adversely affect the special interest of Local Nature Reserves will not be permitted unless the need for the development is of such significance that it outweighs the importance of the designation.

Planning Policy	Purpose /Relevant Sections
	Development that would significantly adversely affect SINCs or RIGs, or which would not provide for appropriate compensatory or mitigation measures will not be permitted, unless it can be demonstrated to meet appropriate social or economic needs where the benefits in such terms would outweigh the harm to the feature concerned. Where development is permitted which would damage the nature conservation value of the site, such damage will be kept to a minimum, and appropriate mitigation or compensatory measures sought.
Trees, Woodland and Hedgerow Protection - EV30	Protection and improved management of woodlands, trees and hedgerows which are important for their visual amenity, historic environment, natural heritage, and/or recreation value will be encouraged, with priority being given to: i. Protecting the remaining areas of ancient semi natural woodland and planted ancient woodland sites, ii. Promoting new planting with species appropriate to the location, where there is no conflict with other land uses or nature conservation interests, and iii. Ensuring that where management involves commercial felling and replanting, protection of amenity interests is achieved.
Environmental Enhancement - EV32	Environmental improvement schemes will be implemented at a number of locations shown on the Proposals Map. These are intended to: i. Improve visual appearance, natural heritage value and recreation potential, ii. Improve the setting of industrial, commercial and residential developments and transport corridors, and iii. Maintain, extend and improve the quality of the urban greenspace network in line with the aims of the 'Greening the City' strategy
Protection of Controlled Waters - EV34	Development proposals that may impact upon the water environment will only be permitted where it can be demonstrated that they would not pose a significant risk to the quality and or quantity of controlled waters. Initiatives that lead to improvements in the quality of surface water will be approved subject to satisfactory ecological and visual safeguards.
Protection of Controlled Waters - EV35	Development that would have an adverse impact on the water environment due to: i. Additional surface water run off leading to a significant risk of flooding on site or an increase in flood risk elsewhere, and/or ii. A reduction in the quality of surface water run-off, will only be permitted where it can be demonstrated that appropriate alleviating measures can be implemented. Sustainable drainage systems (SUDS) will be encouraged wherever

Planning Policy	Purpose /Relevant Sections
	they would be effective and practicable, so as to ensure that development does not increase run off, and potentially damage important landscape features and protected species and habitats. Where SUDS are not provided then any conventional drainage system utilised must improve the status quo.
Air, Noise and Light Pollution EV40	Development proposals will not be permitted that would cause or result in significant harm to health, local amenity, natural heritage, the historic environment or landscape character because of significant levels of air, noise or light pollution.

8.4.2 The table below provides a summary of relevant local planning policies found in the Swansea Local Development Plan 2010 – 2015: Deposit Plan (July 2016). For the precise wording of each specific policy please refer back to the source document.

Planning Policy	Purpose /Relevant Sections
ER 1 Climate Change	To mitigate against the effects of climate change, adapt to its impacts, and to ensure resilience, development proposals should take into account: i. Reducing carbon emissions; ii. Protecting and increasing carbon sinks; iii. Adapting to the implications of climate change at both a strategic and detailed design level; iv. Promoting energy and resource efficiency and increasing the supply of renewable and low carbon energy; v. Avoiding unnecessary flood risk by assessing the implications of development proposals within areas susceptible to flooding and preventing development that unacceptably increases risk, and, vi. Maintaining ecological resilience.
ER 2 Strategic Green Infrastructure Network	Development will be required to maintain or enhance the extent, quality and connectivity of the County's multi-functional green infrastructure network, and where appropriate: i. Create new interconnected areas of green infrastructure between the proposed site and the existing strategic network; ii. Fill gaps in the existing network to improve connectivity; and/or, iii. In instances where loss of green infrastructure is unavoidable, provide mitigation and compensation for the lost assets.
ER 6 Designated Sites of Importance for Nature Conservation	Development will not be permitted that would result in a likely significant adverse effect to sites of international or national nature conservation importance. Development that would affect locally designated sites of nature conservation importance should maintain or enhance the nature conservation interest of the site. Where this cannot be achieved development will only be permitted

	where it can be demonstrated that: i. The need for the development outweighs the need to protect the site for nature conservation purposes; ii. There is no satisfactory alternative location for the development that avoids nature conservation impacts; and, iii. Any unacceptable harm is kept to a minimum by effective avoidance measures and mitigation, or where this is not feasible compensatory measures must be put in place to ensure that there is no overall reduction in the nature conservation value of the area.
ER 8 Habitats and Species	Development proposals that would have a significant adverse effect on the continued viability of habitats and species, including those identified as priorities in the UK or Swansea Local Biodiversity Action Plan, will only be permitted where: i. The need for development outweighs the nature conservation importance of the site; ii. The developer demonstrates that there is no satisfactory alternative location for the development which avoids nature conservation impacts; iii. Effective mitigation measures are provided by the developer; And, iv. Any unavoidable harm is minimised by effective mitigation to ensure that there is no reduction in the overall nature conservation value of the area. Where this is not feasible, compensation measures designed to conserve, enhance, manage and, where appropriate, restore natural habitats and species must be provided.
ER 9 Ecological Networks and Features of Importance for Biodiversity	Development proposals will be expected to maintain, protect and enhance ecological networks and features of importance for biodiversity. Particular importance will be given to maintaining and enhancing the connectivity of ecological networks which enable the dispersal and functioning of protected and priority species. Development proposals that could result in a significant adverse effect on the connectivity of ecological networks and features of importance for biodiversity will only be permitted where: i. The need for the development outweighs the nature conservation value of the site; ii. It can be demonstrated that there is no satisfactory alternative location for the 102 PPW sections 5.5.11 – 5.5.12 and TAN 6 Nature Conservation and Planning (2009) chapter 6 development; iii. A connected element of the natural resource is retained as part of the design of the development; and, iv. Compensatory provision will be made of comparable

	ecological value to that lost as a result of the development.
ER 11 Trees and Development	Development that would adversely affect trees, woodlands and hedgerows of public amenity, natural/cultural heritage value, or that provide important ecosystem services will not normally be permitted. Ancient Woodland, Ancient Woodland Sites, Ancient and Veteran trees merit specific protection and development will not normally be permitted that would result in: i. Fragmentation or loss of Ancient Woodland; ii. The loss of an Ancient or Veteran tree; iii. Ground damage, loss of understorey or ground disturbance to an area of Ancient Woodland or Ancient or Veteran Tree's root protection area; iv. A reduction in the area of other semi natural habitats adjoining Ancient Woodland; v. Significant alteration to the land use adjoining the Ancient Woodland; vi. An increase in the likely exposure of Ancient Woodland, Ancient or Veteran Tree to air, water or light pollution from the surrounding area; vii. Alteration of the hydrology in a way that might impact on Ancient Woodland, Ancient or Veteran Trees; viii. Destruction of important connecting habitats relating to Ancient Woodland; ix. Degradation of important archaeological or historical features within Ancient Woodland or associated with Ancient or Veteran trees; x. Destruction of Plantations on Ancient Woodland Sites (PAWS); and/or, xi. Development within 15m of Ancient Woodland.

Appendix B Target Notes for Phase 1 Habitat Map

Target Note Number	Description
1	The woodlands on either side of the path look like they have received historical infilll planting.
2	Redpoll, goldcrest, blackcap, robin, blue tit, wren, blackcap, blackbird heard in this location.
3	Tree with tag number 01241. Possible TPO.
[redacted]	[redacted]
5	Cuckoo and bullfinch heard in this location.
6	Historical earth bank.
7	Neutral semi-improved grassland on both sides of the track. Species include ribwort plantain, sweet vernal grass, meadow buttercup, silverweed, creeping cinquefoil, black knapweed. This area is, good for reptiles. There is a strip of land used as a horse gallop which is covered in mulch and bark chippings.
8	A large pile of wood within the area of scrub, which provides opportunities for reptiles.
[redacted]	[redacted]
10	Gate.
11	Gate.
12	There is an open area of gravel and semi-improved grassland within woodland area, this has good reptile potential.
13	An area of bracken, some of which has been recently cleared. This area has good reptile potential.
14	There is a gravel path area with semi-improved grass growth. This area has good reptile potential.
15	There is a semi-improved grass bank with some newly planted trees. This area has potential for reptiles.
16	A small area of short perennial vegetation and exposed gravel within the semi-improved grassland.

Target Note Number	Description
17	Some planted hazel and willow within the semi-improved grassland.
18	The area by the pylon is a matric of semi-improved and marsh grassland with planted shrubs. There is good reptile potential here.
19	There is a gabion cage between the scrub and the woodland. This has potential to offer shelter and hibernation opportunities for reptiles.
20	There is scrub on the bank adjacent to a gravel path. This bank has good potential for reptiles.
21	Remnant of stone wall/earth bank hedgerow with native bluebells and oak saplings.
22	Two lapwing seen flying over this field of marshy and improved grassland.
23	Field with solar panels which was not accessed.
24	Raised bank with stone underneath and scattered hawthorn and oak.
25	Public Right of Way (PRoW) stile.
26	PRoW gate.
27	Gate in fence.
28	Pond.
29	Broadleaved woodland trees in this area don't look very suitable for roosting bats. Looks likely to support foraging and commuting bats. A PRoW footpath runs through this woodland.
30	A pile of wood, sheep's wool, manure and straw. This offers some reptile potential.
31	Potential for reptiles on grass verge.
32	Potential for reptiles within grassland on road edge on either side of this road.
33	Potential for dormice within woodland and on edge of road within scrub.
34	Potential for dormice within trees and scrub along road edge.
35	Potential for dormice, foraging and commuting bats and badger.
36	Tall ruderal and scrub vegetation under the pylons on both sides of the road with potential to support reptiles. The area is bordered on either side by trees with potential for commuting and foraging bats.
37	Potential for reptiles.

Target Note Number	Description
38	The scattered scrub and semi-improved grassland on this bank offers low potential for reptiles due to its road barrier.
39	Potential for reptiles on earth bank.
40	Pond.
[redacted]	[redacted]
42	Trees within this woodland need assessment for bat roosts.
43	Brown hare seen in this location on 16/05/17.
44	Location of Pond 16 - dry at time of Phase 1 Habitat Survey.

Appendix C Site Photographs



Photograph 1: Bat Tree 1. Red arrows indicate features of bat interest.



Photograph 2: Bat Tree 5.



Photograph 3: Bat Tree 6.



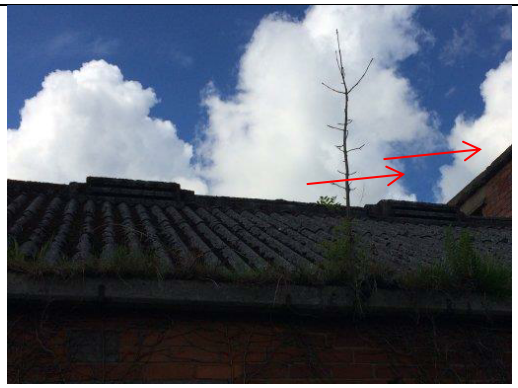
Photograph 4: Bat Tree 7.

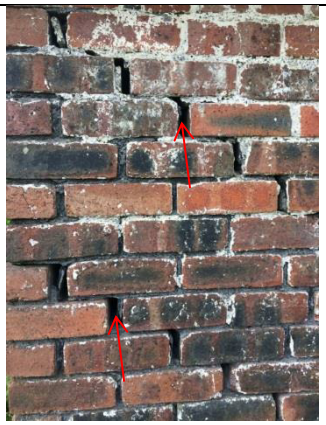


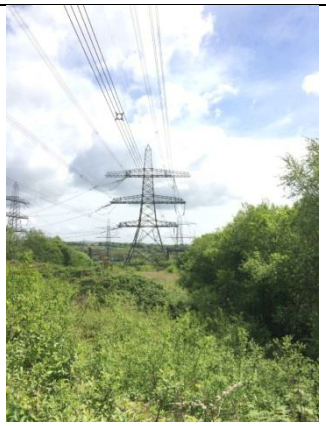
Photograph 5: Bat Tree 8.



Photograph 6: Bat Tree 9.

	
Photograph 7: Building 2.	Photograph 8: Building 2.
	
Photograph 9: Building 2.	Photograph 10: Building 2.
	
Photograph 11: Building 2.	Photograph 12: Building 3.
	
Photograph 13: Building 3.	Photograph 14: Building 3.

	
Photograph 15: Building 3	Photograph 16: Building 4.
	
Photograph 17: Building 4, a close up of photograph 16.	Photograph 18: Japanese knotweed, Invasive Species Point 4.
	
Photograph 19: Area of gravel pathway within semi-improved grassland bordered by scrub and a row of trees (Appendix B: Target Note 14).	Photograph 20: An area of wood, sheep's wool and manure within an improved grassland field (Appendix B: Target Note 30).

	
Photograph 21: An area of semi-improved grassland in the south of the Project Site.	Photograph 22: The road leading to National Grid area, bordered by woodland, hedgerows and rows of trees.
	
Photograph 23: An area of dense scrub bordered by woodland.	Photograph 24: An area of semi-improved grassland and scrub adjacent to woodland.
	
Photograph 25: A track with semi-improved grassland either side. A row trees is visible in the background (Appendix B: Target Note 7).	Photograph 26: An improved grassland field with running water (ditch) and a row of trees.

Appendix 3.2

National Vegetation Classification (NVC) Survey Report 2014

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Abergelli Power Project

National Vegetation Classification (NVC)
Survey Report

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1 Summary

1.1 Abergelli Power Limited (APL) is promoting a new Power Generation Plant with its associated Gas and Electricity Connections (the 'Project') on agricultural land within Abergelli Farm, north of Swansea in the City and County of Swansea (approximately at National Grid Reference 265284, 201431).

1.2 As part of the preliminary ecological appraisal[1] for the Survey Site, a request was made to the South East Wales Biodiversity Records Centre (SEWBReC) and Swansea Council for information on designated sites and protected or otherwise notable species on and around the Project Site boundary at the time of the survey (hereafter referred to as the 'Survey Site'). The information collected during the preliminary ecological appraisal and the desk study was used to identify those areas of the Survey Site that required a more detailed botanical survey (National Vegetation Classification (NVC)). The map of Sites of Importance for Nature Conservation (SINCs) provided by Swansea Council revealed that three SINCs, which contain habitats of potentially high botanical value, lie within the Survey Site boundary. APL commissioned BSG Ecology to undertake an NVC survey of woodlands and grasslands within the 150 ha of pastoral farmland within the Survey Site in June and July 2014, to inform and support an application for Development Consent for the Project.

1.3 The land within the Survey Site that is designated as SINC along with some additional fields that were identified as being potentially 'habitats of principal importance for nature conservation' as referred to in Section 42 of the NERC Act 2006 (S42) were selected for inclusion in the NVC survey.

1.4 The surveys were carried out on 11th June 2014 by Anna Gundrey MCIEEM (woodland), 23rd and 25th June 2014 by Vilas Anthwal MCIEEM (woodland) and 30th June and 1st July 2014 by Thomas Flynn (grasslands and mires). The complex of habitats around the gas compressor station was visited again on 12 September 2014 to confirm the boundaries of some habitats; and on 14 November 2014 Niall Lusby rechecked the woodland canopy composition in survey area WL1 (see Figure 2). The surveyors are all suitably qualified botanists and experienced NVC surveyors.

1.5 The surveyors found that the land selected for survey included:

- Four woodland communities / sub-communities –
  - W1 *Salix cinerea – Galium palustre* woodland;
  - W6e *Alnus glutinosa – Urtica dioica* woodland*, Betula pubescens* sub-community;
  - W7 *Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland; and
  - W10 *Quercus robur – Pteridium aquilinum – Rubus fruticosus* woodland*.*
- Five mire communities / sub-communities –
  - M15b *Scirpus cespitosus – Erica tetralix* wet heath, typical sub-community;
  - M23a *Juncus effusus/acutiflorus - Galium palustre* rush-pasture, *Juncus acutiflorus* sub-community;
  - M23b *Juncus effusus/acutiflorus - Galium palustre* rush-pasture, *Juncus effusus* sub-community;
  - M25a *Molinia caerulea – Potentilla erecta* mire, *Erica tetralix* sub-community; and
  - M25c *Molinia caerulea – Potentilla erecta* mire*, Angelica sylvestris* sub-community*.*
- Two neutral grassland NVC communities / sub-communities –
  - MG6a *Lolium perenne – Cynosurus cristatus* grassland, typical sub-community; and
  - MG10a *Holcus lanatus – Juncus effusus* rush pasture, typical sub-community.
- As well as mosaics of the above communities.

[1] BSG Ecology (2014). Abergelli Power Project: Preliminary Ecological Appraisal.

2 Introduction

2.1 Abergelli Power Limited commissioned BSG Ecology to undertake a National Vegetation Classification (NVC) survey during 2014 to inform and support an application for Development Consent for the Project described below.

Site Description

2.2 The Survey Site consists of approximately 150 ha of pastoral farmland, primarily grazed by horses. The extent of the Survey Site is shown on Figure 1 and is centred at National Grid Reference 265284, 201431. The nearest settlement is Felindre, which is approximately 2 km to the north of the Survey Site, with Swansea approximately 5 km to the south.

2.3 The Survey Site is largely agriculturally improved pasture with several areas of marshy grassland, particularly in the north, south and north-western extents of the Survey Site. The fields are bounded by fences, running along the line of defunct hedgerows, and often accompanied by ditches. There is a block of broadleaved woodland on the eastern boundary of the Survey Site and areas around the marshy grassland to the west of the Survey Site, and around Felindre Gas Compressor Station and the two National Grid 400 kV electrical substations that lie at the south-west end of the Survey Site. The habitats in the surrounding landscape are similar to those within the Survey Site boundary – a mixture of improved and marshy grassland interspersed with occasional patches of woodland.

Description of Project

2.4 APL is promoting a new Power Generation Plant with associated Gas and Electricity Connections within Abergelli Farm. The Power Generation Plant would operate as a Simple Cycle Gas Turbine (SCGT) peaking plant and would be designed to provide an electrical capacity of up to 299 Megawatts (MW). It would be fuelled by natural gas, supplied by a new underground gas pipeline connecting the Power Generation Plant to the existing National Grid Gas (NGG) National Transmission System (NTS). It would also connect to the National Grid Electrical Transmission System (NETS) via underground cable or overhead lines.

2.5 BSG Ecology has been appointed as the ecological consultant to undertake ecology surveys, including a desk study and Extended Phase 1 Habitat Survey as well as a range of Phase 2 surveys, including a NVC survey. These baseline surveys will be included in an appendix to an ecology chapter of an Environmental Statement, which is intended for submission, as an integral part of the application for Development Consent.

Aims of Study

2.6 The aims of this study are as follows:

- Identify habitats on the Survey Site that are potentially sensitive or important, either because of their ecological designation or the plant community that is present; and
- In order to fully describe such habitats, undertake a National Vegetation Classification (NVC) survey to classify those plant communities present in the identified areas.

3 Methods

Desk Study

3.1 As part of the Preliminary Ecological Appraisal (PEA) for the Survey Site[2], a request was made to the South East Wales Biodiversity Records Centre (SEWBReC) and Swansea Council for information on designated sites and protected or otherwise notable species on and around the Survey Site.

3.2 Of relevance to this report was the data provided by Swansea Council on locally-designated SINCs and the botanical data provided by SEWBReC from within a 2km radius of the Survey Site boundary.

3.3 The information collected during the PEA was used to identify those areas of the Survey Site that required a detailed botanical survey.

3.4 These areas were selected for more detailed botanical survey on the basis that either they were identified as NERC Act Section 42 habitats of principal importance for biodiversity (see Appendix 2), and / or they lie within a SINC boundary for which habitats are a qualifying feature, and/or they are identified on the Ancient Woodland Inventory for Wales.

Field Survey

3.5 Each parcel of land included in the survey was initially walked by the surveyor to map the broad community types with the aid of aerial photographs. Quadrats (measuring 2 m x 2 m for grassland and 50 m x 50 m for woodland canopy (with multiple 4 m x 4 m quadrats for field layer and ground flora as dictated by the complexity of the woodland stands) were then marked out in blocks of vegetation that were considered representative of each community type. In the case of narrow linear habitats (two over-mature hedge banks and a narrow strip of woodland) it was very difficult to identify quadrats so whole lengths were surveyed and species' cover values were recorded accordingly.

3.6 The number of quadrats employed in each type or area of vegetation was related to the level of floristic variability present. For uniform areas of vegetation, one or several quadrats were employed. For vegetation exhibiting more variability, larger numbers of quadrats (up to six in this survey) were employed. The number of quadrats utilized for each vegetation type reflected the surveyors' judgement of the number required to sufficiently capture the floristic variation present. In addition, the identification of plant communities is a two stage process with broad communities identified in the field, and more definitive identifications of community and sub-community occurring later, after data analysis. Therefore the numbers of quadrats associated with the final plant community categories is variable. All plant species present within quadrats were recorded, along with estimates of their cover values. Cover values were recorded using the Domin scale of Rodwell *et al*. (1991) (see Appendix 3). The lists of species generated were evaluated against the keys and community accounts in the relevant British Plant Community Volume[3] to establish the closest fit to a National Vegetation Classification (NVC) community.

Survey Limitations

3.7 Access to parts of sites G2 and G3, as shown on Figure 1, was limited by impenetrable vegetation. This limited the number of quadrats that could be employed in these areas. It is possible that the data obtained in these areas may not be representative, particularly with respect to identifying the presence or absence of rare or notable species. One or more quadrats were placed in the more open parts of areas G2 and G3, but quadrat data was not collected from the dense scrub. The dense scrub was assigned to an NVC category by the surveyor in the field, based on the surveyor's judgement and experience. Because the surveyor was an experienced botanist with

[2] BSG Ecology (2014) Abergelli Power Project: Preliminary Ecological Appraisal.

[3] Rodwell, J. S. (Ed.) (1991). British Plant Communities. Volume 1 Woodlands and Scrub. CUP. Rodwell,J.S. (Ed.) (1991) British Plant Communities. Volume 2 Mires and Heaths. CUP. Rodwell,J.S. (Ed.) (1992) British Plant Communities. Volume 3 Grasslands and Montaine Communities. CUP.

considerable experience of NVC surveys, this approach to the survey of areas G2 and G3 is not considered to have affected the aims and value of the survey. The general character of the vegetation and the typical/abundant species in these areas were determined with a high level of confidence and any limitations are not considered to be significant.

3.8 Because of the very narrow and limited extent of the cover of vegetation at WL9, WL11, and a part of WL13, the survey was conducted using the whole compartment as the quadrat. In places there is a limited canopy but the dominant species were clear and communities have been assigned with a reasonably high level of confidence. The assigned communities are consistent with adjacent patches of woodland.

4 Results

Desk Study

4.1 SEWBReC did not provide any records of notable botanical species on the Survey Site.

4.2 The map of SINCs provided by Swansea Council revealed that three SINCs lie within the Survey Site boundary. These are Rhyd-Y-Pandy Valley Grasslands SINC, Waun Garn Wen SINC and Llety Morfil SINC. Brief descriptions of the habitats present in each SINC are provided below and summarised from citations provided by Swansea Council:

- **Rhyd-Y-Pandy Valley and Grasslands**: Wet woodland and woodland with assemblage of ancient woodland indicator species, scrub, purple moor grass *Molinia caerulea* and rush pasture, lowland meadow, neutral grassland, scrub, reed bed and water course habitats;
- **Waun Garn Wen**: Purple moor grass and rush pasture, wet woodland, scrub and watercourse habitats; and
- **Llety Morfil**: Wet and ancient semi-natural woodland, purple moor grass and rush pasture, and scrub habitats.

4.3 Table 1 below lists the areas that were identified as requiring NVC survey and the reason for their selection. Those labelled 'G' are largely grassland or mire habitats; those labelled 'WL' are largely woodland habitats.

Table 1: NVC Survey Areas.

Survey Area	Reason for inclusion in the NVC Survey
G1	Potential Section 42 NERC Act (S42) habitat and part of Waun Garn Wen SINC
G2	Potential S42 habitat and part of Llety Morfil SINC
G3	Potential S42 habitat and part of Llety Morfil SINC
G4	Potential S42 habitat
G5	Part of Rhyd-y-Pandy SINC
G6	Potential S42 habitat
WL1	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL2	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL3	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL4	Potential S42 habitat and part of Waun Garn Wen SINC and Ancient Woodland
WL5	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL6	Potential Section 42 NERC Act (S42) habitat and part of Llety Morfil SINC and Ancient Woodland
WL7	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL8	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL9	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL10	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL11	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL12	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL13	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL14	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL15	Potential S42 habitat and part of Llety Morfil SINC
WL16	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland
WL17	Potential S42 habitat and part of Llety Morfil SINC and Ancient Woodland

Field Survey

4.4 Figures 1 and 2 illustrate the areas that were surveyed and the quadrat sample points.

4.5 The surveys were carried out on 11th June 2014 by Anna Gundrey MCIEEM (woodland), 23rd and 25th June 2014 by Vilas Anthwal MCIEEM (woodland) and 30th June and 1st July 2014 by Thomas Flynn MCIEEM (grasslands and mires). The complex of habitats around the gas compressor station was visited again on 12 September 2014 to confirm the boundaries of some habitats; and on 14 November 2014 Niall Lusby rechecked the woodland canopy composition in survey area WL1 (see Figure 2).

4.6 Table 2 below summarises the NVC communities present in each survey area. This is followed by a more detailed description of each of the communities. The full results, consisting of species lists per quadrat are provided as separate Excel spreadsheets as they are too large for inclusion in the report. The quadrats can be cross-referenced with Figures 1 and 2.

Table 2: NVC Results Summary

Survey Area	NVC	Notes
G1	M15b, M23a, M25a	Purple moor-grass dominated to the north, wet heath to south with patches of rush pasture around margins.
G2	M23b/W1 mosaic	Strip of rush pasture with heavy scrub and tree encroachment forming mosaic. The degree of scrubby cover is variable, increasing to the south / west.
G3	M23b/W1 mosaic	Patch of rush pasture within woodland, with heavy scrub encroachment.
G4	MG6a, MG10a, M23a, M25a,	Patchwork of rush pasture, purple-moor grass mire, wet grassland and more agriculturally improved areas with encroaching willow scrub.
G5	MG6, MG10a, M23a, M23b, M25c	Wet fields ranging from agriculturally semi-improved through rush pasture to purple-moor grass mire at the southern tip of the survey area. The rush pasture at the east of this area was much mown but the unmown parts were relatively species-rich. Based on this, a cautious assessment of the M23 community as M23a has been made.
G6	MG10a	Intensively managed (mown and possibly harrowed) rush pasture.
WL1	W10	Broad-leaved woodland sparse cover of trees and grassy field layer.
WL2	W10	Broad-leaved woodland with dense bramble *Rubus fruticosus agg* understorey.
WL3	W10	Broad-leaved woodland with dense bramble understorey.
WL4	W6e	Wet woodland with Himalayan balsam *Impatiens glandulifera* dominating the ground flora.
WL5	W6e	Open canopy of wet woodland at base of small slope.
WL6	W10	Strip of pedunculate oak *Quercus robur* dominated woodland on the slope. Patchy canopy of tall mature oak.
WL7	W6e	Wet scrubby wood with dense closed canopy occasionally overtopped by oak and alder *Alnus glutinosa* .
WL8	W10	Small mature stand of oak with sparse understorey and thick field layer.
WL9	W10	Mature double hedge bank dominated by oak, with bramble.
WL10	W10	Mature oak with sparse open understorey and some newly planted hawthorn *Crataegus monogyna* and field maple *Acer campestre*.
WL11	W10	Mature hedge bank dominated by oak, with bramble.
WL12	W10	Stand of oak and silver birch *Betula pendula* with a fairly open canopy. Dense field layer.
WL13	W10	Narrow woodland strip. Dominated by oak, with bramble.
WL14	W10	Tall mature stand of oak along boundary. Dense understorey and sparse patchy ground flora.
WL15	W10	Tall stand of scrub wood on a slope with some more recently planted guelder rose

		Viburnum opulus.
WL16	W7/W10 mosaic	Open patchy regrowth of scrub with occasional mature trees. Very open with dominant rush pasture being superseded by willow and gorse scrub.
WL17	W7	Two stands of dense low scrub woodland dominated by birch, alder and willow.

Vegetation Community Descriptions

MG6a *Lolium perenne – Cynosurus cristatus* grassland, typical Sub-Community

4.7 This is the major permanent pasture type on moist free draining neutral soils in lowland Britain. It is generally species-poor and grass-dominated. Typical species include perennial rye-grass *Lolium perenne*, crested dog's-tail *Cynosurus cristatus*, red fescue *Festuca rubra* and common bent *Agrostis capillaris*. Broad-leaved plants are generally sparse and consist of common and widespread species, such as common mouse-ear *Cerastium fontanum*, ribwort plantain *Plantago lanceolata*, white clover *Trifolium repens* and creeping buttercup *Ranunculus repens*.

4.8 A large proportion of the Survey Site is MG6a grassland which, because of its ubiquity, was not included in the NVC survey area. However, some fields that meet this classification are included within the survey area because they lie within a SINC boundary. These are in G4 and G5. The MG6a grassland within G4 is a typical community with perennial rye-grass, crested dog's-tail and Yorkshire fog *Holcus lanatus* being the main grasses; and broad-leaved species including white clover, daisy *Bellis perennis* and ribwort plantain.

4.9 The MG6a grassland at G5 includes more moisture-tolerant species such as marsh thistle *Cirsium palustre*, marsh bedstraw *Galium palustre* and sharp-flowered rush *Juncus acutiflorus*, as well as the more typical perennial rye-grass and white clover. Of particular note was whorled caraway *Carum verticillatum,* a species with very local distribution (confined to the extreme west of Britain), which is more usually found in M23/M25 mire habitats (see below).

MG10a *Holcus lanatus – Juncus effusus* rush pasture, typical sub-community

4.10 This is a neutral grassland community with prominent tussocks of soft rush *Juncus effusus* in and amongst species-poor shorter grassland. Broad-leaved species are generally few in number, but creeping and meadow buttercup *Ranunculus acris* can be abundant along with common species such as white clover, common sorrel *Rumex acetosa*, and cuckoo flower *Cardamine pratensis*.

4.11 This community is found in G4, G5 and G6. The MG10a grassland at G5 is in a close association with MG6a (above). One field has a central wetter area of MG10a grassland within a larger area of MG6a, whilst another is a continuum between the two communities. It has frequent perennial rye-grass and cock's-foot *Dactylis glomerata* indicative of MG6a, but also abundant soft rush and Yorkshire fog. A number of plants of whorled caraway (see paragraph 3.9 above) were also noted.

4.12 The MG10a grassland at G4 also forms a continuum from adjacent slightly drier MG6a habitats. It has abundant soft rush and Yorkshire fog, with smaller proportions of creeping buttercup, fleabane *Pulicaria dysenterica* and selfheal *Prunella vulgaris*.

4.13 The grassland in G6 is heavily disturbed having apparently been mown, harrowed and sprayed to remove the rushes. However, the constant species of MG10a such as soft rush, Yorkshire fog, creeping bent *Agrostis stolonifera* and creeping buttercup are still in evidence.

M15b *Scirpus cespitosus – Erica tetralix* wet heath, typical sub-community

4.14 This is a community of moist acid peats and peaty soils in the western parts of Britain. It is generally characterized by a mixture of varying quantities of purple moor-grass, deer grass *Trichophorum cespitosum (Scirpus cespitosus*), cross-leaved heath *Erica tetralix* and heather *Calluna vulgaris*.

4.15 A large block of the *M15b typical sub-community* is present on G1. Purple moor grass and cross-leaved heath are both abundant here, with frequent deer grass and heather. Other species include common hair grass *Eriophorum angustifolium*, small amounts of hare's-tail cotton grass *Eriophorum vaginatum*, heath milkwort *Polygala serpyllifolia* and marsh lousewort *Pedicularis palustris*.

M23 *Juncus effusus/acutiflorus - Galium palustre* rush-pasture and two sub-communities (M23a *Juncus acutiflorus* sub-community; and M23b *Juncus effusus sub-community*)

4.16 This community is defined by the presence of an abundance of soft rush and/or sharp-flowered rush amongst mesophytic herbs widely occurring in moister agricultural grasslands. It is not a species-rich community, but a diverse range of species can occur amongst the dominant rushes.

4.17 In the habitats present on site, there is mostly a similar proportion of both rushes present, but where soft rush is predominant, and purple moor-grass and whorled caraway are absent, the *Juncus effusus sub-community M23b* has been assigned. This sub-community represents a transition from the drier MG10 rush pasture community described above. Commonly occurring species in this sub-community include Yorkshire-fog, velvet bent *Agrostis canina*, tufted hair grass *Deschampsia cespitosa*, creeping buttercup, marsh bedstraw and marsh thistle. Where sharp-flowered rush is dominant or abundant, or purple moor-grass is abundant, the *Juncus acutiflorus* sub-community M23a has been assigned.

4.18 The M23 community is present on G1 – G5. On G1 there is an area of M23a at the southern tip of the surveyed area. It includes typical M23 species such as velvet bent, soft and sharp flowered rushes, marsh bedstraw and Yorkshire fog, as well species more typical of the M15b wet heath to which it lies adjacent – purple moor grass, tormentil *Potentilla erecta* and heath rush *Juncus squarrosus*. This is a fairly grassy, probably relatively dry example of this community. The local abundance of purple moor-grass suggests affinity with the M23a sub-community, and this vegetation has therefore been mapped as M23a.

4.19 On G2 the M23b sub-community is present within (and in mosaic with) extensive areas of scrub. Much of this area was inaccessible because of the dense scrub cover. The M23b areas surveyed has abundant soft rush cover, with creeping bent, wild angelica *Angelica sylvestris*, greater bird's-foot trefoil *Lotus pedunculatus* and ragged robin *Lychnis flos-cuculi*. Species more typical of scrubby margins were also present in some quantity, including bramble, rosebay willowherb *Chamerion angustifolium*, greater willowherb *Epilobium hirsutum* and hemp agrimony *Eupatorium cannabinum*.

4.20 G3 is similar to G2, consisting of a wetter area surrounded by, and in mosaic with, an extensive area of scrub. The M23b community here is overwhelmingly dominated by soft rush, with occasional wild angelica and bulrush *Typha latifolia*.

4.21 The M23 community on G4 lies along the gallops and is present in association with MG6a, MG10a, and M25 communities. Soft and sharp-flowered rush are both present in some quantity, along with marsh bedstraw, greater bird's-foot trefoil, creeping buttercup, white clover and lesser spearwort *Ranunculus flammula*. Because of the abundance of sharp-flowered rush, the M23 community has been identified as M23a.

4.22 The two fields on the northern and eastern edges of G5 are classified as M23a and M23b. The field to the north has an abundance of soft rush with occasional sharp-flowered rush and so is classified as M23b. It also has abundant creeping bent and frequent marsh bedstraw and greater bird's-foot trefoil and small quantities of wild angelica, Yorkshire fog and tormentil. Purple moor grass is occasionally present. The eastern field has an abundance of both soft and sharp-flowered rush and Yorkshire fog and greater bird's-foot trefoil are both frequent and there are smaller quantities of velvet bent, sweet vernal grass *Anthoxanthum odoratum*, marsh bedstraw and creeping buttercup. While the field could probably be assigned to the wider M23 community, it is worth noting that this area was mown prior to the survey. However, the unmown parts were relatively species-rich and a cautious assessment of the M23 community as M23a has been made.

M25a *Molinea caerulea – Potentilla erecta* mire, *Erica tetralix* sub-community

4.23 This community is characterised by the overwhelming dominance of purple moor grass, which distinguishes it from the M23 community described above. Other species are limited in number and abundance. Soft rush and sharp-flowered rush can be frequent, but tormentil is the only broad-leaved species that occurs regularly.

4.24 A large block of the *Erica tetralix* M25a sub-community is present on G1 and a smaller patch of this community is present on G4. On G1 purple moor grass is dominant, with small amounts of tormentil, cross-leaved heath, soft and sharp-flowered rush, bilberry *Vaccinium myrtillus*, devil's-bit scabious *Succisa pratensis* and deer grass.

4.25 The patch of M25a on G4 is overwhelmingly dominated by purple moor-grass, with no other species recorded.

M25c *Molinea caerulea* – *Potentilla erecta* mire, *Angelica sylvestris* sub-community

4.26 The patch of M25 on G5 lies adjacent to a stream, and has a lower dominance of purple moor-grass, although it is still the most abundant species, and forms distinct tussocks. Other species present include soft rush, marsh bedstraw, greater bird's-foot trefoil and wild angelica. The abundance of wild angelica suggests affinity with the M25c *Angelica sylvestris* sub-community, and this vegetation has therefore been classified as this.

W1 *Salix cinerea – Galium palustre* woodland

4.27 This community has a canopy dominated by grey willow *Salix cinerea*, with scattered silver birch and alder occasionally present. The field layer is variable but often consists of mosaics of more open areas over undulations in wetter and drier ground. Common species are marsh bedstraw, water mint *Mentha aquatica* and soft rush.

4.28 This community is found in mosaic with M23b (see above) on survey areas G2 and G3. The dominant woody species is grey willow, mixed with hazel *Corylus avellana* and bramble. Other species present include soft rush, hemp agrimony and foxglove *Digitalis purpurea*.

W6e *Alnus glutinosa – Urtica dioica* woodland*, Betula pubescens* sub-community

4.29 This classification brings together a variety of canopies dominated by alder*,* willows *Salix* spp., and silver birch. The field layer is generally species-poor, with nettle *Urtica dioica* being the only constant. The *Betula pubescens* sub-community has a greater dominance of downy birch, with an understorey of bramble and honeysuckle *Lonicera periclymenum* and scattered broad-buckler fern *Dryopteris dilatata* and patchily abundant nettle.

4.30 This sub-community is present at WL4, WL5 and WL7. Here the sparse canopy consist largely of downy birch and grey willow, with rowan *Sorbus aucuparia*, sycamore *Acer pseudoplatanus*, and pedunculate oak also present in small numbers. Bramble is frequent in the understorey. The ground flora is dominated by the invasive species Himalayan balsam, which fills a niche usually occupied by nettle. Nettle also remains frequent, and other species occasionally present include cleavers *Galium aparine*, yellow pimpernel *Lysimachia nemorum*, creeping soft grass *Holcus mollis* and ivy *Hedera helix*.

W7 *Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland

4.31 This community tends to have an open and irregular canopy of trees with alder being the only woody constant. The most frequent understorey species are hazel, hawthorn and grey willow; and the ground flora includes creeping buttercup, rough meadow grass *Poa trivialis*, Yorkshire fog and yellow pimpernel.

4.32 The W7 community is found on survey areas WL16 (where it forms a mosaic with rush pasture and W10 woodland) and WL17. On these areas, pedunculate oak and grey willow form the canopy, with lower-growing alder, holly *Ilex aquifolium* and grey willow making up the understorey. Bramble scrub is abundant, and the ground flora is sparse. The ground flora includes ivy, soft rush and marsh bedstraw.

W10 *Quercus robur* – *Pteridium aquilinum – Rubus fruticosus* Woodland

4.33 This is essentially oak woodland, with pedunculate oak being the commonest tree. Birch (usually silver birch, but also downy birch) is also frequently present. Holly, rowan and sometimes beech *Fagus sylvatica* occur, and alder may be present on wetter areas. The understorey generally includes frequent bramble and honeysuckle. The ground flora can include bluebell *Hyacinthoides non-scripta*, creeping soft grass *Holcus* mollis and bracken, and ferns such as male fern *Dryopteris filix-mas* and broad-buckler fern.

4.34 The W10 community is found on survey areas WL1, WL2, WL3, WL6, WL8, WL9, WL10, WL11, WL12, WL13, WL14, WL15 and WL16. In WL9, 11, and 13 the canopy is very narrow, in places only one tree deep. More generally in the W10 areas, pedunculate oak is the dominant canopy tree, with downy birch also frequent. The understorey includes rowan, grey willow and holly, and

also abundant bramble. The ground flora includes frequent ivy, with scattered broad-buckler fern, lady fern *Athyrium filix-femina* and hard fern *Blechnum spicant*. Creeping bent, common bent, bluebell *Hyacinthoides non-scripta*, creeping buttercup and soft rush are amongst other species occasionally present.

4.35 In survey area WL1, the W10 woodland has a relatively sparse and uniform open canopy. Part of WL1 follows a high voltage overhead power line, and presumably tall vegetation is regularly cleared from this area. The canopy here is particularly open and the understorey has a high level of rowan. The field layer in WL1 is dominated by grasses (such as Yorkshire fog and rough meadow-grass *Poa trivialis*), with some woodland species (such as bluebell, and foxglove), and (in places) indicators of damp ground (wavy bitter-cress *Cardamine flexuosa* and creeping buttercup). This field layer shows some similarity with MG10 rush pasture, except for the absence of rushes (*Juncus* sp.); and with MG9 grassland, except for the absence of tufted hair-grass *Deschampsia cespitosa*. The poor fit with plant communities described in the NVC may result from the on-going management in this area. Here, the vegetation is considered to be sparse W10 woodland with a grass-dominated field layer.

Presence of NERC Act Section 42 habitats

4.36 Table 3 summarises the results of the survey by survey area, with reference to the presence or otherwise of NERC Act Section 42 habitats. This has been determined by reference to the document "UK Biodiversity Action Plan Priority Habitat Descriptions"[4] which was used as a reference to draw up the Section 42 list.

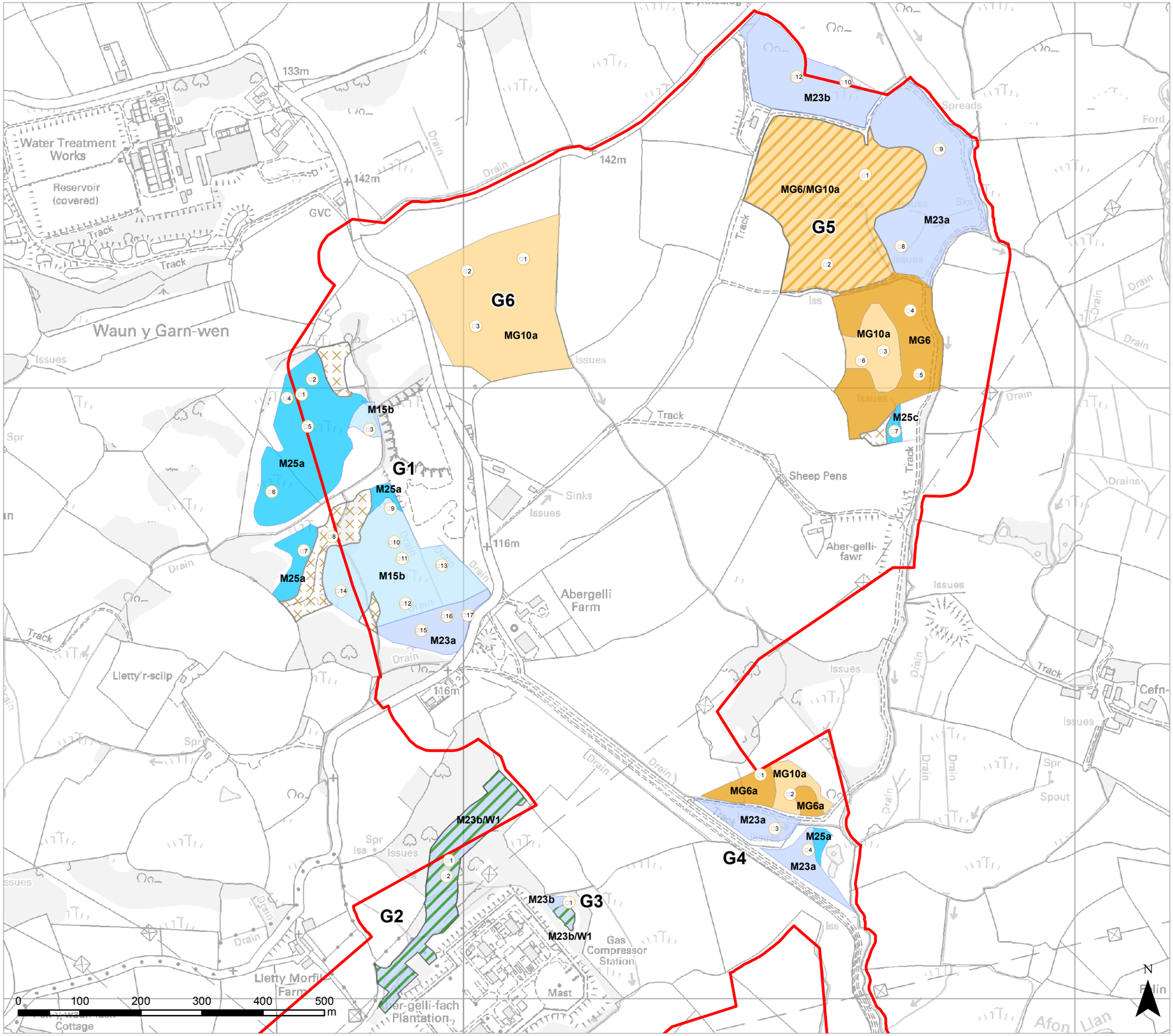
[4] Maddock Ant (Ed), 2008. UK Biodiversity Action Plan Priority Habitat Descriptions. Updated 2011.

Table 3: NERC Act Section 42 Habitats

Survey Area	NVC	Section 42 NERC Act Habitats Present?
G1	M15b, M23a, M25a	Upland heathland
G2	M23b/W1 mosaic	Wet woodland
G3	M23b/W1 mosaic	Wet woodland
G4	MG6a, MG10a, M23a, M25a	Wet woodland
G5	MG6A, MG10a, M23a, M23b, M25a, M25c	Upland flushes, fens and swamps
G6	MG10a	None
WL1	W10	Lowland mixed deciduous woodland
WL2	W10	Lowland mixed deciduous woodland
WL3	W10	Lowland mixed deciduous woodland
WL4	W6e	Wet woodland
WL5	W6e	Wet woodland
WL6	W10	Lowland mixed deciduous woodland
WL7	W6e	Wet woodland
WL8	W10	Lowland mixed deciduous woodland
WL9	W10	Hedgerow
WL10	W10	Lowland mixed deciduous woodland
WL11	W10	Hedgerow
WL12	W10	Lowland mixed deciduous woodland
WL13	W10	Lowland mixed deciduous woodland
WL14	W10	Lowland mixed deciduous woodland
WL15	W10	Lowland mixed deciduous woodland
WL16	W7/W10 mosaic	Wet woodland / lowland mixed deciduous woodland
WL17	W7	Wet woodland

Appendix 1 – Figures

(Overleaf)



LEGEND

- Survey Site boundary
- 1 Grassland survey quadrats
- G1 NVC compartment reference

Grassland survey NVC communities

- M15
- M23
- M23b/W1 mosaic
- M25
- MG6
- MG6/MG10 mosaic
- MG10
- Bracken

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PROJECT TITLE
ABERGELLI POWER PLANT

DRAWING TITLE
Figure 1: NVC survey results (grassland)

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DRAWN: COH APPROVED: JG STATUS: FINAL

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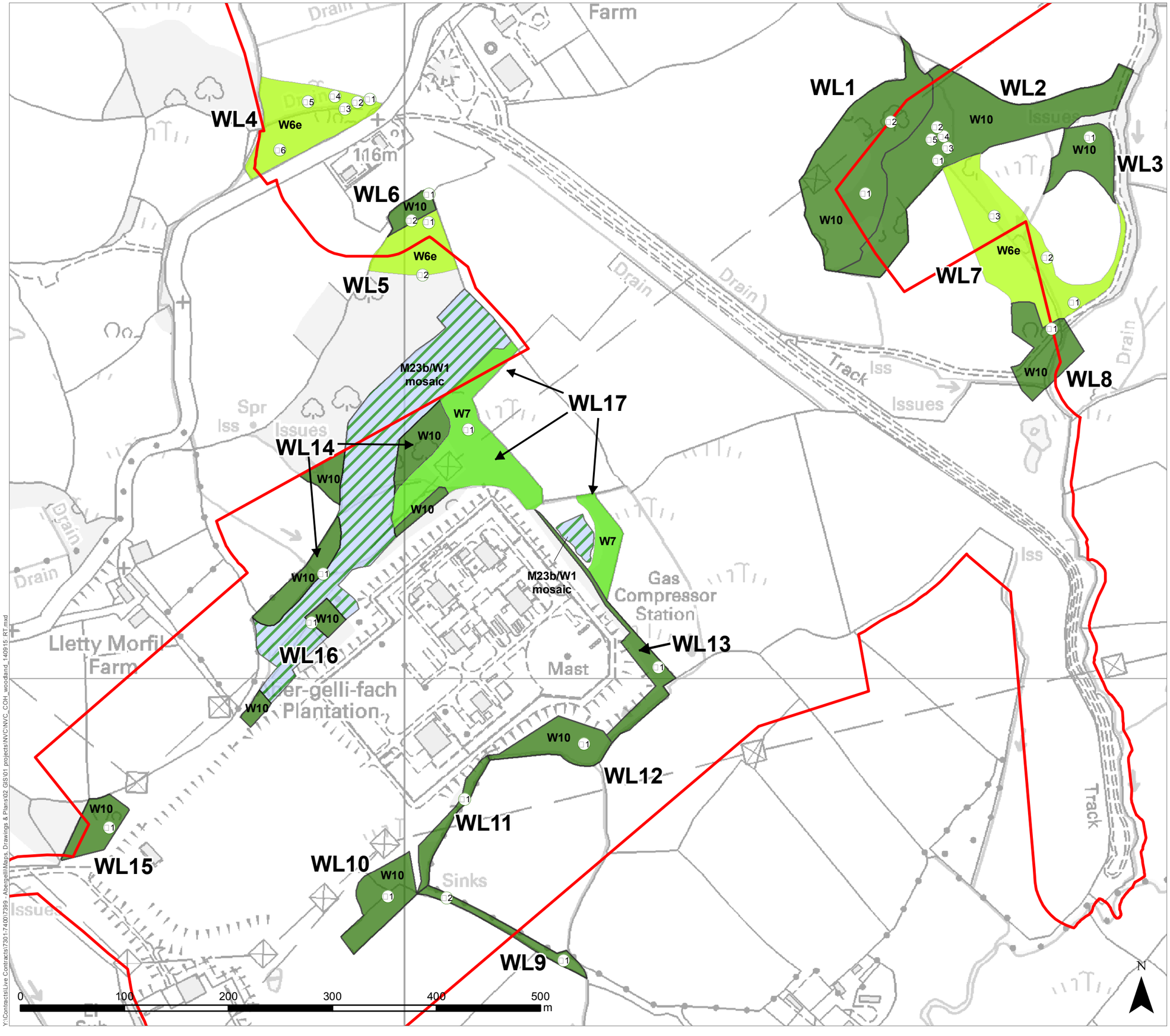

LEGEND

- Survey Site boundary
- 1 Woodland survey quadrats
- WL1 NVC compartment reference

Woodland survey NVC communities

- M23b/W1 mosaic
- W6
- W7
- W10

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PROJECT TITLE
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DRAWING TITLE
Figure 2: NVC survey results (woodland)

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Appendix 2 - Legislation

Natural Environment and Rural Communities (NERC) Act 2006

Section 40 of the Natural Environment and Rural Community Act (NERC) 2006 sets out the duty which public authorities have to conserve biodiversity. Section 40 States that: “every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity”. The term Public Authority includes local authorities and local planning authorities.

Paragraph 40(3) goes on to state that “conserving biodiversity includes, in relation to a living organism or type of habitat, restoring or enhancing a population or habitat”.

Paragraph 42(1) states that “the Secretary of State must, as respects Wales, publish a list of the living organisms and types of habitat which in the Secretary of State’s opinion are of principal importance for the purpose of conserving biodiversity”. This replaces a similar reference to the list that was found in Section 74 of the Countryside and Rights of Way Act 2000 (the CRoW Act).

Appendix 3 – Results

A quantitative measure of abundance of every species was recorded using the Domin scale (Rodwell 1991, 1992) as shown below.

Domin Scale

Cover	Domin Score
91 – 100%	10
76 – 90%	9
51 -75%	8
34 -50%	7
26 -33%	6
11 -24%	5
4 – 10%	4
<4% (with many individuals)	3
<4% (with several individuals)	2
<4% (with few individuals)	1

Appendix 3.3

Invertebrate Survey Report 2014

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Abergelli Power Project

Invertebrate Survey Report

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Client	Stag Energy
Job	Abergelli Power Project
Report title	Invertebrate Survey Report
Draft version/final	FINAL
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	Name	**Position**	**Date**
Originated	Matt Hobbs	Principal Ecologist	04 August 2014
Reviewed	Jim Fairclough	Principal Ecologist	14 August 2014
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1 Summary

1.1 Abergelli Power Limited (APL) is promoting a new Power Generation Plant with its associated Gas and Electricity Connections (the 'Project') on agricultural land within Abergelli Farm, north of Swansea in the City and County of Swansea (approximately at National Grid Reference 265284, 201431).

1.2 As part of the Preliminary Ecological Appraisal (PEA) (BSG Ecology, 2014a) for the Project Site (hereafter referred to as the 'Survey Site'), a request was made to the South East Wales Biodiversity Records Centre (SEWBReC) and Swansea Council for information on designated sites and protected or otherwise notable species within 2 km of the 'Survey Site'. The desk study provided 40 records of four Lepidoptera[1] 'species of principal importance for nature conservation' as referred to in Section 42 of the NERC Act 2006 (S42), within 2 km of the Survey Site, including 29 records of marsh fritillary butterfly *Euphydryas aurinia*. In addition, the desk study revealed that three Sites of Importance for Nature Conservation (SINC) lie within the Survey Site boundary and contain some potentially valuable habitats for invertebrates, with S42 invertebrate species recorded at two of them. The PEA confirmed the presence of several potentially valuable habitats for invertebrates, particularly woodland, marshy grassland, watercourses and ponds.

1.3 APL commissioned BSG Ecology to undertake invertebrate surveys of suitable habitats within the Survey Site boundary. Surveys were carried out during June-September 2014 for moths, marsh fritillary (adult and larval stages), terrestrial Coleoptera[2], and aquatic macroinvertebrates[3] (in ponds and watercourses). The purpose of the surveys was to inform and support an application for Development Consent for the Project.

1.4 A total of 384 species were recorded from the Survey Site. One species is Red Data Book (insufficiently known[4]), two are nationally scarce and fourteen are S42 species. The results of each survey is summarised as follows:

- Terrestrial Coleoptera survey: 150 species were recorded during two surveys (in July and September). These included 112 species of Coleoptera, 20 of which are saproxylic[5] species (see 3.6) although none are indicative of continuous saproxylic habitat, which may be taken as an indicator of the quality of ancient woodland habitat;
- Marsh fritillary survey: This species was not recorded during surveys for adult or larval stages, although seven butterfly and two day-flying moth species were observed. These included one S42 species;
- Moth survey: 118 species of moth were recorded during two night-time surveys. Three locally notable species (see 4.36) were recorded and 13 S42 species;
- Pond survey: 48 species of aquatic macroinvertebrates were recorded during the survey of Ponds 11 and 16, with the highest diversity of species recorded at Pond 11. No scarce or threatened aquatic invertebrates were identified within the samples; and
- Watercourse survey: all of the watercourses sampled were of very good quality. 59 species were recorded with no scarce or threatened aquatic invertebrates identified within the samples.

[1] Butterflies and moths.
[2] Beetles.
[3] An invertebrate that is large enough to be seen without the use of a microscope.
[4] The category insufficiently known refers to species for which insufficient data exists to assign that species to another RDB category, e.g. rare or vulnerable.
[5] Beetles which live in or on dead wood or involved in or dependent on wood decay

2 Introduction

2.1 Abergelli Power Limited commissioned BSG Ecology to undertake an invertebrate survey in 2014 to inform and support an application for Development Consent for the Project described below.

Site Description

2.2 The Survey Site consists of approximately 150 ha of pastoral farmland primarily grazed by horses. The extent of the Survey Site is shown in Figure 1 (Figures are located in Appendix 1) and is centred at National Grid Reference 265284, 201431. The nearest settlement is Felindre, which is located approximately 2 km to the north of the Survey Site, with Swansea approximately 5 km to the south.

2.3 The Survey Site is largely agriculturally improved pasture with several areas of marshy grassland, particularly in the north, south and north-western extents of the Survey Site. The fields are bounded by fences, running along the line of defunct hedgerows, and often accompanied by ditches. There is a block of broadleaved woodland on the eastern boundary of the Survey Site and other areas of woodland around the marshy grassland to the west of the Survey Site, and around Felindre Gas Compressor Station and the two National Grid 400 kV electrical substations that lie at the south-west end of the Survey Site. The habitats in the surrounding landscape are similar to those within the Survey Site boundary comprising a mixture of improved and marshy grassland interspersed with occasional patches of woodland.

Description of Project

2.4 APL is promoting a new Power Generation Plant with associated Gas and Electricity Connections within Abergelli Farm. The Power Generation Plant would operate as a Simple Cycle Gas Turbine (SCGT) peaking plant and would be designed to provide an electrical capacity of up to 299 Megawatts (MW). It would be fuelled by natural gas, supplied by a new underground gas pipeline connecting the Power Generation Plant to the existing National Grid Gas (NGG) National Transmission System (NTS). It would also connect to the National Grid Electrical Transmission System (NETS) via underground cable or overhead lines.

2.5 BSG Ecology has been appointed as the ecological consultant to undertake ecology surveys, including a PEA as well as a range of Phase 2 surveys, including invertebrate surveys. These baseline surveys will be included in an appendix to an ecology chapter of an Environmental Statement, which is intended for submission, in support of the application for Development Consent.

Aims of Study

2.6 The aims of the invertebrate survey were to indicate the quality of habitats present on the Survey Site that are potentially important for invertebrates; and to identify whether any notable species (e.g. rare, scarce or nationally threatened species of invertebrate, including S42 species), are present and if present, to indicate their likely distribution across the Survey Site.

3 Methods

Desk Study

3.1 Existing ecological information for the Survey Site and its surrounding area was requested from the South East Wales Biodiversity Records Centre (SEWBReC). Information on protected[6] or notable species (particularly those identified as S42 species and/or of local conservation importance or LBAP[7] species), including invertebrates, was requested covering the Survey Site and land up to 2 km from the Survey Site boundary. In addition, on-line resources including the Multi Agency Geographic Information for the Countryside (MAGIC, www.magic.gov.uk) website[8] and aerial photography of the area were also reviewed.

Habitat Potential Assessment

3.2 During the Extended Phase 1 Habitat Survey of the Survey Site, carried out to inform the PEA, which was undertaken in three phases (in February, April and July 2014), consideration was given to the suitability of the Survey Site to support important invertebrate communities as well as protected and/or notable invertebrate species. Full details of the PEA are provided in the PEA report (BSG Ecology, 2014).

3.3 As part of this assessment, notes were made of the habitats present, which included observations of features that might limit invertebrate interest as well as those which might be of particular value for invertebrates. In particular, emphasis was placed on the following features (where present):

- Mature open grown trees and veteran trees: especially those with large volumes of standing dead wood;
- Woodland edge and scrub: especially where there is a diverse vegetation structure and species composition;
- Species-rich grassland: especially that in association with scrub, with a high proportion of plants providing nectar and pollen, and with a varied vegetation structure;
- Early successional habitat: (e.g. cliff faces, quarries, eroded banks, periodically disturbed bare or sparsely vegetated ground) especially on free-draining ground where there is a high proportion of exposed bare earth; and
- Wetland: including watercourses (e.g. streams, ditches, flushes and seepages), standing water or waterbodies (e.g. ponds, lakes and swamp) and associated terrestrial habitat (e.g. wet heath and marshy grassland).

3.4 A number of habitats were identified during the survey with the potential to support important invertebrate communities (which are described further in the results section). Subsequent invertebrate surveys were designed, to target key indicator groups of invertebrates within the survey area that may be associated with woodland and marshy grassland in particular, namely Coleoptera (terrestrial beetles) and Lepidoptera (marsh fritillary butterfly and moths). In addition, two ponds (see Figure 1: Pond 11 and Pond 16) and three watercourses (see Figure 2) within the Survey Site were identified as of potential value to aquatic invertebrates.

3.5 The results of these targeted surveys can be used to assess the main groups of invertebrate present within the Survey Site, and to provide an indication of the relative species diversity within the targeted groups.

Targeted Survey for Coleoptera

3.6 Features within the Survey Site that provided the most suitable habitat for this taxonomic order were selected for targeted survey. Surveys for beetles focussed on woodland and woodland edge

[6] Wildlife and Countryside Act 1981 Schedules 1, 5 & 8; Conservation of Habitats and Species Regulations 2010; Protection of Badgers Act.
[7] Those listed under Local Biodiversity Action Plans (LBAP) for Swansea.
[8] http://www.magic.gov.uk/

habitats within the Survey Site as a number of the woodland areas are listed on the Ancient Woodland Inventory for Wales and one of the aims of the survey was to identify whether the beetle fauna present within the Survey Site is indicative of high quality ancient woodland. The assessment of whether woodland is ancient and/or is of high quality to invertebrates can be indicated by surveying the saproxylic beetle fauna. The presence of a particular species or a high diversity of such species can indicate the continuity of woodland on a site. This has been used in the formulation of an Index of Ecological Continuity (Alexander, 2004) based on the scores assigned to 180 species of Coleoptera taken as 'indicative of continuity of saproxylic habitats' from a more general list of 700 saproxylic species. Across the four main areas of woodland on the Survey Site (Woodlands 1-4; see Figure 1) the following sampling methods were employed: pitfall traps, sweep netting, beating, hand searching and sieving. These methods are described below. Whilst Coleoptera formed the focus of the survey, incidental records of other invertebrate taxa were also taken. Surveys were conducted on 10 July 2014 by Don Stenhouse FRES and on 18 September 2014 by Jim Fairclough MCIEEM, both suitably qualified entomologists.

Pitfall Traps

3.7 Two or three pitfall traps were set out in each of the four woodlands within the Survey Site (shown on Figure 1). The number of traps in each woodland was dependent on the availability of suitable locations for trapping and the size and quality of the habitat. Pitfall trapping involved the use of circular plant pot trays (24 cm diameter x 5 cm depth) that were sunk into a circular hole that had been excavated using a spade. The trays were installed such that the tray rims were flush with the surrounding ground level. Preserving fluid, comprising 1 part ethylene glycol (antifreeze) to 3 parts water, was poured into the trays until they were half full. A drop of detergent was added to the fluid to break the surface tension and a layer of mesh (aperture size 2 cm x 1 cm) was balanced over the tray to prevent capture of small mammals, amphibians and reptiles. The traps were operational between 10 and 28 July 2014 as well as between 9 and 18 September 2014. Pitfall trapping is considered to be an effective method for the sampling of ground dwelling beetles, particularly those belonging to the family Carabidae (ground beetles).

Sweep Netting

3.8 Sweep netting involved walking at a steady pace and passing a heavy duty entomologist's sweep net back and forth through scrub and understorey vegetation in a figure of eight motion. This method is particularly suitable for capturing phytophagous (foliage-feeding) families such as Curculionidae (weevils), Chrysomelidae (leaf or flea beetles), Nitidulidae (pollen beetles) and Cantharidae (soldier beetles).

Beating

3.9 Beating is an appropriate technique for extracting beetles from overhanging branches. This method involves placing a beating tray beneath a branch before delivering several sharp blows to the branch and sending any dislodged invertebrates into the beating tray for inspection. This method may uncover a diverse array of beetle families that are similar to those found during the sweeping, and may additionally produce Cerambycids (longhorn beetles) or Elaterids (click beetles), many of which are associated with dead wood habitats.

Hand-searching and Sieving

3.10 Hand searching under logs and bark of dead trees, as well as grass tussocks and pleurocarpous (spreading and branched) mosses is a useful additional technique of extracting invertebrates by hand. In addition, samples of rotten wood, leaf/grass litter or moss were sieved into a white tray to extract additional samples. This technique is particularly appropriate to aid detection of small, often obscure beetles such as Staphylinidae (rove beetles), Anobiidae (wood-boring beetles) and Cryptophagidae (silken fungus beetles).

Weather Conditions

3.11 For the first survey the weather had been warm and settled in the preceding weeks with some rain in the days immediately preceding the survey. On the first survey visit, conducted on 10 July 2014, the weather was dry, sunny and warm (maximum temperature 22°C), with a light wind.

3.12 For the second survey, conditions in the week preceding the survey were dry and warm. On the second survey visit, conducted on 18 September, the weather was overcast but dry with a light wind and a temperature of 19°C.

3.13 The weather during both periods of pitfall trapping was generally warm and dry.

Sample Sorting and Identification

3.14 Whilst some species could be identified in the field, the majority of specimens were stored in 70% methanol solution for subsequent identification, using a stereoscopic microscope with the aid of identification literature. Don Stenhouse carried out identification of all terrestrial invertebrate samples collected from the Survey Site.

Targeted Survey for Marsh Fritillary

Survey for Adult Butterflies

3.15 On 7 and 17 June 2014, Matthew Hobbs MCIEEM, an experienced butterfly surveyor, visited the Survey Site to conduct a walked butterfly transect survey following standard methods described below, with a focus on recording marsh fritillary butterfly in its adult stage.

3.16 A transect route was selected to cover an area of marshy grassland in the north-west of the Survey Site that forms part of the Waun Garn Wen SINC. Marsh fritillary butterfly has apparently not been previously recorded within this SINC, as no desk study records were received and the species is not mentioned in the SINC citation. However, some areas of the marshy grassland habitat comprise the National Vegetation Classification (NVC) habitat type, M25 *Molinia caerulea – Potentilla erecta* mire[9]. This habitat supports a number of devil's bit scabious *Succisa pratensis* plants within the sward. Marsh fritillary larvae will only feed on scabious plants (with devil's bit scabious the most important larval host plant) and this species is the only scabious species present within the Survey Site. As such, this is the only area that has the potential to support a breeding population of marsh fritillary within the Survey Site and is the only area that was surveyed. The area that the transect route covered is shown on Figure 1. The methodology used for the survey adapted the protocol used within the UK Butterfly Monitoring Scheme (UKBMS)[10], as follows:

- Timed counts were made between 10:00 and 16:30 hours, and only carried out in warm, bright and dry weather, with no more than moderate winds;
- A transect route was devised (Figure 1), which was split into sections, each section being of similar length and covering discreet 'field' or habitat types;
- Each section was walked at a slow, steady pace counting all butterflies seen within a fixed distance, 2.5 m either side of the transect line and 5 m ahead;
- Care was taken to maintain a steady pace and avoid waiting at favoured hotspots to improve the count and bias the results;
- Butterfly numbers and percentage of sunshine in each section were recorded using the standard UKBMS proforma. Wind speed was estimated using the Beaufort scale (0 - no wind, 6 - very strong wind); and
- During surveys, species of butterfly other than marsh fritillary and day-flying moths were also recorded.

3.17 During the two surveys on 7 and 17 June, the wind speed was measured as 3 and 2 respectively (light wind) and the average temperature was 16°C and 21°C respectively.

Survey for Larvae

3.18 A second stage of surveys for marsh fritillary, which involved looking for larval webs of this species, was undertaken on 20 August 2014, by Greg Chamberlain MCIEEM, an experienced marsh fritillary surveyor. The survey followed standard methods derived from the UK Butterfly Monitoring

[9] A National Vegetation Classification survey was carried out in 2014 and details are included in the report: BSG Ecology (2014). Abergelli Power Project: National Vegetation Classification Survey Report.
[10] http://www.ukbms.org/Downloads/UKBMS%20G2%20Transect%20field%20guidance%20%20notes.pdf

Scheme (UKBMS)[11]. The survey involved walking 2-5 m strip width transects across the marshy grassland within the Waun Garn Wen SINC which encompassed a similar area to the one used in the surveys for adult marsh fritillary described above. The survey took into account any devil's bit scabious plants that had been recorded in the transect area during other surveys. Following the adult surveys in June, access was no longer available to the northern part of the area surveyed for adults and the larval surveys were restricted to the southern area, where devil's bit scabious had not been recorded. During the June survey no examples of this plant were recorded and no further surveys were scheduled for marsh fritillary larvae.

Targeted Survey for Moths

3.19 Night-time moth surveys were undertaken twice, on 16 June and 14 August 2014. The first survey was conducted by Owain Gabb MCIEEM and Matthew Hobbs MCIEEM, both ecologists competent in moth survey and identification, with the second undertaken by Owain Gabb, with Caitlin McCann assisting. A single 125W Robinson moth trap (using a mercury vapour bulb) and two 40W heath traps (using actinic bulbs) were used during both surveys, with the aim of attracting the greatest number and variety of moths. The traps were positioned on both occasions in habitat areas within the Survey Site that were expected to give the greatest range of species (see Figure 1 for trap locations).

- **Trap M1**: the first heath trap was located in an area of dry heath and rush pasture in the west of the Survey Site;
- **Trap M2**: the Robinson trap was located on a sloping track close to horse-grazed pasture, woodland, scrub, neutral grassland and ruderal vegetation; and
- **Trap M3**: the second heath trap was located on a track bordered with scrub and neutral grassland in horse-grazed pasture between two areas of woodland.

3.20 Weather conditions during the survey on 16 June were good with a temperature range of 13-18ºC, with no rain and little or no wind. On 13 August, conditions were again good with a temperature range of 14-18ºC with a light wind and no rain.

3.21 The lights were switched on approximately 20 minutes before dusk and remained lit until they were switched off after dawn. The Robinson trap was powered via mains electricity (and an extension lead) from a house on site, and the two heath traps by external 12V leisure batteries (and timer switches).

3.22 The Robinson trap was manned for the first few hours of darkness to capture moths drawn to the light but not entering the trap, with the other traps visited periodically. The traps were systematically emptied, and all moths determined to species level the following morning.

3.23 A number of micro-moths were externally determined / verified by Barry Stewart, one of the three authors of The Moths of Glamorgan (Gilmore *et al*., 2014), on the day following each survey.

Targeted Survey of Ponds

3.24 The survey focussed on two of the three ponds present within the Survey Site (Ponds 11 and 16) (for numbering of ponds please see Figure 1 in the great-crested newt survey report (BSG Ecology, 2014b)). A third pond (Pond 17) was not surveyed as it was thought to be suboptimal for aquatic invertebrates due to shading, lack of vegetation and very shallow water levels. The survey was undertaken on 28 July 2014 by Dr Jessica Frame MCIEEM and Rachel Taylor ACIEEM, both skilled freshwater ecologists.

3.25 Benthic macroinvertebrates were collected at the two ponds using standard 3-minute kick sample methodology (Biggs *et al*., 1998) using a 1 mm mesh hand net. One minute of hand searching (of rocks, logs, leaf packs and other submerged debris) was then carried out in search of invertebrates (e.g. caddis fly larvae (Trichoptera), pond skaters (Gerrida) and whirligig beetles (Gyrinida) that might otherwise have been missed during the net sampling.

3.26 Invertebrates were separated from detritus and bed material in the field and preserved immediately in 70% Industrial Methylated Spirit (IMS) for subsequent laboratory analysis.

[11] http://www.ukbms.org/Downloads/UKBMS%20Ng2%20-%20Marsh%20Frit%20Webs%20guidance%20notes.pdf

3.27 A number of water quality parameters, including pH, dissolved oxygen, conductivity and total dissolved solids were also recorded at each pond.

3.28 The weather during the survey was warm (18°), dry, with intermittent sun and a light wind. The location of each of the ponds surveyed is shown in Figure 1.

Targeted Survey of Watercourses

3.29 Surveys of watercourses were carried out on 19 September 2014 by Jim Fairclough and Rachel Taylor, both skilled freshwater ecologists. The survey techniques used at each sampling point are described in detail below.

Sample point selection

3.30 To be effective, biological sampling should ideally use watercourses with a range of habitats that are most likely to yield a diverse invertebrate community sensitive enough to detect changes in biological water quality. Accordingly, sampling locations included reaches of approximately 10 linear metres, typically centred on a shallow fast-moving section of the stream (riffle), across which a sample was collected.

Sample collection

3.31 At each sample point, one minute of hand searching (of rocks, logs, leaf packs and other submerged debris) was carried out in search of invertebrates (e.g. caddis larvae, pond skaters or whirligigs) that might otherwise have been missed during the subsequent kick sampling. Three minutes of kick sampling was then carried out for each sample point. Pond nets were used for sampling and these conformed to Environment Agency standards (1 mm mesh and 0.5 m deep). Care was taken to avoid deep accumulations of soft sediment because this makes sample sorting extremely difficult. Similarly, the netting of large volumes of plant material was avoided.

Sample sorting and identification

3.32 The sample was placed into a sorting tray and all invertebrates were placed in a collection jar for identification in the laboratory. The tray was carefully checked to ensure that no species were missed. Specimens were stored in 70% methanol solution. Any necessary species identification was carried out by a suitably experienced entomologist (Dr Jessica Frame) using a stereoscopic microscope with the aid of identification literature.

Water Quality Assessment

3.33 Assessment of aquatic invertebrate composition and diversity is recognised as an effective way of measuring the water quality and habitat quality of wetland habitat. A common method for the assessment of water quality is the Biological Monitoring Working Party (BMWP) index. This gives a score to freshwater habitat based upon the number of families of invertebrates found in a sample.

3.34 The BMWP works on the basic principle that freshwater pollution levels affect invertebrate families differently. Thus, certain families that are most susceptible to pollution score maximum points. These include many families belonging to the mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddis (Trichoptera). Conversely, those families tolerant of polluted waters score the fewest points, and include families such as the leeches (Hirudinea), worms (Oligochaeta), chironomid midges (Diptera) and the freshwater hog-louse (Isopoda). Accordingly, cleaner watercourses, which have higher water quality, score the highest number of points, whilst polluted watercourses score the lowest. In the mid-1990s, Walley and Hawkes carried out a computer-based revision of the BMWP Scoring System, using data from the 1990 River Quality Survey of England and Wales (Walley and Hawkes, 1996, 1997). This is thought to be a more objective approach to allocating BMWP scores which would lead to a more accurate reflection of the impacts of pollution on invertebrate fauna. For the purposes of this report the revised scores have been calculated.

3.35 An alternative way of expressing the BMWP score is by measuring the Average Score per Taxon (ASPT). This is obtained by dividing the BMWP score by the number of scoring families. This score is sometimes preferred to the BMWP score, since it eliminates any discrepancies associated with 'recorder effort'. As with the BMWP score, the higher the ASPT per sample the cleaner the

watercourse. The cleanest waters might therefore have an ASPT close to '10', whilst the most polluted waters lie closer to '1'. In general terms an ASPT greater than the 'benchline' mark of '5' is indicative of a watercourse in reasonable condition. Water quality monitoring can be carried out using the same scoring index each time and comparing the results.

Laboratory Identification

3.36 All aquatic macroinvertebrate individuals (excluding fly larvae and worms) collected in the field were identified to species-level under a stereoscopic microscope (up to 70 x magnification) using the most up-to-date identification keys available. Identification of aquatic macroinvertebrates was completed by Dr Jessica Frame of BSG Ecology.

Survey Limitations

3.37 It was not possible to access the northern part of the marshy grassland in the north-west of the Survey Site after July and therefore larval surveys for marsh fritillary were not carried out in this area. This is the only area that devil's bit scabious was recorded in the Survey Site and is the only area where there was potential for marsh fritillary to occur. Since the restrictions to land access were applied the Project Site has been subsequently refined due to changes in the design of the Project and the Project Site no longer includes this area.

3.38 No other constraints to the efficacy of the surveys were recorded.

4 Results

Desk Study

4.1 SEWBReC provided 40 records of Section 42 Lepidoptera species. The species recorded are marsh fritillary, dingy skipper *Erynnis tages*, narrow-bordered bee hawk-moth *Hemaris tityus* and small pearl-bordered fritillary *Boloria selene*. Twenty nine of the records are of marsh fritillary; the closest of these is located approximately 0.7 km west of the Survey Site boundary in 2009. This location also contains the closest of the four dingy skipper records, as well as the closest of the five small pearl-bordered fritillary records and the only narrow-bordered bee hawk-moth record. The results of the Habitat Potential Assessment (below) include a discussion regarding whether suitable habitats to support any of these species are present within the Survey Site.

Habitat Potential Assessment

4.2 The results of the desk study were taken into account to assess whether there is suitable habitat for the *Lepidoptera* species within 2 km of the Survey Site and whether further survey for any of these species was justified. The marshy grassland in the north-west of the Survey Site provides broadly suitable habitat for marsh fritillary (see 3.14), although the food plant devil's-bit scabious was only noted in small patches in M25 grassland during the NVC survey (see Figure 1). Of the other Section 42 species recorded from the desk study, suitable habitat is present for narrow-bordered bee hawk-moth, which also largely relies on devil's bit scabious. The methods employed during the marsh fritillary transect surveys (see 3.1.5) included recording of day-flying moths such as this species. For dingy skipper, there are few areas of bare ground, where this species prefers to bask and no areas where it's usual egg-laying food plant, bird's foot trefoil *Lotus corniculatus*, is found in any quantity. Small pearl-bordered fritillary is reliant on violets (*Viola sp*.) as its egg-laying plant, and violets have not been recorded during the PEA (the April survey was timed to record them in flower). It is unlikely that either of these latter two species are present within the Survey Site.

4.3 Much of the Survey Site is pastoral farmland. The fields are grazed by horses and sheep, and are largely bounded by fences with occasional trees, scrub and defunct hedgerows. These areas were discounted from further study on the basis of the habitat being of poor suitability for invertebrates. Only common and widespread species might be expected to occur in association with such habitat.

4.4 Away from these areas, there are four key habitats that have the potential to be important for assemblages of invertebrates, including those that are rare, scarce or nationally threatened. These are:

- The area of marshy grassland in the north-west of the Survey Site, which contains a mosaic of habitats, including M25 grassland, that has the potential to support marsh fritillary;
- Several areas of woodland within the Survey Site, most of which are included on the Ancient Woodland Inventory for Wales and are also SINCs;
- Numerous watercourses on site, mostly in the form of ditches along field boundaries, and also four streams; and
- The two ponds (Ponds 11 and 16) within the Survey Site.

4.5 These habitats formed the main focus of the targeted surveys and are described below.

Marshy grassland

4.6 Most areas of marshy grassland within the Survey Site were degraded due to grazing pressure and were not identified as providing potentially high quality habitat for invertebrates. However, the marshy grassland habitat in the north-west of the Survey Site forms part of the Waun Garn Wen SINC and is of higher quality.

4.7 This area was composed of mire (dominated by purple moor grass *Molinia caerulea*) to the north, with wet heath to the south and rush pasture around the margins. The northern area was characterised by the dominance of purple moor grass, which distinguishes it from the rush pasture

described below. Other species were limited in number and abundance. Soft rush *Juncus effusus* and sharp-flowered rush *Juncus acutiflorus* can be frequent, but tormentil *Potentilla erecta* is the only broad-leaved species that occurred regularly. Other potential food and nectar plants for invertebrates included cross-leaved heath *Erica tetralix*, bilberry *Vaccinium myrtillus*, devil's-bit scabious, marsh bedstraw *Galium palustre*, greater bird's-foot trefoil and wild angelica *Angelica sylvestris*.

4.8 The southern area was largely wet heath, characterised by a mixture of varying quantities of purple moor-grass, deer grass *Trichophorum cespitosum*, cross-leaved heath and heather *Calluna vulgaris*. Other species included wavy hair grass *Deschampsia flexuosa*, small amounts of hare's-tail cotton grass *Eriophorum vaginatum*, heath milkwort *Polygala serpyllifolia* and marsh lousewort *Pedicularis palustris*.

4.9 Around the fringes of this area there were pockets of rush pasture, which were defined by the presence of an abundance of soft rush and/or sharp-flowered rush amongst mesophytic herbs widely occurring in moister agricultural grasslands. This was not a species-rich habitat, but other species present included marsh bedstraw and marsh thistle *Cirsium palustre*, ragged robin *Lychnis flos-cuculi*, bulrush *Typha latifolium*, and lesser spearwort *Ranunculus flammula*. Species more typical of scrubby margins were also present, including bramble *Rubus fruticosus* agg., rosebay willowherb *Chamerion angustifolium*, great willowherb *Epilobium hirsutum* and hemp agrimony *Eupatorium cannabinum*.

4.10 This area was also crossed by wet ditches and contained areas of young woodland and small trees scattered around the edges of the habitat mosaic. It formed part of a much larger area of similar habitats (mostly contained within the Waun Garn Wen SINC) that extend to the west.

4.11 This combination of habitats may provide an important reservoir for invertebrates within the wider landscape, where it is intensively farmed. The grassland habitat is complemented by ruderal vegetation, stands of bracken *Pteridium aquilinum*, wet ditches, trees and scrub; the combination of which should provide complex transitional zones that are often rich in invertebrates, due to the structural diversity they create and the variety of foraging opportunities they provide. The added height and often permanency of features such as grass and sedge tussocks, scrub and trees offers important refuges for invertebrates especially during winter when penetrating frosts may otherwise have adverse consequences.

Woodland

4.12 There were several areas of woodland within the Survey Site. There was a block of broadleaved woodland along the eastern boundary of the Survey Site (Woodland 4; Figure 1). The western end being on a hill, and is dry with widely-spaced trees and a grazed grassland ground flora including common grassland species. The trees here were small to medium-stemmed with very little understorey, and included: silver birch *Betula pendula*, crab-apple *Malus sylvestris*, holly *Ilex aquifolium* and pedunculate oak *Quercus robur*. Dead wood and bracket fungi were also present, which can provide suitable habitat for a range of saproxylic invertebrates. The hill slopes down steeply to the east, where a stream delineates a lower, wetter area of woodland. Here the tree species composition was similar but the understorey was more dense, with bramble predominating. There were also extensive areas of ground flora that were dominated by purple moor-grass with *Sphagnum* moss species also present.

4.13 Another relatively extensive area of broad-leaved woodland was present at the south-west end of the Survey Site around Felindre Gas Compressor Station and the two National Grid 400kV electrical substations (Woodland 1; Figure 1). This formed a strip to the south and a more continuous block to the north of Felindre Gas Compressor Station and the two National Grid 400kV electrical substations. The woodland was generally quite wet, with alder *Alnus glutinous* and willow species *Salix* spp. frequent along with pedunculate oak, birch and holly. The trees were growing close together and were generally small-stemmed and straggly. The understorey was comprised of dense bramble, whilst the ground flora was largely absent. Where the woodland opened out, for example around the margins of Felindre Gas Compressor Station and the two National Grid 400kV electrical substations, soft-rush dominated marshy grassland was present. This woodland is listed as ancient woodland but lacks most features of ancient woodland habitat, including significant dead wood and diverse understorey layers that would be suitable for supporting a diverse invertebrate fauna. To the north, Woodland 2 (Figure 1) was dominated by semi-mature oak, alder, willow and birch with a thick bramble understorey.

4.14 There were also patches of deciduous woodland around the edges of the marshy grassland on the block of land to the west of the road that runs through the Survey Site (Woodland 3). Tree species were largely immature and included oak, birch, holly, hawthorn *Crataegus monogyna* and an understorey dominated by bramble, but also including ivy *Hedera helix*, creeping bent *Agrostis stolonifera*, Yorkshire fog *Holcus lanatus*, soft rush, hard fern *Blechnum spicant*, scaly male fern *Dryopteris affinis* and bracken. The ground flora included nettle *Urtica dioica*, lady fern *Athyrium filix-femina,* wood false brome *Brachypodium sylvaticum* and abundant Himalayan balsam *Impatiens glandulifera*. There was some dead wood present in this area of woodland but it lacked features characteristic of ancient woodland habitat that would be suitable for supporting a diverse invertebrate fauna.

Watercourses

4.15 There were numerous small water courses within the Survey Site. These were mostly ditches along field boundaries, but there were also some larger streams. The block of marshy grassland to the west was criss-crossed by numerous ditches, which were largely dry or with marshy bases when visited in April. There was also a stream that flowed through this block of land – this was shaded by flanking woodland, with a stone bed and shallow banks. These were all deemed unsuitable for survey at the time of watercourse sampling in September.

4.16 Another stream flowed south-east through the Survey Site and was split into smaller tributaries through Woodland 4 (See Figures 1 and 2). It was overgrown with scrub in many places and was shallow and fast-flowing with riffles and pools along its uniform bank structure and stony bed. This stream exhibited local detritus but there was no sewage present. No macrophyte cover was found and in the most heavily shaded sample point (See Figure 2; Sample Point 3) a brown trout *Salmo trutta* (parr) was caught during a standard kick sample.

4.17 Another larger stream flowed along the eastern boundary of the Survey Site. This was relatively unshaded, with a bed of mud, gravel and rocks. The upstream portion of this watercourse was approximately 1.5 m in width and the water depth ranged from approximately 10 cm to 20 cm where pools formed. It was fast flowing and appeared to be clean as there was no turbidity, detritus or sewage. Another brown trout (parr) was caught during kick sampling at Sample Point 1 (See Figure 2). Further downstream where two additional kick samples were taken (Sample Points 5 & 6), the stream widened and formed a wide pool at Sample Point 6. The stream had moderate shade and slight turbidity, was surrounded by scrub and trees and had a substrate of pebbles, sand and silt.

4.18 There were also small watercourses present around the margin of Felindre Gas Compressor Station and the two National Grid 400kV electrical substations. These streams were on average 0.5 m wide and 0.3 m deep with the average bank height being 0.4 m. The first stretch sampled (Sample Point 7) was heavily impinged upon by bank vegetation, mostly scrub that covered the majority of its length (see Image 14). The flow in this watercourse was low both upstream and downstream with only riffles over a substrate of gravel and silt. Pastoral land sits on either side of both streams.

4.19 All features that were visited in February had flowing water, reflecting a period of prolonged wet weather preceding the survey. This was not the case when sampling took place in September. Aquatic vegetation was not apparent in any of the watercourses, but marginal vegetation included frequent soft rush, occasional purple moor-grass and scattered gorse *Ulex europaeus* and bramble.

4.20 Watercourses can support rich and varied assemblages of invertebrates adapted to highly specialised niches across the reach of a watercourse. Taxonomic orders including Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies), Odonata (dragonflies), Diptera (true flies) and aquatic Coleoptera tend to be well represented in such habitats, especially where water quality appears to be unimpaired.

Ponds

4.21 Although neither Pond 11 nor 16 forms part of a wider cluster of ponds or other waterbodies, both were located in good quality habitat, either surrounded by marshy grassland and scrub (Pond 11) or between woodland and neutral grassland (Pond 16). There is likely to be a wide range of

species potentially associated with such ponds, including (but not limited to): snails (Gastropoda), diving beetles (Dytiscidae), water beetles (Hydrophilidae), dragonflies and caddisflies.

Targeted Surveys

4.22 Overall, a total of 384 species were recorded during the targeted invertebrate surveys, the results of which are fully described in the following sections.

Coleoptera

4.23 From the first survey 150 specimens were examined and 95 invertebrate species were identified. Coleoptera was the dominant order recorded with 70 species recorded, reflecting the search emphasis, with Hemiptera making up the majority of other records. Hemiptera were taken more as incidental material and have been included for completeness. During the second survey, 71 species were recorded. Coleoptera was the dominant order recorded with 46 species (four of which were also recorded during the first survey), with Hemiptera well represented at 13 species and a small number of incidental records, such as millipedes, making up the rest. The full list of Coleoptera species recorded within the four woodlands surveyed is displayed in tabular format in Appendix 2.

4.24 The four woodlands produced 19 saproxylic species from the first survey with one more species added from the second survey visit. These species are all included in the general list of Alexander (2004) with none indicative of continuous saproxylic habitat, which may be taken as an indicator of the quality of ancient woodland habitat.

4.25 Combining results for the two sample sets results in a list of 150 species, 75% of which are in the target order, Coleoptera. A total of 20 saproxylic species were recorded, representing 2.8% of the 700 species regarded as saproxylic by Alexander (2004).

4.26 The results of the survey were analysed by measuring the number of locally rare, nationally notable and IUCN red list / RDB species.

4.27 Overall, the majority of the insects recorded are widely distributed and common, with 15 regarded as more local, and two of notable status. These notable species are discussed further in Table 1 below.

Table 1: Summary of notable beetle species status and habitat requirements.

Scientific Name	Status	Notes on Habitat Requirements
Epuraea distincta (a Nitulid beetle)	Nationally Scarce (Notable A)	This species is associated with fungi (notably bracket fungi) on trees, especially in wet woodland. It is shown on the NBN Gateway as well recorded in the West Wales region. Samples were taken from pitfall traps in Woodlands 3 and 4 at the Survey Site.
Orchesia micans (a Melandryid beetle)	Nationally Scarce (Notable B)	This saproxylic species was found on the remnants of fungus on a birch tree in Woodland 4. The NBN Gateway shows this beetle as having a fairly widespread distribution in England and Wales with its core distribution between the Severn and the Wash.

Marsh Fritillary

Survey for Adult Butterflies

4.28 Seven butterfly and two day-flying moth species were observed during the transect surveys. Marsh fritillary was not recorded. A summary of the transect survey results are shown in Table 2 below and the area walked during the transect survey is shown in Figure 1.

Table 2: Summary of Transect Survey Results

		No of sightings	
Common Name	**Latin Name**	**07/06/2014**	**17/06/2014**
Common Blue	*Polyommatus icarus*	1	
Meadow Brown	*Maniola jurtina*		5
Ringlet	*Aphantopus hyperantus*		6
Large Skipper	*Ochlodes sylvanus*		3
Brimstone	*Gonepteryx rhamni*	2	
Small White	*Pieris rapae*	1	
Small Heath	*Coenonympha pamphilus*	3	
6-Spot Burnet (moth)	*Zygaena filipendulae*		4
Burnet companion (moth)	*Euclidia glyphica*	2	

4.29 The diversity of butterfly species is typical for a site of this type and location. The numbers of butterflies recorded were low with the large majority recorded in a narrow strip of flower-rich habitat in the southernmost part of the area that was surveyed. In general, a lack of flowering nectar-rich plants during the surveys is likely to have led to the low abundance of butterflies recorded. The species recorded are generally considered to be common and widespread across south Wales.

4.30 Small heath is the only species recorded that is a S42 species. Although widespread and common and found in a fairly wide variety of habitats with its main food plants being grasses (particularly Bents (various) (*Agrostis spp.*), Fescues (various) (*Festuca spp.*) and Meadow-grasses (various) (*Poa spp.*)), this species has undergone a 10 year decline of 28% (Butterfly Conservation, 2011). None of the S42 butterfly or day-flying moth species recorded from the desk study were recorded during the surveys.

Incidental sightings

4.31 In addition to the Lepidoptera species recorded above, seven green hairstreak *Callophrys rubric* butterflies were recorded while deploying reptile refugia on 16 May in the transect survey area. This species, although widespread, is relatively localised in distribution in Britain.

Survey for Larvae

4.32 No devil's bit scabious plants were recorded during the first survey, and therefore a second survey was not carried out (see 3.18). Marsh fritillary larvae are considered to be absent from the area in which the survey was carried out.

Moths

4.33 The night-time surveys produced 118 taxa of moth in total (see Appendix 3).

4.34 The macro moth fauna of Glamorgan is well recorded, with hectads[12] in Swansea and the Gower Peninsula being very well covered in a vice-county[13] context. Micro Lepidoptera are notably under recorded, however, which makes robust assessment of apparent abundance based on the number of records and/or their geographical spread within the vice-county impossible for many species (Gilmore *et al*., 2014).

4.35 Gilmore *et al.* (2014) provide a detailed summary of the number of records, by species, for all moths in Glamorgan. For macro moths, the authors attribute an assessment of abundance (very rare, rare, scarce, uncommon, common etc.) based on the number of records, qualified by further

[12] A 10 km x 10 km square often used for biological recording.
[13] A vice-county is a geographical division of the British Isles used for the purposes of biological recording and other scientific data-gathering. Glamorgan contains a single vice-county (number 41), which is split into a number of hectads, that sub-divide the vice-county into smaller recording units.

information with regard to how widespread the species is based on the number of hectads it has occurred in.

4.36 None of the macro moths recorded on the Survey Site was less frequent than 'very local', at the vice-county level. The most notable species were map-winged swift *Hepialus fusconebulosa*, and marbled brown *Drymonia dodonaea*. Prior to the survey, map-winged swift had been recorded on 200 previous occasions in the vice-county, and in 25 of the 40 10 km hectads that fall within Glamorgan. Marbled brown had occurred on 186 previous occasions and in 17 hectads: it is a very localised species in Glamorgan which only occurs regularly on the Gower Peninsula and in northern districts of the vice-county. It is associated with native oak species.

4.37 There was one locally notable micro moth species, the grass veneer *Crambus uliginosellus*. This is a localised species of damp grassland, bogs and fens. It was recorded at the heath trap in the area of marshy grassland in the north-west of the Survey Site (M1). Gilmore *et al*. (2014) state that there have been 15 previous records of this species at the vice-county level, and that the species has been noted in six hectads on Gower and at Crymlyn Bog.

4.38 Thirteen moth species collected were noteworthy due to their status as S42 species. Table 3, below gives more detailed information about each species and their habitat requirements.

Table 3: Summary of Moth Species Status and Habitat Requirements

Scientific Name	Status	Notes on Habitat Requirements
Dusky brocade *Apamea remissa*	S42: Decline of 76% over 35 years; research needed (JNCC, 2010)	Waring & Townsend (2003) state that this species is common throughout Great Britain. Gilmore *et al.* (2014) confirm this remains the case in Glamorgan. The moth is associated with grasses, and there are patches of tall grassland along tracks, roads and on waste ground within the Survey Site.
Garden tiger *Arctia caja*	S42: Decline of 86% over 35 years; research needed (JNCC, 2010)	This species has become scarce in eastern Glamorgan, but remains common in the south and west, particularly on the coast (Gilmore et al., 2014). Waring & Townsend (2003) indicate that the species could be being affected by both the general 'tidying up' of the countryside and climatic change.
Latticed heath *Chiasmia clathrata*	S42: Decline of 87% over 35 years; research needed (JNCC, 2010)	Waring & Townsend (2003) state that this species is common and well distributed in West Wales (much of England and Southern Scotland). Gilmore *et al.* (2014) indicate that it is common and widespread in southern Glamorgan.
Broom moth *Melanchra pisi*	S42: Decline of 77% over 35 years; research needed (JNCC, 2010)	Waring & Townsend (2003) state that this species is common throughout Great Britain, being most abundant on heather moorland. Gilmore *et a*l (2014) note that the moth is frequently encountered in all parts of the vice-county other than the Vale of Glamorgan. Locally, the favoured larval food plant is bracken.
Shoulder-striped wainscot *Mythimna comma*	S42: Decline of 72% over 35 years; research needed (JNCC, 2010)	Waring & Townsend (2003) state that this species is common in southern Britain. Gilmore *et al.* (2014) confirm that this status remains relevant to Glamorgan. The larvae feed on a range of grasses.
White ermine *Spilosoma lubricipeda*	S42: Decline of 77% over 35 years; research needed (JNCC, 2010)	Waring & Townsend (2003) state that this species is common and very well distributed throughout Britain. Gilmore *et al.* (2014) confirm this status for Glamorgan. The larvae feed on a range of herbaceous plants.
Buff ermine *Spilosoma luteum*	S42: Decline of 73% over 35 years; research	Waring & Townsend (2003) state that this species is common and very well distributed throughout Britain. Gilmore *et al.* (2014) confirm this status for Glamorgan.

Scientific Name	Status	Notes on Habitat Requirements
	needed (JNCC, 2010)	The larvae have relatively catholic feeding preferences.
Blood vein *Timandra comae*	S42: Decline of 79% over 35 years; research needed (JNCC, 2010)	According to Waring & Townsend (2003), this species is common across England and Wales. The moth is associated with a variety of herbaceous plants, but docks in particular, so it would have been well suited to the field margins and woodland within the Survey Site. Gilmore *et al.* (2014) state that it is common throughout Glamorgan.
Cinnabar *Tyria jacobaeae*	S42: Decline of 83% over 35 years; research needed (JNCC, 2010)	Waring & Townsend (2003) state that this species is common across England and Wales, and Gilmore *et al.* (2014) confirm that this remains its status in Glamorgan. The moth is almost exclusively associated with common ragwort *Jacobaea vulgaris* and there are some small patches of this plant within the Survey Site, many of which hold larvae of this species.
Ear moth agg. *Amphipoea oculea*	S42: Declined by 71% over the last 35 years; research needed (JNCC, 2010)	There are four species of ear moth that could account for the records. These can only be distinguished based on dissection of genitalia. All have a localised distribution, and even the commonest *Amphipoea oculea* typically occurs at low density in the UK. *Amphipoea crinanensis* has not been recorded in the vice-county to date. The three ear moths that have been recorded in Glamorgan are all either uncommon or rare in the county. However their relative abundance (in relation to each other) is currently unknown (Gilmore *et al*., 2014). Based on the habitat present, and the altitude of the site however, the records are most likely to refer to *Amphipoea oculea* as opposed to *A. fucosa paludis* or *A. lucens*. *A. oculea* is considered an uncommon but widespread resident in the county.
Small phoenix *Ecliptopera silaceata*	S42: Declined by 77% over the last 35 years; research needed (JNCC, 2010)	Waring & Townsend (2003) state that this species is common throughout mainland Britain, the Inner Hebrides and Ireland. Gilmore *et al.* (2014) state that it is a common, widespread resident in Glamorgan, and found in a range of habitats.
Dusky thorn *Ennomos fuscantaria*	S42: Declined by 98% over the last 35 years; research needed (JNCC, 2010)	A common resident that is fairly generally distributed and often frequent in England and Wales. It occurs wherever the foodplant, ash *Fraxinus excelsior* is found (Waring & Townsend, 2003). In Glamorgan the species is found throughout southern areas, but is more localised in northern districts.
Rosy rustic *Hydraecia micacea*	S42: Declined by 86% over the last 35 years; research needed (JNCC, 2010)	Occurs in a wide range of habitats including gardens, waste ground, pasture, fens, marshes and woodland rides. It is common and well distributed in Britain and Ireland (Waring & Townsend, 2003). It is a common, widespread resident in Glamorgan (Gilmore *et al*., 2014)

Ponds

4.39 A description of each of the ponds surveyed is provided in Table 4 below and images of the ponds are provided in Appendix 4.

Table 4: Pond Habitat Descriptions..

Pond Ref.	Location	Pond Description	Water Quality
11	SN6494301754	This waterbody covered an area of approximately 52 m^2 with an average depth of ca. 0.75 m and a maximum depth of over 1 m. The aquatic plant community in this pond included common bulrush *Typha latifolia*, branched bur-reed *Sparganium erectum*, broad-leaved pondweed *Potamogeton natans* and floating sweet grass *Glyceria fluitans*.	pH: 7.14 Temp: 18.05°C Conductivity: 419 µS/cm TDS*: 210 mg/L DO*: 34% (3.19 mg/L)
16	SN6560701225	This waterbody covered an area of approximately 25 m^2 with an average depth of over 0.75 m and a maximum depth of over 1 m. The aquatic plant community was dominated by water horsetail *Equisetum fluviatile* with patches of broad-leaved pondweed present. The highly invasive floating pennywort *Hydrocotyle ranunculoides* was also present at the northern end of the pond.	pH: 6.70 Temp: 18.61°C Conductivity: 103 µS/cm TDS: 52 mg/L DO: 10% (1.10 mg/L)

* TDS = total dissolved solids; DO = dissolved oxygen

4.40 Both ponds are characterised by circumneutral pH and low dissolved oxygen availability.

4.41 Forty eight different species were recorded during the pond survey. Pond 11 supported the highest diversity of aquatic macroinvertebrates, with total of 46 taxa recorded. Pond 16 supported a more moderate diversity of 32 taxa. The samples were generally dominated by beetles (21 unique taxa), followed by bugs (11 unique taxa). No scarce or threatened aquatic invertebrates were identified within the samples. A complete list of all the macroinvertebrate taxa recorded at each of the ponds can be found in Appendix 5.

4.42 Table 5 summarises the results of the aquatic invertebrate survey.

Table 5: Results summary for aquatic macroinvertebrates found in ponds.

	Pond 11	Pond 16
No. of taxa	46	32
No. of beetle taxa	21	6
No. of water bug taxa	9	8
No. of mayfly taxa	1	1
No. of caddis taxa	0	0
No. of dragonfly / damselfly taxa	2	2
No. of snail / bivalve taxa	2	3
Notable species	None	None

Watercourses

Water Quality Monitoring Baseline

4.43 The samples were analysed to at least family level as required to obtain a BMWP/ASPT score for the stream sections sampled; where possible species were also recorded for completeness and so that any rare species collected would be identified. The BMWP/ASPT score is then given a quality rating (Table 6 below). The scores and ratings calculated for the sample points are recorded in Table 7 (below), and a complete macroinvertebrate taxa list is provided in Appendix 5, Table 2.

Table 6: Ratings for BMWP and ASPT scores

BMWP		ASPT	
BMWP Score	**Quality**	**ASPT**	**Quality**
Over 150	A. Very good biological quality	Over 5.4	Very good
101 – 150	B. Good biological quality	4.81 – 5.4	Good
51 – 100	C. Fair biological quality	4.21 – 4.8	Fair
16 – 50	D. Poor biological quality	3.61 – 4.2	Poor
0 – 15	E. Very poor biological quality	3.6 or less	Very poor

Table 7: BMWP and ASPT score and rating for the samples.

Sample Point	Number of Scoring Taxa	BMWP	Quality (BMWP)	ASPT	Quality (ASPT)
1	15	104	B	6.93	Very good
2	17	119	B	7.00	Very good
3	18	115	B	6.39	Very good
4	13	85	C	6.54	Very good
5	14	89	C	6.36	Very good
6	19	118	B	6.21	Very good
7	18	105	B	5.83	Very good
8	20	119	B	5.95	Very good

4.44 The scores for the spring-fed stream (Sampling points 2-4) improve with each step downstream, but water quality was generally good. There is an increase in distance from the edge of the stream to the pastoral fields further downstream, from no buffer to a 10 m buffer with trees and scrub. This

may be a reason for the improving scores, as there is less risk of sediment deposition / spray drift from adjacent fields when a buffer is present.

5 References

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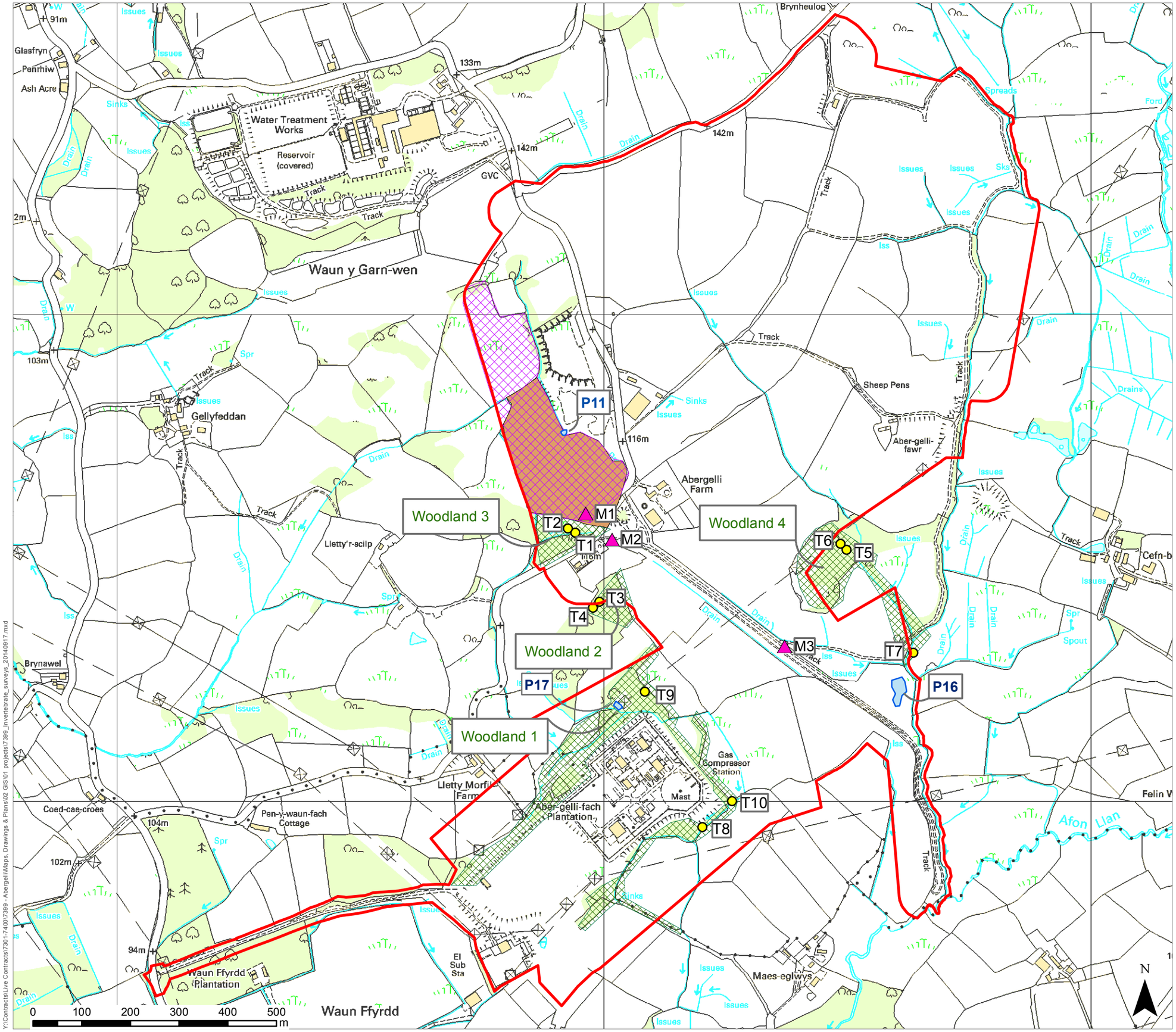
Appendix 1: Figures.

(overleaf)



LEGEND

- Survey Site Boundary
- Moth trap locations
- Terrestrial beetle pitfall trap
- Ponds within the site. Notation for the ponds, e.g. P11, is based on that used in the great-crested newt survey report (BSG Ecology, 2014)
- Marsh Fritillary butterfly transect area
- Marsh Fritillary larval search area
- Woodland surveyed for terrestrial beetles

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T: 01600 891576

JOB REF: 7399

PROJECT TITLE
ABERGELLI POWER PROJECT

DRAWING TITLE
Figure 1 - Invertebrate survey

DATE: 17.09.2014 CHECKED: MH SCALE: 1:7,500
DRAWN: RT APPROVED: MH STATUS: FINAL

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Sources: BSG Ecology survey data

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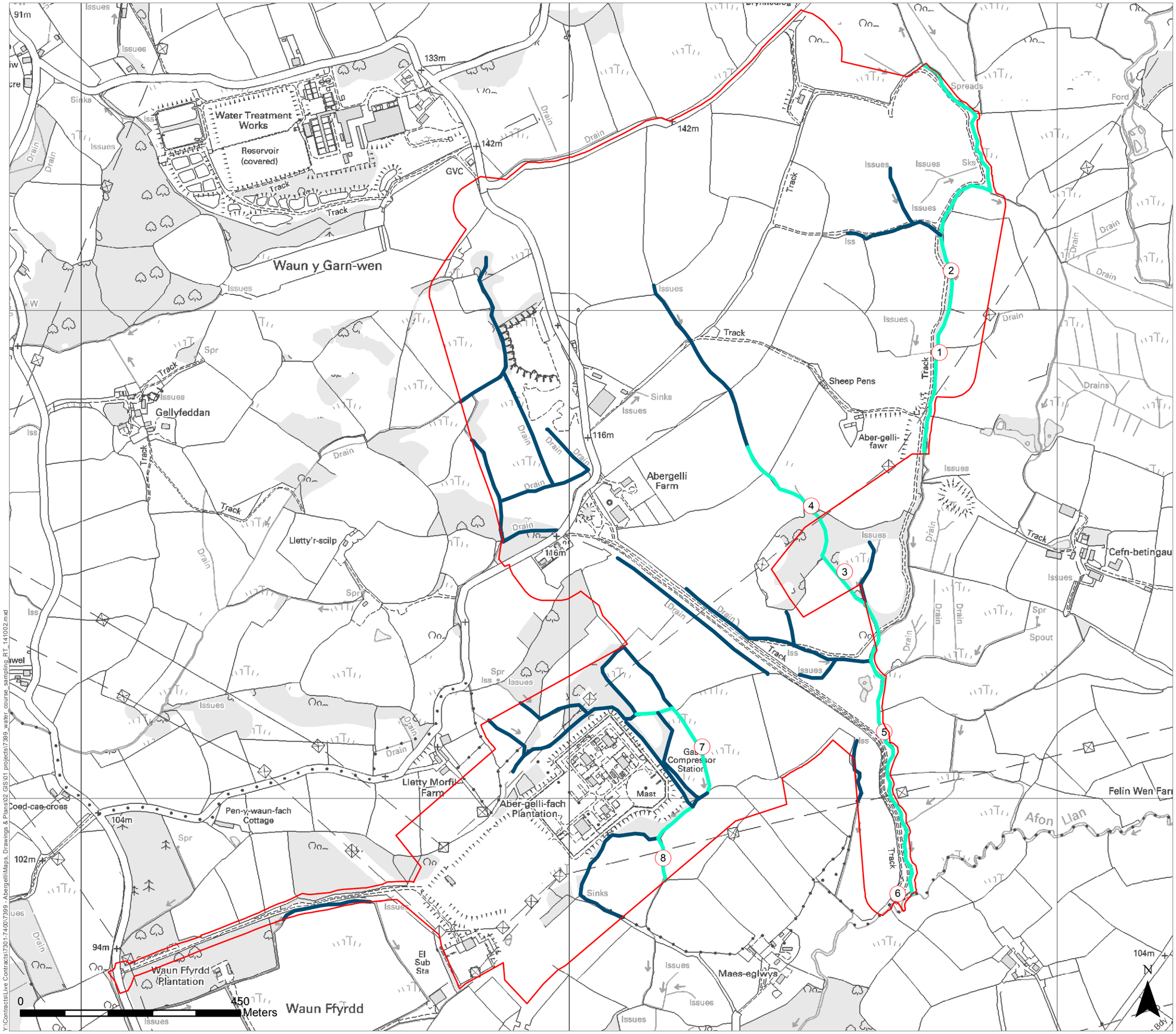

LEGEND

Survey Site boundary

Water course sample points

Water Course Suitability

Water course unsuitable for survey

Water course surveyed

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JOB REF: 7399.00

PROJECT TITLE

ABERGELLI POWER PLANT

DRAWING TITLE

Figure 2 - Water Course Invertebrate Survey

DATE: 02.10.2014 CHECKED: MH SCALE: 1:7,500

DRAWN: RT APPROVED: JG STATUS: Final

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Appendix 2: Species list from targeted Coleoptera surveys.

Species Number	Order	Family	Taxon	Status	Woodland Number	Saproxylic
1	Amphipoda	*Talitridae*	*Orchestia cavimana*	None	W2&3	
2	Coleoptera	*Apionidae*	*Exapion ulicis*	None	W1	
3	Coleoptera	*Apionidae*	*Protapion apricans*	None	W1	
4	Coleoptera	*Apionidae*	*Protapion fulvipes*	None	W4	
5	Coleoptera	*Byturidae*	*Byturus tomentosus*	None	W2	
6	Coleoptera	*Cantharidae*	*Rhagonycha fulva*	None	W4	
7	Coleoptera	*Carabidae*	*Abax parallelepipedus*	None	W2,3&4	
8	Coleoptera	*Carabidae*	*Agonum emarginatum*	Local	W1&2	
9	Coleoptera	*Carabidae*	*Bembidion mannerheimi*	Local	W1	
10	Coleoptera	*Carabidae*	*Bembidion tetracolum*	None	W2	
11	Coleoptera	*Carabidae*	*Bradycellus sharpi*	Local	W4	
12	Coleoptera	*Carabidae*	*Calathus melanocephalus*	None	W2	
13	Coleoptera	*Carabidae*	*Calodromius spilotus*	None	W4	
14	Coleoptera	*Carabidae*	*Cychrus caraboides*	Local	W1&2	
15	Coleoptera	*Carabidae*	*Elaphrus cupreus*	None	W2	
16	Coleoptera	*Carabidae*	*Leistus rufescens*	None	W1	
17	Coleoptera	*Carabidae*	*Loricera pilicornis*	None	W2&4	
18	Coleoptera	*Carabidae*	*Nebria brevicollis*	None	W2	
19	Coleoptera	*Carabidae*	*Notiophilus biguttatus*	None	W2	
20	Coleoptera	*Carabidae*	*Notiophilus rufipes*	Local	W2	
21	Coleoptera	*Carabidae*	*Ocys harpaloides*	None	W3	Y
22	Coleoptera	*Carabidae*	*Paranchus albipes*	None	W2	
23	Coleoptera	*Carabidae*	*Patrobus atrorufus*	None	W2	
24	Coleoptera	*Carabidae*	*Platynus assimilis*	None	W2&4	
25	Coleoptera	*Carabidae*	*Pterostichus diligens*	None	W4	
26	Coleoptera	*Carabidae*	*Pterostichus madidus*	None	W1,2&4	
27	Coleoptera	*Carabidae*	*Pterostichus nigrita*	None	W2	
28	Coleoptera	*Carabidae*	*Pterostichus strenuus*	None	W4	
29	Coleoptera	*Carabidae*	*Trechus quadristriatus*	None	W4	
30	Coleoptera	*Cerambycidae*	*Grammoptera ruficornis*	None	W4	Y
31	Coleoptera	*Cerambycidae*	*Pogonocherus hispidulus*	Local	W2	Y
32	Coleoptera	*Cerambycidae*	*Rhagium bifasciatum*	None	W1&4	Y
33	Coleoptera	*Cerylonidae*	*Cerylon ferrugineum*	Local	W4	Y
34	Coleoptera	*Chrysomelidae*	*Altica palustris*	None	W1	
35	Coleoptera	*Chrysomelidae*	*Chaetocnema concinna*	None	W4	
36	Coleoptera	*Chrysomelidae*	*Chrysomela aenea*	Local	W2	
37	Coleoptera	*Chrysomelidae*	*Crepidodera aurea*	None	W1,3&4	
38	Coleoptera	*Chrysomelidae*	*Crepidodera fulvicornis*	None	W1&3	
39	Coleoptera	*Chrysomelidae*	*Cryptocephalus pusillus*	Local	W1	
40	Coleoptera	*Chrysomelidae*	*Phyllotreta nemorum*	None	W4	
41	Coleoptera	*Ciidae*	*Cis boleti*	None	W3	Y
42	Coleoptera	*Ciidae*	*Octotemnus glabriculus*	None	W4	Y
43	Coleoptera	*Cryptophagidae*	*Cryptophagus dentatus*	None	W4	Y
44	Coleoptera	*Cryptophagidae*	*Cryptophagus lycoperdi*	None	W2	
45	Coleoptera	*Curculionidae*	*Barypeithes araneiformis*	None	W4	
46	Coleoptera	*Curculionidae*	*Dorytomus melanophthalmus*	Local	W4	
47	Coleoptera	*Curculionidae*	*Dorytomus taeniatus*	None	W3	
48	Coleoptera	*Curculionidae*	*Euophryum confine*	None	W2&4	Y
49	Coleoptera	*Curculionidae*	*Liophloeus tessulatus*	None	W3	
50	Coleoptera	*Curculionidae*	*Otiorhynchus singularis*	None	W2	
51	Coleoptera	*Curculionidae*	*Sitona lineatus*	None	W1	

Species Number	Order	Family	Taxon	Status	Woodland Number	Saproxylic
52	Coleoptera	*Curculionidae*	*Strophosoma melanogrammum*	None	W4	
53	Coleoptera	*Dytiscidae*	*Agabus sturmii*	None	W4	
54	Coleoptera	*Dytiscidae*	*Hydroporus memnonius*	None	W3	
55	Coleoptera	*Endomychidae*	*Mycetaea subterranea*	Local	W4	
56	Coleoptera	*Helophoridae*	*Helophorus brevipalpis*	None	W1	
57	Coleoptera	*Helophoridae*	*Helophorus grandis*	None	W1	
58	Coleoptera	*Hydraenidae*	*Hydraena riparia*	Local	W3	
59	Coleoptera	*Hydrophilidae*	*Anacaena globulus*	None	W1,3&4	
60	Coleoptera	*Hydrophilidae*	*Cercyon melanocephalus*	None	W4	
61	Coleoptera	*Hydrophilidae*	*Limnebius truncatellus*	None	W3	
62	Coleoptera	*Latridiidae*	*Cartodere nodifer*	None	W4	
63	Coleoptera	*Leiodidae*	*Catops nigrita*	None	W3	
64	Coleoptera	*Leiodidae*	*Nargus velox*	None	W1	
65	Coleoptera	*Melandryidae*	*Orchesia micans*	NbB	W4	Y
66	Coleoptera	*Nitidulidae*	*Epuraea distincta*	NbA	W3&4	Y
67	Coleoptera	*Nitidulidae*	*Meligethes aeneus*	None	W4	
68	Coleoptera	*Ptiliidae*	*Acrotrichis rosskotheni*	Local	W2	
69	Coleoptera	*Ptinidae*	*Ochina ptinoides*	Local	W4	Y
70	Coleoptera	*Ptinidae*	*Ptilinus pectinicornis*	None	W4	Y
71	Coleoptera	*Salpingidae*	*Salpingus planirostris*	None	W4	Y
72	Coleoptera	*Scirtidae*	*Cyphon coarctatus*	None	W1,2,3&4	
73	Coleoptera	*Scirtidae*	*Cyphon ochraceus*	None	W3	
74	Coleoptera	*Silphidae*	*Silpha atrata*	None	W4	
75	Coleoptera	*Sphindidae*	*Aspidiphorus orbiculatus*	Local	W2	Y
76	Coleoptera	*Staphylinidae*	*Anotylus complanatus*	None	W3	
77	Coleoptera	*Staphylinidae*	*Anotylus rugosus*	None	W1,2&4	
78	Coleoptera	*Staphylinidae*	*Anotylus sculpturatus*	None	W1	
79	Coleoptera	*Staphylinidae*	*Atheta crassicornis*	None	W1&3	
80	Coleoptera	*Staphylinidae*	*Atheta fungi*	None	W1&3	
81	Coleoptera	*Staphylinidae*	*Bisnius fimetarius*	None	W1&W2	
82	Coleoptera	*Staphylinidae*	*Bolitochara obliqua*	None	W4	Y
83	Coleoptera	*Staphylinidae*	*Bryaxis bulbifer*	None	W3	
84	Coleoptera	*Staphylinidae*	*Callicerus rigidicornis*	Local	W2	Y
85	Coleoptera	*Staphylinidae*	*Carpelimus elongatulus*	None	W3	
86	Coleoptera	*Staphylinidae*	*Gabrius splendidulus*	None	W4	Y
87	Coleoptera	*Staphylinidae*	*Halobrecta flavipes*	None	W4	
88	Coleoptera	*Staphylinidae*	*Leptusa ruficollis*	None	W3	
89	Coleoptera	*Staphylinidae*	*Lordithon trinotatus*	None	W4	
90	Coleoptera	*Staphylinidae*	*Megarthrus prosseni*	None	W1	
91	Coleoptera	*Staphylinidae*	*Microdota amicula*	None	W3	
92	Coleoptera	*Staphylinidae*	*Mocyta fungi*	None	W2	
93	Coleoptera	*Staphylinidae*	*Mycetota laticollis*	None	W1	
94	Coleoptera	*Staphylinidae*	*Ocypus olens*	None	W1,2&4	
95	Coleoptera	*Staphylinidae*	*Olophrum piceum*	None	W1	
96	Coleoptera	*Staphylinidae*	*Othius punctulatus*	None	W2	
97	Coleoptera	*Staphylinidae*	*Oxypoda vittata*	Local	W3	Y
98	Coleoptera	*Staphylinidae*	*Philonthus decorus*	None	W2,3&4	
99	Coleoptera	*Staphylinidae*	*Philonthus politus*	None	W1	
100	Coleoptera	*Staphylinidae*	*Philonthus varians*	None	W4	
101	Coleoptera	*Staphylinidae*	*Phloeopora testacea*	None	W1&4	Y
102	Coleoptera	*Staphylinidae*	*Stenichnus collaris*	Local	W4	
103	Coleoptera	*Staphylinidae*	*Stenus aceris*	None	W4	
104	Coleoptera	*Staphylinidae*	*Stenus impressus*	None	W1	
105	Coleoptera	*Staphylinidae*	*Stenus juno*	None	W1	
106	Coleoptera	*Staphylinidae*	*Stenus nitidiusculus*	None	W4	

Species Number	Order	Family	Taxon	Status	Woodland Number	Saproxylic
107	Coleoptera	*Staphylinidae*	*Stenus tarsalis*	None	W2&4	
108	Coleoptera	*Staphylinidae*	*Tachinus laticollis*	Local	W3	
109	Coleoptera	*Staphylinidae*	*Tachinus marginellus*	None	W1&4	
110	Coleoptera	*Staphylinidae*	*Tachinus rufipes*	None	W2&4	
111	Coleoptera	*Staphylinidae*	*Tachyporus chrysomelinus*	None	W1&3	
112	Coleoptera	*Staphylinidae*	*Tachyporus hypnorum*	None	W1&3	
113	Coleoptera	*Staphylinidae*	*Tasgius morsitans*	Local	W1&2	
114	Dermaptera	*Forficulidae*	*Forficula auricularia*	None	W1&4	
115	Diptera	*Ptychopteridae*	*Ptychoptera albimana*	None	W4	
116	Diptera	*Syrphidae*	*Helophilus pendulus*	None	W1	
117	Diptera	*Syrphidae*	*Sphaerophoria scripta*	None	W3	
118	Glomerida	*Glomeridae*	*Glomeris marginata*	None	W1	
119	Hemiptera	*Anthocoridae*	*Anthocoris nemorum*	None	W1,2&3	
120	Hemiptera	*Aphrophoridae*	*Aphrophora alni*	None	W3	
121	Hemiptera	*Aphrophoridae*	*Philaenus spumarius*	None	W1&4	
122	Hemiptera	*Aradidae*	*Aneurus laevis*	None	W3	
123	Hemiptera	*Berytidae*	*Metatropis rufescens*	None	W1	
124	Hemiptera	*Cicadellidae*	*Anoscopus albifrons*	None	W1	
125	Hemiptera	*Delphacidae*	*Conomelus anceps*	None	W4	
126	Hemiptera	*Lygaeidae*	*Drymus brunneus*	None	W1,2&3	
127	Hemiptera	*Lygaeidae*	*Kleidocerys resedae*	None	W1	
128	Hemiptera	*Lygaeidae*	*Lamproplax picea*	Local	W3	
129	Hemiptera	*Lygaeidae*	*Scolopostethus thomsoni*	None	W1&3	
130	Hemiptera	*Miridae*	*Bryocoris pteridis*	None	W1&2	
131	Hemiptera	*Miridae*	*Campyloneura virgula*	None	W2	
132	Hemiptera	*Miridae*	*Closterotomus norwegicus*	None	W4	
133	Hemiptera	*Miridae*	*Dicyphus epilobii*	None	W1	
134	Hemiptera	*Miridae*	*Leptopterna dolabrata*	None	W1	
135	Hemiptera	*Miridae*	*Monalocoris filicis*	None	W2	
136	Hemiptera	*Miridae*	*Neolygus contaminatus*	None	W1	
137	Hemiptera	*Miridae*	*Plagiognathus arbustorum*	None	W4	
138	Hemiptera	*Miridae*	*Stenodema calcarata*	None	W3	
139	Hemiptera	*Miridae*	*Stenodema holsata*	None	W4	
140	Hemiptera	*Pentatomidae*	*Palomena prasina*	None	W2	
141	Hemiptera	*Saldidae*	*Saldula saltatoria*	None	W2&3	
142	Hymenoptera	*Apidae*	*Apis mellifera*	None	W3	
143	Hymenoptera	*Formicidae*	*Formica fusca*	None	W3	
144	Hymenoptera	*Formicidae*	*Lasius niger*	None	W3	
145	Hymenoptera	*Formicidae*	*Myrmica ruginodis*	None	W1,2&4	
146	Isopoda	*Porcellionidae*	*Porcellio scaber*	None	W2	
147	Julida	*Julidae*	*Ommatoiulus sabulosus*	None	W3	
148	Julida	*Julidae*	*Ophyiulus pilosus*	None	W1	
149	Julida	*Julidae*	*Tachypodoiulus niger*	None	W3	
150	Opiliones	*Phalangiidae*	*Dicranopalpus ramosus*	Local	W2	

Appendix 3: Moths recorded during surveys

16th June 2014

Number	Taxon	Vernacular	Quantity	Determiner	Trap No	Status in Glamorgan (Gilmore, Slade & Stewart [2014])	Section 42 Species
1	*Abrostola tripartita*	Spectacle	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1934 records.	
2	*Acronicta leporina*	Miller	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 253 records.	
3	*Aethes cnicana*		1	Owain Gabb / Matt Hobbs	M3	Locally common: 91 records	
4	*Agrotis exclamationis*	Heart and Dart	18	Owain Gabb / Matt Hobbs	M3	Common and widespread: 5523 records	
	Agrotis exclamationis	Heart and Dart	6	Owain Gabb / Matt Hobbs	M2	Common and widespread: 5523 records	
	Agrotis exclamationis	Heart and Dart	2	Owain Gabb / Matt Hobbs	M3	Common and widespread: 5523 records	
5	*Alcis repandata*	Mottled Beauty	4	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1609 records	
	Alcis repandata	Mottled Beauty	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 1609 records	
	Alcis repandata	Mottled Beauty	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1609 records	
6	*Anaplectoides prasina*	Green Arches	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 625 records	
7	*Apamea crenata*	Clouded-bordered Brindle	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1148 records	
	Apamea crenata	Clouded-bordered Brindle	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 1148 records	
8	*Apamea monoglypha*	Dark Arches	4	Owain Gabb / Matt Hobbs	M3	Common and widespread: 4626 records	
	Apamea monoglypha	Dark Arches	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 4626 records	
9	*Apamea remissa*	Dusky Brocade	2	Owain Gabb / Matt Hobbs	M3	Common and widespread: 592 records	Yes
	Apamea remissa	Dusky Brocade	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 592 records	Yes
10	*Arctia caja*	Garden Tiger	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 606 records	Yes
11	*Axylia putris*	Flame	7	Owain Gabb /	M3	Common and widespread: 2459 records	

Number	Taxon	Vernacular	Quantity	Determiner	Trap No	Status in Glamorgan (Gilmore, Slade & Stewart [2014])	Section 42 Species
				Matt Hobbs			
12	*Bactra lancealana*		1	Barry Stewart	M3	Locally common: 426 records	
13	*Biston betularia*	Peppered Moth	5	Owain Gabb / Matt Hobbs	M3	Common and widespread: 2207 records	
	Biston betularia	Peppered Moth	5	Owain Gabb / Matt Hobbs	M2	Common and widespread: 2207 records	
	Biston betularia	Peppered Moth	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 2207 records	
14	*Blastobasis lacticolella*		1	Barry Stewart	M3	Recent addition to county fauna (common): 146 records	
15	*Cabera pusaria*	Common White Wave	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1263 records	
16	*Campaea margaritata*	Light Emerald	3	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1212 records	
17	*Celypha lacunana*		1	Barry Stewart	M3	Very common: 746 records	
18	*Celypha striana*		1	Owain Gabb / Matt Hobbs	M3	Widespread: 579 records	
19	*Chiasmia clathrata*	Latticed Heath	7	Owain Gabb / Matt Hobbs	M3	Common and widespread: 287 records	Yes
20	*Chilodes maritimus*	Silky Wainscot	1	Owain Gabb / Matt Hobbs	M3	Scarce, restricted resident. Likely wanderer. 27 records	
21	*Chrysoteuchia culmella*	Garden Grass-veneer	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1966 records	
22	*Crambus pascuella*		1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 595 records	
	Crambus pascuella		1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 595 records	
	Crambus pascuella		2	Owain Gabb / Matt Hobbs	M3	Common and widespread: 595 records	
23	*Crambus uliginosellus*		3	Owain Gabb / Matt Hobbs	M3	Local: 15 records	
24	*Deilephila elpenor*	Elephant Hawk-moth	10	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1897 records	
25	*Diarsia brunnea*	Purple Clay	4	Owain Gabb / Matt Hobbs	M3	Common: 669 records	
	Diarsia brunnea	Purple Clay	1	Owain Gabb / Matt Hobbs	M3	Common: 669 records	
26	*Diarsia mendica*	Ingrailed Clay	11	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1219 records	
	Diarsia mendica	Ingrailed Clay	2	Owain Gabb / Matt Hobbs	M2	Common and widespread: 1219 records	
	Diarsia mendica	Ingrailed Clay	3	Owain Gabb /	M3	Common and widespread: 1219 records	

Number	Taxon	Vernacular	Quantity	Determiner	Trap No	Status in Glamorgan (Gilmore, Slade & Stewart [2014])	Section 42 Species
				Matt Hobbs			
27	*Diarsia rubi*	Small Square-spot	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1443 records	
28	*Drymonia dodonaea*	Marbled Brown	3	Owain Gabb / Matt Hobbs	M3	Very local / moderately common: 186 records	
29	*Drymonia dodonaea*	Marbled Brown	1	Owain Gabb / Matt Hobbs	M2	Very local / moderately common: 186 records	
	Eupithecia pulchellata	Foxglove Pug	3	Owain Gabb / Matt Hobbs	M3	Common and widespread: 562 records	
	Eupithecia pulchellata	Foxglove Pug	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 562 records	
30	*Euplexia lucipara*	Small Angle Shades	2	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1284 records	
	Euplexia lucipara	Small Angle Shades	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 1284 records	
	Euplexia lucipara	Small Angle Shades	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1284 records	
31	*Eurrhypara hortulata*	Small Magpie	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1498 records	
32	*Hepialus fusconebulosa*	Map-winged Swift	1	Owain Gabb / Matt Hobbs	M3	Moderately common, widespread: 200 records (male)	
33	*Idaea aversata*	Riband Wave	3	Owain Gabb / Matt Hobbs	M3	Common and widespread: 3536 records	
	Idaea aversata	Riband Wave	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 3536 records	
34	*Lacanobia oleracea*	Bright-line Brown-eye	14	Owain Gabb / Matt Hobbs	M3	Very common and widespread: 3388 records	
35	*Lacanobia thalassina*	Pale-shouldered Brocade	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 229 records	
36	*Lomaspilis marginata*	Clouded Border	2	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1218 records	
37	*Lycophotia porphyrea*	True Lover's Knot	11	Owain Gabb / Matt Hobbs	M3	Common and widespread: 715 records	
38	*Macaria alternata*	Sharp-angled Peacock	5	Owain Gabb / Matt Hobbs	M3	Common and widespread: 480 records	
	Macaria alternata	Sharp-angled Peacock	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 480 records	
39	*Macrothylacia rubi*	Fox Moth	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 240 records	
40	*Melanchra pisi*	Broom Moth	5	Owain Gabb / Matt Hobbs	M3	Common and widespread: 730 records	Yes
	Melanchra pisi	Broom Moth	2	Owain Gabb /	M2	Common and widespread: 730 records	Yes

Number	Taxon	Vernacular	Quantity	Determiner	Trap No	Status in Glamorgan (Gilmore, Slade & Stewart [2014])	Section 42 Species
				Matt Hobbs			
	Melanchra pisi	Broom Moth	2	Owain Gabb / Matt Hobbs	M3	Common and widespread: 730 records	Yes
41	*Mythimna comma*	Shoulder-striped Wainscot	3	Owain Gabb / Matt Hobbs	M3	Common and widespread: 704 records	Yes
42	*Noctua pronuba*	Large Yellow Underwing	4	Owain Gabb / Matt Hobbs	M3	Common and widespread: 7556 records	
	Noctua pronuba	Large Yellow Underwing	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 7556 records	
43	*Notodonta ziczac*	Pebble Prominent	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1014 records	
44	*Ochropleura plecta*	Flame Shoulder	5	Owain Gabb / Matt Hobbs	M3	Common and widespread: 4974 records	
	Ochropleura plecta	Flame Shoulder	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 4974 records	
45	*Oligia fasciuncula*	Middle-barred Minor	3	Owain Gabb / Matt Hobbs	M3	Common and widespread: 584 records	
46	*Oligia latruncula*	Tawny Marbled Minor	2	Matt Hobbs	M3	External characters alone. Identification therefore provisional.	
47	*Pandemis cerasana*	Barred Fruit-tree Tortrix	5	Owain Gabb / Matt Hobbs	M3	Widespread: 344 records	
	Pandemis cerasana	Barred Fruit-tree Tortrix	2	Owain Gabb / Matt Hobbs	M2	Widespread: 344 records	
48	*Peribatodes rhomboidaria*	Willow Beauty	2	Owain Gabb / Matt Hobbs	M3	Common and widespread: 3383 records	
49	*Petrophora chlorosata*	Brown Silver-line	6	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1535 records	
50	*Phalera bucephala*	Buff-tip	4	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1608 records	
	Phalera bucephala	Buff-tip	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 1608 records	
	Phalera bucephala	Buff-tip	2	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1608 records	
51	*Pheosia gnoma*	Lesser Swallow Prominent	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 675 records	
52	*Plagodis dolabraria*	Scorched Wing	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 428 records	
53	*Polia nebulosa*	Grey Arches	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 389 records	
54	*Protodeltote pygarga*	Marbled White Spot	8	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1034 records	
	Protodeltote pygarga	Marbled White	1	Owain Gabb /	M2	Common and widespread: 1034 records	

Number	Taxon	Vernacular	Quantity	Determiner	Trap No	Status in Glamorgan (Gilmore, Slade & Stewart [2014])	Section 42 Species
		Spot		Matt Hobbs			
	Protodeltote pygarga	Marbled White Spot	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1034 records	
55	*Pseudargyrotoza conwagana*		1	Owain Gabb / Matt Hobbs	M3	Widespread: 263 records	
56	*Pterapherapteryx sexalata*	Small Seraphim	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 253 records	
	Pterapherapteryx sexalata	Small Seraphim	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 253 records	
57	*Ptilodon capucina*	Coxcomb Prominent	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 872 records	
58	*Rivula sericealis*	Straw Dot	3	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1731 records	
	Rivula sericealis	Straw Dot	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 1731 records	
59	*Scoparia ambigualis*		9	Barry Stewart	M3	Widespread: 845 records	
	Spilosoma lubricipeda	White Ermine	6	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1533 records	Yes
60	*Spilosoma lubricipeda*	White Ermine	9	Owain Gabb / Matt Hobbs	M2	Common and widespread: 1533 records	Yes
	Spilosoma lubricipeda	White Ermine	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1533 records	Yes
61	*Spilosoma luteum*	Buff Ermine	8	Owain Gabb / Matt Hobbs	M3	Common and widespread: 2762 records	Yes
	Spilosoma luteum	Buff Ermine	5	Owain Gabb / Matt Hobbs	M2	Common and widespread: 2762 records	Yes
62	*Stauropus fagi*	Lobster Moth	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 2762 records	
	Stauropus fagi	Lobster Moth	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 325 records	
63	*Thyatira batis*	Peach Blossom	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 325 records	
64	*Timandra comae*	Blood-vein	1	Owain Gabb / Matt Hobbs	M2	Common and widespread: 729 records	Yes
	Tyria jacobaeae	Cinnabar	10	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1485 records	Yes
65	*Tyria jacobaeae*	Cinnabar	1	Owain Gabb / Matt Hobbs	Field record/observation	Common and widespread: 1485 records	Yes
66	*Xestia triangulum*	Double Square-spot	4	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1378 records	
	Xestia triangulum	Double Square-	1	Owain Gabb /	M2	Common and widespread: 1378 records	

Number	Taxon	Vernacular	Quantity	Determiner	Trap No	Status in Glamorgan (Gilmore, Slade & Stewart [2014])	Section 42 Species
		spot		Matt Hobbs			
	Xestia triangulum	Double Square-spot	1	Owain Gabb / Matt Hobbs	M3	Common and widespread: 1378 records	

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Number	Taxon	Vernacular	Quantity	Determiner	Trap No.	Status in Glamorgan (Gilmore, Slade & Stewart [2014])	Section 42 Species
1	*Abrostola tripartita*	Spectacle	1	Owain Gabb	M2	Common and widespread: 1934 records	
	Abrostola tripartita	Spectacle	2	Owain Gabb	M1	Common and widespread: 1934 records	
2	*Agonopterix angelicella*		1	Barry Stewart	M1	Few modern records: 7 records	
3	*Agriphila latistria*		1	Owain Gabb	M1	Local: 162 records	
4	*Agriphila straminella*		2	Barry Stewart	M1	Common and widespread: 1410 records	
5	*Agriphila tristella*		4	Barry Stewart	M1	Very common: 1180 records	
6	*Agrotis exclamationis*	Heart and Dart	2	Owain Gabb	M1	Common and widespread: 5523 records	
7	*Agrotis puta*	Shuttle-shaped Dart	1	Owain Gabb	M2	Common and widespread: 2188 records	
	Agrotis puta	Shuttle-shaped Dart	1	Owain Gabb	M1	Common and widespread: 2188 records	
8	*Amphipoea oculea agg.*	Ear Moth agg.	4	Owain Gabb	M2	Three species have been recorded. Status of each is unclear.	Yes
	Amphipoea oculea agg.	Ear Moth agg.	1	Owain Gabb	M3	Three species have been recorded. Status of each is unclear.	Yes
	Amphipoea oculea agg.	Ear Moth agg.	3	Owain Gabb	M1	Three species have been recorded. Status of each is unclear.	Yes
9	*Apamea monoglypha*	Dark Arches	1	Owain Gabb	M1	Common and widespread: 4626 records	
	Apamea monoglypha	Dark Arches	1	Owain Gabb	M3	Common and widespread: 4626 records	
10	*Apotomis betuletana*		1	Barry Stewart	M1	Local at low density: 59 records	
11	*Axylia putris*	Flame	1	Owain Gabb	M3	Common and widespread: 2459 records	
	Axylia putris	Flame	2	Owain Gabb	M1	Common and widespread: 2459 records	
12	*Blastobasis adustella*		1	Owain Gabb	M1	Common and widespread: 891 records	
13	*Cabera exanthemata*	Common Wave	2	Owain Gabb	M1	Common and widespread: 979 records	
14	*Cabera pusaria*	Common White Wave	2	Owain Gabb	M1	Common and widespread: 1263 records	
15	*Celypha striana*		1	Owain Gabb	M3	Widespread: 579 records	
16	*Cerapteryx graminis*	Antler Moth	1	Owain Gabb	M3	Common and widespread: 346 records	
	Cerapteryx graminis	Antler Moth	3	Owain Gabb	M1	Common and widespread: 346 records	
17	*Chiasmia clathrata*	Latticed Heath	1	Owain Gabb	M2	Common and widespread: 287 records	Yes

Number	Taxon	Vernacular	Quantity	Determiner	Trap No.	Status in Glamorgan (Gilmore, Slade & Stewart [2014])	Section 42 Species
	Chiasmia clathrata	Latticed Heath	11	Owain Gabb	M1	Common and widespread: 287 records	Yes
18	*Chloroclysta truncata*	Common Marbled Carpet	1	Owain Gabb	M1	Common and widespread: 4419 records	
19	*Chloroclystis v-ata*	V-Pug	1	Owain Gabb	M1	Common and widespread: 884 records	
20	*Chortodes pygmina*	Small wainscot	1	Barry Stewart	M1	Common and widespread: 219 records	
21	*Cosmorhoe ocellata*	Purple Bar	1	Owain Gabb	M1	Common and widespread: 760 records	
22	*Cydia ulicetana*		1	Barry Stewart	M1	Common: 311 records	
23	*Depressaria heraclei*	Parsnip Moth	1	Barry Stewart	M1	Common: 90 records	
24	*Discestra trifolii*	Nutmeg	1	Barry Stewart	M1	Uncommon, restricted resident: 93 records	
25	*Drepana falcataria*	Pebble Hook-tip	5	Owain Gabb	M1	Common and widespread: 507 records	
26	*Ecliptopera silaceata*	Small Phoenix	5	Owain Gabb	M1	Common and widespread: 1795 records	Yes
27	*Ennomos alniaria*	Canary-shouldered Thorn	10	Owain Gabb	M1	Common and widespread: 667 records	
28	*Ennomos fuscantaria*	Dusky Thorn	1	Owain Gabb	M1	Common and widespread: 482 records	Yes
29	*Epinotia nisella*		1	Barry Stewart	M1	Common: 85 records	
30	*Epirrhoe alternata*	Common Carpet	1	Owain Gabb	M1	Common and widespread: 1936 records	
31	*Eudonia mercurella*		12	Owain Gabb	M1	Common and widespread: 696 records	
32	*Euthrix potatoria*	Drinker	1	Owain Gabb	M1	Common and widespread: 978 records	
	Euthrix potatoria	Drinker	1	Owain Gabb	M3	Common and widespread: 978 records	
	Euthrix potatoria	Drinker	1	Owain Gabb	M2	Common and widespread: 978 records	
33	*Gymnoscelis rufifasciata*	Double-striped pug	5	Barry Stewart	M1	Common and widespread: 2744 records	
34	*Hadena bicruris*	Lychnis	1	Owain Gabb	M1	Common and widespread: 571 records	
35	*Hydraecia micacea*	Rosy Rustic	2	Owain Gabb	M1	Common and widespread: 640 records	Yes
36	*Hydriomena furcata*	July Highflyer	1	Owain Gabb	M2	Common and widespread: 1074 records	
	Hydriomena furcata	July Highflyer	1	Owain Gabb	M1	Common and widespread: 1074 records	
37	*Idaea dimidiata*	Single-dotted Wave	1	Owain Gabb	M1	Common and widespread: 631 records	
38	*Ipimorpha retusa*	Double Kidney	1	Owain Gabb	M2	Uncommon, restricted resident: 97 records	
39	*Lacanobia oleracea*	Bright-line Brown-eye	1	Owain Gabb	M1	Common and widespread: 3388 records	
40	*Lomaspilis marginata*	Clouded Border	1	Owain Gabb	M1	Common and widespread: 1218 records	
41	*Luperina testacea*	Flounced Rustic	1	Owain Gabb	M1	Common and widespread: 1637 records	

Number	Taxon	Vernacular	Quantity	Determiner	Trap No.	Status in Glamorgan (Gilmore, Slade & Stewart [2014])	Section 42 Species
42	*Lycophotia porphyrea*	True Lover's Knot	2	Owain Gabb	M2	Common and widespread: 715 records	
43	*Macaria alternata*	Sharp-angled Peacock	2	Owain Gabb	M1	Common and widespread: 480 records	
44	*Mesapamea secalis agg.*	Common Rustic agg.	3	Owain Gabb	M3	Both species common and widespread	
	Mesapamea secalis agg.	Common Rustic agg.	5	Owain Gabb	M1	Both species common and widespread	
	Mesapamea secalis agg.	Common Rustic agg.	1	Owain Gabb	M2	Both species common and widespread	
45	*Miltochrista miniata*	Rosy Footman	1	Owain Gabb	M1	Common and widespread: 495 records	
46	*Mythimna impura*	Smoky Wainscot	1	Owain Gabb	M1	Common and widespread: 736 records	
47	*Nicrophorus investigator*	A burying beetle	1	Owain Gabb	M1	N/a	
48	*Noctua comes*	Lesser Yellow Underwing	1	Owain Gabb	M1	Common and widespread: 4138 records	
49	*Noctua interjecta*	Least Yellow Underwing	2	Owain Gabb	M1	Common and widespread: 354 records	
50	*Noctua janthe*	Lesser Broad-bordered Yellow Underwing	1	Owain Gabb	M3	Common and widespread: 1959 records	
	Noctua janthe	Lesser Broad-bordered Yellow Underwing	7	Owain Gabb	M1	Common and widespread: 1959 records	
	Noctua janthe	Lesser Broad-bordered Yellow Underwing	1	Owain Gabb	M1	Common and widespread: 1959 records	
51	*Noctua pronuba*	Large Yellow Underwing	60	Owain Gabb	M1	Common and widespread: 7556 records	
	Noctua pronuba	Large Yellow Underwing	1	Owain Gabb	M2	Common and widespread: 7556 records	
	Noctua pronuba	Large Yellow Underwing	4	Owain Gabb	M3	Common and widespread: 7556 records	
52	*Notodonta dromedarius*	Iron Prominent	2	Owain Gabb	M1	Common and widespread: 736 records	
53	*Notodonta ziczac*	Pebble Prominent	2	Owain Gabb	M1	Common and widespread: 1014 records	
54	*Ochropleura plecta*	Flame Shoulder	20	Owain Gabb	M1	Common and widespread: 4974 records	
	Ochropleura plecta	Flame Shoulder	8	Owain Gabb	M3	Common and widespread: 4974 records	
	Ochropleura plecta	Flame Shoulder	2	Owain Gabb	M2	Common and widespread: 4974 records	
55	*Opisthograptis luteolata*	Brimstone Moth	7	Owain Gabb	M1	Common and widespread: 5163 records	
	Opisthograptis luteolata	Brimstone Moth	1	Owain Gabb	M2	Common and widespread: 5163 records	

Number	Taxon	Vernacular	Quantity	Determiner	Trap No.	Status in Glamorgan (Gilmore, Slade & Stewart [2014])	Section 42 Species
	Opisthograptis luteolata	Brimstone Moth	1	Owain Gabb	M3	Common and widespread: 5163 records	
56	*Pandemis corylana*	Chequered Fruit-tree Tortrix	2	Owain Gabb	M1	Widespread: 172 records	
57	*Peribatodes rhomboidaria*	Willow Beauty	1	Owain Gabb	M3	Common and widespread: 3383 records	
58	*Pheosia gnoma*	Lesser Swallow Prominent	2	Owain Gabb	M1	Common and widespread: 675 records	
59	*Phlogophora meticulosa*	Angle Shades	1	Owain Gabb	M1	Common and widespread: 2812 records	
60	*Phragmatobia fuliginosa*	Ruby Tiger	1	Owain Gabb	M1	Common and widespread: 629 records	
61	*Pleuroptya ruralis*	Mother of Pearl	3	Owain Gabb	M1	Common and widespread: 1323 records	
62	*Plusia festucae*	Gold Spot	1	Owain Gabb	M3	Common and widespread: 589 records	
	Plusia festucae	Gold Spot	4	Owain Gabb	M1	Common and widespread: 589 records	
63	*Pterostoma palpina*	Pale Prominent	1	Owain Gabb	M1	Common and widespread: 675 records	
64	*Rivula sericealis*	Straw Dot	2	Owain Gabb	M3	Common and widespread: 1731 records	
	Rivula sericealis	Straw Dot	16	Owain Gabb	M1	Common and widespread: 1731 records	
65	*Schrankia costaestrigalis*	Pinion-streaked Snout	1	Owain Gabb	M1	Common and widespread: 216 records	
66	*Selenia dentaria*	Early Thorn	1	Owain Gabb	M1	Common and widespread: 1780 records	
67	*Thyatira batis*	Peach Blossom	1	Owain Gabb	M1	Common and widespread: 858 records	
68	*Timandra comae*	Blood-vein	1	Owain Gabb	M1	Common and widespread: 729 records	Yes
69	*Udea ferrugalis*	Rusty-dot Pearl	5	Owain Gabb	M1	Immigrant: 896 records	
70	*Udea ferrugalis*	Rusty-dot Pearl	1	Owain Gabb	M3	Immigrant: 896 records	
71	*Xanthorhoe designata*	Flame Carpet	1	Owain Gabb	M2	Common and widespread: 1196 records	
	Xanthorhoe designata	Flame Carpet	1	Owain Gabb	M1	Common and widespread: 1196 records	
72	*Xestia c-nigrum*	Setaceous Hebrew Character	12	Owain Gabb	M2	Common and widespread: 3440 records	
	Xestia c-nigrum	Setaceous Hebrew Character	2	Owain Gabb	M3	Common and widespread: 3440 records	
	Xestia c-nigrum	Setaceous Hebrew Character	56	Owain Gabb	M1	Common and widespread: 3440 records	
73	*Xestia xanthographa*	Square-spot Rustic	2	Owain Gabb	M1	Common and widespread: 3182 records	

Appendix 4: Images

Image 1: Woodland 1



Image 2: Woodland 4



Image 3: Marshy grassland in NW of Survey Site



Image 4: Marshy grassland in NW of Survey Site



Image 5: Pond 11



Image 6: Pond 16



Image 7: Watercourse Sampling Point 1



Image 8: Watercourse Sampling Point 2



Image 9: Watercourse Sampling Point 3



Image 10: Watercourse Sampling Point 4



Image 11: Watercourse Sampling Point 5

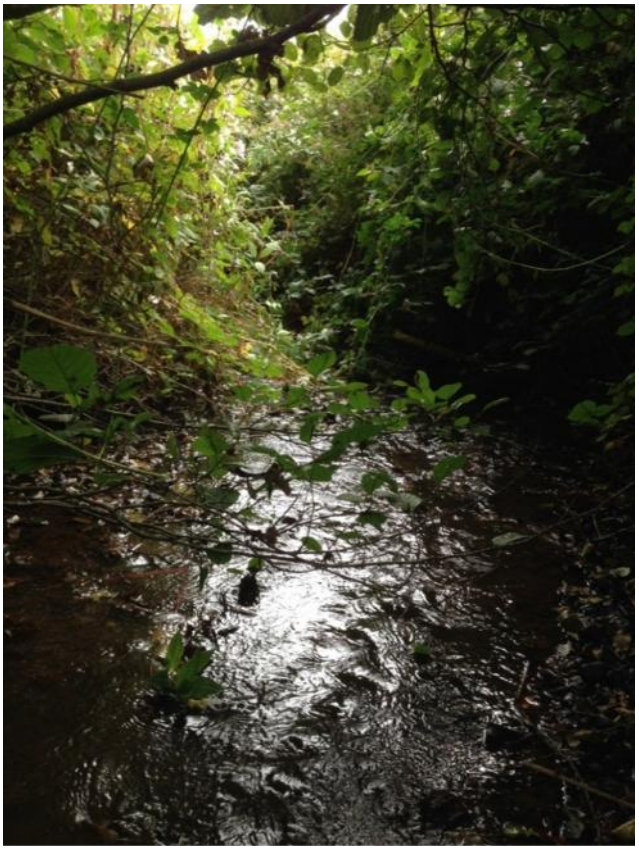

Image 12: Watercourse Sampling Point 6



Image 13: Watercourse Sampling Point 7



Image 14: Watercourse Sampling Point 8



Appendix 5: Aquatic Macroinvertebrate Data

Table 1: Pond Survey

Species Number	Taxa	Pond 11	Pond 16
1	*Crangonyx pseudogracilis*	13	15
2	*Pisidium* spp.	19	16
3	*Coleoptera* spp.	5	4
	Dytiscidae spp.	1	3
4	*Dytiscus marginalis*	1	
5	*Hydroglyphus geminus*	2	
6	*Hydroporus palustris*	1	
7	*Hydroporus pubescens*	2	
8	*Hyphydrus ovatus*	4	5
9	*Laccophilius minutus*	1	
10	*Stictonectes lepidus*	22	
11	*Gyrinus substriatus*		3
12	*Haliplus lineatocollis*	1	
13	*Haliplus ruficollis*	9	2
14	*Haliplus ruficollis* grp	24	6
15	*Helophorus brevipalpis*	80	7
16	*Helophorus flavipes*	3	
17	*Helophorus obscurus*	4	3
18	*Helophorus obscurus/flavipes grp*	15	4
19	*Hydraena gracilis*	1	
20	*Hydraena rufipes* grp	1	
21	*Anacaena limbata*	3	
22	*Anacaena lutescens*	14	1
23	*Enochrus spp.*	2	
24	*Hydrobius fuscipes*	1	
25	*Laccobius minutus*	3	
26	*Laccobius sinuatus*	1	
27	*Chaoboridae* spp.	1	1
28	*Chironimidae* spp.	3	19
29	*Diptera* spp.	1	
30	*Dixidae* spp.		2
31	*Cloeon dipterum*	29	8
32	*Lymnaea peregra*	6	5
33	*Physa fontinalis*		15
34	*Corixa panzeri*	1	
	Corixidae spp.	1	4
35	*Hesperocorixa castanea*		4
36	*Hesperocorixa linnaei*	6	
37	*Hesperocorixa sahlbergi*	2	11
38	*Sigara nigrolineata*	1	1

Species Number	Taxa	Pond 11	Pond 16
	Gerridae spp. nymph	4	3
39	*Gerris lacustris*	2	1
40	*Hydrometra stagnorum*	1	2
41	*Ilyocoris cimicoides*	8	1
42	*Nepa cinerea*		1
43	*Notonecta obliqua*	4	3
44	*Microvelia reticulata*	4	
	Microvelia spp.	4	
45	*Hydracarina*		1
46	*Sialis lutaria*		2
47	*Aeshna mixta*	1	
	Aeshnidae spp.	6	2
48	*Ishnura elegans*	12	22

Table 2: Watercourse Survey

				Sampling Point							
Species Number	**Order**	**Family**	**Taxa**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	Amphipoda	*Gammaridae*	*Gammarus pulex*	26	20	67	13	15	106	26	22
2	Anisoptera	*Cordulegasteridae*	*Cordulegaster boltonii*		1	2	1			1	1
3	Bivalvia	*Ancylidae*	*Ancylus fluviatilis*				2		3		
4	Bivalvia	*Sphaeriidae*	*Pisidium* sp.								1
5	Coleoptera	*Dytiscidae*	*Deronectes latus*								1
6	Coleoptera	*Dytiscidae*	*Dytiscidae indet*							10	27
7	Coleoptera	*Dytiscidae*	*Oreodytes sanmarkii*						53		22
8	Coleoptera	*Elmidae*	*Elmidae indet*	1	1	1	2		15	2	2
9	Coleoptera	*Elmidae*	*Elmis aenea*			1	1	2	6	2	
10	Coleoptera	*Elmidae*	*Limnius volkmari*					4	12		1
11	Coleoptera	*Gyrinidae*	*Gyrinus substriatus*				1				
12	Coleoptera	*Haliplidae*	*Haliplus lineatocollis*					2			
13	Coleoptera	*Hydraenidae*	*Hydraena gracilis*						2		
14	Coleoptera	*Hydraenidae*	*Hydraena rufipes grp*					1	1		
15	Coleoptera	*Hydrophilidae*	*Anacaena globulus*							1	
16	Coleoptera	*Scirtidae*	*Scirtidae indet*	1	3	9		1		5	
17	Diptera	*Ceratopogonidae*	*Ceratopogonidae*				1		1	1	
18	Diptera	*Chironomidae*	*Chironomidae*	8	7	16	7	10	8	19	20
19	Diptera	*Dixidae*	*Dixidae*	11	6		3	3		1	2
20	Diptera	*Empididae*	*Empididae*		1						
21	Diptera	*Pediciidae*	*Pediciidae*	2	3				2		
22	Diptera	*Psychodidae*	*Psychodidae*							1	
23	Diptera	*Simuliidae*	*Simuliidae*	5	12	4		9	2	25	
24	Diptera	*Tabanidae*	*Tabanidae*								1
25	Diptera	*Tipulidae*	*Tipulidae*					1			
26	Ephemeroptera	*Baetidae*	*Baetis* sp.	21	27	1	16	2	53	7	3
27	Ephemeroptera	*Ephemerellidae*	*Seratella ignita*	1					1		
28	Ephemeroptera	*Ephemeridae*	*Ephemera danica*		1						
29	Ephemeroptera	*Heptageniidae*	*Ecdyonurus* sp.	32	56	3	10	10	20	2	2
30	Ephemeroptera	*Leptophlebiidae*	*Paraleptophlebia* sp.			5				1	3
31	Gastropoda	*Hydrobiidae*	*Potamopyrgus antipodarum*			2					
32	Gastropoda	*Lymnaeidae*	*Lymnaea peregra*						17	6	9
33	Hemiptera	*Gerridae*	*Gerris gibbifer*								2

				Sampling Point							
Species Number	**Order**	**Family**	**Taxa**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
34	Hemiptera	*Veliidae*	*Velia caprai*				1				
35	Hemiptera	*Veliidae*	*Veliidae indet*		1		1				
36	Megaloptera	*Sialidae*	*Sialis fuliginosa*							1	1
37	Megaloptera	*Sialidae*	*Silais lutaria*								1
38	Neuroptera	*Osmylidae*	*Osmylus fulvicephalus*					1			
39	Oligochaeta	*Oligochaeta*	*Oligochaeta*			2			1	4	2
40	Plectoptera	*Leuctridae*	*Leuctra fusca*	28	39	105	49	64	31	20	17
41	Plectoptera	*Nemouridae*	*Nemoura cambrica*		1	2	2	6		1	1
42	Plectoptera	*Nemouridae*	*Nemouridae indet*				1				
43	Plectoptera	*Nemouridae*	*Protonemura praecox*						2		
44	Plectoptera	*Perlodidae*	*Perlodes microcephala*	1				1		1	
45	Trichoptera	*Glossosomatidae*	*Agapetus fuscipes*						3		
46	Trichoptera	*Hydropsychidae*	*Hydropsyche siltalai*	9	3				18	1	2
47	Trichoptera	*Lepidostomatidae*	*Lepidostoma hirtum*		2						
48	Trichoptera	*Leptoceridae*	*Mystacides azurea*					1			
49	Trichoptera	*Leptroceridae*	*Adicella reducta*			2					
50	Trichoptera	*Limnephilidae*	*Potamophylax rotundipennis*	1	1	2					
51	Trichoptera	*Odontoceridae*	*Odontocerum albicorne*	1	1				1		
52	Trichoptera	*Philopotamadie*	*Wormaldia occipitalis*	8	1	6	2				
53	Trichoptera	*Polycentropodidae*	*Plectrocnemia conspersa*			1	5				
54	Trichoptera	*Polycentropodidae*	*Polycentropus flavomaculatus*						9		
55	Trichoptera	*Rhyacophilidae*	*Rhyacophila dorsalis*	9	4	1	2		8		2
56	Trichoptera	*Rhyacophilidae*	*Rhyacophila* sp.			1					
57	Trichoptera	*Sericostomatidae*	*Sericostoma personatum*						1		1
58	Zygoptera	*Calopterygidae*	*Calopteryx virgo*								2
59	Zygoptera	*Coenagrionidae*	*Coenagrionidae indet*								1

Appendix 3.4

Great Crested Newt Survey Report

Abergelli Power Project
Great Crested Newt Survey Report

Abergelli Power Limited
May 2018

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1. Executive Summary

1.1.1 AECOM were commissioned to undertake Great Crested Newt Surveys on ponds identified as suitable to support GCN within the Project Site and within 500 m of the Project Site. The Project Site is approximately 30.66 ha and located near to the village of Felindre, Swansea.

1.1.2 The Abergelli Power Project development proposals are for a proposed 299MW Open Cycle Gas Turbine power station.

1.1.3 The Abergelli Power Project comprises the following principal elements:

- A new Power Generation Plant;
- A new integral Electrical Connection; and,
- A new integral Gas Connection.

1.1.4 The Power Generation Plant, Gas Connection and Electrical Connection together are referred to as the Project.

1.1.5 The Project will require the partial removal of terrestrial and aquatic habitat suitable to support GCN.

1.1.6 It is understood that construction is programmed to commence no sooner than 2020/2021

1.1.7 The GCN is protected under European law through Annexes II and IV of the EC Habitats Directive (Council Directive 92/43/EEC). Protection is given to all life stages (e.g. adults, sub-adults, larvae, and eggs). This is implemented into UK law under section 41 of the Conservation of Habitats and Species Regulations, 2010 where it is listed as a European protected species under Schedule 2. GCN is an Environment (Wales) Act 2016 Section 7 Priority Species.

1.1.8 A total of 26 ponds were identified within proximity of the Project Site.

1.1.9 A Habitat Suitability Index (HIS) Assessment was undertaken an all ponds within 500m of the Site and ponds outside of the 500 m but clustered with ponds within the 500m of the Project Site boundary. Further surveys were undertaken, where appropriate, following the results of the HSI Assessment.

1.1.10 Following the HSI Assessment, off the 26 ponds identified, two were classed as poor (a further survey was undertaken on one of these) nine were dry and seven were not accessible and therefore could not be surveyed. A combination of manual and eDNA surveys were undertaken on nine ponds.

1.1.11 No great crested newts were identified during the manual surveys and the eDNA surveys undertaken were all returned with a negative result. The manual surveys ceased once the results of the eDNA surveys had been received. Common amphibians were identified during the surveys.

1.1.12 Of the seven ponds that were not accessible. These are considered unlikely to support great crested newts given the lack of GCN records from the local records centre and the absence of GCN identified in other ponds during the surveys

1.1.13 No further surveys for great crested newts are required and there will be no impact on great crested newts as part of the Project.

1.1.14 The Project will require the removal of three ponds (Ponds 16, 22 and 23). Pond 22 currently supports palmate newts and is likely to support other amphibians including frogs and toads as well as a range of generalist aquatic invertebrates. Pond 16 was dry. Pond 23 could not be assessed but if it contains water has the potential to support generalist aquatic invertebrates and common amphibians.

1.1.15 Where the scheme design allows, ponds, swales or water bodies, should be considered to mitigate the loss of the ponds and enhance the Site for common amphibians.

1.1.16 Log piles and hibernacula could be created in suitable areas of habitat (such as grassland and scrub/woodland edges), to enhance the area for amphibians.

2. Introduction

2.1.1 AECOM were commissioned to undertake Great Crested Newt (GCN) Surveys on ponds identified as suitable to support GCN within the Abergelli site and within proximity of the Abergelli site (hereafter referred to as the 'Project Site'). An Habitat Suitability Index (HSI) Assessment was undertaken an all ponds, where access allowed, within 500 m of the Site and ponds outside of the 500m but clustered with ponds within the 500 m of the Project Site boundary. Further surveys were undertaken following the HSI Assessment.

2.2 The Project

2.2.1 The Project Site is located near to the village of Felindre, Swansea, as shown in Figure 1.1, and the central grid reference for the Project Site is SN65280143. A full description of the development is provided in **Chapter 3: Project and Site Description** of the ES.

2.3 Great Crested Newt Ecology

2.3.1 GCNs are one of the two European Protected Species of amphibian found in the UK.

2.3.2 GCNs, like all British amphibians, rely on water bodies for breeding but otherwise spend much of their lives on land. They are ectotherms and have permeable skins, so most movement occurs when the air temperature is above approximately 5ºC and there is, or has recently been rain.

2.3.3 Adults and immature newts spend the winter in places where they will be protected from frost and flooding. Whilst on land outside of the hibernation period, GCNs will also take refuge to shelter from extremes of weather; hence during the day they will often rest in dense vegetation, under refuges or underground. Adult GCNs normally begin moving from their over-wintering land sites between February and April, with some adult newts not reaching the desired water body until May, but this is very weather dependant. Not all life-stages enter water over the course of a year; immature newts (or efts) may spend all year on land until they reach breeding condition.

2.3.4 Upon reaching the pond, the peak courtship and egg-laying period is normally from mid-March to mid-May. The larvae hatch out after about three weeks, and then take another two to three months to complete larval development. The larvae emerge from the pond upon completion of metamorphosis and enter the eft land stage. This move usually begins in early August and lasts for about two months. Adult newts generally leave the breeding ponds from late May onwards, a movement which occurs gradually with most newts having left by August but some staying until October or even remaining over winter.

2.3.5 GCNs in a given area often form a metapopulation (a series of sub-populations that are linked by dispersal of individuals). Newt populations function in this way since they depend on habitats which vary in quality over time, and where the distribution of suitable habitats often changes. This metapopulation concept complicates the study and conservation of this species, since impacts to a single pond may have knock-on effects on newts in nearby ponds. GCNs commonly move between ponds that are up to 250 m from each other but are known to range up to 500 m from breeding ponds in some cases.

2.3.6 English Nature (Ref. 1) lists the following pond characteristics as being favourable for GCN populations:

- Surface area between 100 and 300 m^2;
- Variable depth, but preferably not so deep that aquatic and emergent vegetation is unable to take root. A maximum depth around 4 m is acceptable;
- Substantial cover of submerged and marginal vegetation;
- Open areas to facilitate courtship behaviour;
- Good populations of invertebrates and other amphibians as prey;
- Ponds in clusters rather than in isolation;
- Absence of shading on the south side;
- Absence of fish; and
- Absence of waterfowl.

2.4 Great Crested Newt Legislation

2.4.1 The GCN is protected under European law through Annexes II and IV of the EC Habitats Directive (Council Directive 92/43/EEC). Protection is given to all life stages (e.g. adults, sub-adults, larvae, and eggs). This is implemented into UK law under section 41 of the Conservation of Habitats and Species Regulations, 2010 where it is listed as a European protected species under Schedule 2, which in summary makes it an offence to:

- Deliberately take (capture), injure or kill a GCN. (In a court, 'deliberately' would probably be interpreted as someone who, although not intending to take, injure or kill a GCN, performed the relevant action, being sufficiently informed and aware of the consequence his/her action will most likely have.);
- Deliberately disturb a GCN in a way that would affect its ability to survive, breed or rear young, hibernate or migrate or significantly affect the local distribution or abundance of the species;
- Damage or destroy a breeding site or resting place of a GCN;
- Possess or control any live or dead specimen or anything derived from a GCN; and,
- Intentionally take or destroy the eggs of a GCN.

2.4.2 The GCN is also given full protection under Section 9 of the Wildlife and Countryside Act 1981 (as amended) through its inclusion on Schedule 5. In summary, the legislation makes it an offence to:

- Intentionally or recklessly take (capture), injure or kill a GCN;
- Intentionally or recklessly disturb a GCN;

- Intentionally or recklessly damage or destroy, or obstruct access to, any structure or place which a GCN uses for shelter or protection or intentionally or recklessly disturb a GCN while it uses such a place; and,
- Possess or advertise/sell/exchange a GCN (dead or alive) or any part of a GCN.

2.4.3 The inclusion of this species on Annex II of the Habitats Directive also means that a Special Area of Conservation (SAC) can be designated as a protected area due to a significant presence of this species.

2.4.4 The Natural Environment and Rural Communities (NERC) Act (2006), as amended, puts an obligation on public bodies to have regard, so far as is consistent with the proper exercise of their functions, to the purpose of conserving biodiversity. Under the terms of the Act, conserving biodiversity includes restoring or enhancing populations and/or habitats. The local planning authority (LPA) or other determining authority must therefore consider the effects of planning applications upon biodiversity and how it can be mitigated for or enhanced.

2.4.5 In addition, Government Circular ODPM 06/2005: "Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System" sets out further detail on how species and habitats should be considered during planning applications.

2.4.6 GCN is an Environment (Wales) Act 2016 Section 7 Priority Species. These are the species found in Wales which were identified as requiring action under the UK BAP and which continue to be regarded as conservation priorities under the UK Post-2010 Biodiversity Framework. As such, it is targeted for measures necessary to support its conservation status in the UK.

2.5 Quality Assurance

2.5.1 The surveys and subsequent report was undertaken in line with AECOM's Integrated Management System (IMS). Our IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the international standards BS EN ISO 9001:2008 and 14001:2004 and BS OHSAS 18001:2007. In addition our IMS requires careful selection and monitoring of the performance of all sub consultants and contractors.

2.5.2 All AECOM Ecologists who led surveys and completed the reporting for this project are members of (at the appropriate level) the Chartered Institute of Ecology and Environmental Management (CIEEM) and all follow their code of professional conduct (CIEEM, 2013) when undertaking ecological work.

3. Methodology

3.1 Desk Study

3.1.1 A full desk study was not undertaken to establish the number of ponds within the Project Site and within 500 m of the Project Site as the client provided AECOM with the location and number of ponds identified by WSP/PB in March 2017 (Appendix 8.17).

Previous Surveys

3.1.2 The client provided AECOM with a copy of GCN surveys undertaken at the Project Site by BSG Ecology in 2014 (ES Appendix 8.17).

3.2 Habitat Suitability Assessment

3.2.1 The client provided AECOM with a list of 23 ponds, 19 of these had been subject to a HSI assessment undertaken by WSP/PB in March 2017. Where access allowed, these ponds were visited by AECOM in May 2017 to check the assessment score.

3.2.2 HSI is a tool used to assess the likelihood that a water body will support GCN. It incorporates ten suitability indices (SI), all of which are factors thought to affect the suitability of a water body to support GCN, such as the quality of the water and the presence / absence of different predators (particularly fish and waterfowl). Each variable is assessed separately and then mathematically combined to provide a numerical index, between 0 and 1 (Ref. 3). The HSI Categorisations is described in Table 3-1 below.

3.2.3 The following equation is used (Ref. 3):

HSI = (SI1*SI2*SI3*SI4*SI5*SI6*SI7*SI8*SI9*SI10).

Table 3-1. Categorisation of HSI Scores

HSI Score	Pond Suitability
< 0.5	Poor
0.5 - 0.59	Below Average
0.6 - 0.69	Average
0.7 - 0.79	Good
> 0.8	Excellent

3.3 Manual Surveys

3.3.1 Manual GCN surveys were undertaken on ponds (where access allowed) with a score of below average or above. GCN surveys were undertaken paying due regard to Natural England's Great Crested Newt Standing Advice (Ref. 3) and Froglife's Great Crested Newt Conservation Handbook (Ref. 1). GCN Surveys were undertaken by an appropriately licenced ecologist and in suitable weather conditions. Manual surveys ceased once a negative eDNA sampling result had been received. The manual surveys that were undertaken were carried out within the Natural Resources Wales (NRW) approved survey season window.

3.3.2 Four GCN manual survey visits are required to establish GCN presence/ absence within the period mid-March to mid-June (with at least two surveys during mid-April to mid-May). An additional two surveys (six in total) are required to estimate GCN population. Three out of five survey techniques are required on each of the ponds surveyed. A combination of four survey techniques were utilised as appropriate. Torchlight searching, bottle trapping, egg searching and netting. All manual survey methods were undertaken by at least one NRW GCN licence holder. A description of the survey techniques used is as follows:

a) Torching

3.3.3 The water body was thoroughly searched using torch light between dusk and midnight. The surveyor walked slowly around the perimeter of the water body once (where access was possible), checking for newts in the torch beam every 2 – 3 m, paying particular attention to marginal vegetation and potential display areas on the pond bottom. Care was taken with the torch to minimise disturbance to the newts and other wildlife which may have been present (e.g. nesting birds). To allow comparison between ponds, the same power of torch (between 100,000 – 1,000,000 candlepower) was used on every occasion.

b) Bottle Trapping

3.3.4 Bottle traps were set around the margin of the water body in the evening and left overnight to catch adults during the breeding season. Traps were set at an appropriate density of one trap per two metres of shoreline dependent upon individual site variations. The guidelines set out by Natural England, Froglife, and the Herpetofauna Workers Manual was followed strictly to ensure the welfare of trapped newts and other aquatic organisms.

c) Egg Searching

3.3.5 Submerged and floating aquatic vegetation was checked by the surveyor in order to locate great crested newt eggs. Egg searches are terminated when presence of great crested newt eggs is confirmed. This method is unreliable for population estimates. Terminated egg searches where great crested newt eggs have been identified avoids excess damage to the eggs by minimising impacts of predation and UV light.

d) Netting

3.3.6 A sturdy dip-net with a 2 – 4 mm mesh was used for netting for fifteen minutes per 50m of pond shoreline.

3.4 eDNA Sampling

3.4.1 eDNA sampling was undertaken following the methodologies provided in Biggs et al (Ref. 5). eDNA kits were purchased from SureScreen. Water sampling was undertaken by at least one NRW GCN licenced surveyor per pond. Water samples were taken from 20 locations around each pond as described in the instructions provided by SureScreen and in Ref. 5. Samples were stored in accordance with the instructions provided by SureScreen and returned to SureScreen for analysis. Care was taken at all steps in the procedure to avoid contamination of samples.

3.4.2 The following NRW GCN licenced surveyors were used to undertake the manual and eDNA surveys:

3.4.3 Clare Morgans GradCIEEM, Ben Walsh ACIEEM and Jack Muskett GradCIEEM.

3.5 Limitations

a) Pond Access

3.5.1 Of the 26 ponds identified, seven were not accessible. Six of these were not accessible due to land access restrictions (Ponds 12-14, 18, 23 and 24) and one was surrounded by a large, tall area of dense bramble vegetation (Pond 10) and therefore could not be surveyed. (see Section 4.1.2, Table 4-1).

3.5.2 Ponds 12-14 and 18 are located close to each other approximately 400-500 m east of the Project Site boundary. There is the possibility that these ponds may support GCN, although this is considered unlikely given the lack of GCN records from the local records centre and the absence of GCN identified in other ponds during the surveys.

3.5.3 Pond 10 is not considered likely to support GCN. It has previously been surveyed and no evidence of GCN was found (ES Appendix 8.17). No records of GCN were returned from the local records centre. Ponds 9 and 21 which are within close proximity were deemed not suitable to support GCN and no evidence of GCN was found in Pond 19a.

3.5.4 Pond 23 is not considered likely to support GCN given the lack of GCN records from the local records centre and the absence of GCN in other ponds within a 500 m radius.

3.5.5 Pond 24 is located to the west of the Project Site and may support GCN, although this is considered unlikely given the lack of GCN records from the local records centre and the absence of GCN identified in other ponds during the surveys.

b) Manual Surveys

3.5.6 The three required manual survey methods were not undertaken on Ponds 1b, 4, 11 and 19b (see Section 4.1.2, Table 4-1 and Section 4.2, Table 4-4) due to a combination of health and safety issues and dense vegetation.

3.5.7 Ponds 1b and 4 are within a cluster of ponds to the north west of the Project Site. No evidence of GCN was identified for Pond 7 and Pond 8 which is within this cluster of ponds and therefore the manual survey limitation is not deemed significant.

3.5.8 Pond 11 has previously been surveyed and no evidence of GCN was found (ES Appendix 8.17). Therefore the manual survey limitation is not deemed significant.

3.5.9 On the first survey visit to Pond 19b, the water level had dropped making it impossible to bottle trap. Torching was attempted but not possible due to the low water level and vegetation cover. Egg searching was not possible as the access was restricted to the vegetation due to deep soft mud. Pond 19b is connected to Pond 19a. Pond 19a was deemed poor as part of the HSI assessment. However, due to the limitation to the surveys on Pond 19b, manual surveys and an eDNA survey were undertaken on Pond 19a. No evidence of GCN was returned for Pond 19a and therefore the manual survey limitation on Pond 19b is not deemed significant.

3.5.10 Manual surveys were not undertaken on Pond 17, as AECOM did not gain land access permission to the pond within the required survey season time. However, once granted it was possible to eDNA sample Pond 17 within the approved survey season window.

3.5.11 A summary of the manual survey and eDNA limitations is given in Table 3-2.

c) eDNA Sampling

3.5.12 eDNA surveys were undertaken on all ponds, where access allowed, of below average category and above, with the exception of Ponds 19a and 19b. On the first manual survey visit to Pond 19b, the water level had dropped and deep soft mud was exposed on the edges making it unsuitable for eDNA sampling. As Pond 19b is connected to Pond 19a, the decision was taken to proceed with an eDNA survey on Pond 19a despite it being categorised as Poor. As the GCN eDNA result returned for Pond 19a was negative, it was assumed that Pond 19b was also negative as the two ponds are connected.

3.5.13 The eDNA sampling was restricted due to accessibility on Ponds 1b, 4 and 11 caused by dense vegetation and soft, deep mud. Approximately only 5% of the perimeter of the pond was accessible to sample (see Table 3-2 and Table 4-5). Usually a GCN eDNA water sample which has been taken from such a restricted area reduces the confidence in any negative result returned as GCN eDNA can be patchy depending upon where the animals have been in the pond.

3.5.14 However on this occasion, given the lack of evidence of GCN within other ponds in close proximity of Ponds 1b, 4 and 11 and the previous survey undertaken on Pond 11 which returned no results for GCN (ES Appendix 8.17). The eDNA limitation on Ponds 1b, 4 and 11 is not deemed significant.

3.6 Survey Limitations Summary

Table 3-2: Survey Limitation Summary Table

Pond Number	Manual Survey Limitation	eDNA Survey Limitation
1b	Not possible to bottle trap or net due to deep and soft mud surrounding the waterbody. Torched only from limited accessible areas.	Only 5% of pond perimeter accessible to sample.
4	Not possible to bottle trap or net due to deep and soft mud surrounding the waterbody. Torched only from limited accessible areas.	Only 5% of pond perimeter accessible to sample.
7	A dead water shrew was found in one of the bottle traps during the first survey visit in Pond 7, therefore bottle trapping ceased for Pond 7 and the netting technique was used for future surveys.	None
8	A dead water shrew was found in one of the bottle traps during the first survey visit in Pond 7. Due to the proximity of Pond 8 to Pond 7 and the risk of trapping water shrews, bottle trapping ceased for Pond 8 and the netting technique was used for future surveys.	None
11	Only approximately 5% of edge is accessible. Low water level and steep sides, not suitable for bottle trapping and dense vegetation will restrict torching. Small area was torched on 1st survey visit but ineffective. No further manual surveys were undertaken.	Only 5% of pond perimeter accessible to sample.
17	No manual surveys undertaken as access not granted within the required survey season time.	None
19b	Low water level, dense vegetation and soft mud. Not be suitable for bottle trapping, torching or egg searching. Access restricted by soft mud. Small area was torched on 1st survey visit but ineffective. No further manual surveys were undertaken on 19b. Manual surveys undertaken on Pond 19a	No eDNA sample undertaken on Pond 19b. Pond 19a was sampled instead.

	undertaken as connected to Pond 19b.	

4. Results

4.1 Desk Study

4.1.1 WSP/PB identified a total of 23 ponds within 500 m of the previous Project Site boundary and undertook a HSI assessment on 19 of these, 16 of which were considered suitable to support GCN (see Table 4-1).

4.1.2 The Preliminary Ecological Appraisal (PEA) undertaken by AECOM in May 2017 (ES Appendix 8.1) identified a further two ponds within 500 m of the Project Site (See Table 4-1 Pond 23 and 24).

4.1.3 The WSP/PB (ES Appendix 8.13) and the AECOM PEA (ES Appendix 8.1) desk study highlighted that no GCN records were returned within 2 km of the Project Site from the local records centre.

a) Previous Surveys

4.1.4 The GCN surveys undertaken by BSG Ecology in 2014 did not identify any GCN from the ponds surveyed (ES Appendix 8.17). Palmate newts Lissotriton helveticus and smooth newts Lissotriton vulgaris were identified.

b) Habitat Suitability Assessment

4.1.5 During the pond scoping survey to check the HSI categorisation AECOM identified an additional pond, Pond 1b.

4.1.6 Table 4-1 shows the number of ponds identified, the pond category given by WSP/PB, the updated AECOM pond category and change in conditions/ limitations identified by AECOM in May 2017and the approximate distance and direction to the pond from the Project Site boundary. Figure 1 shows the location of the ponds and the AECOM pond category.

Table 4-1: HSI Assessment Pond Category and Change in Conditions

Pond Number	WSP/PB HSI Assessment Pond Category	AECOM HSI Assessment Pond Category	Change in Conditions/ Limitations	Approximate Distance and Direction from the Project Site boundary
1	Below average	Dry	Unable to survey, pond is dry.	650 m west
1b	Not assessed	Below average	Not possible to bottle trap or net due to deep and soft mud surrounding the waterbody. Torched only from limited accessible areas.	670 m west
2	Below average	Dry	Unable to survey pond is dry.	600 m west
3	Average	Dry	Unable to survey pond is dry.	580 m west
4	Average	Average	Not possible to bottle trap or net due to deep and soft mud surrounding the waterbody. Torched only from limited accessible areas	560 m west
5	Below average	Dry	Unable to survey pond is dry	500 m west
6	Average	Dry	Unable to survey pond is dry	460 m west
7	Excellent	Excellent	N/A	400 m west
8	Good	Good	N/A	380 m west
9	Average	Dry	Unable to survey pond is dry.	160 m north east
10	Average	Not assessed	Could not access pond due to dense bramble.	215 m north east
11	Good	Good	Only approximately 5% of edge is accessible. Low water level and steep sides, not suitable for bottle trapping. Torching may be possible but vegetation is dense.	150 m west
12	Not assessed, no	Not assessed, no	N/A	400 m east

Pond Number	WSP/PB HSI Assessment Pond Category	AECOM HSI Assessment Pond Category	Change in Conditions/ Limitations	Approximate Distance and Direction from the Project Site boundary
	access	access		
13	Not assessed, no access	Not assessed, no access	N/A	450 m east
14	Not assessed, no access	Not assessed, no access	N/A	490 m east
15	Pond not present during March 2017.	Dry	N/A	25 m east
16	Average	Dry	Unable to survey pond is dry.	Within Project Site boundary
17	Average	Average	N/A	190 m west
18	Not assessed, no access	Not assessed, no access	N/A	415 m east
19a	Poor	Poor	N/A	440 m north
19b	Below average	Below average	Low water level, dense vegetation and soft mud. May not be suitable for bottle trapping, torching or egg searching. Access restricted by soft mud.	540 m north
20	Poor	Dry	Unable to survey pond is dry.	460 m west
21	Below average	Poor	Pond recently cleared of all vegetation.	170 m north east
22	Below average	Below average	N/A	Within Project Site boundary
23	Not assessed	Not assessed, no access	N/A	Within Project Site boundary

Pond Number	WSP/PB HSI Assessment Pond Category	AECOM HSI Assessment Pond Category	Change in Conditions/ Limitations	Approximate Distance and Direction from the Project Site boundary
24	Not assessed	Not assessed, no access	N/A	150 north west

4.2 Manual Surveys

4.2.1 Following the AECOM updated HSI assessment, manual surveys were undertaken on all ponds, where access allowed, of below average category and above (with the exception of Pond 19a see Section 3.5). Access to Pond 17 was granted at a later stage than the other ponds and part of the manual survey season was missed. Therefore manual surveys were not undertaken on this pond. eDNA sampling was undertaken on Pond 17 (see Section 4.3).

4.2.2 The results of the surveys are shown in Table 4-2 and the weather conditions are shown in Table 4-3. No GCN were recorded during any of the manual surveys. Other amphibians were present in the ponds including palmate newts, frogs and toads and a range of aquatic invertebrates including diving beetle, dragonfly nymphs and pond skaters.

4.2.3 Weather conditions were considered favourable during all of the surveys as shown in Table 4-3. The manual surveys ceased once the results of the eDNA surveys had been received.

4.2.4 In 2014 manual surveys were undertaken by BSG Ecology on Ponds 10, 11 and 15-17 and no GCN were identified (ES Appendix 8.17).

Table 4-2: Survey Results

Pond No.	Survey No.	Date	Survey Method	Great Crested Newt				Palmate Newt				Smooth Newt				Smooth/Palmate			Newt Total
				F	M	U	Total	F	M	U	Total	F	M	U	Total	F	J	Total	
1b#	1	10/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	3	0	**3**	**3**
	2	16/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	**0**
4#	1	10/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	5	0	**5**	**5**
	2	16/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	**0**
	3	17/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	1	0	**1**	**1**
7	1	10/05/17	Torching	0	0	0	**0**	0	5	0	**5**	0	0	0	**0**	3	0	**3**	**8**
		11/05/17	Bottle Trapping**	0	0	0	0	0	3	0	**3**	0	0	0	0	0	0	0	**3**
		11/05/17	Egg Searching	No Eggs or leaf folds seen															
	2	16/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	5	0	**5**	5
		17/05/17	Netting	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0
		17/05/17	Egg Searching	No Eggs or leaf folds seen															
8	1	10/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	1	0	**1**	35	0	**35**	36
		11/05/17	Bottle Trapping**	0	0	0	**0**	5	2	0	**7**	0	0	0	**0**	0	0	**0**	7
		11/05/17	Egg Searching	No Eggs or leaf folds seen															
	2	16/05/17	Torching	0	0	0	**0**	0	2	0	**2**	0	0	0	**0**	17	0	**17**	19

Pond No.	Survey No.	Date	Survey Method	Great Crested Newt				Palmate Newt				Smooth Newt				Smooth/Palmate			Newt Total
				F	M	U	Total	F	M	U	Total	F	M	U	Total	F	J	Total	
		17/05/17	Netting	0	0	0	**0**	1	0	0	**1**	0	0	0	**0**	0	0	**0**	1
		17/05/17	Egg Searching	No Eggs or leaf folds seen															
11[#] (see Table 4-4)	1	08/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0
				F	**M**	**U**	**Total**	**F**	**M**	**U**	**Total**	**F**	**M**	**U**	**Total**	**F**	**J**	**Total**	
19a (see Table 4-4)	1	11/05/17	Torching	0	0	0	**0**	0	3	0	**3**	0	0	0	0	12	0	12	**15**
		12/05/17	Netting	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0	0	0	**0**
		12/05/17	Egg Searching	No Eggs or leaf folds seen															
19a (see Table 4-4)	2	16/05/17	Torching	0	0	0	**0**	0	3	0	**3**	0	0	0	**0**	17	0	**17**	**20**
		17/05/17	Netting	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	1	**1**	**1**
		17/05/17	Egg Searching	No Eggs or leaf folds seen															
19b[#] (see Table 4-4)	1	09/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	1
22	1	08/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	1	2	**3**	3

Pond No.	Survey No.	Date	Survey Method	Great Crested Newt				Palmate Newt				Smooth Newt				Smooth/Palmate			Newt Total
				F	M	U	Total	F	M	U	Total	F	M	U	Total	F	J	Total	
		09/05/17	Bottle Trapping	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0
		09/05/17	Egg Searching	No Eggs or leaf folds seen															
	2	10/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	1	0	**1**	1
		11/05/17	Bottle Trapping	0	0	0	**0**	0	1	0	**1**	0	0	0	**0**	0	0	**0**	1
		11/05/17	Egg Searching	No Eggs or leaf folds seen															
	3	16/05/17	Torching	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	3	0	**3**	3
		17/05/17	Bottle Trapping	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0
		17/05/17	Egg Searching	No Eggs or leaf folds seen															

Table 4-3: Survey Weather Conditions

Pond No.	Survey No.	Date	Survey Method	Air Temperature °C	Water Temperature °C	Conditions
1b	1	10/05/17	Torching	10.8	Gauge not working.	Dry and mild
	2	16/05/17	Torching	14.7	14	Very light rain during survey and mild
4	1	10/05/17	Torching	10.8	Gauge not working.	Dry and mild
	2	16/05/17	Torching	13.9	14.4	Very light rain during survey and mild
	3	17/05/17	Torching	11.6	12.0	Dry and mild
7	1	10/05/17	Torching	11	12.6	Dry and mild
		11/05/17	Bottle Trapping and Egg Searching	In: 16.0 Out:8.9	In:13.5 Out: 12.8	Dry and mild
	2	16/05/17	Torching	13.5	13.1	Very light rain during survey and mild
		17/05/17	Netting and Egg Searching	14.7	12.4	Dry and mild
8	1	10/05/17	Torching	11	14	Dry and mild
		11/05/17	Bottle Trapping and Egg Searching	In: 20.1 Out: 9.6	In: 15.7 Out: 12.8	Dry and mild
	2	16/05/17	Torching	13.5	13.6	Very light rain during survey and mild
		17/05/17	Netting and Egg Searching	12.8	13.5	Dry and mild

Pond No.	Survey No.	Date	Survey Method	Air Temperature °C	Water Temperature °C	Conditions
11	1	08/05/17	Torching	11.7	Gauge not working.	Dry and mild
19a	1	11/05/17	Torching	15.6	17.4	Dry and mild
		12/05/17	Netting and Egg Searching	13.5	16.0	Very light rain during survey and mild
	2	16/05/17	Torching	11.9	14.4	Very light rain during survey and mild
		17/05/17	Netting and Egg Searching	13.8	14.0	Dry and mild
19b	1	09/05/17	Torching	7.5	Gauge not working.	Dry
22	1	08/05/17	Torching	11.3	Gauge not working.	Dry and mild
		09/05/17	Bottle Trapping and Egg Searching	In:15.0 Out:8.0	Gauge not working.	Dry and mild
	2	10/05/17	Torching	13.0	9.6	Dry and mild
		11/05/17	Bottle Trapping and Egg Searching	In:15.3 Out: 12.0	In: 12.0 Out: 1.0	Dry and mild
	3	16/05/17	Torching	12.7	11.8	Very light rain during survey and mild
		17/05/17	Bottle Trapping and Egg Searching	In: 15.6 Out: 13.9	In:11.5 Out:11.6	Very light rain during survey and mild

[#]*Details for ponds which had less than the three required manual survey methods are given in Section 3.5 and in the limitations section in Table 4-1.*

***A dead water shrew was found in one of the bottle traps in Pond 7, therefore bottle trapping ceased for Ponds 7 and 8 and the netting technique was used for future surveys (see Section 3.5)*

Key: M = Male, F = Female, J = Juvenile, U = Unknown sex.

4.3 eDNA Sampling

4.3.1 Following the AECOM updated HSI assessment eDNA surveys were undertaken on all ponds, where access allowed, of below average category and above, with the exception of Pond 19a (see Section 3.5).

4.3.2 Table 4-4 lists the ponds that were sampled for GCN eDNA, the weather conditions when collecting the samples, any limitations noted during sample collection and the results returned by SureScreen.

4.3.3 All the ponds sampled for GCN eDNA came back with a negative result.

Table 4-4: eDNA Sampling Results

Pond Number	Sample Date	Air Temp °C	Limitations (see Section 3.5)	GCN Result Returned
1b	11/05/17	16.0	Only 5% of pond perimeter accessible to sample.	Negative
4	11/05/17	16.0	Only 5% of pond perimeter accessible to sample.	Negative
7	11/05/17	13.0	None	Negative
8	11/05/17	12.0	None	Negative
11	11/05/17	16.0	Only 5% of pond perimeter accessible to sample.	Negative
17	25/05/17	26.0	None	Negative
19a	11/05/17	15.0	None	Negative
22	11/05/17	15.3	None	Negative

5. Ecological Constraints and Indicative Potential Impacts

5.1.1 The indicative potential impacts of the Project on habitats and protected species are outlined below; potential impacts will be assessed fully during the Ecology Impact Assessment (EcIA).

5.1.2 No GCN were identified within nine ponds surveyed (Ponds 1b, 4, 7, 8, 11, 17, 19a, 19b and 22). The local records centre did not return any records of GCN within 2 km of the Project Site. Previous surveys of ponds 10, 11, 15, 16 and 17 by BSG Ecology in 2014 did not identify the presence of GCN (ES Appendix 8.17). Therefore, it is considered unlikely that any GCN will be present within any of the ponds that were not surveyed or within 500 m of these ponds in surrounding habitat given the absence of GCN from all nearby ponds, and it is considered that there will be no impacts on GCN.

5.1.3 The Project will require the removal of three ponds (Ponds 16, 22 and 23). Pond 22 currently supports palmate newts and is likely to support other amphibians including frogs and toads, as well as a range of generalist aquatic invertebrates. Pond 16 was dry. Pond 23 could not be assessed but if it contains water has the potential to support generalist aquatic invertebrates and common amphibians. Removal of the ponds will result in loss of habitat for a small number of common amphibians and common aquatic invertebrates.

6. Further Surveys and Recommendations

6.1 Further Surveys

6.1.1 No further surveys are recommended.

6.2 Recommendations for Mitigation and Enhancement

6.2.1 The Project will require the removal of three ponds (Ponds 16, 22 and 23). Pond 22 currently supports palmate newts and is likely to support other amphibians including frogs and toads as well as a range of generalist aquatic invertebrates. Pond 16 was dry. Pond 23 could not be assessed but if it contains water has the potential to support generalist aquatic invertebrates and common amphibians.

6.2.2 Where the scheme design allows, ponds, swales or water bodies, should be considered to mitigate the loss of the ponds and enhance the Project Site for common amphibians.

6.2.3 If a waterbody is included in the scheme design this should be managed specifically for amphibians and not stocked with fish. The waterbody could include planting of marginal and floating vegetation. The waterbody and any bankside vegetation should be managed to control over shading.

6.2.4 Log piles and hibernacula could be created in suitable areas of habitat (such as grassland and scrub/woodland edges), to enhance the area for amphibians.

7. References

Ref. 1 Langton T.E.S., Beckett, C.L. and Foster, J.P. 2001. Great Crested Newt Conservation Handbook. Froglife, Halesworth.

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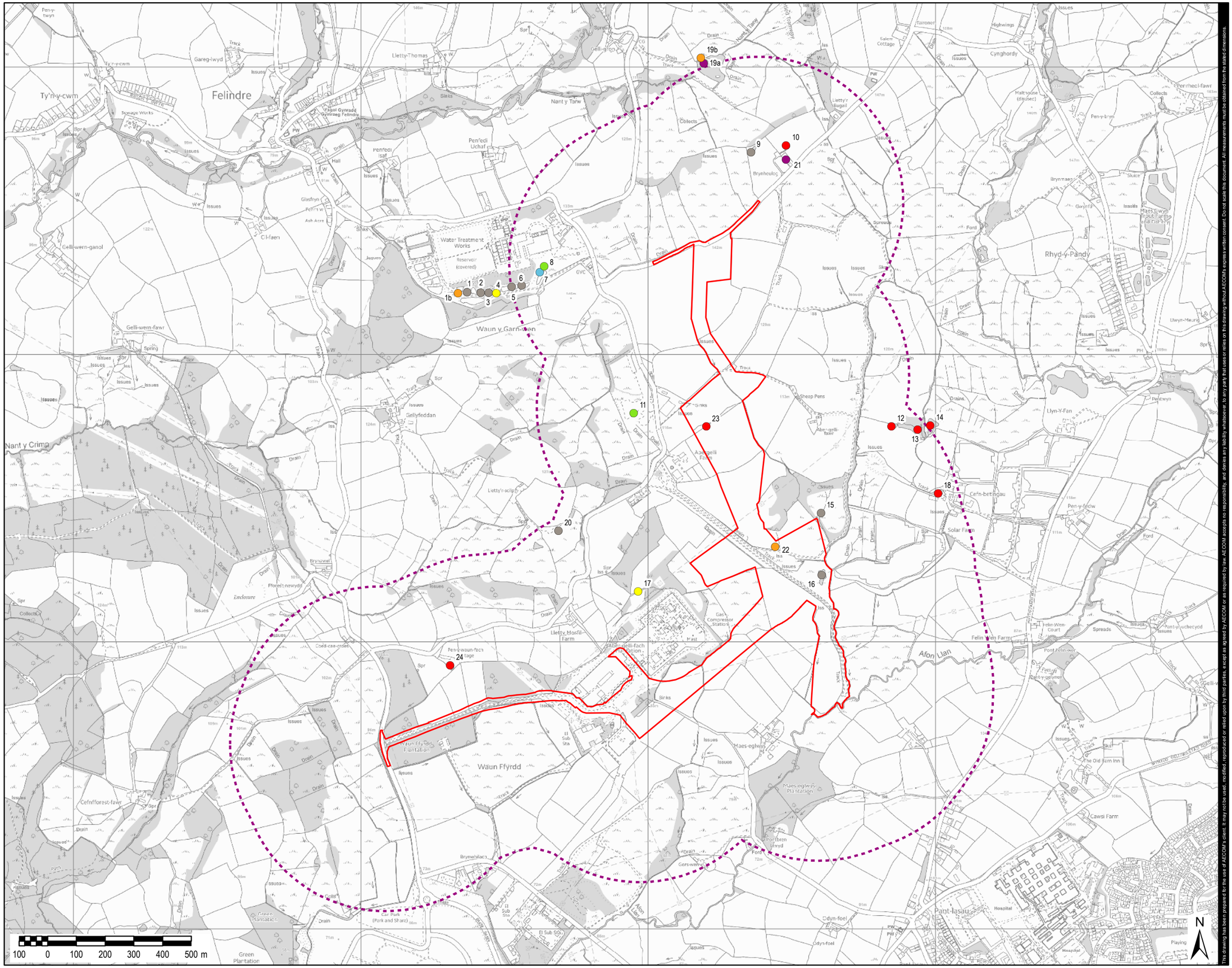
Ref. 5 Biggs J, Ewald N, Valentini A, Gaboriaud C, Griffiths RA, Foster J, Wilkinson J, Arnett A, Williams P and Dunn F. 2014. Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA. Freshwater Habitats Trust, Oxford.

Figure 1: AECOM 2017 Habitat Suitability Index for Pond



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Project Title:

ABERGELLI POWER PROJECT

Client:

STAG ENERGY

LEGEND

- Project Site Boundary
- 500m Study Area

GCN 2017 Pond HSI Assessment

- Poor
- Below Average
- Average
- Good
- Excellent
- Dry
- Not Assessed, No Access

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Appendix 3.5

Reptile Survey Report

Abergelli Power Project
Reptile Survey Report

Abergelli Power Limited
May 2018

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APPENDICES

Appendix A Reptile Survey Results

1. Reptile Survey Report

1.1 Introduction

1.1.1 AECOM was commissioned to undertake a suite of ecological survey work to inform the Abergelli Power Project (the "Project").

1.1.2 The Project Site is located near to the village of Felindre, Swansea, as shown in Figure 1, and the central grid reference for the Site is SN 6528 0143. A full description of the Project is provided in Chapter 3: Project and Site Description.

1.1.3 The Preliminary Ecological Appraisal Report (AECOM, June 2017) identified that surveys for reptiles were required within areas of suitable habitat at the Project Site.

1.1.4 This report outlines the presence of reptiles within the reptile survey area and outlines initial recommendations for further surveys, mitigation and enhancement.

1.1.5 The reptile survey area encompasses all suitable habitats accessible within the Project Site boundary, as shown on Figure 2.

a) Objectives of this Survey

1.1.6 The objectives of this survey were:

- To identify any designated nature conservation sites within or in the vicinity of the Project Site boundary that have the potential to support reptiles;
- To identify any known records and/or populations of reptiles in the vicinity of the Project Site boundary;
- To record and map evidence of reptiles;
- To make an initial ecological assessment of the Project Site boundary in respect to reptiles;
- To highlight any initial potential ecological constraints in respect to reptiles;
- To outline further survey work that may be required; and,
- To make initial suggestions for mitigation, compensation and enhancement of the natural features identified on the within the Project Site boundary in respect to reptiles.

1.2 Legislation

1.2.1 British reptiles are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended).

1.2.2 For sand lizard *Lacerta agilis* and smooth snake *Coronella austriaca* all parts of Section 9 apply. This prohibits:

- intentional killing;
- injuring or taking (capture. etc);
- possession;
- intentional disturbance whilst occupying a 'place used for shelter or protection' and destruction of these places; and,

- trade (i.e. sale, barter, exchange, transporting for sale and advertising to sell or to buy).

1.2.3 For the four widespread species of reptile, namely the common lizard *Zootoca vivipara*, slow-worm *Anguis fragilis*, grass snake *Natrix helvetica helvetica* and European adder *Vipera berus*, only part of sub-section 9(1) and all of sub-section 9(5) apply. These prohibit:

- intentional killing;
- injuring; and,
- trade (i.e. sale, barter, exchange, transporting for sale and advertising to sell or to buy).

1.3 Quality Assurance

1.3.1 This survey and subsequent report was undertaken in line with AECOM's Integrated Management System (IMS). Our IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the international standards BS EN ISO 9001:2008 and 14001:2004 and BS OHSAS 18001:2007. In addition, our IMS requires careful selection and monitoring of the performance of all sub-consultants and contractors.

1.3.2 All AECOM Ecologists who worked on this project are members of (at the appropriate level) the Chartered Institute of Ecology and Environmental Management (CIEEM) and follow their code of professional conduct (CIEEM, 2013) when undertaking ecological work.

1.4 Methodology

a) Desk study

1.4.1 The objective of the desk study is to review the existing information available in the public domain concerning species and habitats to identify the following:

- Internationally and nationally designated sites for reptiles, up to 2 km from the Project Site using the Multi Agency Geographic Information for the Countryside (MAGIC) website (www.magic.gov.uk);
- Reptile records and records of locally designated sites for reptiles up to 2 km from the Project Site, using the South East Wales Biodiversity Records Centre (SEWBReC);
- The Section 7 list of Principal Importance for Conservation of Biological Diversity in Wales was reviewed for inclusion of reptiles; and,
- Aerial photographs and Ordnance Survey (OS) maps were reviewed to identify features of ecological interest surrounding the Project Site, nearby areas of ecological interest and features connecting these habitats (hedgerows, watercourses, railway lines).

1.4.2 The reports of previous surveys undertaken by BSG Ecology were provided by the client and subsequently reviewed.

b) Reptile Presence / Likely Absence Survey

1.4.3 The Phase 1 Habitat map (AECOM, 2017) and OS mapping were used to identify habitat suitable for supporting reptiles within the Project Site boundary.

1.4.4 The reptile survey methodology paid due regard to reptile survey guidelines provided by Froglife Advice Sheet 10 (Froglife, 1999) and the Herpetofauna Workers' Manual (Gent, T and Gibson, S, 1998).

1.4.5 Artificial refugia (approximately 0.5 m x 0.5 m square sheets of heavy-duty mineral roofing felt – known as 'reptile survey mats') were placed in suitable locations within suitable habitat (e.g. sunny areas adjacent denser vegetation and south facing) on the 21st August 2017. These were left for 10 days to 'bed-in', until the start of September when the suitable reptile survey period started.

1.4.6 A total of 99 reptile survey mats were placed within an area of 3.8 ha. This exceeds the minimum density of 10 per hectare recommended in guidelines provided by Froglife, 1999.

1.4.7 Figure 1 shows the Phase 1 Habitat map used to assess suitable reptile habitat. Figure 2 shows the location of the reptile survey mats.

1.4.8 Reptile survey mats were checked on seven subsequent occasions in suitable weather conditions (within a constant temperature range of between 10 – 20°C, rain and windy conditions are usually unsuitable, sunny spells after rain can be suitable (Froglife, 1999)). Each reptile survey mat was initially inspected from a suitable distance to identify any reptiles that may be present basking on top of the reptile survey mats, without causing disturbance. The refugia were then approached quietly and carefully, and lifted swiftly to examine the ground beneath; any reptiles present were noted. During each survey, other artificial debris (such as waste wood, plastic sheeting) and other naturally occurring habitat features likely to be used by reptiles (such as small logs) were also checked for the presence of reptiles.

1.4.9 Surveys were completed by suitably qualified ecologists with at least five years' experience of ecological consultancy and with experience completing reptile surveys.

1.4.10 The weather conditions were considered largely suitable for undertaking reptile surveys. Weather conditions and survey dates are shown in Table 1.2.

c) Evaluation

1.4.11 In order to assess the value of any given reptile population, two assessment methodologies may be applied. Nationally, the guidelines for the selection of Sites of Special Scientific Interest (JNCC, 1989) provide criteria for identifying nationally important populations of reptiles. The methodology developed by Froglife (1999) used in the identification of Key Reptile Sites can be used to evaluate reptile populations at a local or regional level.

1.4.12 To qualify as a Key Reptile Site, a site must meet at least one of the following criteria:

- Supports three or more reptile species;
- Supports two snake species;
- Supports an exceptional population (see Table 1.1) of one species;
- Supports an assemblage of species scoring at least 4 (see Table 1.1); or,
- Does not meet any of the previous criteria, but is of particular regional importance due to local rarity.

Table 1.1: Key Reptile Criteria

European Adder	<5	5 – 10	>10
Grass Snake	<5	5 – 10	>10
Common Lizard	<5	5 – 20	>20
Slow-Worm	<5	5 – 20	>20

Source: Froglife, 1999.

**Figures in the table refer to the maximum number of adults seen by one person in one day.*

1.5 Limitations

1.5.1 Biological records can be received from a wide variety of sources and may or may not be comprehensive and accurate. However, if assessed in conjunction with a survey, they can contribute to a robust ecological assessment of a site.

1.5.2 Several areas of habitat suitable for supporting reptiles within the Project Site boundary could not be surveyed using artificial refugia due to the presence of grazing livestock. Artificial refugia would pose a health and safety risk to the livestock as well as posing a risk of trampling to sheltering reptile utilising the artificial refugia. These areas lacked features where reptiles might be easily observed and as such a walkover survey of these areas was not deemed appropriate. There is the potential for reptiles to have gone unrecorded in these areas. These areas have been indicated on Figure 2.

1.5.3 The survey method is designed to identify the presence or likely absence of common reptile species. There is the potential for the survey to have recorded a small sample of the populations present and if a reptile species occurs at a low density it may have been missed.

1.6 Baseline Environment

a) Desk Study Results

1.6.1 The designated habitats, sites and features within proximity to the site are listed in Table 1.2 below.

Table 1.2: Desk Study Results

Designation / Feature	Description
Nationally and Internationally Designated Sites within 2 km	There are no national or international sites designated for reptiles within 2 km of the Project Site boundary.
Locally Designated Sites within 2 km	There are no local sites designated for reptiles within 2 km of the Project Site boundary.
Reptile Records from the last 10 years within 2 km	The following reptiles records were returned from within 2 km of the Project Site boundary. Direction and approximate distance from the nearest point of the Project Site boundary have been provided: • Slow-worm: records from 1 km south and 2 km east; • Grass snake: records from 2 km south west; • Adder: records from 150 m north east, 1 km south and 2.3 km south west; • Common lizard: records from 170 m north west, 350 m south, 1 km south and 1.5 km north.
Priority Species – Section 7 List	The following reptile species are listed in the Environment Act (Wales) 2016 Section 7: • Slow-worm;

Designation / Feature	Description
	• Sand lizard; • Common lizard; • Grass snake; and, • Adder.
Surrounding Land Use	The Project Site is located to the north of Junction 46 of the M4 Motorway close to the village of Felindre, Swansea. The Project Site has agricultural fields to the east, south and north. Areas of woodland are located to the south, east and west of the Project Site. Afon Llan runs adjacent the southern Project Site boundary. Areas of the Substation and Felindre Compressor station with associated roads and buildings are partially within and adjacent to the Project Site boundary. A water treatment works is located in the north west outside of the Project Site boundary.
Ponds within 500m (See Figure 1)	OS mapping shows 25 ponds within 500 m of the Site Boundary, three of these (Ponds 16, 22 and 23) are within the Project Site boundary: • Ponds 1 – 8: Located near to waste water treatment works approximately 350 m west. Connected to the Project Site via woodland and grassland; • Ponds 9, 10 and 21: Located approximately 350 m east and connected to the north-east tip of the road boundary via grassland; • Pond 11: Approximately 210 m west of the Project Site boundary and connected to the Project Site via grassland and scrub; • Ponds 12 – 14 and 18: Located approximately 450 m east and connected to the Project Site via woodland and grassland; • Pond 15: Located approximately 130 m north and connected to the Project Site via woodland and grassland; • Pond 16: Within the Project Site boundary, dry during the Phase 1 Habitat Survey; • Pond 17: Located approximately 200 m west and connected to the Project Site via woodland, grassland and scrub; • Ponds 19a and 19b: Approximately 400 m north and connected to the Project Site via grassland; • Pond 20: Approximately 450 m north, connected to the Project Site via grassland. This pond was identified as dry in 2017; • Pond 22: Within the Project Site Boundary; • Pond 23: Within the Project Site boundary and identified during the Phase 1 Habitat Survey. This pond was not accessible due to the presence of horses; and, • Pond 24: Approximately 150 m north within the garden of Pen-y-Waun Fach Cottage. The pond is connected to the Project Site via grassland and woodland.

Designation / Feature	Description
Previous Surveys undertaken by BSG Ecology, 2014	Common Lizard A total of 163 adult and juvenile common lizard observations were recorded, with a peak count of 50 recorded on one survey visit. Observations were across the survey area within the Project Site boundary. During the course of the survey both male and female common lizard were recorded with some of the females being gravid, which confirmed that there was a breeding population present. (Appendix 8.5 of the ES). Grass Snake In total ten observations were recorded for grass snake with a peak count of five recorded on one survey visit. The majority of observations of grass snake were made in the area of marshy grassland close to a pond. Juvenile grass snake was recorded along with adults which suggested a breeding population present. As grass snake are a wide ranging species and the location of the animals recorded were near to the boundary, the presence of juveniles could not necessarily confirm that breeding was taking place within the Project Site boundary (Appendix 8.5 of the ES).

b) Reptile Survey Results

1.6.2 The weather conditions and timings for each of the reptile surveys are given in Table 1.3 and a summary of the results of the reptile survey are given in Table 1.4. For the table of the full results see Appendix A.

1.6.3 Figure EC1 shows the Phase 1 habitats and Figure EC2 shows the location of the reptile survey refugia and the distribution of the reptile survey results.

Table 1.3: Reptile Survey Weather Conditions

Survey Visit Number	Survey Date	Start Time	Temperature (°C)	Humidity (%)	Rainfall	Average Wind Speed (MPH)
1	01/09/2017	10:00	17.7	71.7	None	2.3
2	05/09/2017	08:00	15.4	99.2	None	1.3
3	08/09/2017	10:10	15.5	91.4	Rain before, none during	1.2
4	12/09/2017	08:28	13.9	83.3	None	1.2
5	14/09/2017	10:35	14.8	86.4	Rain showers before; none during	2.2
6	18/09/2017	10:22	16.5	68.6	None	0.6
7	26/09/2017	12:20	17.3	83	None	1.7

Table 1.4: Reptile Survey Results

Survey No.	Common Lizard						Other
	Male	Female	Adult (sex unknown)	Juvenile / Sub-Adult	Adult Total	Sloughed Skin	Toad
1	0	0	1	1	1	0	2
2	1	0	0	0	1	0	0
3	0	1	4	8	5	2	9
4	1	0	1	2	2	0	6
5	1	0	1	6	2	1	9
6	0	0	5	0	5	0	Not recorded
7	3	1	2	10	6	0	8

1.6.4 An incidental sighting of a common lizard was made during positioning bat survey equipment during daylight hours, this was seen basking on top of a reptile survey mat on 23 August 2017 at SN65360132, likely to be reptile refugia number 64.

1.7 Conclusions

a) Project Site Assessment

1.7.1 The desk study confirmed the presence of slow-worm, grass snake, adder and common lizard within 2 km, and the presence of grass snake and common lizard within the Project Site boundary.

1.7.2 During the 2017 reptile survey a total of 51 adult and juvenile common lizard observations were recorded, with a peak count of 6 adults recorded on one survey visit. Observations of common lizard were recorded from across the reptile survey area within the Project Site boundary. The majority of records were from the verges either side of the grassy track running through the centre of the Project Site and from the semi-improved neutral grassland present around the National Grid site.

1.7.3 During the course of the reptile survey male, female and juvenile common lizards were recorded, which confirmed that there was a breeding population present within the Project Site boundary.

1.7.4 No grass snakes were identified within the reptile survey area including the area with the highest abundance during the 2014 surveys (Appendix 8.5 of the ES). However, there is the potential for grass snake to be present within the Project Site boundary and to have gone unrecorded since:

- grass snake are wide ranging;
- Pond 16, where the majority of the 2014 records were from was mostly dry throughout the 2017 reptile survey period, making the areas less suitable for supporting grass snake; and,
- the area in the north of the reptile survey area where grass snake were recorded in 2014 could not be accessed for survey in 2017 due to grazing livestock.

1.7.5 As such, it should be assumed grass snake is likely to be present at low densities within the Project Site boundary and surrounding habitat.

b) Population and ‘Key reptile Site’ Criteria

1.7.6 Based on the survey results and the criteria laid out in Table 1.1, the Project Site supports a ‘Good population’ of common lizard.

1.7.7 The Project Site does not meet the criteria for a ‘Key Reptile Site’.

c) Amphibian Species

1.7.8 Common toads were recorded under the reptile survey mats across the reptile survey area, including juvenile and adults and as such it can be assumed that common toad is breeding within or near to the Project Site boundary.

1.8 Recommendations

d) Recommendations for Further Surveys

1.8.1 It is anticipated that no further surveys will be required.

e) Recommendations for Mitigation

1.8.2 At this stage the following key recommendations have been made:

- Prior to construction commencing, areas within the Project Site boundary that are suitable for supporting reptiles or are known to support reptiles should undergo an exclusion fencing and translocation programme, including habitat management, to move reptiles out of construction zones into suitable habitat thereby limiting harm, injury or killing;
- As part of the translocation programme, a suitable receptor site will need to be identified to accept the reptiles translocated from the areas impacted by construction phase activities and operational footprint of the Project.
- The receptor site will need a population survey for reptiles undertaken to ascertain it's suitability for holding greater numbers of reptiles, this may be possible within the Order Limits and it is proposed to discuss the findings of this report with CCS and NRW and identify an area within the existing Order Limits. An area of suitable or sub-optimal habitat can be utilised within the Project Site boundary. If the area is sub-optimal, habitat management works will be required to increase its suitability for reptiles with the aim to create structurally diverse habitats. These will include:
  - Areas of cover to provide shelter and protection from predators;
  - Open areas in sunny spots and south facing slopes to provide areas for basking; and
  - Mosaic of structural diversity including areas with different plant species, age and height.
- In addition, there must be:
  - Connectivity of habitats to allow movement between hibernating, foraging and basking areas and to allow dispersal of populations; and
  - Inclusion of habitat edges and transitional zones including woodland edges and grassland/scrub interface.
- Habitat management works may take up to two years, depending on the current condition of the area, to allow habitats to grow and develop these features suitable for supporting reptile; and,
- A Method Statement for the translocation and habitat management programme should be written by a suitability experienced ecologist and agreement of the Method Statement sought from the county ecologist.

f) Recommendations for Biodiversity Enhancement

1.8.3 At this stage the following precautionary recommendations have been made:

- Consider reptiles in the landscaping of the Project Site where possible.
- Create artificial habitat features including:
  - Log and brash piles – to create cover, provide structural diversity and enhance prey availability; and

    - Artificial hibernacula – create piles of rocks, logs, rubble etc. Some of this should be buried below ground. Southward facing and well drained locations are the most successful.
    - Basking sites – create south facing banks in open areas.
- Manage the Project Site boundary under client ownership for reptiles. Appropriate techniques should be adopted to prevent succession change in areas of suitable habitat.

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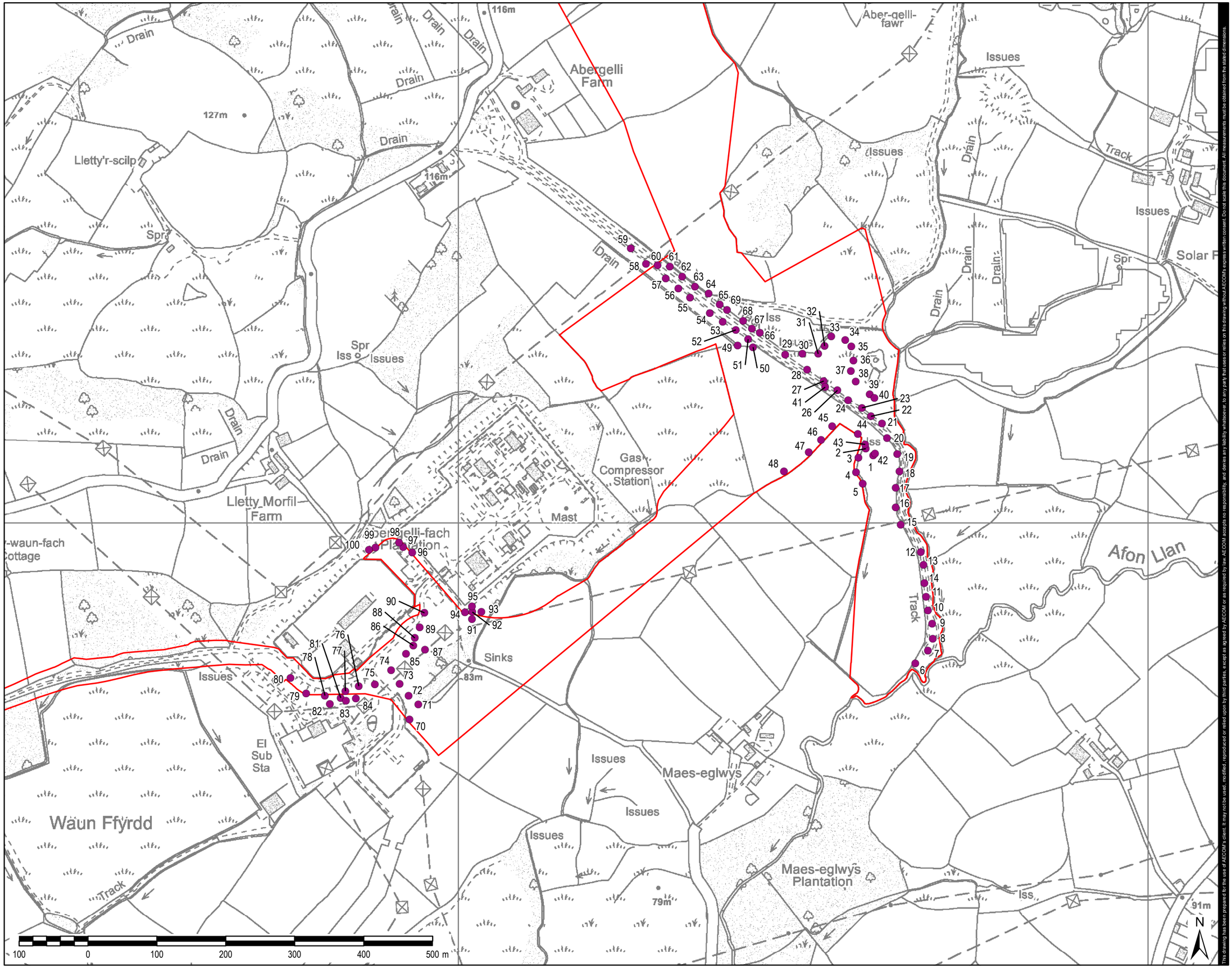
Gent, T. and Gibson, S. (1998) Herpetofauna Workers' Manual. JNCC, Peterborough.

Joint Nature Conservation Committee (1989). Guidelines for the selection of biological SSSIs. Part 2: Detailed guidelines for habitats and species groups - 15 REPTILES AND AMPHIBIANS. Under Revision. http://jncc.defra.gov.uk/page-2303

Figure 1 – Phase 1 Habitat Map



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Project Title:

ABERGELLI POWER PROJECT

Client:

STAG ENERGY

LEGEND

- Project Site Boundary
- Reptile Refugia

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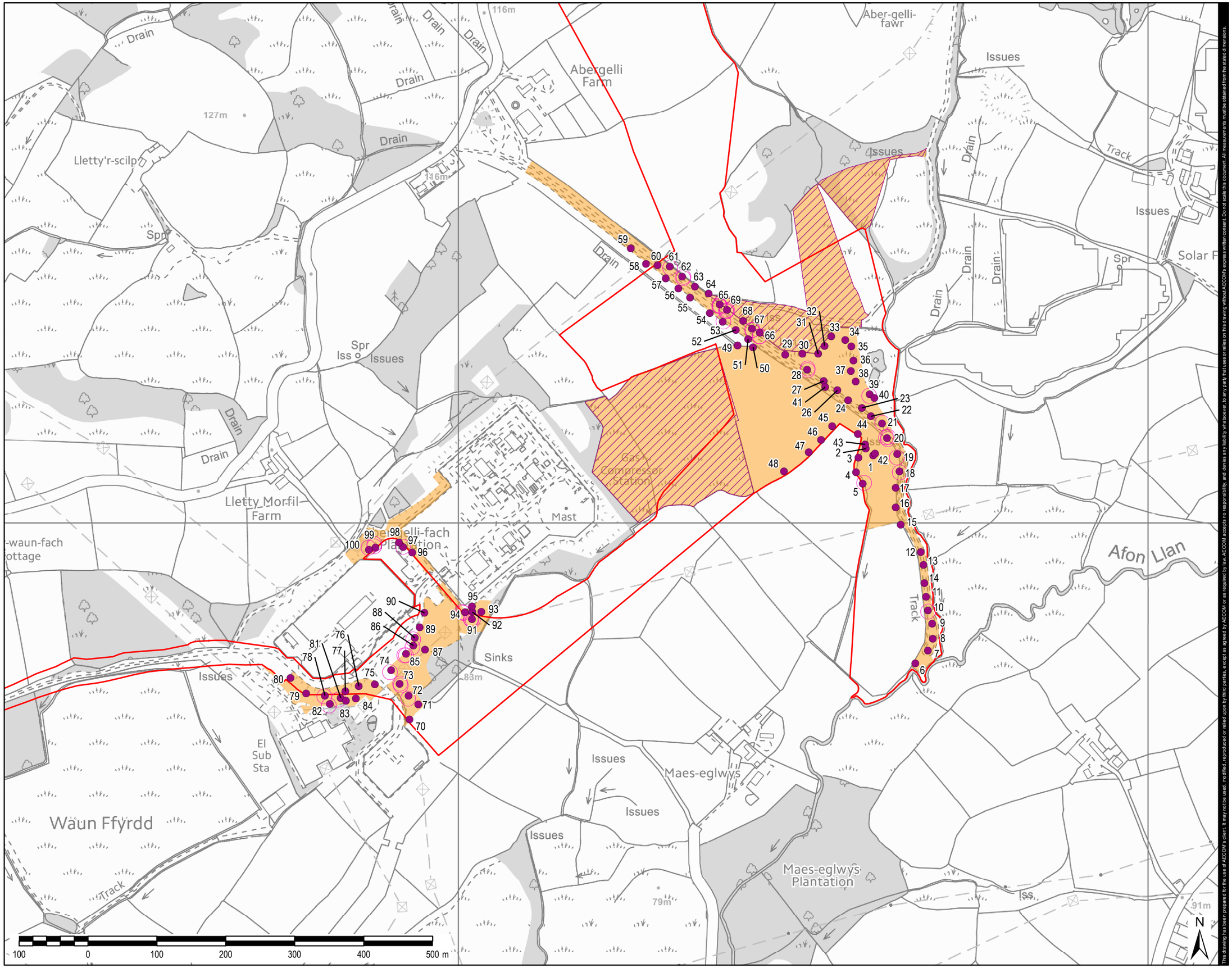
Figure 2 – Reptile Survey Results



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Project Site Boundary
- Reptile Refugia
- Reptile Identified - Viviparous Lizard
- Areas not accessible
- Areas suitable for reptiles

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Appendix A Reptile Survey Results

Date	Species	Number	Observation	Activity	Location	Sex	Maturity	Note
01/09/2017	Common Lizard	1	Seen	Basking	39	Unknown	Juvenile	JUST SAW DISAPPEARING INTO UNDERGROWTH
01/09/2017	Common Lizard	1	Seen	Basking	91	Unknown	Adult	
06/09/2017	Common Lizard	1	Seen	Basking	62	Male	Adult	
08/09/2017	Common Lizard	1	Slough found	Basking	5	Unknown	Adult	SKIN
08/09/2017	Common Lizard	1	Slough found	Basking	28	Unknown	Adult	SKIN, REMOVED
08/09/2017	Common Lizard	1	Seen	Basking	66	Unknown	Sub-adult	ON TOP OF MAT
08/09/2017	Common Lizard	1	Seen	Basking	67	Female	Adult	
08/09/2017	Common Lizard	2	Seen	Basking	69	Unknown	Juvenile	ON TOP OF MAT
08/09/2017	Common Lizard	1	Seen	Basking	65	Unknown	Juvenile	ON TOP OF MAT
08/09/2017	Common Lizard	1	Seen	Basking	72	Unknown	Juvenile	ON TOP OF MAT
08/09/2017	Common Lizard	1	Seen	Basking	82	Unknown	Adult	ON TOP OF MAT
08/09/2017	Common Lizard	1	Seen	Basking	81	Unknown	Juvenile	ON TOP OF MAT
08/09/2017	Common Lizard	1	Seen	Basking	74	Unknown	Adult	ON TOP OF MAT
08/09/2017	Common Lizard	1	Seen	Basking	88	Unknown	Juvenile	ON TOP OF MAT
08/09/2017	Common Lizard	1	Seen	Basking	94	Unknown	Juvenile	ON TOP OF MAT
08/09/2017	Common Lizard	1	Seen	Basking	91	Unknown	Juvenile	ON TOP OF MAT
12/09/2017	Common Lizard	1	Seen	Basking	62	Male	Adult	
12/09/2017	Common Lizard	1	Seen	Basking	73	Unknown	Adult	
12/09/2017	Common Lizard	1	Seen	Basking	99	Unknown	Juvenile	
12/09/2017	Common Lizard	1	Seen	Basking	20	Unknown	Juvenile	ON TOP OF MAT
14/09/2017	Common Lizard	1	Seen	Basking	21	Unknown	Juvenile	
14/09/2017	Common Lizard	1	Seen	Basking	20	Unknown	Juvenile	

Date	Species	Number	Observation	Activity	Location	Sex	Maturity	Note
14/09/2017	Common Lizard	1	Seen	Basking	69	Unknown	Juvenile	ON TOP OF MAT
14/09/2017	Common Lizard	1	Seen	Basking	65	Male	Adult	
14/09/2017	Common Lizard	1	Seen	Basking	85	Unknown	Adult	SCURRIED AWAY
14/09/2017	Common Lizard	1	Seen	Basking	86	Female	Sub-adult	
14/09/2017	Common Lizard	1	Seen	Basking	97	Unknown	Juvenile	ON TOP OF MAT
14/09/2017	Common Lizard	1	Slough found	Basking	99	Unknown	Juvenile	
14/09/2017	Common Lizard	1	Seen	Basking	100	Unknown	Juvenile	ON TOP OF MAT
18/09/2017	Common Lizard	1	Seen	Basking	18	Unknown	Adult	
18/09/2017	Common Lizard	1	Seen	Basking	28	Unknown	Adult	
18/09/2017	Common Lizard	1	Seen	Basking	73	Unknown	Adult	
18/09/2017	Common Lizard	1	Seen	Basking	78	Unknown	Adult	
18/09/2017	Common Lizard	1	Seen	Basking	91	Unknown	Adult	
26/09/2017	Common Lizard	3	Seen	Basking	85	Unknown	Juvenile	TWO ON TOP, ONE UNDER
26/09/2017	Common Lizard	1	Seen	Basking	94	Unknown	Juvenile	
26/09/2017	Common Lizard	2	Seen	Basking	53	Unknown	Juvenile	ON TOP OF MAT
26/09/2017	Common Lizard	2	Seen	Basking	66	Unknown	Juvenile	ON TOP OF MAT
26/09/2017	Common Lizard	1	Seen	Basking	67	Female	Adult	
26/09/2017	Common Lizard	2	Seen	Basking	69	Unknown	Juvenile	ON TOP OF MAT
26/09/2017	Common Lizard	1	Seen	Basking	65	Male	Adult	ON TOP OF MAT
26/09/2017	Common Lizard	1	Seen	Basking	61	Unknown	Adult	ON TOP OF MAT
26/09/2017	Common Lizard	1	Seen	Basking	20	Male	Adult	
26/09/2017	Common Lizard	1	Seen	Basking	19	Unknown	Adult	ON TOP OF MAT
26/09/2017	Common Lizard	1	Seen	Basking	10	Male	Adult	ON TOP OF MAT

Appendix 3.6a

Breeding Bird Survey Report

Abergelli Power Project
Breeding Bird Survey Report

Abergelli Power Limited
May 2018

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1. Breeding Bird Survey Report

1.1 Introduction

1.1.1 AECOM was commissioned to undertake a suite of ecological survey work to inform the Abergelli Power Project (the "Project"), and support the Environmental Statement (ES).

1.1.2 The Project Site is located near to the village of Felindre, Swansea, as shown in Figure 1, and the central grid reference for the Project Site is SN65280143. A full description of the development is provided in Chapter 3 (Project and Site Description).

1.1.3 The Preliminary Ecological Appraisal Report (AECOM, 2017) identified that surveys for breeding birds were required at the Project Site.

1.1.4 This baseline report describes the status of breeding birds within the breeding bird survey area and makes initial indications of potential effects and outlines initial recommendations for further surveys, mitigation and enhancement.

1.1.5 The breeding bird survey area encompasses all suitable and accessible areas of woodland, hedgerows and scrub within proximity of and within the Project Site boundary, as shown on Figure 1.

1.1.6 Previous surveys have been undertaken by BSG Ecology is provided in the ES Appendix 8.16.

a) Objectives of the Study

1.1.7 The objectives of this study were:

- To identify any designated nature conservation sites within or in the vicinity of the Project Site boundary that have the potential to support notable breeding bird species or assemblages;
- To identify any known records of breeding birds in the vicinity of the Project Site boundary;
- To record and map evidence of breeding bird activity;
- To make an initial ecological assessment of the value of the Project Site to breeding birds;
- To highlight any initial potential ecological constraints related to breeding birds;
- To outline further survey work that may be required; and,
- To make initial suggestions for mitigation, compensation and enhancement of the natural features identified within the Project Site with respect to the breeding bird assemblage.

1.2 Legislation

1.2.1 There are several different acts of legislation and regulations which refer to the protection of wildlife. Legislation with particular relevance to birds is outlined below.

1.2.2 This is a brief summary of the legislation and is not to be regarded as a definitive legal opinion. When dealing with individual cases, the client is advised to consult the full texts of the relevant legislation and obtain further legal advice.

b) Statutory Legislation

1.2.3 Key legislation for birds in the UK includes:

- Council Directive 79/409/EEC on the conservation of wild birds (the EC Birds Directive); and,
- Wildlife and Countryside Act 1981 (as amended) [WCA].

1.2.4 Annex 1 of the EC Birds Directive lists rare and vulnerable species of regularly occurring or migratory wild birds that are subject to special conservation measures. The Directive also provides for the designation of SPAs for the protection of these species, which form part of the Natura 2000 network of sites protected by European wildlife legislation.

1.2.5 Part 1 of the WCA sets out how the provisions of the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention'), the EC Birds Directive and the EC Habitats Directive are implemented in Great Britain. Under Part 1, Section 1 of the WCA it is an offence to:

- Kill, injure or take any wild bird intentionally;
- Take, damage or destroy the nest of any wild bird while that nest is in use or being built; and,
- Take or destroy the egg(s) of any wild bird.

1.2.6 Schedule 1 of the WCA lists a number of species which, in addition to the provisions listed above, are protected by special penalties at all times, including against disturbance when breeding.

1.2.7 The WCA requires the prosecuting authority to prove that an offence was intentional, however the Countryside and Rights of Way (CROW) Act 2000 strengthens the provisions of the WCA by introducing an additional offence of “reckless” disturbance, which means that ignorance of the presence of a protected species cannot be used as a reliable defence should a breach of the WCA be committed. The Natural Environment and Rural Communities (NERC) Act 2006 strengthens the WCA further with respect to the protection of the nests of certain birds listed on Schedule Z1A, even when they are not in use. The NERC Act also offers additional protection to birds released into the wild as part of a repopulation programme and provides minor amendments to the WCA with respect to captive birds.

1.2.8 The Environment (Wales) Act 2016 strengthens the duty previously applied under the Natural Environment and Rural Communities Act (2006) placed on planning authorities to have due regard to biodiversity when making decisions. A number of species of bird are listed on the Environment (Wales) Act 2016 Section 7 Priority Species. These are the species found in Wales which were identified as requiring action under the UK Biodiversity Action Plan (BAP) and which continue to be regarded as conservation priorities under the UK Post-2010 Biodiversity Framework. As such, it is targeted for measures necessary to support its conservation status in the UK.

c) Non Statutory Policy

1.2.9 The RSPB (2009) and Eaton *et al*. (2009) have published lists of Birds of Conservation Concern (BoCC). Red List species are those whose breeding population or range is rapidly declining (50% or more in the last 25 years), recently or historically, and those of global conservation concern. Amber List species are those whose breeding population is in moderate decline (25 – 49% in the last 25 years), rare breeders, internationally important and localised species and those of unfavourable conservation status in Europe.

1.2.10 These lists confer no legal status; however they are useful when assessing the significance of predicted impacts and determining the level of mitigation that may be required when birds are affected by development or any other activity. Furthermore, inclusion on the Red List is a factor in determining the species which may be added to the list of species of principal importance under the Environment (Wales) Act.

1.3 Quality Assurance

1.3.1 This survey and subsequent report was undertaken in line with AECOM's Integrated Management System (IMS). Our IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the international standards BS EN ISO 9001:2008 and 14001:2004 and BS OHSAS 18001:2007. In addition, our IMS requires careful selection and monitoring of the performance of all sub-consultants and contractors.

1.3.2 All AECOM Ecologists who worked on this project are members of (at the appropriate level) the Chartered Institute of Ecology and Environmental Management (CIEEM) and follow their code of professional conduct (CIEEM, 2013) when undertaking ecological work.

1.4 Methodology

a) Desk Study

1.4.1 The objective of the desk study is to review the existing information available in the public domain concerning species and habitats to identify the following:

- Internationally and nationally designated sites for birds, up to 2 km from the Project Site using the Multi Agency Geographic Information for the Countryside (MAGIC) website (NE, 2017);
- Bird records and records of locally designated sites for breeding birds up to 2 km from the Project Site, using the South East Wales Biodiversity Records Centre (SEWBReC);
- Bird species within the Section 7 list of Principal Importance for Conservation of Biological Diversity in Wales;
- Features of ecological interest surrounding the Project Site, nearby areas of ecological interest and features connecting these habitats (hedgerows, watercourses, railway lines) using aerial photographs and Ordnance Survey (OS) maps.

1.4.2 The reports of previous surveys undertaken by BSG Ecology were provided by the client and were reviewed (ES Appendix 8.16).

b) Breeding Bird Survey

1.4.3 The Project Site was visited on two occasions to identify the presence and status of breeding birds within the Project Site. Surveys were undertaken paying due regard to guidance provided in Breeding Bird Survey (BBS) methodology. All parts of the Project Site were visited on foot to within 50 m where visibility extended or closer where visibility was needed for example in woodlands or behind hedgerows. Surveys were carried out on days with little or no wind, rain or mist in order to maximise the potential for detection of birds and to avoid the possibility of bird activity being suppressed by inclement weather conditions. Surveys were completed by personnel with experience of the likely species assemblage for this geography and habitat type. Survey dates, personnel and weather conditions are shown in Table 1.1.

1.4.4 Species were identified by sight or sound and details of behaviour and activity was recorded. A range of optical equipment including binoculars and telescope were used as required and to minimise disturbance to potentially breeding species. A species list of common passerine birds was compiled for the site; details of activity and behaviour were made. The results were analysed to assess the status of the birds on site as one of the following:

- Non-breeding – Flyover or species observed within unsuitable breeding habitat;
- Possible breeding – Species observed in breeding season in suitable nesting habitat;
- Probable breeding – Pair observed in suitable nesting habitat in breeding season, territorial behaviour observed on at least two occasions, courtship and display observed, observed visiting probable nest site, agitated behaviour or anxiety calls from adults or nest building observed; or
- Confirmed breeding – Used nest or eggshells, distraction display/injury feigning observed, recently fledged young, adults on nest, adult carrying faecal sac or food, nest containing eggs or nest with young seen/heard.

Table 1.1: Survey Dates, Times, Personnel and Weather Conditions

Survey date and times	Survey Personnel	Weather Conitions
17 May 2017 19.00 – 21.25	Kevin Webb CEcol	Clear with no rain, wind speed 12mph SW and temperature at start of survey 11^0C
18 May 2017 04.55 – 11.05	Kevin Webb CEcol	Clear with no rain, wind speed 8mph W and temperature at start of survey 10^0C
14 June 2017 17.25 – 22.40	Kevin Webb CEcol	Clear with no rain, wind speed 6mph S and temperature at start of survey 17^0C
15 June 2017 04.10 – 04.45*	Kevin Webb CEcol	Clear with no rain, wind speed 2mph SW and temperature at start of survey 14^0C

* see Section 1.5: Limitations

1.5 Limitations

1.5.1 BBS methodology was not followed in its entirety; species and activity were recorded on a base map and species list and locations and behaviours recorded. This gave a broad assessment of species present, potential for breeding and potential ornithological constraints at the site. Territory mapping was not undertaken since the surveys started in the later part of the breeding season and many species had fledged and were recorded through the presence of dependent (or recently independent) young as breeding.

1.5.2 The second survey visit on 14 June included an evening survey of the northern part of the Site followed by a dusk walkover of marshy grassland in the south of the Project Site looking for evidence of crepuscular species. The intention was to complete the survey of the remainder of the Project Site the next morning (15 June) from dawn onwards but the survey was unable to be completed due to a persistent threat to surveyor safety.

1.5.3 There is potential for some birds to be missed or to go unnoticed due to the nature of breeding bird surveys and possibility of birds not vocalising and/or being present in dense vegetation. When combined with previous surveys and given the relatively simple nature of habitats it is considered that the current BBS provides an accurate assessment of the ornithological value of the Project Site to breeding birds.

1.5.4 There were no further limitations to this survey.

1.6 Baseline Environment

a) Desk Study Results

1.6.1 The designated habitats, sites and features within proximity to the site that are relevant to breeding birds are listed in Table 1.2 below.

Table 1.2: Desk Study Results

Designation / Feature	Description
Nationally and Internationally Designated Sites relevant to breeding birds within 2 km	**Nant Y Crimp Site of Special Scientific Interest (SSSI)** Distance and Direction: Approximately 1.3 km west Description: Nant y Crimp is of special interest for its wet pastures, species-rich neutral grasslands and semi-natural woodland as well as associated scrub, which are host to several uncommon plant species. Although not mentioned on the citation the site is known to support breeding lapwing *Vanellus vanellus*.
Locally Designated Sites within 2 km relevant to breeding birds	**Felindre Grasslands Site of Nature Conservation Interest (SNCI)** Distance and Direction: Adjacent to the west of the Project Site boundary. Description: Native wet woodland, lowland mixed deciduous woodland, structurally-diverse and species-rich gorse scrub, and purple moor-grass and rush pasture; and a number of Section 7 listed invertebrate and bird species, and the Schedule 1 listed birds barn owl *Tyto alba* and Northern goshawk *Accipiter gentilis*. **Rhos Fawr SNCI** Distance and Direction: Adjacent to the northern Project Site boundary Description: Supporting the habitats: woodland containing ancient woodland indicator species, structurally-diverse and species-rich scrub, species-rich neutral grassland, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species. **Rhyd-Y-Pandy Valley and Grasslands SNCI** Distance and Direction: Approximately 50 m east Description: Supporting the habitats: native wet woodland, woodland containing ancient woodland indicator species, gorse stands, lowland meadow, species-rich neutral grassland, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, reedbeds, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species, and the Schedule 1 listed birds barn owl and red kite *Milvus milvus*. **Waun Garn Wen SNCI**

Designation / Feature	Description
	Distance and Direction: Approximately 200 m west Description: Supporting the habitats: native wet woodland, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species. **Pant Lasau SNCI** Distance and Direction: Approximately 250 m south Description: Supporting the habitats: native wet woodland, lowland mixed deciduous woodland, gorse stands, lowland fen, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species. **Cefn Forest Stream SNCI** Distance and Direction: Approximately 300 m south west Description: Supporting the habitats: woodland containing ancient woodland indicator species, upland mixed ash woodland, native wet woodland, lowland mixed deciduous woodland, lowland meadow, species-rich neutral grassland, structurally-diverse and species-rich scrub, degraded lowland heath, lowland fen, purple moor-grass and rush pasture, ponds, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species, and the Schedule 1 listed bird barn owl. **Lower Lliw Reservoir SNCI** Distance and Direction: Approximately 700 m north Description: Supporting the habitats: woodland containing ancient woodland indicator species, gorse stands, species-rich bracken, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species, and the Schedule 1 listed birds kingfisher *Alcedo atthis*, merlin *Falco columbarius* and red kite. **Cefn Forest Stream SNCI** Distance and Direction: Approximately 300m south west Description: Supporting the habitats: woodland containing ancient woodland indicator species, upland mixed ash woodland, native wet woodland, lowland mixed deciduous woodland, lowland meadow, species-rich neutral grassland, structurally-diverse and species-rich scrub, degraded lowland heath, lowland fen, purple moor-grass and rush pasture, ponds, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species, and the Schedule 1 listed bird barn owl.

Designation / Feature	Description
Bird records from the last 10 years within 2 km	**The following bird species have been recorded within 2 km of the Project Site within the last ten years**: Lesser redpoll *Acanthis cabaret*, goshawk, skylark *Alauda arvensis*, kingfisher, tree pipit *Anthus trivialis*, little ringed plover *Charadrius dubius*, ringed plover *Charadrius hiaticula*, black-headed gull *Chroicocephalus ridibundus*, cuckoo *Cuculus canorus*, lesser spotted woodpecker *Dendrocopos minor*, yellowhammer *Emberiza citronella*, reed bunting *Emberiza schoeniclus*, merlin, peregrine *Falco peregrinus*, hobby *Falco subbuteo*, kestrel *Falco tinnunculus*, pied flycatcher *Ficedula hypoleuca*, linnet *Linaria cannabina*, grasshopper warbler *Locustella naevia*, common crossbill *Loxia curvirostra*, common scoter *Melanitta nigra*, red kite, spotted flycatcher *Muscicapa striata*, curlew *Numenius arquata*, osprey *Pandion haliaetus*, house sparrow *Passer domesticus*, wood warbler *Phylloscopus sibilatrix*, willow tit *Poecile montana*, marsh tit *Poecile palustris*, dunnock *Prunella modularis*, bullfinch *Pyrrhula pyrrhula*, starling *Sturnus vulgaris*, redwing *Turdus iliacus*, song thrush *Turdus philomelos*, fieldfare *Turdus pilaris*, barn owl and lapwing.
Priority Species – Listed on The Environment Act (Wales) 2016 Section 7	Fifty one species are listed on Section 7 of which nineteen are of potential relevance to the Project Site: tree pipit, lesser redpoll, linnet, cuckoo, lesser spotted woodpecker, yellowhammer, reed bunting, kestrel, pied flycatcher, grasshopper warbler, yellow wagtail *Motacilla flava*, spotted flycatcher, house sparrow, dunnock, willow tit, marsh tit, bullfinch, skylark, wood warbler, turtle dove, *Streptopelia turtur*, starling, song thrush and lapwing.
Surrounding Land Use	The Project Site is located to the north of Junction 46 of the M4 Motorway close to the village of Felindre, Swansea. The Project Site has agricultural fields to the east, south and north. Areas of woodland are located to the south, east and west of the Site. Areas of the National Grid Compound with associated roads and buildings are partially within and adjacent to the Project Site boundary. A water treatment works is located in the north west outside of the Project Site boundary.
Previous Surveys undertaken by BSG Ecology	The client provided AECOM with the reports of previous surveys undertaken in 2014 by BSG Ecology within the Site (ES Appendix 8.16). The red line boundary included within these reports is different to the 2017 Project Site boundary. It was noted that the 2017 Project Site boundary is smaller than the red line boundary used by BSG Ecology in 2014. However, the current Project Site boundary is within the same area as the 2014 red line boundary provided to BSG Ecology and therefore the surveys undertaken would have captured the current Project Site area. The 2014 BSG Ecology Breeding Bird Survey Report identified 30 species of birds breeding within the Project Site and an additional 23 species using the Project Site or flying over. The surveys were

Designation / Feature	Description
	undertaken on three dates between April and June under suitable weather conditions (Appendix 8.16).

b) Breeding Bird Survey Results

1.6.2 A breeding bird survey was conducted at the Project Site on two occasions during May and June 2017. The results are summarised in Table 1.3. Birds were considered to be confirmed breeding if either direct evidence of nesting was found (active nest or adult bird carrying food or faecal pellet) or if males were observed displaying territorial behaviour (singing, calling or aggression) in suitable habitat for breeding on each visit. An assemblage of common birds typical of the habitats on Project Site was recorded. No Annex 1 or Schedule 1 birds were recorded.

1.6.3 Out of a total of 45 species recorded only swift was definitely not breeding within the Project Site boundary. Twelve species listed on Section 7 were recorded all of which may have been breeding within the Project Site boundary or immediate surrounds: bullfinch, cuckoo, dunnock, house sparrow, lapwing, lesser redpoll, linnet, reed bunting, skylark, song thrush, starling and tree pipit. Ten species are also listed on the BoCC Red list: cuckoo, house sparrow, lapwing, lesser redpoll, linnet, mistle thrush, skylark, song thrush, starling and tree pipit. Eight further species were recorded which are listed on the BoCC Amber List: bullfinch, dunnock, meadow pipit, redstart, reed bunting, swift, tawny owl and willow warbler.

Table 1.3: Summary of Birds and Behaviour recorded during Breeding Bird Survey

Species	Number Recorded		Summary	Breeding Status	Species Designation
	Visit 1	Visit 2			
Barn swallow	4	7	Hunting throughout the Site on each visit, may breed in farm buildings	Possible breeding.	
Blackbird	9	9 (5 juv)	Up to seven pairs may have bred but breeding confirmed of at least two pairs.	Confirmed breeding	
Blackcap	12	17	Up to 8 singing males recorded and fledged young recorded on second visit.	Confirmed breeding.	
Bullfinch	3	6	Recently fledged young recorded on second visit.	Confirmed breeding	Section 7 BoCC Amber List
Blue tit	24	16 (inc. juv)	Common throughout woodland and mature hedgerows. Up to 12 pairs likely to have bred.	Confirmed breeding	
Carrion crow	34	9	One active nest found on first visit and common throughout. Up to 6 pairs	Confirmed breeding	

Species	Number Recorded		Summary	Breeding Status	Species Designation
	Visit 1	Visit 2			
			likely to breed.		
Chiff-chaff	15	10	Peak count of 15 singing males on first visit indicative of likely number of pairs.	Probable breeding	
Chaffinch	16	9	Up to 16 singing/calling males recorded with 4 family parties on second visit. Likely to be up to 12 pairs breeding.	Confirmed breeding	
Collared dove	2		One pair observed on first visit only.	Possible breeding	
Common buzzard	2	2	Pair soaring over site on both visits likely to be breeding within site or locally.	Probable breeding	
Cuckoo	2	1	Male heard calling from close to substation on first visit and outside of site further west	Possible breeding	Section 7 BoCC Red List
Dunnock	8	4	Common across the Site with up to 8 pairs likely to breed	Probable breeding	Section 7 BoCC Amber List
Garden warbler	2	1	Two males singing from close to substation on visit 1 and one male in the same location on visit 2	Probable breeding	
Goldcrest	4	5	Four singing males recorded first visit and fledged young seen in family party on second visit.	Confirmed breeding	
Goldfinch	23	3	Up to six singing/calling males on first visit and small feeding groups. Up to 6 pairs likely to have bred.	Probable breeding	
Great spotted woodpecker		1	One flying over south of site on visit two	Possible breeding	
Great tit	9	2	Up to five pairs likely to breed in woodland.	Probable breeding	
Greenfinch	5	1	Up to 3 singing/calling males and two with associated females recorded on first visit	Probable breeding	
House	31	4	Present around farm	Probable	Section 7

Species	Number Recorded		Summary	Breeding Status	Species Designation
	Visit 1	Visit 2			
sparrow			buildings just outside Site. Up to 12 pairs likely to breed locally.	breeding	BoCC Red List
Jackdaw	14		Feeding flock observed on first visit only. May breed locally	Possible breeding	
Jay	2		Two birds heard calling from substation area on first visit	Possible breeding	
Lapwing	3		Up to two pairs may breed in fields to the north of the Project Site although only recorded immediately outside of Project Site boundary chasing corvids.	Possible breeding	Section 7 BoCC Red List
Lesser redpoll	6		Three pairs heard calling in flight on first visit	Possible breeding	Section 7 BoCC Red List
Lesser whitethroat	1	3	One pair bred on site in mature hedgerow in southern part of the Project Site. Observed feeding young on second visit.	Confirmed breeding	
Linnet	5		Small feeding party observed in northern part of the Project Site	Possible breeding	Section 7 BoCC Red List
Long tailed tit		6	Family party observed on second visit only near the Project Site boundary in west.	Probable breeding	
Meadow pipit	8	11	Commonly occurring and presumed breeding in marshy grassland across the Site with up to 5 pairs likely.	Probable breeding	BoCC Amber List
Mistle thrush	4	2	Small family party seen in field at northern part of the Project Site on first visit and two juveniles on second survey in same area.	Probable breeding	BoCC Red List
Nuthatch	1		One bird heard calling on first visit close to substation.	Possible breeding	
Pied wagtail	2		One pair seen carrying food near the centre of	Confirmed breeding	

Species	Number Recorded		Summary	Breeding Status	Species Designation
	Visit 1	Visit 2			
			the Site on first visit.		
Raven	1		Single bird flying over on first visit.	Possible breeding	
Robin	18	11	Common breeder with adults and young observed on each survey. Likely to be up to 15 pairs breeding.	Confirmed breeding	
Rook	45	19	Seen feeding in fields with sheep to the south of the Site on each visit.	Possible breeding	
Redstart	3	1	Three alarm calling males observed on first visit likely to be indicative of breeding of up to three pairs.	Probable breeding	BoCC Amber List
Reed bunting	3		Two males one definitely paired observed in marshy grassland.	Probable breeding.	Section 7 BoCC Amber List
Skylark	4	4	Four singing males observed on each visit three from south and one in north of Site.	Probable breeding.	Section 7 BoCC Red List
Song thrush	8	2	Eight singing males recorded on first visit although survey commenced late in season so probably under-recorded. Up to 12 pairs likely to breed.	Probable breeding.	Section 7 BoCC Red List
Stonechat	2	2	One pair observed close to the centre of the Site and a pair observed along the northern boundary on the second survey. Rookery on site.	Probable breeding.	
Starling	13	2	Small feeding flock on first visit and two fledged juveniles recorded on second visit. Likely to breed in farm buidlings within or close to Project Site.	Confirmed breeding	Section 7 BoCC Red List
Swift	16		Hunting over marshy grassland at dusk on first visit.	Not breeding	BoCC Amber List
Tawny owl		1	Male heard calling on second visit only in	Possible breeding	BoCC Amber List

Species	Number Recorded		Summary	Breeding Status	Species Designation
	Visit 1	Visit 2			
			woodland south of the Project Site boundary.		
Tree pipit	4	1	Adults only observed in south of the Project Site on both visits.	Probable breeding	Section 7 BoCC Red List
Whitethroat	13	5	Up to eight pairs likely to breed. Common in scrub and mature hedgerows across the Project Site.	Probable breeding	
Wren	21	7	Common breeding species throughout the Site with up to 15 pairs likely. Juveniles being fed observed on second visit	Confirmed breeding	
Willow warbler	24	9 (including juv recently fledged)	Common breeder throughout the Project Site. Up to 20 pairs likely.	Confirmed breeding	BoCC Amber List

1.7 Conclusions

1.7.1 The Site supports a varied assemblage of breeding birds typical of the size, habitat types and regional location. The surveys undertaken in both 2014 and 2017 produced very similar results which is unsurprising considering that the habitats and management practices have changed little between the two surveys.

1.8 Preliminary Recommendations

a) Recommendations for Further Surveys

1.8.1 A full assessment of required further surveys has been made during EcIA and reported in the ES. At this stage it is anticipated that further surveys should be undertaken in early 2018 in order to fully assess the assemblage of species using the Project Site earlier in the season.

b) Recommendations for Mitigation

1.8.2 A full series of recommendations for further surveys and mitigation at construction and operation has been undertaken for the EcIA. Mitigation should focus on avoiding removal of habitat within the bird breeding season of March – August inclusive and to ensure that replacement landscape planting seeks to provide alternative habitat for those species present.

c) Recommendations for Biodiversity Enhancement

1.8.3 A full series of recommendations for biodiversity enhancement has been made during the EcIA and reported in the ES. At this stage the following preliminary recommendations have been made for general biodiversity enhancements:

- Provide nesting boxes in woodland and buildings for a range of species including house sparrow, starling and tawny owl; and,
- Improve the availability of breeding and foraging habitat within the Project Site by planting new scrub, hedgerows, and infilling current gaps in hedgerows with whips and creating green corridors. It is recommended to use native species.

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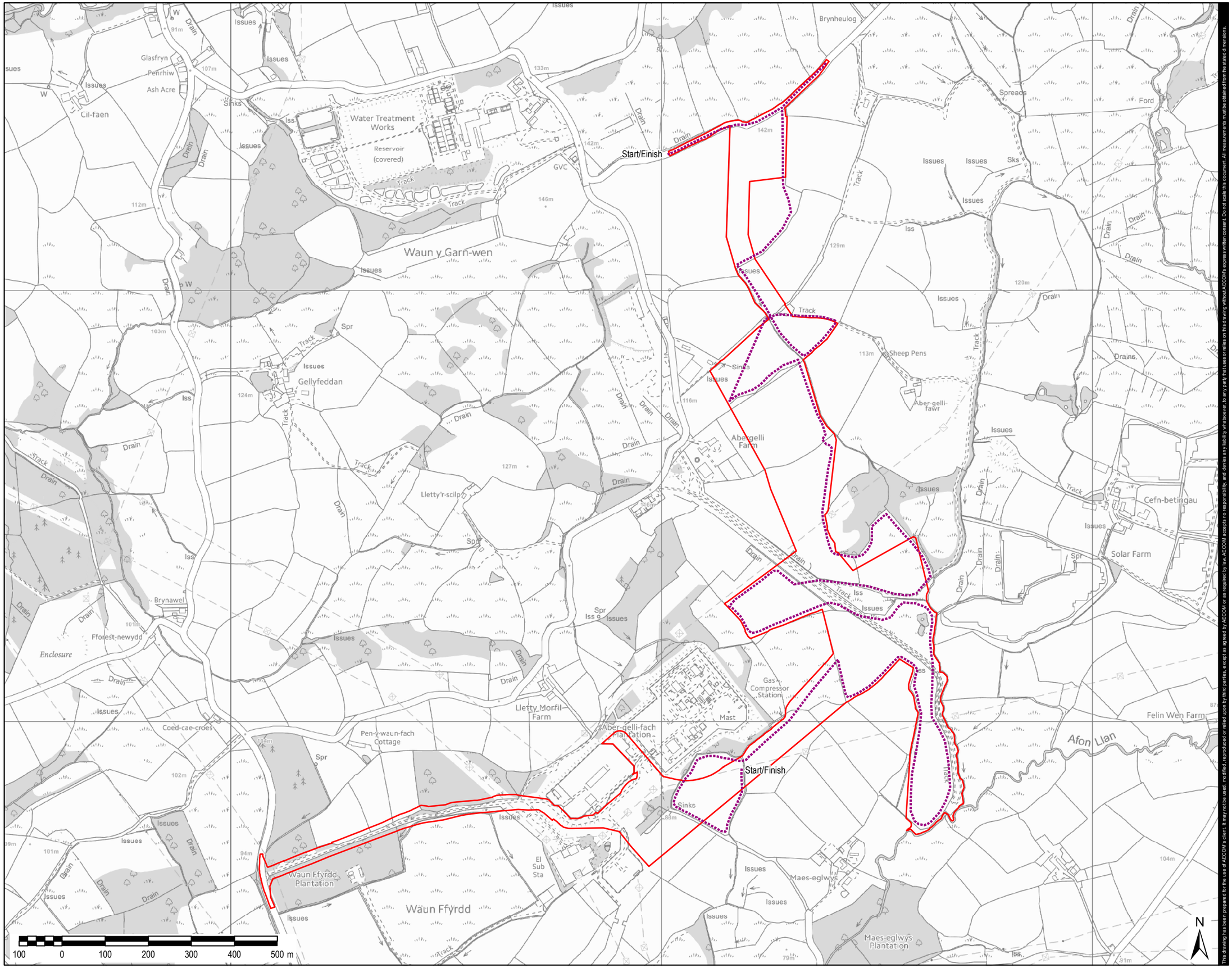
Figure 1 Breeding Bird Survey Transect


Start/Finish
Start/Finish
Water Treatment Works
Reservoir (covered)
Waun y Garn-wen
Gellyfeddan
Llwyn-y-gog
Llwyn-y-gog Plantation
Llwyn-y-gog Cottage
Llwyn-y-gog Farm
Llwyn-y-gog Quarry
Llwyn-y-gog Mast
Llwyn-y-gog Tip
Llwyn-y-gog Tip (Disused)
Llwyn-y-gog Tip (Disused)
Llwyn-y-gog Tip (Disused)

Appendix 3.6b

Breeding Bird Update Survey Report

Abergelli Power Project Breeding Bird Update Survey

Abergelli Power Limited
June 2018

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1. Breeding Bird Survey Report

1.1 Introduction

1.1.1 AECOM was commissioned to undertake a suite of ecological survey work to inform the Abergelli Power Project (the "Project"), and support the Environmental Statement (ES).

1.1.2 The Project Site is located near to the village of Felindre, Swansea, as shown in Figure 1, and the central grid reference for the Project Site is SN65280143. A full description of the development is provided in ES Chapter 3 (Project and Site Description).

1.1.3 The Preliminary Ecological Appraisal Report (Appendix 8.1) identified that surveys for breeding birds were required at the Project Site.

1.1.4 This baseline report describes the status of breeding birds within the breeding bird survey area and makes initial indications of potential effects and outlines initial recommendations for further surveys, mitigation and enhancement.

1.1.5 The breeding bird survey area encompasses all suitable and accessible areas of woodland, hedgerows and scrub within proximity of and within the Project Site Boundary, as shown on Figure 1.

1.1.6 Additional surveys were undertaken after the submission of the ES in May 2018, therefore this report is provided as an update to the Breeding Birds Report, ES Appendix 8.6.

1.1.7 Surveys have been undertaken in 2017 and 2018. Surveys undertaken in 2017 were focussed on a larger area that encompassed the Project Site Boundary due to the uncertainty of the Project Site Boundary at the time of survey. Surveys undertaken in 2018 were focused within the Project Site Boundary only. Previous surveys have been undertaken by BSG Ecology are provided in the ES Appendix 8.16.

a) Objectives of the Study

1.1.8 The objectives of this study were:

- To identify any designated nature conservation sites within or in the vicinity of the Project Site boundary that have the potential to support notable breeding bird species or assemblages;
- To identify any known records of breeding birds in the vicinity of the Project Site boundary;
- To record and map evidence of breeding bird activity;
- To make an initial ecological assessment of the value of the Project Site to breeding birds;
- To highlight any initial potential ecological constraints related to breeding birds;
- To outline further survey work that may be required; and,

- To make initial suggestions for mitigation, compensation and enhancement of the natural features identified within the Project Site with respect to the breeding bird assemblage.

1.2 Legislation

1.2.1 There are several different acts of legislation and regulations which refer to the protection of wildlife. Legislation with particular relevance to birds is outlined below.

1.2.2 This is a brief summary of the legislation and is not to be regarded as a definitive legal opinion. When dealing with individual cases, the client is advised to consult the full texts of the relevant legislation and obtain further legal advice.

b) Statutory Legislation

1.2.3 Key legislation for birds in the UK includes:

- Council Directive 79/409/EEC on the conservation of wild birds (the EC Birds Directive); and,
- Wildlife and Countryside Act 1981 (as amended) [WCA].

1.2.4 Annex 1 of the EC Birds Directive lists rare and vulnerable species of regularly occurring or migratory wild birds that are subject to special conservation measures. The Directive also provides for the designation of SPAs for the protection of these species, which form part of the Natura 2000 network of sites protected by European wildlife legislation.

1.2.5 Part 1 of the WCA sets out how the provisions of the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention'), the EC Birds Directive and the EC Habitats Directive are implemented in Great Britain. Under Part 1, Section 1 of the WCA it is an offence to:

- Kill, injure or take any wild bird intentionally;
- Take, damage or destroy the nest of any wild bird while that nest is in use or being built; and,
- Take or destroy the egg(s) of any wild bird.

1.2.6 Schedule 1 of the WCA lists a number of species which, in addition to the provisions listed above, are protected by special penalties at all times, including against disturbance when breeding.

1.2.7 The WCA requires the prosecuting authority to prove that an offence was intentional, however the Countryside and Rights of Way (CROW) Act 2000 strengthens the provisions of the WCA by introducing an additional offence of "reckless" disturbance, which means that ignorance of the presence of a protected species cannot be used as a reliable defence should a breach of the WCA be committed. The Natural Environment and Rural Communities (NERC) Act 2006 strengthens the WCA further with respect to the protection of the nests of certain birds listed on Schedule Z1A, even when they are not in use. The NERC Act also offers additional protection to birds released into the wild as part of a repopulation programme and provides minor amendments to the WCA with respect to captive birds.

1.2.8 The Environment (Wales) Act 2016 strengthens the duty previously applied under the Natural Environment and Rural Communities Act (2006) placed on planning authorities to have due regard to biodiversity when making decisions. A number of species of bird are listed on the Environment (Wales) Act 2016 Section 7 Priority Species. These are the species found in Wales which were identified as requiring action under the UK Biodiversity Action Plan (BAP) and which continue to be regarded as conservation priorities under the UK Post-2010 Biodiversity Framework. As such, it is targeted for measures necessary to support its conservation status in the UK.

c) Non Statutory Policy

1.2.9 The RSPB (2009) and Eaton *et al*. (2009) have published lists of Birds of Conservation Concern (BoCC) which are regularly updated to reflect recent trends in bird populations. Red List species are those whose breeding population or range is rapidly declining (50% or more in the last 25 years), recently or historically, and those of global conservation concern. Amber List species are those whose breeding population is in moderate decline (25 – 49% in the last 25 years), rare breeders, internationally important and localised species and those of unfavourable conservation status in Europe.

1.2.10 These lists confer no legal status; however they are useful when assessing the significance of predicted impacts and determining the level of mitigation that may be required when birds are affected by development or any other activity. Furthermore, inclusion on the Red List is a factor in determining the species which may be added to the list of species of principal importance under the Environment (Wales) Act.

1.3 Quality Assurance

1.3.1 This survey and subsequent report was undertaken in line with AECOM's Integrated Management System (IMS). Our IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the international standards BS EN ISO 9001:2008 and 14001:2004 and BS OHSAS 18001:2007. In addition, our IMS requires careful selection and monitoring of the performance of all sub-consultants and contractors.

1.3.2 All AECOM Ecologists who worked on this project are members of (at the appropriate level) the Chartered Institute of Ecology and Environmental Management (CIEEM) and follow their code of professional conduct (CIEEM, 2017) when undertaking ecological work.

1.4 Methodology

a) Desk Study

1.4.1 The objective of the desk study is to review the existing information available in the public domain concerning species and habitats to identify the following:

- Internationally and nationally designated sites for birds, up to 2 km from the Project Site using the Multi Agency Geographic Information for the Countryside (MAGIC) website (NE, 2017);
- Bird records and records of locally designated sites for breeding birds up to 2 km from the Project Site, using the South East Wales Biodiversity Records Centre (SEWBReC);
- Bird species within the Section 7 list of Principal Importance for Conservation of Biological Diversity in Wales;
- Features of ecological interest surrounding the Project Site, nearby areas of ecological interest and features connecting these habitats (hedgerows, watercourses, railway lines) using aerial photographs and Ordnance Survey (OS) maps.

1.4.2 The reports of previous surveys undertaken by BSG Ecology were provided by the client and were reviewed (ES Appendix 8.16).

b) Breeding Bird Survey

1.4.3 Surveys were completed by personnel with experience of the likely species assemblage for this geography and habitat type. Survey dates, personnel and weather conditions are shown in Table 1.1.

1.4.4 Species were identified by sight or sound and details of behaviour and activity was recorded. A range of optical equipment including binoculars and telescope were used as required and to minimise disturbance to potentially breeding species. A species list of common passerine birds was compiled for the site; details of activity and behaviour were made. The results of breeding bird surveys were analysed to assess the status of the birds on site as one of the following:

- Non-breeding – Flyover or species observed within unsuitable breeding habitat;
- Possible breeding – Species observed in breeding season in suitable nesting habitat;
- Probable breeding – Pair observed in suitable nesting habitat in breeding season, territorial behaviour observed on at least two occasions, courtship and display observed, observed visiting probable nest site, agitated behaviour or anxiety calls from adults or nest building observed; or
- Confirmed breeding – Used nest or eggshells, distraction display/injury feigning observed, recently fledged young, adults on nest, adult carrying faecal sac or food, nest containing eggs or nest with young seen/heard.

i. Breeding Bird Surveys 2017

1.4.5 The Project Site was visited on two occasions to identify the presence and status of breeding birds within the Project Site. Surveys were undertaken paying due regard to guidance provided in Breeding Bird Survey (BBS) methodology. All parts of the Project Site were visited on foot to within 50 m where visibility extended or closer where visibility was needed for example in woodlands or behind hedgerows.

1.4.6 Surveys were carried out on days with little or no wind, rain or mist in order to maximise the potential for detection of birds and to avoid the possibility of bird activity being suppressed by inclement weather conditions.

ii. Breeding Bird Surveys 2018

1.4.7 Four breeding bird surveys were undertaken between April and May 2018. Surveys were undertaken paying due regard to guidance provided in BBS methodology.

1.4.8 A survey transect (located in Figure 1) was designed to encompass habitat within the Project Site boundary suitable for supporting breeding birds such as hedgerows and woodland.

1.4.9 The transect was walked at dusk and dawn on the same or consecutive day in April and May. The direction of the transect was swapped for each survey to help reduce bias. The dusk survey commenced two hours before sunset and finished at sunset. The dawn survey commenced fifteen minutes before sunrise and continued for two hours. All birds heard or seen whilst walking the transect were recorded including species, location and activity.

1.4.10 Surveys were carried out on days with little or no wind, rain or mist in order to maximise the potential for detection of birds and to avoid the possibility of bird activity being suppressed by inclement weather conditions.

1.4.11 An additional survey was undertaken in late February 2018 aimed at detecting the presence of displaying goshawk *Accipiter gentilis*. This survey paid due regard to the guidance in Raptors: a field guide for surveys and monitoring, (Hardey et al, 2013). The survey consisted of a Vantage Point watch over the area of woodland within the Project Site boundary. Goshawk seek large undisturbed blocks of woodland in which to breed and therefore the survey area was selected accordingly. The survey period deviated from that in the guidance to reflect the likely earlier breeding recorded in South Wales compared to the reference surveys further north.

Table 1.1: Survey Dates, Times, Personnel and Weather Conditions

Survey date and times	Survey Personnel	Weather Conditions
17 May 2017 19.00 – 21.25	Kevin Webb CEcol	Clear with no rain, wind speed 12mph SW and temperature at start of survey 11^{0}C
18 May 2017	Kevin Webb CEcol	Clear with no rain, wind speed 8mph W

Survey date and times	Survey Personnel	Weather Conditions
04.55 – 11.05		and temperature at start of survey 10^0C
14 June 2017 17.25 – 22.40	Kevin Webb CEcol	Clear with no rain, wind speed 6mph S and temperature at start of survey 17^0C
15 June 2017 04.10 – 04.45*	Kevin Webb CEcol	Clear with no rain, wind speed 2mph SW and temperature at start of survey 14^0C
20 February 2018 06.40 – 09.20	Lucy Foster ACIEEM	Clear with no rain, wind speed 16mph N and temperature at start of survey 4^0C
11 April 2018 18.05-20.04	Lucy Foster ACIEEM Ursula Jones CIEEM	Dry, cloud 8/8, temp 10°C, wind F2
12 April 2018 06.00-07.55	Lucy Foster ACIEEM Ursula Jones CIEEM	Dry, cloud 2/8, temp 5°C, wind F1
10 May 2018 05.15-07.20	Lucy Foster ACIEEM Ursula Jones CIEEM	Dry, cloud 0/8, temp 4°C, wind F1
10 May 2018 18.50-20.49	Lucy Foster ACIEEM Ursula Jones CIEEM	Dry, cloud 3/8, temp 14°C, wind F2

* see Section 1.5: Limitations

1.5 Limitations

1.5.1 BBS methodology was not followed in its entirety; species and activity were recorded on a base map and species list and locations and behaviours recorded. This gave a broad assessment of species present, potential for breeding and potential ornithological constraints at the site. Territory mapping was not undertaken since the assemblage of birds recorded were relatively common and as such this would not add any value to the assessment of impacts in the ES.

1.5.2 It was not possible to access the access road leading to the Felindre Gas Compressor Station and National Grid 400 kV electrical substations due to the gate being locked between the hours of 16:00 and 08:00 (Figure 1). Habitats suitable for supporting breeding birds in this area are limited to trees and hedgerows, adjacent habitats include improved and semi-improved grassland and woodland. As such, the suite of species will be similar to those found elsewhere within the Project Site boundary and this is not considered to be a significant limitation.

1.5.3 The second survey visit on 14 June 2017 included an evening survey of the northern part of the Site followed by a dusk walkover of marshy grassland in the south of the Project Site looking for evidence of crepuscular species. The intention was to complete the survey of the remainder of the Project Site the next morning (15 June 2017) from dawn onwards but the survey was unable to be completed due to a persistent threat to surveyor safety.

1.5.4 In 2018 the survey was undertaken across the entire Project Site. In 2018 the transect was reduced to include only the areas which are within the Project Site boundary. The 2018 survey area is smaller than the 2017 survey area and as such the results have been reported separately to avoid over or under valuing of the Project Site in relation to breeding birds.

1.5.5 There is potential for some birds to be missed or to go unnoticed due to the nature of breeding bird surveys and possibility of birds not vocalising and/or being present in dense vegetation. A total of six surveys have been undertaken by AECOM. When combined with previous surveys and given the relatively simple nature of habitats it is considered that the BBS as described in this report provides an accurate assessment of the ornithological value of the Project Site to breeding birds.

1.5.6 There were no further limitations to this survey.

1.6 Baseline Environment

a) Desk Study Results

1.6.1 The designated habitats, sites and features within proximity to the Project Site that are relevant to breeding birds are listed in Table 1.2 below.

Table 1.2: Desk Study Results

Designation / Feature	Description
Nationally and Internationally Designated Sites relevant to breeding birds within 2 km	**Nant Y Crimp Site of Special Scientific Interest (SSSI)** Distance and Direction: Approximately 1.3 km west Description: Nant y Crimp is of special interest for its wet pastures, species-rich neutral grasslands and semi-natural woodland as well as associated scrub, which are host to several uncommon plant species. Although not mentioned on the citation the site is known to support breeding lapwing *Vanellus vanellus*.
Locally Designated Sites within 2 km relevant to breeding birds	**Felindre Grasslands Site of Nature Conservation Interest (SINC)** Distance and Direction: Adjacent to the west of the Project Site boundary. Description: Native wet woodland, lowland mixed deciduous woodland, structurally-diverse and species-rich gorse scrub, and purple moor-grass and rush pasture; and a number of Section 7 listed invertebrate and bird species, and the Schedule 1 listed birds barn owl *Tyto alba* and Northern goshawk. **Rhos Fawr SINC** Distance and Direction: Adjacent to the northern Project Site boundary Description: Supporting the habitats: woodland containing ancient woodland indicator species, structurally-diverse and species-rich

Designation / Feature	Description
	scrub, species-rich neutral grassland, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species. **Rhyd-Y-Pandy Valley and Grasslands SINC** Distance and Direction: Approximately 50 m east Description: Supporting the habitats: native wet woodland, woodland containing ancient woodland indicator species, gorse stands, lowland meadow, species-rich neutral grassland, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, reedbeds, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species, and the Schedule 1 listed birds barn owl and red kite *Milvus milvus*. **Waun Garn Wen SINC** Distance and Direction: Approximately 200 m west Description: Supporting the habitats: native wet woodland, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species. **Pant Lasau SINC** Distance and Direction: Approximately 250 m south Description: Supporting the habitats: native wet woodland, lowland mixed deciduous woodland, gorse stands, lowland fen, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species. **Cefn Forest Stream SINC** Distance and Direction: Approximately 300 m south west Description: Supporting the habitats: woodland containing ancient woodland indicator species, upland mixed ash woodland, native wet woodland, lowland mixed deciduous woodland, lowland meadow, species-rich neutral grassland, structurally-diverse and species-rich scrub, degraded lowland heath, lowland fen, purple moor-grass and rush pasture, ponds, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species, and the Schedule 1 listed bird barn owl. **Lower Lliw Reservoir SINC** Distance and Direction: Approximately 700 m north Description: Supporting the habitats: woodland containing ancient woodland indicator species, gorse stands, species-rich bracken,

Designation / Feature	Description
	structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species, and the Schedule 1 listed birds kingfisher *Alcedo atthis*, merlin *Falco columbarius* and red kite. **Cefn Forest Stream SINC** Distance and Direction: Approximately 300m south west Description: Supporting the habitats: woodland containing ancient woodland indicator species, upland mixed ash woodland, native wet woodland, lowland mixed deciduous woodland, lowland meadow, species-rich neutral grassland, structurally-diverse and species-rich scrub, degraded lowland heath, lowland fen, purple moor-grass and rush pasture, ponds, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species, and the Schedule 1 listed bird barn owl.
Bird records from the last 10 years within 2 km	**The following bird species have been recorded within 2 km of the Project Site within the last ten years**: Lesser redpoll *Acanthis cabaret*, Northern goshawk, skylark *Alauda arvensis*, kingfisher, tree pipit *Anthus trivialis*, little-ringed plover *Charadrius dubius*, ringed plover *Charadrius hiaticula*, black-headed gull *Chroicocephalus ridibundus*, cuckoo *Cuculus canorus*, lesser spotted woodpecker *Dendrocopos minor*, yellowhammer *Emberiza citronella*, reed bunting *Emberiza schoeniclus*, merlin, peregrine *Falco peregrinus*, hobby, kestrel *Falco tinnunculus*, pied flycatcher *Ficedula hypoleuca*, linnet *Linaria cannabina*, grasshopper warbler *Locustella naevia*, common crossbill *Loxia curvirostra*, common scoter *Melanitta nigra*, red kite, spotted flycatcher *Muscicapa striata*, curlew *Numenius arquata*, osprey *Pandion haliaetus*, house sparrow *Passer domesticus*, wood warbler *Phylloscopus sibilatrix*, willow tit *Poecile montana*, marsh tit *Poecile palustris*, dunnock *Prunella modularis*, bullfinch *Pyrrhula pyrrhula*, starling *Sturnus vulgaris*, redwing *Turdus iliacus*, song thrush *Turdus philomelos*, fieldfare *Turdus pilaris*, barn owl and lapwing.
Priority Species – Listed on The Environment Act (Wales) 2016 Section 7	Fifty one species are listed on Section 7 of which nineteen are of potential relevance to the Project Site: tree pipit, lesser redpoll, linnet, cuckoo, lesser spotted woodpecker, yellowhammer, reed bunting, kestrel, pied flycatcher, grasshopper warbler, yellow wagtail *Motacilla flava*, spotted flycatcher, house sparrow, dunnock, willow tit, marsh tit, bullfinch, skylark, wood warbler, turtle dove, *Streptopelia turtur*, starling, song thrush and lapwing.
Surrounding Land Use	The Project Site is located to the north of Junction 46 of the M4 motorway close to the village of Felindre, Swansea. The Project Site has agricultural fields to the east, south and north. Areas of woodland are located to the south, east and west of the Project Site. Areas of the National Grid Compound with

Designation / Feature	Description
	associated roads and buildings are partially within and adjacent to the Project Site boundary. A water treatment works is located in the north west outside of the Project Site boundary.
Previous Surveys undertaken by BSG Ecology	The client provided AECOM with the reports of previous surveys undertaken in 2014 by BSG Ecology within the Site (ES Appendix 8.16). The red line boundary included within these reports is different to the 2017 Project Site boundary. It was noted that the 2017 Project Site boundary is smaller than the red line boundary used by BSG Ecology in 2014. However, the current Project Site boundary is within the same area as the 2014 red line boundary provided to BSG Ecology and therefore the surveys undertaken would have captured the current Project Site area. The 2014 BSG Ecology Breeding Bird Survey Report identified 30 species of birds breeding within the Project Site and an additional 23 species using the Project Site or flying over. The surveys were undertaken on three dates between April and June under suitable weather conditions (ES Appendix 8.16).

b) Breeding Bird Survey Results

1.6.2 A breeding bird survey was conducted at the Project Site on two occasions during May and June 2017, four occasions during April and May 2018, and one occasion in February 2018 aimed at identifying the presence of Northern goshawk. The results of the BBS are summarised in Table 1.3.

1.6.3 Birds were considered to be confirmed breeding if either direct evidence of nesting was found (active nest or adult bird carrying food or faecal pellet) or if males were observed displaying territorial behaviour (singing, calling or aggression) in suitable habitat for breeding on each visit. An assemblage of common birds typical of the habitats on the Project Site was recorded. One red kite was recorded during the survey in February 2018 soaring over woodland outside of the Project Site Boundary but otherwise there were no records of Annex 1 or Schedule 1 breeding species (including Northern goshawk).

1.6.4 Results have been split into 2017 and 2018 due to the variation in survey area. The results from 2018 are more representative of the actual impacts of the scheme as they were undertaken over a reduced survey area within the Project Site Boundary.

1.6.5 Out of a total of 45 species recorded only swift was definitely not breeding within the Project Site Boundary. Twelve species listed on Section 7 were recorded all of which may have been breeding within the Project Site Boundary or immediate surrounds: bullfinch, cuckoo, dunnock, house sparrow, lapwing, lesser redpoll, linnet, reed bunting, skylark, song thrush, starling and tree pipit. Ten species are also listed on the BoCC Red List: cuckoo, house sparrow, lapwing, lesser redpoll, linnet, mistle thrush, skylark, song thrush, starling and tree pipit. Eight further species were recorded which are listed on the BoCC Amber List: bullfinch, dunnock, meadow pipit, redstart, reed bunting, swift, tawny owl and willow warbler.

c) Incidental Records During Goshawk Suvrey

1.6.6 The following species were recorded during the goshawk survey around the vantage point :

- Robin;
- Dunnock;
- Blackbird;
- Song thrush;
- Starling;
- Carrion crow;
- Wood pigeon;
- Canada goose;
- Jay;
- Great tit;
- Bullfinch – pair;
- Herring gull;
- Green woodpecker;
- Magpie;
- Fieldfare;
- House sparrow;
- Chaffinch;
- Goldfinch;
- Jackdaw;
- Blue tit;
- Pied wagtail;
- Nuthatch;
- Red kite; and,
- Mistle thrush

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Table 1.3: Summary of Birds and Behaviour Recorded during Breeding Bird Survey

Species	Survey						Summary 2017	Breeding Status 2017	Summary 2018	Breeding Status 2018	Species Designation
	Visit 1 (2017)	Visit 2 (2017)	Visit 4 (2018)	Visit 5 (2018)	Visit 6 (2018)	Visit 7 (2018)					
Barn swallow	4	7	0	0	0	6	Hunting throughout the Project Site on several visits, may breed in farm buildings.	Possible breeding	Hunting throughout the Site on final visit.	Possible breeding	N/A
Blackbird	9	9 (5 juv)	10	8	15	12	Up to seven pairs may have bred but breeding confirmed of at least two pairs.	Confirmed breeding	Up to eleven pairs probably breeding.	Probable breeding	N/A
Blackcap	12	17	1	1	1	0	Up to eight singing males recorded and fledged young recorded on second visit.	Confirmed breeding.	Recorded in woodland around substation.	Probable breeding	N/A
Bullfinch	3	6	0	0	0	0	Recently fledged young recorded on second visit.	Confirmed breeding	N/A	N/A	Section 7 BoCC Amber List
Blue tit	24	16 (inc. juv)	10	8	10	7	Common throughout woodland and mature hedgerows. Up to twelve pairs likely to have bred.	Confirmed breeding	Common throughout woodland and mature hedgerows. Up to five pairs likely to have bred.	N/A	N/A
Carrion crow	34	9	2	0	0	0	One active nest found on first visit and common throughout. Up to six pairs likely to breed.	Confirmed breeding	N/A	N/A	N/A
Chiff-chaff	15	10	4	10	2	1	Peak count of fifteen singing males on first visit indicative of likely number of pairs.	Probable breeding	Peak count of ten singing males on first visit indicative of likely number of pairs.	Probable breeding	N/A
Chaffinch	16	9	3	2	0	4	Up to sixteen singing/calling males recorded with four family parties on second visit. Likely to be up to twelve pairs breeding.	Confirmed breeding	Up to four singing/calling males recorded across the Site.	Probable breeding	N/A
Coal tit	0	0	2	2	0	2	N/A	N/A	Up to two pairs probably breeding.	Probable breeding	N/A
Collared dove	2	0	0	0	0	0	One pair observed on first visit only.	Possible breeding	N/A	N/A	N/A
Common buzzard	2	2	0	0	0	0	Pair soaring over Project Site on both visits likely to be breeding within Project Site or locally.	Probable breeding	N/A	N/A	N/A
Cuckoo	2	1	0	0	2	0	Male heard calling from close to substation on first visit and outside of Project Site further west	Possible breeding	Male heard calling around centre of the Project Site.	Possible breeding	Section 7 BoCC Red List
Dunnock	8	4	4	3	2	4	Common across the Project Site with up to eight pairs likely to breed	Probable breeding	Common across the Project Site with up to four pairs likely to breed	Probable breeding	Section 7 BoCC Amber List
Garden warbler	2	1	0	0	0	0	Two males singing from close to substation on first visit and one male in the same location on second visit.	Probable breeding	N/A	N/A	N/A
Goldcrest	4	5	1	1	0	1	Four singing males recorded first visit and fledged young seen in family party on second visit.	Confirmed breeding	One singing male recorded in south east of the Project Site	Probable breeding	N/A
Goldfinch	23	3	5	4	6	11	Up to six singing/calling males on	Probable	Up to four singing/calling	N/A	N/A

Species	Survey						Summary 2017	Breeding Status 2017	Summary 2018	Breeding Status 2018	Species Designation
	Visit 1 (2017)	Visit 2 (2017)	Visit 4 (2018)	Visit 5 (2018)	Visit 6 (2018)	Visit 7 (2018)					
							first visit and small feeding groups. Up to six pairs likely to have bred.	breeding	males, one pair and small feeding groups. Up to five pairs likely to have bred.		
Great spotted woodpecker	0	1	0	0	0	0	One flying over south of Project Site on visit two.	Possible breeding	N/A	N/A	N/A
Great tit	9	2	7	5	9	1	Up to five pairs likely to breed in woodland.	Probable breeding	Up to nine pairs likely to breed in woodland.	N/A	N/A
Green woodpecker	0	0	0	1	0	1	N/A	N/A	One pair likely to breed in woodland.	Probable breeding	N/A
Greenfinch	5	1	1	0	0	0	Up to three singing/calling males and two with associated females recorded on first visit.	Probable breeding	One singing male recorded on first visit.	Probable breeding	N/A
House sparrow	31	4	0	1	1	1	Present around farm buildings just outside the Project Site. Up to twelve pairs likely to breed locally.	Probable breeding	Recorded around buildings.	Probable breeding	Section 7 BoCC Red List
Herring gull	0	0	2	0	0	0	N/A	N/A	Flyover.	Non-breeding	BoCC Red List
Jackdaw	14	0	0	0	0	0	Feeding flock observed on first visit only. May breed locally.	Possible breeding	N/A	N/A	N/A
Jay	2	0	0	0	1	0	Two birds heard calling from substation area on first visit.	Possible breeding	One bird calling in woodland around substation.	Possible breeding	N/A
Lapwing	3	0	0	0	6	0	Up to two pairs recorded, may breed in fields to the north of the Project Site although only recorded immediately outside of Project Site Boundary chasing corvids.	Possible breeding	Three pairs recorded displaying, recorded between fields in the north of the Project Site and to the north beyond the Project Site Boundary. Likely to breed outside of the Project Site Boundary due to absence of suitable habitat in the north of the Site and suitable habitat availability to the north of the Site.	Non breeding (Probable breeding outside Project Site)	Section 7 BoCC Red List
Lesser redpoll	6	0	5	0	0	0	Three pairs heard calling in flight on first visit.	Possible breeding	Pair and flock of three recorded in flight during early visit.	Possible breeding	Section 7 BoCC Red List
Lesser whitethroat	1	3	0	0	0	0	One pair bred on site in mature hedgerow in southern part of the Project Site. Observed feeding young on second visit.	Confirmed breeding	N/A	N/A	N/A
Linnet	5	0	0	4	0	0	Small feeding party observed in northern part of the Project Site.	Possible breeding	Small party observed in flight in southern part of the Project Site.	Possible breeding	Section 7 BoCC Red List
Long tailed tit	0	6	2	2	0	0	Family party observed near the Project Site Boundary in west.	Probable breeding	Pairs and individual birds recorded in the south of the Project Site.	Probable breeding	N/A

Species	Survey						Summary 2017	Breeding Status 2017	Summary 2018	Breeding Status 2018	Species Designation
	Visit 1 (2017)	Visit 2 (2017)	Visit 4 (2018)	Visit 5 (2018)	Visit 6 (2018)	Visit 7 (2018)					
Meadow pipit	8	11	1	1	0	2	Commonly occurring and presumed breeding in marshy grassland across the Project Site with up to five pairs likely.	Probable breeding	Recorded in marshy grassland in the south of the Project Site.	N/A	BoCC Amber List
Mistle thrush	4	2	0	0	0	1	Small family party seen in field at northern part of the Project Site on first visit and two juveniles on second survey in same area.	Probable breeding	One individual recorded in south of the Project Site.	N/A	BoCC Red List
Nuthatch	1	0	0	1	2	1	One bird heard calling on first visit close to substation.	Possible breeding	Heard calling in woodland in the centre of the Project Site and around substation.	Probable breeding	N/A
Pied wagtail	2	0	0	0	0	1	One pair seen carrying food near the centre of the Project Site on first visit	Confirmed breeding	Single bird flying over, near woodland.	Possible breeding	N/A
Raven	1	0	0	0	0	0	Single bird flying over on first visit.	Possible breeding	N/A	N/A	N/A
Robin	18	11	18	22	10	16	Common breeder with adults and young observed on each survey. Likely to be up to fifteen pairs breeding.	Confirmed breeding	Common across the Project Site in woodland and hedgerows, up to twenty pairs.	Probable breeding.	N/A
Rook	45	19	16	1	0	0	Seen feeding in fields with sheep to the south of the Project Site on each visit.	Possible breeding	Flock of ten and five recorded in centre of the Project Site. Flew from large tree, possible rookery.	Possible breeding	N/A
Redstart	3	1	0	0	0	0	Three alarm calling males observed on first visit likely to be indicative of breeding of up to three pairs.	Probable breeding	N/A	N/A	BoCC Amber List
Reed bunting	3	0	0	0	0	0	Two males one definitely paired observed in marshy grassland.	Probable breeding.	N/A	N/A	Section 7 BoCC Amber List
Skylark	4	4	0	0	3	1	Four singing males observed on each visit three from south and one in north of Project Site.	Probable breeding.	Singing males observed across the Project Site.	Probable breeding.	Section 7 BoCC Red List
Song thrush	8	2	8	9	7	4	Eight singing males recorded on first visit although survey commenced late in season so probably under-recorded. Up to twelve pairs likely to breed.	Probable breeding.	Up to nine singing males recorded across the Project Site.	N/A	Section 7 BoCC Red List
Stonechat	2	2	0	1	2	4	One pair observed close to the centre of the Project Site and a pair observed along the northern boundary on the second survey.	Probable breeding.	Up to two pairs. One pair observed close to the centre of the Project Site and a pair observed along the northern boundary.	N/A	N/A
Starling	13	2	0	0	0	0	Small feeding flock on first visit and two fledged juveniles recorded on second visit. Likely to breed in farm buildings within or close to Project Site.	Confirmed breeding	N/A	N/A	Section 7 BoCC Red List

Species	Survey						Summary 2017	Breeding Status 2017	Summary 2018	Breeding Status 2018	Species Designation
	Visit 1 (2017)	Visit 2 (2017)	Visit 4 (2018)	Visit 5 (2018)	Visit 6 (2018)	Visit 7 (2018)					
Swift	16	0	0	0	0	0	Hunting over marshy grassland at dusk on first visit.	Not breeding	N/A	N/A	BoCC Amber List
Tawny owl		1	0	0	0	0	Male heard calling on second visit only in woodland south of the Project Site Boundary.	Possible breeding	N/A	N/A	BoCC Amber List
Tree pipit	4	1	2	2	2	2	Adults only observed in south of the Project Site on all visits.	Probable breeding	Recorded in south of the Project Site and centre of the Project Site along the track.	N/A	Section 7 BoCC Red List
Whitethroat	13	5	0	0	2	2	Up to eight pairs likely to breed. Common in scrub and mature hedgerows across the Project Site.	Probable breeding	Recorded in centre of the Project Site in hedgerows along the track.	N/A	N/A
Wren	21	7	10	25	20	8	Common breeding species throughout the Project Site with up to fifteen pairs likely. Juveniles being fed observed on second visit.	Confirmed breeding	Common across the Project Site in woodland and hedgerows.	Probable breeding	N/A
Willow warbler	24	9 (including juv recently fledged)	0	5	5	7	Common breeder throughout the Project Site. Up to twenty pairs likely.	Confirmed breeding	Common in woodland in centre and south of the Project Site.	Probable breeding	BoCC Amber List

1.7 Conclusions

1.7.1 The Project Site supports a varied assemblage of breeding birds typical of the size, habitat types and regional location. The surveys undertaken in 2014 and 2017 produced very similar results which is unsurprising considering that the habitats and management practices have changed little between the surveys.

1.7.2 The 2018 surveys recorded similar species assemblages as for 2014 and 2017 but the numbers of birds were reduced due to a reduced survey area.

1.8 Recommendations

a) Recommendations for Further Surveys

1.8.1 No further surveys are required.

b) Recommendations for Mitigation

1.8.2 A full series of recommendations for further surveys and mitigation at construction and operation has been undertaken for the EcIA. Mitigation should focus on avoiding removal of habitat within the bird breeding season of March – August inclusive and to ensure that replacement landscape planting seeks to provide alternative habitat for those species present. Ecological mitigation methods are set out in the Landscape and Ecology Mitigation Plan (ES Appendix 3.4) and secured through the Development Consent Order (DCO).

c) Recommendations for Biodiversity Enhancement

1.8.3 A full series of recommendations for biodiversity enhancement has been made during the EcIA and reported in the Landscape and Ecology Mitigation Plan (ES Appendix 3.4), and secured through the Development Consent Order (DCO).

1.8.4 Following additional surveys in 2018 the following recommendations as set out in the ES still remain valid:

- Provide nesting boxes in woodland and buildings for a range of species including house sparrow, starling and tawny owl; and,
- Improve the availability of breeding and foraging habitat within the Project Site by planting new scrub, hedgerows, and infilling current gaps in hedgerows with whips and creating green corridors. It is recommended to use native species.

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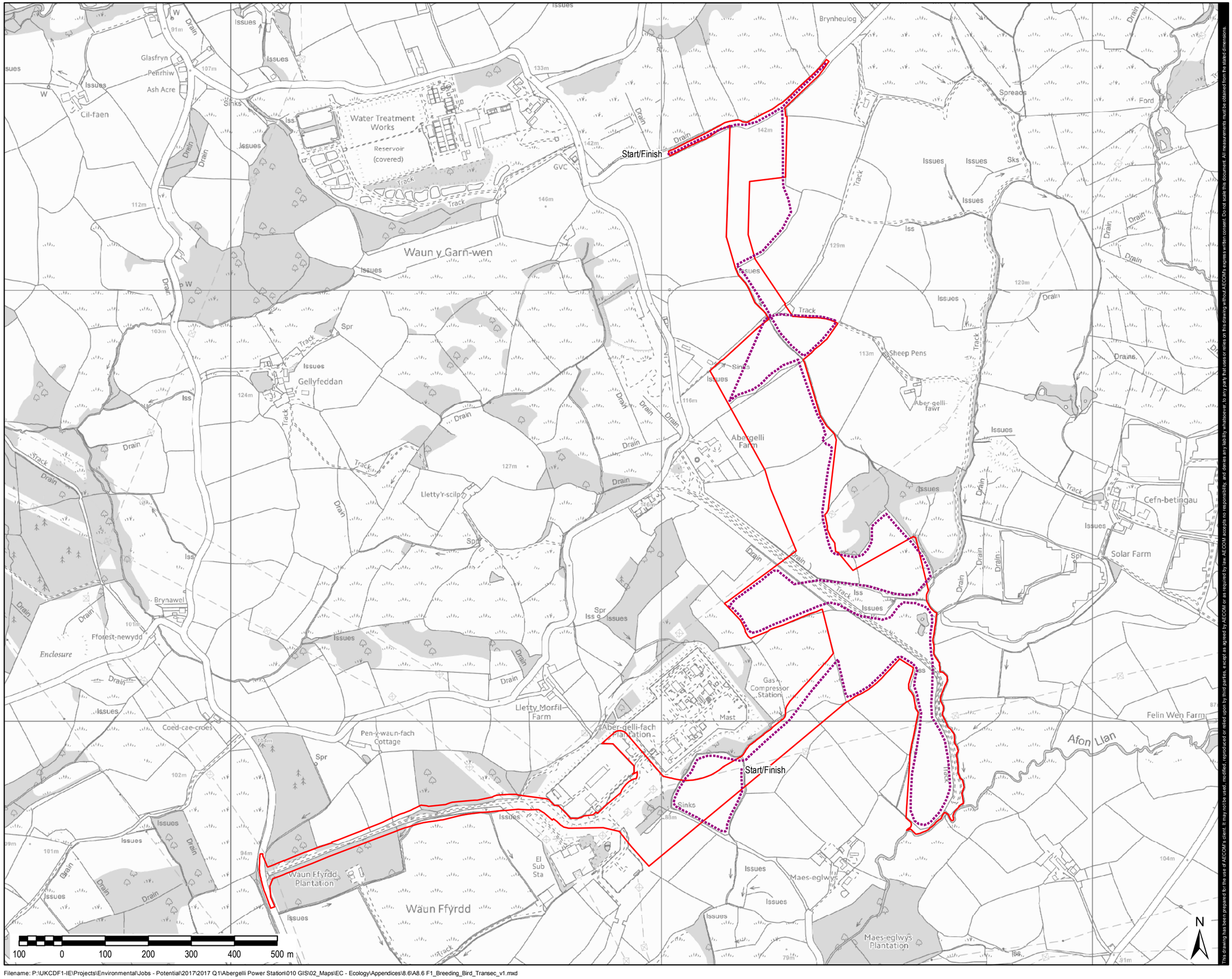
Figure 1 Breeding Bird Transect



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Project Title:

ABERGELLI POWER PROJECT

Client:

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LEGEND

- Breeding Bird Transect
- Project Site Boundary

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Appendix 3.7a

Bat Activity and Roost Survey Report

Abergelli Power Project
Bat Activity and Roost Survey

Abergelli Power Limited
April 2018

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1. Bat Survey Report

1.1 Introduction

1.1.1 AECOM was commissioned to undertake a suite of ecological survey work to inform the Abergelli Power Project (the "Project").

1.1.2 The Project Site is located near to the village of Felindre, Swansea, as shown in Figure 1.1. The central grid reference for the Project Site is SN65280143.

1.1.3 The Preliminary Ecological Appraisal (PEA) Report (Appendix 8.1 of the ES) identified that surveys for bats were required at the Project Site. The Project Site was assessed as having 'High' commuting and foraging potential (Collins, 2016). Four buildings (outside of, but adjacent to the Project Site boundary) were assessed as having the potential to support roosting bats (Appendix 8.1 of the ES).

1.1.4 This baseline report outlines the presence of bat species within the Project Site boundary and makes initial indications of potential effects and outlines initial recommendations for further surveys, mitigation and enhancement.

1.1.5 The bat survey encompasses suitable habitat in close proximity to and within the Project Site boundary, as shown on Figure 1 and Figures 3.1-3.4.

1.1.6 Previous surveys have been undertaken by BSG Ecology in 2014 which are presented in Appendix 8.1 of the ES.

1.2 Site Description

1.2.1 The Project Site supports semi-natural broadleaved and plantation woodland, rows of broadleaved trees, standalone broadleaved trees, dense and scattered scrub, improved and semi-improved grassland and marshy grassland, tall ruderal, running water ditches, ponds, species-rich hedgerow with trees, species-poor hedgerow with trees, species-poor intact hedgerows, earth banks, fences and bare ground (hard standing). In order to cover the Project Site adequately two walked transects were undertaken and nine static detector monitoring locations were established across the Project Site.

1.2.2 The walked transect North (Figure 3.1) predominantly encompasses improved grassland fields with hedgerows and mature tree lines. It also includes a few areas of dense scrub, semi-improved neutral grassland, and a running water ditch (which is connected to the Afon Llan watercourse outside of the Project Site) and a tree lined minor road and track.

1.2.3 The walked transect South (Figiure 3.1) predominantly encompasses; marshy and improved grassland fields with hedgerows and treelines, with ancient and semi-natural woodland. It also includes semi-improved neutral grassland and areas of scattered scrub. There are three running water ditches and the walked transect runs adjacent to a an area of running water on the eastern Project Site boundary which connects to the Afon Llan watercourse, which is outside of the Project Site.

1.2.4 Plates 1.6 and 1.7 show exmaples of the transect habitats.

1.2.5 The nine static detector monitoring locations were placed on field boundaries across the Project Site, sampling improved grassland, semi-improved grassland, marshy grassland, field boundaries, woodland edges and trees lines. Table 1.25 describes the habitats around each static detector location and locations of the static detectors are shown in Figure 3.4.

1.3 The Project

1.3.1 Full details of the Project and Site Description are provided in Chapter 3: Project & Site Description.

1.4 Objectives of the Study

1.4.1 The objectives of this study were:

- To identify nature conservation sites within the Project Site or within 10km of the Project Site boundary designated for bats;
- To identify any known records and/or populations of bats within the Project Site or within 2km of the Project Site boundary;
- To establish the presence of any bat roosts within the Project Site;
- To establish bat species composition within the Project Site;
- To record and map spatial distribution and temporal bat activity within the Project Site;
- To highlight any potential ecological constraints in respect to bats;
- To outline further survey work that may be required; and,
- To make suggestions for mitigation, compensation and enhancement of the natural features identified within the Project Site in respect to bats.

1.5 Legislation

1.5.1 All bats and their roosts in Wales are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). They are also included in Schedule 2 of the Conservation of Habitats and Species Regulations 2010, known as The Habitats Regulations. The Wildlife and Countryside Act 1981 was amended by the Countryside and Rights of Way Act 2000 (CRoW) which adds an extra offence of recklessly disturbing roosting bats or obstructing access to their roosts; makes species offences arrestable, increases the time limits for some prosecutions and increases penalties.

1.5.2 The Wildlife and Countryside Act, the Habitats Regulations and the CRoW Act, together make it an offence, among other things, to recklessly, intentionally or deliberately:

- Deliberately capture, injure or kill any wild animal which is a European Protected Species (EPS),
- Deliberately disturb wild animals of any such species, and,
- Damage or destroy a breeding site or resting place of such an animal

1.5.3 Disturbance is defined as that which is likely:

- To impair their ability:
  - To survive, to breed or reproduce, or to rear or nurture their young, or
  - In the case of animals of a hibernating or migratory species, to hibernate or migrate; or
- To affect significantly the local distribution or abundance of the species to which they belong.

1.5.4 A bat roost is defined as "*any structure or place (including trees) which any bat uses for shelter or protection".* Because bats tend to re-use the same roosts, legal opinion is that the roost is protected whether or not the bat(s) are present at the time.

1.5.5 If the Project is likely to destroy or disturb bats or their roosts, then a European Protected Species License (EPSL) will be required from Natural Resources Wales (NRW), which would be subject to appropriate mitigation and working methods to protect bats.

1.5.6 This is a brief summary of the legislation. When dealing with individual cases, the client is advised to consult the full texts of the relevant legislation and obtain further legal advice.

1.6 Quality Assurance

1.6.1 This survey and subsequent report was undertaken in line with AECOM's Integrated Management System (IMS). Our IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the international standards BS EN ISO 9001:2008 and 14001:2004 and BS OHSAS 18001:2007. In addition, our IMS requires careful selection and monitoring of the performance of all sub-consultants and contractors.

1.6.2 All AECOM Ecologists who worked on this project are members of (at the appropriate level) the Chartered Institute of Ecology and Environmental Management (CIEEM) and follow their code of professional conduct (CIEEM, 2017) when undertaking ecological work.

1.7 Methodology

a) Desk study

1.7.1 The desk study was completed as part of the AECOM PEA (Appendix 8.1 of the ES). In relation to bats, the objectives of the desk study were to review the existing information available in the public domain to identify the following:

- Special Areas of Conservation (SACs) and Sites of Special Scientific Interest (SSSIs) designated for bats within a 10km radius of the Project Site boundary paying due regard to Bat Conservation Trust (BCT) guidelines (Collins, 2016) ,

using the Multi Agency Geographic Information for the Countryside (MAGIC) website (NE, 2017);

- Bat records up to 2km from the Project Site boundary, purchased from the South East Wales Biodiversity Records Centre (SEWBReC);
- Ancient Semi-Natural Woodland (ASNW), Plantation on Ancient Woodland Site (PAWS), Restored Ancient Woodland Site (RAWS) or Ancient Woodland Site of Unknown category (AWSU) within or adjacent to the Project Site using Ancient Woodland Inventory 2011 dataset downloaded from the Lle website (WG and NRW, 2017);
- The Section 7 list of species of Principal Importance for Conservation of Biological Diversity in Wales; and,
- Features of ecological interest surrounding the Project Site, and features connecting these habitats (e.g. hedgerows, watercourses, railway lines) using aerial photographs and Ordnance Survey (OS) maps.

1.7.2 The County Ecologist and Glamorgan Bat Group was consulted regarding locally designated site citations, local bat records not available from SEWBReC and any local knowledge about the area.

1.7.3 Appendix 8.8 of the ES which contains the previous bat surveys undertaken by BSG Ecology in 2014 was provided by the client and reviewed.

b) Bat Roosts in Buildings

i. Preliminary Ground Level Roost Assessments

1.7.4 There are no buildings within the Project Site. Buildings adjacent (adjacent is defined as up to 20m from the Site boundary) to the Project Site boundary were classified into categories dependent on the presence of features suitable as bat roost habitat.

1.7.5 The assessment was conducted via an external appraisal from the ground using binoculars where necessary. Table 1.1 provides descriptions of the roost potential categories for buildings.

ii. Emergence/Re-Entry Surveys

1.7.6 Surveys paid due regard to Bat Surveys: Good Practice Guidelines (Collins, 2016). Each survey consisted of two surveyors stood around the buildings so that bats could be observed leaving/re-entering Potential Roost Features (PRF). Bat activity was also recorded if observed by the surveyors.

1.7.7 Emergence surveys started at least 15 minutes before sunset and continued for 2 hours. The dawn re-entry survey started at least 2 hours before sunrise and continued until 15 minutes after sunrise.

1.7.8 Broadband frequency division detectors were used and digital recordings were made to assist with species identification if required.

Table 1.1 Building and Tree Bat Roost Potential Categories

Roost Suitability	Descriptions for Buildings	Descriptions for Trees
Known or Confirmed	Confirmed signs of bat presence/ occupation (droppings, oily staining around entry points, insect remains, odour, scratching) and actual bat presence.	Confirmed signs of bat presence/ occupation (droppings, oily staining around entry points, insect remains, odour, scratching) and actual bat presence.
High	A structure with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potential for longer periods of time due to their size, shelter, protection, conditions (e. g. temperature, humidity, height above ground level, light levels or levels of disturbance) and surrounding habitat. Can include structures with points of access to the interior of the building and poorly maintained fabric providing ready access points for bats into structures, but at the same time not draughty. Structures of traditional stone, brick or timber construction. Structures with large (>20cm) roof timbers with mortice joints, cracks and holes. Structures of pre or early 20th century construction. Structures with large complicated and/or uncluttered roof spaces providing unobstructed flying spaces. Structures with weather boarding and/or hanging tiles with gaps. Structures with accessible south facing roofs. Structures with proximity to good foraging habitat such as woodland, wetland, water and /or good hedgerows.	A tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potential for longer periods of time due to their size, shelter, protection, conditions (e. g. temperature, humidity, height above ground level, light levels or levels of disturbance) and surrounding habitat.
Moderate	A structure with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions (e. g. temperature, humidity, height above ground level, light levels or levels of disturbance) and surrounding habitat but unlikely to support a roost of high conservation status. Can include structures with some potential to support roosting bats, but fewer features than a high risk building. Features may include areas suitable for crevice dwelling and/or access points into structures. Some proximity to foraging habitat.	A tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status.

Roost Suitability	Descriptions for Buildings	Descriptions for Trees
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter protection, appropriate conditions and/or suitable habitat to be used on a regular basis or by large numbers of bats (i. e. unlikely to be suitable for maternity or hibernation).	Tree of sufficient size and age to contain potential roost features but with none seen from the ground or features seen have only very limited roosting potential.
Negligible	No features suitable for roosting bats. Can include structures constructed from unsuitable materials e. g. prefabricated with steel and sheet material. Structure is draughty, light and cool buildings with no roosting opportunities. High levels of regular disturbance including external and/or internal lighting. Building is isolated from areas of foraging habitat.	Trees with no potential to support bats.

Source: Category descriptions drawn from Collins, 2016 and Mitchell-Jones, 2004 to be applied using professional judgement

c) Bat Roosts in Trees

i. Preliminary Ground Assessment

1.7.9 The bat study area comprised the land within the Project Site boundary and the area within the Zone of Influence (ZoI) (Figure 2). The Bat Survey Guidelines (Collins, 2016) state that bat roost assessments must be considered within the Project Site boundary and the areas under the ZoI of the project. For potential bat roosts the ZoI was assessed to be all land within the Project Site boundary; and using professional judgement, within a 50 m buffer surrounding area where the Generating Equipment Site will be situated due to noise, vibration and lighting during construction, operation and decommissioning.

1.7.10 Trees within or adjacent (adjacent is defined as up to 20m from the Site boundary) to the Project Site boundary were classified into categories dependent on the presence of features suitable as bat roost habitat.

1.7.11 Trees up to 50m from the Generating Equipment Site were classified into categories dependent on the presence of features suitable as bat roost habitat.

1.7.12 The assessment was conducted via an external appraisal from the ground using binoculars where necessary. Table 1.1 provides descriptions of the roost potential categories for trees.

1.7.13 Eleven trees with bat roost potential were identified during the PEA (Appendix 8.1 of the ES). Thirty four trees were identified during a ground level roost assessment of trees in July 2017.

ii. Potential Roost Feature Climbed Inspection Survey

1.7.14 Following the Ground Level Roost Assessment trees which were assessed as having ‘Low or Moderate’ bat roost potential were subject to a PRF climbed inspection. No trees with High bat roost potential were identified.

1.7.15 These PRF climbed inspections were undertaken in August 2017. The inspections were completed by certified and bat licenced tree climbers.

1.7.16 The inspections paid due regard to Bat Surveys: Good Practice Guidelines (Collins, 2016), Bat Workers Manual (Mitchell-Jones and McLeish, 2004) and Bats and Woodland Management (Forestry Commission, 2005).

1.7.17 Trees were climbed using ropes and/or ladders. Once accessed, features were examined in detail using a torch, endoscope or mirror to inspect (where possible) the full extent of the features and search for bats or evidence of bat activity (e. g. droppings, urine stains, odour, feeding remains, scratch marks, grease stains, wear marks). Where necessary, trees were re-categorised following the PRF climbed inspection.

1.7.18 Two trees identified as having bat roost potential during the preliminary ground level roost assessments were not climbed as they were approximately 20 and 55m outside of the Project Site boundary.

1.7.19 Sixteen trees could not be accessed and two could not be found during the PRF climbed inspections, as described in the Limitations (Section 1.8).

iii. Emergence/Re-Entry Surveys

1.7.20 Following the Ground Level Roost Assessment and PRF climbed inspections, emergence/re-entry surveys were undertaken on trees with a category of Moderate or above.

1.7.21 Surveys paid due regard to Bat Surveys: Good Practice Guidelines (Collins, 2016). Each survey consisted of one surveyor stood so that bats could be observed leaving/re-entering the PRF. Bat activity was also recorded if observed by the surveyors.

1.7.22 Emergence surveys started at least 15 minutes before sunset and continued for 2 hours (see Limitations). The dawn re-entry survey started at least 2 hours before sunrise and continued until 15 minutes after sunrise.

1.7.23 Broadband frequency division detectors were used and digital recordings were made to assist with species identification if required. The weather conditions during the surveys were recorded and were largely considered favourable for bats. Survey dates and weather conditions are given in Table 1.3.

d) Bat Activity Surveys

i. Preliminary Assessment of Potential Commuting and Foraging Habitat

1.7.24 The Project Site was assessed as having High commuting and foraging potential for bats (Collins, 2016) during the PEA (Appendix 8.1 of the ES). Habitats within the Project Site were classified into categories dependent on the presence of features suitable for bats to commute and forage. Table 1.2 provides category descriptions for commuting and foraging habitat.

Table 1.2 Commuting and Foraging Habitat Potential Categories

Roost Suitability	Descriptions
High	Continuous high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.
Moderate	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
Low	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or un-vegetated stream, but isolated, i. e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small number of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Negligible	Negligible habitat features on site likely to be used by commuting or foraging bats.

Source: Category descriptions drawn from Collins, 2016 to be applied using professional judgement

ii. Bat Activity – Walked Transects

1.7.25 Surveys paid due regard to Bat Surveys: Good Practice Guidelines (Collins, 2016). Two walked transect routes were developed to sample the Project Site, one in the north and one in the south. These are shown on Figures 3.1 to 3.3.

1.7.26 Each transect was walked twice per month. Dusk activity surveys were completed in June, July, August, September and October 2017. One dusk and dawn survey within one 24 hour period was completed in September 2017.

1.7.27 No surveys were completed in April and May 2017 due to the late commencement of the Project. Activity surveys following the methodology above are due to be undertaken in April and May 2018.

1.7.28 Each survey consisted of two surveyors walking a pre-determined transect route at a steady pace across the Project Site. The start point and direction of each transect was varied across the months to reduce bias.

1.7.29 The transect contained set Listening Points (LPs) which the surveyors stopped at for three minutes. Each transect contained 12 LPs, with the exception of the first set of surveys in June which had 11 LPs (see Section 1.8, Limitations). The locations of the LPs are shown on Figures 3.1 to 3.3.

1.7.30 Tables 1.23 and 1.24 describe the habitat at each of the LPs.

1.7.31 Dusk transect surveys began 15 minutes before sunset and continued for up to 3 hours after sunset, except for one occasion (see Section 1.8, Limitations). The dawn transect started at least 2 hours before sunrise and continued until sunrise, except on one occasion (see Limitations).

1.7.32 A broadband frequency division detector was used (Bat Box Duet with EM3) and digital recordings made to assist with species identification if required.

1.7.33 The weather conditions for all but one of the surveys (see Section 1.8, Limitations) completed to date was considered to be favourable for bats. The weather conditions and survey dates are given in Table 1.3.

iii. Bat Activity – Static Detector Surveys

1.7.34 Surveys paid due regard to Bat Surveys for Professional Ecologists: Good Practice Guidelines (Collins, 2016). Nine static detector locations were selected within the Project Site to incorporate a range of habitats and give spatial coverage of the Project Site. The locations of the static detectors are shown in Figure 3.4.

1.7.35 Static detector surveys were completed in June, July, August, September and October 2017.

1.7.36 The dates of the static detector surveys were:

- June 26 – 01 July 2017;

- 24 July – 29 July 2017;
- 23 August 2017 – 01 September 2017;
- 12 September 2017 – 18 September 2017; and,
- 17 October - 21 October 2017.

1.7.37 No surveys were completed in April and May 2017 due to the late commencement of the Project. Activity surveys following the methodology above are due to be undertaken in April and May 2018.

1.7.38 The static detectors were set to begin recording 30 minutes before sunset and continue until 30 minutes after sunrise for a period of five consecutive nights (Collins, 2016). Some equipment failures reduced the static detector recording time (see Limitations and Appendix 3A).

1.7.39 Full spectrum frequency detectors (Wildlife Acoustics Song Meter 2 (SM2/SM2+) with sample rate 384kHz) and ultrasonic SMX-U1 omnidirectional microphones were used to obtain digital recordings of bat echolocation calls in order to determine the species present at each Static Detector Location.

e) Data Analysis and Interpretation

1.7.40 Bat echolocation call analysis where required was undertaken by a suitably experienced ecologist, with support from reference material including the British Bat Calls Species Identification Guide (Russ, 2012).

1.7.41 The AnalookW software programme (version 4.2n) was used to analyse bat echolocation calls. A series of custom made filters in Analook were applied to the bat echolocation call data. All calls were manually checked once filters had been applied, and any additional or incorrect calls were relabelled.

1.7.42 Long-eared bats have very quiet echolocation calls and these are often not recorded on bat detectors but may be audible using bat detectors. Where long-eared bats are suspected but the echolocation call has not been recorded then the long-eared bat (possible) category has been used. This is shown in Tables 1.8 to 1.12.

1.7.43 There are six resident species of Myotid bat in Britain. Myotid bats are difficult to identify to species level as the echolocation calls can have overlapping frequencies and can be visually similar when viewed on bat echolocation call software, such as Analook. Therefore all Myotid bat echolocation calls were grouped together for the purposes of calculating Bat Activity Index (BAI).

1.7.44 Where possible, calls with characteristics of specific Myotid bats were noted to inform the species composition within the Project Site.

1.7.45 For the walked transect data, a BAI was calculated as the number of passes divided by the survey time in ‘hours’. Survey time was calculated to the nearest 15 minutes, expressed as 0.25 hours, to account for minor differences in survey duration (see Section 1.8, Limitations).

1.7.46 For the static detector survey data, a BAI was calculated as the number of passes divided by the survey time in 'nights'. Survey time was calculated to the nearest 0.5 nights, to account for differences in survey duration (see Section 1.8, Limitations and Appendix 3A). The half way point for each night was calculated using the start and finish time. If the static detector failed before the half way point then 0.5 of a night was used in the BAI calculations. If the static detector failed after the half way time point the whole night was used in the BAI calculations.

1.7.47 Bat activity is an indication of the amount of use bats make of an area (Collins, 2016). A bat pass is defined by BCT as a sequence of greater than two echolocation calls made as a single bat flies past the microphone (BCT, 2017). A bat pass is an index of bat activity rather than a measure of number of individuals in a population (Collins, 2016).

1.7.48 The statistics software programme 'R' (R Core Team, 2013) was used to assist data interpretation and to help look for statistically significant differences and/or relationships. This was completed by an ecologist with appropriate statistical knowledge and experience of the programme.

1.7.49 Due to the variation in successful recording nights, statistical tests could only be completed from the first night of data from each static detector, for each month.

1.7.50 The data was assessed for normal distribution and the most appropriate statistical tests applied. The data was not normally distributed and therefore non parametric tests, Kruskal-Wallis and Mann Whitney-Wilcoxon, were used.

1.7.51 Calculated values within this report have been given to one decimal place, except for survey times in Table 1.13, BAI totals in Table 1.18 and BAI values in Table 1.20.

Table 1.3 Survey Dates and Weather Conditions

Survey Date	Sunset/ Sunrise Time	Start Time	End Time	Survey Type	Surveyors	Temp (°C) Start/ End	Humidity (%) Start/ End	Wind Speed Avg. (mph) Start/ End	Cloud Cover (Octars) Start/ End	Rain
13 June 2017	21:34	21:19	00:27	South Transect	LN & CM	13.7 12.6	87.4 86. 5	0.0 0.0	1/8 0/8	None
14 June 2017	21:35	21:20	00:18	North Transect	LN & CM	19.5 14.0	66.6 80.3	0.0 0.0	7/8 8/8	None
26 June 2017	21:38	21:23 21:23	00:19 00:51	North Transect South Transect	LN & UJ CM & BW	15.9 Nr	74.4 Nr	0.0 Nr	8/8 Nr	Light rain at 23:16 for a few minutes
06 July 2017	21:34	21:20	00:35	South Transect	LN & UJ	16.9 17.1	85.4 86.3	0.0 0.0	1/8 7/8	None
10 July 2017	21:32	21:20	00:28	North Transect	UJ & SB	14.0 15.7	83.0 85.0	0.7 0.6	5/8 8/8	Very light drizzle at 00:20
24 July 2017	21:17	21:00 21:00	00:17 00:17	North Transect South Transect	LF & SB LN & NW	17.3 13.0	75.8 86.0	0.0 0.0	1/8 0/8	None
07 August 2017	20:55	20:39 20:40	23:44 00:00	North Transect South Transect	UJ & SB LN & LF	13.0 17.0	81.0 81 0	F1 - Light Wind (Beaufort Scale)	2/8 8/8	None
08 August 2017	20:53	20:30	22:53	Building 3 – Roost	LN & LF	14.9 12.9	82.0 85.2	0.0 0.7	6/8 5/8	None
09 August 2017	05:51	03:47 03:41	06:06 06:06	Tree 36 – Roost Tree 44 – Roost	LN LF	15.2 12.5	79.4 93.8	0.0 0.6	8/8 Nr	Light rain but sheltered in woodland
15 August 2017	20:39	20:24 20:24	22:39 22:39	Tree 3 – Roost Tree 19 – Roost	LF UJ	15.7 12.1	83.3 92.8	0.0 0.9	3/8 2/8	None

Survey Date	Sunset/ Sunrise Time	Start Time	End Time	Survey Type	Surveyors	Temp (°C) Start/ End	Humidity (%) Start/ End	Wind Speed Avg. (mph) Start/ End	Cloud Cover (Octars) Start/ End	Rain
		20:20	22:39	Tree 21 – Roost	LN					
21 August 2017	20:27	20:12	22:27	Building 4 – Roost	UJ & RS	20.1 18.4	81.4 86.1	0.0 0.0	8/8 6/8	None, light drizzle day before
23 August 2017	20:23	20:08 20:08	23:23 23:19	North Transect South Transect	LN & LF UJ & CM	15.7 15.0	83.7 91.5	0.8 1.2	4/8 7/8	Light rain at 21:20 for a few minutes
29 August	20:05	19:35 19:30	22:05 22:05	Tree 36 – Roost Tree 44 – Roost	LN CM	14.2 11.0	76.5 85.6	0.0 0.0	7/8 7/8	None
30 August 2017	06:23	04:23 04:21 04:23	06:38 06:38 06:38	Tree 3 – Roost Tree 19 – Roost Tree 21 – Roost	RS CM LN	11.3 12.7	100.0 89.7	0.9 0.0	8/8 8/8	Rain until 04:40, then dry
31 August 2017	06:26	04:26	06:41	Building 4 – Roost	LN & CM	11.7 8.9	91.4 90.7	0.0 0.7	5/8 1/8	None
06 September 2017	06:35	04:35 04:35	06:50 06:50	Building 3 – Roost Tree 19 - Roost	LN & SB UJ	14.8 11.4	85.1 89.3	0.0 0.6	8/8 3/8	None
07 September 2017	06:37	04:37 04:37	06:42 06:37	North Transect South Transect	LN & LF UJ & SB	14.1 13.0	80.1 82.3	0.0 0.0	8/8 6/8	None
11 September 2017	19:40	19:25	22:27	North Transect	UJ & BW	13.2 11.2	89.2 87.2	0.6 1. 2 (max)	3/8 0/8	Day before, dry during survey
12 September 2017	06:45	04:45	06:44	North Transect	LN & SB	10.1 10.3	86.6 89.9	0.8 0. 9	1/8 1/8	Showers day before, dry during survey
13 September 2017	06:47	04:17	06:42	South Transect	LN & SB	10.4 11.0	80.3 85.1	2.3 2. 3	1/8 3/8	Rain in night, dry

Survey Date	Sunset/ Sunrise Time	Start Time	End Time	Survey Type	Surveyors	Temp (°C) Start/ End	Humidity (%) Start/ End	Wind Speed Avg. (mph) Start/ End	Cloud Cover (Octars) Start/ End	Rain
										during survey
13 September 2017	19:36	19:21	22:27	South Transect	UJ & BW	15.0 9.0	72.0 88.6	0.0 2.4	7/8 8/8	Rain before survey. Dry at start of survey. Light rain at 21:33. Heavy rain at 21:50, lighter rain at 22:17.
03 October 2017	18:50	18:35 18:36	21:50 21:50	North Transect South Transect	BW & SB LN & RS	11.4 12.9	75.8 73.4	0.8 1.2	2/8 8/8	None
17 October 2017	18:19	18:04 18:04	21:18 21:18	North Transect South Transect	UJ & RS CM & SB	13.0 13.0	Nr Nr	0.0 0.0	7/8 7/8	None

Nr=not recorded

LN – NRW Bat Licenced Ecologist, UJ – Senior Ecologist, LF – Ecologist, CM – Ecologist, BW – NRW Bat Licenced Ecologist, SB – Assistant Ecologist, RS – Sustainability Consultant, NW – Environmental Consultant.

1.8 Limitations

1.8.1 Biological records can be received from a wide variety of sources and may or may not be comprehensive and accurate. However, if assessed in conjunction with a survey, they can contribute to a robust ecological assessment of a site.

a) Suitable Roost Feature Climbed Inspection Survey

1.8.2 There are 16 trees which were not climbed due to access and/or health and safety restrictions and there are two trees which were not climbed as they could not be found due to dense woodland, however were the subject of emergence survey at a later date. These trees did not have their bat roost suitability category altered from the original assigned category and all trees with Moderate suitability subsequently had emergence/re-entry surveys. Therefore this is not deemed to be a significant limitation.

b) Roost Survey

1.8.3 Building 1 did not have a full Ground Level Preliminary Assessment due to time constraints (Appendix 8.1 of the ES). However this building is approximately 120m outside of the Project Site boundary and no further surveys were considered necessary on this building. Therefore this is not a significant limitation.

1.8.4 Access was not granted to Buildings 7 and 8 (collectively known as Abergelli Farm) to the west of, but outside of the Project Site boundary and these could not be assessed for their suitability to support roosting bats. However, these buildings (BSG Buildings 4 and 5) were previously assessed by BSG (PB, 2015) (see Table 1.4). The previous results will be used in the assessment. These buildings will be subject to emergence and re-entry surveys in 2018.

c) Bat Activity Walked Transect Survey

1.8.5 The first set of June walked transect surveys had 11 LPs per transect, this was increased to 12 LPs per transect for all subsequent surveys. This was done to increase the spread of sample points. This is not deemed to be a significant limitation to the surveys or this report.

1.8.6 On 10 July 2017 during the Northern Transect the SD recording card briefly came out of the EM3 bat detector and calls during that period were not recorded electronically. However, this was replaced and all bats heard during the period were recorded on the survey sheet and were of common species which the surveyor was able to determine species identification with confidence. This is not deemed to be a significant limitation to the survey or the results.

1.8.7 On 13 September 2017 the dawn South Transect survey finished at 06:42 which was 5 minutes before sunrise, however no bats had been heard since 06:16 and therefore this is not deemed to be a significant limitation.

1.8.8 On a small number of occasions surveyors walked past an LPs or LPs were not accessible meaning that bat data was not recorded for 3 minutes at that location. For calculations of Bat Activity Index, the survey time at each LP has been adjusted to reflect this variation and will mitigate the impact of this limitation of the comparisons of bat activity between LPs. The occasions are listed below:

- On 10 July 2017 North Transect LP 4 was missed;
- On 23 August and 7, 11 and 12 September 2017, North Transect LP1 was not accessible due to horses being present in the field. A replacement LP was completed as close as possible to the original location at LP1a, as shown on Figure 5.2;
- On 7 and 13 September 2017 LP7 on the South Transect not accessible due to the presence of rams in the field. On 7 September 2017, LP9 was missed, this was replaced with LP9a (see Table 1. 12, LP9a and Figure 5. 3). As LP9 was replaced with another LP close to the original location, this is not deemed to be a significant limitation;
- On 3 October 2017, LP9 was missed, this was replaced with LP9b (See Table 1.12, LP9b and Figure 5. 3). As LP9 was replaced with another LP close to the original location, this is not deemed to be a significant limitation.

1.8.9 No surveys were completed in April and May 2017 due to the late commencement of the Project. Best practice guidelines recommend transect surveys are undertaken between April and October (Collins, 2016). Activity walked transect surveys following the methodology described above are due to be undertaken in April and May 2018.

1.8.10 The weather conditions encountered on the dusk transect surveys on 13 September 2017 (see Table 1.3) were not considered wholly favourable for bats, but not so bad as to need to abandon the survey. There was light rain at 21:33 and a spell of heavy rain between 21:50 and 22:17. The North Transect was also sampled at dusk on 11 September 2017 in September in favourable weather conditions.

1.8.11 It was not possible to incorporate land within the National Grid land within a walked bat activity transect due to due to site access restrictions at night and during the early morning.

d) Bat Activity Static Detector Survey

1.8.12 Some of the static detectors did not record for the full five night period. Details of malfunctions and reduced survey nights are provided in Appendix 3A Static Detector Limitations.

1.8.13 No data was recorded at South 3 in June 2017 and South 1 in July 2017.

1.8.14 Data in these locations was successfully collected in the other 4 months.

1.8.15 No data was recorded at: Lane 2 in August and September 2017. Two other static detectors (Lane 1 and Lane 3) were positioned within the Lane and have captured bat activity which is representative of the Lane.

e) Data Analysis and Interpretation

1.8.16 Different bat species vary in their likelihood of detection using bat detectors and therefore it is not relevant to compare numbers of bat passes from different species (Collins, 2016).

1.8.17 Results of the statistical analysis could only utilise the first night of data for each location in each month, due to the variation in successful recording nights. Therefore, the results are less powerful than if the full five nights could have been compared. However, the statistical analysis provides an additional tool, alongside BAI and count data in the interpretation of bat activity.

1.9 Baseline Environment

a) Desk Study Results

1.9.1 The designated habitats, sites and features, in relation to bats, within proximity to the Project Site are listed in Table 1.4 below.

Table 1.4 Desk Study Results

Designation / Feature	Description
Nationally and Internationally Designated Sites for bats within 10km	There are no sites designated for bats within 10km of the Project Site boundary.
Locally Designated Sites within 2km	There are several locally designated sites within 2km of the Project Site boundary (Appendix 8.1 of the ES). However, none of these are designated for bats or specifically mention bat species on the citations
Bat records from the last 10 years within 2km	The following recent (last 10 years) bat species have been recorded within 2km of the Project Site: Daubenton's *Myotis daubentonii*, Natterer's *Myotis nattereri*, Noctule *Nyctalus noctule*, pipistrelle species *Pipistrellus sp*., common pipistrelle *Pipistrellus pipistrellus,* soprano pipistrelle *Pipistrellus pygmaeus,* long-eared species *Plecotus sp.,* brown long-eared *Plecotus auritus* and generic records of bat species *Chiroptera*. None of these records of bats were from within the Project Site There are records of known roost sites within 2km of the Project Site as follows: • A noctule tree roost approximately 1km north-west of the Project Site boundary; • Common pipistrelle roost approximately 1.3km east of the Project Site boundary; • A common pipistrelle roost approximately 1.8km south-east • A common pipistrelle roost approximately 1km southeast of the Project Site boundary; • A common pipistrelle roost approximately 1km north-west of the Project Site boundary; • A soprano pipistrelle roost approximately 2km south-west of the Project Site boundary; • A soprano pipistrelle roost approximately 2km north-west of the Project site boundary; • A long-eared bat and brown-long-eared bat roost approximately 1.6km east of the Project Site boundary; and • A long-eared bat and brown long-eared bat roost approximately 1.1km north-west of the Project Site boundary. The specific location of the bat roosts is confidential.

Designation / Feature	Description
Priority Species – Listed on The Environment Act (Wales) 2016 Section 7	Barbastelle *Barbestella barbastellus*, Bechstein's *Myotis bechsteinii*, noctule, common pipistrelle, soprano pipistrelle, brown long-eared, greater horseshoe *Rhinolophus ferrumequinum* and lesser horseshoe *Rhinolophus hipposideros* bats are listed on the Section 7 list.
Ancient Woodland	The following five areas have been identified: • An 8.1ha area of RAWS within and extending south-west outside the Project Site. Part of this RAWS is known as Waun ffyrdd Plantation; • A 15.1 ha area of ASWU within and extending south-west outside the Project Site. Part of this ASWU area covers the National Grid site which is currently hardstanding and the ASWU is no longer present; • A 0. 9ha area of PAWS adjacent to the south-west Project Site boundary; • A 4.3ha area of RAWS within and adjacent to the Project Site boundary in the south-west; and, • A 1.6ha ASNW, adjacent to the east of the Project Site boundary. This area is also subject to Tree Protection Orders (Appendix 8.1 of the ES).
Surrounding Land Use	The Project Site is located north of Junction 46 of the M4 Motorway close to the village of Felindre, Swansea. The Project Site has agricultural fields to the east, south and north. Areas of woodland are located to the south, east and west of the Project Site. Areas of the National Grid Power Station with associated roads and buildings are partially within and adjacent to the Project Site. A water treatment works is located in the north west outside of the Project Site.
County Ecologist	The County Ecologist was contacted by email on 9 November 2017 to gather any local knowledge of bat species and bat habitats in proximity to the Site. To date AECOM has not received a response.
Local Bat Group	The local bat group was contacted by email on 9 November 2017 to gather any local knowledge of bat species and bat habitats in proximity to the Site. To date AECOM has not received a response.
Previous Bat Roost and Activity Surveys - BSG Ecology 2014	Previous surveys have been undertaken by BSG Ecology. See Appendix 8.8 of the ES. The Site boundary included within these reports is different to the 2017 Project Site boundary. The 2017 Project Site is smaller than the red line boundary used by BSG in 2014, however lies entirely within the area covered by the 2014 BSG surveys. A summary of the previous bat species surveys is detailed below: <u>Building – Ground Level Roost Assessments and Internal Inspections</u>

Designation / Feature	Description
	Eleven buildings with bat roost potential were identified. Internal inspections of buildings confirmed non- maternity roosts in three buildings. These are shown in Appendix 2A: • BSG Building 4: A scattering of long-eared bat, pipistrelle and lesser horseshoe bat droppings were found in the store rooms; • BSG Building 8: Small piles of long-eared bat and pipistrelle droppings found in both first and second storey at the north of the building; and, • BSG Building 10: Two pipistrelle droppings were found on the floor. BSG Building 1, 2, 5 and 11 were categorised as having Moderate bat roost potential. BSG Building 7 was categorised as having Low bat roost potential. BSG Building 3 and 9 were categorised as having Negligible bat roost potential (Hundt, 2012). The buildings identified by BSG in 2014 fall outside of the 2017 Project Site. However, some of these buildings adjacent to the Project Site have been reassessed by AECOM in 2017. Details are provided in Table 1.5**.** <u>Tree – Ground Level Roost Assessments</u> Thirty three trees were considered to have potential to support roosting bats. 29 of these were subject to a climbed inspection. Emergence and/or re-entry surveys were carried out on eight trees. BSG Trees T3, T4 and T9 are located within the 2017 Project Site. No bats were recorded emerging or re-entering any potential roost features. No tree roosts were identified. Trees within the Project Site have been reassessed by AECOM in 2017. Details are provided in Section 1.11. <u>Bat Activity Walked Transect Surveys</u> At least seven species of bat were recorded during transect surveys; common pipistrelle, soprano pipistrelle, Myotis sp., long-eared bat, noctule, Leisler's bat, and lesser horseshoe bat. All of these species and an additional three were recorded during automated static detector surveys; Nathusius' pipistrelle *Pipistrellus nathusii*, serotine *Eptesicus serotinus* and greater horseshoe.

b) Bat Roost Survey Results

i. Bat Roosts in Buildings

Buildings - Preliminary Ground Level Roost Assessments

1.9.2 Six buildings were assessed for their potential to support roosting bats in 2017 and 11 buildings were assessed by BSG in 2014. The results of the assessment are provided in Table 1.5.

1.9.3 Building locations are provided in Figure 2. A map showing the AECOM 2017 results is provided in Figure 4.1 and a map showing the 2014 BSG building locations is provided in Figure 4.2.

1.9.4 Access was not granted to Buildings 7 and 8 (known as Abergelli Farm) in 2017 (outside the Project Site) and therefore these could not be assessed for their potential to support roosting bats in 2017. Details are given in Section 1.8 Limitations.

1.9.5 In November 2017, a trial shaft and adit, adjacent to the Project Site was identified. Underground sites can be of value to hibernating bats, including horseshoe, long-eared and Myotis species. The approximate locations mine shaft and adit are shown in Figure 6. These were assessed for their suitability to support roosting bats in March 2018. The adit is sealed, with no potential for underground hibernation and this has been capped and filled in. The adit is close to Building 4. The trial shaft entrance was located and a depression in the ground which was grassed over was visible. Historical maps had identified that the trail shaft had been dug to 57ft and 6 inches and backfilled. There were no access points for bats. The trail shaft is not suitable for hibernation.

Table 1.5 Building Ground Assessment Results

AECOM Building Number (2017)	BSG Building Number (ES Appendix 8.8)	Building Description from Ground Level Roost Assessment	Initial BRP Category
1	Not surveyed.	A residential bungalow. Approximately 120m outside of the Project Site boundary to the north-east. This was not fully assessed due to time constraints of the PEA survey (Appendix 8.1 of the ES). This is a modern building with a tiled roof. There were no obvious gaps. House sparrows were observed using spaces in the roof.	AECOM 2017: Low BSG 2014: Not Surveyed
2	BSG 8	External out building within Abergelli Farm yard. Approximately 75m outside of the Project Site boundary to the west. A brick built building with a tower and asbestos pitched roof. There are potential fly-in access points and features suitable for crevice dwelling species such as pipistrelle BSG Identified: *"Single storey brick barn with second story tower*	AECOM 2017: High BSG 2014: Confirmed Roost.

AECOM Building Number (2017)	BSG Building Number (ES Appendix 8.8)	Building Description from Ground Level Roost Assessment	Initial BRP Category
		at the northern end. Multiple fly-in opportunities to both storeys. Small piles of long-eared bat and pipistrelle droppings found in both first and second storey at the north of the building" (Appendix 8.8 of the ES of ES).	
3	BSG 7	Approximately 5m outside of the Project Site boundary to the west. A single story brick built out building with a pitched asbestos roof. There are gaps in the mortar and brick work and behind the wooden facia boards BSG Identified: *"Brick outbuilding with corrugated roof. The cavity wall may be accessible through broken vents. No signs of use by bats were observed"* (Appendix 8.8 of the ES).	AECOM 2017: Moderate BSG 2014: Moderate
4	Not surveyed	Approximately 10m outside of the Project Site boundary to the west. A single story brick built out building located within a field. There are gaps leading to a cavity wall. Gaps are present on the east and south face of this building.	AECOM 2017: Moderate BSG 2014: Not Surveyed
5	BSG 6	Modern steel barn; industrial building of steel frame construction with asbestos and transparent corrugated sheet roof and asbestos and steel walls. Within the building light enters via the transparent corrugated roof sheets. The building is used regularly for farm maintenance and horses are kept in the east section. There are openings that would allow bats to access the building (open sections to the east and west, small hole 20x20cm within wall on southern aspect, door to the east and west usually left open). No evidence of bats (droppings) was found around the outside of the building. BSG identified: "*Corrugated iron barn, used as horse stable and machinery store. No potential roost features or signs of use by bats observed"* (Appendix 8.8 of the ES).	AECOM 2017: Negligible BSG 2014: Negligible
6	BSG 3	Abergelli Farm buildings. Approximately 110m from the Project Site boundary.	AECOM 2017: Negligible BSG 2014:

AECOM Building Number (2017)	BSG Building Number (ES Appendix 8.8)	Building Description from Ground Level Roost Assessment	Initial BRP Category
		BSG identified: "*Corrugated iron barn, used as horse stable. No potential roost features or signs of use by bats were observed"* (Appendix 8.8 of the ES).	Negligible
7	BSG 4	Abergelli Farm buildings. Approximately 90m from the Project Site boundary. Not assessed by AECOM. BSG identified: *"Stone built stable block. Confirmed as a lesser horseshoe, long-eared and pipistrelle roost*" (Appendix 8.8 of the ES).	AECOM 2017: Not Surveyed BSG 2014: Confirmed Roost.
8	BSG 5	Abergelli Farm, residential buildings Approximately 65m from the Project Site boundary. Not assessed by AECOM. BSG Identified: *"Terraced housing. Some missing tiles, lifted lead flashing and access to boxed eaves due to damage could be used by bats. No signs of use by bats were observed. There was no access available to the roof void"* (Appendix 8.8 of the ES	AECOM 2017: Not Surveyed BSG 2014: Moderate
BSG 1	BSG 1	Assessment not required. Approximately 265m outside of the Project Site boundary. BSG identified: *"A number of missing slates and gaps under ridge tiles offer potential for roosting bats. No signs of use by bats were observed. There was no access available to the roof void"* (Appendix 8.8 of the ES).	AECOM 2017: Not Surveyed BSG 2014: Moderate
BSG 2	BSG 2	Assessment not required. Approximately 290m outside of the Project Site boundary. BSG identified: "*Detached house. A number of missing slates and gaps under ridge tiles offer potential for roosting bats. No signs of use by bats were observed. There was no access available to the*	AECOM 2017: Not Surveyed BSG 2014: Moderate

AECOM Building Number (2017)	BSG Building Number (ES Appendix 8.8)	Building Description from Ground Level Roost Assessment	Initial BRP Category
		roof void" (Appendix 8.8 of the ES).	
BSG 9	BSG 9	Assessment not required. Approximately 235m outside of the Project Site boundary. BSG identified: *"Breeze block shed with corrugated roof. No potential roost features or signs of use by bats observed"* (Appendix 8.8 of the ES).	AECOM 2017: Not Surveyed BSG 2014: Negligible
BSG 10	BSG 10	Assessment not required. Approximately 155m outside of the Project Site boundary. BSG identified: *"Brick out-house, single room, no doors or windows. Flat concrete roof. Missing bricks allow access to the cavity wall in a number of places. Two pipistrelle droppings were found on the floor"* (Appendix 8.8 of the ES).	AECOM 2017: Not Surveyed BSG 2014: Confirmed Roost
BSG 11	BSG 11	Assessment not required. Approximately 195m outside of the Project Site boundary. BSG identified: *"Derelict stone cottage, two distinct standing walls, no roof. Walls are very exposed. Some roosting opportunities between the stone, and gaps into a rubble filled wall. No signs of use by bats were observed"* (Appendix 8.8 of the ES).	AECOM 2017: Not Surveyed BSG 2014: Moderate

Buildings - Emergence/Re-entry Surveys

1.9.6 The results of the 2014 and 2017 emergence/re-entry surveys are provided in Table 1.6. The locations of the buildings and the roost results from 2017 are shown on Figure 4.1.

1.9.7 Further surveys were not undertaken on AECOM Buildings 1 and 2 due to their distance from the Project Site. Further surveys were not undertaken on Buildings 5 and 6 in 2017 as they had Negligible bat roost suitability.

Table 1.6 Building Emergence/Re-entry Survey Results

AECOM Building Number	BRP Category (AECOM 2017 and BSG 2014 combined – Table 1.5)	Roost Surveys Completed - AECOM 2017	Roost Status – (AECOM 2017 and BSG 2014 combined)
1	Low	No survey completed. Approximately 125m from the Project Site boundary	Unknown
2	Confirmed Roost	No survey completed. Approximately 70 m from the Project Site boundary	Confirmed Roost BSG confirmed this as a non-maternity long-eared and pipistrelle roost in 2014 (BSG Building 8) (Appendix 8.8 of the ES)
3	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost
4	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost
5	Negligible	No surveys required	No Roost
6	Negligible	No surveys required	No Roost BSG internal inspection did not find any evidence of use by bats (BSG Building 3) (Appendix 8.8 of the ES). Due to the lack of features suitable for bats an internal inspection is sufficient to determine if this building is a roost
7	Confirmed Roost.	No surveys completed in 2017. Three surveys are scheduled to be undertaken in 2018. Building 7 is approximately 90m from the Project Site	Confirmed Roost BSG confirmed this as a lesser horseshoe, long-eared and pipistrelle roost (BSG Building 4) (Appendix 8.8 of the ES)

AECOM Building Number	BRP Category (AECOM 2017 and BSG 2014 combined – Table 1.5)	Roost Surveys Completed - AECOM 2017	Roost Status – (AECOM 2017 and BSG 2014 combined)
		boundary.	
8	Moderate	No surveys completed in 2017. Three surveys are scheduled to be undertaken in 2018. Building 8 is approximately 65m from the Project Site boundary.	Unknown BSG internal inspection did not find evidence of bats but not all areas were accessible (BSG Building 5) (Appendix 8.8 of the ES). Due to the bat roost features identified an internal inspection only is not sufficient to determine if this building is being used as a roost

AECOM Building Number	BRP Category (AECOM 2017 and BSG 2014 combined – Table 1.5)	Roost Surveys Completed - AECOM 2017	Roost Status – (AECOM 2017 and BSG 2014 combined)
BSG 1	Moderate	No surveys completed - Assessment not required. Approximately 265m outside of the Project Site boundary.	Unknown. BSG identified: *"A number of missing slates and gaps under ridge tiles offer potential for roosting bats. No signs of use by bats were observed. There was no access available to the roof void"* (Appendix 8.8 of the ES).
BSG 2	Moderate	No surveys completed - Assessment not required. Approximately 290m outside of the Project Site boundary.	Unknown. BSG identified: "*Detached house. A number of missing slates and gaps under ridge tiles offer potential for roosting bats. No signs of use by bats were observed. There was no access available to the roof void"* (Appendix 8.8 of the ES).
BSG 9	Negligible	No surveys required. Also, approximately 235m outside of the Project Site boundary.	No Roost
BSG 10	Confirmed Roost	No surveys completed - Assessment not required. Approximately 155m outside of the Project Site boundary.	Confirmed Roost BSG identified: *"Brick out-house, single room, no doors or windows. Flat concrete roof. Missing bricks allow access to the cavity wall in a number of places. Two pipistrelle droppings were found on the floor"* (Appendix 8.8 of the ES).
BSG 11	Moderate	No surveys completed. Assessment not required. Approximately 195m outside of the Project Site boundary.	Unknown. BSG identified: *"Derelict stone cottage, two distinct standing walls, no roof. Walls are*

AECOM Building Number	BRP Category (AECOM 2017 and BSG 2014 combined – Table 1.5)	Roost Surveys Completed - AECOM 2017	Roost Status – (AECOM 2017 and BSG 2014 combined)
			very exposed. Some roosting opportunities between the stone, and gaps into a rubble filled wall. No signs of use by bats were observed" (Appendix 8.8 of the ES).

ii. Bat Roosts in Trees

Trees - Preliminary Ground Level Roost Assessment

1.9.8 The results of the Preliminary Ground Level Roost Assessment are provided in Appendix 1A.

Trees - Potential Roost Feature Climbed Inspections

1.9.9 All trees with Low or Moderate bat roost suitability were put forward for climbed inspection. A full table of results from the climbed inspections are provided in Appendix 1A.

1.9.10 All trees inspected were reduced to Negligible or Low bat roost suitability. No bat roosts were identified.

1.9.11 Trees 3, 19, 21, 36 and 44 could not be accessed and therefore retained their original Moderate rating. These trees were taken forward for emergence and re-entry surveys, in the absence of the climbed inspection assessment.

1.9.12 Trees with Low bat roost suitability do not require further survey but may need to be checked for roosting bats before removal.

Emergence/Re-entry Surveys

1.9.13 The results of the emergence /re-entry surveys are provide in Table 1.7. The locations of the trees and the roost results are shown on Figure 4.

1.9.14 Of the five trees surveyed, one bat roost was confirmed in Tree 19. Whilst the bat was seen entering the tree, no calls were detected. This is possibly due to the distance of the tree canopy from the surveyor, and the angle of the bat from the detector. It has been concluded that the species is likely to be a common pipistrelle, because a brief common pipistrelle pass was heard approximately nine seconds before the roosting bat was seen flying around and then disappearing into the crown of Tree 19.

1.9.15 A Photograph of Tree 19 is provided in Plate 1.1.

Table 1.7 Tree Emergence/Re-entry Survey Results

AECOM Tree Number	BRP Category	Roost Surveys Completed	Roost Status
Tree 3	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost
Tree 19	Moderate	2 X Dusk Emergence 1 X Dawn Re-entry	Confirmed Roost. Lone male or lone non-breeding female summer roost for one common pipistrelle bat
Tree 21	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost
Tree 36	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost
Tree 44	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost

Plate 1.1: Tree 19 – Confirmed Bat Roost



c) Bat Activity Survey Results from 2017

iii. Walked Transects

1.9.16 The location of the walked transects and locations of the LPs are shown on Figures 3.1 to 3.3.

1.9.17 The results of the walked transect surveys are displayed in Tables 1.8 to 1.16.

1.9.18 Tables 1.8 to 1.10 display the count of bat passes for each species or species group.

1.9.19 Tables 1.11 to 1.14 display Bat Activity Index (BAI), expressed as bat passes per hour.

1.9.20 Tables 1.11 to 1.14 display BAI (passes/hr), by Listening Point (LP).

1.9.21 Tables 1.15 to 1.16 display BAI (passes/hr), by month.

1.9.22 The results of the transect surveys and the distribution of the bat passes recorded are shown Figures 5.1, 5.2 and 5.3.

1.9.23 A Site Assessment Summary is provided in Section 1.10.

Table 1.8 Bat Activity – Walked Transect Results – Species Composition

Species	Count of Bat Passes (June to October)	Percentage %	June Bat Passes	July Bat Passes	August Bat Passes	September Bat Passes	October Bat Passes
Lesser horseshoe	1	0.1	0	0	1	0	0
Common pipistrelle	512	54.4	99	115	153	56	89
Soprano pipistrelle	302	32.1	60	54	83	58	47
Nathusius' pipistrelle	2	0.2	0	2	0	0	0
Myotis species	92	9.8	10	16	28	17	21
Noctule/Serotine	17	1.8	5	5	4	1	2
Long-eared	1	0.1	0	0	0	1	0
Long-eared (possible)	4	0.4	1	0	2	0	1
Indeterminate	9	1.0	3	0	0	3	3
All Species	**940**	**-**	**178**	**192**	**271**	**136**	**163**

Table 1.9 Bat Activity – North Transect Results – Species Composition

Species	Count of Bat Passes (June to October)	Percentage %	June Bat Passes	July Bat Passes	August Bat Passes	September Bat Passes	October Bat Passes
Lesser horseshoe	0	0.0	0	0	0	0	0
Common pipistrelle	252	59.0	53	60	66	33	40
Soprano pipistrelle	129	30.2	29	22	30	32	16
Nathusius' pipistrelle	1	0.2	0	1	0	0	0
Myotis species	33	7.7	2	6	10	5	10
Noctule/Serotine	8	1.9	2	2	2	0	2
Long-eared	1	0.2	0	0	0	1	0
Long-eared (possible)	1	0.2	0	0	1	0	0
Indeterminate	2	0.5	1	0	0	0	1
All Species	**427**	**-**	**87**	**91**	**109**	**71**	**69**

Table 1.10 Bat Activity – South Transect Results – Species Composition

Species	Count of Bat Passes (June to October)	Percentage %	June Bat Passes	July Bat Passes	August Bat Passes	September Bat Passes	October Bat Passes
Lesser horseshoe	1	0.2	0	0	1	0	0
Common pipistrelle	260	50.7	46	55	87	23	49
Soprano pipistrelle	173	33.7	31	32	53	26	31
Nathusius' pipistrelle	1	0.2	0	1	0	0	0
Myotis species	59	11.5	8	10	18	12	11
Noctule/Serotine	9	1.8	3	3	2	1	0
Long-eared	0	0.0	0	0	0	0	0
Long-eared (possible)	3	0.6	1	0	1	0	1

Species	Count of Bat Passes (June to October)	Percentage %	June Bat Passes	July Bat Passes	August Bat Passes	September Bat Passes	October Bat Passes
Indeterminate	7	1.4	2	0	0	3	2
All Species	**513**	**-**	**91**	**101**	**162**	**65**	**94**

Table 1.11 Bat Activity – North Transect Results-BAI (bat passes/hr) by Listening Point (Spatial Distribution)

Listening Point	Lesser horseshoe	Common pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Myotis species	Noctule/Serotine	Long-eared	Long-eared (possible)	Indeterminate	All Species
1	0	4.4	2.2	0.0	0.0	0.0	0.0	0.0	0.0	6.7
1a	0	10.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	15.0
2	0	23.6	7.3	0.0	1.8	0.0	0.0	1.8	0.0	34.5
3	0	25.5	10.9	0.0	3.6	0.0	0.0	0.0	0.0	40.0
4	0	10.0	14.0	0.0	6.0	0.0	0.0	0.0	0.0	30.0
5	0	12.7	12.7	0.0	1.8	0.0	0.0	0.0	0.0	27.3
6	0	10.9	5.5	0.0	1.8	0.0	0.0	0.0	0.0	18.2
7	0	9.1	3.6	0.0	0.0	0.0	0.0	0.0	0.0	12.7
8	0	7.3	5.5	0.0	0.0	1.8	0.0	0.0	1.8	16.4
9	0	9.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1
10	0	5.5	1.8	0.0	0.0	0.0	0.0	0.0	0.0	7.3
11	0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8
12	0	12.0	2.0	0.0	4.0	0.0	0.0	0.0	0.0	18.0
All LPs	**0.0**	**11.1**	**5.3**	**0.0**	**1.7**	**0.2**	**0.0**	**0.2**	**0.2**	**18.5**

Table 1.12 Bat Activity – South Transect Results – BAI (bat passes/hr) by Listening Point (Spatial Distribution)

Listening Point	Lesser horseshoe	Common pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Myotis species	Noctule/Serotine	Long-eared	Long-eared (possible)	Indeterminate	All Species
1	0	1.8	3.6	0.0	7.3	0.0	0.0	0.0	0.0	12.7

Listening Point	Lesser horseshoe	Common pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Myotis species	Noctule/Serotine	Long-eared	Long-eared (possible)	Indeterminate	All Species
2	0	10.9	1.8	0.0	7.3	0.0	0.0	0.0	0.0	20.0
3	0	9.1	5.5	0.0	3.6	0.0	0.0	0.0	0.0	18.2
4	0	9.1	7.3	0.0	1.8	0.0	0.0	1.8	1.8	21.8
5	0	16.4	18.2	0.0	7.3	0.0	0.0	0.0	0.0	41.8
6	0	10.9	21.8	0.0	5.5	0.0	0.0	0.0	0.0	38.2
7	0	22.2	2.2	0.0	2.2	0.0	0.0	0.0	0.0	26.7
8	0	12.7	7.3	0.0	1.8	3.6	0.0	0.0	0.0	25.5
9	0	8.9	6.7	0.0	2.2	0.0	0.0	0.0	0.0	17.8
9a	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9b	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0	1.8	1.8	0.0	1.8	1.8	0.0	0.0	0.0	7.3
11	0	5.5	5.5	0.0	1.8	0.0	0.0	0.0	0.0	12.7
12	0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
All LPs	**0.0**	**9.0**	**6.8**	**0.0**	**3.6**	**0.5**	**0.0**	**0.2**	**0.2**	**20.2**

Table 1.13 Bat Activity – Listening Point Survey Times and BAI - North

North – Listening Point	North – LP Survey Time in hours	North – All Species – BAI (Bat passes/hour)
1	0.45	6.7
1a	0.20	15.0
2	0.55	34.5
3	0.55	40.0
4	0.50	30.0
5	0.55	27.3
6	0.55	18.2
7	0.55	12.7
8	0.55	16.4
9	0.55	9.1
10	0.55	7.3

North – Listening Point	North – LP Survey Time in hours	North – All Species – BAI (Bat passes/hour)
11	0.55	1.8
12	0.50	18.0
All LPs - North	**6.60**	**18.5**

Three minutes is expressed as 0.05hrs

Table 1.14 Bat Activity – Listening Point Survey Times and BAI - South

South – Listening Point	South – LP Survey Time	South – BAI (Bat passes/hour)
1	0.55	12.7
2	0.55	20.0
3	0.55	18.2
4	0.55	21.8
5	0.55	41.8
6	0.55	38.2
7	0.45	26.7
8	0.55	25.5
9	0.45	17.8
9a	0.05	0.0
9b	0.05	0.0
10	0.55	7.3
11	0.55	12.7
12	0.5	2.0
All LPs – South	**6.45**	**20.2**

Three minutes is expressed as 0.05hrs

Table 1.15 Bat Activity – North Transect Results 2017-BAI by Month (Temporal Distribution)

Transect	All Surveyed Months	June	July	August	September	October
Transect Survey Time (Hrs)	32.3	5.9	6.4	6.3	7.1	6.5
BAI (Bat passes/hour)	**13.2**	**7.0**	**7.0**	**8.5**	**4.8**	**5.3**

Table 1.16 Bat Activity – South Transect Results 2017-BAI by Month (Temporal Distribution)

Transect	All Surveyed Months	June	July	August	September	October
Transect Survey Time (Hrs)	33.7	6.6	6.5	6.5	7.6	6.5
BAI (Bat passes/hour)	**15.2**	**2.7**	**3.0**	**4.8**	**1.9**	**2.8**

iv. Static Detector Surveys

1.9.24 The Static Detector Locations are shown in Figure 3.4.

1.9.25 The results of the static detector surveys are presented in Tables 1.17 to 1.22.

1.9.26 33,764 bat passes were recorded at the Project Site between June and October 2017. A total of 173.5 recording nights were completed.

1.9.27 Table 1.17 and 1.19 display the count of bat passes for each species or species group.

1.9.28 Table 1.18 displays the BAI for each species or species group.

1.9.29 Tables 1.20 to 1.21 display BAI, expressed as bat passes per night.

1.9.30 Table 1.20 displays BAI (passes/night), by Static Detector Location.

1.9.31 Table 1.21 displays BAI (passes/night), by month.

1.9.32 Table 1.22 displays the bat passes and BAI for each Static Detector Location Group.

1.9.33 Appendix 4A Tables 2.2 to 2.6 provide the results of the Kruskal-Wallis and Mann Whitney-Wilcoxon non parametric tests.

1.9.34 Plates 1. 2 and 1.3 displays box plots for bat passes (shown on the y axis as bat call frequency) for location and month, respectively.

1.9.35 Plates 1. 4 and 1.5 display box plots for bat species richness for location and month, respectively. Bat species richness is defined as the number of different bat species recorded at each location.

1.9.36 A Site Assessment Summary is provided in Section 1.10.

Table 1.17 Bat Activity Static Detector Results – Bat Passes and Species Composition

Month	Static Detector Location Number	Static Detector Location Name	Long-eared	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species
June 2017	1	North 1	0	1	2	0	0	248	3	0	0	253
	2	North 2	0	38	2	0	0	1336	72	0	0	1448
	3	North 3	0	0	1	0	0	682	43	0	0	726
	4	South 1	0	66	5	0	0	824	412	0	0	1307
	5	South 2	0	4	0	0	0	397	382	0	0	783
	6	South 3	Equipment malfunction, no results									
	7	Lane 1	0	242	2	1	0	513	40	0	0	798
	8	Lane 2	0	166	2	0	0	1158	896	0	0	2222
	9	Lane 3	0	36	3	0	0	191	117	0	0	347
	Total		**0**	**553**	**17**	**1**	**0**	**5348**	**1965**	**0**	**0**	**7884**
July 2017	1	North 1	0	16	3	0	0	43	36	0	0	98
	2	North 2	0	2	1	0	0	17	6	0	0	26
	3	North 3	0	18	2	0	0	113	9	0	0	142
	4	South 1	Equipment malfunction, no results									
	5	South 2	0	7	1	0	0	82	91	0	0	181
	6	South 3	1	7	8	0	0	13	17	0	1	47
	7	Lane 1	0	351	4	0	0	4126	216	0	0	4697
	8	Lane 2	0	365	0	0	1	4567	4656	1	0	9590
	9	Lane 3	0	38	5	0	0	45	32	0	2	122
	Total		**1**	**804**	**24**	**0**	**1**	**9006**	**5063**	**1**	**3**	**14903**
August 2017	1	North 1	0	94	3	0	0	1268	505	0	0	1870
	2	North 2	5	3	6	0	0	35	31	0	0	80
	3	North 3	2	14	8	0	1	567	70	0	0	662
	4	South 1	1	60	5	0	0	2179	393	0	0	2638
	5	South 2	3	32	2	0	0	39	37	0	6	119
	6	South 3	2	15	10	0	0	31	26	0	1	85
	7	Lane 1	1	41	5	0	0	46	29	0	1	123
	8	Lane 2	Equipment malfunction, no results									
	9	Lane 3	9	125	18	0	2	386	832	0	0	1366
	Total		**17**	**384**	**57**	**0**	**3**	**4551**	**1923**	**0**	**8**	**6943**

Month	Static Detector Location Number	Static Detector Location Name	Long-eared	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species
September 2017	1	North 1	0	5	0	0	0	13	9	0	0	27
	2	North 2	0	1	1	0	0	24	4	0	0	30
	3	North 3	0	64	1	0	0	253	31	0	0	349
	4	South 1	0	28	1	0	0	1893	395	0	0	2317
	5	South 2	0	0	1	0	0	7	6	0	0	14
	6	South 3	0	0	0	0	0	0	0	0	0	0
	7	Lane 1	0	4	0	0	0	17	9	0	1	31
	8	Lane 2	Equipment malfunction, no results									
	9	Lane 3	0	5	1	0	1	15	11	0	1	34
	Total		**0**	**107**	**5**	**0**	**1**	**2222**	**465**	**0**	**2**	**2802**
October 2017	1	North 1	0	0	0	0	0	0	0	0	0	0
	2	North 2	0	11	3	1	1	23	58	0	0	97
	3	North 3	0	6	2	0	0	20	11	0	0	39
	4	South 1	0	0	0	0	0	0	0	0	0	0
	5	South 2	0	3	7	0	0	104	151	0	0	265
	6	South 3	1	2	1	0	0	11	8	0	0	23
	7	Lane 1	0	9	2	0	0	26	22	0	0	59
	8	Lane 2	0	0	0	0	0	371	319	0	0	690
	9	Lane 3	3	2	8	0	0	25	20	0	1	59
	Total		**4**	**33**	**23**	**1**	**1**	**580**	**589**	**0**	**1**	**1232**
June to October 2017	**Grand Total**		**22**	**1881**	**126**	**2**	**6**	**21707**	**10005**	**1**	**14**	**33764**

N/S/L = Noctule/Serotine/Leisler's; N.Pip= Nathusius' pipistrelle, Pip = pipistrelle species, C.Pip = Common pipistrelle, S.Pip= Soprano pipistrelle, GHS = Greater horseshoe; LHS = Lesser horseshoe

Table 1.18 Bat Activity Static Detector Results – Bat Activity and Species Composition

Month	Static Detector Location Number	Static Detector Location Name	L-E	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All	Number of Recording Nights
June 2017	1	North 1	0.0	0.2	0.4	0.0	0.0	49.4	0.6	0.0	0.0	50.6	5
	2	North 2	0.0	7.6	0.4	0.0	0.0	267.2	14.4	0.0	0.0	289.6	5
	3	North 3	0.0	0.0	0.2	0.0	0.0	136.4	8.6	0.0	0.0	145.2	5
	4	South 1	0.0	22.0	1.7	0.0	0.0	274.7	137.3	0.0	0.0	435.7	3
	5	South 2											5
	6	South 3	Equipment malfunction, no results										0
	7	Lane 1	0.0	96.8	0.8	0.4	0.0	205.2	16.0	0.0	0.0	319.2	2.5
	8	Lane 2	0.0	66.4	0.8	0.0	0.0	463.2	358.4	0.0	0.0	888.8	2.5
	9	Lane 3	0.0	7.2	0.6	0.0	0.0	38.2	23.4	0.0	0.0	69.4	5
	Total		**0.0**	**16.76**	**0.52**	**0.03**	**0.00**	**162.06**	**59.55**	**0.00**	**0.00**	**238.9**	**33**
July 2017	1	North 1	0.0	3.2	0.6	0.0	0.0	8.6	7.2	0.0	0.0	19.6	5
	2	North 2	0.0	0.4	0.2	0.0	0.0	3.4	1.2	0.0	0.0	5.2	5
	3	North 3	0.0	4.0	0.4	0.0	0.0	25.1	2.0	0.0	0.0	31.6	4.5
	4	South 1	Equipment malfunction, no results										0
	5	South 2	0.0	1.4	0.2	0.0	0.0	16.4	18.2	0.0	0.0	36.2	5
	6	South 3	0.2	1.4	1.6	0.0	0.0	2.6	3.4	0.0	0.2	9.4	5
	7	Lane 1	0.0	70.2	0.8	0.0	0.0	825.2	43.2	0.0	0.0	939.4	5
	8	Lane 2	0.0	73.0	0.0	0.0	0.2	913.4	931.2	0.2	0.0	1918.0	5
	9	Lane 3	0.0	7.6	1.0	0.0	0.0	9.0	6.4	0.0	0.4	24.4	5
	Total		**0.03**	**20.35**	**03641**	**0.00**	**0.03**	**228.0**	**128.18**	**0.03**	**0.08**	**377.29**	**39.5**
August 2017	1	North 1	0.0	18.8	0.6	0.0	0.0	253.6	101.0	0.0	0.0	374.0	5
	2	North 2	1.1	0.7	1.3	0.0	0.0	7.8	6.9	0.0	0.0	17.8	4.5
	3	North 3	0.4	2.8	1.6	0.0	0.2	113.4	14.0	0.0	0.0	132.4	5
	4	South 1	0.2	12.0	1.0	0.0	0.0	435.8	78.6	0.0	0.0	527.6	5
	5	South 2	0.7	7.1	0.4	0.0	0.0	8.7	8.2	0.0	1.3	26.4	4.5
	6	South 3	0.4	3.0	2.0	0.0	0.0	6.2	5.2	0.0	0.2	17.0	5
	7	Lane 1	0.3	10.3	1.3	0.0	0.0	11.5	7.3	0.0	0.3	30.8	4
	8	Lane 2	Equipment malfunction, no results										0
	9	Lane 3	0.6	25.0	3.6	0.0	0.4	77.2	166.4	0.0	0.0	273.2	5
	Total		**0.45**	**10.11**	**1.50**	**0.00**	**0.08**	**119.76**	**50.61**	**0.00**	**0.21**	**182.71**	**38**

Month	Static Detector Location Number	Static Detector Location Name	L-E	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All	Number of Recording Nights
September 2017	1	North 1	0.0	1.7	0.0	0.0	0.0	4.3	3.0	0.0	0.0	9.0	3
	2	North 2	0.0	0.2	0.2	0.0	0.0	4.8	0.8	0.0	0.0	6.0	5
	3	North 3	0.0	12.8	0.2	0.0	0.0	50.6	6.2	0.0	0.0	69.8	5
	4	South 1	0.0	5.6	0.2	0.0	0.0	378.6	79.0	0.0	0.0	463.4	5
	5	South 2	0.0	0.0	0.3	0.0	0.0	2.0	1.7	0.0	0.0	4.0	3.5
	6	South 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
	7	Lane 1	0.0	1.0	0.0	0.0	0.0	4.3	2.3	0.0	0.3	7.8	4
	8	Lane 2	Equipment malfunction, no results										0
	9	Lane 3	0.0	1.3	0.3	0.0	0.3	3.8	2.8	0.0	0.3	8.5	4
	Total		**0.00**	**3.45**	**0.16**	**0.00**	**0.03**	**71.68**	**15.00**	**0.00**	**0.06**	**90.39**	**31**
October 2017	1	North 1	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
	2	North 2	0.0	2.2	0.6	0.2	0.2	4.6	11.6	0.0	0.0	19.4	5
	3	North 3	0.0	1.7	0.6	0.0	0.0	5.7	3.1	0.0	0.0	11.1	3.5
	4	South 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
	5	South 2	0.0	0.6	1.4	0.0	0.0	20.8	30.2	0.0	0.0	53.0	5
	6	South 3	0.3	0.6	0.3	0.0	0.0	3.1	2.3	0.0	0.0	6.6	3.5
	7	Lane 1	0.0	2.6	0.6	0.0	0.0	7.4	6.3	0.0	0.0	16.9	3.5
	8	Lane 2	0.0	0.0	0.0	0.0	0.0	74.2	63.8	0.0	0.0	138.0	5
	9	Lane 3	0.9	0.6	2.3	0.0	0.0	7.1	5.7	0.0	0.3	16.9	3.5
	Total		**0.13**	**1.03**	**0.72**	**0.03**	**0.03**	**18.13**	**18.41**	**0.00**	**0.03**	**38.50**	**32**
June-October 2017	**Grand Total**		**0.13**	**10.84**	**0.73**	**0.01**	**0.03**	**125.11**	**57.67**	**0.01**	**0.08**	**194.61**	**173.5**

Bat Activity Index = Bat Pass / Survey Nights. *L-E = Long-eared, N/S/L = Noctule*/Serotine/Leisler's; *N.Pip= Nathusius' pipistrelle, Pip = pipistrelle species, C.Pip = Common pipistrelle, S.Pip= Soprano pipistrelle,GHS = Greater horseshoe; LHS = Lesser horseshoe*

Table 1.19 Bat Activity Static Detector Results – Bat Passes by Static Detector Location (Spatial Distribution)

Month	Static Detector Location Number	Static Detector Location Name	L-E	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species	Number of Recording Nights
June-October 2017	1	North 1	0	116	8	0	0	1571	553	0	0	2248	19.5
	2	North 2	5	55	13	1	1	1435	171	0	0	1681	24.5
	3	North 3	2	102	14	0	1	1635	164	0	0	1918	23
	4	South 1	1	154	11	0	0	4896	1200	0	0	6262	14.5
	5	South 2	3	46	11	0	0	629	667	0	6	1362	23
	6	South 3	4	24	19	0	0	55	51	0	2	155	15
	7	Lane 1	1	647	13	1	0	4728	316	0	2	5708	19
	8	Lane 2	0	531	2	0	1	6096	5871	1	0	12502	12.5
	9	Lane 3	6	206	35	0	3	662	1012	0	4	1928	22.5
	All		**22**	**1881**	**126**	**2**	**6**	**21707**	**10005**	**1**	**14**	**33764**	**173.5**

L-E = Long-eared, N/S/L = Noctule/Serotine/Leisler's; N.Pip= Nathusius' pipistrelle, Pip = pipistrelle species, C.Pip = Common pipistrelle, S.Pip= Soprano pipistrelle, GHS = Greater horseshoe; LHS = Lesser horseshoe

Table 1.20 Bat Activity Static Detector Results – Bat Activity by Static Detector Location (Spatial Distribution)

Month	Static Detector Location Number	Static Detector Location Name	L-E	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species
June-October 2017	1	North 1	0.00	116.00	8.00	0.00	0.00	1571.00	553.0	0.00	0.00	2248.00
	2	North 2	5.00	44.45	10.12	0.04	0.04	1412.94	115.37	0.00	0.00	1587.96
	3	North 3	2.00	96.26	12.09	0.00	1.00	1615.87	153.48	0.00	0.00	1880.70
	4	South 1	1.00	154.00	11.00	0.00	0.00	4896.00	1200.00	0.00	0.00	6262.00
	5	South 2	3.00	43.13	4.30	0.00	0.00	529.52	522.57	0.00	6.00	1108.52
	6	South 3	3.07	22.13	18.07	0.00	0.00	44.73	43.53	0.00	2.00	133.53
	7	Lane 1	1.00	638.47	11.11	1.00	0.00	4703.37	295.16	0.00	2.00	5652.11
	8	Lane 2	0.00	531.00	2.00	0.00	1.00	5754.68	5577.52	1.00	0.00	11867.20
	9	Lane 3	3.13	204.09	27.36	0.00	3.00	638.11	992.89	0.00	3.04	1871.62
	All		**0.13**	**10.84**	**0.73**	**0.01**	**0.03**	**125.11**	**57.67**	**0.01**	**0.08**	**194.61**

Bat Activity Index = Bat Pass / Survey Nights. *L-E = Long-eared,* N/S/L = Noctule/Serotine/Leisler's; *N.Pip = Nathusius' pipistrelle, Pip = pipistrelle species, C.Pip = Common pipistrelle, S.Pip= Soprano pipistrelle, GHS = Greater horseshoe; LHS = Lesser horseshoe*

Table 1.21 Bat Activity Static Detector Results – Bat Activity by Month (Temporal Distribution)

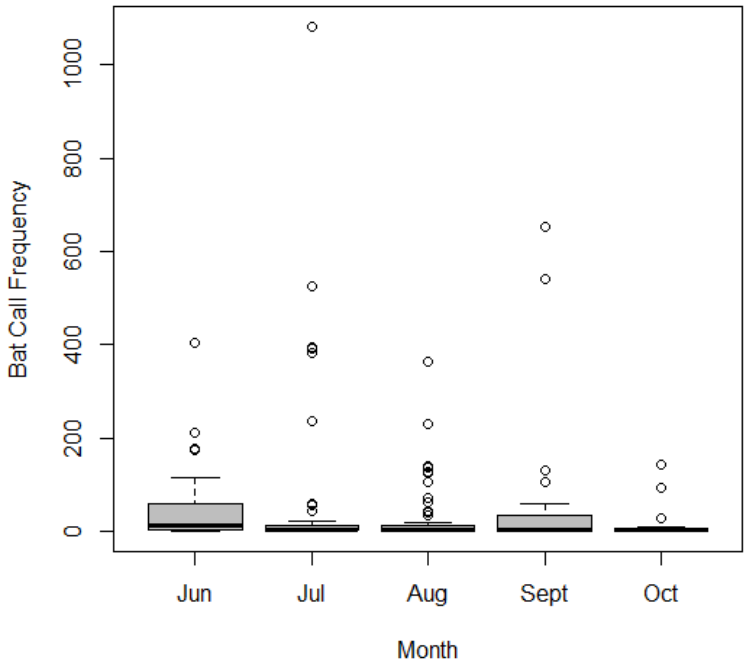
	June	July	August	September	October	All Survey Months
Bat Passes (Count)	7884	14903	6943	2802	1232	33764
Survey Time (Nights)	33	39.5	38	31	32	173.5
Bat Activity Index (BAI) (Bat passes/ Time)	238.9	377.3	182.7	90.4	38.5	194.6

Bat Activity Index = Bat Pass / Survey Time in Survey Nights

Table 1.22 Bat Activity Static Detector Results – Bat Passes and BAI by Static Detector Location Group

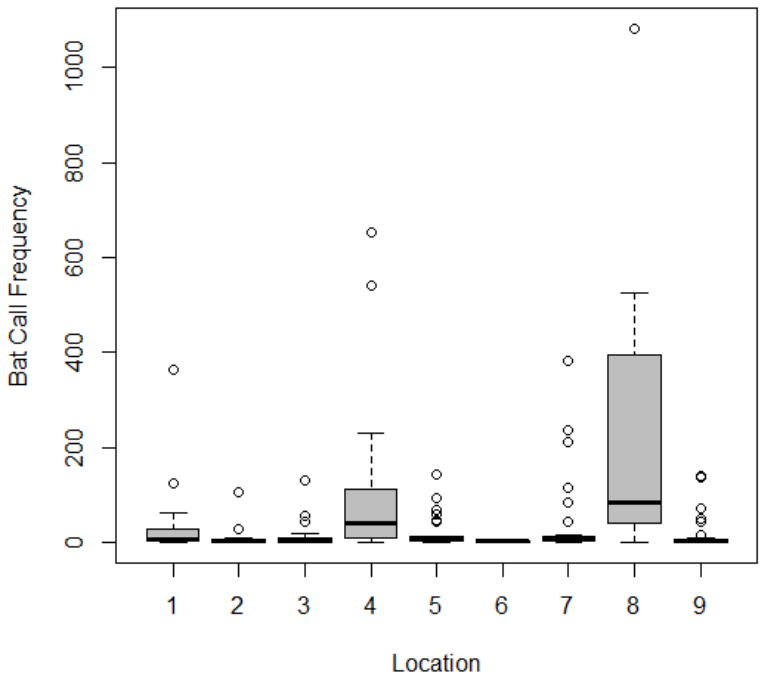
Static Detector Location Group	Total Passes	BAI
North (1-3)	5847	87.3
South (4-6)	7779	148.2
Lane (7-9)	20138	372.9

Plate 1.2: Box Plots for Static Detector Statistical Analysis - Bat passes by Month.



Bat passes is shown on the y axis as 'bat call frequency'. The boxes span the first quartile to the third quartile values (the interquartile range), with the thick black line in the box being the median value. The 'T' shape or 'Whiskers' above and below the box show the minimum and maximum values. The points on the graph show the outliers.

Plate 1.3: Box Plots for Static Detector Statistical Analysis - Bat passes by Location



KEY:
Location 1 = North 1
Location 2 = North 2
Location 3 = North 3
Location 4 = South 1
Location 5 = South 2
Location 6 = South 3
Location 7 = Lane 1
Location 8 = Lane 2
Location 9 = Lane 3

Bat passes is shown on the y axis as 'bat call frequency'

Plate 1.4: Box Plots for Static Detector Statistical Analysis - Bat Species Richness by Month.

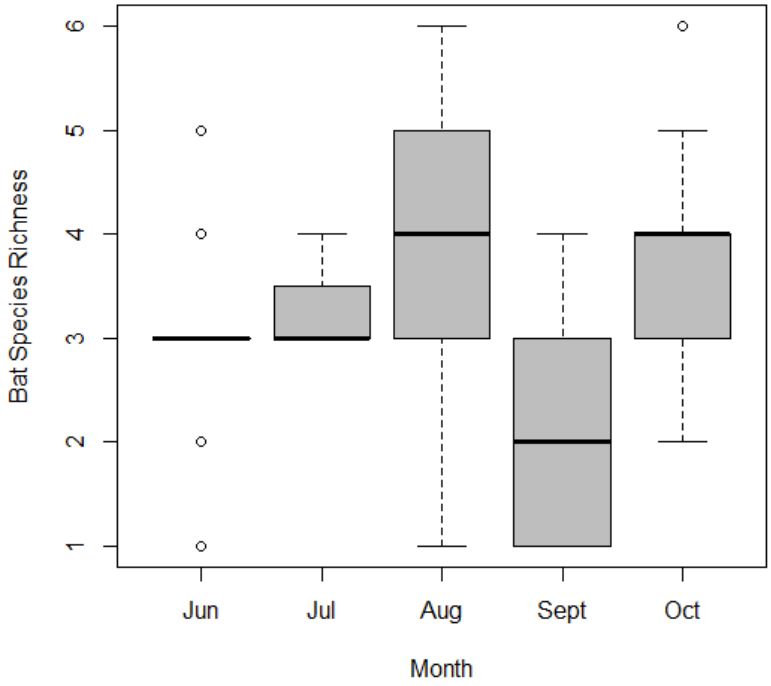
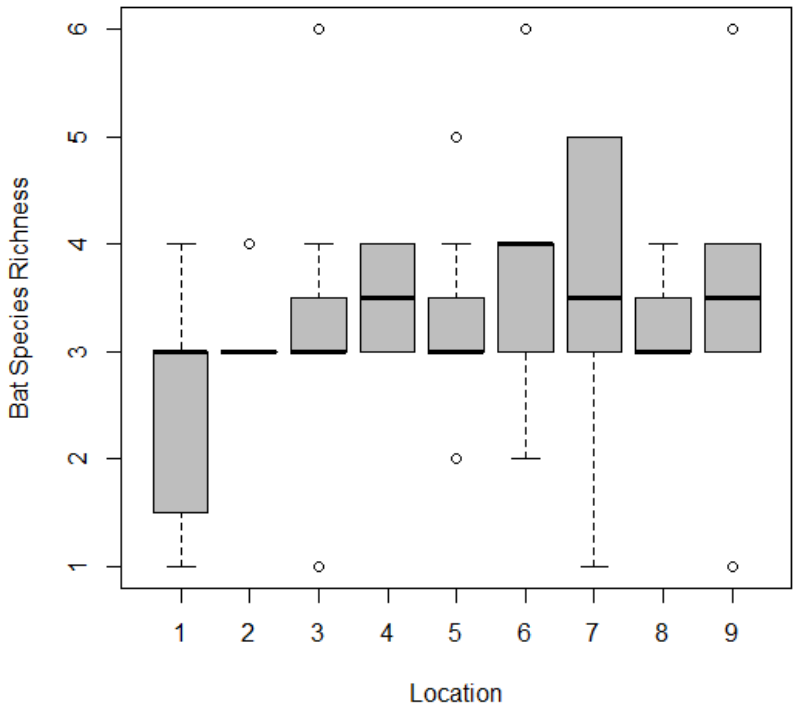


Plate 1.5: Box Plots for Static Detector Statistical Analysis - Bat Species Richness by Location.



KEY:
Location 1 = North 1
Location 2 = North 2
Location 3 = North 3
Location 4 = South 1
Location 5 = South 2
Location 6 = South 3
Location 7 = Lane 1
Location 8 = Lane 2
Location 9 = Lane 3

1.10 Preliminary Project Site Assessment

a) Bat Roosts

i. Bat Roosts in Buildings

1.10.1 There are no buildings, and hence no building bat roosts, within the Project Site.

1.10.2 Buildings adjacent to the Project Site were assessed. None of the buildings surveyed by AECOM supported bat roosts. Previous surveys by BSG in 2014 confirmed roosts in buildings not surveyed by AECOM in 2017 (Appendix 8.8 of the ES). This is expressed in Table 1.6 and shown on Figure 4.2:

ii. Bat Roosts in Trees

1.10.3 Tree 19 is a lone male or non-breeding female common pipistrelle summer roost. No other trees were identified as bat roosts. A photograph of Tree 19 is shown in Plate 1.1.

b) Bat Activity – Species Composition

1.10.4 At least 13 species of bat were recorded foraging and/or commuting in close proximity of and within the Project Site. The following species have been identified during bat surveys at the Project Site:

- Greater horseshoe
- Lesser horseshoe;
- Common pipistrelle;
- Soprano pipistrelle;
- Nathusius' pipistrelle;
- Daubenton's;
- Natterer's;
- Mytois species; (including calls with characteristics of Bechstein's, Brandt's *Myotis brandti* and Whiskered *Myotis mystacinus*);
- Noctule;
- Serotine;
- Leisler's;
- Long-eared species; and,
- Indeterminate species.

i. Pipistrelle species

1.10.5 Common and soprano pipistrelles were the most commonly recorded species in the Project Site. Overall pipistrelle species comprised 86.8 % of all passes recorded on the walked transect surveys and 93.9% of the static detector surveys. They were also the most commonly recorded species during the emergence/re-entry surveys. Pipistrelle species comprised of 89.5% of the passes recorded on the North Transect and 84.6% of the passes recorded on the South Transect.

1.10.6 Pipistrelle species were similarly the most commonly recorded species during the BSG 2014 transect and static detector surveys (Appendix 8.8 of the ES).

1.10.7 Two passes of Nathusius' pipistrelle were recorded during the July transect surveys, one record from the South Transect and one record from the North Transect, making up 0.2% of total bat passes.

1.10.8 One pass of Nathusius' pipistrelle was recorded at Lane 1 in June and one pass of Nathusius' pipistrelle at North 2 in October, making up <0.1% of the total bat passes.

1.10.9 One pass of Nathusius' pipistrelle was recorded during the BSG static detector surveys in 2014 at Location D8 (ES Appendix 8.8)). Location D8 is in a similar area to the AECOM South 1. Nathusius' pipistrelle were not identified during the BSG 2014 activity transect surveys (Appendix 8.8 of the ES).

ii. Myotis species

1.10.10 Myotis species comprised 9.8% of the total calls recorded on the transect surveys. Myotis species comprised 7.7% of the passes recorded on the North Transect and 11.5% of the calls recorded on the South Transect

1.10.11 Activity levels for Myotis species during the 2017 transects surveys were comparable with the activity levels recorded during the BSG 2014 transect surveys (Appendix 8.8 of the ES).

1.10.12 A total of 1881 Myotid bat passes, 5.6% of the total calls, were recorded during the static detector surveys. Myotis species were recorded in every month, with the highest level of activity recorded in July with BAI of 20.6, and the second highest level recorded in June with a BAI of 17.0.

1.10.13 Some of the Myotid bat echolocation calls from the static detector surveys were considered to have characteristics of Bechstein's (85 passes), Brandt's (50 passes) and whiskered (87 passes). BSG did not identify Myotis to species level (Appendix 8.8 of the ES).

iii. Noctule, Serotine, and Lieslers Species

1.10.14 Noctule and serotine bats comprised 1.8% of the passes recorded on walked transect surveys. Noctule and serotine bats comprised of 1.9% of the passes recorded on the North Transect and 1.8% of the passes recorded on the South Transect. BSG did not breakdown these species into percentages (Appendix 8.8 of the ES).

1.10.15 Noctule, serotine and Leisler's (N/S/L) bats comprised 0.4% of the passes recorded during the static detector surveys.

1.10.16 Noctule, serotine and Leisler's were recorded during the BSG 2014 static detector surveys Serotine were not identified during the BSG 2014 activity transect surveys (ES Appendix 8.8).

iv. Long-eared Species

1.10.17 Long-eared and possible long-eared bat comprised a total of 0.5% of the passes recorded on the North Transect and 0.6% recorded on the South Transect surveys. BSG did not breakdown these species into percentages (Appendix 8.8 of the ES).

1.10.18 Long-eared bats comprised 0.1% of the passes recorded during the static detector surveys.

v. Horseshoe Bat Species

1.10.19 There was a single lesser horseshoe bat pass recorded on the South Transect, equating to 0.2% of the total passes for the South Transect and 0.1% of the total passes for the Project Site. This was recorded in August 2017. BSG 2014 also recorded only one lesser horseshoe bat pass, again recorded on the BSG south transect (Appendix 8.8 of the ES).

1.10.20 A total of 14 lesser horseshoe passes were recorded during the static detector survey:

- Three passes recorded in July; one pass at South 3 and two passes at Lane 3;
- Eight passes recorded in August; six passes at South 2, one pass at South 3 and one pass at Lane 1:
- Two passes in September: one at Lane 1 and one at Lane 3; and
- One pass in October at Lane 3.

1.10.21 BSG recorded a single lesser horseshoe pass at Location D3 (Appendix 8.8 of the ES), which is in a similar area to AECOM South 3.

1.10.22 Greater horseshoe was not detected during the walked transect survey. A single greater horseshoe pass was recorded at Lane 2 in July during the static detector surveys. BSG recorded two greater horseshoe passes in 2014, in Locations D5 and D8 (Appendix 8.8 of the ES). Location D5 was located along the Gallops near to Abergelli Farm and is not comparable with any of the AECOM locations as this is outside of the Project Site Boundary. Location D8 is relatively close to AECOM South 1.

c) Bat Activity – Spatial Distribution

1.10.23 Figure 5.1 shows the spatial distribution of individual bat passes recorded during the transect surveys. Figure 3.4 shows the static detector locations.

1.10.24 In total 940 bat passes were recorded during the walked transects.

1.10.25 Higher levels of activity were recorded in the Southern Transect (513 bat passes; 15.2 BAI), compared to the Northern Transect (427 bat passes, 13. 2 BAI). The bat activity levels are broadly similar.

1.10.26 In total 33,764 bat passes were recorded during the static detector surveys. Table 1.22 gives the bat activity by the Static Detector Location Groups. Higher levels of activity were recorded in the Southern Static Detector Locations (7,779 total bat passes; 148.2 BAI), compared to the Northern Static Detector Locations (5,847 total bat passes, 87.3 BAI), reflecting the pattern of the walked transect.

1.10.27 Using the first night data from static detector surveys, the species richness recorded across different locations was not statistically significant (Appendix 4A: Table 2.5). Therefore, similarly to the walked transect results, the bat activity levels between North and South are broadly similar.

1.10.28 The highest level of activity was recorded in the Lane Static Detector Locations (20,138 total bat passes, 372.9 BAI). The Lane Static Detector Locations (even with the equipment malfunctions, see Limitations) had higher levels of activity compared to both the North and South Static Detector Locations combined. This may be because the Lane is likely used for foraging, along the sheltered woodland edge, and detectors may have been recording multiple passes by the same bats up and down the Lane.

1.10.29 During the walked transects bat activity was recorded across the Project Site (Figure 5.1). Vegetated stream or wet ditch corridors appear to be important for bats within the Project Site. The distribution of bat call suggests the following general patterns of activity. This is a qualitative assessment only:

- Pipistrelle bats were recorded across the Project Site;
- Myotis Species showed some association with mature tree lines and/or areas near water;
- Noctule and Serotine bats were primarily recorded at height over open fields across the Project Site;
- Long-eared bats showed some association with mature tree lines and are focused more towards the centre and south-east of the Project Site. The passes recorded are within approximately 315m to 700m of the BSG confirmed long-eared roost in Building 7 and approximately 270m and 850m of the BSG confirmed long-eared roost in Building 2;
- The single lesser horseshoe was recorded on the South Transect along a mature tree line approximately 900m south of the closest known lesser horseshoe roost in Building 2.

1.10.30 The distribution of bat echolocation calls detected during the static detector surveys suggests the following general patterns of activity. This is a qualitative assessment only:

- Pipistrelle bats were recorded across the Project Site;
- Myotis species were recorded across the Project Site;
- Noctule, Serotine and Leisler bats were recorded across the Project Site ;
- Long-eared bats were recorded at the majority of Static Detector Location except for North 1 and Lane 2;
- The single greater horseshoe was recorded at Lane 2 in the south-west of the Project Site; and
- Lesser horseshoe bats were recorded within the south and south-west of the Project Site at South 2, South 3, Lane 1 and Lane 2.

i. North Transect

1.10.31 Figure 5.2 shows the spatial spread of bat passes recorded on the North Transect.

1.10.32 Table 1.23 below provides the BAI values for the North Transect LPs and a description of the habitat at the LP.

1.10.33 LP2 and LP8 had the highest species richness, with a total of four different species recorded at each.

1.10.34 LP3 had the highest BAI, with LP4 having the second highest BAI. LP3 is located adjacent to a watercourse and riparian woodland with mature trees. LP4 is located next to a row of mature trees which are connected to the Abergelli Farm buildings to the west and a watercourse to the east.

1.10.35 LP11 had the lowest BAI, with only one bat pass was recorded over all the months.

1.10.36 Photographs highlighting some of the habitat types within the North Transect are provided in Plate 1.6.

Table 1.23 North Transect – BAI Results and Habitat Descriptions for LPs

Listening Point	BAI for All Species	Habitat Description
3	40.0	Within the corner of improved grassland field adjacent to a vegetated stream corridor with mature trees and scrub. Field is grazed by sheep.
2	34.5	On the 'cross roads' of a vegetated stream corridor with mature trees and scrub; and a mature tree line with partially wet ditch. Improved grassland field are adjacent to these linear features, grazed by horses and sheep.
4	30.0	Adjacent to a mature tree line and a wet ditch, within an improved grassland field, which has patches of soft rush.
5	27.3	On a farm track which has a mature hedgerow species, on one side including mature hawthorn and other mature trees. Surrounding the track are improved grassland fields grazed by horses and sheep.
6	18.2	On a farm track, further north than LP 5, which has a mature hedgerow species, on one side including mature hawthorn and other mature trees. Surrounding the track are improved grassland fields grazed by horses and sheep. There is a residential property nearby.
12	18.0	On a farm track, further south than LP 5, which has a mature hedgerow species, on one side including mature hawthorn and other mature trees. Surrounding the track are improved grassland fields grazed by horses and sheep. This point is an interchange between a number of hedgerows.
8	16.4	On the edge of an improved grassland field, adjacent to a wet ditch/source of a stream which is lined with mature trees.
1a	15.0	In the corner of an improved grassland field, adjacent to intact hedgerows and near to farm buildings. Fields are grazed by horses and sheep. No ditches or watercourses.
7	12.7	On the edge of an improved grassland field to a defunct hedgerow of sparsely distributed hawthorn trees. This is near the brow of the hill and near to the highest point of the site. No ditches or watercourses.
9	9.1	In the corner of improved grassland field adjacent to wire fence and species poor hedgerow, predominantly of bracken, this borders a minor road. No ditches or watercourses.
10	7.3	On the edge of an improved grassland field adjacent to a species poor hedgerow, predominantly of bracken, this borders a minor road. No ditches or watercourses.
1	6.7	On track next to corner of an improved grassland field, adjacent to intact hedgerows and near to farm buildings. Fields are grazed by horses and sheep. No ditches or watercourses.
11	1.8	On a farm track which has some mature trees and some sections of hedgerow. The track is between a solar farm and a semi-improved grassland field. No ditches or watercourses.

ii. South Transect

1.10.37 Figure 5.3 shows the spatial spread of individual bat records during the north transect surveys.

1.10.38 Table 1.24 provides the BAI values for the South Transect LPs and a description of the habitat at the LP.

1.10.39 LP4, LP8 and LP10 had the highest level of species richness, with a total of four different species recorded at each.

1.10.40 LP5 had the highest BAI, with LP6 having the second highest BAI. LP5 is located next to an area of riparian woodland and watercourse. LP6 is located at the end of a mature tree line, next to a wet ditch and marshy grassland. LP5 and LP6 are located within the south-east of the Project Site.

1.10.41 LP12 had the lowest BAI over all the months.

1.10.42 Photographs highlighting some of the habitat within the South Transect are provided in Plate 1.7.

Table 1.24 South Transect – BAI Results and Habitat Descriptions for LPs

Listening Point	BAI for All Species	Habitat Description
5	41.8	On the Gallops / farm track adjacent to semi-natural riparian woodland on the east and marshy grassland to the west. The LP is at the confluence of two riparian corridors, an unnamed stream and the Afon Llan River.
6	38.2	At the end of a line of mature trees adjacent to a wet ditch. Surrounding fields are of marshy grassland and improved grassland grazed by sheep.
7	26.7	On the edge of an improved grassland field adjacent to a woodland edge, with mature trees and running water. To the north of the LP is semi-improved neutral grassland.
8	25.5	On the edge of an improved grassland field adjacent to barbed wire fence with running water. There is no hedgerow or trees at this point on the stream. Mature trees border the stream a short distance to the south.
4	21.8	On the Gallops / farm track adjacent to marshy grassland. This is in proximity to LP6, and bats were on occasion seen flying from the tree line at LP6 across the Gallops and foraging over the marshy grassland.
2	20.0	On the ‘cross roads of three rides in the semi-natural woodland. A vegetated stream corridor is nearby.
3	18.2	On the edge of semi natural woodland (ancient woodland), adjacent to improved grassland field gazed by horses.
9	17.8	On the edge of an improved grassland field, on the end of a wet ditch, next to a wire fence.
1	12.7	On a farm track on the edge of an area of semi-natural woodland, adjacent to a small pond generated by run off from the field.
11	12.7	On the edge of a marshy grassland field adjacent to a hedgerow with trees and a wet flowing ditch.
10	7.3	In the corner of a marshy grassland field adjacent to a mature tree line. No ditches or watercourses.
12	2.0	On the farm track adjacent to a semi-improved grassland field grazed by horses. No wet ditches or watercourses.
9a	0.0	On edge of a marshy grassland field, adjacent to hedgerow. On same corridor as LP11. Ditch with running water on opposite side of hedge.
9b	0.0	Within a marshy grassland field, adjacent to a wire fence. No wet ditches or watercourses.

iii. Static Detector Surveys

1.10.43 Figure 3.4 shows the Static Detector Locations.

1.10.44 Table 1.25 provides the BAI values for Static Detector Locations and a description of the habitat at the Locations.

1.10.45 The statistical analysis shows that the number of bat passes is influenced by location (Appendix 4A: Table 2.2).

Table 1.25 Static Detector - BAI Results and Habitat Description for Locations

Static Detector Locations	BAI for All Species	Habitat Description
Lane 2	1000.2	Located with a hedgerow next on the north edge of the Access Road. The microphone faces south into the Lane. There is a row of mature trees on the north edge of the Lane and Ancient Woodland along the south. There is a matrix of semi-improved and marshy grassland adjacent to the north.
South 1	431.9	Located on a sycamore which is within a strip of broadleaved woodland on the south bank of a wet ditch. The microphone faces south-east over an improved grassland field.
Lane 1	300.4	Located on a tree on the tree lined north edge of the Access Road. The tree line stops at this location and is on the edge of a strip of scrub where the woodland has been cleared and managed and kept open below power lines. The microphone faces south-east into the Lane and scrub clearing.
North 1	115.3	Located on a fence post, on the intersection of a vegetated stream corridor with mature trees and a mature tree line with partially wet ditch. The microphone faces south along the stream. Improved grassland field are adjacent to these linear features, grazed by horses and sheep.
Lane 3	85.7	Located on an alder, within the tree lined north edge of the Access Road. There is a row of mature trees and broadleaved woodland on the north edge of the Lane and Ancient Woodland along the south. The microphone faces south-east into the Lane.
North 3	83.4	Located on a mature oak, within a row of mature trees along the vegetated stream corridor. The microphone faces south-west across the stream and towards an improved grassland field grazed by horses and sheep horses.
North 2	68.6	Located on a hawthorn tree within a defunct hedgerow of hawthorn, on the edge of an improved grassland field. The microphone faces west out over the field. This is near the brow of the hill and near to the highest elevation of the site. No ditches or watercourses.

South 2	59.2	Located on a silver birch which is within a strip of broadleaved woodland on the south bank of a wet ditch. Near the Gallops / farm track and adjacent to marshy grassland. The microphone faces south-east over the marshy grassland.
South 3	10.3	Located on a fence post adjacent to the Gallops / farm track and a partially wet ditch and a semi improved grassland field grazed by horses. The microphone faces north-east across the ditch and semi improved grassland field.

d) Bat Activity – Temporal Distribution

1.10.46 Bat activity was recorded at the Project Site between June and October 2017. Bat surveys for April and May are due to be undertaken in 2018.

1.10.47 August had the highest BAI for both transects. The North Transect had a BAI of 8.5 and the South Transect had a BAI of 4.8.

1.10.48 For the North Transect, the second highest BAI was 7.0, both in June and July.

1.10.49 For the South Transect, the second highest BAI was 3.0 in July and the third highest was 2.8 in October.

1.10.50 For the static detector surveys, July had the highest BAI of 377.3, the second highest BAI was 238.9 in June.

1.10.51 Higher levels of Myotis species activity in June and July during the 2017 static detector surveys were comparable with the higher activity levels recorded in June and July during the BSG 2014 static detector surveys (PB, 2015), although it should be noted that BSG did not have any static detectors placed within the lane area to the west of the Project Site.

1.10.52 As seen in Plate 1.4 the months of August and October have a greater level of species richness than September. This was a statistically significant result as seen in Appendix 4A: Tables 2.5 and 2.6.

1.10.53 The statistical analysis of the first night of static detector data show that bat passes is influenced by month (Plate 1.2 and Appendix 4A: Table 2.2). June has a significantly higher bat echolocation call frequency than August and October (Appendix 4A: Table 2.3). This result differs from the walked transect results which showed highest level of bat activity in July and June as the second highest. Both survey methods indicate that the summer months had the highest level of activity. This is likely due to general bat ecology, with bats being most active in mid-summer.

1.10.54 Young bats are typically born in June and July and during August the young are starting to leave the roosts to fly and feed. October is part of the bat mating period and a time when bats are extensively foraging for food as they are looking to store fat for the winter hibernation period. The general ecology of bat species is likely to influence the temporal activity for the Project Site.

Plate 1.6 North Transect – Examples of Habitat



Part of the north of the Project Site, within North Transect, near to the Electrical Connection looking south.



Example of hedgerow with mature trees and improved grassland fields, within the North Transect, near to the Electrical Connection looking west towards Abergelli Farm

Plate 1.7: South Transect - Examples of Riparian Habitat



An area of riparian woodland with mature trees, near to the South Transect, near the Ancient Woodland.



An area of riparian woodland, within South Transect, running alongside the Gallops/ farm track in the south- of the Project Site.

1.11 Preliminary Potential Effects

1.11.1 A full assessment of effects at construction and operation has been undertaken for the Ecological Impact Assessment (EcIA) and reported in the ES.

1.11.2 Figure 7 indicates the location of potential constraints / impacts. At this stage the following potential effects have been identified:

a) Bat Roosts

i. Destruction and Loss of a Roost

1.11.3 Tree 19 was the only confirmed roost within the Project Site. The Project will not require the removal of Tree 19.

ii. Killing and Injury

1.11.4 Based on the current known distribution of bat roosts within the Project Site, there is no risk of killing or injuring bats during construction and operation.

iii. Disturbance

1.11.5 Without mitigation, there is potential for disturbance to bats due to noise and vibration and external lighting during construction and operation.

b) Bat Commuting and Foraging

i. Habitat Loss

1.11.6 The Project Site is used by bats, particularly the vegetated watercourse/wet ditch corridors, followed by woodland edges and hedgerows with mature trees.

1.11.7 A proportion of the broadleaved semi-natural woodland, semi-improved grassland and marshy grassland will be removed as part of the Project. Without mitigation, hedgerows and mature trees lines will be removed for construction of the Electrical Connection and new section of Access Road. This will reduce the amount of habitat available to foraging bats.

ii. External Lighting

1.11.8 An Outline Lighting Strategy provided in Appendix 3.5 of the ES. There will be an increase in external lighting at the Project Site during construction and operation. There is currently no external lighting within the majority of the Project Site. If external lighting for the Project is poorly designed there is potential for a light spill onto hedgerows, tree lines, woodland edges and vegetated areas. Many species of bat are adverse to light, with different species having different tolerances. External lighting can make areas of previous foraging habitat unsuitable or inaccessible and therefore cause in-direct habitat loss.

iii. Noise

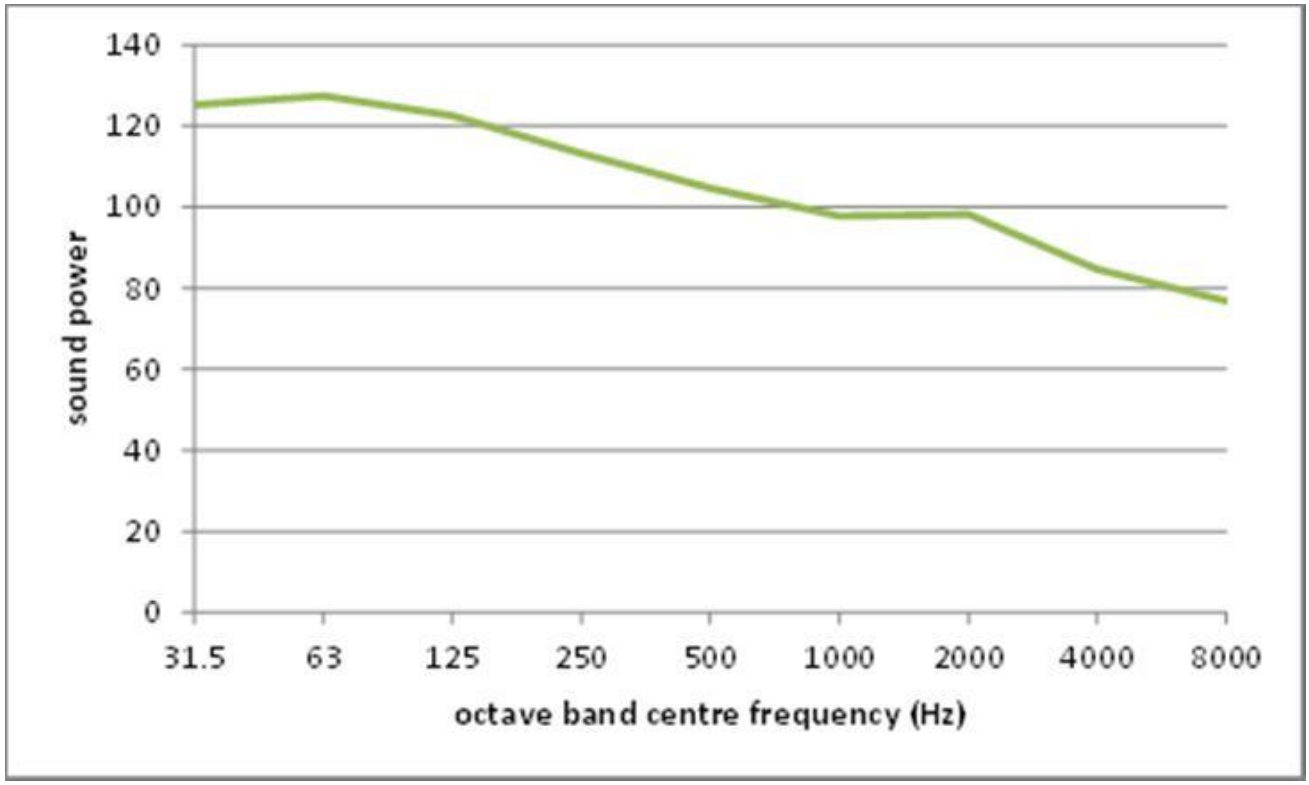
1.11.9 There will be an increase in ambient noise at the Project Site during construction and operation. Construction noise will be temporary and is considered unlikely to impact on foraging bats in the long-term. Operational noise is discussed further below.

1.11.10 The Generating Equipment will only be operational intermittently at times of peak demand and will not emit ultrasonic noise (ultrasonic being noise which is higher than the upper audible limit of human hearing, typically considered to be above 20kHz).

1.11.11 The Generating Equipment is predicted to emit a sound power level of around 100dB $_{LWA}$, the power peaks at a frequency of around 50/63 Hz and roughly halves with every doubling of frequency above that. A typical attenuated power station sound power spectrum is shown in Plate 1.8. This only goes up to 8,000Hz (8kHz) but the tail off in the spectrum continues with increased frequency, showing that there will be little sound power (dB L_A) above 10,000Hz (10kHz).

1.11.12 The specific sound level near the Project Site boundary is estimated to be approximately 55dB LAeq (ES Chapter 7 Noise – Figure 7.1) (this term is the Equivalent Continuous Level, a type of average, where noisy events have a significant influence). The theoretical average sound pressure level (dB L_A) at the Project Site boundary approximately 30m from the Generating Equipment will be approximately 55 dB L_A to 63 dB L_A. Equivalent general sounds comparisons are: 50 dB L_A is light traffic or rainfall; 60 – 65 dB L_A is normal conversation; and 85 dB L_A is heavy traffic.

Plate 1.8: A Typical Attenuated Power Station Sound Power Spectrum (Not Site Specific)



1.11.13 There is limited research on the impact of anthropogenic noise on foraging bats and no directly comparable research on the impacts of power station noise have been identified. Research that exists shows that increased anthropogenic noise can negatively impact foraging activity of some species of bats, particularly low frequency bats (<35kHz), as a result of prey masking and avoidance of noise. Two of these are summarised below.

1.11.14 Bunkley *et. al*. (2015) investigated the potential effects of gas compressor station noise in the USA on the activity levels of the local bat assemblage. The gas compressor stations run 24 hour a day, 365 days a year. The mean background sound level (dB L_A) recorded at 50m from the gas compressor site centre was between 70 and 85dB L_A. The frequency of the compressor noise was 24kHz.

1.11.15 Bunkley *et. al.* (2015) found that activity levels for the Brazilian free-tailed bat (*Tadarida brasiliensis*) were 40% lower at loud compressor sites compared to quieter well pads, whereas the activity levels of four other species (*Myotis californicus, M. cillolabrum, M. lucifugus, Parastrellus hesperus*) were not affected by noise. The assemblage of bat species emitting low frequency (<35kHz) echolocation calls showed a 70% reduction in activity levels at loud sites compared to quieter well pad sites whereas the assemblage using high frequency (>35kHz) echolocation did not exhibit altered activity levels. Bunkley *et. al*. (2015) concluded that lower activity levels of Brazilian free-tailed bats at loud sites indicate a potential reduction in habitat for this species and that this species modifies its echolocation search calls in noise, producing longer calls with a narrower bandwidth, which might affect prey detection.

1.11.16 Luo *et al.*, 2015 investigated how anthropogenic noise impairs foraging, which has direct consequences for animal survival and reproductive success, using Daubenton's bats, which find prey by echolocation. The study looked to identify the potential mechanisms of disturbance in any species capable of detecting the noise, namely acoustic masking of prey echoes, reduced attention and noise avoidance. The study used playback of traffic noise and was laboratory based. Traffic noise was played at around 76dB L_A, at nonoverlapping frequencies below 25kHz (not spectrally overlapping the minimum call frequency of Daubenton's, which is at 28kHz), and overlapping frequencies above 25kHz.

1.11.17 Luo *et al.*, 2015 found that traffic noise reduced foraging efficiency in most Daubenton's bats. This effect was present even if the playback noise did not overlap in frequency with the prey echoes. Neither overlapping noise nor nonoverlapping noise influenced the search effort required for a successful prey capture. Hence, noise did not mask prey echoes or reduce the attention of bats. Instead, traffic noise acted as an aversive stimulus that caused avoidance response, thereby reducing foraging efficiency.

1.11.18 The frequency emitted from the Generating Equipment (between 50Hz and 10,000Hz (10kHz)) is unlikely to mask the frequencies of large bat prey items, which are generally in the range of 20 - 35kHz and frequencies less than 1 kHz are probably inaudible to bats (Luo *et al.*, 2015).

1.11.19 Bunkley et. al. (2015) suggests that bat species emitting low frequency (<35kHz) echolocation calls may be more affected by noise than other species. At the Project Site, bats which echolocate at frequencies <35kHz include the large bats; noctule, serotine and Leisler's. Lower frequency bats at the Project Site make up 5.8% of the total composition of bat species, the rest are higher frequency bat species (>35kHz). However, the predicted frequencies emitted from the Generating Equipment (between 50Hz and 10,000Hz (10kHz)) were much lower than in Bunkley et. al. (2015) and, as above, are unlikely to mask prey items for any bat species.

1.11.20 There may be some noise avoidance by some bat species when the Generating Equipment is operating, as there is little research available to be able to completely rule out potential avoidance from noise of 55 – 63dB L_A . However, the generation of noise would be sporadic and the sound power anticipated at the Project Site boundary is lower than that in the studies summarised above and it would be anticipated that any impact from avoidance would therefore be comparably lower. No studies were identified which looked at potential foraging impacts from sound power (dB L_A) less than 70dB L_A to be able to draw any direct conclusion.

1.11.21 At the Project Site, the sporadic nature of the noise generated with times of peak demans most likely to occur during winter (when bats are hibernating) during the early evening (16:00 – 18:00, when people get home from work and before bats emerge from roosts), combined with the sound power peaking at a frequency well below the typical frequency used by echolocating bats, it is considered that noise will not have a significant impact on the population of foraging bats within the Project Site.

iv. Severance and Fragmentation

1.11.22 The removal of trees and woodland is required to facilitate the construction of the new section of Access Road. Without mitigation, this will sever the connectivity to habitats either side of the track, resulting in severance and fragmentation of retained areas.

1.11.23 The removal of tree lines and hedgerows may be required in order to facilitate the construction of the Gas Connection in the north of the Project Site. Removal or severance of tree lines and hedgerow will sever the connectivity they provide and create fragmentation of retained habitat.

1.11.24 During construction of the Project natural habitats including hedgerows and tree lines will be removed and converted to new areas of hardstanding and buildings. This will fragment and sever the connectivity of the habitats located to the north and to the south of the Project. This will impact on bats using the existing features in the landscape to commute and forage between these two areas.

1.11.25 An Outline Lighting Strategy provided in Appendix 3.5 of the ES. There will be an increase in external lighting at the Project Site during construction and operation. There is currently no external lighting within the majority of the Project Site. Many species of bat are adverse to light, with different species having different tolerances. External lighting can make areas of previous foraging habitat unsuitable and fragment commuting routes. If external lighting for the Project is poorly designed there is potential for a light spill onto hedgerows, tree lines, woodland edges and vegetated areas which will negatively impact on bats, severing commuting routes and impeding access to foraging habitat. Poorly designed lighting also has the potential to affect areas outside the Project Site boundary.

1.12 Preliminary Recommendations for Further Surveys and Mitigation

a) Recommendations for Further Surveys

1.12.1 A full assessment of required further surveys has been made during EcIA and reported in the ES. At this stage it is anticipated that further surveys will be required. The following recommendations have been made:

- Walked bat activity transect surveys in April and May 2018 using the same methodology for the walked bat activity surveys undertaken in 2017;
- Static detector bat surveys in April and May 2018 and assessment to augment the walked transect data;
- Building assessments and further bat surveys on Buildings 7 and 8 within the Abergelli Farm (schedule to be undertaken in 2018);
- Pre-construction checks on trees, scheduled for removal, should be assessed for their current bat roost suitability with consideration of the seasonal survey timings.

1.12.2 Although further surveys are recommended it is considered that, utilising data from 2014 and 2017 surveys undertaken to date, an accurate assessment of bat activity within the Project Site has been made. Further surveys are recommended to confirm that the most appropriate and effective mitigation measures have been determined; mitigation has been included in a Landscape and Ecological Mitigation Plan (LEMP).

b) Recommendations for Mitigation

1.12.3 A full series of recommendations for further surveys and mitigation at construction and operation has been undertaken for the EcIA and reported in the ES. At this stage the following key recommendations have been made:

- Based on the current Project proposals a European Protected Species Licence (EPSL) is not a requirement. However, should the scope of the Project change and/or if further bat roosts are identified a EPSL may be required;
- Compensate for loss of foraging habitat;
- Maintain connectivity of foraging and commuting habitats by the retention of trees and hedgerows wherever possible. Figure 7 shows areas of potential conflict;
- Utilising ‘brown hedgerows’ of brash, to maintain connectivity during construction;
- Create new green corridors to mitigate loss, provide alternative routes and enhance the local landscape;
- For construction of the Electrical Connection consider directional drilling under hedgerows and mature tree lines to avoid felling and avoid severance;
- If less important hedgerows need to be severed temporarily during construction of the Electrical Connection the severed areas should be replanted with whips and standards;
- It is recommended that reasonable avoidance measures should be taken if any trees with a Low bat roost potential need removing as part of the Project (Hundt, 2012). This is likely to include soft-felling of trees under ecological supervision from a bat licenced ecologist;

- Plant a mix of locally native species of standard trees and whips along both sides of the new section of Access Road to create a 'hedgerow with trees'; and,
- Avoid external lighting wherever possible. Only light areas which need to be lit to meet minimum standard. Where external lighting is needed it should be designed to avoid and reduce light spill following best practice guidelines for lighting and bats (Gunnell 2012, BCT 2009), and should be reviewed by an ecologist. Where external road lighting is needed the use of bollards with louveres should be considered to keep lighting directional and below head height, timer or motion sensors should be used.

c) Recommendations for Biodiversity Enhancement

1.12.4 A full series of recommendations for biodiversity enhancement has been made during the EcIA and reported in the ES. At this stage the following precautionary recommendations have been made:

- Woodcrete bat boxes on trees;
- Improve existing hedgerows by infilling with locally native species standard trees to maintain connectivity to key foraging areas; and,
- Creation of new hedgerows and green corridors of locally native species.

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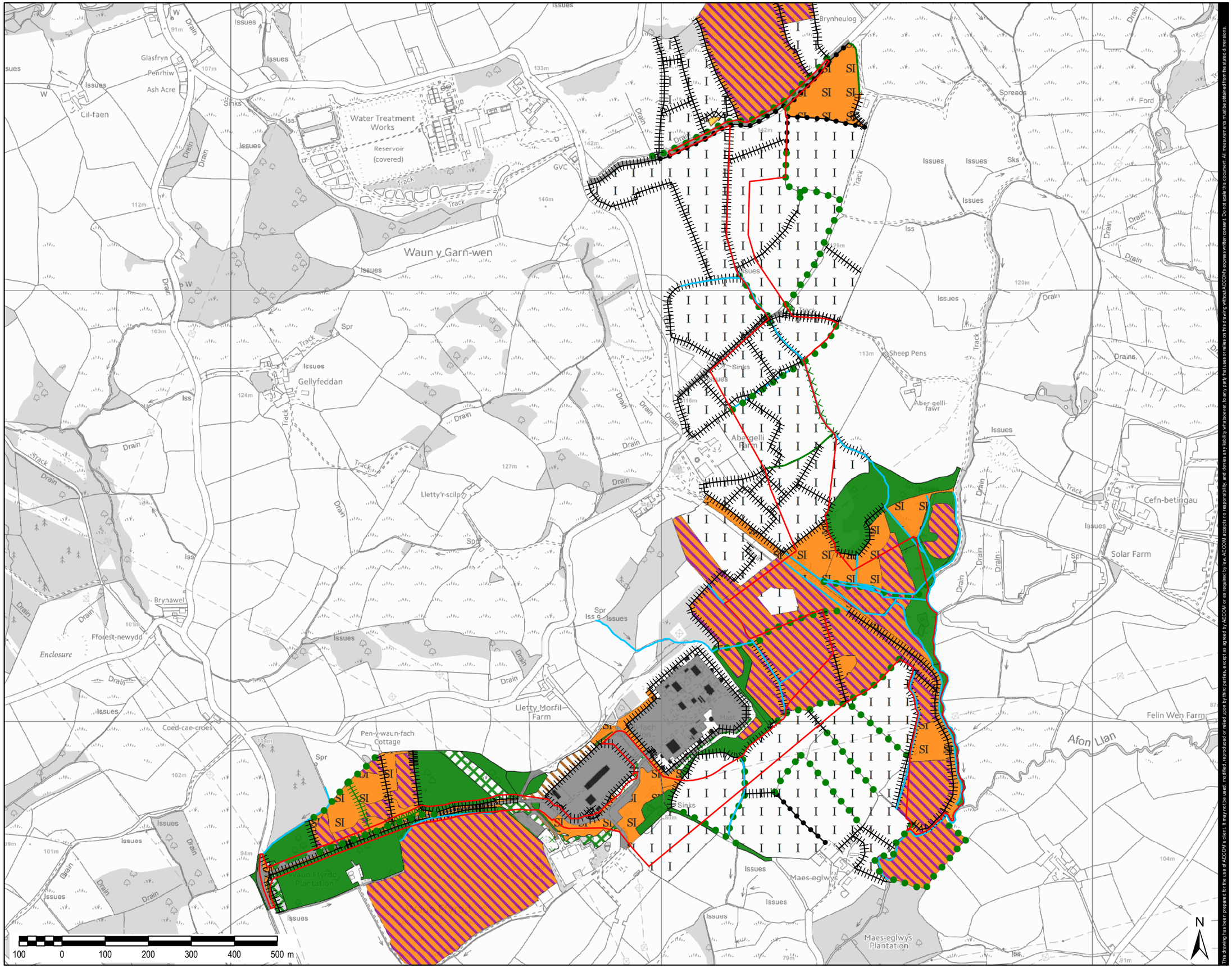
Figure 1 Phase 1 Habitat Map



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Project Site Boundary

Phase 1 Habitat Linear Features

- Scrub - Scattered
- Row of trees - broadleaved
- Running Water
- Intact Hedge - Species-Poor
- Defunct Hedge - Species-Poor
- Hedge with Trees - Native Species-Rich
- Hedge with Trees - Species-Poor
- Fence
- Earth Bank

Phase 1 Habitat Areas

- Broadleaved woodland - semi-natural
- Broadleaved woodland - plantation
- Dense/Continuous scrub
- Scattered scrub
- Semi-improved - neutral grassland
- Improved grassland
- Marsh/marshy grassland
- Tall ruderal - herb and fern
- Dry heath/acid grassland mosaic
- Buildings
- Bare ground
- Hard standing

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PHASE 1 HABITAT MAP

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FIGURE 1			005
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GM	CC	CA	02/05/18

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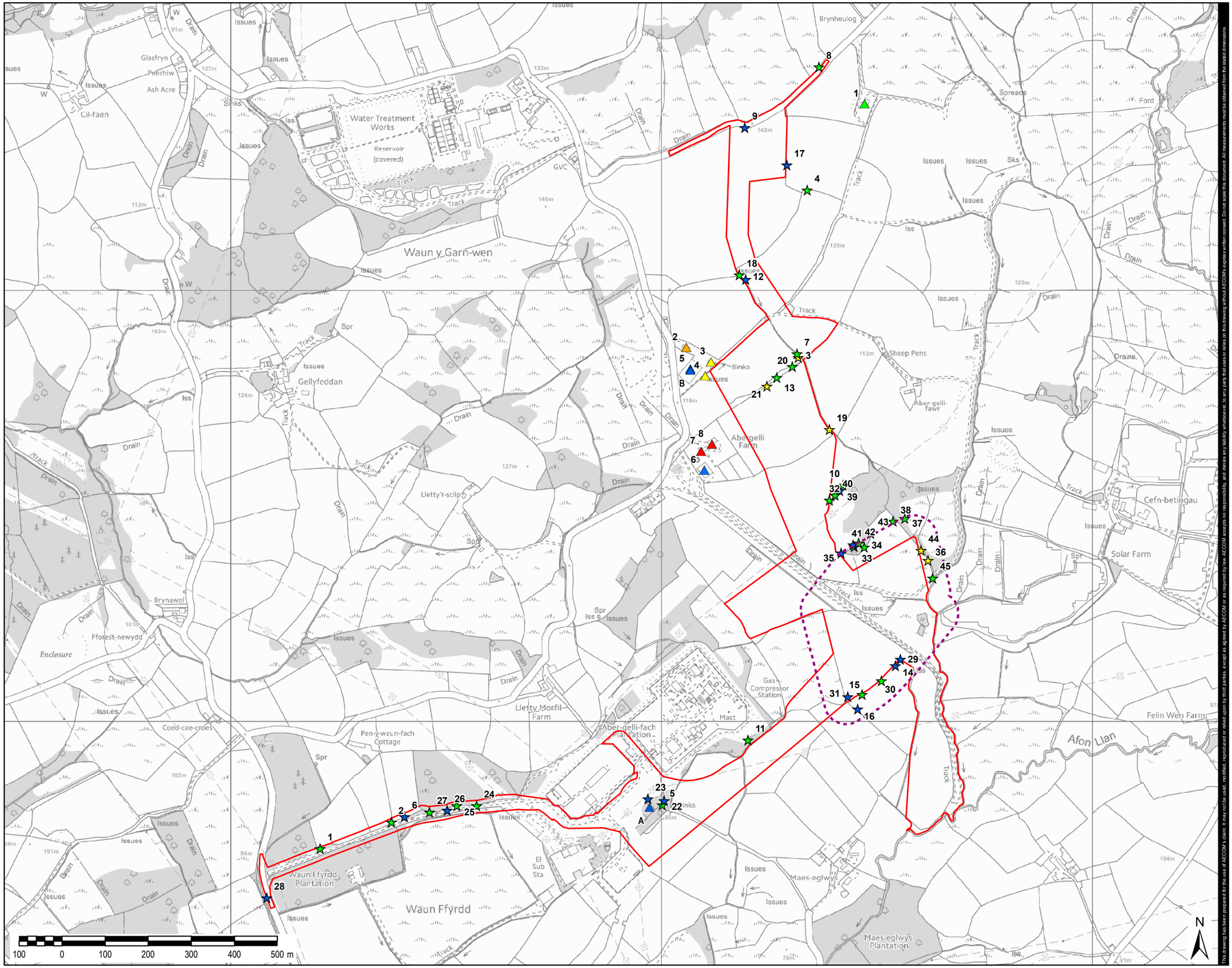
Figure 2 Building Ground Level Roost Assessment Results and Tree Potential Bat Roost Feature Climbed Inspection Results



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Project Title:

ABERGELLI POWER PROJECT

Client:

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LEGEND

- Project Site Boundary
- 50m Zone of Influence

Potential Tree Roost Feature Climbed Inspection Results

- Moderate
- Low
- Negligible

Preliminary Ground Level Assessment Results for Buildings

- Confirmed
- High
- Moderate
- Low
- Negligible

Note:
Buildings 7 and 8 based on BSG 2014. Not assessed in 2017.

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Drawing Title:

PRELIMINARY GROUND LEVEL ASSESSMENT RESULTS FOR BUILDINGS AND POTENTIAL ROOST FEATURE CLIMBED INSPECTION RESULTS

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FIGURE 2			001
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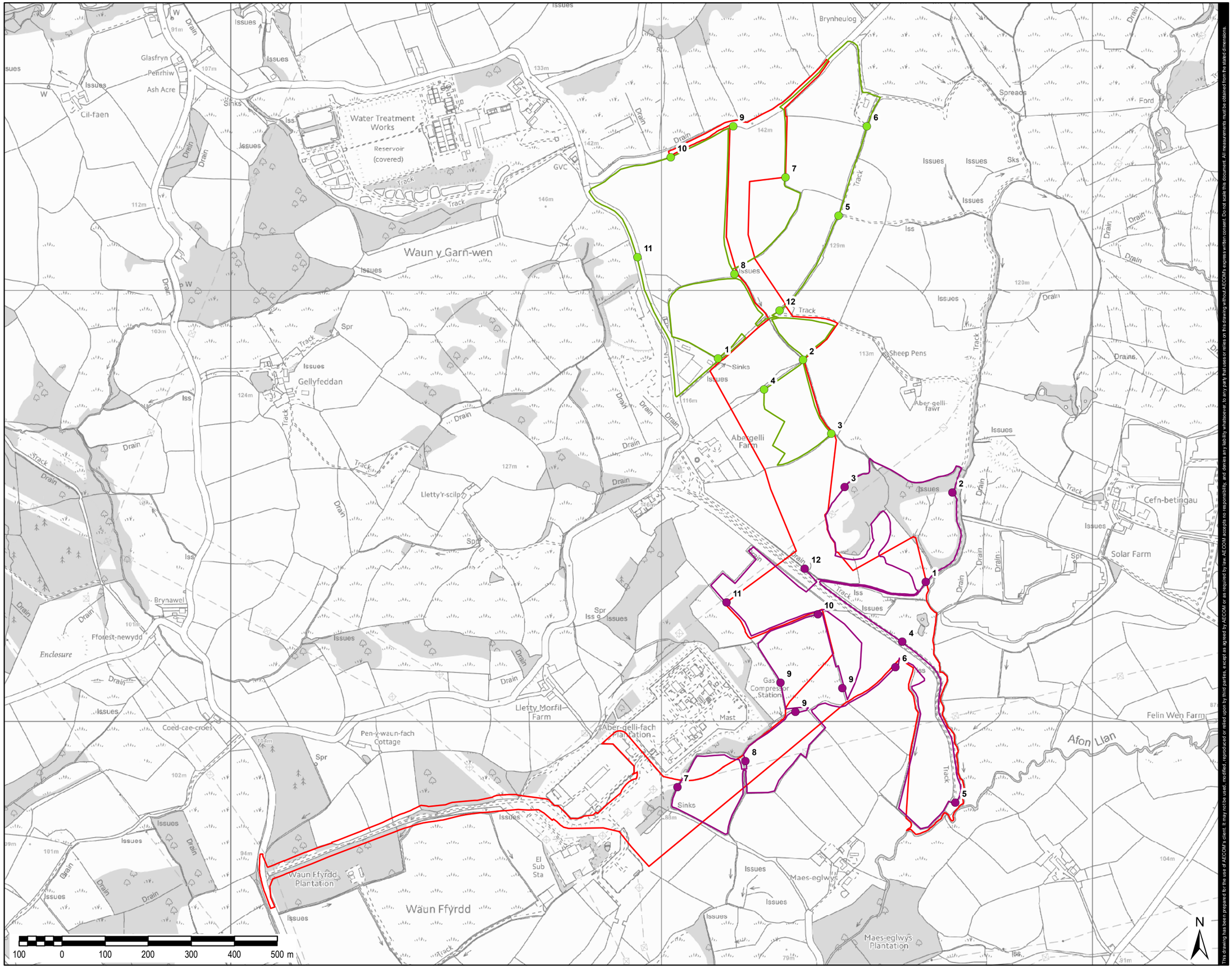
GM	CM	CA	02/05/18

Figure 3.1 Bat Activity Transects North and South with Listening Points



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Project Title:

ABERGELLI POWER PROJECT

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LEGEND

- North Transect Listening Points
- South Transect ListeningPoints
- North Transect - 4.65km
- South Transect - 6.08km
- Project Site Boundary

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BAT ACTIVITY TRANSECTS WITH LISTENING POINTS

Scale at A3: 1:8,000

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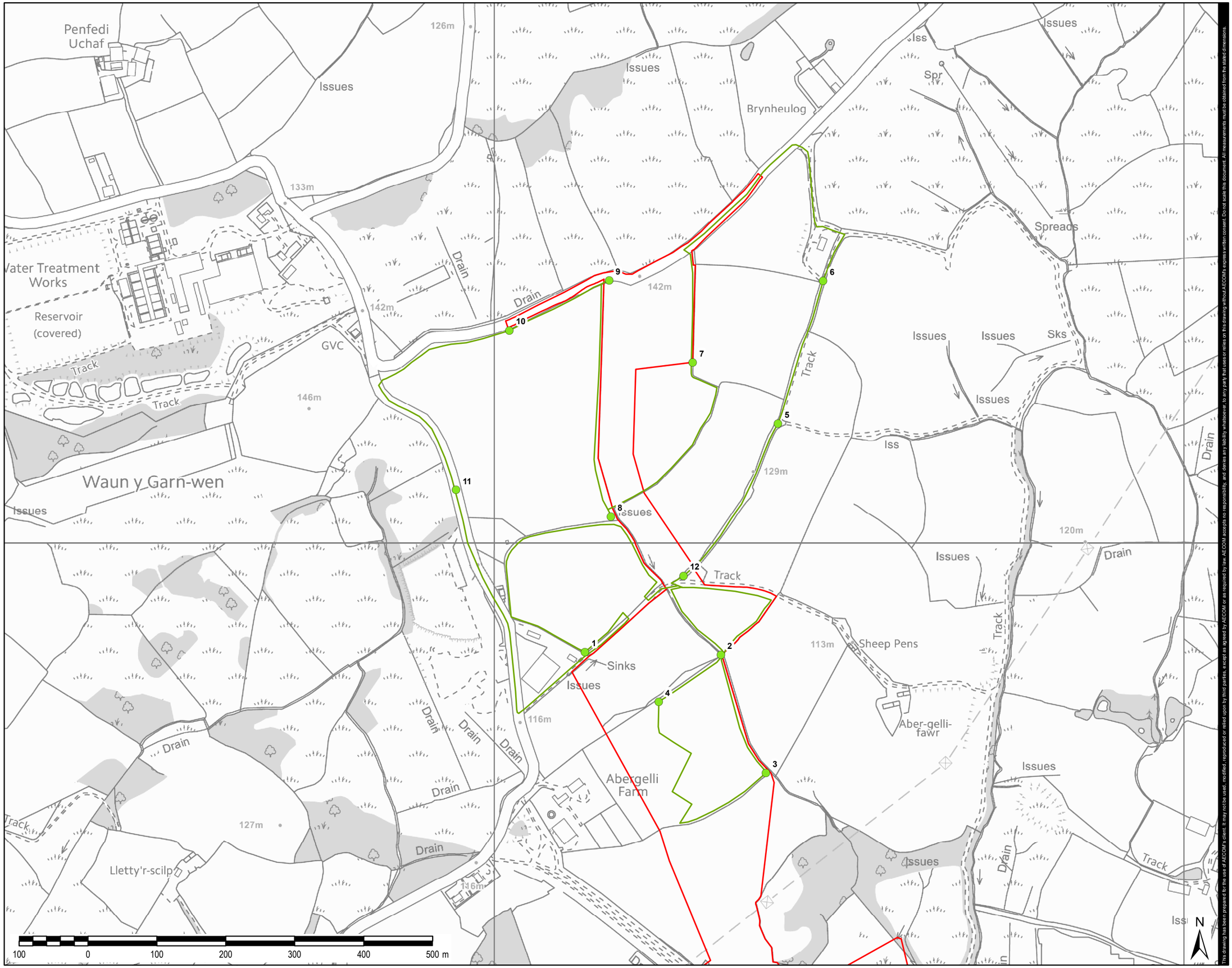
Filename: P:\UKCDF1-IE\Projects\Environmental\Jobs - Potential\2017\2017 Q1\Abergelli Power Station\010 GIS\02_Maps\EC - Ecology\Appendices\8.7\F3_1_Activity_Transect_v1.mxd

Figure 3.2 Bat Activity Transects North with Listening Points



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www.aecom.com

Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- North Transect Listening Points
- North Transect - 4.65km
- Project Site Boundary

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Drawing Title:

BAT ACTIVITY TRANSECT NORTH WITH LISTENING POINTS

Scale at A3: 1:5,000

Drawing No:			Rev:
FIGURE 3.2			001
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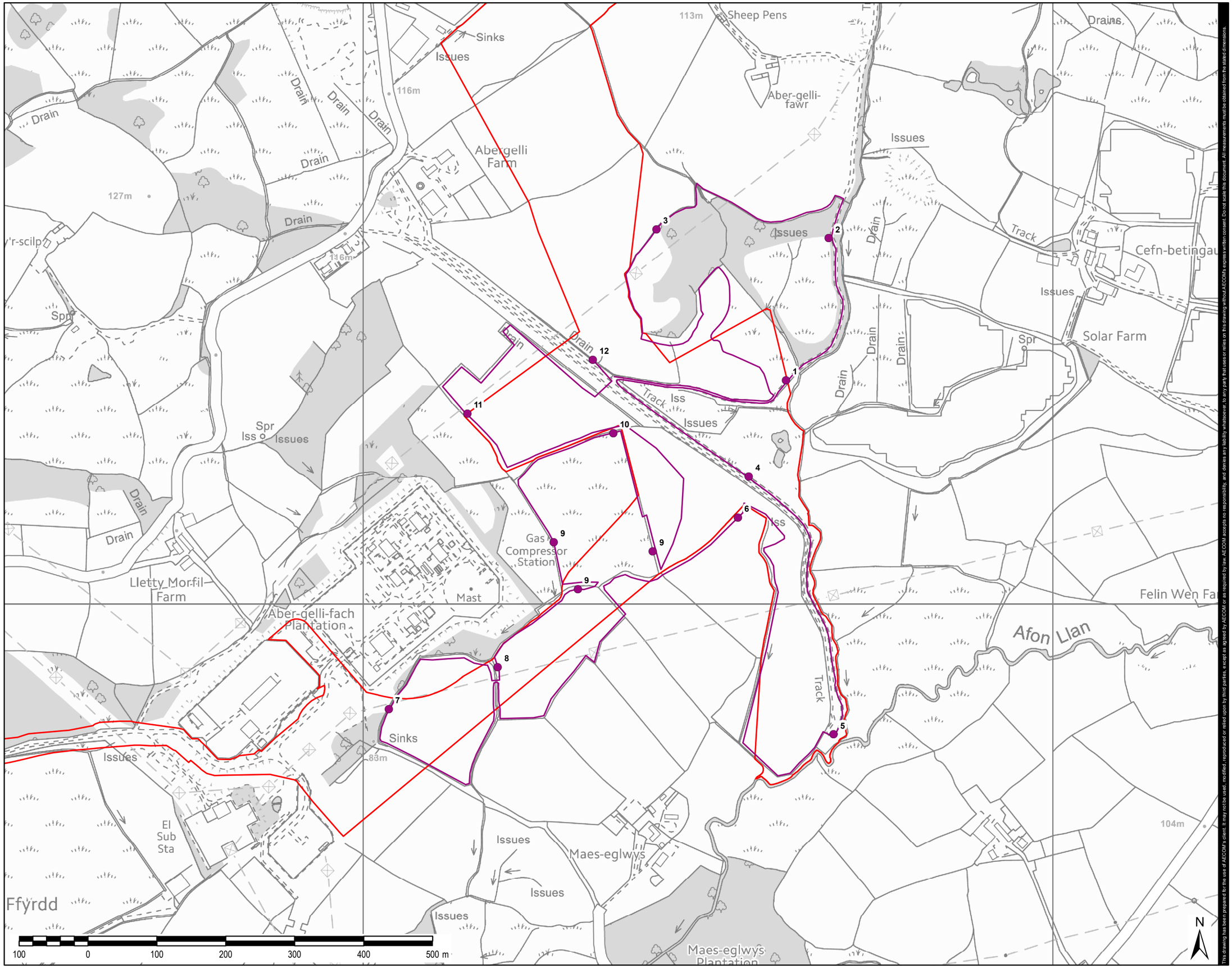
Figure 3.3 Bat Activity Transects South with Listening Points



Filename: P:\UKCDF1-IE\Projects\Environmental\Jobs - Potential\2017\2017 Q1\Abergelli Power Station\010 GIS\02_Maps\EC - Ecology\Appendices\8.7\F3_3_Activity_Transect_South_v1.mxd

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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- South Transect ListeningPoints
- South Transect - 6.08km
- Project Site Boundary

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Drawing Title:

BAT ACTIVITY TRANSECT SOUTH WITH LISTENING POINTS

Scale at A3: 1:5,000

Drawing No:			Rev:
FIGURE 3.3			001
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Figure 3.4 Bat Activity Static Detector Locations

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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Static Detector Location, and Direction of Microphone
- Project Site Boundary

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Drawing Title:

BAT ACTIVITY STATIC DETECTOR LOCATIONS

Scale at A3: 1:8,000

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FIGURE 3.4			001
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100 0 100 200 300 400 500 m

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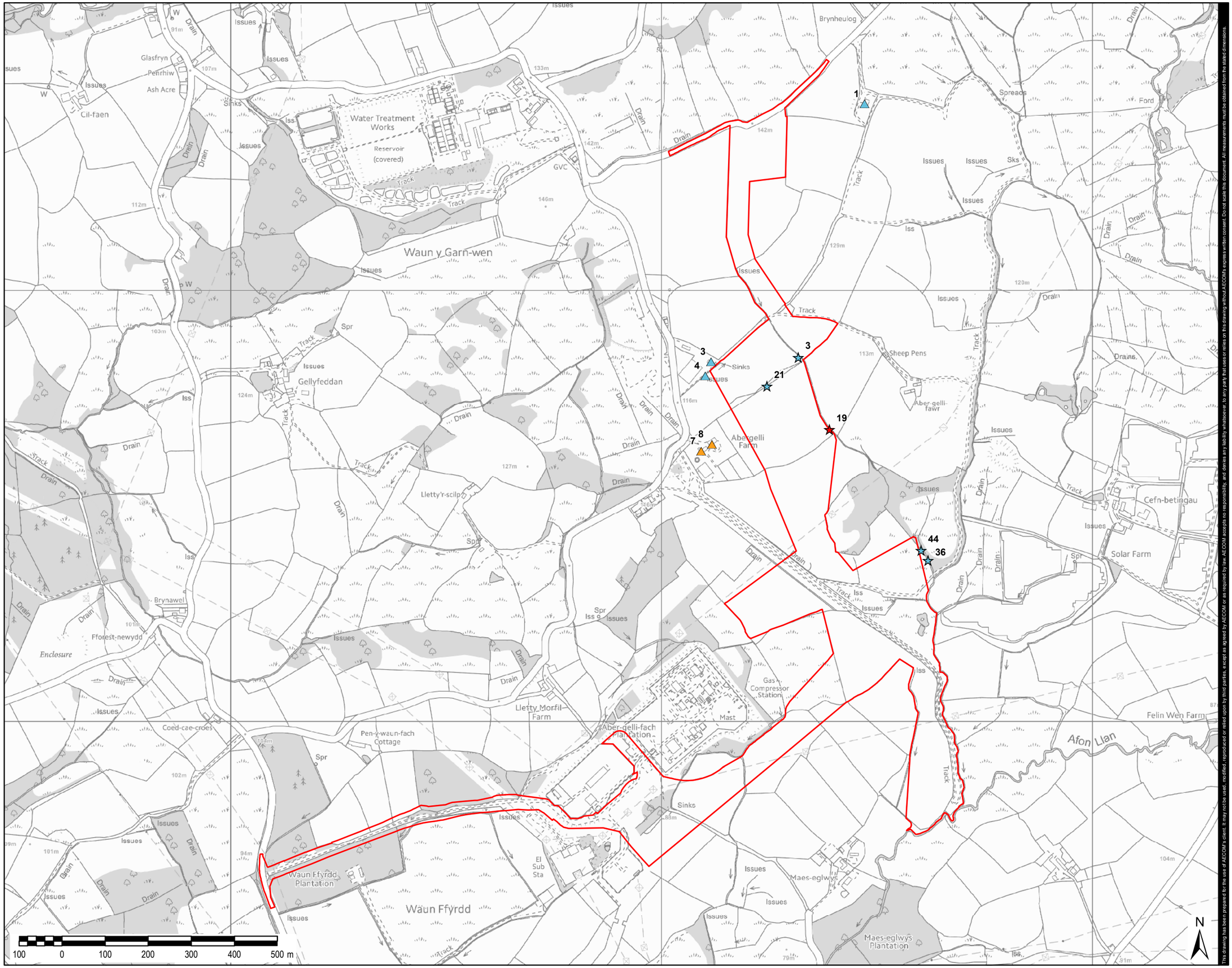
Figure 4.1 2017 Building and Tree Roost Results



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Project Site Boundary
- Trees - Confirmed roost
- Trees - No confirmed roost
- Buildings - No confirmed roost
- Not assessed in 2017

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Drawing Title:

BUILDING AND TREE ROOST RESULTS

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE 4.1			001
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GM	CM	CA	02/05/18

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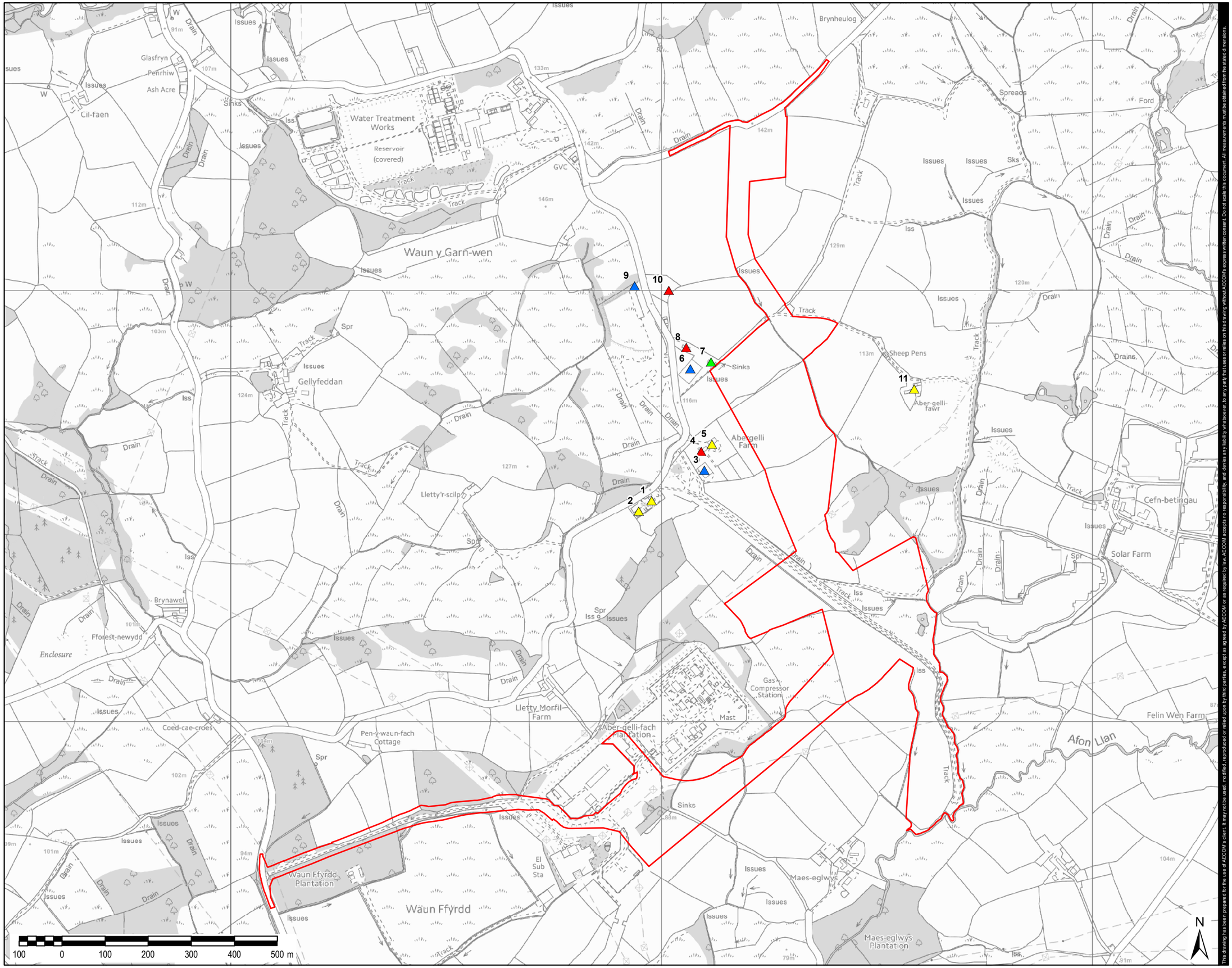
Figure 4.2 BSG Building Results 2014



Filename: P:\UKCDF1-IE\Projects\Environmental\Jobs - Potential\2017\2017 Q1\Abergelli Power Station\010 GIS\02_Maps\EC - Ecology\Appendices\8.7\F4_2_BSG Building Results 2014_v1.mxd

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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Project Site Boundary
- Confirmed
- Moderate
- Low
- Negligible

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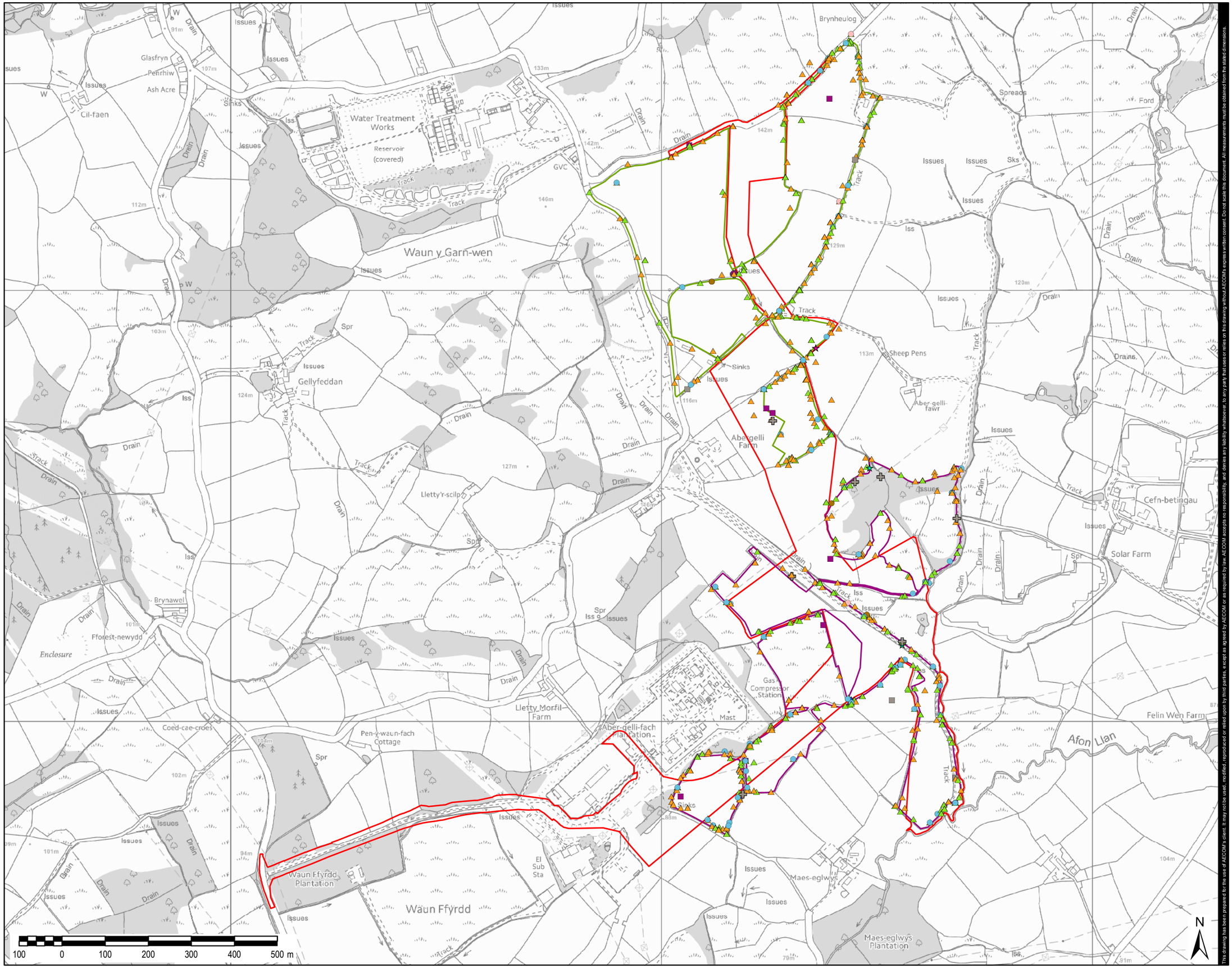
Drawing Title:

BSG BUILDING RESULTS 2014

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE 4.2			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CM	CA	02/05/18

Figure 5.1 Bat Activity Transect Results



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- Daubenton's
- Myotis species
- Natterer's
- Noctule
- Serotine
- Long-eared
- Possible long-eared
- Lesser horseshoe
- Indeterminate
- North Transect - 4.65km
- South Transect - 6.08km
- Project Site Boundary

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Drawing Title:

BAT ACTIVITY TRANSECT RESULTS

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE 5.1			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
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Figure 5.2 Bat Activity Transect Results – North

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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- Daubenton's
- Myotis species
- Natterer's
- Noctule
- Serotine
- Long-eared
- Possible long-eared
- Indeterminate
- North Transect Listening Points
- North Transect - 4.65km
- Solar Parks
- Project Site Boundary

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Drawing Title:

BAT ACTIVITY TRANSECT RESULTS NORTH

Scale at A3: 1:5,000

Drawing No:			Rev:
FIGURE 5.2			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
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100 0 100 200 300 400 500 m

N

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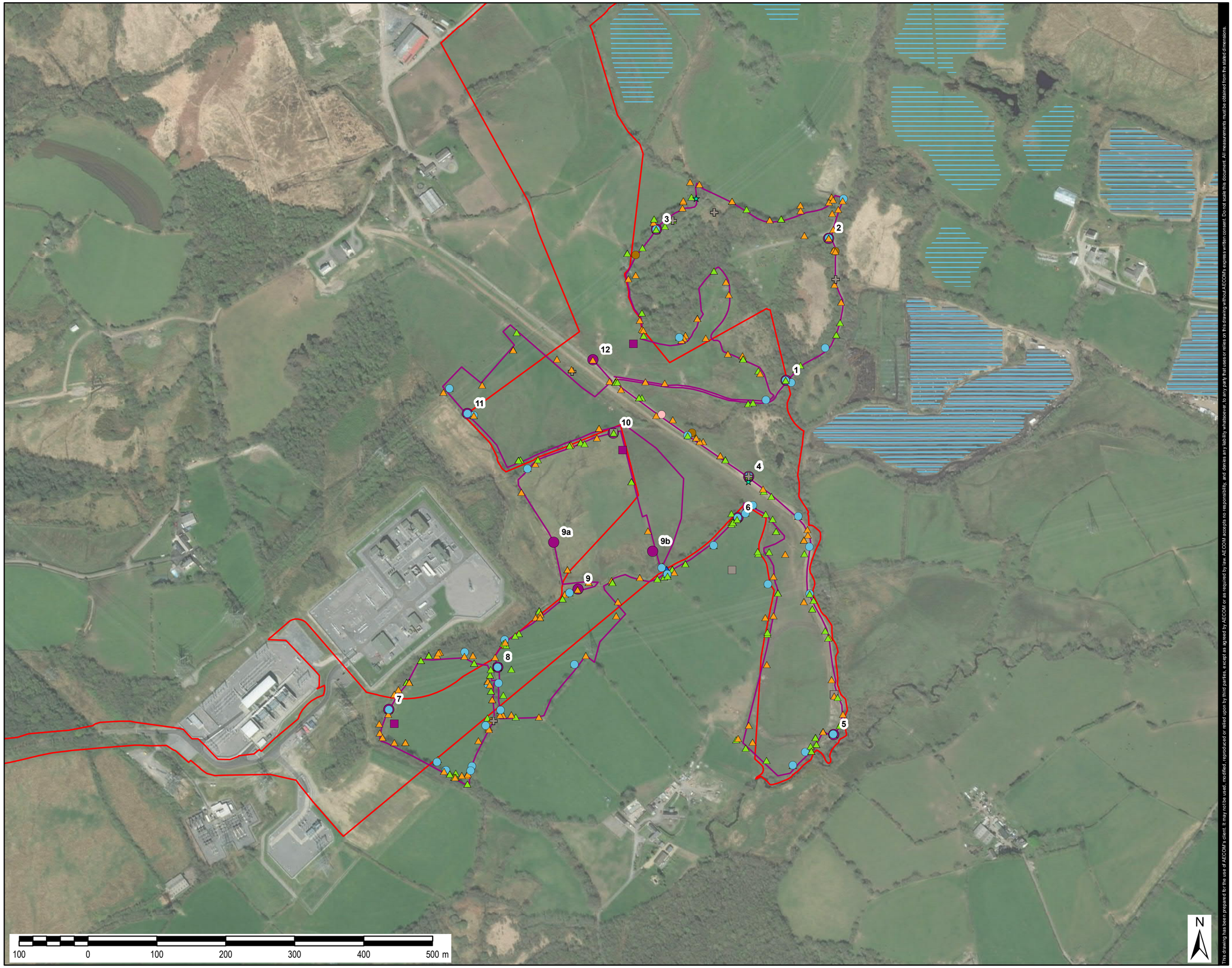
Figure 5.3 Bat Activity Transect Results – South



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- Daubenton's
- Myotis species
- Natterer's
- Noctule
- Serotine
- Possible long-eared
- Lesser horseshoe
- Indeterminate
- South Transect Listening Points
- South Transect - 6.08km
- Project Site Boundary
- Solar Parks

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Drawing Title:

BAT ACTIVITY TRANSECT RESULTS SOUTH

Scale at A3: 1:5,000

Drawing No:			Rev:
FIGURE 5.3			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
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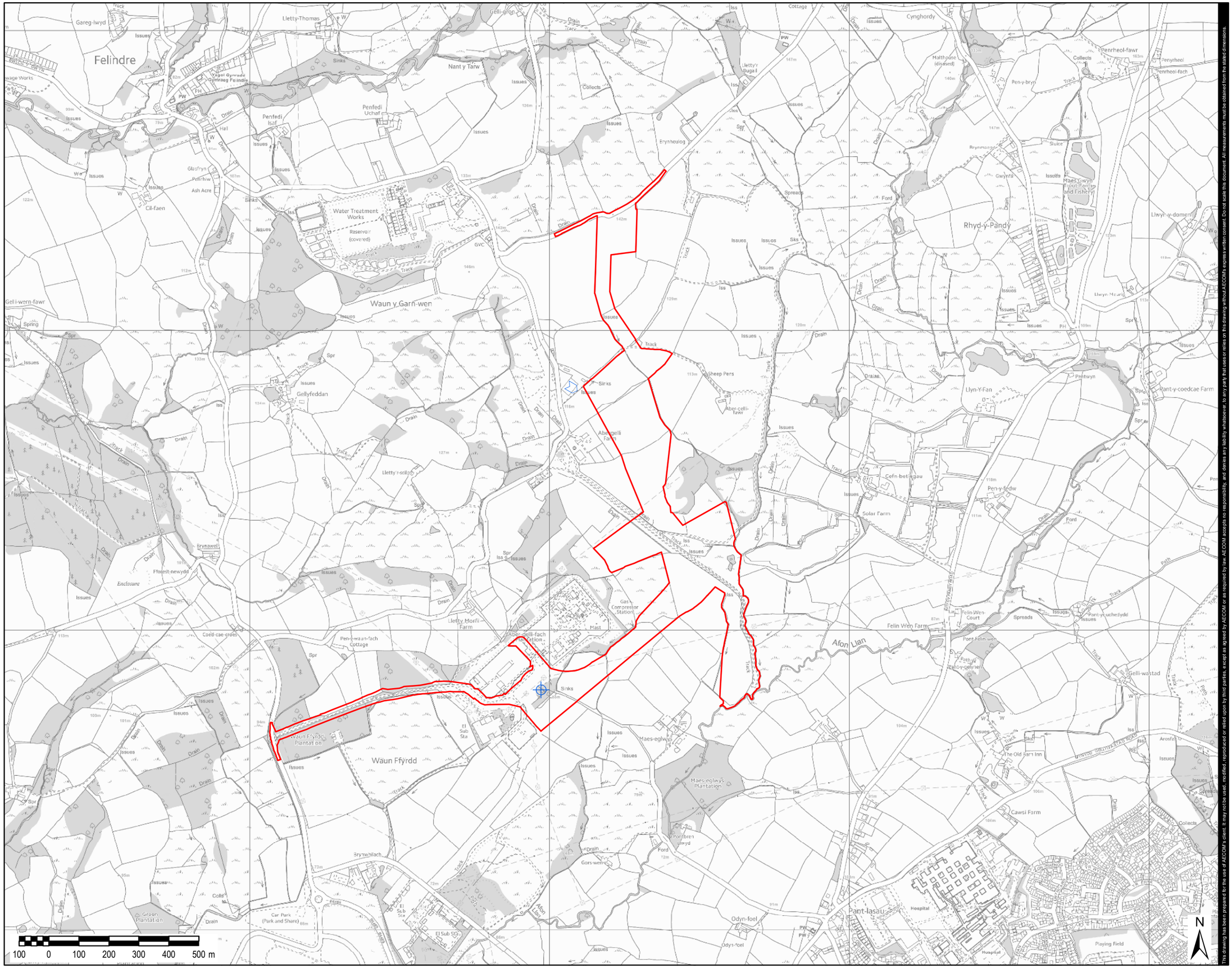
Figure 6 Mining Features – Hibernation Potential



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Disused adit
- Disused mine shaft
- Project Site Boundary

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AECOM Internal Project No:

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Drawing Title:

MINING FEATURES - HIBERNATION POTENTIAL

Scale at A3: 1:11,500

Drawing No:			Rev:
FIGURE 6			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
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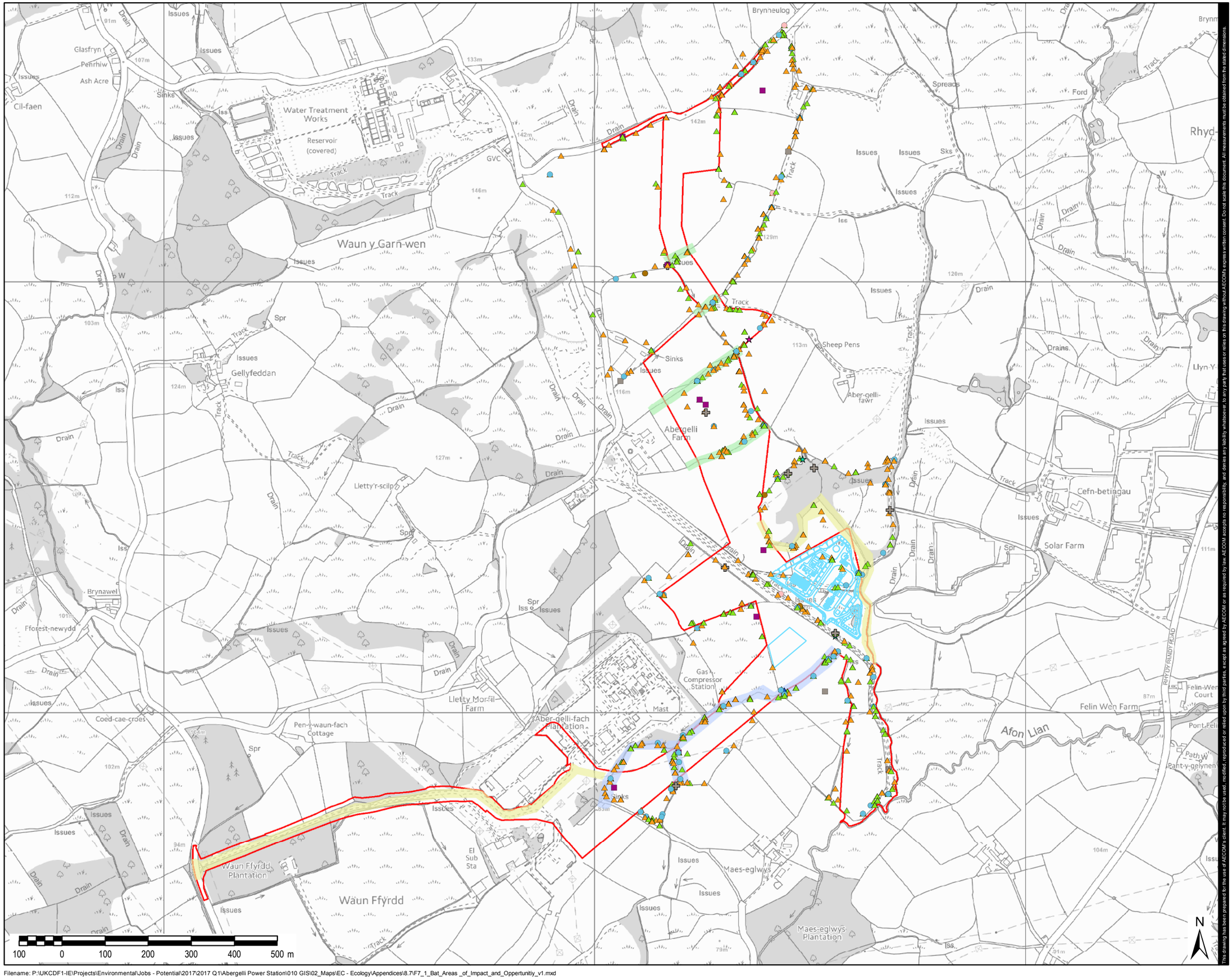
Figure 7 Bat Activity – Areas of Potential Impact



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- Daubenton's
- Myotis species
- Natterer's
- Noctule
- Serotine
- Long-eared
- Possible long-eared
- Lesser horseshoe
- Indeterminate
- Generating Equipment Site
- Indicative Area of Potential Impacts from Lighting
- Indicative Area of Potential Impacts from Severance
- Indicative Area of Potential Impacts from Severance and Lighting
- Project Site Boundary

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Drawing Title:

BAT ACTIVITY - INDICATIVE AREAS OF POTENTIAL IMPACT

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE 7			001
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Appendix 1A Results of Preliminary Ground Level Roost Assessment – Buildings and Trees and Results of Potential Roost Feature Climbed Inspection

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
Building 1	Approximately 120m outside of the Project Site boundary to the north east This was not fully assessed due to time constraints of the PEA survey (Appendix 8.1 of the ES). This is a modern building with a tiled roof. There were no obvious gaps. House sparrows were observed using spaces in the roof.	Low	Not climbed	N/A	No further survey required – outside of Project Site boundary
Building 2	Approximately 75m outside of the Project Site boundary to the west. A brick built building with a tower and asbestos pitched roof. There are fly-in access and crevice points.	High. BSG confirmed this as a roost in 2014 (PB, 2015).	Not climbed	N/A	No further survey required – outside of Project Site boundary
Building 3	Approximately 5m outside of the Project Site boundary to the west. A brick built building with a pitched asbestos roof. There are gaps in the mortar and brick work and behind the wooden facia boards.	Moderate	Not climbed	N/A	One dusk, one dawn; at least one before end of August
Building 4	Approximately 10m outside of the Project Site boundary to the west. A single story brick built building with gaps leading to a cavity wall. Gaps are present on the east and south face of this building.	Moderate	Not climbed	N/A	One dusk, one dawn; at least one before end of August
Building 5	Modern steel barn; industrial building of steel frame construction with asbestos corrugated roof and asbestos and steel walls. Within the building there are a number of transparent corrugated sheet	Negligible	Not climbed	N/A	No further survey required

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	allowing light to enter. High disturbance as the building is used regularly for farm maintenance and horses are kept in the east section. There is an opening that would allow bats to access the building (open sections to the east and west, small hole 20x20cm within wall on southern aspect, door to the east and west usually left open). However, no evidence of bats (droppings) was found around the outside of the building.				
Building 6	Modern steel barn; industrial building of steel frame construction with double pitched asbestos corrugated roof with asbestos facia boards and asbestos and steel walls. High disturbance as the building is used regularly used to stable horses. Lighting is present internally and externally. There are entrances for bats to fly through, but no evidence of bats (droppings) was found around the outside of the building.	Negligible	Not climbed	N/A	No further survey required
Tree 1	Within the Project Site Boundary. An oak species, 14m in height with a Diameter at Breast Height (BBH) of 0. 7m. This tree has south facing split at 6m.	Low	Unable to access fully to inspect due to dense bramble – same BRP.	Low	No further survey required
Tree 2	Within the Project Site Boundary. An oak species, 12m in height with a DBH of 0. 6m. This tree had dense ivy cover which could be obscuring suitable bat features. The ivy itself did not appear to be a suitable	Low	Cannot climb on road and ivy present – same BRP.	N/A	No further survey required

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	feature for use by bats.				
Tree 3	Within the Project Site Boundary. An oak species, 17m in height with a DBH of 1. 1m. There is a knothole at 3m facing north west and a crack in the limb at 5m facing west.	Moderate	Unable to access - same BRP.	Moderate	One dusk, one dawn; at least one before end of August
Tree 4	Assessed as part of the PEA (Appendix 8.1 of the ES). Removed from this report as approximately 55m outside of the Project Site boundary.	Low	N/A	N/A	N/A
Tree 5	Approximately 20m outside of the Project Site boundary to the south. An oak species, 14m in height with a DBH of 0. 8m. A hollow at 0. 5m within the base of the tree.	Low	Not climbed – outside of Project Site boundary	N/A	No further survey required
Tree 6	Within the Project Site Boundary. A pedunculate oak, 12m in height with a DBH of 0. 7m. There is a spilt in the stem facing south towards the road and a woodpecker hole.	Moderate	Features not suitable, open, exposed and does not extend into cavity.	Negligible	No further survey required
Tree 7	Within the Project Site Boundary. A pedunculate oak, 8m in height with a DBH of 1m. There are splits in the stem facing west. .	Low	Unable to access - same BRP.	Low	No further survey required
Tree 8	Within the Project Site Boundary. An oak species, 12m in height with a DBH of 0. 6m. There is a trunk cavity at 1. 5m, viewed from the road. The tree is located within an area of no access and the other side could not be viewed.	Moderate	Feature checked with endoscope, no cavity, and open at top. Kept in as could not see/access one side of tree.	Low	No further survey required
Tree 9	Within the Project Site Boundary. An oak species 8m in height with a DBH of 0. 5m. There are thick stems of	Moderate	Ivy not dense enough to support roosting bats, no other features present.	Negligible	No further survey required

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	ivy on the east face.				
Tree 10	Approximately 25m outside of the Project Site boundary to the east. A rowan 12m in height with a DBH of 0. 4m. There is cavity approximately 1m from the ground which appears to extend upwards. There is currently an active wasp nest in the cavity which may deter bats from using it (no nest as of 28/07/17). Fallen branch in front of feature.	Moderate	Feature checked using endoscope, no bats or evidence of bats. Chance it could be used by individual/small number of bats.	Low	No further survey required
Tree 11	Within the Project Site Boundary. A multi-stem oak species 14m in height with a DBH of 0. 6m. There is some loose bark and a gap in the base.	Low	Features checked using endoscope, no bats or evidence of bats. Loose bark not suitable as too exposed. Hole at base may be suitable for roosting bats. No bats or evidence of bats recorded.	Low	No further survey required
Tree 12	A willow; 12m tall, multi stem 0. 25m average. DBH. Split on inside of main stem opens into cavity at 1m above ground. In tree line along fence.	Low	Checked with endoscope, feature not suitable, open and exposed.	Negligible	No further survey required
Tree 13	An oak; 15m tall; 0. 6m DBH; Missing limbs at 5m could open up into cavity; small gaps where stem has broken.	Low	Unable to access.	Low	No further survey required
Tree 14	An oak; 10m tall; 0. 6m DBH; knothole at 2m; cannot see if it opens up into cavity. Check with endoscope. Outside of fence line in southern field.	Low	Checked with endoscope, no cavity present, shallow does not extend, not suitable for roosting bats.	Negligible	No further survey required
Tree 15	An oak; 15m tall; 0. 75m DBH; Thick	Low	Unable to climb due to	Low	No further survey

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	ivy stems; no features observed but of suitable size/age to support BRP features that may be hidden by ivy. In treeline along fence.		ivy cover.		required
Tree 16	No ground level assessment required. Tree approximately 30m from the Project Site boundary/	N/A	N/A	N/A	N/A
Tree 17	A birch; 10m tall; 0. 4m DBH; split and cavity A0. 5m on south face.	Low	Checked with endoscope, feature does not extend, no cavity present.	Negligible	No further survey required
Tree 18	An oak; 10m tall; 0. 5m DBH; split in branch on south face.	Low	Unable to climb, unsafe.	Low	No further survey required
Tree 19	An ash; 20m tall; 1. 5m DBH; Possible cavity inside main trunk, viewable from south face, hollow on the east face approx. 1m above ground; thick ivy covering and creating gaps for bats.	Moderate	Unable to access.	Moderate	One dusk, one dawn; at least one before end of August
Tree 20	An oak; 12m tall; 1m DBH; Stems removed leaving some gaps under bark and holes approx. 6m above ground. Cannot enter field due to horses.	Low	Unable to access.	Low	No further survey required
Tree 21	An oak; 15m tall; 1m DBH; missing limb with cracks and split in stem, both facing south and approx. 1m above ground. Did not enter field in which tree is rooted due to horses.	Moderate	Unable to access.	Moderate	One dusk, one dawn; at least one before end of August
Tree 22	An oak; 8m tall; 0. 3m DBH; two knotholes on east face.	Low	Holes do not extend, too open and exposed, features not suitable.	Negligible	No further survey required
Tree 23	Edge of woodland adjacent to SI grassland containing pylon. Willows not suitable; some alder may support	Negligible/Low	Woodland not accessed.	Negligible /Low	No further survey required

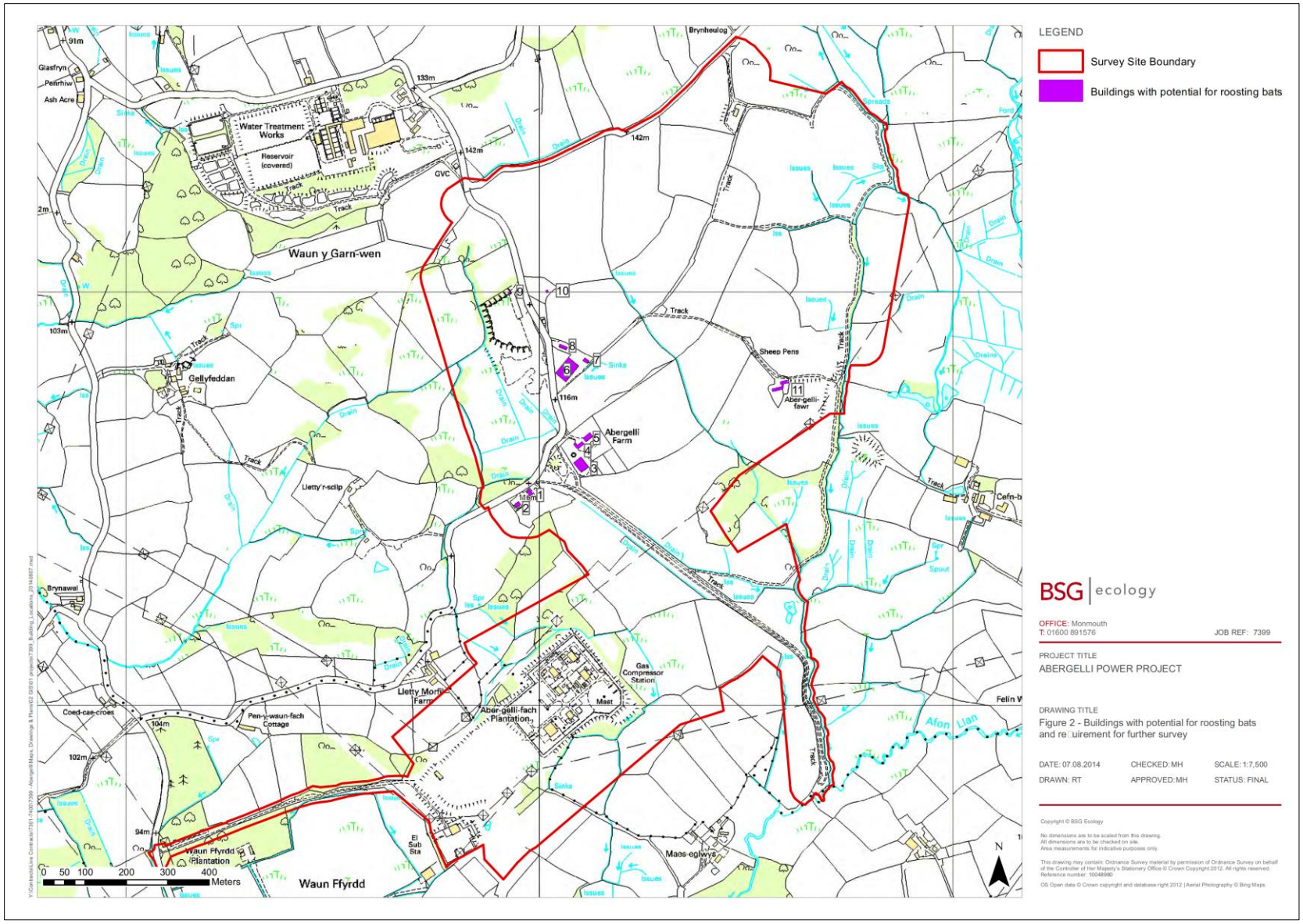
Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	low BRP features; could not access woodland to assess each tree. Recommend any felling undertaken under supervision as for Low BRP trees for alder.				
Tree 24	An unknown dead species; 10m tall; 0. 25m DBH; loose bark covering an area greater than an A4 page on south face from ground level to approx. 4m above ground level. Ivy covering trunk; only able to view south face, no access in woodland in which it is rooted.	Low	Unable to access fully – keep as Low.	Low	No further survey required
Tree 25	A birch; 15m tall; 0. 3m DBH; cavity in trunk, no access to land to be able to see if the cavity leads anywhere; feature on east face approx. 2. 5m above ground.	Low	Unable to access fully – keep as low.	Low	No further survey required
Tree 26	An oak; 12m tall; 0. 3m DBH; loose bark Approx. 2m up on west face of rotten stem; located behind fence.	Low	Exposed from above, feature not suitable.	Negligible	No further survey required
Tree 27	A dead tree possibly oak; 8m tall; 0,25m DBH; large knothole on south face approx. 2m above ground; located behind fence.	Low	Not able to access fully – keep as low.	Low	No further survey required
Tree 28	An oak; 11m tall; 0. 4m DBH; rotten and missing limbs at approx. 5m above ground on south face; adjacent to road, not climbable; viewed from opposite side of road only.	Low	No cavities present, features not suitable, open and exposed.	Negligible	No further survey required
Tree 29	A birch; 12m tall; 0. 5m DBH; Two downward facing holes on north face approx. 1m above ground; located between two fences. First tree in	Low	Holes do not extend, too wet, not suitable.	Negligible	No further survey required

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	row from track.				
Tree 30	An oak; 11m tall; 0. 6m DBH; Hole where limb is missing at approx. 2. 5m above ground on west face; access from north side of fence.	Low	Feature checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 31	An oak; 10m tall; 0. 5m DBH; downward facing hole on main stem approx. 1. 25m above ground on east face. In corner of field on own.	Low	Hole downward facing, full of water, not suitable.	Negligible	No further survey required
Tree 32	An ash (multi stemmed); 15m tall; 0. 3m DBH on average. ; knothole on north face at 3m above ground; splits on west and north faces at 1 – 2m above ground; knothole on branch overhanging woodland to south facing west at4. 5m. Located on edge of woodland.	Moderate	Does not extend, open and exposed. One upward feature may be suitable, no bats or evidence of bats.	Low	No further survey required
Tree 33	A birch; 15 m tall; 0. 3m DBH; knothole at 3m on west face. Set back into wood approx. 10m from edge.	Low	Features checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 34	A birch (multi stemmed); 15m tall; 0. 4m DBH on average; cavity on south-west at 2m; set back in woodland approx. 5m from edge.	Moderate	Feature checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 35	An oak; 20m tall; 0. 5m DBH; missing limb (part of) on south-west at 2. 5m. On edge of woodland.	Low	Open from above, exposed, feature not suitable.	Negligible	No further survey required
Tree 36	A birch; 30m tall; 0. 8m DBH. Very large cavity in trunk on west face at 2m. Next to stream in woodland.	Moderate	Unable to find.	Moderate	One dusk, one dawn; at least one before end of August

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
Tree 37	An oak; 20m tall; 0,4m DBH; woodpecker hole on east face viewed from a distance. Access to woodland not possible at the time of survey. Trees in woodland likely to have BRP features.	Low	Unable to access.	Low	No further survey required
Tree 38	An oak; 20m tall; 0. 3m DBH; knothole at 8m on west face Access to woodland not possible at the time of survey. Trees in woodland likely to have BRP features.	Low	Unable to access.	Low	No further survey required
Tree 39	A silver birch; 12m tall; 0. 5m DBH; possible cavity at 3. 5m facing south-west and thick ivy stems; multi stem.	Low	No cavity present, no other features present.	Negligible	No further survey required
Tree 40	A rowan; 10m tall; 0. 25m DBH; cavity at 1m from ground facing south-west.	Low	Feature checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 41	SN 65445 01410 (+/-4m); rowan; 12m tall; 0. 3m DBH; split at 0. 5m from ground extends up into tree, facing west. Set back from woodland edge. Photograph 55.	Moderate	Feature not suitable, does not extend, open, wet inside.	Negligible	No further survey required
Tree 42	A silver birch; 10m tall; 0. 3m DBH; cavity at 2m extends up into tree facing west.	Moderate	Feature checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 43	A birch; 8m tall; 0. 2m DBH; cavity at ground level extends up into tree; facing south-west.	Low	Feature checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 44	An oak; 9m tall; 0. 3m DBH; cavity in	Moderate	Unable to find.	Moderate	One dusk, one

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	main trunk from ground facing south. Endoscope. In dense woodland juts to the east of the stream.				dawn; at least one before end of August
Tree 45	An oak; 7m tall; 0. 3m DBH; loose bark all the way up the main trunk from ground level, Choked with ivy.	Moderate	Features checked using endoscope, no bats or evidence of bats, however some features may be suitable for roosting bats. Loose bark not suitable – too open and exposed.	Low	No further survey required
Tree 46	Beech. 23m tall. 1.2m DBH. Rot at base of trunk on east face, fungal growth blocking any access; block knotholes on east, south and west faces. Knotholes at 3 – 5m	Negligible	Not Required	Negligible	No further survey required
Tree 47	Oak. 25m tall. 0.8m DBH. A few missing small limbs, but no BRP	Negligible	Not Required	Negligible	No further survey required
Tree 48	Oak. 20m tall. 0.8m DBH Viewed north face only with binoculars; split in large limb at 7m. Could not access tree due to horses.	Low	Not climbed. No access due to horses.	Low	No further survey required
Tree 49	Oak. 20m tall. 1m DBH Missing limb on SE face with small hole at 4m.	Low	Not climbed. No access due to horses.	Low	No further survey required

Appendix 2A BSG Report Buildings with Potential for Roosting Bats



Appendix 3A Static Detector Limitations

Table 2.1 Static Detector Recording Time Limitations

Month	Location	Number of Recording Nights	Comments
June 2017	Lane 1	2.5	SD cards inside machine filled up preventing the recording of any more bat echolocation calls
	Lane 2	2.5	Suspected SD inside machine filled up preventing the recording of any more bat echolocation calls
	South 1	3	Suspected SD inside machine filled up preventing the recording of any more bat echolocation calls
	South 3	0	Malfunction. Static detector did not turn on.
July 2017	North 3	4.5	Suspected battery fatigue.
	South 1	0	Detector was running for 2.5 nights only, but no bat echolocation calls were recorded during this time. Due to the number of bat echolocation calls recorded at this location in other months, it is assumed that the lack of bat echolocation calls is due to equipment malfunction and not because no bats were present in this location.
August 2017	Lane 1	4	Suspected battery fatigue.
	Lane 2	0	Detector was running for 1.5 nights only; but no bat echolocation calls were recorded during this time. Due to the number of bat echolocation calls recorded at this location in other months, it assumed that the lack of bat echolocation calls is due to equipment malfunction and not because no bats were present in this location.
	North 2	4.5	Suspected battery fatigue.
	South 2	4.5	Suspected battery fatigue.

Month	Location	Number of Recording Nights	Comments
September 2017	Lane 1	4	Suspected battery fatigue.
	Lane 2	0	Detector was running for 1.5 nights only; but no bat echolocation calls were recorded during this time. Due to the number of bat echolocation calls recorded at this location in other months, it assumed that the lack of bat echolocation calls is due to equipment malfunction and not because no bats were present in this location.
	Lane 3	4	Suspected battery fatigue.
	North 1	3	Suspected battery fatigue.
	South 2	3.5	Suspected battery fatigue.
	South 3	1.5	Suspected battery fatigue.
October 2017	Lane 1	3.5	Suspected battery fatigue.
	Lane 3	3.5	Detector recorded data for 3.5 nights only; the cable attaching the microphone to the SM2 was removed by an unknown person during its deployment.
	North 1	1.5	Suspected battery fatigue.
	North 3	3.5	Suspected battery fatigue.
	South 1	1.5	Suspected battery fatigue.
	South 3	3.5	Suspected battery fatigue.

Appendix 4A Static Detector Statistical Analysis Results

Table 2.2 Kruskal-Wallis Test Results for Bat Passes by Location and Bat Passes by Month

Tests Used for Normality	Data Normally Distributed?	Test Description	Kruskal-WallisTest Results	Significant?
Histogram and Shapiro-Wilks	No	Bat Passes by Location	$\chi 2 = 47.521$, df=8, $P < 0.001$	Yes
Histogram and Shapiro-Wilks	No	Bat Passes by Month	$\chi 2 = 14.797$, df=4, $P = 0.005$	Yes

If the P value is < 0.05 then the result is significant

Table 2.3 Post-hoc Mann Whitney-Wilcoxon Test Results for Bat Pass Comparisons by Month

Months	Mann-Wilcoxon Test Results	Significant?
June vs. July	W = 855, P = 0.049	No
June vs. August	**W = 950.5, P = 0.009**	**Yes**
June vs. September	W = 528, P = 0.148	No
June vs. October	**W = 1431, P = 0.0001**	**Yes**
July vs. August	W = 1495, P = 0.419	No
July vs. September	W = 551.5, P = 0.694	No
July vs. October	W = 1443, P = 0.046	No
August vs. September	W = 615, P = 0.876	No
August vs. October	W = 1617.5, P = 0.206	No
September vs. October	W = 382, P = 0.327	No

If the P value is < 0.01 then the result is significant (P value= 0.05/number of months)

Table 2.4 Post-hoc Mann Whitney-Wilcoxon Test Results for Bat Pass Comparisons by Location

Locations	Mann-Wilcoxon Test Results	Significant?
North 1 vs. North 2	W = 322.5, P = 0.097	No
North 1 vs. North 3	W = 284.5, P = 0.182	No
North 1 vs. South 1	W = 125, P = 0.027	No
North 1 vs. South 2	W = 267, P = 0.885	No
North 1 vs. South 3	**W = 350, P = 0.003**	**Yes**
North 1 vs. Lane 1	W = 371, P = 0.718	No
North 1 vs. Lane 2	**W = 39.5, P = 0.0009**	**Yes**
North 1 vs. Lane 3	W = 468.5, P = 0.097	No
North 2 vs. North 3	W = 285.5, P = 0.975	No
North 2 vs. South 1	**W = 98.5, P = 0.0003**	**Yes**
North 2 vs. South 2	W = 242, P = 0.116	No
North 2 vs. South 3	W = 353.5, P = 0.166	No
North 2 vs. Lane 1	W = 341, P = 0.146	No
North 2 vs. Lane 2	**W = 29.5, P = 0.00004**	**Yes**
North 2 vs. Lane 3	W = 462, P = 1	No
North 3 vs. South 1	**W = 107, P = 0.001**	**Yes**
North 3 vs. South 2	W = 231, P = 0.171	No
North 3 vs. South 3	W = 313.5, P = 0.270	No
North 3 vs. Lane 1	W = 331, P = 0.252	No
North 3 vs. Lane 2	**W = 31.5, P = 0.0001**	**Yes**
North 3 vs. Lane 3	W = 420.5, P = 0.944	No
South 1 vs. South 2	W = 393.5, P = 0.010	No
South 1 vs. South 3	**W = 415.5, P = 0.00004**	**Yes**
South 1 vs. Lane 1	**W = 530, P = 0.0059**	**Yes**
South 1 vs. Lane 2	W = 89.5, P = 0.099	No
South 1 vs. Lane 3	**W = 604, P = 0.0004**	**Yes**
South 2 vs. South 3	**W = 443, P = 0.004**	**Yes**
South 2 vs. Lane 1	W = 464.5, P = 0.895	No
South 2 vs. Lane 2	**W = 52.5, P = 0.0005**	**Yes**
South 2 vs. Lane 3	W = 596, P = 0.106	No
South 3 vs. Lane 1	**W = 221, P = 0.003**	**Yes**
South 3 vs. Lane 2	**W = 18.5, P = 0.00001**	**Yes**
South 3 vs. Lane 3	W = 338, P = 0.175	No
Lane 1 vs. Lane 2	**W = 66.5, P = 0.0002**	**Yes**
Lane 1 vs. Lane 3	W = 718.5, P = 0.128	No
Lane 2 vs. Lane 3	**W = 426, P = 0.00004**	**Yes**

If the P value is < 0.006 then the result is significant (P value= 0.05/number of locations)

Table 2.5 Kruskal-Wallis Test Results for Bat Species Richness by Location and by Month

Tests Used for Normality	Data Normally Distributed?	Test Description	Kruskal-WallisTest Results	Significant?
Histogram and Shapiro-Wilks	No	Bat Species Richness by Location	$\chi 2 = 7.717$, df=8, P = 0.462	No
Histogram and Shapiro-Wilks	No	Bat Species Richness by Month	$\chi 2 = 14.789$, df=4, P = 0.005	Yes

If the P value is < 0.05 then the result is significant

Table 2.6 Post-hoc Mann Whitney-Wilcoxon Test Results for Bat Species Richness by Month

Months	Mann-Wilcoxon Test Results	Significant?
June vs. July	W = 126, P = 0.486	No
June vs. August	W = 156.5, P = 0.049	No
June vs. September	W = 90, P = 0.070	No
June vs. October	W = 53, P = 0.090	No
July vs. August	W = 172, P = 0.068	No
July vs. September	W = 112, P = 0.011	No
July vs. October	W = 66, P = 0.121	No
August vs. September	**W = 119.5, P = 0.006**	**Yes**
August vs. October	W = 103.5, P = 0.735	No
September vs. October	**W = 90.5, P = 0.008**	**Yes**

If the P value is < 0.01 then the result is significant (P value= 0.05/number of months)

Appendix 3.7b

Bat Roost and Walked Activity Transect Survey Report UPDATE

Abergelli Power Project
Bat Activity and Roost Update Survey

Abergelli Power Limited
August 2018

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1. Bat Survey Update Report

1.1 Introduction

1.1.1 AECOM was commissioned to undertake a suite of ecological survey work to inform the Abergelli Power Project (the "Project").

1.1.2 Previous bat surveys have been undertaken by BSG Ecology in 2014 which are presented in Appendix 8.1 of the ES and AECOM in 2017 (ES Appendix 8.7).

1.1.3 This report is provided as an update to the Bat Report submitted as part of the Environmental Statement in May 2018 (ES Appendix 8.7). Additional bat surveys have been undertaken since submission, and this document now reflects these results.

1.1.4 The Project Site is located near to the village of Felindre, Swansea, as shown in Figure 1.1. The central grid reference for the Project Site is SN65280143.

1.1.5 The Preliminary Ecological Appraisal (PEA) Report (Appendix 8.1 of the ES) identified that surveys for bats were required at the Project Site. The Project Site was assessed as having 'High' commuting and foraging potential (Collins, 2016). Four buildings (outside of, but adjacent to the Project Site Boundary) were assessed as having the potential to support roosting bats (Appendix 8.1 of the ES).

1.1.6 This baseline report outlines the presence of bat species within the Project Site Boundary and makes initial indications of potential effects and outlines initial recommendations for further surveys, mitigation and enhancement.

1.1.7 The bat survey encompasses suitable habitat in close proximity to and within the Project Site Boundary, as shown on Figure 1 and Figures 3.1-3.4.

1.2 Site Description

1.2.1 The Project Site supports semi-natural broadleaved and plantation woodland, rows of broadleaved trees, standalone broadleaved trees, dense and scattered scrub, improved and semi-improved grassland and marshy grassland, tall ruderal, running water ditches, ponds, species-rich hedgerow with trees, species-poor hedgerow with trees, species-poor intact hedgerows, earth banks, fences and bare ground (hard standing). In order to cover the Project Site adequately two walked transects were undertaken and nine static detector monitoring locations were established across the Project Site.

1.2.2 The walked transect North (Figure 3.1) predominantly encompasses improved grassland fields with hedgerows and mature tree lines. It also includes a few areas of dense scrub, semi-improved neutral grassland, and a running water ditch (which is connected to the Afon Llan watercourse outside of the Project Site) and a tree lined minor road and track.

1.2.3 The walked transect South (Figure 3.1) predominantly encompasses; marshy and improved grassland fields with hedgerows and treelines, with ancient and semi-natural woodland. It also includes semi-improved neutral grassland and areas of scattered scrub. There are three running water ditches and the walked transect runs adjacent to a an area of running water on the eastern Project Site Boundary which connects to the Afon Llan watercourse, which is outside of the Project Site.

1.2.4 Plates 1.6 and 1.7 show examples of the transect habitats.

1.2.5 The nine static detector monitoring locations were placed on field boundaries across the Project Site, sampling improved grassland, semi-improved grassland, marshy grassland, field boundaries, woodland edges and trees lines. Table 1.25 describes the habitats around each static detector location and locations of the static detectors are shown in Figure 3.4.

1.3 The Project

1.3.1 Full details of the Project and Site Description are provided in Chapter 3: Project & Site Description.

1.4 Objectives of the Study

1.4.1 The objectives of this study were:

- To identify nature conservation sites within the Project Site or within 10km of the Project Site Boundary designated for bats;
- To identify any known records and/or populations of bats within the Project Site or within 2km of the Project Site Boundary;
- To establish the presence of any bat roosts within the Project Site;
- To establish bat species composition within the Project Site;
- To record and map spatial distribution and temporal bat activity within the Project Site;
- To highlight any potential ecological constraints in respect to bats;
- To outline further survey work that may be required; and,
- To make suggestions for mitigation, compensation and enhancement of the natural features identified within the Project Site in respect to bats.

1.5 Legislation

1.5.1 All bats and their roosts in Wales are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). They are also included in Schedule 2 of the Conservation of Habitats and Species Regulations 2017, known as The Habitats Regulations. The Wildlife and Countryside Act 1981 was amended by the Countryside and Rights of Way Act 2000 (CRoW) which adds an extra offence of recklessly disturbing roosting bats or obstructing access to their roosts; makes species offences arrestable, increases the time limits for some prosecutions and increases penalties.

1.5.2 The Wildlife and Countryside Act, the Habitats Regulations and the CRoW Act, together make it an offence, among other things, to recklessly, deliberately or intentionally:

- Capture, injure or kill any wild animal which is a European Protected Species (EPS),
- Distrub wild animal of any such species; and

1.5.3 Damage or destroy a breeding or resting site of any such animal. Disturbance is defined as that which is likely:

- To impair their ability:
- To survive, to breed or reproduce, or to rear or nurture their young, or
- In the case of animals of a hibernating or migratory species, to hibernate or migrate; or
- To affect significantly the local distribution or abundance of the species to which they belong.

1.5.4 A bat roost is defined as "*any structure or place (including trees) which any bat uses for shelter and protection".* Because bats tend to re-use the same roosts, legal opinion is that the roost is protected whether or not the bat(s) are present at the time.

1.5.5 If the Project is likely to destroy or disturb bats or their roosts, then a European Protected Species License (EPSL) will be required from Natural Resources Wales (NRW), which would be subject to appropriate mitigation and working methods to protect bats.

1.5.6 This is a brief summary of the legislation. When dealing with individual cases, the client is advised to consult the full texts of the relevant legislation and obtain further legal advice.

1.6 Quality Assurance

1.6.1 This survey and subsequent report was undertaken in line with AECOM's Integrated Management System (IMS). Our IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the international standards BS EN ISO 9001:2015 and 14001:2004 and BS OHSAS 18001:2007. In addition, our IMS requires careful selection and monitoring of the performance of all sub-consultants and contractors.

1.6.2 All AECOM Ecologists who worked on this project are members of (at the appropriate level) the Chartered Institute of Ecology and Environmental Management (CIEEM) and follow their code of professional conduct (CIEEM, 2017) when undertaking ecological work.

1.7 Methodology

a) Desk study

1.7.1 The desk study was completed as part of the AECOM PEA (Appendix 8.1 of the ES). In relation to bats, the objectives of the desk study were to review the existing information available in the public domain to identify the following:

- Special Areas of Conservation (SACs) and Sites of Special Scientific Interest (SSSIs) designated for bats within a 10km radius of the Project Site Boundary paying due regard to Bat Conservation Trust (BCT) guidelines (Collins, 2016), using the Multi Agency Geographic Information for the Countryside (MAGIC) website (NE, 2017);
- Bat records up to 2km from the Project Site Boundary, purchased from the South East Wales Biodiversity Records Centre (SEWBReC);
- Ancient Semi-Natural Woodland (ASNW), Plantation on Ancient Woodland Site (PAWS), Restored Ancient Woodland Site (RAWS) or Ancient Woodland Site of Unknown category (AWSU) within or adjacent to the Project Site using Ancient Woodland Inventory 2011 dataset downloaded from the LIe website (WG and NRW, 2017);
- The Section 7 list of species of Principal Importance for Conservation of Biological Diversity in Wales; and,
- Features of ecological interest surrounding the Project Site, and features connecting these habitats (e.g. hedgerows, watercourses, railway lines) using aerial photographs and Ordnance Survey (OS) maps.

1.7.2 The County Ecologist and Glamorgan Bat Group were consulted regarding locally designated site citations, local bat records not available from SEWBReC and any local knowledge about the area.

1.7.3 Appendix 8.8 of the ES which contains the previous bat surveys undertaken by BSG Ecology in 2014 was provided by the client and reviewed.

b) Bat Roosts in Buildings

i. Preliminary Ground Level Roost Assessments

1.7.4 There are no buildings within the Project Site. Buildings adjacent (adjacent is defined as up to 20m from the Project Site Boundary) to the Project Site Boundary were classified into categories dependent on the presence of features suitable as bat roost habitat.

1.7.5 The assessment was conducted via an external appraisal from the ground using binoculars where necessary. Table 1.1 provides descriptions of the roost potential categories for buildings.

ii. Internal Inspection

1.7.6 A bat licenced ecologist conducted an internal inspection of Building 7. A systematic search was made of the interior of the building to identify potential or actual bat access points and roosting places and to locate evidence of bats. Bat evidence can include:

- Bat speciemens (live or dead);
- Droppings;
- Urine splashes;
- Fur-oil staining;
- Feeding remains (e.g moth wings);
- Squeaking noises;
- Bat-fly pupal cases; and,
- Odour.

iii. Emergence/Re-Entry Surveys

1.7.7 Surveys paid due regard to Bat Surveys for Professional Ecologists: Good Practice Guidelines (Collins, 2016). Each survey consisted of two surveyors stood at vantage points looking at the buildings so that bats could be observed leaving/re-entering Potential Roost Features (PRF). Bat activity was also recorded if observed by the surveyors.

1.7.8 Emergence surveys started at least 15 minutes before sunset and continued for 2 hours. The dawn re-entry survey started at least 2 hours before sunrise and continued until 15 minutes after sunrise.

1.7.9 Broadband frequency division detectors were used and digital recordings were made to assist with species identification if required.

Table 1.1 Building and Tree Bat Roost Potential Categories

Roost Suitability	Descriptions for Buildings	Descriptions for Trees
Known or Confirmed	Confirmed signs of bat presence/ occupation (droppings, oily staining around entry points, insect remains, odour, scratching) and actual bat presence.	Confirmed signs of bat presence/ occupation (droppings, oily staining around entry points, insect remains, odour, scratching) and actual bat presence.
High	A structure with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potential for longer periods of time due to their size, shelter, protection, conditions (e. g. temperature, humidity, height above ground level, light levels or levels of disturbance) and surrounding habitat. Can include structures with points of access to the interior of the building and poorly maintained fabric providing ready access points for bats into structures, but at the same time not draughty. Structures of traditional stone, brick or timber construction. Structures with large (>20cm) roof timbers with mortice joints, cracks and holes. Structures of pre or early 20th century construction. Structures with large complicated and/or uncluttered roof spaces providing unobstructed flying spaces. Structures with weather boarding and/or hanging tiles with gaps. Structures with accessible south facing roofs. Structures with proximity to good foraging habitat such as woodland, wetland, water and /or good hedgerows.	A tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potential for longer periods of time due to their size, shelter, protection, conditions (e. g. temperature, humidity, height above ground level, light levels or levels of disturbance) and surrounding habitat.
Moderate	A structure with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions (e. g. temperature, humidity, height above ground level, light levels or levels of disturbance) and surrounding habitat but unlikely to support a roost of high conservation status. Can include structures with some potential to support roosting bats, but fewer features than a high risk building. Features may include areas suitable for crevice dwelling and/or access points into structures. Some proximity to foraging habitat.	A tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status.

Roost Suitability	Descriptions for Buildings	Descriptions for Trees
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter protection, appropriate conditions and/or suitable habitat to be used on a regular basis or by large numbers of bats (i. e. unlikely to be suitable for maternity or hibernation).	Tree of sufficient size and age to contain potential roost features but with none seen from the ground or features seen have only very limited roosting potential.
Negligible	No features suitable for roosting bats. Can include structures constructed from unsuitable materials e. g. prefabricated with steel and sheet material. Structure is draughty, light and cool buildings with no roosting opportunities. High levels of regular disturbance including external and/or internal lighting. Building is isolated from areas of foraging habitat.	Trees with no potential to support bats.

Source: Category descriptions drawn from Collins, 2016 and Mitchell-Jones, 2004 to be applied using professional judgement

c) Bat Roosts in Trees

i. Preliminary Ground Assessment

1.7.10 The bat study area comprised the land within the Project Site Boundary and the area within the Zone of Influence (ZoI) (Figure 2). The Bat Survey Guidelines (Collins, 2016) state that bat roost assessments must be considered within the Project Site Boundary and the areas under the ZoI of the project. For potential bat roosts the ZoI was assessed to be all land within the Project Site Boundary; and using professional judgement, within a 50m buffer surrounding area where the Generating Equipment Site will be situated due to noise, vibration and lighting during construction, operation and decommissioning.

1.7.11 Trees within or adjacent (adjacent is defined as up to 20m from the Project Site Boundary) to the Project Site Boundary were classified into categories dependent on the presence of features suitable as bat roost habitat.

1.7.12 Trees up to 50m from the Generating Equipment Site were classified into categories dependent on the presence of features suitable as bat roost habitat.

1.7.13 The assessment was conducted via an external appraisal from the ground using binoculars where necessary. Table 1.1 provides descriptions of the roost potential categories for trees.

1.7.14 Eleven trees with bat roost potential were identified during the PEA (Appendix 8.1 of the ES). Thirty four trees were identified during a ground level roost assessment of trees in July 2017.

ii. Potential Roost Feature Climbed Inspection Survey

1.7.15 Following the Ground Level Roost Assessment trees which were assessed as having ‘Low or Moderate’ bat roost potential were subject to a PRF climbed inspection. No trees with High bat roost potential were identified.

1.7.16 These PRF climbed inspections were undertaken in August 2017. The inspections were completed by certified and bat licenced tree climbers.

1.7.17 The inspections paid due regard to Bat Surveys for Professional Ecologists: Good Practice Guidelines (Collins, 2016), Bat Workers Manual (Mitchell-Jones and McLeish, 2004) and Bats and Woodland Management (Forestry Commission, 2005).

1.7.18 Trees were climbed using ropes and/or ladders. Once accessed, features were examined in detail using a torch, endoscope or mirror to inspect (where possible) the full extent of the features and search for bats or evidence of bat activity (e. g. droppings, urine stains, odour, feeding remains, scratch marks, grease stains, wear marks). Where necessary, trees were re-categorised following the PRF climbed inspection.

1.7.19 Two trees identified as having bat roost potential during the preliminary ground level roost assessments were not climbed as they were approximately 20m and 55m outside of the Project Site Boundary.

1.7.20 Sixteen trees could not be accessed and two could not be found during the PRF climbed inspections, as described in the Limitations (Section 1.8).

iii. Emergence/Re-Entry Surveys

1.7.21 Following the Ground Level Roost Assessment and PRF climbed inspections, emergence/re-entry surveys were undertaken on trees with a category of Moderate or High.

1.7.22 Surveys paid due regard to Bat Surveys for Professional Ecologists: Good Practice Guidelines (Collins, 2016). Each survey consisted of one surveyor positioned so that bats could be observed leaving/re-entering the PRF. Bat activity was also recorded if observed by the surveyors.

1.7.23 Emergence surveys started at least 15 minutes before sunset and continued for 2 hours (see Limitations). The dawn re-entry survey started at least 2 hours before sunrise and continued until 15 minutes after sunrise.

1.7.24 Broadband frequency division detectors were used and digital recordings were made to assist with species identification if required. The weather conditions during the surveys were recorded and were largely considered favourable for bats. Survey dates and weather conditions are given in Table 1.3.

d) Bat Activity Surveys

i. Preliminary Assessment of Potential Commuting and Foraging Habitat

1.7.25 The Project Site was assessed as having High commuting and foraging potential for bats (Collins, 2016) during the PEA (Appendix 8.1 of the ES). Habitats within the Project Site were classified into categories dependent on the presence of features suitable for bats to commute and forage. Table 1.2 provides category descriptions for commuting and foraging habitat.

Table 1.2 Commuting and Foraging Habitat Potential Categories

Roost Suitability	Descriptions
High	Continuous high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.
Moderate	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
Low	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or un-vegetated stream, but isolated, i. e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small number of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Negligible	Negligible habitat features on site likely to be used by commuting or foraging bats.

Source: Category descriptions drawn from Collins, 2016 to be applied using professional judgement

ii. Bat Activity – Walked Transects

1.7.26 Surveys paid due regard to Bat Surveys for Professional Ecologists: Good Practice Guidelines (Collins, 2016). Two walked transect routes were developed to sample the Project Site, one in the north and one in the south. These are shown on Figures 3.1 to 3.3.

1.7.27 Each transect was walked twice per month. Dusk activity surveys were completed in June, July, August, September and October 2017 and in April and May 2018. One dusk and dawn survey within one 24 hour period was completed in September 2017.

1.7.28 Each survey consisted of two surveyors walking a pre-determined transect route at a steady pace across the Project Site. The start point and direction of each transect was varied across the months to reduce bias.

1.7.29 The transect contained set Listening Points (LPs) which the surveyors stopped at for three minutes. Each transect contained 12 LPs, with the exception of the first set of surveys in June which had 11 LPs (see Section 1.8, Limitations). The locations of the LPs are shown on Figures 3.1 to 3.3.

1.7.30 Tables 1.23 and 1.24 describe the habitat at each of the LPs.

1.7.31 Dusk transect surveys began 15 minutes before sunset and continued for up to 3 hours after sunset, except for one occasion (see Section 1.8, Limitations). The dawn transect started at least 2 hours before sunrise and continued until sunrise (see Section 1.8, Limitations).

1.7.32 A broadband frequency division detector was used (Bat Box Duet with EM3) and digital recordings made to assist with species identification if required.

1.7.33 The weather conditions for all but one of the surveys (see Section 1.8, Limitations) completed to date was considered to be favourable for bats. The weather conditions and survey dates are given in Table 1.3.

iii. Bat Activity – Static Detector Surveys

1.7.34 Surveys paid due regard to Bat Surveys for Professional Ecologists: Good Practice Guidelines (Collins, 2016). Nine static detector locations were selected within the Project Site to incorporate a range of habitats and give spatial coverage of the Project Site. The locations of the static detectors are shown in Figure 3.4.

1.7.35 Static detector surveys were completed in June, July, August, September and October 2017 and April and May 2018.

1.7.36 The dates of the static detector surveys were:

- June 26 – 01 July 2017;
- 24 July – 29 July 2017;
- 23 August – 28 August 2017;

- 12 September – 17 September 2017;
- 17 October - 22 October 2017;
- 25 April – 30 April 2018; and,
- 23 May – 28 May 2018.

1.7.37 The static detectors were set to begin recording 30 minutes before sunset and continue until 30 minutes after sunrise for a period of five consecutive nights (Collins, 2016). Some equipment failures reduced the static detector recording time (see Limitations and Appendix 3A).

1.7.38 Full spectrum frequency detectors (Wildlife Acoustics Song Meter 2 (SM2/SM2+) with sample rate 384kHz) and ultrasonic SMX-U1 omnidirectional microphones were used to obtain digital recordings of bat echolocation calls in order to determine the species present at each Static Detector Location.

e) Data Analysis and Interpretation

1.7.39 Bat echolocation call analysis where required was undertaken by a suitably experienced ecologist, with support from reference material including the British Bat Calls Species Identification Guide (Russ, 2012).

1.7.40 The AnalookW software programme (version 4.2n) was used to analyse bat echolocation calls. A series of custom made filters in Analook were applied to the bat echolocation call data. Ten percent of pipistrelle calls and all calls of the remaining bat species were manually checked once filters had been applied, and any additional or incorrect calls were relabelled.

1.7.41 Long-eared bats have very quiet echolocation calls and these are often not recorded on bat detectors but may be audible using bat detectors. Where long-eared bats are suspected but the echolocation call has not been recorded then the long-eared bat (possible) category has been used. This is shown in Tables 1.8 to 1.12.

1.7.42 There are six resident species of Myotid bat in Britain. Myotid bats are difficult to identify to species level as the echolocation calls can have overlapping frequencies and can be visually similar when viewed on bat echolocation call software, such as Analook. Therefore all Myotid bat echolocation calls were grouped together for the purposes of calculating Bat Activity Index (BAI).

1.7.43 Where possible, calls with characteristics of specific Myotid bats were noted to inform the species composition within the Project Site.

1.7.44 For the walked transect data, a BAI was calculated as the number of passes divided by the survey time in ‘hours’. Survey time was calculated to the nearest 15 minutes, expressed as 0.25 hours, to account for minor differences in survey duration (see Section 1.8, Limitations).

1.7.45 For the static detector survey data, a BAI was calculated as the number of passes divided by the survey time in 'nights'. Survey time was calculated to the nearest 0.5 nights, to account for differences in survey duration (see Section 1.8, Limitations and Appendix 3A). The half way point for each night was calculated using the start and finish time. If the static detector failed before the half way point then 0.5 of a night was used in the BAI calculations. If the static detector failed after the half way time point the whole night was used in the BAI calculations.

1.7.46 Bat activity is an indication of the amount of use bats make of an area (Collins, 2016). A bat pass is defined by BCT as a sequence of greater than two echolocation calls made as a single bat flies past the microphone (BCT, 2017). A bat pass is an index of bat activity rather than a measure of number of individuals in a population (Collins, 2016).

1.7.47 The statistics software programme 'R' (R Core Team, 2013) was used to assist data interpretation and to help look for statistically significant differences and/or relationships. This was completed by an ecologist with appropriate statistical knowledge and experience of the programme.

1.7.48 Due to the variation in successful recording nights, statistical tests could only be completed from the first night of data from each static detector, for each month.

1.7.49 The data was assessed for normal distribution and the most appropriate statistical tests applied. The data was not normally distributed and therefore non parametric tests, Kruskal-Wallis and Mann Whitney-Wilcoxon, were used.

1.7.50 Calculated values within this report have been given to one decimal place, except for survey times in Tables 1.13 and 1.14, BAI values in Table 1.18 and BAI values in Table 1.20.

Table 1.3 Survey Dates and Weather Conditions

Survey Date	Sunset/ Sunrise Time	Start Time	End Time	Survey Type	Surveyors	Temp (°C) Start/ End	Humidity (%) Start/ End	Wind Speed Avg. (mph) Start/ End	Cloud Cover (Octars) Start/ End	Rain
13 June 2017	21:34	21:19	00:27	South Transect	LN & CM	13.7/12.6	87.4/86.5	0.0/0.0	1/8 / 0/8	None
14 June 2017	21:35	21:20	00:18	North Transect	LN & CM	19.5/14.0	66.6/80.3	0.0/0.0	7/8 / 8/8	None
26 June 2017	21:38	21:23 21:23	00:19 00:51	North Transect South Transect	LN & UJ CM & BW	15.9/Nr	74.4/Nr	0.0/Nr	8/8 / Nr	Light rain at 23:16 for a few minutes
06 July 2017	21:34	21:20	00:35	South Transect	LN & UJ	16.9/17.1	85.4/86.3	0.0/0.0	1/8 / 7/8	None
10 July 2017	21:32	21:20	00:28	North Transect	UJ & SB	14.0/15.7	83.0/85.0	0.7/0.6	5/8 / 8/8	Very light drizzle at 00:20
24 July 2017	21:17	21:00 21:00	00:17 00:17	North Transect South Transect	LF & SB LN & NW	17.3/ 13.0	75.8/86.0	0.0/0.0	1/8 / 0/8	None
07 August 2017	20:55	20:39 20:40	23:44 00:00	North Transect South Transect	UJ & SB LN & LF	13.0/17.0	81.0/81 0	F1 - Light Wind (Beaufort Scale)	2/8 / 8/8	None
08 August 2017	20:53	20:30	22:53	Building 3 – Roost	LN & LF	14.9/12.9	82.0/85.2	0.0/0.7	6/8 / 5/8	None
09 August 2017	05:51	03:47 03:41	06:06 06:06	Tree 36 – Roost Tree 44 – Roost	LN LF	15.2/12.5	79.4/93.8	0.0/0.6	8/8 / Nr	Light rain but sheltered in woodland
15 August 2017	20:39	20:24 20:24 20:20	22:39 22:39 22:39	Tree 3 – Roost Tree 19 – Roost Tree 21 – Roost	LF UJ LN	15.7/12.1	83.3/92.8	0.0/0.9	3/8 / 2/8	None
21 August 2017	20:27	20:12	22:27	Building 4 – Roost	UJ & RS	20.1/18.4	81.4/ 86.1	0.0/ 0.0	8/8 / 6/8	None, light drizzle day before

Survey Date	Sunset/ Sunrise Time	Start Time	End Time	Survey Type	Surveyors	Temp (°C) Start/ End	Humidity (%) Start/ End	Wind Speed Avg. (mph) Start/ End	Cloud Cover (Octars) Start/ End	Rain
23 August 2017	20:23	20:08 20:08	23:23 23:19	North Transect South Transect	LN & LF UJ & CM	15.7/15.0	83.7/91.5	0.8/1.2	4/8 / 7/8	Light rain at 21:20 for a few minutes
29 August	20:05	19:35 19:30	22:05 22:05	Tree 36 – Roost Tree 44 – Roost	LN CM	14.2/11.0	76.5/85.6	0.0/0.0	7/8 / 7/8	None
30 August 2017	06:23	04:23 04:21 04:23	06:38 06:38 06:38	Tree 3 – Roost Tree 19 – Roost Tree 21 – Roost	RS CM LN	11.3/12.7	100.0/89.7	0.9/0.0	8/8 / 8/8	Rain until 04:40, then dry
31 August 2017	06:26	04:26	06:41	Building 4 – Roost	LN & CM	11.7/8.9	91.4/90.7	0.0/0.7	5/8 / 1/8	None
06 September 2017	06:35	04:35 04:35	06:50 06:50	Building 3 – Roost Tree 19 - Roost	LN & SB UJ	14.8/11.4	85.1/89.3	0.0/0.6	8/8 / 3/8	None
07 September 2017	06:37	04:37 04:37	06:42 06:37	North Transect South Transect	LN & LF UJ & SB	14.1/13.0 13.0/Nr	80.1/82.3 82.3/Nr	0.0/0.0 0.0/Nr	8/8 / 6/8 6/8 / Nr	None None
11 September 2017	19:40	19:25	22:27	North Transect	UJ & BW	13.2/11.2	89.2/87.2	0.6/1.2 (max)	3/8 / 0/8	Day before, dry during survey
12 September 2017	06:45	04:45	06:44	North Transect	LN & SB	10.1/10.3	86.6/89.9	0.8/0.9	1/8 / 1/8	Showers day before, dry during survey
13 September 2017	06:47	04:17	06:42	South Transect	LN & SB	10.4/11.0	80.3/85.1	2.3/2.3	1/8 / 3/8	Rain in night, dry during survey
13 September 2017	19:36	19:21	22:27	South Transect	UJ & BW	15.0/9.0	72.0/88.6	0.0/2.4	7/8 / 8/8	Rain before survey. Dry at start of

Survey Date	Sunset/ Sunrise Time	Start Time	End Time	Survey Type	Surveyors	Temp (°C) Start/ End	Humidity (%) Start/ End	Wind Speed Avg. (mph) Start/ End	Cloud Cover (Octars) Start/ End	Rain
										survey. Light rain at 21:33. Heavy rain at 21:50, lighter rain at 22:17.
03 October 2017	18:50	18:35 18:36	21:50 21:50	North Transect South Transect	BW & SB LN & RS	11.4/Nr 11.4/Nr	75.8/Nr 75.8/Nr	0.8/Nr 0.8/Nr	2/8 / Nr 2/8 / Nr	None None
17 October 2017	18:19	18:04 18:04	21:18 21:18	North Transect South Transect	UJ & RS CM & SB	13.0/ Nr 13.0/13.0	Nr/Nr Nr/Nr	0.0/0.0 0.0/Nr	8/8 / Nr 7/8 / Nr	None None
12 April 2018	20:08	19:53 19:53	23:08 23:06	North Transect South Transect	LN & CM UJ & LF	11.2/10.9 12.9/9.2	79.4/74.8 72.2/79.4	0.8/0.0 0.0/0.0	8/8 / 8/8 8/8 / 8/8	None None
25 April 2018	20:30	20:15 20:15	23:14 23:27	North Transect South Transect	LN & LJ UJ & LF	9.3/8.1 10.4/9.9	79.0/82.9 79.6/82.5	2.1/2.2 2.3/2.7	4/8 / 4/8 6/8 / 1/8	None None
10 May 2018	20:54	20:43* 20:39	23:54 23:44	North Transect South Transect	LN & CM UJ & LF	10.5/Nr 9.0/7.5	73.4/Nr 76.8/88.1	0.0/Nr 0.0/0.8	1/8 / Nr 1/8 / 4/8	None None
23 May 2018	21:14	20:59 20:59	00:14 00:11	North Transect South Transect	UJ & SR CM & LF	17.2/17.3 19.5/16.3	65.7/63.1 64.5/67.0	1.5/0.7 0.0/1.6	0/8 / 8/8 7/8 / 0/8	None None

Nr=not recorded *=Late start due to horse obstruction

LN – NRW Bat Licenced Ecologist, LJ – NRW Bat Licenced Ecologist, UJ – Senior Ecologist, LF – Ecologist, CM – Ecologist, BW – NRW Bat Licenced Ecologist, SB – Assistant Ecologist, RS – Sustainability Consultant, NW – Environmental Consultant, SR – Placement Student.

1.8 Limitations

1.8.1 Biological records can be received from a wide variety of sources and may or may not be comprehensive and accurate. However, if assessed in conjunction with a survey, they can contribute to a robust ecological assessment of a site.

a) Suitable Roost Feature Climbed Inspection Survey

1.8.2 There are 16 trees which were not climbed due to access and/or health and safety restrictions and there are two trees which were not climbed as they could not be found by the climbing team due to dense woodland, however these trees were the subject of emergence/ re-entry survey at a later date. These trees did not have their bat roost suitability category altered from the original assigned category and all trees with Moderate suitability subsequently had emergence/re-entry surveys. Therefore, this is not deemed to be a significant limitation.

b) Roost Survey

1.8.3 Building 1 did not have a full Ground Level Preliminary Assessment due to time constraints (Appendix 8.1 of the ES). However, this building is approximately 120m outside of the Project Site Boundary and no further surveys were considered necessary on this building. Therefore, this is not a significant limitation.

1.8.4 Two dusk emergence surveys were undertaken on Buildings 7 and 8, rather than one dusk and one separate dawn re-entry as recommended by Collins, 2016. The deviation from the suvey guidance was required to facilitate a favourable access agreement with the householder for the bat surveys, to limit access disturbance. Both of these buildings were confirmed as bat roosts during these dusk surveys and therefore this limitation is not deemed to be significant.

c) Bat Activity Walked Transect Survey

1.8.5 The first set of June walked transect surveys had 11 LPs per transect, this was increased to 12 LPs per transect for all subsequent surveys. This was changed to increase the spread of sample points. This is not deemed to be a significant limitation to the surveys or this report.

1.8.6 On 10 July 2017 during the Northern Transect the SD recording card briefly came out of the EM3 bat detector and calls during that period were not recorded electronically. However, this was replaced and all bats heard during the period were recorded on the survey sheet and were of common species which the surveyor was able to determine species identification with confidence. This is not deemed to be a significant limitation to the survey or the results.

1.8.7 On 13 September 2017 the dawn South Transect survey finished at 06:42 which was 5 minutes before sunrise, however no bats had been heard since 06:16 and therefore this is not deemed to be a significant limitation.

1.8.8 On a small number of occasions surveyors walked past an LPs or LPs were not accessible meaning that bat data was not recorded for 3 minutes at that location. For calculations of Bat Activity Index, the survey time at each LP has been adjusted to reflect this variation and will mitigate the impact of this limitation of the comparisons of bat activity between LPs. The occasions are listed below:

i. North Transect:

- On 10 July 2017 North Transect LP4 was missed;
- On 23 August and 7, 11 and 12 September 2017, North Transect LP1 was not accessible due to horses being present in the field. A replacement LP was completed as close as possible to the original location at LP1a (s See Table 1.11, LP1a and Figure 5.2). As LP1 was replaced with another LP close to the original location, this is not deemed to be a significant limitation.
- On 7 August, North Transect LP1 was missed;
- On 12 and 25 April and 10 and 23 May North Transect LP3 was not accessible due to horses being present in the field. A replacement LP was completed as close as possible to the original location at LP3a (See Table 1.11, LP3a and Figure 5.2). As LP3 was replaced with another LP close to the original location, this is not deemed to be a significant limitation;
- 23 May 2018 North Transect LP3a as missed;
- On 12 and 25 April and 10 May North Transect LP4 was not accessible due to horses being present in the field. A replacement LP was completed as close as possible to the original location at LP4a (See Table 1.11, LP4a and Figure 5.2). As LP4 was replaced with another LP close to the original location, this is not deemed to be a significant limitation; and,
- On 25 April 2018 North Transect LP12 was missed.

ii. South Transect:

- On 7 and 13 September 2017 LP7 on the South Transect not accessible due to the presence of rams in the field.
- On 7 September 2017, LP9 was missed, this was replaced with LP9a (See Table 1. 12, LP9a and Figure 5. 3). As LP9 was replaced with another LP close to the original location, this is not deemed to be a significant limitation;
- On 3 October 2017, LP9 was missed, this was replaced with LP9b (See Table 1.12, LP9b and Figure 5. 3). As LP9 was replaced with another LP close to the original location, this is not deemed to be a significant limitation; and,
- On 25 April 2018 LP9 on the South Transect was missed.

1.8.9 The weather conditions encountered on the dusk South Transect surveys on 13 September 2017 (see Table 1.3) were not considered wholly favourable for bats, but not so bad as to need to abandon the survey. There was light rain at 21:33 and a spell of heavy rain between 21:50 and 22:17. The South Transect was also sampled at dusk on 7 September 2017 in favourable weather conditions.

1.8.10 It was not possible to incorporate land owned by National Grid within a walked bat activity transect due to due to site access restrictions at night and early morning.

d) Bat Activity Static Detector Survey

1.8.11 Some of the static detectors did not record for the full five night period. Details of malfunctions and reduced survey nights are provided in Appendix 3A Static Detector Limitations.

1.8.12 No data was recorded at North 1 in October 2017. Data in this location was successfully collected in the other 6 months.

1.8.13 No data was recorded at South 1 in July and October 2017. Data in this location was successfully collected in the other 5 months.

1.8.14 No data was recorded at South 3 in June and September 2017. Data in this location was successfully collected in the other 5 months.

1.8.15 No data was recorded at South 1 in July and October 2017. Data in this location was successfully collected in the other 5 months.

1.8.16 No data was recorded at Lane 2 in August and September 2017. Two other static detectors (Lane 1 and Lane 3) were positioned within the Lane and have captured bat activity which is representative of the Lane.

e) Data Analysis and Interpretation

1.8.17 Different bat species vary in their likelihood of detection using bat detectors and therefore it is not relevant to compare numbers of bat passes from different species (Collins, 2016).

1.8.18 Only the first night of data for each location in each month could be used for statistical analysis, due to the variation in successful recording nights. Therefore, the results are less powerful than if the full five nights could have been compared. However, the statistical analysis provides an additional tool, alongside BAI and count data in the interpretation of bat activity.

1.9 Baseline Environment

a) Desk Study Results

1.9.1 The designated habitats, sites and features, in relation to bats, within proximity to the Project Site are listed in Table 1.4 below.

Table 1.4 Desk Study Results

Designation / Feature	Description
Nationally and Internationally Designated Sites for bats within 10km	There are no sites designated for bats within 10km of the Project Site Boundary.
Locally Designated Sites within 2km	There are several locally designated sites within 2km of the Project Site Boundary (Appendix 8.1 of the ES). However, none of these are designated for bats or specifically mention bat species on the citations.
Bat records from the last 10 years within 2km	The following recent (last 10 years) bat species have been recorded within 2km of the Project Site: Daubenton's *Myotis daubentonii*, Natterer's *Myotis nattereri*, Noctule *Nyctalus noctule*, pipistrelle species *Pipistrellus sp.*, common pipistrelle *Pipistrellus pipistrellus,* soprano pipistrelle *Pipistrellus pygmaeus,* long-eared species *Plecotus sp.,* brown long-eared *Plecotus auritus* and generic records of bat species *Chiroptera*. None of these records of bats were from within the Project Site There are records of known roost sites within 2km of the Project Site as follows: • A noctule tree roost approximately 1km north-west of the Project Site Boundary; • A common pipistrelle roost approximately 1.3km east of the Project Site Boundary; • A common pipistrelle roost approximately 1.8km south-east of the Project Site Boundary; • A common pipistrelle roost approximately 1km south-east of the Project Site Boundary; • A common pipistrelle roost approximately 1km north-west of the Project Site Boundary; • A soprano pipistrelle roost approximately 2km south-west of the Project Site Boundary; • A soprano pipistrelle roost approximately 2km north-west of the Project site Boundary; • A long-eared bat and brown-long-eared bat roost approximately 1.6km east of the Project Site Boundary; and, • A long-eared bat and brown long-eared bat roost approximately 1.1km north-west of the Project Site Boundary.

Designation / Feature	Description
	The specific location of the bat roosts is confidential.
Priority Species – Listed on The Environment Act (Wales) 2016 Section 7	Barbastelle *Barbestella barbastellus*, Bechstein's *Myotis bechsteinii*, noctule, common pipistrelle, soprano pipistrelle, brown long-eared, greater horseshoe *Rhinolophus ferrumequinum* and lesser horseshoe *Rhinolophus hipposideros* bats are listed on the Section 7 list.
Ancient Woodland	The following five areas have been identified: • 8.1ha RAWS within and extending south-west outside the Project Site. Part of this RAWS is known as Waun ffyrdd Plantation; • 15.1ha ASWU within and extending south-west outside the Project Site. Part of this ASWU area covers the National Grid site which is currently hardstanding and the ASWU is no longer present; • 0.9ha PAWS adjacent to the south-west of the Project Site Boundary; • 4.3ha RAWS within and adjacent to the Project Site Boundary in the south-west; and, • 1.6ha ASNW, adjacent to the east of the Project Site Boundary. This area is also subject to Tree Protection Orders (Appendix 8.1 of the ES).
Surrounding Land Use	The Project Site is located north of Junction 46 of the M4 Motorway close to the village of Felindre, Swansea. The Project Site has agricultural fields to the east, south and north. Areas of woodland are located to the south, east and west of the Project Site. Areas of the National Grid Power Station with associated roads and buildings are partially within and adjacent to the Project Site. A water treatment works is located in the north west outside of the Project Site.
County Ecologist	The County Ecologist was contacted by email on 9 November 2017 to gather any local knowledge of bat species and bat habitats in proximity to the Site. To date AECOM has not received a response.
Local Bat Group	The local bat group was contacted by email on 9 November 2017 to gather any local knowledge of bat species and bat habitats in proximity to the Site. To date AECOM has not received a response.
Previous Bat Roost and Activity Surveys - BSG Ecology 2014	Previous surveys have been undertaken by BSG Ecology. See Appendix 8.8 of the ES. The Site boundary included within these reports is different to the current Project Site Boundary. The current Project Site is smaller than the red line boundary used by BSG in 2014, however it lies entirely within the area covered by the 2014 BSG surveys. A summary of the previous bat species surveys is detailed below:

Designation / Feature	Description
	Building – Ground Level Roost Assessments and Internal Inspections Eleven buildings with bat roost potential were identified. Internal inspections of buildings confirmed non-maternity roosts in three buildings. These are shown in Appendix 2A: • BSG Building 4: A scattering of long-eared bat, pipistrelle and lesser horseshoe bat droppings were found in the store rooms; • BSG Building 8: Small piles of long-eared bat and pipistrelle droppings found in both first and second storey at the north of the building; and, • BSG Building 10: Two pipistrelle droppings were found on the floor. BSG Building 1, 2, 5 and 11 were categorised as having Moderate bat roost potential. BSG Building 7 was categorised as having Low bat roost potential. BSG Building 3 and 9 were categorised as having Negligible bat roost potential (Hundt, 2012). The buildings identified by BSG in 2014 fall outside of the current Project Site. However, some of these buildings adjacent to the Project Site have been reassessed by AECOM in 2017/2018. Details are provided in Table 1.5. Tree – Ground Level Roost Assessments Thirty three trees were considered to have potential to support roosting bats. 29 of these were subject to a climbed inspection. Emergence and/or re-entry surveys were carried out on eight trees. BSG Trees T3, T4 and T9 are located within the current Project Site. No bats were recorded emerging or re-entering any potential roost features. No tree roosts were identified. Trees within the Project Site have been reassessed by AECOM in 2017. Details are provided in Section 1.11. Bat Activity Walked Transect Surveys At least seven species of bat were recorded during transect surveys; common pipistrelle, soprano pipistrelle, Myotis sp., long-eared bat, noctule, Leisler's bat, and lesser horseshoe bat. All of these species and an additional three were recorded during automated static detector surveys; Nathusius' pipistrelle *Pipistrellus nathusii*, serotine *Eptesicus serotinus* and greater horseshoe.

b) Bat Roost Survey Results

i. Bat Roosts in Buildings

Buildings - Preliminary Ground Level Roost Assessments

1.9.2 Six buildings were assessed for their suitability to support roosting bats in 2017, two buildings were assessed in 2018 and 11 buildings were assessed by BSG in 2014. The results of the assessment are provided in Table 1.5.

1.9.3 Building locations are provided in Figure 2. A map showing the AECOM 2017 and 2018 results is provided in Figure 4.1 and a map showing the 2014 BSG building locations is provided in Figure 4.2.

1.9.4 In November 2017, a disued mine trial shaft and adit, adjacent to the Project Site was identified. Underground sites can be of value to hibernating bats, including horseshoe, long-eared and Myotis species. The approximate locations of the mine shaft and adit are shown in Figure 6. These were assessed for their suitability to support roosting bats in March 2018. The adit is sealed, with no potential for underground hibernation and this has been capped and filled in. The adit is close to Building 4. The trial shaft entrance was located and a depression in the ground which was grassed over was visible. Historical maps had identified that the trial shaft had been dug to 57ft and 6 inches and backfilled. There were no access points for bats. The trial shaft is not suitable for hibernation.

Buildings – Internal Inspection

1.9.5 An internal inspection of Building 7 was undertaken by a bat licenced ecologist in June 2018. The results of the internal inspection are included in Table 1.5.

Table 1.5 Building Assessment Results

AECOM Building Number	BSG Building Number (ES Appendix 8.8)	Building Assessment Description	Initial BRP Category
1	Not surveyed.	A residential bungalow. Approximately 120m outside of the Project Site Boundary to the north-east. This was not fully assessed due to time constraints of the PEA survey (Appendix 8.1 of the ES). This is a modern building with a tiled roof. There were no obvious gaps. House sparrows were observed using spaces in the roof.	AECOM 2017: Low BSG 2014: Not Surveyed
2	BSG 8	External outbuilding within Abergelli Farm yard. Approximately 75m outside of the Project Site Boundary to the west. A brick built building with a tower and asbestos pitched roof. There are potential fly-in access points and features suitable for crevice dwelling species such as	AECOM 2017: High BSG 2014: Confirmed Roost.

AECOM Building Number	BSG Building Number (ES Appendix 8.8)	Building Assessment Description	Initial BRP Category
		pipistrelle BSG Identified: *"Single storey brick barn with second story tower at the northern end. Multiple fly-in opportunities to both storeys. Small piles of long-eared bat and pipistrelle droppings found in both first and second storey at the north of the building"* (Appendix 8.8 of the ES of ES).	
3	BSG 7	Approximately 5m outside of the Project Site Boundary to the west. A single story brick built out building with a pitched asbestos roof. There are gaps in the mortar and brick work and behind the wooden facia boards BSG Identified: *"Brick outbuilding with corrugated roof. The cavity wall may be accessible through broken vents. No signs of use by bats were observed"* (Appendix 8.8 of the ES).	AECOM 2017: Moderate BSG 2014: Moderate
4	Not surveyed	Approximately 10m outside of the Project Site Boundary to the west. A single story brick built out building located within a field. There are gaps leading to a cavity wall. Gaps are present on the east and south face of this building.	AECOM 2017: Moderate BSG 2014: Not Surveyed
5	BSG 6	Approximately 15m outside of the Project Site Boundary to the west. A modern steel barn; industrial building of steel frame construction with asbestos and transparent corrugated sheet roof and asbestos and steel walls. Within the building light enters via the transparent corrugated roof sheets. The building is used regularly for farm maintenance and horses are kept in the east section. There are openings that would allow bats to access the building (open sections to the east and west, small hole 20x20cm within wall on southern aspect, door to the east and west usually left open). No evidence of bats (droppings) was found around the outside of the building. BSG identified: "*Corrugated iron barn, used as horse stable and*	AECOM 2017: Negligible BSG 2014: Negligible

AECOM Building Number	BSG Building Number (ES Appendix 8.8)	Building Assessment Description	Initial BRP Category
		machinery store. No potential roost features or signs of use by bats observed" (Appendix 8.8 of the ES).	
6	BSG 3	Abergelli Farm buildings. Approximately 110m from the Project Site Boundary. A steel barn with a pitched asbestos roof partially used as a horse stable. There were fly in access points, however the building is drafty inside and internal and external lighting is present making it unlikely to support roosting bats. BSG identified: "*Corrugated iron barn, used as horse stable. No potential roost features or signs of use by bats were observed"* (Appendix 8.8 of the ES).	AECOM 2017: Negligible BSG 2014: Negligible
7	BSG 4	Abergelli Farm buildings. Approximately 90m from the Project Site Boundary. Stone built stable block with a pitched roof with bitumen felt and roof tiles. Several potential access points for crevice dwelling bats identified underneath the ridge tiles and within a gap in the facia boards and soffit boxes. Potential fly in access points identified by the open stable doors and an open window. AECOM Internal Inspection found approximatley 10 scattered bat droppings with characteristics of brown long-eared and pipistrelle species. No large piles of droppings or live bats were observed. These were scattered in both the garage and rear store room. The east gable end has gaps internally and a cavity wall which may be suitable for roosting, there were gaps in building fabric in the rear store room which is also the darkest part of the building. BSG identified: *"Stone built stable block. Confirmed as a lesser horseshoe, long-eared and pipistrelle roost*" (Appendix 8.8 of the ES).	AECOM 2018: Internal Inspection: Confirmed Roost Ground Level Assessment: Moderate BSG 2014: Confirmed Roost.

AECOM Building Number	BSG Building Number (ES Appendix 8.8)	Building Assessment Description	Initial BRP Category
8	BSG 5	Abergelli Farm, residential buildings Approximately 65m from the Project Site Boundary. Semi-detached buildings of brick construction with concrete clad walls and a pitched tiled roof. Gaps were identified at the edge of the ridge tiles on the north-west face which may offer access between the tiles and the felt and/or access to the roof void. A further gap was observed in the soffit box on the end of the south-east face and a gap in the soffit on the edge on the east face. Gaps were observed along the ridge line tiles. The gaps are suitable for crevice dwelling species such as pipistrelle. BSG Identified: *"Terraced housing. Some missing tiles, lifted lead flashing and access to boxed eaves due to damage could be used by bats. No signs of use by bats were observed. There was no access available to the roof void"* (Appendix 8.8 of the ES	AECOM 2018: Moderate BSG 2014: Moderate
BSG 1	BSG 1	Assessment not required. Approximately 265m outside of the Project Site Boundary. BSG identified: *"A number of missing slates and gaps under ridge tiles offer potential for roosting bats. No signs of use by bats were observed. There was no access available to the roof void"* (Appendix 8.8 of the ES).	AECOM 2017: Not Surveyed BSG 2014: Moderate
BSG 2	BSG 2	Assessment not required. Approximately 290m outside of the Project Site Boundary. BSG identified: "*Detached house. A number of missing slates and gaps under ridge tiles offer potential for roosting bats. No signs of use by bats were observed. There was no access available to the roof void"* (Appendix 8.8 of the ES).	AECOM 2017: Not Surveyed BSG 2014: Moderate
BSG 9	BSG 9	Assessment not required. Approximately 235m outside of the Project Site Boundary.	AECOM 2017: Not Surveyed

AECOM Building Number	BSG Building Number (ES Appendix 8.8)	Building Assessment Description	Initial BRP Category
		BSG identified: *"Breeze block shed with corrugated roof. No potential roost features or signs of use by bats observed"* (Appendix 8.8 of the ES).	BSG 2014: Negligible
BSG 10	BSG 10	Assessment not required. Approximately 155m outside of the Project Site Boundary. BSG identified: *"Brick out-house, single room, no doors or windows. Flat concrete roof. Missing bricks allow access to the cavity wall in a number of places. Two pipistrelle droppings were found on the floor"* (Appendix 8.8 of the ES).	AECOM 2017: Not Surveyed BSG 2014: Confirmed Roost
BSG 11	BSG 11	Assessment not required. Approximately 195m outside of the Project Site Boundary. BSG identified: *"Derelict stone cottage, two distinct standing walls, no roof. Walls are very exposed. Some roosting opportunities between the stone, and gaps into a rubble filled wall. No signs of use by bats were observed"* (Appendix 8.8 of the ES).	AECOM 2017: Not Surveyed BSG 2014: Moderate

Buildings - Emergence/Re-entry Surveys

1.9.6 The results of the 2014 and 2017/2018 emergence/re-entry surveys are provided in Table 1.6. The locations of the buildings and the roost results from 2017/2018 are shown on Figure 4.1.

1.9.7 Further surveys were not undertaken on AECOM Buildings 1 and 2 due to their distance from the Project Site. Further surveys were not undertaken on Buildings 5 and 6 in 2017 as they had Negligible bat roost suitability.

Table 1.6 Building Emergence/Re-entry Survey Results

AECOM Building Number	BRP Category (AECOM 2017/2018 and BSG 2014 combined – Table 1.5)	Roost Surveys Completed - AECOM 2017/2018	Roost Status – (AECOM 2017/2018 and BSG 2014 combined)
1	Low	No survey completed. Approximately 125m from the Project Site Boundary	Unknown
2	Confirmed Roost	No survey completed. Approximately 70 m from the Project Site Boundary	Confirmed Roost BSG confirmed this as a non-maternity long-eared and pipistrelle roost in 2014 (BSG Building 8) (Appendix 8.8 of the ES)
3	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost
4	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost
5	Negligible	No surveys required	No Roost
6	Negligible	No surveys required	No Roost BSG internal inspection did not find any evidence of use by bats (BSG Building 3) (Appendix 8.8 of the ES). Due to the lack of features suitable for bats an internal inspection is sufficient to determine if this building is a roost
7	Confirmed Roost.	2 X Dusk Emergence (see Section 1.8, Limitations)	Confirmed Roost Summer, non-maternity, roost for at least two lone roosting common pipistrelle bats. A summer roost,

AECOM Building Number	BRP Category (AECOM 2017/2018 and BSG 2014 combined – Table 1.5)	Roost Surveys Completed - AECOM 2017/2018	Roost Status – (AECOM 2017/2018 and BSG 2014 combined)
			possibly maternity roost, for at least 8 brown long-eared, based on the numbers present. A suspected roost for at least one Myotis sp. BSG confirmed this as a lesser horseshoe, long-eared and pipistrelle roost (BSG Building 4) (Appendix 8.8 of the ES)
8	Moderate	2 X Dusk Emergence (see Section 1.8, Limitations)	Confirmed Roost AECOM confirmed this as a summer, non-maternity, roost for at least two lone roosting pipistrelle bats. BSG internal inspection did not find evidence of bats but not all areas were accessible (BSG Building 5) (Appendix 8.8 of the ES). Due to the bat roost features identified an internal inspection only is not sufficient to determine if this building is being used as a roost

AECOM Building Number	BRP Category (AECOM 2017/2018 and BSG 2014 combined – Table 1.5)	Roost Surveys Completed - AECOM 2017/2018	Roost Status – (AECOM 2017/2018 and BSG 2014 combined)
BSG 1	Moderate	No surveys completed - Assessment not required. Approximately 265m outside of the Project Site Boundary.	Unknown. BSG identified: *"A number of missing slates and gaps under ridge tiles offer potential for roosting bats. No signs of use by bats were observed. There was no access available to the roof void"* (Appendix 8.8 of the ES).
BSG 2	Moderate	No surveys completed - Assessment not required. Approximately 290m outside of the Project Site Boundary.	Unknown. BSG identified: "*Detached house. A number of missing slates and gaps under ridge tiles offer potential for roosting bats. No signs of use by bats were observed. There was no access available to the roof void"* (Appendix 8.8 of the ES).
BSG 9	Negligible	No surveys required. Also, approximately 235m outside of the Project Site Boundary.	No Roost
BSG 10	Confirmed Roost	No surveys completed - Assessment not required. Approximately 155m outside of the Project Site Boundary.	Confirmed Roost BSG identified: *"Brick out-house, single room, no doors or windows. Flat concrete roof. Missing bricks allow access to the cavity wall in a number of places. Two pipistrelle droppings were found on the floor"* (Appendix 8.8 of the ES).
BSG 11	Moderate	No surveys completed. Assessment not required. Approximately 195m outside of the Project Site Boundary.	Unknown. BSG identified: *"Derelict stone cottage, two distinct standing walls, no roof. Walls are*

AECOM Building Number	BRP Category (AECOM 2017/2018 and BSG 2014 combined – Table 1.5)	Roost Surveys Completed - AECOM 2017/2018	Roost Status – (AECOM 2017/2018 and BSG 2014 combined)
			very exposed. Some roosting opportunities between the stone, and gaps into a rubble filled wall. No signs of use by bats were observed" (Appendix 8.8 of the ES).

ii. Bat Roosts in Trees

Trees - Preliminary Ground Level Roost Assessment

1.9.8 The results of the Preliminary Ground Level Roost Assessment are provided in Appendix 1A.

Trees - Potential Roost Feature Climbed Inspections

1.9.9 All trees with Low or Moderate bat roost suitability were put forward for climbed inspection. A full table of results from the climbed inspections are provided in Appendix 1A.

1.9.10 All trees inspected were reduced to Negligible or Low bat roost suitability. No bat roosts were identified.

1.9.11 Trees 3, 19, 21, 36 and 44 could not be accessed and therefore retained their original Moderate rating. These trees were taken forward for emergence and re-entry surveys, in the absence of the climbed inspection assessment.

1.9.12 Trees with Low bat roost suitability do not require further survey but may need to be checked for roosting bats before removal.

Emergence/Re-entry Surveys

1.9.13 The results of the emergence/re-entry surveys are provide in Table 1.7. The locations of the trees and the roost results are shown on Figure 4.

1.9.14 Of the five trees surveyed, one bat roost was confirmed in Tree 19. Whilst the bat was seen entering the tree, no calls were detected. This is possibly due to the distance of the tree canopy from the surveyor, and the angle of the bat from the detector. It has been concluded that the species is likely to be a common pipistrelle, because a brief common pipistrelle pass was heard approximately nine seconds before the roosting bat was seen flying around and then disappearing into the crown of Tree 19.

1.9.15 A Photograph of Tree 19 is provided in Plate 1.1.

Table 1.7 Tree Emergence/Re-entry Survey Results

AECOM Tree Number	BRP Category	Roost Surveys Completed	Roost Status
Tree 3	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost
Tree 19	Moderate	2 X Dusk Emergence 1 X Dawn Re-entry	Confirmed Roost. Lone male or lone non-breeding female summer roost for one common pipistrelle bat
Tree 21	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost
Tree 36	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost
Tree 44	Moderate	1 X Dusk Emergence 1 X Dawn Re-entry	No Roost

Plate 1.1: Tree 19 – Confirmed Bat Roost



c) Bat Activity Survey Results

iii. Walked Transects

1.9.16 The location of the walked transects and locations of the LPs are shown on Figures 3.1 to 3.3.

1.9.17 The results of the walked transect surveys are displayed in Tables 1.8 to 1.16.

1.9.18 Tables 1.8 to 1.10 display the count of bat passes for each species or species group.

1.9.19 Tables 1.11 to 1.14 display Bat Activity Index (BAI), expressed as bat passes per hour.

1.9.20 Tables 1.11 to 1.14 display BAI (passes/hr), by Listening Point (LP).

1.9.21 Tables 1.15 to 1.16 display BAI (passes/hr), by month.

1.9.22 The results of the transect surveys and the distribution of the bat passes recorded are shown Figures 5.1, 5.2 and 5.3.

1.9.23 A Site Assessment Summary is provided in Section 1.10.

Table 1.8 Bat Activity – Walked Transect Results – Species Composition

Species	Count of Bat Passes (June 2017 to May 2018)	Percent%	Bat Passes						
			2017					2018	
			June	July	August	September	October	April	May
Lesser horseshoe	1	0.1	0	0	1	0	0	0	0
Common pipistrelle	718	56.6	99	115	153	56	89	60	146
Soprano pipistrelle	389	30.7	60	54	83	58	47	37	50
Nathusius' pipistrelle	2	0.2	0	2	0	0	0	0	0
Myotis species	120	9.5	10	16	28	17	21	4	24
Noctule/Serotine	23	1.8	5	5	4	1	2	2	4
Long-eared	1	0.1	0	0	0	1	0	0	0
Long-eared (possible)	4	0.3	1	0	2	0	1	0	0
Indeterminate	10	0.8	3	0	0	3	3	0	1
All Species	**1268**	**100.0-**	**178**	**192**	**271**	**136**	**163**	**103**	**225**

Table 1.9 Bat Activity – North Transect Results – Species Composition

Species	Count of Bat Passes (June 2017 to May 2018)	Percent %	Bat Passes						
			2017					2018	
			June	July	August	September	October	April	May
Lesser horseshoe	0	0.0	0	0	0	0	0	0	0
Common pipistrelle	335	60.4	53	60	66	33	40	18	65
Soprano pipistrelle	163	29.4	29	22	30	32	16	13	21
Nathusius' pipistrelle	1	0.2	0	1	0	0	0	0	0
Myotis species	43	7.7	2	6	10	5	10	0	10
Noctule/Serotine	9	1.6	2	2	2	0	2	0	1
Long-eared	1	0.2	0	0	0	1	0	0	0
Long-eared (possible)	1	0.2	0	0	1	0	0	0	0
Indeterminate	2	4	1	0	0	0	1	0	0
All Species	**555**	**100.0-**	**87**	**91**	**109**	**71**	**69**	**31**	**97**

Table 1.10 Bat Activity – South Transect Results – Species Composition

Species	Count of Bat Passes (June 2017 to May 2018)	Percentage %	Bat Passes						
			2017					2018	
			June	July	August	September	October	April	May
Lesser horseshoe	1	0.2	0	0	1	0	0	0	0
Common pipistrelle	383	53.7	46	55	87	23	49	42	81
Soprano pipistrelle	226	31.7	31	32	53	26	31	24	29
Nathusius' pipistrelle	1	0.1	0	1	0	0	0	0	0
Myotis species	77	10.8	8	10	18	12	11	4	14
Noctule/Serotine	14	2.0	3	3	2	1	0	2	3
Long-eared	0	0.0	0	0	0	0	0	0	0
Long-eared (possible)	3	0.4	1	0	1	0	1	0	0
Indeterminate	8	1.1	2	0	0	3	2	0	1
All Species	**713**	**100.0**	**91**	**101**	**162**	**65**	**94**	**72**	**128**

Table 1.11 Bat Activity – North Transect Results-BAI (bat passes/hr) by Listening Point (Spatial Distribution)

Listening Point	Lesser horseshoe	Common pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Myotis species	Noctule/ Serotine	Long-eared	Long-eared (possible)	Indeterminate	All Species
1	0	6.2	1.5	0.0	0.0	0.0	0.0	0.0	0.0	7.7
1a	0	40.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	60.0
2	0	22.7	10.7	0.0	1.3	0.0	0.0	1.3	0.0	36.0
3	0	25.5	10.9	0.0	3.6	0.0	0.0	0.0	0.0	40.0
3a	0	33.3	13.3	0.0	0.0	0.0	0.0	0.0	0.0	46.7
4	0	12.7	12.7	0.0	7.3	0.0	0.0	0.0	0.0	32.7
4a	0	53.3	33.3	0.0	6.7	0.0	0.0	0.0	0.0	93.3
5	0	10.7	9.3	0.0	1.3	0.0	0.0	0.0	0.0	21.3
6	0	8.0	5.3	0.0	4.0	0.0	0.0	0.0	0.0	17.3
7	0	6.7	2.7	0.0	0.0	0.0	0.0	0.0	0.0	9.3
8	0	5.3	4.0	0.0	0.0	1.3	0.0	0.0	1.3	12.0
9	0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
10	0	4.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	5.3
11	0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7
12	0	9.2	3.1	0.0	3.1	1.5	0.0	0.0	0.0	16.9
All LPs	**0.0**	**11.0**	**5.5**	**0.0**	**1.7**	**0.2**	**0.0**	**0.1**	**0.1**	**18.6**

Table 1.12 Bat Activity – South Transect Results – BAI (bat passes/hr) by Listening Point (Spatial Distribution)

Listening Point	Lesser horseshoe	Common pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Myotis species	Noctule/ Serotine	Long-eared	Long-eared (possible)	Indeterminate	All Species
1	0	2.7	4.0	0.0	6.7	0.0	0.0	0.0	0.0	13.3
2	0	16.0	2.7	0.0	5.3	0.0	0.0	0.0	0.0	24.0
3	0	8.0	5.3	0.0	4.0	0.0	0.0	0.0	0.0	17.3
4	0	10.7	6.7	0.0	2.7	0.0	0.0	1.3	1.3	22.7
5	0	18.7	16.0	0.0	5.3	0.0	0.0	0.0	0.0	40.0
6	0	10.7	17.3	0.0	4.0	0.0	0.0	0.0	0.0	32.0
7	0	24.6	3.1	0.0	3.1	1.5	0.0	0.0	0.0	32.3
8	0	12.0	8.0	0.0	1.3	4.0	0.0	0.0	0.0	25.3
9	0	6.7	5.0	0.0	1.7	0.0	0.0	0.0	0.0	13.3
9a	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9b	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0	1.3	2.7	0.0	2.7	1.3	0.0	0.0	0.0	8.0
11	0	8.0	5.3	0.0	1.3	0.0	0.0	0.0	0.0	14.7
12	0	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7
All LPs	**0.0**	**10.2**	**6.4**	**0.0**	**3.2**	**0.6**	**0.0**	**0.1**	**0.1**	**20.6**

Table 1.13 Bat Activity – Listening Point Survey Times and BAI – North

North – Listening Point	North – LP Survey Time (Hrs)	North – All Species – BAI (Bat passes/hour)
1	0.65	7.7
1a	0.05	60.0
2	0.75	36.0
3	0.55	40.0
3a	0.15	46.7
4	0.55	32.7
4a	0.15	93.3
5	0.75	21.3
6	0.75	17.3
7	0.75	9.3
8	0.75	12.0
9	0.75	6.7
10	0.75	5.3
11	0.75	2.7
12	0.65	16.9
All LPs - North	**8.75**	**18.6**

Three minutes is expressed as 0.05hrs

Table 1.14 Bat Activity – Listening Point Survey Times and BAI – South

South – Listening Point	South – LP Survey Time (Hrs)	South – BAI (Bat passes/hour)
1	0.75	13.3
2	0.75	24.0
3	0.75	17.3
4	0.75	22.7
5	0.75	40.0
6	0.75	32.0
7	0.65	32.3
8	0.75	25.3
9	0.60	13.3
9a	0.05	0.0
9b	0.05	0.0
10	0.75	8.0
11	0.75	14.7
12	0.70	5.7
All LPs – South	**8.80**	**20.6**

Three minutes is expressed as 0.05hrs

Table 1.15 Bat Activity – North Transect Results - BAI by Month (Temporal Distribution)

Transect	All Surveyed Months	2017					2018	
		June	July	August	September	October	April	May
Transect Survey Time (Hrs)	45.2	5.9	6.4	6.3	7.1	6.5	6.5	6.4
BAI (Bat passes/hour)	12.3	14.7	14.2	17.2	10.0	10.6	4.8	15.1

Table 1.16 Bat Activity – South Transect Results - BAI by Month (Temporal Distribution)

Transect	All Surveyed Months	2017					2018	
		June	July	August	September	October	April	May
Transect Survey Time (Hrs)	46.4	6.6	6.5	6.5	7.6	6.5	6.4	6.3
BAI (Bat passes/hour)	15.4	13.8	15.5	24.9	8.6	14.5	11.2	20.4

iv. Static Detector Surveys

1.9.24 The Static Detector Locations are shown in Figure 3.4.

1.9.25 The results of the static detector surveys are presented in Tables 1.17 to 1.22.

1.9.26 82,329 bat passes were recorded at the Project Site between June and October 2017 and April, May 2018. A total of 247.5 recording nights were completed.

1.9.27 Table 1.17 and 1.19 display the count of bat passes for each species or species group.

1.9.28 Table 1.18 displays the BAI for each species or species group.

1.9.29 Tables 1.20 to 1.21 display BAI, expressed as bat passes per night.

1.9.30 Table 1.20 displays BAI (passes/night), by Static Detector Location.

1.9.31 Table 1.21 displays BAI (passes/night), by month.

1.9.32 Table 1.22 displays the bat passes and BAI for each Static Detector Location Group.

1.9.33 Appendix 4A Tables 2.2 to 2.4 provide the results of the Kruskal-Wallis and Mann Whitney-Wilcoxon non parametric tests.

1.9.34 Plates 1.2 and 1.3 display box plots for bat passes for location and month, respectively. The log of the number of bat passes is used on the y-axis to aid with the visual interpretation of the box plots.

1.9.35 Plates 1.4 and 1.5 display box plots for bat species richness for location and month, respectively. Bat species richness is defined as the number of different bat species recorded at each location.

1.9.36 A Site Assessment Summary is provided in Section 1.10.

Table 1.17 Bat Activity Static Detector Results – Bat Passes and Species Composition

Month	Static Detector Location Number	Static Detector Location Name	Long-eared	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species
June 2017	1	North 1	0	1	5	0	11	286	6	0	0	309
	2	North 2	1	106	5	0	11	1628	96	0	0	1847
	3	North 3	0	39	1	0	0	1404	88	2	0	1534
	4	South 1	0	25	3	0	31	942	390	0	0	1391
	5	South 2	0	88	6	0	11	440	456	0	0	1001
	6	South 3	Equipment malfunction, no results									
	7	Lane 1	0	61	5	0	0	532	18	1	2	619
	8	Lane 2	0	73	2	0	4	1192	834	0	1	2106
	9	Lane 3	2	6	6	0	3	193	110	0	0	320
	Total		**3**	**399**	**33**	**0**	**71**	**6617**	**1998**	**3**	**3**	**9127**
July 2017	1	North 1	4	51	3	0	17	1991	448	0	0	2514
	2	North 2	0	8	6	0	2	339	35	0	0	390
	3	North 3	0	31	3	0	15	26	13	0	0	88
	4	South 1	No calls, see Limitations									
	5	South 2	0	15	0	0	3	81	139	0	0	238
	6	South 3	2	25	13	0	5	165	172	1	1	384
	7	Lane 1	0	331	1	0	0	3275	95	0	0	3702
	8	Lane 2	1	462	1	0	41	4091	4727	1	0	9324
	9	Lane 3	4	72	2	0	12	687	622	0	3	1402
	Total		**11**	**995**	**29**	**0**	**95**	**10655**	**6251**	**2**	**4**	**18042**
August 2017	1	North 1	2	296	6	0	19	1933	709	0	0	2965
	2	North 2	8	51	21	0	0	312	147	0	1	540
	3	North 3	1	106	7	0	29	1040	189	0	0	1372
	4	South 1	0	76	3	0	9	2245	533	0	0	2866
	5	South 2	3	167	5	0	4	1628	866	0	18	2691
	6	South 3	4	39	23	0	7	207	115	0	1	396
	7	Lane 1	0	181	4	0	627	2202	209	0	1	3224

Month	Static Detector Location Number	Static Detector Location Name	Long-eared	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species
	8	Lane 2	No calls, see Limitations									
	9	Lane 3	3	298	15	0	169	445	1090	0	0	2020
	Total		**21**	**1214**	**84**	**0**	**864**	**10012**	**3858**	**0**	**21**	**16074**
September 2017	1	North 1	0	74	0	0	0	532	129	0	0	735
	2	North 2	0	2	4	0	0	28	4	0	0	38
	3	North 3	0	108	0	0	0	336	60	0	0	504
	4	South 1	0	83	0	0	1	2179	633	0	0	2896
	5	South 2	0	1	1	0	0	85	96	1	0	184
	6	South 3	No calls, see Limitations									
	7	Lane 1	2	24	4	0	0	383	36	0	0	449
	8	Lane 2	No calls, see Limitations									
	9	Lane 3	4	11	5	0	0	162	201	0	0	383
	Total		**6**	**303**	**14**	**0**	**1**	**3705**	**1159**	**1**	**0**	**5189**
October 2017	1	North 1	No calls, see Limitations									
	2	North 2	0	16	1	1	0	28	58	0	0	104
	3	North 3	3	91	0	0	21	891	190	0	0	1196
	4	South 1	No calls, see Limitations									
	5	South 2	0	10	3	0	6	112	171	0	0	302
	6	South 3	3	7	3	0	4	46	14	0	1	78
	7	Lane 1	2	47	5	0	2	109	860	0	0	1025
	8	Lane 2	0	30	1	0	74	5090	2822	0	0	8017
	9	Lane 3	6	24	0	0	0	585	148	0	1	764
	Total		**14**	**225**	**13**	**1**	**107**	**6861**	**4263**	**0**	**2**	**11486**
April 2018	1	North 1	1	111	6	0	0	253	44	0	2	417
	2	North 2	2	4	0	0	0	20	8	0	0	34
	3	North 3	3	34	3	0	0	333	82	13	1	469
	4	South 1	0	35	3	0	0	856	12	0	0	906
	5	South 2	0	28	8	0	0	839	463	13	9	1360

Month	Static Detector Location Number	Static Detector Location Name	Long-eared	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species
	6	South 3	1	30	10	0	0	115	68	2	5	231
	7	Lane 1	0	66	6	0	0	1175	77	2	7	1333
	8	Lane 2	5	98	18	0	0	519	182	1	6	829
	9	Lane 3	2	88	2	0	0	473	136	0	1	702
	Total		**14**	**494**	**56**	**0**	**0**	**4583**	**1072**	**31**	**31**	**6281**
May 2018	1	North 1	2	111	17	0	3	2772	351	0	1	3257
	2	North 2	1	21	8	0	0	487	44	0	0	561
	3	North 3	0	120	3	0	0	2131	362	1	1	2618
	4	South 1	1	50	19	0	0	1793	418	0	2	2283
	5	South 2	3	104	5	0	0	830	1393	2	34	2371
	6	South 3	6	35	34	0	1	612	203	0	1	892
	7	Lane 1	1	193	7	0	0	2358	67	0	4	2630
	8	Lane 2	No calls, see Limitations									
	9	Lane 3	13	298	22	0	0	2091	92	2	0	2518
	Total		**27**	**932**	**115**	**0**	**4**	**13074**	**2930**	**5**	**43**	**17130**
All	**Grand Total**		**96**	**4,562**	**344**	**1**	**1,142**	**55,507**	**21,531**	**42**	**104**	**83,329**

N/S/L = Noctule/Serotine/Leisler's; N.Pip= Nathusius' pipistrelle, Pip = pipistrelle species, C.Pip = Common pipistrelle, S.Pip= Soprano pipistrelle, GHS = Greater horseshoe; LHS = Lesser horseshoe

Table 1.18 Bat Activity Static Detector Results – Bat Activity and Species Composition

Month	Static Detector Location Number	Static Detector Location Name	Long-eared	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species	Number of Recording Nights
June 2017	1	North 1	0.00	0.20	1.00	0.00	2.20	57.20	1.20	0.00	0.00	61.80	5
	2	North 2	0.20	21.20	1.00	0.00	2.20	325.60	19.20	0.00	0.00	369.40	5
	3	North 3	0.00	7.80	0.20	0.00	0.00	280.80	17.60	0.40	0.00	306.80	5
	4	South 1	0.00	8.33	1.00	0.00	10.33	314.00	130.00	0.00	0.00	463.67	3
	5	South 2	0.00	17.60	1.20	0.00	2.20	88.00	91.20	0.00	0.00	200.20	5
	6	South 3	Equipment malfunction, no results										0
	7	Lane 1	0.00	24.40	2.00	0.00	0.00	212.80	7.20	0.40	0.80	247.60	2.5
	8	Lane 2	0.00	29.20	0.80	0.00	1.60	476.80	333.60	0.00	0.40	842.40	2.5
	9	Lane 3	0.40	1.20	1.20	0.00	0.60	38.60	22.00	0.00	0.00	64.00	5
	Total		**0.09**	**12.09**	**1.00**	**0.00**	**2.15**	**200.52**	**60.55**	**0.09**	**0.09**	**276.58**	**33**
July 2017	1	North 1	0.80	10.20	0.60	0.00	3.40	398.20	89.60	0.00	0.00	502.80	5
	2	North 2	0.00	1.60	1.20	0.00	0.40	67.80	7.00	0.00	0.00	78.00	5
	3	North 3	0.00	6.89	0.67	0.00	3.33	5.78	2.89	0.00	0.00	19.56	4.5
	4	South 1	No calls, see Limitations										0
	5	South 2	0.00	3.00	0.00	0.00	0.60	16.20	27.80	0.00	0.00	47.60	5
	6	South 3	0.40	5.00	2.60	0.00	1.00	33.00	34.40	0.20	0.20	76.80	5
	7	Lane 1	0.00	66.20	0.20	0.00	0.00	655.00	19.00	0.00	0.00	740.40	5
	8	Lane 2	0.20	92.40	0.20	0.00	8.20	818.20	945.40	0.20	0.00	1864.80	5
	9	Lane 3	0.80	14.40	0.40	0.00	2.40	137.40	124.40	0.00	0.60	280.40	5
	Total		**0.28**	**25.19**	**0.73**	**0.00**	**2.41**	**269.75**	**158.25**	**0.05**	**0.10**	**456.76**	**39.5**
August 2017	1	North 1	0.40	59.20	1.20	0.00	3.80	386.60	141.80	0.00	0.00	593.00	5
	2	North 2	1.78	11.33	4.67	0.00	0.00	69.33	32.67	0.00	0.22	120.00	4.5
	3	North 3	0.20	21.20	1.40	0.00	5.80	208.00	37.80	0.00	0.00	274.40	5
	4	South 1	0.00	15.20	0.60	0.00	1.80	449.00	106.60	0.00	0.00	573.20	5

Month	Static Detector Location Number	Static Detector Location Name	Long-eared	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species	Number of Recording Nights
	5	South 2	0.67	37.11	1.11	0.00	0.89	361.78	192.44	0.00	4.00	598.00	4.5
	6	South 3	0.80	7.80	4.60	0.00	1.40	41.40	23.00	0.00	0.20	79.20	5
	7	Lane 1	0.00	45.25	1.00	0.00	156.75	550.50	52.25	0.00	0.25	806.00	4
	8	Lane 2	No calls, see Limitations										0
	9	Lane 3	0.60	59.60	3.00	0.00	33.80	89.00	218.00	0.00	0.00	404.00	5
	Total		**0.55**	**31.95**	**2.21**	**0.00**	**22.74**	**263.47**	**101.53**	**0.00**	**0.55**	**423.00**	**38**
September 2017	1	North 1	0.00	24.67	0.00	0.00	0.00	177.33	43.00	0.00	0.00	245.00	3
	2	North 2	0.00	0.40	0.80	0.00	0.00	5.60	0.80	0.00	0.00	7.60	5
	3	North 3	0.00	21.60	0.00	0.00	0.00	67.20	12.00	0.00	0.00	100.80	5
	4	South 1	0.00	16.60	0.00	0.00	0.20	435.80	126.60	0.00	0.00	579.20	5
	5	South 2	0.00	0.29	0.29	0.00	0.00	24.29	27.43	0.29	0.00	52.57	3.5
	6	South 3	No calls, see Limitations										0
	7	Lane 1	0.50	6.00	1.00	0.00	0.00	95.75	9.00	0.00	0.00	112.25	4
	8	Lane 2	No calls, see Limitations										0
	9	Lane 3	1.00	2.75	1.25	0.00	0.00	40.50	50.25	0.00	0.00	95.75	4
	Total		**0.20**	**10.27**	**0.47**	**0.00**	**0.03**	**125.59**	**39.29**	**0.03**	**0.00**	**175.90**	**29.5**
October 2017	1	North 1	No calls, see Limitations										0
	2	North 2	0.00	3.20	0.20	0.20	0.00	5.60	11.60	0.00	0.00	20.80	5
	3	North 3	0.86	26.00	0.00	0.00	6.00	254.57	54.29	0.00	0.00	341.71	3.5
	4	South 1	No calls, see Limitations										0
	5	South 2	0.00	2.00	0.60	0.00	1.20	22.40	34.20	0.00	0.00	60.40	5
	6	South 3	0.86	2.00	0.86	0.00	1.14	13.14	4.00	0.00	0.29	22.29	3.5
	7	Lane 1	0.57	13.43	1.43	0.00	0.57	31.14	245.71	0.00	0.00	292.86	3.5
	8	Lane 2	0.00	6.00	0.20	0.00	14.80	1018.00	564.40	0.00	0.00	1603.40	5
	9	Lane 3	1.71	6.86	0.00	0.00	0.00	167.14	42.29	0.00	0.29	218.29	3.5
	Total		**0.48**	**7.76**	**0.45**	**0.03**	**3.69**	**236.59**	**147.00**	**0.00**	**0.07**	**396.07**	**29**

Month	Static Detector Location Number	Static Detector Location Name	Long-eared	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species	Number of Recording Nights
April 2018	1	North 1	0.25	27.75	1.50	0.00	0.00	63.25	11.00	0.00	0.50	104.25	4
	2	North 2	0.44	0.89	0.00	0.00	0.00	4.44	1.78	0.00	0.00	7.56	4.5
	3	North 3	0.75	8.50	0.75	0.00	0.00	83.25	20.50	3.25	0.25	117.25	4
	4	South 1	0.00	7.78	0.67	0.00	0.00	190.22	2.67	0.00	0.00	201.33	4.5
	5	South 2	0.00	7.00	2.00	0.00	0.00	209.75	115.75	3.25	2.25	340.00	4
	6	South 3	0.22	6.67	2.22	0.00	0.00	25.56	15.11	0.44	1.11	51.33	4.5
	7	Lane 1	0.00	14.67	1.33	0.00	0.00	261.11	17.11	0.44	1.56	296.22	4.5
	8	Lane 2	1.25	24.50	4.50	0.00	0.00	129.75	45.50	0.25	1.50	207.25	4
	9	Lane 3	0.44	19.56	0.44	0.00	0.00	105.11	30.22	0.00	0.22	156.00	4.5
	Total		**0.36**	**12.83**	**1.45**	**0.00**	**0.00**	**119.04**	**27.84**	**0.81**	**0.81**	**163.14**	**38.5**
May 2018	1	North 1	0.40	22.20	3.40	0.00	0.60	554.40	70.20	0.00	0.20	651.40	5
	2	North 2	0.20	4.20	1.60	0.00	0.00	97.40	8.80	0.00	0.00	112.20	5
	3	North 3	0.00	24.00	0.60	0.00	0.00	426.20	72.40	0.20	0.20	523.60	5
	4	South 1	0.20	10.00	3.80	0.00	0.00	358.60	83.60	0.00	0.40	456.60	5
	5	South 2	0.60	20.80	1.00	0.00	0.00	166.00	278.60	0.40	6.80	474.20	5
	6	South 3	1.20	7.00	6.80	0.00	0.20	122.40	40.60	0.00	0.20	178.40	5
	7	Lane 1	0.20	38.60	1.40	0.00	0.00	471.60	13.40	0.00	0.80	526.00	5
	8	Lane 2	No calls, see Limitations										0
	9	Lane 3	2.60	59.60	4.40	0.00	0.00	418.20	18.40	0.40	0.00	503.60	5
	Total		**0.68**	**23.30**	**2.88**	**0.00**	**0.10**	**326.85**	**73.25**	**0.13**	**1.08**	**428.25**	**40**
All	**Grand Total**		**0.39**	**18.43**	**1.39**	**0.00**	**4.61**	**224.27**	**86.99**	**0.17**	**0.42**	**336.68**	**247.5**

Bat Activity Index = Bat Pass / Survey Nights. *L-E = Long-eared, N/S/L = Noctule*/Serotine/Leisler's; *N.Pip= Nathusius' pipistrelle, Pip = pipistrelle species, C.Pip = Common pipistrelle, S.Pip= Soprano pipistrelle,GHS = Greater horseshoe; LHS = Lesser horseshoe.*

Table 1.19 Bat Activity Static Detector Results – Bat Passes by Static Detector Location (Spatial Distribution)

Month	Static Detector Location Number	Static Detector Location Name	L-E	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species	Number of Recording Nights
June 2017 -May 2018	1	North 1	9	644	37	0	50	7767	1687	0	3	10197	27
	2	North 2	12	208	45	1	13	2842	392	0	1	3514	34
	3	North 3	7	529	17	0	65	6161	984	16	2	7781	32
	4	South 1	1	269	28	0	41	8015	1986	0	2	10342	22.5
	5	South 2	6	413	28	0	24	4015	3584	16	61	8147	32
	6	South 3	16	136	83	0	17	1145	572	3	9	1981	23
	7	Lane 1	5	903	32	0	629	10034	1362	3	14	12982	28.5
	8	Lane 2	6	663	22	0	119	10892	8565	2	7	20276	16.5
	9	Lane 3	34	797	52	0	184	4636	2399	2	5	8109	32
	All		**96**	**4562**	**344**	**1**	**1142**	**55507**	**21531**	**42**	**104**	**83329**	**247.5**

L-E = Long-eared, N/S/L = Noctule/Serotine/Leisler's; N.Pip= Nathusius' pipistrelle, Pip = pipistrelle species, C.Pip = Common pipistrelle, S.Pip= Soprano pipistrelle, GHS = Greater horseshoe; LHS = Lesser horseshoe

Table 1.20 Bat Activity Static Detector Results – Bat Activity by Static Detector Location (Spatial Distribution)

Month	Static Detector Location Number	Static Detector Location Name	L-E	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species
June 2017 -May 2018	1	North 1	0.33	23.85	1.37	0.00	1.85	287.67	62.48	0.00	0.11	377.67
	2	North 2	0.35	6.12	1.32	0.03	0.38	83.59	11.53	0.00	0.03	103.35
	3	North 3	0.22	16.53	0.53	0.00	2.03	192.53	30.75	0.50	0.06	243.16
	4	South 1	0.04	11.96	1.24	0.00	1.82	356.22	88.27	0.00	0.09	459.64
	5	South 2	0.19	12.91	0.88	0.00	0.75	125.47	112.00	0.50	1.91	254.59
	6	South 3	0.70	5.91	3.61	0.00	0.74	49.78	24.87	0.13	0.39	86.13
	7	Lane 1	0.18	31.68	1.12	0.00	22.07	352.07	47.79	0.11	0.49	455.51
	8	Lane 2	0.36	40.18	1.33	0.00	7.21	660.12	519.09	0.12	0.42	1228.85

Month	Static Detector Location Number	Static Detector Location Name	L-E	Myotis	N/S/L	N. Pip	Pip	C. Pip	S. Pip	GHS	LHS	All Species
	9	Lane 3	1.06	24.91	1.63	0.00	5.75	144.88	74.97	0.06	0.16	253.41
	All		**0.39**	**18.43**	**1.39**	**0.00**	**4.61**	**224.27**	**86.99**	**0.17**	**0.42**	**336.68**

Bat Activity Index = Bat Pass / Survey Nights. *L-E = Long-eared,* N/S/L = Noctule/Serotine/Leisler's; *N.Pip = Nathusius' pipistrelle, Pip = pipistrelle species, C.Pip = Common pipistrelle, S.Pip= Soprano pipistrelle, GHS = Greater horseshoe; LHS = Lesser horseshoe*

Table 1.21 Bat Activity Static Detector Results – Bat Activity by Month (Temporal Distribution)

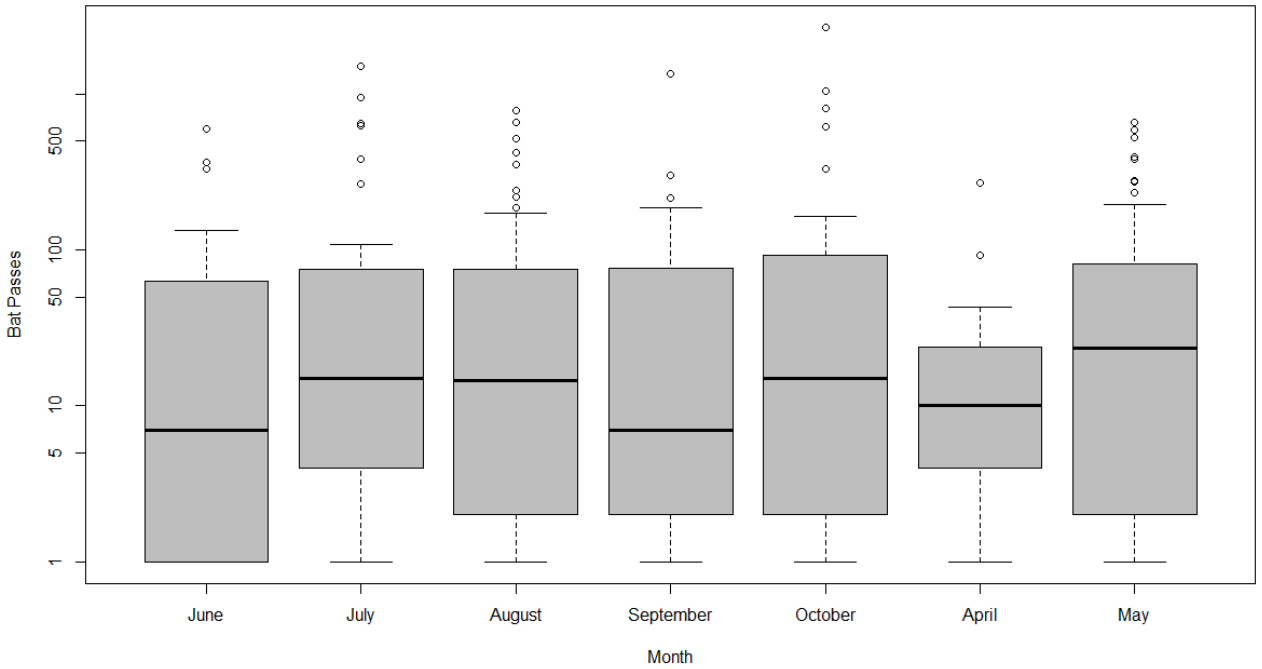
	2017					2018		All Survey Months
	June	July	August	September	October	April	May	
Bat Passes (Count)	9127	18042	16074	5189	11486	6281	17130	83,329
Survey Time (Nights)	33	39.5	38	29.5	29	38.5	40	247.5
Bat Activity Index (BAI) (Bat passes/ Time)	276.6	456.8	423.0	175.9	396.1	163.1	428.3	336.7

Bat Activity Index = Bat Pass / Survey Time in Survey Nights

Table 1.22 Bat Activity Static Detector Results – Bat Passes and BAI by Static Detector Location Group

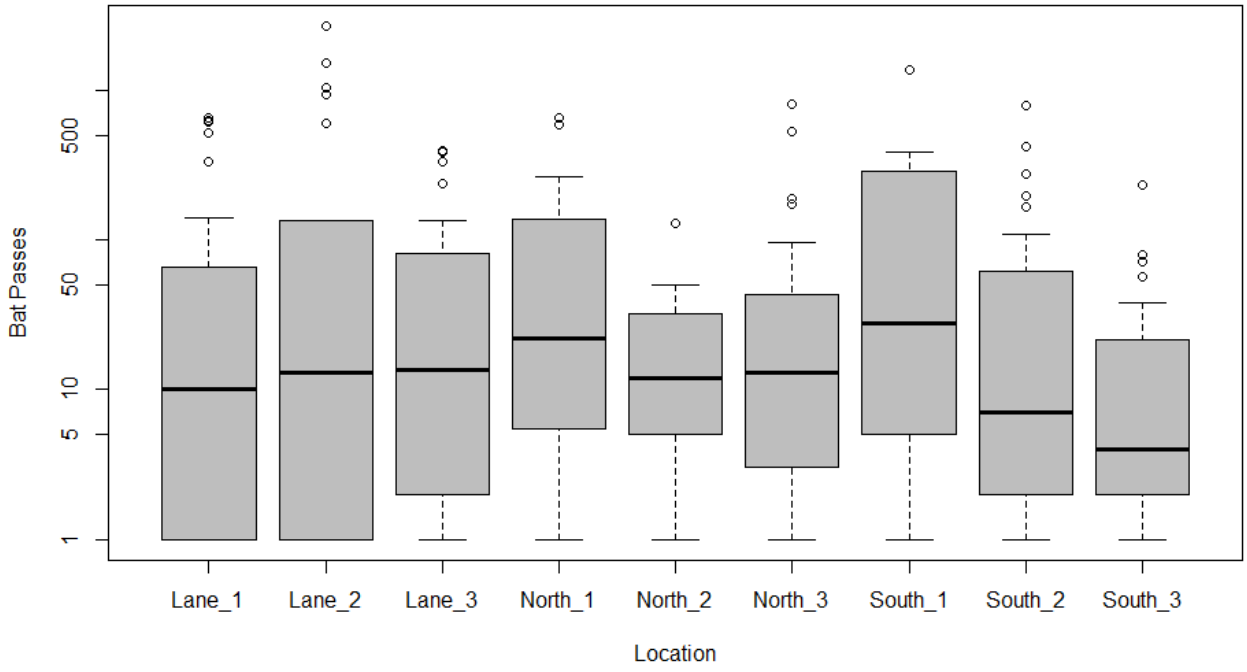
Static Detector Location Group	Total Passes	BAI	Survey Time (Nights)
North (1-3)	21492	231.10	93
South (4-6)	20470	264.13	77.5
Lane (7-9)	41367	537.23	77

Plate 1.2: Box Plots for Static Detector Statistical Analysis - Bat passes by Month.



The log number of bat passes is shown on the y axis '. The boxes span the first quartile to the third quartile values (the interquartile range), with the thick black line in the box being the median value. The 'T' shape or 'Whiskers' above and below the box show the minimum and maximum values. The points on the graph show the outliers.

Plate 1.3: Box Plots for Static Detector Statistical Analysis - Bat passes by Location.



The log number of bat passes is shown on the y axis.'

Plate 1.4: Box Plots for Static Detector Statistical Analysis - Bat Species Richness by Month.

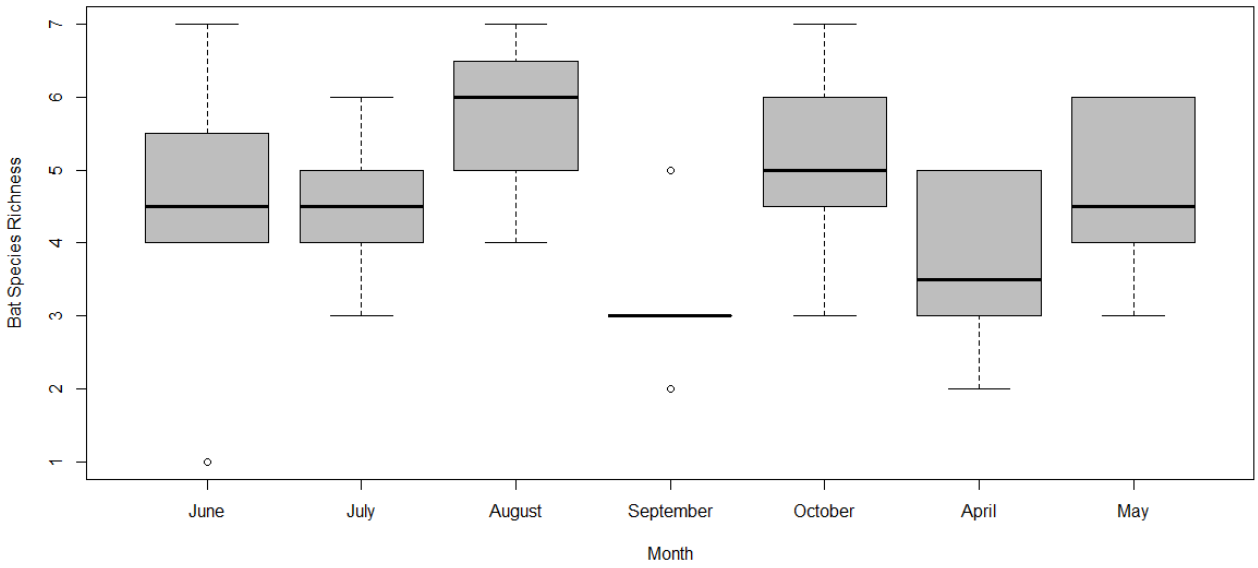
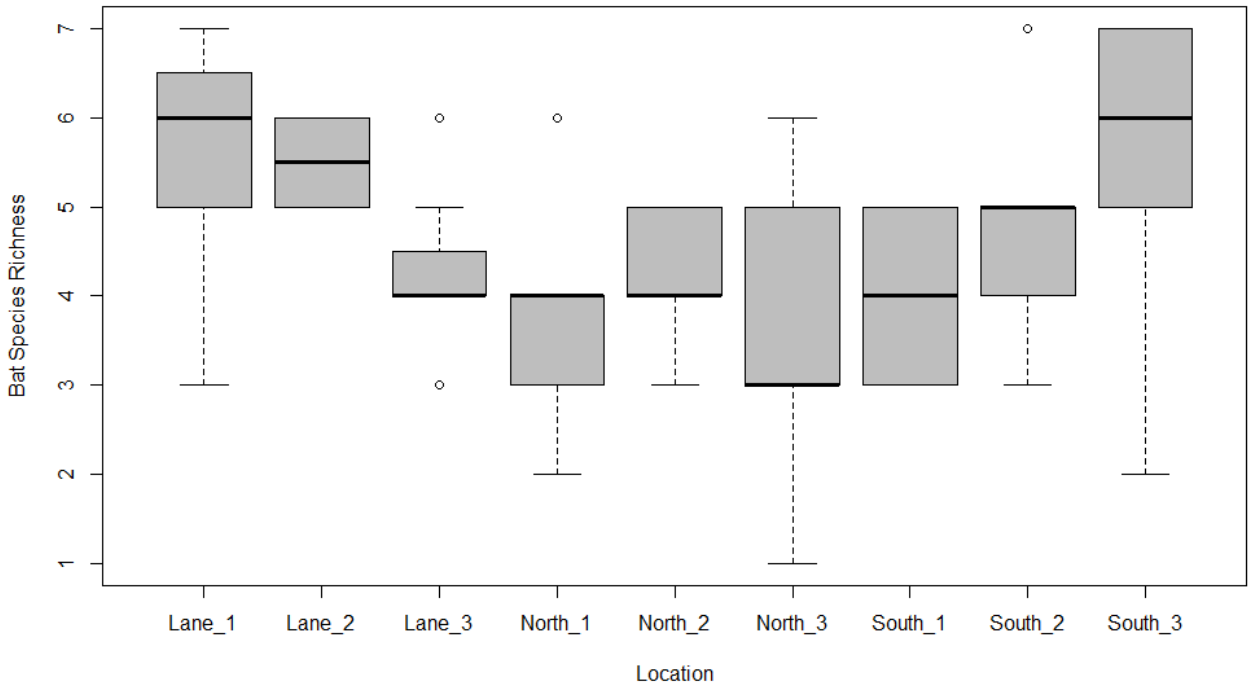


Plate 1.5: Box Plots for Static Detector Statistical Analysis - Bat Species Richness by Location.



1.10 Project Site Assessment

a) Bat Roosts

i. Bat Roosts in Buildings

1.10.1 There are no buildings and hence no building bat roosts within the Project Site.

1.10.2 Buildings adjacent to the Project Site were assessed. Building 7 is a confirmed summer, non-maternity roost for at least two lone roosting common pipistrelle bats, a summer roost, possibly maternity, for at least 8 long-eared bats and a suspected roost for at least one Myotis sp. Building 8 is a confirmed summer non-maternity roost for at least two lone roosting common pipistrelle bats. None of the other buildings surveyed by AECOM supported bat roosts. This is expressed in Table 1.6 and shown on Figure 4.2.

ii. Bat Roosts in Trees

1.10.3 Tree 19 is a lone male or non-breeding female common pipistrelle summer roost. No other trees were identified as bat roosts. A photograph of Tree 19 is shown in Plate 1.1.

b) Bat Activity – Species Composition

1.10.4 At least 13 species of bat were recorded foraging and/or commuting in close proximity of and within the Project Site. The following species have been identified during bat surveys:

- Greater horseshoe;
- Lesser horseshoe;
- Common pipistrelle;
- Soprano pipistrelle;
- Nathusius' pipistrelle;
- Daubenton's;
- Natterer's;
- Mytois species; (including calls with characteristics of Bechstein's, Brandt's *Myotis brandtii* and Whiskered *Myotis mystacinus*);
- Noctule;
- Serotine;
- Leisler's;
- Long-eared species; and,
- Indeterminate species.

i. Pipistrelle Species

1.10.5 Common and soprano pipistrelles were the most commonly recorded species in the Project Site. Overall pipistrelle species comprised 87.3% of all passes recorded on the walked transect surveys and 93.8% of the static detector surveys. They were also the most commonly recorded species during the emergence/re-entry surveys.

1.10.6 Pipistrelle species comprised of 89.9% of the passes recorded on the North Transect and 85.6% of the passes recorded on the South Transect.

1.10.7 Similarly, pipistrelle species were the most commonly recorded species during the BSG 2014 transect and static detector surveys (Appendix 8.8 of the ES).

1.10.8 Two passes of Nathusius' pipistrelle were recorded during the July transect surveys, one record from the South Transect and one from the North Transect, making up 0.2% of total bat passes.

1.10.9 One pass of Nathusius' pipistrelle pass was recorded at the static detector location North 2 in October, making up <0.1% of the total bat passes.

1.10.10 One pass of Nathusius' pipistrelle was recorded during the BSG static detector surveys in 2014 at Location D8 (ES Appendix 8.8). Location D8 is in a similar area to the AECOM South 1. Nathusius' pipistrelle were not identified during the BSG 2014 activity transect surveys (Appendix 8.8 of the ES).

ii. Myotis Species

1.10.11 Myotis species comprised 9.5% of the total calls recorded on the transect surveys. Myotis species comprised 7.7% of the passes recorded on the North Transect and 10.8% of the calls recorded on the South Transect.

1.10.12 Activity levels for Myotis species during the transect surveys were comparable with the activity levels recorded during the BSG 2014 transect surveys (Appendix 8.8 of the ES).

1.10.13 A total of 4562 Myotid bat passes, 5.5% of the total calls, were recorded during the static detector surveys.

Some of the Myotid bat echolocation calls from the static detector surveys were considered to have characteristics of Bechstein's, Brandt's Daubenton's, Natterer's and whiskered.

iii. Noctule, Seortine and Leislers

1.10.14 Noctule, serotine and Leisler's (N/S/L) bats comprised 1.8% of the passes recorded on walked transect surveys. N/S/L bats comprised of 1.6% of the passes recorded on the North Transect and 2.0% of the passes recorded on the South Transect. BSG did not breakdown these species into percentages (Appendix 8.8 of the ES).

1.10.15 Noctule, serotine and Leisler's (N/S/L) bats comprised 0.4% of the passes recorded during the static detector surveys.

1.10.16 Noctule, serotine and Leisler's were recorded during the BSG 2014 static detector surveys. Serotine were not identified during the BSG 2014 activity transect surveys (ES Appendix 8.8).

iv. Long-eared Species

1.10.17 Long-eared and possible long-eared bat comprised a total of 0.4% of the passes recorded on the North Transect and 0.4% recorded on the South Transect surveys. BSG did not breakdown these species into percentages (Appendix 8.8 of the ES).

1.10.18 Long-eared bats comprised 0.1% of the passes recorded during the static detector surveys.

v. Horseshoe Bat Species

1.10.19 There was a single lesser horseshoe bat pass recorded on the South Transect, equating to 0.2% of the total bat passes for the South Transect and 0.1% of the total passes for the Project Site. This was recorded in August 2017. BSG 2014 also recorded only one lesser horseshoe bat pass, again recorded on the BSG south transect (Appendix 8.8 of the ES).

1.10.20 A total of 104 lesser horseshoe passes were recorded during the static detector surveys:

- North Static Detector Locations = 6 bat passes;
- South Static Detector Locations = 72 bat passes; and
- Lane Static Detector Locations = 26 bat passes.

1.10.21 BSG recorded a single lesser horseshoe pass at Location D3 (Appendix 8.8 of the ES), which is in a similar area to AECOM South 3.

1.10.22 Greater horseshoe was not detected during the walked transect survey.

1.10.23 A total of 42 greater horseshoe passes were recorded during the static detector surveys:

- North Static Detector Locations = 16 bat passes;
- South Static Detector Locations = 19 bat passes; and
- Lane Static Detector Locations = 7 bat passes.

1.10.24 BSG recorded two greater horseshoe passes in 2014, in Locations D5 and D8 (Appendix 8.8 of the ES). Location D5 was located along the Gallops near to Abergelli Farm and is not comparable with any of the AECOM locations as this is outside of the Project Site Boundary. Location D8 is relatively close to AECOM South 1.

c) Bat Activity – Spatial Distribution

1.10.25 Figure 5.1 shows the spatial distribution of individual bat passes recorded during the transect surveys. Figure 3.4 shows the static detector locations.

1.10.26 In total 1,268 bat passes were recorded during the walked transects.

1.10.27 Higher counts of bat passess were recorded in the Southern Transect (713 bat passes; 15.4 BAI), compared to the Northern Transect (555 bat passes, 12.3 BAI). The bat activity levels are broadly similar.

1.10.28 In total 83,329 bat passes were recorded during the static detector surveys. Table 1.22 gives the bat activity by the Static Detector Location Groups. Higher levels of activity were recorded in the Southern Static Detector Locations (20,470 total bat passes; 264.1 BAI), compared to the Northern Static Detector Locations (21,492 total bat passes, 231.1 BAI), reflecting the pattern of the walked transect.

1.10.29 Using the first night data from static detector surveys, the species richness recorded across different locations was not statistically significant (Appendix 4A: Table 2.3), i.e. one location did not support a significantly different diversity of bats than any other location.

1.10.30 The highest level of activity was recorded in the Lane Static Detector Locations (41,367 total bat passes, 537.23 BAI). The Lane Static Detector Locations (even with the equipment malfunctions, see Limitations) had higher levels of activity compared to both the North and South Static Detector Locations combined. This may be because the Lane is likely used for foraging, along the sheltered woodland edge, and detectors may have been recording multiple passes by the same bats up and down the Lane.

1.10.31 During the walked transects bat activity was recorded across the Project Site (Figure 5.1). Vegetated stream or wet ditch corridors appear to be important for bats within the Project Site. The distribution of bat call suggests the following general patterns of activity. This is a qualitative assessment only:

- Pipistrelle bats were recorded across the Project Site;
- Myotis species showed some association with mature tree lines and/or areas near water;
- Noctule, serotine and Leisler bats were primarily recorded at height over open fields across the Project Site;
- Long-eared bats showed some association with mature tree lines and are focused more towards the centre and south-east of the Project Site. The

passes recorded are within approximately 315m to 700m of the confirmed long-eared roost in Building 7 and approximately 270m and 850m of the BSG confirmed long-eared roost in Building 2;
- The single lesser horseshoe was recorded on the South Transect along a mature tree line approximately 900m south of the closest known lesser horseshoe roost in Building 2.

1.10.32 The distribution of bat echolocation calls detected during the static detector surveys suggests the following general patterns of activity. This is a qualitative assessment only:

- Pipistrelle bats were recorded across the Project Site;
- Myotis species were recorded across the Project Site;
- Noctule, Serotine and Leisler bats were recorded across the Project Site;
- Long-eared bats were recorded across the Project Site, with highest numbers recorded at Lane 3, followed by South 3 and North 2;
- Greater horseshoe bats were recorded across the Project Site, with the South having the highest number of passes; and,
- Lesser horseshoe bats were recorded across the Project Site within the highest number recorded in the south and south-west of the Project Site at South 2, South 3, Lane 1 and Lane 2.

i. North Transect

1.10.33 Figure 5.2 shows the spatial spread of bat passes recorded on the North Transect.

1.10.34 Table 1.23 below provides the BAI values for the North Transect LPs and a description of the habitat at each LP.

1.10.35 LP2, LP8 and LP12 had the highest species richness, with a total of four different species recorded at each.

1.10.36 The combined totals of LP4 and LP4a had the highest BAI, with the combined totals of LP3 and LP3a having the second highest BAI. LP4 and LP4a are located next to a row of mature trees which are connected to the Abergelli Farm buildings to the west and a watercourse to the east. LP3 and LP3a are located adjacent to a watercourse and riparian woodland with mature trees.

1.10.37 LP11 had the lowest BAI, with only two bat passes recorded over all the months.

1.10.38 Photographs highlighting some of the habitat types within the North Transect are provided in Plate 1.6.

Table 1.23 North Transect – BAI Results and Habitat Descriptions for LPs

Listening Point	BAI for All Species	Habitat Description
4a	93.3	Adjacent to a mature tree line and a wet ditch, within an improved grassland field and opposite to LP4.
4	32.7	Adjacent to a mature tree line and a wet ditch, within an improved grassland field, which has patches of soft rush.
4 and 4a	Combined Total 45.7	As above.
3a	46.7	Within the corner of a semi-improved area of grassland adjacent to a vegetated stream corridor with mature trees and scrub and opposite to LP3.
3	40.0	Within the corner of improved grassland field adjacent to a vegetated stream corridor with mature trees and scrub. Field is grazed by sheep.
3 and 3a	Combined Total 41.4	As above.
2	36.0	On the 'cross roads' of a vegetated stream corridor with mature trees and scrub; and a mature tree line with partially wet ditch. Improved grassland field are adjacent to these linear features, grazed by horses and sheep.
5	21.3	On a farm track which has a mature hedgerow species, on one side including mature hawthorn and other mature trees. Surrounding the track are improved grassland fields grazed by horses and sheep.
6	17.3	On a farm track, further north than LP 5, which has a mature hedgerow species, on one side including mature hawthorn and other mature trees. Surrounding the track are improved grassland fields grazed by horses and sheep. There is a residential property nearby.
12	16.9	On a farm track, further south than LP 5, which has a mature hedgerow species, on one side including mature hawthorn and other mature trees. Surrounding the track are improved grassland fields grazed by horses and sheep. This point is an interchange between a number of hedgerows.
8	12.0	On the edge of an improved grassland field, adjacent to a wet ditch/source of a stream which is lined with mature trees.
1a	60.0	In the corner of an improved grassland field, adjacent to intact hedgerows and near to farm buildings. Fields are grazed by horses and sheep. No ditches or watercourses. Opposite to LP1.
1	7.7	On track next to corner of improved grassland field, adjacent to intact hedgerows and near to farm buildings. Fields are grazed by horses and sheep. No ditches or watercourses.
1 and 1a	Combined Total 11.4	As above.

7	9.3	On the edge of an improved grassland field to a defunct hedgerow of sparsely distributed hawthorn trees. This is near the brow of the hill and near to the highest point of the site. No ditches or watercourses.
9	6.7	In the corner of improved grassland field adjacent to wire fence and species poor hedgerow, predominantly of bracken, this borders a minor road. No ditches or watercourses.
10	5.3	On the edge of an improved grassland field adjacent to a species poor hedgerow, predominantly of bracken, this borders a minor road. No ditches or watercourses.
11	2.7	On a farm track which has some mature trees and some sections of hedgerow. The track is between a solar farm and a semi-improved grassland field. No ditches or watercourses.

ii. South Transect

1.10.39 Figure 5.3 shows the spatial spread of individual bat records during the north transect surveys.

1.10.40 Table 1.24 provides the BAI values for the South Transect LPs and a description of the habitat at the LP.

1.10.41 LP4, LP8 and LP10 had the highest level of species richness, with a total of four different species recorded at each.

1.10.42 LP5 had the highest BAI, with LP7 having the second highest and LP6 having the third highest. LP5 is located next to an area of riparian woodland and watercourse. LP7 is located adjacent to a woodland edge. LP6 is located at the end of a mature tree line, next to a wet ditch and marshy grassland. LP5 and LP6 and LP7 are located within the south-east of the Project Site.

1.10.43 LP12 had the lowest BAI over all the months.

1.10.44 Photographs highlighting some of the habitat within the South Transect are provided in Plate 1.7.

Table 1.24 South Transect – BAI Results and Habitat Descriptions for LPs

Listening Point	BAI for All Species	Habitat Description
5	40.0	On the Gallops / farm track adjacent to semi-natural riparian woodland on the east and marshy grassland to the west. The LP is at the confluence of two riparian corridors, an unnamed stream and the Afon Llan River.
7	32.3	On the edge of improved grassland field adjacent to a woodland edge, with mature trees and running water. To the north of the LP is semi-improved neutral grassland.
6	32.0	At the end of a line of mature trees adjacent to a wet ditch. Surrounding fields are of marshy grassland and improved grassland grazed by sheep.
8	25.3	On the edge of an improved grassland field adjacent to barbed wire fence with running water. There is no hedgerow or trees at this point on the stream. Mature trees border the stream a short distance to the south.
4	22.7	On the Gallops / farm track adjacent to marshy grassland. This is in proximity to LP6, and bats were on occasion seen flying from the tree line at LP6 across the Gallops and foraging over the marshy grassland.
2	24.0	On the ‘cross roads of three rides in the semi-natural woodland. A vegetated stream corridor is nearby.
3	17.3	On the edge of semi natural woodland (ancient woodland), adjacent to improved grassland field gazed by horses.
11	14.7	On the edge of a marshy grassland field adjacent to a hedgerow with trees and a wet flowing ditch.
1	13.3	On a farm track on the edge of an area of semi-natural woodland, adjacent to a small pond generated by run off from the field.
9	13.3	On the edge of an improved grassland field, on the end of a wet ditch, next to a wire fence.
9a	0.0	On edge of a marshy grassland field, adjacent to hedgerow. On same corridor as LP11. Ditch with running water on opposite side of hedge.
9b	0.0	Within a marshy grassland field, adjacent to a wire fence. No wet ditches or watercourses.
9, 9a and 9b	Combined Total 11.4	As above.
10	8.0	In the corner of a marshy grassland field adjacent to a mature tree line. No ditches or watercourses.
12	5.7	On the farm track adjacent to a semi-improved grassland field grazed by horses. No wet ditches or watercourses.

iii. Static Detector Surveys

1.10.45 Figure 3.4 shows the Static Detector Locations.

1.10.46 Table 1.25 provides the BAI values for Static Detector Locations and a description of the habitat at the Locations.

1.10.47 Statistical analysis of the first night of static detector data found that was no statistical difference between the number of bat passes at each location (Plate 1.3 and Appendix 4A: Table 2.2).

Table 1.25 Static Detector - BAI Results and Habitat Description for Locations

Static Detector Locations	BAI for All Species	Habitat Description
Lane 2	1228.8	Located within a hedgerow next on the north edge of the Access Road. The microphone faces south into the Lane. There is a row of mature trees on the north edge of the Lane and Ancient Woodland along the south. There is a matrix of semi-improved and marshy grassland adjacent to the north.
South 1	459.6	Located on a sycamore which is within a strip of broadleaved woodland on the south bank of a wet ditch. The microphone faces south-east over an improved grassland field.
Lane 1	455.5	Located on a tree on the tree lined north edge of the Access Road. The tree line stops at this location and is on the edge of a strip of scrub where the woodland has been cleared and managed and kept open below power lines. The microphone faces south-east into the Lane and scrub clearing.
North 1	377.7	Located on a fence post, on the intersection of a vegetated stream corridor with mature trees and a mature tree line with partially wet ditch. The microphone faces south along the stream. Improved grassland field are adjacent to these linear features, grazed by horses and sheep.
South 2	254.6	Located on a silver birch which is within a strip of broadleaved woodland on the south bank of a wet ditch. Near the Gallops / farm track and adjacent to marshy grassland. The microphone faces south-east over the marshy grassland.
Lane 3	253.4	Located on an alder, within the tree lined north edge of the Access Road. There is a row of mature trees and broadleaved woodland on the north edge of the Lane and Ancient Woodland along the south.

Static Detector Locations	BAI for All Species	Habitat Description
		The microphone faces south-east into the Lane.
North 3	243.2	Located on a mature oak, within a row of mature trees along the vegetated stream corridor. The microphone faces south-west across the stream and towards an improved grassland field grazed by horses and sheep horses.
North 2	103.4	Located on a hawthorn tree within a defunct hedgerow of hawthorn, on the edge of an improved grassland field. The microphone faces west out over the field. This is near the brow of the hill and near to the highest elevation of the site. No ditches or watercourses.
South 3	86.1	Located on a fence post adjacent to the Gallops / farm track and a partially wet ditch and a semi improved grassland field grazed by horses. The microphone faces north-east across the ditch and semi improved grassland field.

d) Bat Activity – Temporal Distribution

1.10.48 Bat activity was recorded at the Project Site between June and October 2017 and April and May 2018.

1.10.49 August had the highest BAI for both transects. The North Transect had a BAI of 17.2 and the South Transect had a BAI of 24.9.

1.10.50 May had the second highest BAI for both transects. The North Transect had a BAI of 15.1 and the South Transect had a BAI of 20.4.

1.10.51 For the static detector surveys, July had the highest BAI of 456.8; the second highest BAI was 428.3 in May and third highest BAI was 423.0 in August.

1.10.52 As seen in Plate 1.4 the month of August has a greater level of species richness than April and September. This was a statistically significant result as seen in Appendix 4A: Tables 2.3 and 2.4.

1.10.53 The statistical analysis of the first night of static detector data showed that there is no significant difference between the bat activity in each month sampled (Plate 1.2 and Appendix 4A: Table 2.2) as there was not statistically significant results between any of the months.

1.10.54 Young bats are typically born in June and July and during August the young are starting to leave the roosts to fly and feed. October is part of the bat mating period and a time when bats are extensively foraging for food as they are looking to store fat for the winter hibernation period. The general ecology of bat species is likely to influence the temporal activity for the Project Site.

Plate 1.6 North Transect – Examples of Habitat



Part of the north of the Project Site, within North Transect, near to the Electrical Connection looking south.



Example of hedgerow with mature trees and improved grassland fields, within the North Transect, near to the Electrical Connection looking west towards Abergelli Farm.

Plate 1.7: South Transect - Examples of Riparian Habitat



An area of riparian woodland with mature trees, near to the South Transect, near the Ancient Woodland.



An area of riparian woodland, within South Transect, running alongside the Gallops/ farm track in the south- of the Project Site.

1.11 Preliminary Potential Effects

1.11.1 A full assessment of effects at construction and operation has been undertaken for the Ecological Impact Assessment (EcIA) and reported in the ES.

1.11.2 Figure 7 indicates the location of potential constraints / impacts. At this stage the following potential effects have been identified:

a) Bat Roosts

i. Destruction and Loss of a Roost

1.11.3 Tree 19 was the only confirmed roost within the Project Site. The Project will not require the removal of Tree 19.

ii. Killing and Injury

1.11.4 Based on the current known distribution of bat roosts within the Project Site, there is no risk of killing or injuring bats during construction and operation.

iii. Disturbance

1.11.5 Without mitigation, there is potential for disturbance to bats due to noise and vibration and external lighting during construction and operation.

b) Bat Commuting and Foraging

i. Habitat Loss

1.11.6 The Project Site is used by bats, particularly the vegetated watercourse/wet ditch corridors, followed by woodland edges and hedgerows with mature trees.

1.11.7 A proportion of the broadleaved semi-natural woodland, semi-improved grassland and marshy grassland will be removed as part of the Project. Without mitigation, hedgerows and mature trees lines will be removed for construction of the Electrical Connection and new section of Access Road. This will reduce the amount of habitat available to foraging bats.

ii. External Lighting

1.11.8 An Outline Lighting Strategy provided in Appendix 3.5 of the ES. There will be an increase in external lighting at the Project Site during construction and operation. There is currently no external lighting within the majority of the Project Site. If external lighting for the Project is poorly designed there is potential for a light spill onto hedgerows, tree lines, woodland edges and vegetated areas. Many species of bat are adverse to light, with different species having different tolerances. External lighting can make areas of previous foraging habitat unsuitable or inaccessible and therefore cause in-direct habitat loss.

iii. Noise

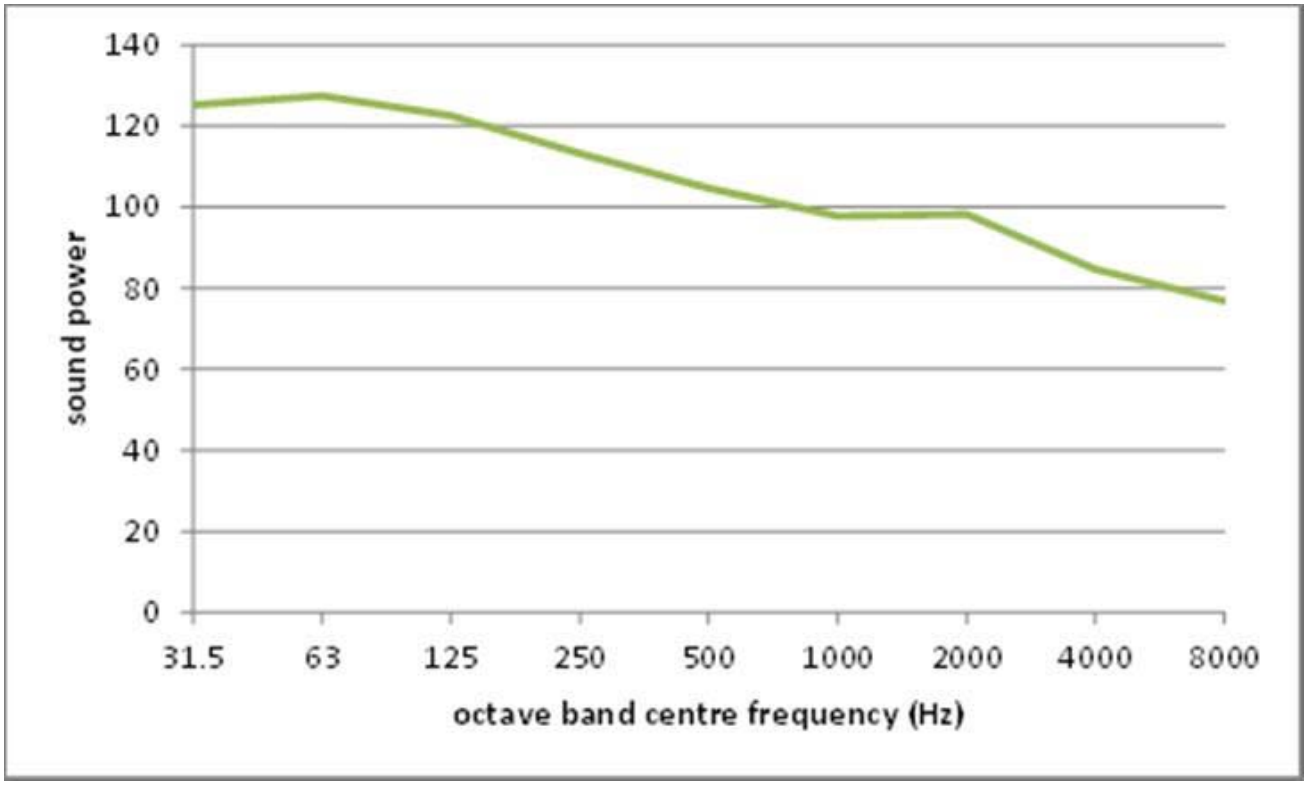
1.11.9 There will be an increase in ambient noise at the Project Site during construction and operation. Construction noise will be temporary and is considered unlikely to impact on foraging bats in the long-term. Operational noise is discussed further below.

1.11.10 The Generating Equipment will only be operational intermittently at times of peak demand and will not emit ultrasonic noise (ultrasonic being noise which is higher than the upper audible limit of human hearing, typically considered to be above 20kHz).

1.11.11 The Generating Equipment is predicted to emit a sound power level of around 100dB $_{LWA}$, the power peaks at a frequency of around 50/63 Hz and roughly halves with every doubling of frequency above that. A typical attenuated power station sound power spectrum is shown in Plate 1.8. This only goes up to 8,000Hz (8kHz) but the tail off in the spectrum continues with increased frequency, showing that there will be little sound power (dB L_A) above 10,000Hz (10kHz).

1.11.12 The specific sound level near the Project Site Boundary is estimated to be approximately 55dB LAeq (ES Chapter 7 Noise – Figure 7.1) (this term is the Equivalent Continuous Level, a type of average, where noisy events have a significant influence). The theoretical average sound pressure level (dB L_A) at the Project Site Boundary approximately 30m from the Generating Equipment will be approximately 55 dB L_A to 63 dB L_A. Equivalent general sounds comparisons are: 50 dB L_A is light traffic or rainfall; 60 – 65 dB L_A is normal conversation; and 85 dB L_A is heavy traffic.

Plate 1.8: A Typical Attenuated Power Station Sound Power Spectrum (Not Site Specific)



1.11.13 There is limited research on the impact of anthropogenic noise on foraging bats and no directly comparable research on the impacts of power station noise have been identified. Research that exists shows that increased anthropogenic noise can negatively impact foraging activity of some species of bats, particularly low frequency bats (<35kHz), as a result of prey masking and avoidance of noise. Two of these are summarised below.

1.11.14 Bunkley *et. al*., 2015, investigated the potential effects of gas compressor station noise in the USA on the activity levels of the local bat assemblage. The gas compressor stations run 24 hours a day, 365 days a year. The mean background sound level (dB L_A) recorded at 50m from the gas compressor site centre was between 70 and 85dB L_A. The frequency of the compressor noise was 24kHz.

1.11.15 Bunkley *et. al.,* 2015, found that activity levels for the Brazilian free-tailed bat (*Tadarida brasiliensis*) were 40% lower at loud compressor sites compared to quieter well pads, whereas the activity levels of four other species (*Myotis californicus, M. cillolabrum, M. lucifugus, Parastrellus hesperus*) were not affected by noise. The assemblage of bat species emitting low frequency (<35kHz) echolocation calls showed a 70% reduction in activity levels at loud sites compared to quieter well pad sites whereas the assemblage using high frequency (>35kHz) echolocation did not exhibit altered activity levels. Bunkley *et. al*. (2015) concluded that lower activity levels of Brazilian free-tailed bats at loud sites indicate a potential reduction in habitat for this species and that this species modifies its echolocation search calls in noise, producing longer calls with a narrower bandwidth, which might affect prey detection.

1.11.16 Luo *et al.*, 2015, investigated how anthropogenic noise impairs foraging, which has direct consequences for animal survival and reproductive success, using Daubenton's bats, which find prey by echolocation. The study looked to identify the potential mechanisms of disturbance in any species capable of detecting the noise, namely acoustic masking of prey echoes, reduced attention and noise avoidance. The study used playback of traffic noise and was laboratory based. Traffic noise was played at around 76dB L_A, at non-overlapping frequencies below 25kHz (not spectrally overlapping the minimum call frequency of Daubenton's, which is at 28kHz), and overlapping frequencies above 25kHz.

1.11.17 Luo *et al.*, 2015, found that traffic noise reduced foraging efficiency in most Daubenton's bats. This effect was present even if the playback noise did not overlap in frequency with the prey echoes. Neither overlapping noise nor non-overlapping noise influenced the search effort required for a successful prey capture. Hence, noise did not mask prey echoes or reduce the attention of bats. Instead, traffic noise acted as an aversive stimulus that caused avoidance response, thereby reducing foraging efficiency.

1.11.18 The frequency emitted from the Generating Equipment (between 50Hz and 10,000Hz (10kHz)) is unlikely to mask the frequencies of large bat prey items, which are generally in the range of 20 - 35kHz and frequencies less than 1kHz are probably inaudible to bats (Luo *et al.*, 2015).

1.11.19 Bunkley et. al.,2015, suggests that bat species emitting low frequency (<35kHz) echolocation calls may be more affected by noise than other species. At the Project Site, bats which echolocate at frequencies <35kHz include the large bats; noctule, serotine and Leisler's. Lower frequency bats at the Project Site make up 1.8% of the total composition of bat species, the rest are higher frequency bat species (>35kHz). However, the predicted frequencies emitted from the Generating Equipment (between 50Hz and 10,000Hz (10kHz)) were much lower than in Bunkley et. al., 2015, and, as above, are unlikely to mask prey items for any bat species.

1.11.20 There may be some noise avoidance by some bat species when the Generating Equipment is operating, as there is little research available to be able to completely rule out potential avoidance from noise of 55 – 63dB L_A . However, the generation of noise would be sporadic and the sound power anticipated at the Project Site Boundary is lower than that in the studies summarised above and it would be anticipated that any impact from avoidance would therefore be comparably lower. No studies were identified which looked at potential foraging impacts from sound power (dB L_A) less than 70dB L_A to be able to draw any direct conclusion.

1.11.21 At the Project Site, the sporadic nature of the noise generated with times of peak demand is most likely to occur during winter (when bats are hibernating) during the early evening (16:00 – 18:00, when people get home from work and before bats emerge from roosts), combined with the sound power peaking at a frequency well below the typical frequency used by echolocating bats, it is considered that noise will not have a significant impact on the population of foraging bats within the Project Site.

iv. Severance and Fragmentation

1.11.22 The removal of trees and woodland is required to facilitate the construction of the new section of Access Road. Without mitigation, this will sever the connectivity to habitats either side of the track, resulting in severance and fragmentation of retained areas.

1.11.23 The removal of tree lines and hedgerows may be required in order to facilitate the construction of the Gas Connection in the north of the Project Site. Removal or severance of tree lines and hedgerow will sever the connectivity they provide and create fragmentation of retained habitat.

1.11.24 During construction of the Project natural habitats including hedgerows and tree lines will be removed and converted to new areas of hardstanding and buildings. This will fragment and sever the connectivity of the habitats located to the north and to the south of the Project. This will impact on bats using the existing features in the landscape to commute and forage between these two areas.

1.11.25 An Outline Lighting Strategy provided in Appendix 3.5 of the ES. There will be an increase in external lighting at the Project Site during construction and operation. There is currently no external lighting within the majority of the Project Site. Many species of bat are adverse to light, with different species having different tolerances. External lighting can make areas of previous foraging habitat unsuitable and fragment commuting routes. If external lighting for the Project is poorly designed there is potential for a light spill onto hedgerows, tree lines, woodland edges and vegetated areas which will negatively impact on bats, severing commuting routes and impeding access to foraging habitat. Poorly designed lighting also has the potential to affect areas outside the Project Site Boundary.

1.12 Preliminary Recommendations for Further Surveys and Mitigation

a) Recommendations for Further Surveys

1.12.1 A full assessment of required further surveys has been made during EcIA and reported in the ES. At this stage it is anticipated that pre-construction checks will be required as follows:

- Pre-construction checks on trees, scheduled for removal, should be assessed for their current bat roost suitability with consideration of the seasonal survey timings.

1.12.2 It is considered that, utilising data from 2014, 2017 and 2018 surveys, an accurate assessment of bat activity within the Project Site has been made. Pre-construction checks are recommended. Mitigation measures have been determined; mitigation has been included in a Landscape and Ecological Mitigation Plan (LEMP).

b) Recommendations for Mitigation

1.12.3 A full series of recommendations for further surveys and mitigation at construction and operation has been undertaken for the EcIA and reported in the ES. At this stage the following key recommendations have been made:

- Based on the current Project proposals a European Protected Species Licence (EPSL) is not a requirement. However, should the scope of the Project change and/or if further bat roosts are identified a EPSL may be required;
- Compensate for loss of foraging habitat;
- Maintain connectivity of foraging and commuting habitats by the retention of trees and hedgerows wherever possible. Figure 7 shows areas of potential conflict;
- Utilising 'brown hedgerows' of brash, to maintain connectivity during construction;
- Create new green corridors to mitigate loss, provide alternative routes and enhance the local landscape;
- For construction of the Electrical Connection consider directional drilling under hedgerows and mature tree lines to avoid felling and avoid severance;
- If less important hedgerows need to be severed temporarily during construction of the Electrical Connection the severed areas should be replanted with whips and standards;
- It is recommended that reasonable avoidance measures should be taken if any trees with a Low bat roost potential need removing as part of the Project (Hundt, 2012). This is likely to include soft-felling of trees under ecological supervision from a bat licenced ecologist;
- Plant a mix of locally native species of standard trees and whips along both sides of the new section of Access Road to create a 'hedgerow with trees'; and,
- Avoid external lighting wherever possible. Only light areas which need to be lit to meet minimum standard. Where external lighting is needed it should be designed to avoid and reduce light spill following best practice guidelines for lighting and bats (Gunnell 2012, BCT 2009), and should be reviewed by an ecologist. Where external road lighting is needed the use of bollards with

louvers should be considered to keep lighting directional and below head height, timer or motion sensors should be used.

c) Recommendations for Biodiversity Enhancement

1.12.4 A full series of recommendations for biodiversity enhancement has been made during the EcIA and reported in the ES. At this stage the following precautionary recommendations have been made:

- Woodcrete bat boxes on trees;
- Improve existing hedgerows by infilling with locally native species standard trees to maintain connectivity to key foraging areas; and,
- Creation of new hedgerows and green corridors of locally native species.

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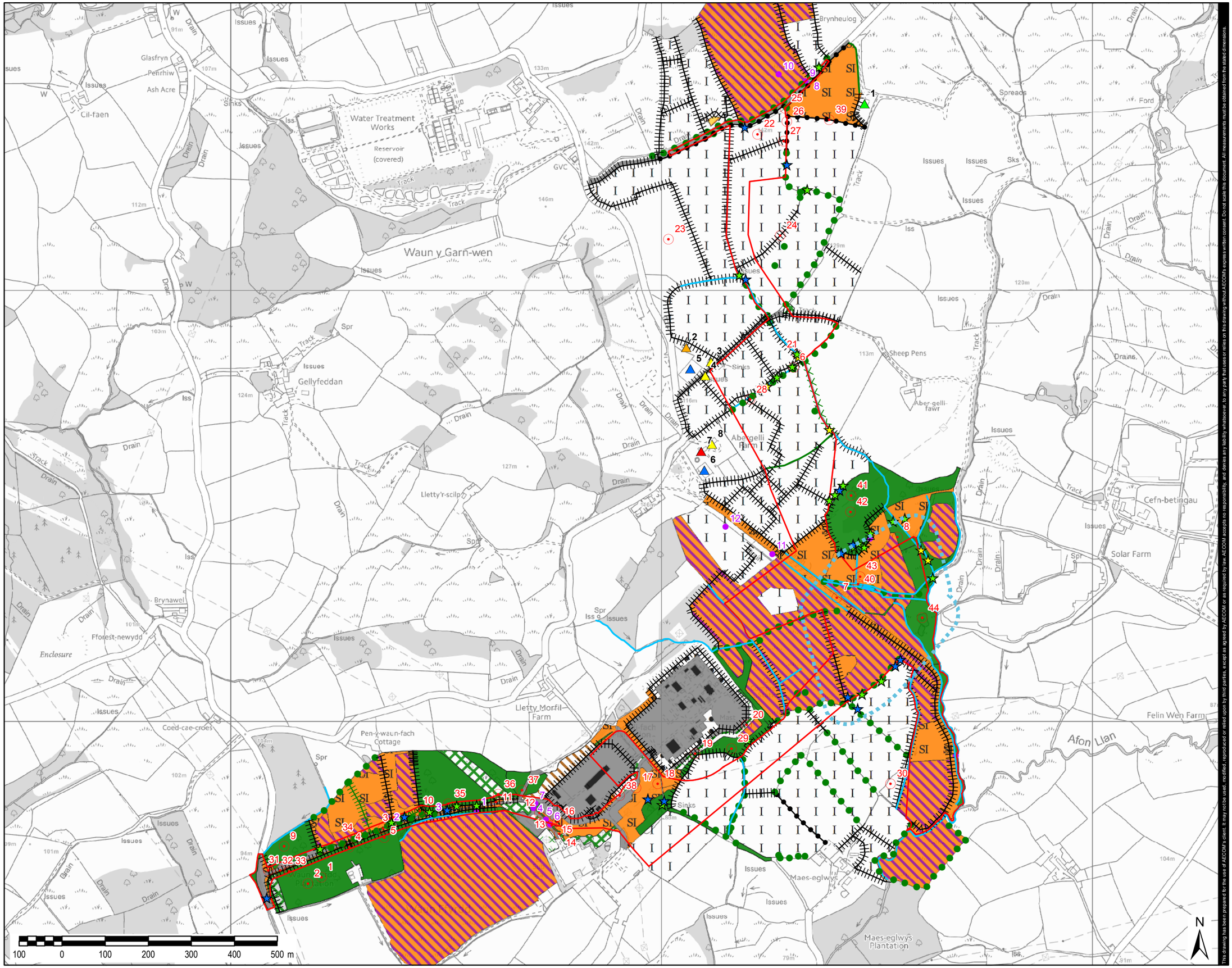
Figure 1 Phase 1 Habitat Map



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Project Title:

ABERGELLI POWER STATION

Client:

STAG ENERGY

LEGEND

- 50m Bat Survey Area
- Project Site Boundary
- Target Notes
- Trees
- Invasive Species

Bat Roost Potential for Buildings

- Confirmed
- High
- Moderate
- Low
- Negligible

Bat Roost Potential for Trees

- Negligible
- Low
- Moderate

Phase 1 Habitat Linear Features

- Scrub - Scattered
- Row of trees - broadleaved
- Running Water
- Intact Hedge - Species-Poor
- Defunct Hedge - Species-Poor
- Hedge with Trees - Native Species-Rich
- Hedge with Trees - Species-Poor
- Fence
- Earth Bank

Phase 1 Habitat Areas

- Broadleaved woodland - semi-natural
- Broadleaved woodland - plantation
- Dense/Continuous scrub
- Scattered scrub
- Semi-improved - neutral grassland
- Improved grassland
- Marsh/marshy grassland
- Tall ruderal - herb and fern
- Dry heath/acid grassland mosaic
- Buildings
- Bare ground
- Hard standing

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PHASE 1 HABITAT MAP

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FIGURE 1			004
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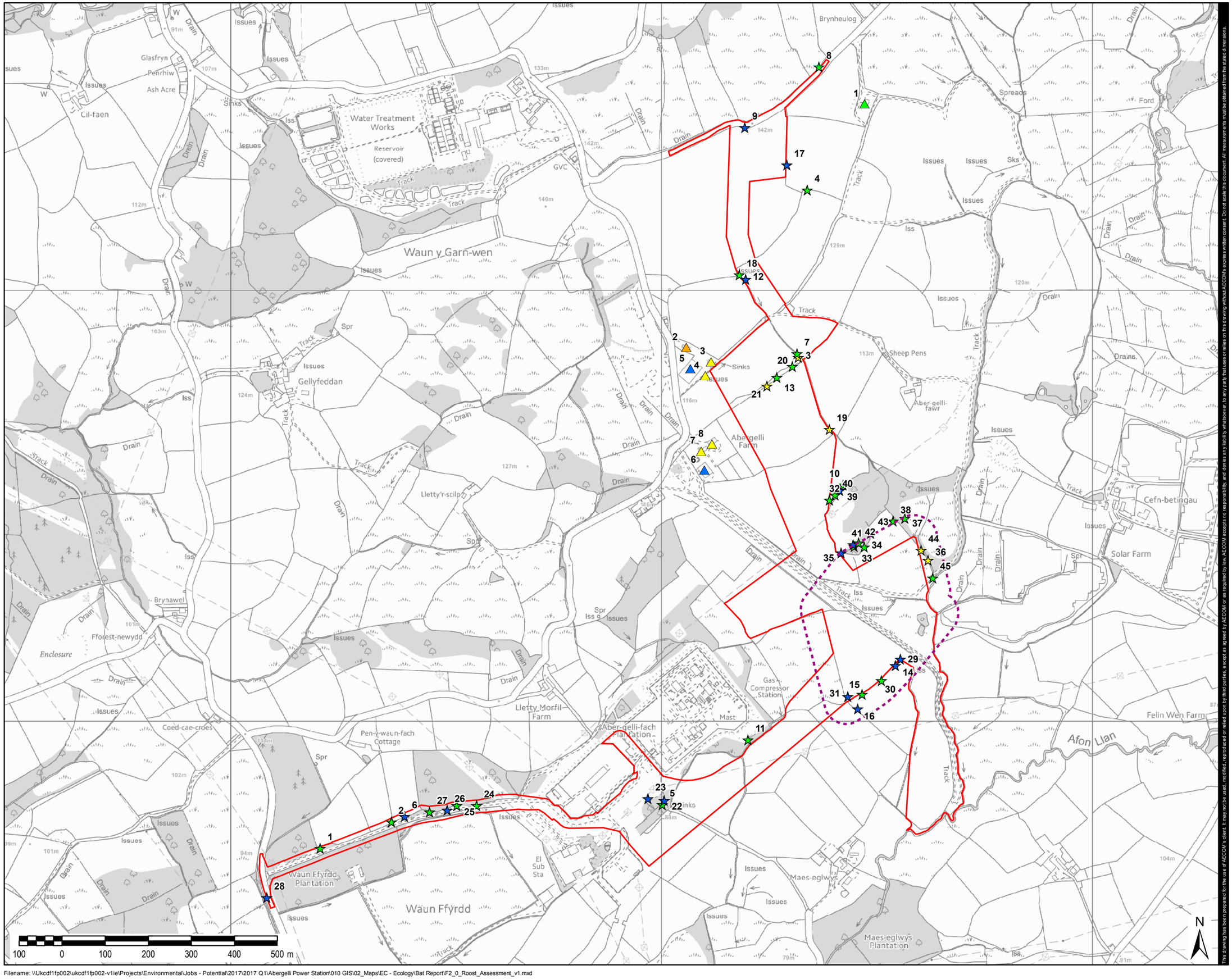
Figure 2 Building Ground Level Roost Assessment Results and Tree Potential Bat Roost Feature Climbed Inspection Results



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Project Title:

ABERGELLI POWER STATION

Client:

ABERGELLI POWER LTD.

LEGEND

- Project Site Boundary
- 50m Zone of Influence

Potential Tree Roost Feature Climbed Inspection Results

- Moderate
- Low
- Negligible

Preliminary Ground Level Assessment Results for Buildings

- High
- Moderate
- Low
- Negligible

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PRELIMINARY GROUND LEVEL ASSESSMENT RESULTS FOR BUILDINGS AND POTENTIAL ROOST FEATURE CLIMBED INSPECTION RESULTS

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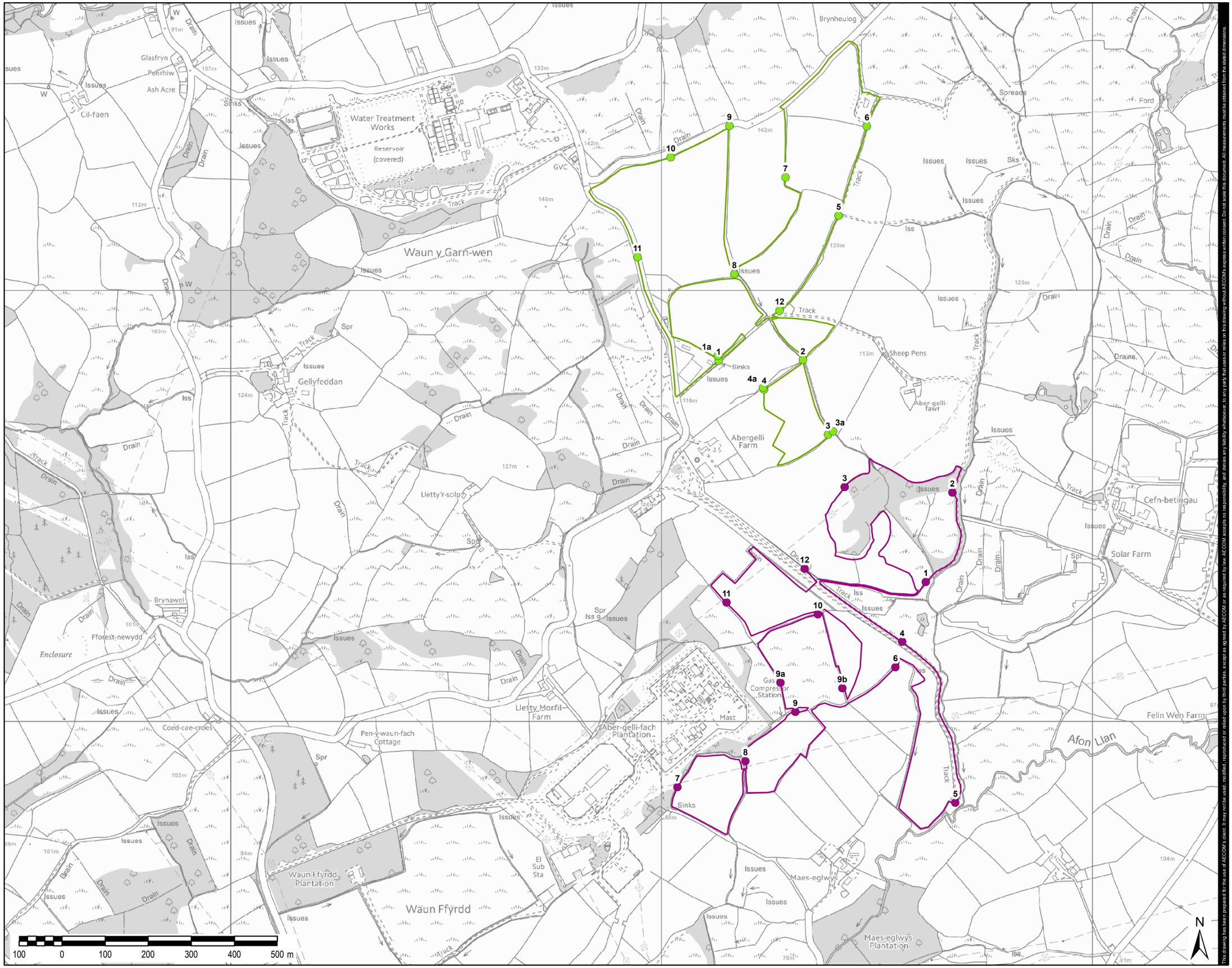
Figure 3.1 Bat Activity Transects North and South with Listening Points



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- North Transect Listening Points
- South Transect ListeningPoints
- North Transect - 4.65km
- South Transect - 6.08km

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BAT ACTIVITY TRANSECTS WITH LISTENING POINTS

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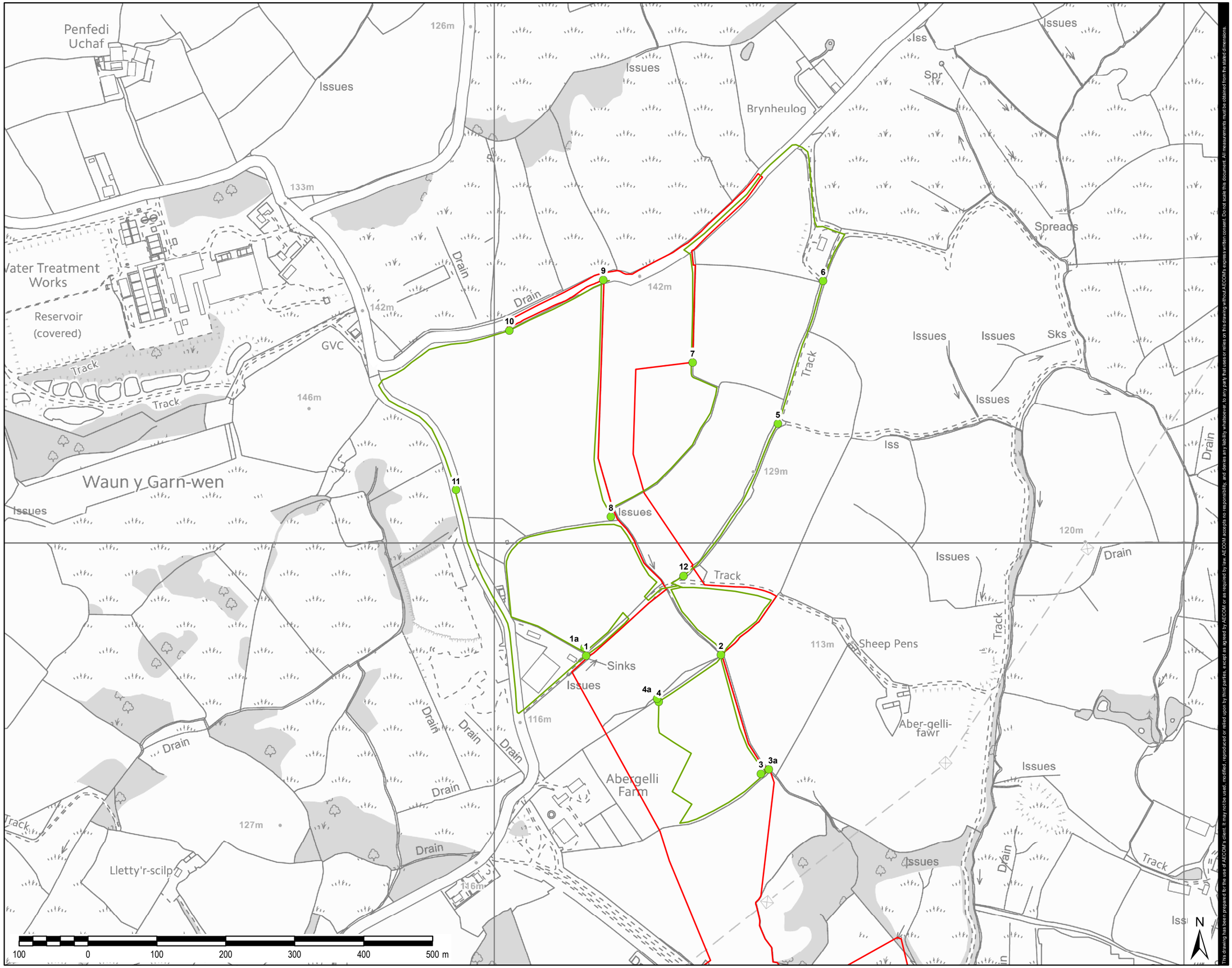
Figure 3.2 Bat Activity Transects North with Listening Points



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Project Title:

ABERGELLI POWER PROJECT

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LEGEND

- North Transect Listening Points
- North Transect - 4.65km
- Project Site Boundary

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BAT ACTIVITY TRANSECT NORTH WITH LISTENING POINTS

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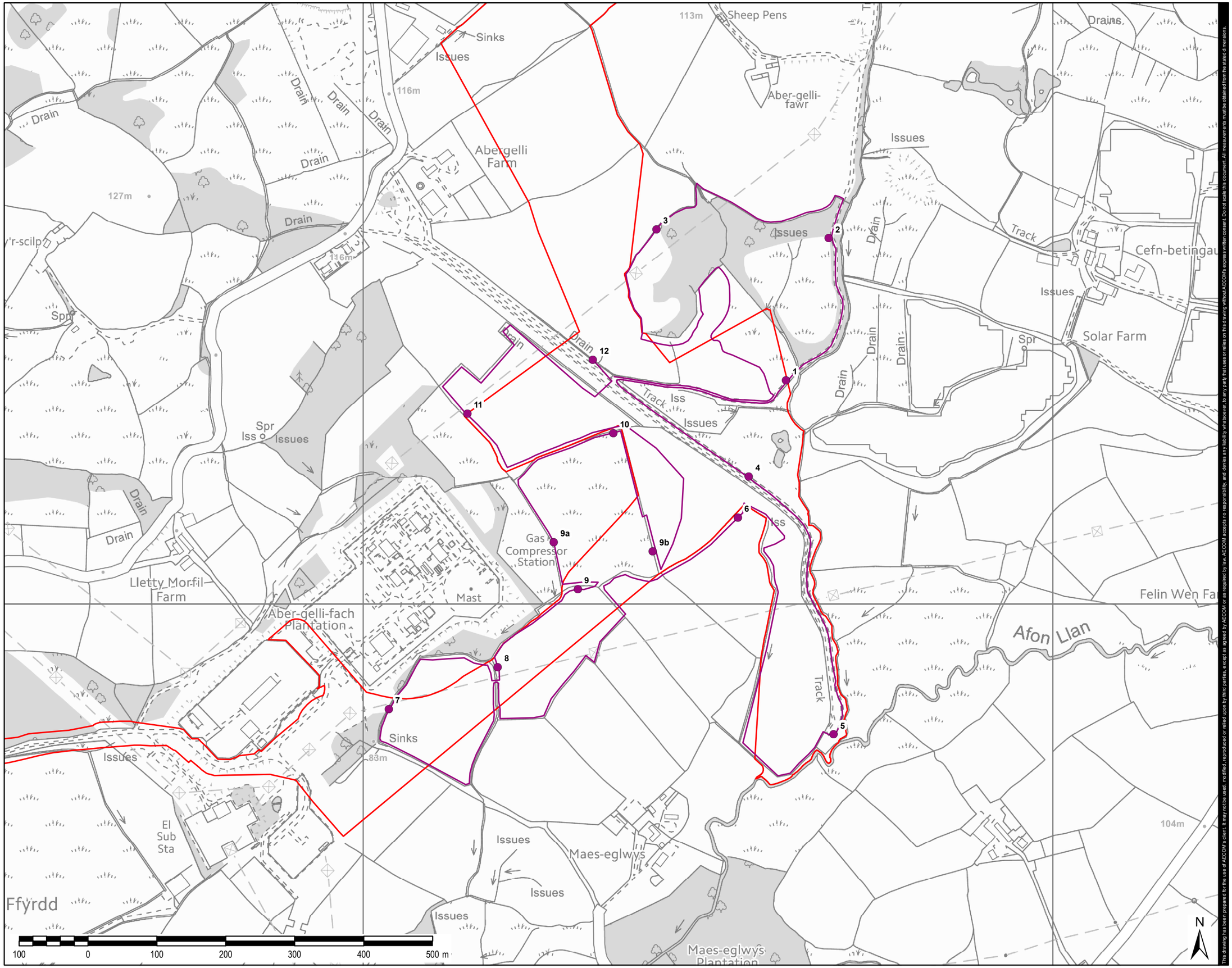
Figure 3.3 Bat Activity Transects South with Listening Points



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Project Title:

ABERGELLI PROJECT

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LEGEND

- South Transect ListeningPoints
- South Transect - 6.08km
- Project Site Boundary

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Drawing Title:

BAT ACTIVITY TRANSECT SOUTH WITH LISTENING POINTS

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Figure 3.4 Activity Static Detector

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North 2
North 1
North 3
South 3
South 2
South 1
Lane 1
Lane 2
Lane 3

Water Treatment Works
Reservoir (covered)
Waun y Garn-wen
Gellyfeddan
Waun Ffyrdd
Waun Ffyrdd Plantation
Abergelli Farm
Sheep Pens
Aber-gelli-fawr
Gas Compressor Station
Mast
Aber-gelli-fach Plantation
Llety Morfil Farm
Pen-y-waun-fach Cottage
Coed-cae-croes
Brynawel
Maes-eglwys
Maes-eglwys Plantation
Solar Farm
Felin Wen Farm
Felin-Wen-Court
Pont Fe'in-wen
Afon Llan
Llyn-Y-Fan
Rhyd-y-Pandy
Cefn-betingau
Pen-y-fe
Pant-y-gelynen
RHYDYPANDY ROAD

100 0 100 200 300 400 500 m

N

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Project Title:

ABERGELLI POWER PROJECT

Client:

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LEGEND

- Static Detector Location, and Direction of Microphone
- Project Site Boundary

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AECOM Internal Project No:

60542910

Drawing Title:

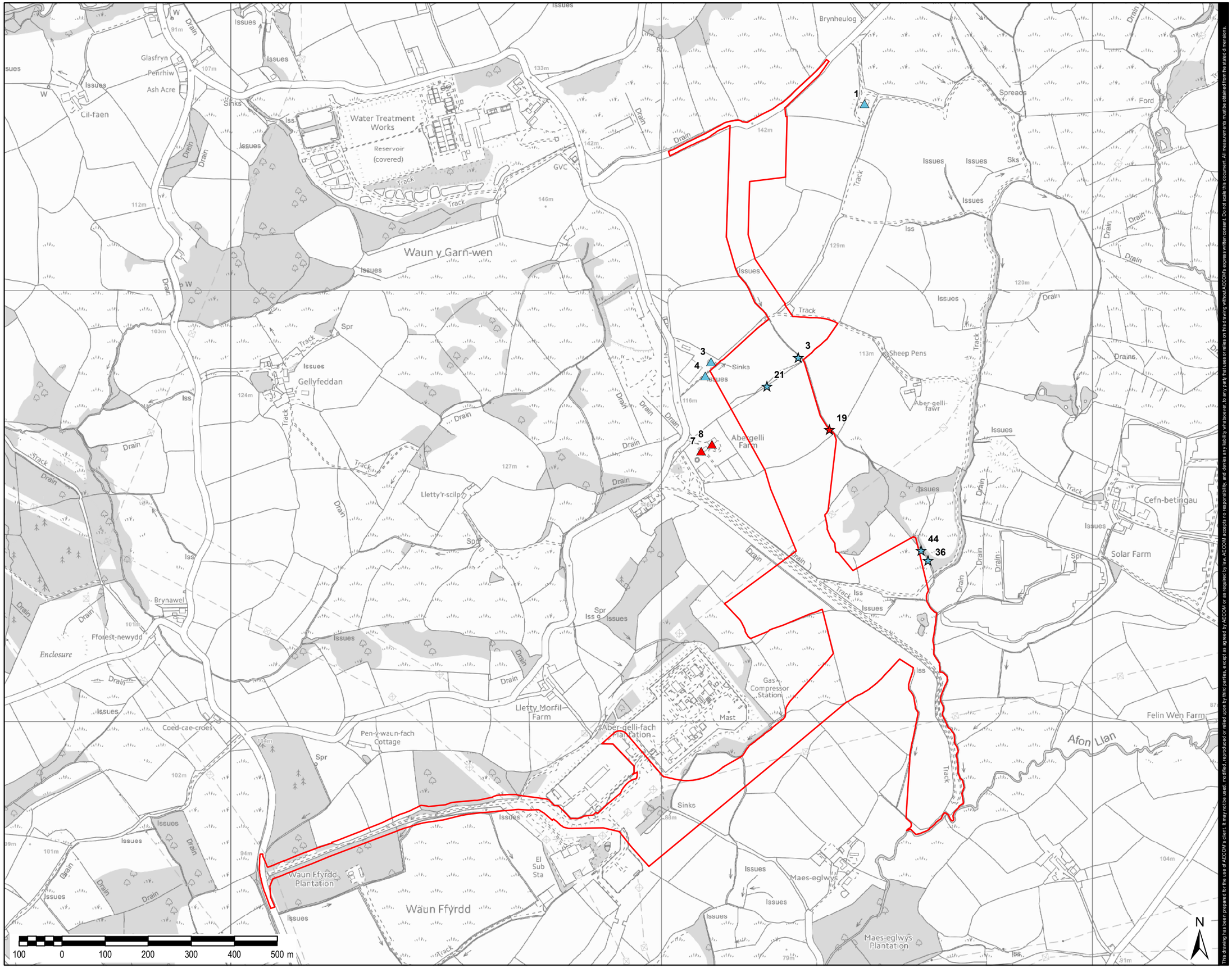
BAT ACTIVITY STATIC DETECTOR LOCATIONS

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE 3.4			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CM	CA	19/04/18

Filename: P:\UKCDF1-IE\Projects\Environmental\Jobs - Potential\2017\2017 Q1\Abergelli Power Station\010 GIS\02_Maps\EC - Ecology\Bat Report\F3_4_Activity_Static_Detector_v1.1.mxd

Figure 4.1 Building and Tree Roost Results



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AECOM Limited
1 Callaghan Square
Cardiff, CF10 5BT
+44 (0)29 2067 4600 tel
www.aecom.com

Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Project Site Boundary
- Trees - Confirmed roost
- Trees - No confirmed roost
- Buildings - No confirmed roost
- Buildings – Confirmed Roost

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AECOM Internal Project No:

60542910

Drawing Title:

BUILDING AND TREE ROOST RESULTS

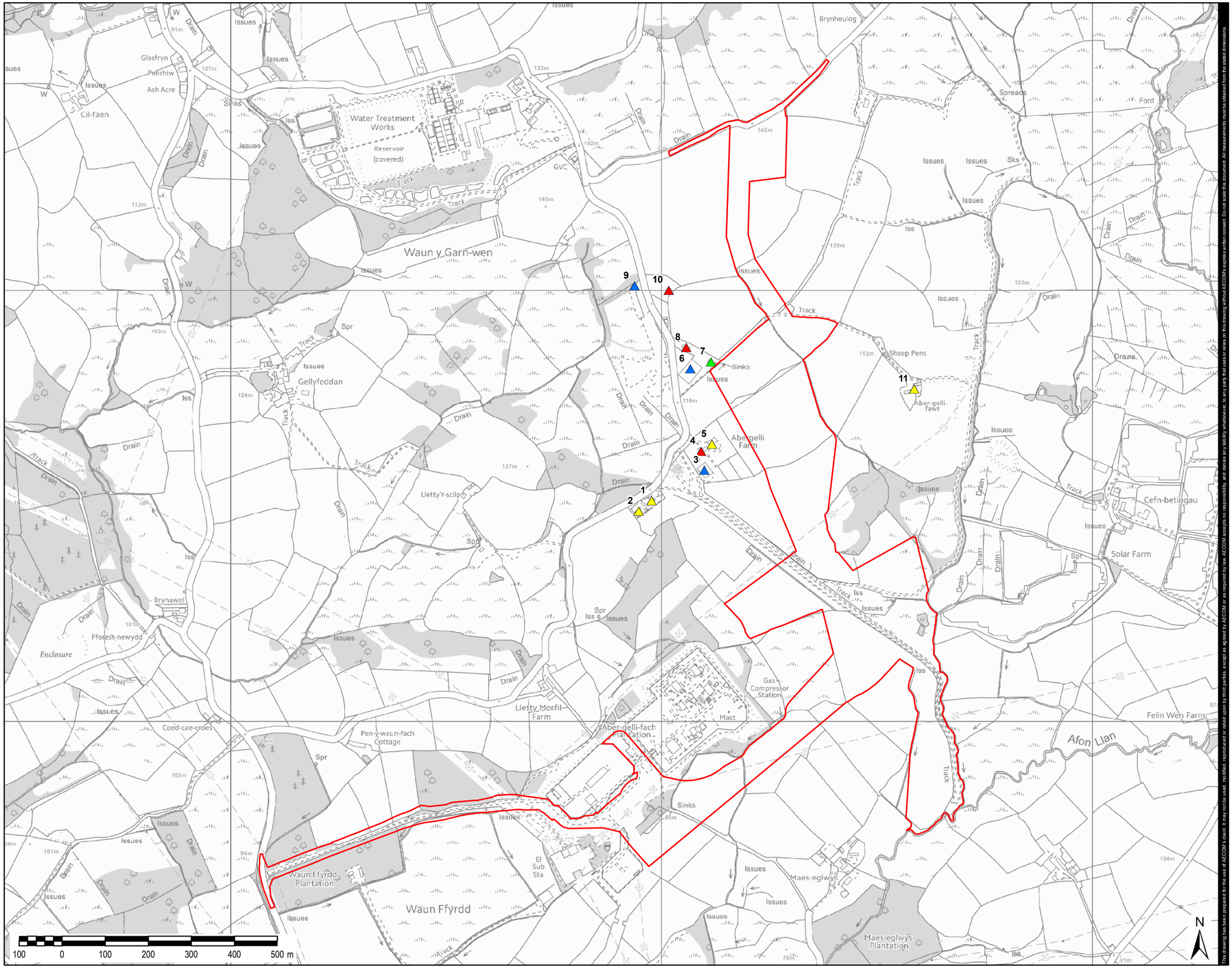
Scale at A3: 1:8,000

Drawing No:	Rev:
FIGURE 4.1	001

Drawn:	Chk'd:	App'd:	Date:
GM	CM	CA	18/07/18

Filename: P:\UKCDF1-IE\Projects\Environmental\Jobs - Potential\2017\2017 Q1\Abergelli Power Station\010 GIS\02_Maps\EC - Ecology\Bat Report\F4_1_Roost_Assessment_Results_v1.mxd

Figure 4.2 BSG Building Results 2014



Filename: P:\UKCDF1-IE\Projects\Environmental\Jobs - Potential\2017\2017 Q1\Abergelli Power Station\010 GIS\02_Maps\EC - Ecology\Bat Report\F4_2_BSG Building Results 2014_v1.mxd

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www.aecom.com

Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Project Site Boundary
- Confirmed
- Moderate
- Low
- Negligible

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AECOM Internal Project No:

60542910

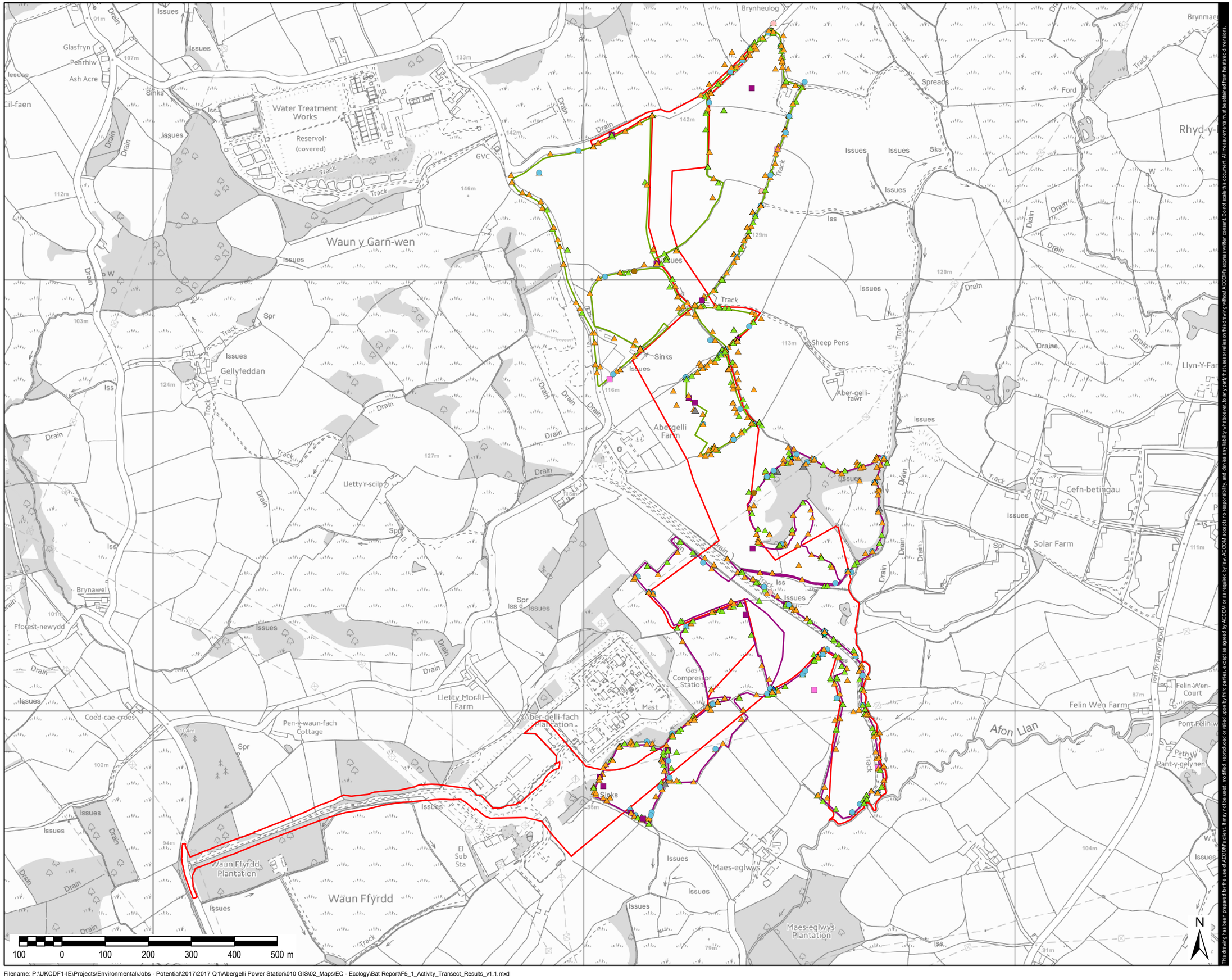
Drawing Title:

BSG BUILDING RESULTS 2014

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE 4.2			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CM	CA	19/04/18

Figure 5.1 Bat Activity Transect Results



Filename: P:\UKCDF1-IE\Projects\Environmental\Jobs - Potential\2017\2017 Q1\Abergelli Power Station\010 GIS\02_Maps\EC - Ecology\Bat Report\F5_1_Activity_Transect_Results_v1.1.mxd

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www.aecom.com

Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- Daubenton's
- Myotis species
- Natterer's
- Noctule
- Serotine
- Long-eared
- Possible long-eared
- Lesser horseshoe
- Indeterminate
- North Transect - 4.65km
- South Transect - 6.08km
- Project Site Boundary

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AECOM Internal Project No:

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Drawing Title:

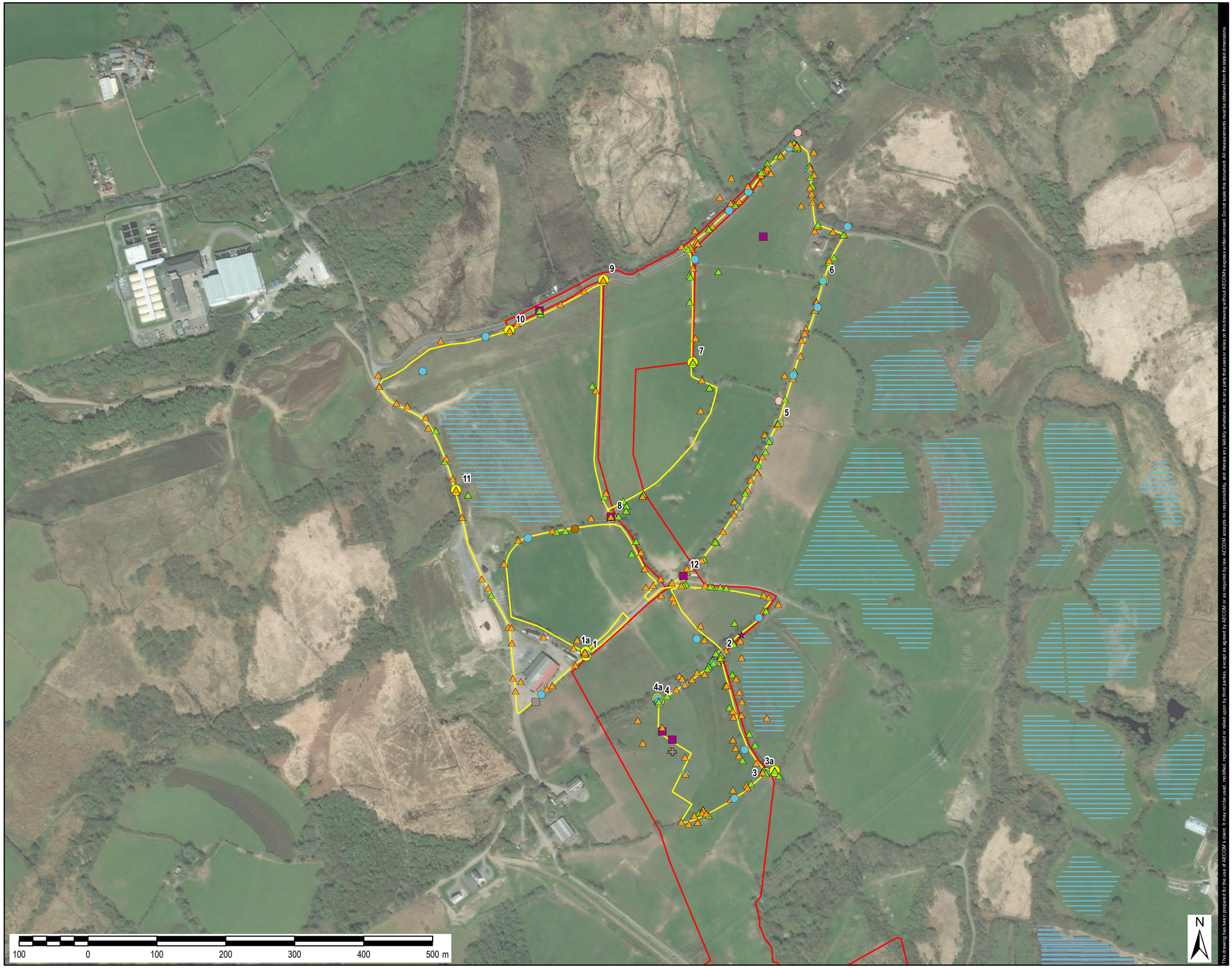
BAT ACTIVITY TRANSECT RESULTS

Scale at A3: 1:8,000

Drawing No:	Rev:
FIGURE 5.1	001

Drawn:	Chk'd:	App'd:	Date:
GM	CM	CA	18/07/18

Figure 5.2 Bat Activity Transect Results - North



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- Daubenton's
- Myotis species
- Natterer's
- Noctule
- Serotine
- Long-eared
- Possible long-eared
- Indeterminate
- North Transect Listening Points
- North Transect - 4.65km
- Solar Parks
- Project Site Boundary

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AECOM Internal Project No:

60542910

Drawing Title:

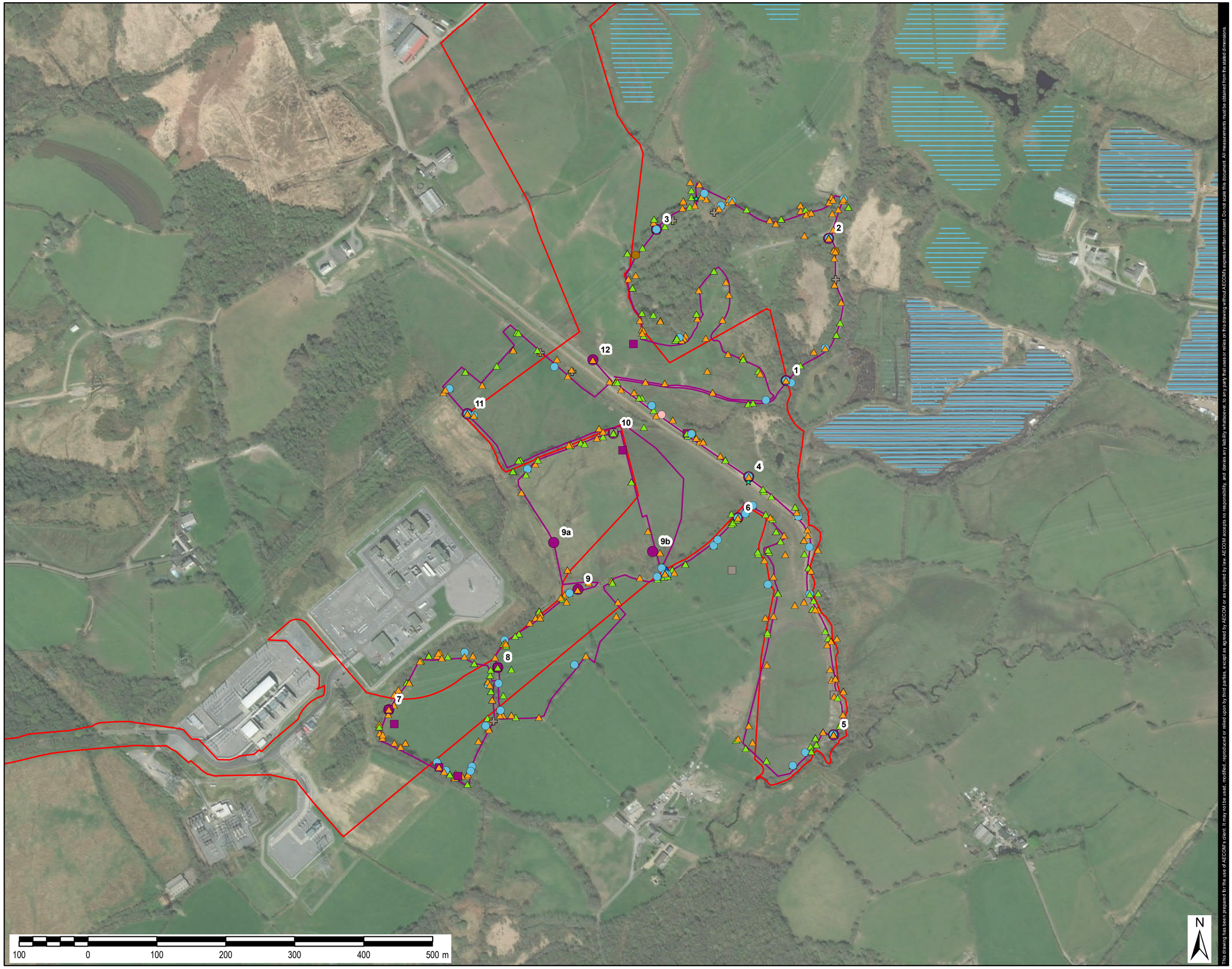
BAT ACTIVITY TRANSECT RESULTS NORTH

Scale at A3: 1:5,000

Drawing No:			Rev:
FIGURE 5.2			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CM	CA	18/07/18

Filename: \\Ukcdf1fp002\ukcdf1fp002-v1ie\Projects\Environmental\Jobs - Potential\2017\2017 Q1\Abergelli Power Station\010 GIS\02_Maps\EC - Ecology\Bat Report\F5_2_Activity_Transect_Results_North_v1.mxd

Figure 5.3 Bat Activity Transect Results – South



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- Daubenton's
- Myotis species
- Natterer's
- Noctule
- Serotine
- Possible long-eared
- Lesser horseshoe
- Indeterminate
- South Transect Listening Points
- South Transect - 6.08km
- Project Site Boundary
- Solar Parks

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AECOM Internal Project No:

60542910

Drawing Title:

BAT ACTIVITY TRANSECT RESULTS SOUTH

Scale at A3: 1:5,000

Drawing No:			Rev:
FIGURE 5.3			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CM	CA	18/07/18

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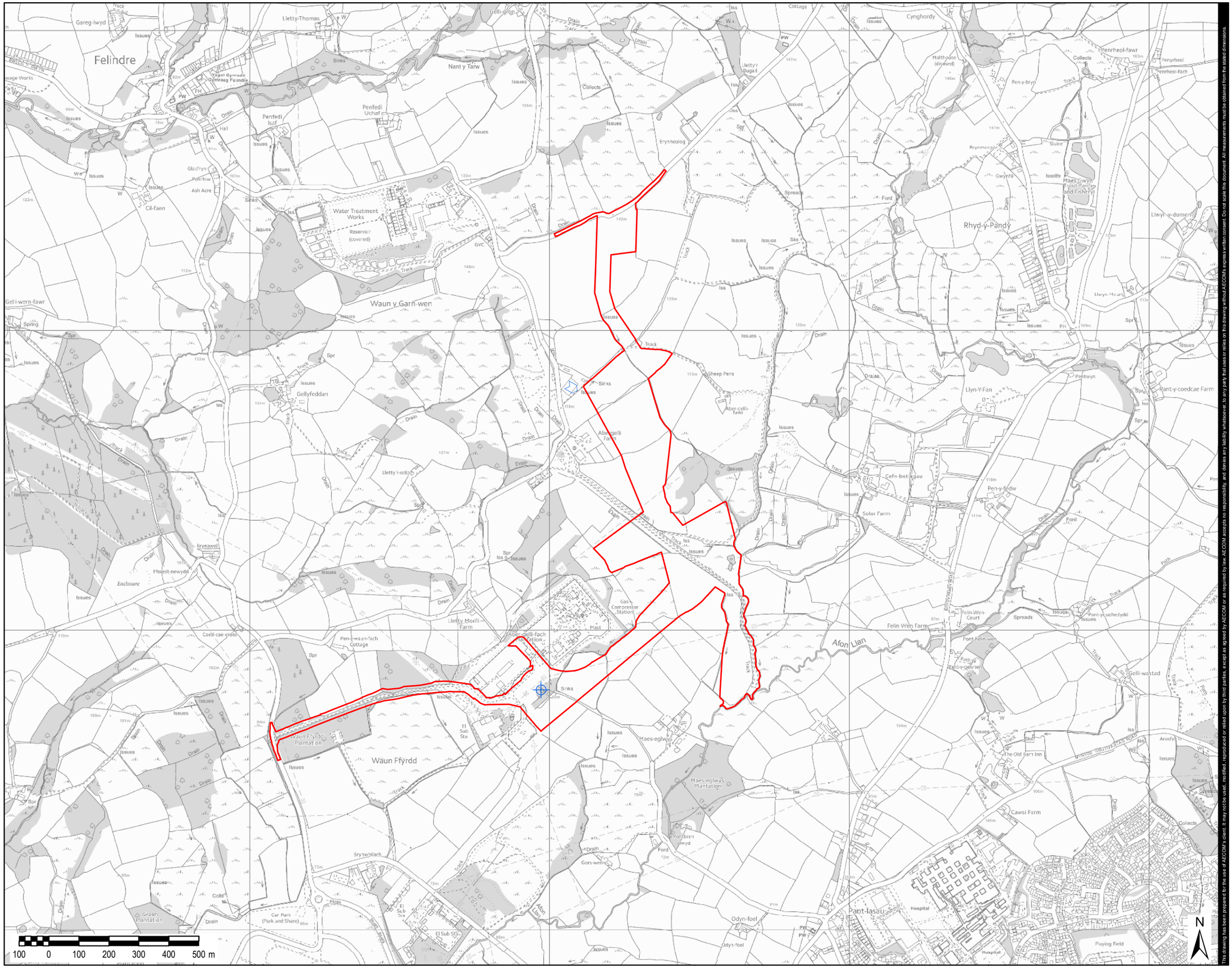
Figure 6 Mining Features - Hibernation Potential


Felindre
Llwyn-y-domen
Rhyd-y-Pandy
Waun y Garn-wen
Waun Ffŷrdd
Water Treatment Works
Reservoir (covered)
Abergelli Farm
Abergelli Power Station
Gas Compressor Station
Mast
Afon Llan
Maes Gwyn Trout Farming and Fishery
Penrheol-fawr
Penrheol-fach
Penfedi Isaf
Penfedi Uchaf
Nant y Tarw
Llwyn Meurig
Pentwyn
Llyn-Y-Fan
Pant-y-coedcae Farm
Cawsi Farm
Felin Wen Farm
Pant-lasau
Hospital
Playing Field
The Old Barn Inn
Solar Farm
Maes-eglwys Plantation
Aber-celli-fach Plantation
Waun Ffŷrdd Plantation
Green Plantation
Enclosure
Car Park (Park and Share)
Sheep Pens
Aber-celli-Tawr
Pont-breu-lwyd
Odyn-foel
Gors-wen
Brynawel
Brytwillach
Llety-morfi Farm
Llety-scilod
Gellyfeddan
Gelli-wern-fawr
Gareg-lwyd
Llety-Thomas
Gelli-grop
Llety'r Bugail
Cynghordy
Malthouse (disused)
Pen-y-bryn
Pen-y-fedw
Cefn-bettgau
Felin-Wen-Court
Pant-yr-uchedydd
Pont-Felin-wen
Pant-y-gelynen
Gelli-wastad
Ffynnon-Gronw Stad Work
Penyrheol
Penrheol-fach
Ryhaeulog
Glasfryn
Penrhiw
Ash Acre
Cil-faen
Llety-Thomas
Vogel Gymraeg Gymraeg Felindre
Sheep Pens
Spreads
Ford
Sluice
Collects
Sinks
Spring
Track
Drain
Issues
Spr
Trough
Gate
Hall
PH
PW
GVC
El Sub Sta
Cottage
Malthouse
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Sks
Trig Pt
Path
Bridleway
Footpath
Forestry Commission Boundary
Public Right of Way
Permissive Path
Bridleway
Footpath
Byway Open to All Traffic
Restricted Byway
Unclassified Road
Unsurfaced Road
Track
Path
Ford
Gate
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Bridge
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Electricity Transmission Line
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Electricity Transmission Line (Proposed Underground)
Electricity Transmission Line (Proposed Underground) (Under Construction)
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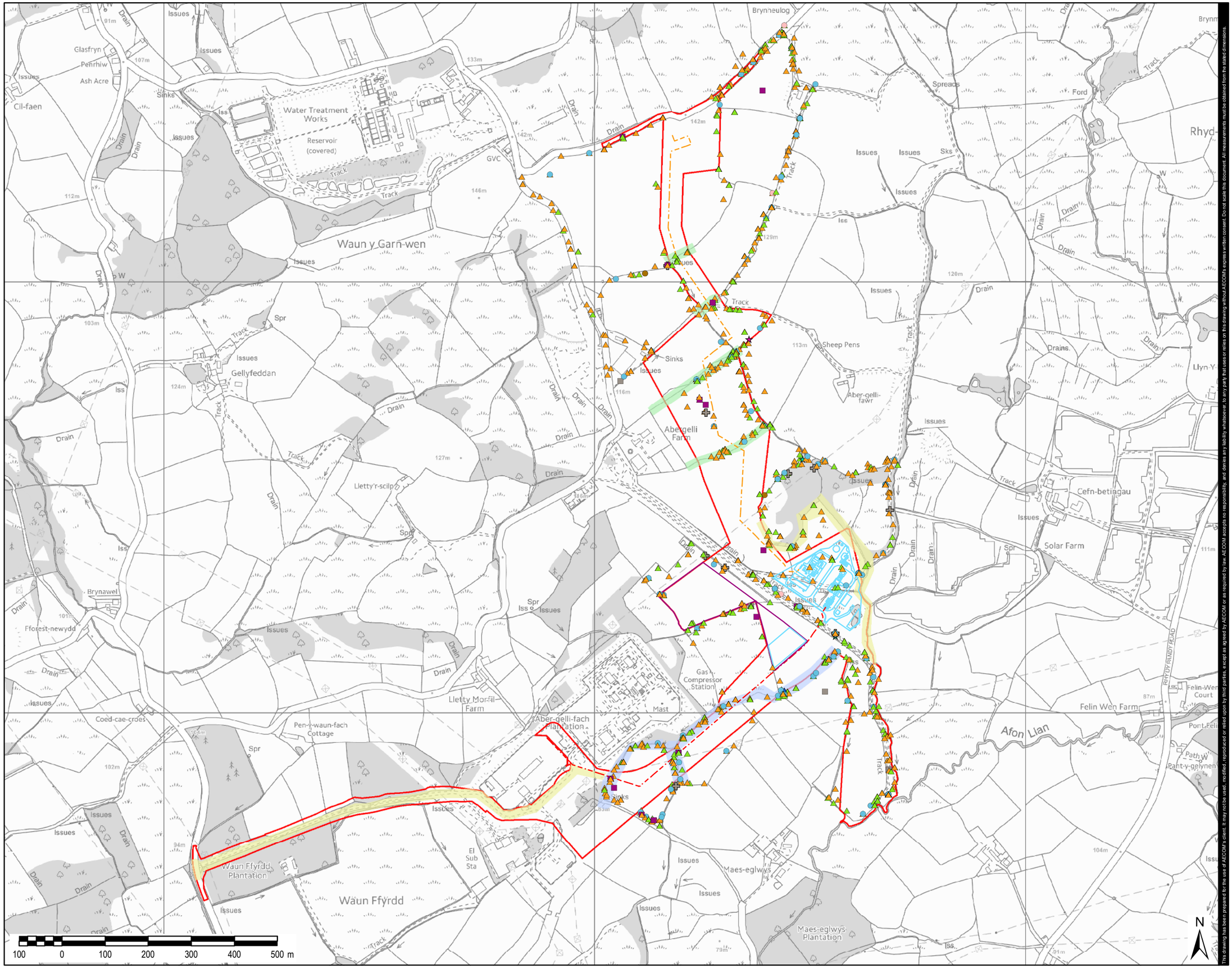
Figure 7 Bat Activity - Areas of Potential Impact



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- Daubenton's
- Myotis species
- Natterer's
- Noctule
- Serotine
- Long-eared
- Possible long-eared
- Lesser horseshoe
- Indeterminate
- Generating Equipment Site
- Electrical Connection (400 kV)
- Gas Connection
- Laydown Areas
- Indicative Area of Potential Impacts from Lighting
- Indicative Area of Potential Impacts from Severance
- Indicative Area of Potential Impacts from Severance and Lighting
- Project Site Boundary

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AECOM Internal Project No:

60542910

Drawing Title:

BAT ACTIVITY - INDICATIVE AREAS OF POTENTIAL IMPACT

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE 7.0			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CM	CA	18/07/18

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Appendix 1A Results of Preliminary Ground Level Roost Assessment – Buildings and Trees and Results of Potential Roost Feature Climbed Inspection

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
Building 1	Approximately 120m outside of the Project Site Boundary to the north east This was not fully assessed due to time constraints of the PEA survey (Appendix 8.1 of the ES). This is a modern building with a tiled roof. There were no obvious gaps. House sparrows were observed using spaces in the roof.	Low	Not climbed	N/A	No further survey required – outside of Project Site Boundary
Building 2	Approximately 75m outside of the Project Site Boundary to the west. A brick built building with a tower and asbestos pitched roof. There are fly-in access and crevice points.	High. BSG confirmed this as a roost in 2014 (PB, 2015).	Not climbed	N/A	No further survey required – outside of Project Site Boundary
Building 3	Approximately 5m outside of the Project Site Boundary to the west. A brick built building with a pitched asbestos roof. There are gaps in the mortar and brick work and behind the wooden facia boards.	Moderate	Not climbed	N/A	One dusk, one dawn; at least one before end of August
Building 4	Approximately 10m outside of the Project Site Boundary to the west. A single story brick built building with gaps leading to a cavity wall. Gaps are present on the east and south face of this building.	Moderate	Not climbed	N/A	One dusk, one dawn; at least one before end of August
Building 5	Modern steel barn; industrial building of steel frame construction with asbestos corrugated roof and asbestos and steel walls. Within the building there are a number of transparent corrugated sheet	Negligible	Not climbed	N/A	No further survey required

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	allowing light to enter. High disturbance as the building is used regularly for farm maintenance and horses are kept in the east section. There is an opening that would allow bats to access the building (open sections to the east and west, small hole 20x20cm within wall on southern aspect, door to the east and west usually left open). However, no evidence of bats (droppings) was found around the outside of the building.				
Building 6	Modern steel barn; industrial building of steel frame construction with double pitched asbestos corrugated roof with asbestos facia boards and asbestos and steel walls. High disturbance as the building is used regularly used to stable horses. Lighting is present internally and externally. There are entrances for bats to fly through, but no evidence of bats (droppings) was found around the outside of the building.	Negligible	Not climbed	N/A	No further survey required
Building 7	Stone built stable block with a pitched roof with bitumen felt and roof tiles. Several potential access points for crevice dwelling bats identified underneath the ridge tiles and within a gap in the facia boards and soffit boxes. Potential fly in access points identified by the open stable doors and an open window.	Moderate	Not climbed	N/A	One dusk, one dawn; at least one before end of August
Building 8	Semi-detached buildings of brick construction with concrete clad walls	Moderate	Not climbed	N/A	One dusk, one dawn; at least one

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	and a pitched tiled roof. Gaps were identified at the edge of the ridge tiles on the north-west face which may offer access between the tiles and the felt and/or access to the roof void. A further gap was observed in the soffit box on the end of the south-east face and a gap in the soffit on the edge on the east face. The gaps are suitable for crevice dwelling species such as pipistrelle.				before end of August
Tree 1	Within the Project Site Boundary. An oak species, 14m in height with a Diameter at Breast Height (BBH) of 0. 7m. This tree has south facing split at 6m.	Low	Unable to access fully to inspect due to dense bramble – same BRP.	Low	No further survey required
Tree 2	Within the Project Site Boundary. An oak species, 12m in height with a DBH of 0. 6m. This tree had dense ivy cover which could be obscuring suitable bat features. The ivy itself did not appear to be a suitable feature for use by bats.	Low	Cannot climb on road and ivy present – same BRP.	N/A	No further survey required
Tree 3	Within the Project Site Boundary. An oak species, 17m in height with a DBH of 1. 1m. There is a knothole at 3m facing north west and a crack in the limb at 5m facing west.	Moderate	Unable to access - same BRP.	Moderate	One dusk, one dawn; at least one before end of August
Tree 4	Assessed as part of the PEA (Appendix 8.1 of the ES). Removed from this report as approximately 55m outside of the Project Site Boundary.	Low	N/A	N/A	N/A
Tree 5	Approximately 20m outside of the Project Site Boundary to the south.	Low	Not climbed – outside of Project Site Boundary	N/A	No further survey required

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	An oak species, 14m in height with a DBH of 0. 8m. A hollow at 0. 5m within the base of the tree.				
Tree 6	Within the Project Site Boundary. A pedunculate oak, 12m in height with a DBH of 0. 7m. There is a spilt in the stem facing south towards the road and a woodpecker hole.	Moderate	Features not suitable, open, exposed and does not extend into cavity.	Negligible	No further survey required
Tree 7	Within the Project Site Boundary. A pedunculate oak, 8m in height with a DBH of 1m. There are splits in the stem facing west. .	Low	Unable to access - same BRP.	Low	No further survey required
Tree 8	Within the Project Site Boundary. An oak species, 12m in height with a DBH of 0. 6m. There is a trunk cavity at 1. 5m, viewed from the road. The tree is located within an area of no access and the other side could not be viewed.	Moderate	Feature checked with endoscope, no cavity, and open at top. Kept in as could not see/access one side of tree.	Low	No further survey required
Tree 9	Within the Project Site Boundary. An oak species 8m in height with a DBH of 0. 5m. There are thick stems of ivy on the east face.	Moderate	Ivy not dense enough to support roosting bats, no other features present.	Negligible	No further survey required
Tree 10	Approximately 25m outside of the Project Site Boundary to the east. A rowan 12m in height with a DBH of 0. 4m. There is cavity approximately 1m from the ground which appears to extend upwards. There is currently an active wasp nest in the cavity which may deter bats from using it (no nest as of 28/07/17). Fallen branch in front of feature.	Moderate	Feature checked using endoscope, no bats or evidence of bats. Chance it could be used by individual/small number of bats.	Low	No further survey required
Tree 11	Within the Project Site Boundary. A multi-stem oak species 14m in height	Low	Features checked using endoscope, no bats or	Low	No further survey required

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	with a DBH of 0. 6m. There is some loose bark and a gap in the base.		evidence of bats. Loose bark not suitable as too exposed. Hole at base may be suitable for roosting bats. No bats or evidence of bats recorded.		
Tree 12	A willow; 12m tall, multi stem 0. 25m average. DBH. Split on inside of main stem opens into cavity at 1m above ground. In tree line along fence.	Low	Checked with endoscope, feature not suitable, open and exposed.	Negligible	No further survey required
Tree 13	An oak; 15m tall; 0. 6m DBH; Missing limbs at 5m could open up into cavity; small gaps where stem has broken.	Low	Unable to access.	Low	No further survey required
Tree 14	An oak; 10m tall; 0. 6m DBH; knothole at 2m; cannot see if it opens up into cavity. Check with endoscope. Outside of fence line in southern field.	Low	Checked with endoscope, no cavity present, shallow does not extend, not suitable for roosting bats.	Negligible	No further survey required
Tree 15	An oak; 15m tall; 0. 75m DBH; Thick ivy stems; no features observed but of suitable size/age to support BRP features that may be hidden by ivy. In treeline along fence.	Low	Unable to climb due to ivy cover.	Low	No further survey required
Tree 16	No ground level assessment required. Tree approximately 30m from the Project Site Boundary/	N/A	N/A	N/A	N/A
Tree 17	A birch; 10m tall; 0. 4m DBH; split and cavity A0. 5m on south face.	Low	Checked with endoscope, feature does not extend, no cavity present.	Negligible	No further survey required
Tree 18	An oak; 10m tall; 0. 5m DBH; split in	Low	Unable to climb, unsafe.	Low	No further survey

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	branch on south face.				required
Tree 19	An ash; 20m tall; 1. 5m DBH; Possible cavity inside main trunk, viewable from south face, hollow on the east face approx. 1m above ground; thick ivy covering and creating gaps for bats.	Moderate	Unable to access.	Moderate	One dusk, one dawn; at least one before end of August
Tree 20	An oak; 12m tall; 1m DBH; Stems removed leaving some gaps under bark and holes approx. 6m above ground. Cannot enter field due to horses.	Low	Unable to access.	Low	No further survey required
Tree 21	An oak; 15m tall; 1m DBH; missing limb with cracks and split in stem, both facing south and approx. 1m above ground. Did not enter field in which tree is rooted due to horses.	Moderate	Unable to access.	Moderate	One dusk, one dawn; at least one before end of August
Tree 22	An oak; 8m tall; 0. 3m DBH; two knotholes on east face.	Low	Holes do not extend, too open and exposed, features not suitable.	Negligible	No further survey required
Tree 23	Edge of woodland adjacent to SI grassland containing pylon. Willows not suitable; some alder may support low BRP features; could not access woodland to assess each tree. Recommend any felling undertaken under supervision as for Low BRP trees for alder.	Negligible/Low	Woodland not accessed.	Negligible /Low	No further survey required
Tree 24	An unknown dead species; 10m tall; 0. 25m DBH; loose bark covering an area greater than an A4 page on south face from ground level to approx. 4m above ground level. Ivy covering trunk; only able to view south face, no access in woodland in	Low	Unable to access fully – keep as Low.	Low	No further survey required

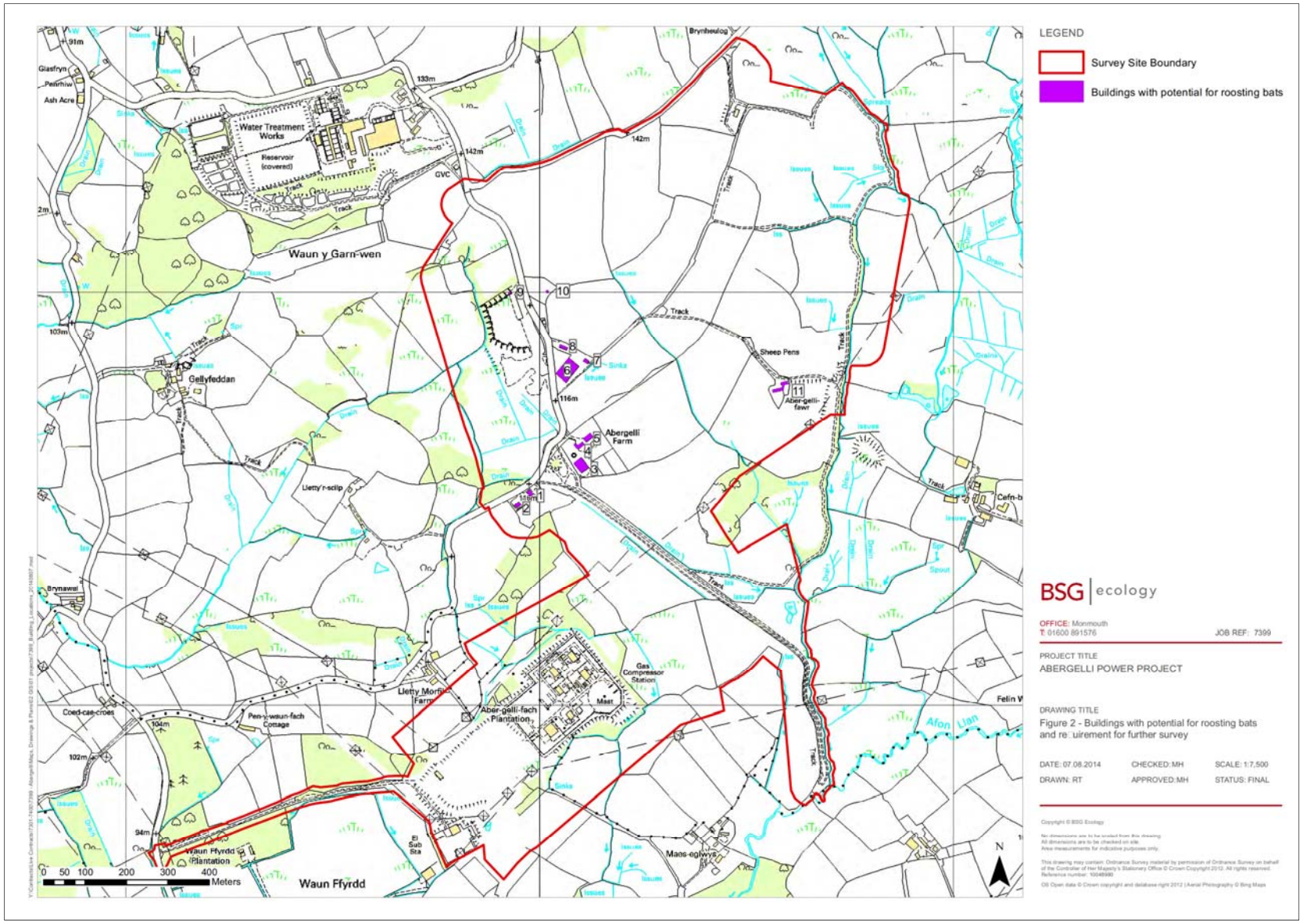
Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	which it is rooted.				
Tree 25	A birch; 15m tall; 0. 3m DBH; cavity in trunk, no access to land to be able to see if the cavity leads anywhere; feature on east face approx. 2. 5m above ground.	Low	Unable to access fully – keep as low.	Low	No further survey required
Tree 26	An oak; 12m tall; 0. 3m DBH; loose bark Approx. 2m up on west face of rotten stem; located behind fence.	Low	Exposed from above, feature not suitable.	Negligible	No further survey required
Tree 27	A dead tree possibly oak; 8m tall; 0,25m DBH; large knothole on south face approx. 2m above ground; located behind fence.	Low	Not able to access fully – keep as low.	Low	No further survey required
Tree 28	An oak; 11m tall; 0. 4m DBH; rotten and missing limbs at approx. 5m above ground on south face; adjacent to road, not climbable; viewed from opposite side of road only.	Low	No cavities present, features not suitable, open and exposed.	Negligible	No further survey required
Tree 29	A birch; 12m tall; 0. 5m DBH; Two downward facing holes on north face approx. 1m above ground; located between two fences. First tree in row from track.	Low	Holes do not extend, too wet, not suitable.	Negligible	No further survey required
Tree 30	An oak; 11m tall; 0. 6m DBH; Hole where limb is missing at approx. 2. 5m above ground on west face; access from north side of fence.	Low	Feature checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 31	An oak; 10m tall; 0. 5m DBH; downward facing hole on main stem approx. 1. 25m above ground on east face. In corner of field on own.	Low	Hole downward facing, full of water, not suitable.	Negligible	No further survey required
Tree 32	An ash (multi stemmed); 15m tall; 0.	Moderate	Does not extend, open	Low	No further survey

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
	3m DBH on average. ; knothole on north face at 3m above ground; splits on west and north faces at 1 – 2m above ground; knothole on branch overhanging woodland to south facing west at4. 5m. Located on edge of woodland.		and exposed. One upward feature may be suitable, no bats or evidence of bats.		required
Tree 33	A birch; 15 m tall; 0. 3m DBH; knothole at 3m on west face. Set back into wood approx. 10m from edge.	Low	Features checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 34	A birch (multi stemmed); 15m tall; 0. 4m DBH on average; cavity on south-west at 2m; set back in woodland approx. 5m from edge.	Moderate	Feature checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 35	An oak; 20m tall; 0. 5m DBH; missing limb (part of) on south-west at 2. 5m. On edge of woodland.	Low	Open from above, exposed, feature not suitable.	Negligible	No further survey required
Tree 36	A birch; 30m tall; 0. 8m DBH. Very large cavity in trunk on west face at 2m. Next to stream in woodland.	Moderate	Unable to find.	Moderate	One dusk, one dawn; at least one before end of August
Tree 37	An oak; 20m tall; 0,4m DBH; woodpecker hole on east face viewed from a distance. Access to woodland not possible at the time of survey. Trees in woodland likely to have BRP features.	Low	Unable to access.	Low	No further survey required
Tree 38	An oak; 20m tall; 0. 3m DBH; knothole at 8m on west face Access to woodland not possible at the time of survey. Trees in woodland likely to have BRP features.	Low	Unable to access.	Low	No further survey required

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
Tree 39	A silver birch; 12m tall; 0. 5m DBH; possible cavity at 3. 5m facing south-west and thick ivy stems; multi stem.	Low	No cavity present, no other features present.	Negligible	No further survey required
Tree 40	A rowan; 10m tall; 0. 25m DBH; cavity at 1m from ground facing south-west.	Low	Feature checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 41	SN 65445 01410 (+/-4m); rowan; 12m tall; 0. 3m DBH; split at 0. 5m from ground extends up into tree, facing west. Set back from woodland edge. Photograph 55.	Moderate	Feature not suitable, does not extend, open, wet inside.	Negligible	No further survey required
Tree 42	A silver birch; 10m tall; 0. 3m DBH; cavity at 2m extends up into tree facing west.	Moderate	Feature checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 43	A birch; 8m tall; 0. 2m DBH; cavity at ground level extends up into tree; facing south-west.	Low	Feature checked using endoscope, no bats or evidence of bats, however feature may be suitable for roosting bats.	Low	No further survey required
Tree 44	An oak; 9m tall; 0. 3m DBH; cavity in main trunk from ground facing south. Endoscope. In dense woodland juts to the east of the stream.	Moderate	Unable to find.	Moderate	One dusk, one dawn; at least one before end of August
Tree 45	An oak; 7m tall; 0. 3m DBH; loose bark all the way up the main trunk from ground level, Choked with ivy.	Moderate	Features checked using endoscope, no bats or evidence of bats, however some features may be suitable for roosting bats. Loose bark not suitable – too open and exposed.	Low	No further survey required

Feature	Description from Ground Based Assessment	Initial BRP Category from Ground Level	Description from Aerial Assessment	BRP Category from Climbed Survey/Endoscope	Further Survey
Tree 46	Beech. 23m tall. 1.2m DBH. Rot at base of trunk on east face, fungal growth blocking any access; block knotholes on east, south and west faces. Knotholes at 3 – 5m	Negligible	Not Required	Negligible	No further survey required
Tree 47	Oak. 25m tall. 0.8m DBH. A few missing small limbs, but no BRP	Negligible	Not Required	Negligible	No further survey required
Tree 48	Oak. 20m tall. 0.8m DBH Viewed north face only with binoculars; split in large limb at 7m. Could not access tree due to horses.	Low	Not climbed. No access due to horses.	Low	No further survey required
Tree 49	Oak. 20m tall. 1m DBH Missing limb on SE face with small hole at 4m.	Low	Not climbed. No access due to horses.	Low	No further survey required

Appendix 2A BSG Report Buildings with Potential for Roosting Bats



Appendix 3A Static Detector Limitations

Table 2.1 Static Detector Recording Time Limitations

Month	Location	Number of Recording Nights	Comments
June 2017	Lane 1	2.5	SD cards inside machine filled up preventing the recording of any more bat echolocation calls
	Lane 2	2.5	Suspected SD inside machine filled up preventing the recording of any more bat echolocation calls
	South 1	3	Suspected SD inside machine filled up preventing the recording of any more bat echolocation calls
	South 3	0	Malfunction. Static detector did not turn on.
July 2017	North 3	4.5	Suspected battery fatigue.
	South 1	0	Detector ran for 2.5 nights only, but no bat echolocation calls were recorded during this time. Due to the number of bat echolocation calls recorded at this location in other months, it is assumed that the lack of bat echolocation calls is due to equipment malfunction and not because no bats were present in this location.
August 2017	Lane 1	4	Suspected battery fatigue.
	Lane 2	0	Detector was running for 1.5 nights only; but no bat echolocation calls were recorded during this time. This was due to constant interference noise between 80-150khz which prevented any bat calls from being recorded.
	North 2	4.5	Suspected battery fatigue.
	South 2	4.5	Suspected battery fatigue.

Month	Location	Number of Recording Nights	Comments
September 2017	Lane 1	4	Suspected battery fatigue.
	Lane 2	0	Detector was running for 1.5 nights only; but no bat echolocation calls were recorded during this time. This was due to A constant interference noise between 120-150khz which prevented any bat calls from being recorded.
	Lane 3	4	Suspected battery fatigue.
	North 1	3	Suspected battery fatigue.
	South 2	3.5	Suspected battery fatigue.
	South 3	0	Detector was running for 1.5 nights only; but no bat echolocation calls were recorded during this time. This was due to a constant interference noise between 65-85khz which prevented any bat calls from being recorded.
October 2017	Lane 1	3.5	Suspected battery fatigue.
	Lane 3	3.5	Detector recorded data for 3.5 nights only; the cable attaching the microphone to the SM2 was removed by an unknown person during its deployment.
	North 1	0	Detector was running for 1.5 nights only; but no bat echolocation calls were recorded during this time. This was due to A constant interference noise between 75-160khz which prevented any bat calls from being recorded.
	North 3	3.5	Suspected battery fatigue.
	South 1	0	Detector was running for 1.5 nights only; but no bat echolocation calls were recorded during this time. This was due to A constant interference noise between 45-65khz which prevented any bat calls from being recorded.
	South 3	3.5	Suspected battery fatigue.
April 2018	Lane 1	4.5	Suspected battery fatigue.
	Lane 2	4	Suspected battery fatigue.
	Lane 3	4.5	Suspected battery fatigue.
	North 1	4	Suspected battery fatigue.
	North 2	4.5	Suspected battery fatigue.
	North 3	4	Suspected battery fatigue.
	South 1	4.5	Suspected battery fatigue.
	South 2	4	Suspected battery fatigue.

Month	Location	Number of Recording Nights	Comments
	South 3	4.5	Suspected battery fatigue.
May 2018	Lane 2	3	Detector was running for 3 nights only; but no bat echolocation calls were recorded during this time. This was due to A constant interference noise between 25-100khz which prevented any bat calls from being recorded.

Appendix 4A Static Detector Statistical Analysis Results

Table 2.2 Kruskal-Wallis Test Results for Bat Passes by Location and Bat Passes by Month

Tests Used for Normality	Data Normally Distributed?	Test Description	Kruskal-WallisTest Results	Significant?
Histogram and Shapiro-Wilks	No	Bat Passes by Location	$\chi 2 = 9.267$, df = 9, p-value = 0.413	No
Histogram and Shapiro-Wilks	No	Bat Passes by Month	$\chi 2 = 6.0067$, df = 6, p-value = 0.4224	No

If the P value is < 0.05 then the result is significant

Table 2.3 Kruskal-Wallis Test Results for Bat Species Richness by Location and by Month

Tests Used for Normality	Data Normally Distributed?	Test Description	Kruskal-WallisTest Results	Significant?
Histogram and Shapiro-Wilks	No	Bat Species Richness by Location	$\chi 2 = 7.717$, df=8, P = 0.462	No
Histogram and Shapiro-Wilks	No	Bat Species Richness by Month	**$\chi 2 = 14.789$, df=4, P = 0.005**	**Yes**

If the P value is < 0.05 then the result is significant

Table 2.4 Post-hoc Mann Whitney-Wilcoxon Test Results for Bat Species Richness by Month

Months	Mann-Wilcoxon Test Results	Significant?
April v May	W = 17.5, p-value = 0.1314	No
April v June	W = 21.5, p-value = 0.2813	No
April v July	W = 20.5, p-value = 0.2282	No
April v Aug	**W = 6.5, p-value = 0.007244**	**Yes**
April v Sept	W = 31, p-value = 0.3635	No
April v Oct	W = 13.5, p-value = 0.0905	No
May v June	W = 31, p-value = 0.9565	No
May v July	W = 28, p-value = 0.7012	No
May v Aug	W = 47, p-value = 0.1136	No
May v Sept	W = 41.5, p-value = 0.02332	No
May v Oct	W = 23.5, p-value = 0.6355	No
June vs. July	W = 30, p-value = 0.8694	No
June vs. August	W = 47, p-value = 0.1182	No
June vs. September	W = 38, p-value = 0.07534	No
June vs. October	W = 22.5, p-value = 0.5505	No
July vs. August	W = 52, p-value = 0.03464	No
July vs. September	W = 40.5, p-value = 0.03176	No
July vs. October	W = 20.5, p-value = 0.3973	No
August vs. September	**W = 46, p-value = 0.004576**	**Yes**
August vs. October	W = 35.5, p-value = 0.4028	No
September vs. October	W = 36.5, p-value = 0.02507	No

If the P value is < 0.07 then the result is significant (P value= 0.05/number of months)

Appendix 3.8

Bat Survey Report 2014

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Bat Survey Report

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Client	Stag Energy
Job	Abergelli Power Project
Report title	Complete Bat Survey Report
Draft version/final	FINAL
File reference	7399_R_Bats_full_APPR (v3)_100315

	Name	**Position**	**Date**
Originated	Rachel Taylor	Ecologist	17 October 2014
Reviewed	Matt Hobbs	Principal Ecologist	21 October 2014
Approved for issue to client	Matt Hobbs	Principal Ecologist	21 October 2014
Issued to client	Matt Hobbs	Principal Ecologist	21 October 2014
Updated and 2nd issue to client	Matt Hobbs	Principal Ecologist	06 November 2014
Updated and 3rd issue to client	Matt Hobbs	Principal Ecologist	10 March 2015

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1 Summary

1.1 Abergelli Power Limited (APL) is promoting a new Power Generation Plant with its associated Gas and Electricity Connections (the 'Project') on agricultural land within Abergelli Farm, north of Swansea in the City and County of Swansea (approximately at National Grid Reference 265284, 201431).

1.2 The Preliminary Ecological Appraisal (PEA) (BSG Ecology, 2014) identified records of a number of bat species within 2 km of the Project Site boundary, and suitable habitat to support these species within the Project Site boundary, as defined at the time of the survey (hereafter referred to as the 'Survey Site'). APL commissioned BSG Ecology to undertake surveys for bats within the 150 ha of pastoral farmland at and around Abergelli Farm between April and October 2014 within the Survey Site, as part of a range of ecological surveys to inform and support an application for Development Consent for the Project.

1.3 A range of surveys were carried out in accordance with published best-practice guidance focusing on investigating the distribution and variety of bat species present within the Survey Site. These included; walked transects, automated bat detector surveys, and internal and external inspections of trees and buildings.

1.4 At least seven species of bats were recorded during transect surveys; common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, *Myotis* sp., long-eared bat *Plecotus* sp., noctule *Nyctalus noctula*, Leisler's bat *Nyctalus leisleri*, and lesser horseshoe bat *Rhinolophus hipposideros*. All of these species and an additional three were recorded during automated bat detector surveys; Nathusius' pipistrelle *Pipistrellus nathusii,* serotine *Eptesicus serotinus, and* greater horseshoe bat *Rhinolophus ferrumequinum*. By far the most frequently recorded species were common and soprano pipistrelle with 90 % of calls identified as one or other of these two species. *Myotis* sp. bats were also recorded frequently with noctule recorded infrequently but regularly. The six other species of bats were recorded occasionally or singly.

1.5 Roost surveys of buildings within the Survey Site confirmed that at least three buildings contained bat droppings and were used as bat roosts. Droppings from at least three species of bats (pipistrelle sp., long-eared bat sp. and lesser horseshoe bat) were found. Thirty three trees were located within the Survey Site that are thought to have potential to support roosting bats. Emergence and / or re-entry surveys were carried out on eight trees all of which would potentially be directly affected by the Project. No bats were recorded emerging from or entering these potential tree roosts.

2 Introduction

2.1 Abergelli Power Limited commissioned BSG Ecology to undertake surveys for bats between April and October 2014 as part of a suite of ecological surveys to inform and support an application for Development Consent for the Project described below.

Site Description

2.2 The Survey Site consists of approximately 150 ha of pastoral farmland, primarily grazed by horses. The extent of the Survey Site is shown in (Figure 1, Appendix 1) and is centred at National Grid Reference 265284, 201431. The nearest settlement is Felindre, which is located approximately 2 km to the north of the Survey Site, with Swansea approximately 5 km to the south.

2.3 The Survey Site is largely agriculturally improved pasture with several areas of marshy grassland, particularly in the north, south and north-western extents of the Survey Site. The fields are bounded by fences, running along the line of defunct hedgerows, and often accompanied by ditches. There is a block of broadleaved woodland on the eastern boundary of the Survey Site and other areas of woodland around the marshy grassland to the west of the Survey Site, and around Felindre Gas Compressor Station and the two National Grid 400 kV electrical substations that lie at the south-west end of the Survey Site. The habitats in the surrounding landscape are similar to those within the Survey Site and comprise a mixture of improved and marshy grassland interspersed with occasional patches of woodland.

Description of Project

2.4 APL is promoting a new Power Generation Plant with associated Gas and Electricity Connections within Abergelli Farm. The Power Generation Plant would operate as a Simple Cycle Gas Turbine (SCGT) peaking plant and would be designed to provide an electrical capacity of up to 299 Megawatts (MW). It would be fuelled by natural gas, supplied by a new underground gas pipeline connecting Power Generation Plant to the existing National Grid Gas (NGG) National Transmission System (NTS). It would also connect to the National Grid Electrical Transmission System (NETS) via underground cable or overhead lines.

2.5 BSG Ecology has been appointed as the ecological consultant to undertake an ecology survey, which includes a PEA as well as a range of Phase 2 surveys, including bat surveys. These baseline surveys will be included in an appendix to an ecology chapter of an Environmental Statement, which is intended for submission in support of the application for Development Consent.

Aims of Study

2.6 The aims of the bat surveys within the Survey Site were to:

- Identify the bat species using the Survey Site and the activity levels of bats within the Survey Site;
- Identify whether there are any features that are capable of supporting roosting bats; and
- If the above features are likely to be affected by the Project, establish whether they are used by roosting bats.

3 Methods

Desk Study

3.1 Existing ecological information for the Survey Site and the surrounding area was requested from the South East Wales Biodiversity Records Centre (SEWBReC). Information on European and nationally protected[1] species, including bats, was requested covering the Survey Site and land up to 2 km from the Survey Site boundary.

Site Appraisal

3.2 The areas of marshy grassland, trees, scrub, woodland and streams within the Survey Site potentially provide good foraging habitat for bats, with similar habitat present in the surrounding landscape providing habitat continuity and connectivity throughout the landscape. The desk study returned records of five species of bats, which are all fairly common and widespread. In addition, the Survey Site has habitat that is capable of supporting roosting and foraging habitat for rarer species of bat that have been recorded in the Swansea area, for example lesser horseshoe bat, greater horseshoe bat and barbastelle *Barbastella barbastellus*.

3.3 Overall, the Survey Site has been assessed as being of 'Medium Habitat Quality' following consideration of the current best practice bat survey guidelines (Hundt, 2012). Therefore the following methods were used at the appropriate level of survey effort, as recommended by the guidelines:

- Walked transects; and
- Automated detector surveys.

3.4 In addition, a number of buildings and trees within the Survey Site were surveyed for presence / likely absence of roosting bats. The following methods were used:

- Internal and external building inspection or tree roost climbing inspection; and
- Dusk emergence and pre-dawn re-entry surveys of potential roosts that are likely to be affected by the Project.

Bat Activity Surveys

Walked Transects

3.5 Walked surveys of two pre-determined transect routes (northern and southern, see Figure 1) were undertaken monthly between April and October 2014. The pre-determined transect routes were largely contained within the Survey Site, with the southern route extending a short distance to the east of the Survey Site in one area.

3.6 Each transect started around sunset and took approximately 2-3 hours to complete. The timing of the surveys therefore covered the bat emergence period and the period of most intense foraging activity when invertebrate prey is most abundant (Altringham, 2003).

3.7 The same transect route was walked on each survey visit with the start points and direction changed on each visit to ensure that different parts of the Survey Site were surveyed at different times of the night. This approach was adopted to remove any bias that could be introduced into the survey data if each survey was walked in the same direction. This bias could otherwise have resulted in any given point on the transect route being visited at approximately the same interval after sunset. Static recording points were selected for each transect. At these points the surveyors were stationary for three minutes to listen and record all bat passes.

3.8 Bat activity was recorded using Anabat hand-held electronic bat detectors. This model of detector automatically records all the bat passes they detect, which significantly reduces the chances that

[1] Wildlife and Countryside Act 1981 Schedules 1, 5 & 8; Conservation of Habitats and Species Regulations 2010; Protection of Badgers Act.

bats could be missed due to human error. Wherever possible, surveyors recorded the observed behaviour and numbers of bats onto a field proforma. This was to aid identification and also to provide additional detail on the behaviour of observed bats. Field notes included a record of the time of each bat encounter, allowing results to be cross-referenced with the recorded data.

3.9 The main aim of the transect walks was to identify areas of high bat activity, such as foraging areas and/or commuting routes (e.g. wet ditches, marshy grassland and hedgerows). Accordingly, the transect routes focussed on such areas.

3.10 When possible, all walked transects avoided heavy rain, strong winds and dusk temperatures below 10°C as recommended in the BCT guidelines (Hundt, 2012).

Automated detector surveys

3.11 In addition to the transect surveys, automated surveys were conducted using Wildlife Acoustics Song Meter 2 (SM2BAT+) bat detectors which are full spectrum detectors that are triggered automatically to record bat echolocation calls. These detectors can be deployed and left to remotely record bat activity for a period of several nights.

3.12 The BCT guidance recommends that two locations per transect route are surveyed each month. In this case, eight survey locations were used across the Survey Site with four in each half of the Survey Site (north and south). Each location was surveyed every other month to enable a larger number of survey locations to be sampled over the survey season but ensure that each location was sampled in spring, summer and autumn. Bat detectors would be deployed at four locations (two in the north and two in the south) in April, June, August and October with the other half of the locations sampled in May, July and September.

3.13 The detectors were deployed for five nights at each of the locations, which allowed continuous monitoring to take place during the period when bats are active, i.e. sunset to sunrise. They were programmed to begin recording from half an hour before sunset until half an hour after sunrise. Survey hours varied throughout the survey season according to daylight hours and have been calculated for each recording session in order to accurately calculate activity indices.

Materials and Data Analysis

Full details of the equipment used for surveys and the data analysis methods are provided in Appendix 2.

Bat Roost Surveys

Internal and External Building Inspection

3.14 The internal/external survey of eleven buildings within the Survey Site was undertaken on 25th June 2014 by Principal Ecologist and experienced bat worker Matthew Hobbs MCIEEM (Natural Resources Wales (NRW) Licence number 52240:OTH:CSAB:2014) with assistance from Rachel Taylor ACIEEM and Caitlin McCann. Eleven buildings (Buildings B1 – B11) (see Figure 2, Appendix 1) were inspected to assess their potential to support roosting bats and to search for evidence of bat activity.

3.15 The survey included all the buildings within the Survey Site, except for those contained within the Felindre Gas Compressor Station and the two National Grid 400 kV electrical substations that lie at the south-west end of the Survey Site, which were visually inspected using binoculars from boundary fences during the PEA survey in July. The buildings within these sites do not apparently have any features that could support roosting bats and it was not necessary to arrange access to these sites to carry out a more detailed inspection of any of the buildings.

3.16 During the survey a thorough search was made of the buildings including all accessible areas and crevices for bats, their droppings, food remains or characteristic grease marks at potential roost exit/entrance points. The exterior of the buildings were searched, paying particular attention to window ledges, where droppings can gather undisturbed, and under potential roost access points, such as loose tiles and gaps between boarding. Where possible, internal inspections were also undertaken.

3.17 Signs of bat activity searched for included:

- Live bats;
- Droppings;
- Urine staining;
- Feeding remains (e.g. discarded wings of flying invertebrates);
- Oil staining;
- Smell;
- Daytime vocalisations;
- Absence of cobwebs (a well-used bat roost and its access points are typically clear of cobwebs);
- Scratching; and
- Dead bats.

3.18 All buildings were assigned a category defining their potential to support roosting bats in accordance with Table 1 below.

Table 1: Categories defining the potential for buildings to support roosting bats.

Level of Bat Potential	**Rationale**
Negligible	Building with no or very limited roosting opportunities for bats, no evidence of use by bats and where the feature is isolated from foraging habitat.
Low	Building with a limited number of roosting opportunities, no evidence of current use by bats and with poor connectivity to foraging habitat.
Medium	Building with some roosting opportunities, with no evidence of current use by bats and with connectivity to moderate – high quality foraging habitat.
High	Building with multiple roosting opportunities for one or more species of bat, and with good connectivity to high quality foraging habitat.
Confirmed Roost	Presence of bats or evidence of recent use by bats.

Internal and External Tree Inspection

Preliminary Ground Level Inspection of Trees

3.19 The Preliminary Ecological Appraisal conducted (on 24 February, 14 April and 9 July 2014) included a preliminary ground-level assessment of trees for their potential to support roosting bats. Features of trees that may be used by roosting bats include:

- Natural holes;
- Woodpecker holes;
- Cracks or splits in major limbs;
- Loose bark; and
- Hollows or cavities.

3.20 Any trees with apparent roosting features were recorded and assigned a category defining their potential to support roosting bats in accordance with Table 2 below, as adapted from Hundt, 2012 (Table 8.4, p. 60). The locations of these trees are shown in Figure 3a, Appendix 1.

Table 2: Categories defining the potential for trees to support roosting bats.

Level of Bat Potential	Rationale
1*	Trees with multiple, highly suitable features capable of supporting larger roosts.
1	Trees with definite bat potential, supporting fewer suitable features than category 1* trees or with potential for use by single bats.
2	Trees with no obvious potential, although the tree is of a size and age that elevated surveys may result in cracks or crevices being found; or the tree supports some features which may have limited potential to support bats.
3	Trees with no potential to support roosting bats.

Roped Access Survey of Trees

3.21 Any trees that were identified during the Phase 1 survey as category 2 or above, i.e. have potential to support roosting bats were further assessed by Anton Kattan[2] and Ted Bodsworth, during a roped access (or tree climbing) survey. The aim of this survey was to closely inspect features identified during the Phase 1 survey and re-categorise trees as necessary. The trees were surveyed from 15-17 July 2014. Weather conditions during the three day period were generally good with light rain on 16 July 2014.

Dusk emergence and Dawn Re-entry Surveys

3.22 Following on from the internal and external inspections described above, dusk emergence and dawn re-entry surveys were undertaken between 12 and 28 August 2014. The survey was undertaken in a smaller area than the Survey Site described above; due to refinements in the Project design and extent of the Project Site which assisted in determining which potential roosts would be affected by the Project and, therefore, would require further survey. A plan of the reduced area was provided on 8 August 2014 and the trees within this reduced area, along with their roost potential categorisation are shown in Figure 3b, Appendix 1. No buildings are anticipated to be directly affected by the Project, and therefore all the buildings were excluded from further surveys. The recommendations included in the BCT guidance (Hundt, 2012) for the level of survey effort required to determine the presence or absence of bats from a structure are shown in Table 3.

Table 3: Survey effort required for determining presence / absence of bats at a potential roost

Level of bat potential	Survey effort required
High roost potential	3 dusk emergence and/or pre-dawn re-entry surveys during May-September including 2 between mid-May and August.
Low to moderate roost potential	2 dusk emergence and/or pre-dawn re-entry surveys during May-September including 2 between mid-May and August.
Low roost potential	1 dusk emergence and/or pre-dawn re-entry surveys during May-September.

3.23 The roped access surveys are considered equal effort to one emergence or re-entry survey, therefore reducing the number of further activity surveys by one. The tree categories were split into the three roost potential categories as follows: 1* - high roost potential; 1 – low to moderate potential; 2 – low roost potential; and 3 – no roost potential. Table 4 shows the additional activity surveys required on each of the trees. Where it was not possible to carry out a roped access survey on the trees within the reduced area, namely T5, T32 and T35, an additional emergence or re-entry survey was carried out.

[2] Natural Resources Wales licence number - 51661:OTH:CSAB:2013

Table 4: Trees within the reduced area for which additional surveys were required (see Figure 3b).

Tree Number	Species	BCT Potential	BCT Tree Category	Roped access survey	Additional surveys required
T3	Birch	Low - Moderate	1	Yes	1
T4	Oak	High	1*	Yes	2
T5	Birch	Low - Moderate	2	No	2
T6	Birch	Low - Moderate	1	Yes	1
T9	Oak	Low - Moderate	1	Yes	1
T23	Oak	High	1*	Yes	2
T32	Elm	Low	2	No	1
T35	Birch	Low - Moderate	1	No	2

3.24 The dusk emergence surveys commenced approximately 15 - 30 minutes before sunset and continued until approximately 1½ - 2 hours after sunset. The dawn re-entry survey commenced approximately 1½ - 2 hours before sunrise and finished 15 minutes after sunrise.

3.25 Surveyors used two different bat detectors on each survey to supplement visual observations: a Batbox Duet detector for listening to bat calls from the combined heterodyne/frequency division output and an Anabat frequency division detector for recording calls for subsequent identification.

Limitations of Study Methods

3.26 No significant limitations to the study methods were noted. The access route in the south-west of the Survey Site (Access Road Option 2) and the western part of the land surrounding the Felindre Gas Compressor Station and the two National Grid 400 kV electrical substations were not included in the transect surveys as access to these areas could not be arranged until late in June and was not permitted at night for security reasons. This area is a small proportion of the Survey Site that does not contain habitats significantly different to those present in other parts of the Survey Site, and is unlikely to support a more diverse species assemblage than the rest of the Survey Site. As such, it is not considered that this is a significant limitation to the survey methods.

3.27 No access was granted to the roof voids of the three residential buildings (buildings 1, 2, and 5 – see Table 12) surveyed for roosting bats. This limitation to the survey is unlikely to be significant given that these buildings will not be directly affected by the Project.

4 Results

Desk Study

4.1 There were 126 bat records provided by SEWBREC from the 2 km radius search area. Of these the majority were recorded during bat transects carried out to inform a separate unrelated development proposal, named 'Felindre development site' in the records which was located approximately 1 km to the south west of the Survey Site boundary.

4.2 The bat species recorded from the desk study include brown long-eared bat *Plecotus auritus*, common pipistrelle, Natterer's bat *Myotis nattereri*, noctule, and whiskered bat *Myotis mystacinus*. There were also records of unidentified *Pipistrellus sp*. and other records where the bat species was not specified.

4.3 There are four bat roosts amongst the records provided. The closest of these is a record of 50 unspecified bat species 1.8 km to the south-east of the Survey Site at Ynystawe, Swansea from 1992. The next closest is a night / feeding roost of an unspecified species 1.9 km south west of the Survey Site boundary in Tredegar-Fawr farm buildings from 1998. A record of a roost of 87 whiskered bats also comes from approximately 1.9 km to the north west of the Survey Site boundary in Felindre, Swansea from 1993. The fourth record is a roost of 70 bats of unspecified species, 2.5 km to the south east of the Survey Site in Ynysforgan, Swansea from 1993.

Bat Activity Surveys

Walked transects

4.4 Details of transect surveys along with survey timings and weather conditions are provided in Table 5. A map of walked transect routes is presented in Figure 1, Appendix 1, with maps showing the number of passes and species recorded during each transect survey presented in Figures 4a – c (north transect) and 5a – c (south transect), Appendix 1.

Table 5: Details of walked transect surveys. (GL – Gareth Lang, MH – Matt Hobbs, RT - Rachel Taylor, ST – Stuart Thomas, CMC – Caitlin McCann, NL – Niall Lusby)

Date	Survey Area	Surveyor	Time	Weather[3]
24/04/14	North	GL, MH	20:28-22:42	START: Wind F0-1 SE, 70% cloud, no rain, 12.5˚C FINISH: Wind F0-1 SE, 70% cloud, no rain, 8.8˚C
30/04/14	South	RT, ST	20:15-22:45	START: Wind F1, 100% cloud, light rain, 14.2˚C FINISH: Wind F1 SW, 90% cloud, no rain, 10.4˚C
22/05/14	North	GL, RT	21:17-00:33	START: Wind F1-2 NW, 50% cloud, no rain, 11.3˚C FINISH: Wind F2-3 SW, 50% cloud, no rain, 10.8˚C
03/06/14	South	GL, MH	21:25 – 23:56	START: Wind F0 SE, 60% cloud, no rain, 15.0˚C FINISH: Wind F0-1 SE,9 0% cloud, no rain, 13.0˚C
19/06/14	North	RT, CMC	21:22-00:28	START: Wind F0-1 SE, 5% cloud, no rain, 15.3˚C FINISH: Wind F0-1 SE, 0% cloud, no rain, 11.9˚C
25/06/14	South	RT, CMC	21:19-00:24	START: Wind F0, 70% cloud, no rain, 16.0˚C FINISH: Wind F0, 0% cloud, no rain, 16.0˚C
17/07/14	South	CMC, GL	21:11-23:45	START: Wind F1, 60% cloud, no rain, 23.0 ˚C FINISH: Wind F0, 80% cloud, moderate rain, 23.0 ˚C

[3] Wind strength is given in the Beaufort scale. This is an empirical measure that relates wind speed to observed conditions at sea or on land.

Date	Survey Area	Surveyor	Time	Weather[3]
30/07/14	North	CMC, NL	20:52-23:31	START: Wind F2, 50% cloud, no rain, 17.0 ˚C FINISH: Wind F2, 80% cloud, no rain, 18.0 ˚C
19/08/14	South	GL, RT	20:20-23:05	START: Wind F1-2W, 20% cloud, no rain, 11.4 ˚C FINISH: Wind F1, 10% cloud, no rain, 7.0 ˚C
26/08/14	North	GL, CMC	20:00-22:41	START: Wind F1-2, 40% cloud, no rain, 16˚C FINISH: Wind F2-3 NW, 0% cloud, no rain, 14˚C
03/09/14	South	GL, NL	19:43-22:21	START: Wind F1, 50% cloud, no rain, 18 ˚C FINISH: Wind F1, 50% cloud, no rain, 19 ˚C
18/09/14	North	RT, CMC	19:09-21:40	START: Wind F0-1, 100% cloud, no rain, 21˚C FINISH: Wind F1-2NE, 40% cloud, no rain, 20˚C
01/10/14	South	GL, NL	18:40-21:20	START: Wind F2, 25% cloud, no rain, 14 ˚C FINISH: Wind F1, 25% cloud, no rain, 12.5 ˚C
06/10/14	North	RT, GL	18:35-20:54	START: Wind F0-1, 30% cloud, no rain, 9˚C FINISH: Wind F0-1, 90% cloud, no rain, 8˚C

4.5 In total 958 bat passes (B) of at least seven species of bats were recorded during walked transect surveys in 2014. Table 6 summarises the relative activity level (Bat passes per hour (B/h)) recorded during walked transects for all species; for the definition of B and B/h used in this analysis see 'Materials and Data Analysis' in Appendix 2.

Table 6: Number of passes recorded (B) and relative activity (B/h) for each species during all walked transects.

Species	B	B/h
Common pipistrelle	577	15.4
Soprano pipistrelle	240	6.4
Myotis species	67	1.8
Noctule	26	0.7
Leisler's bat	1	>0.1
Long-eared bat sp.	1	>0.1
Lesser horseshoe bat	1	>0.1
Total	**958**	**25.6**

4.6 There were 43 *Pipistrelle* sp. passes recorded during the walked transect that could not be identified to species level, as the peak frequency of the calls were within a frequency range used by more than one species (see 'Materials and Data Analysis' in Appendix 2 for details of how pipistrelle bats were identified). These have not been included in the results tables.

4.7 A total of 464 bat passes (B) were recorded during the north transect, including at least five species, a total of 494 bat passes were recorded during the south transect, including at least seven species. The relative activity level (Bat passes per hour (B/h) for the definition of B and B/h used in this analysis see 'Materials and Data Analysis' in Appendix 2) recorded during the north and south transects is recorded in Table 7.

Table 7: Number of passes and relative activity recorded during walked transect surveys.

Species	North		South	
	B	**B/h**	**B**	**B/h**
Common pipistrelle	318	16.9	259	13.9
Soprano pipistrelle	86	4.6	154	8.3
Myotis species	29	1.5	38	2.0
Noctule	9	0.5	17	0.9
Leisler's bat	0	0	1	>0.1
Long-eared bat sp.	1	>0.1	0	0
Lesser horseshoe bat	0	0	1	>0.1
Total	**464**	**24.7**	**494**	**26.6**

Relative Activity of Bats

4.8 Across the survey season, common pipistrelle was the most frequently encountered species during walked transects with 15.4 B/h and 60.2 % of all passes recorded as this species (B = 577). Soprano pipistrelle was the second most numerous with 6.4 B/h. When passes from unidentified pipistrelles are added to the total, 89.8 % of all the recorded passes were identified as bats from the Pipistrellus genus[4]. Activity levels of 1.8 B/h and 0.7 B/h were recorded for *Myotis* sp. and noctule respectively with one pass recorded for Leisler's bat, lesser horseshoe bat and long-eared bat sp.

4.9 Bat activity levels varied between transects, with a mean of 26.1 B/h (range; 7.3–70.4 B/h). Fluctuations between surveys are within normal limits, being influenced by factors such as short-term variations in weather conditions and prey availability and seasonal variations. During April, an average across both surveys of 49.8 B/h was recorded, which then declined in May to 22.3 B/h and in June (14.4 B/h) and then rose again in July (36.5 B/h). In the autumn bat activity declined again with an average of 24.2 B/h recorded in September, which dropped again in October (12.2 B/h). The highest level of activity recorded during a single transect survey occurred during the April transect in SA2 when an activity rate of 70.4 B/h (B = 176) was recorded.

Spatial Distribution of Bats

4.10 Common and soprano pipistrelle bats were recorded during every survey and occurred in most of the Survey Site. The highest number of passes was recorded along linear features such as hedges or streams, with lower activity over open fields. Passes were recorded throughout transect surveys, with the majority being recorded later in the night; however, 12 passes were recorded within 20 minutes of sunset.

4.11 A total of 67 passes of *Myotis* bats were recorded, with a relatively wide scatter of records throughout the Survey Site. The highest proportion of passes was recorded along the stream to the east and woodlands in the south of the Survey Site. No passes were recorded within 20 minutes of sunset.

4.12 Noctule was recorded infrequently and in low numbers with just 26 passes recorded. Most passes were recorded during the southern transect, with single passes scattered throughout the Survey Site. Twelve of the passes recorded were within the first 20 minutes after sunset.

4.13 One pass of lesser horseshoe bat was recorded on 3 June near the woodland at the north corner of the National Grid gas compressor station. This was recorded 67 minutes after sunset.

Automated Detector Surveys

4.14 Automated bat detectors were operating for a total of 132 nights, equating to 1,266 hours and 50 minutes of survey time between April and October 2014. Table 8 gives details of automated bat detector deployment dates and locations with the latter illustrated in Figure 1, Appendix 1. Table 9

[4] See Appendix 2 for identification parameters used for the *Pipistrellus* genus.

gives details of the number of passes and relative activity recorded during automated detector surveys.

Table 8: Numbers and deployment dates of automated detectors.

No.	OS Grid Ref	Apr	May	Jun	Jul	Aug	Sep	Oct
D1	SN6482401614	24-29/04		17-22/06		19-24/08		01-05/10
D2	SN6517902032	24-29/04		17-22/06		19-24/08		01-05/10
D3	SN6538401492	26-30/04		17-22/06		19-24/08		01-05/10
D4	SN6567100799	24-26/04		17-22/06		19-24/08		01-05/10
D5	SN6506701490		16-21/05		17-22/07		18-22/09	
D6	SN6582902329		16-19/05		17-22/07		18-22/09	
D7	SN6494702070		16-21/05		17-22/07		18-22/09	
D8	SN6525501006		16-21/05		17-19/07		18-22/09	

Table 9: Number of bat passes (B) and relative activity (B/h) at automated detector locations.

Detector number	B	B/h
D1	416	2.0
D2	3573	32.8
D3	4273	115.7
D4	3898	157.9
D5	3257	77.2
D6	843	11.1
D7	3249	46.8
D8	2613	75.9
Total	**22122**	**56.2**

Relative Activity of Bats

4.15 A total of 27,634 passes from at least ten species of bat were recorded. Figure 6 illustrates the proportion of activity recorded for different species at each automated survey location, for the whole survey period as well as spring (April-May), summer (June-August) and autumn (September-October) in Figures 7 to 9. Data for bats not identified to species-level (e.g. common/soprano pipistrelle), or for which there were so few calls recorded that the activity rate cannot be meaningfully illustrated (e.g. greater and lesser horseshoe bat), have not been illustrated in the Figures provided in Appendix 1. The relative activity of bat species recorded at all detector locations is recorded in Table 10.

Table 10: The relative activity of bat species recorded at all detector locations.

	Detector Number								
Species	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**Total B/h**
Nathusius' pipistrelle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<0.01	**<0.01**
Common / Nathusius' pipistrelle	0.0	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
Common pipistrelle	1.5	14.6	19.1	13.4	20.7	5.5	19.5	22.7	**14.2**
Common / soprano pipistrelle	0.1	0.2	0.6	1	0.8	0.4	1.1	0.7	**0.6**
Soprano pipistrelle	0.6	5.2	2.6	13.0	3.0	2,6	3.1	9.5	**4.8**
Greater horseshoe bat	0.0	0.0	0.0	0.0	<0.1	0.0	0.0	<0.1	**<0.1**
Lesser horseshoe bat	0.0	0.0	<0.1	<0.1	<0.1	0.0	<0.1	0.0	**<0.1**
Long-eared bat sp.	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**<0.1**
Myotis / long-eared bat sp.	<0.1	0.0	0.0	0.0	0.0	<0.1	<0.1	0.0	**<0.1**
Myotis species	0.1	0.9	1.6	2.7	5.0	1.5	1.8	2.2	**1.8**
Noctule	0.2	0.2	0.3	0.2	0.1	0.3	<0.1	0.1	**0.2**
Noctule / Leisler's bat	<0.1	<0.1	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Leisler's bat	0.0	0.0	0.0	0.0	<0.1	<0.1	0.0	0.0	<0.1
Serotine / Leisler's bat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	**<0.1**
Serotine	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	<0.1	**<0.1**
Noctule / Leisler's bat / serotine	0.0	0.0	0.0	0.0	<0.1	<0.1	<0.1	0.2	**<0.1**
Unidentified bat species	0.0	0.0	0.0	0.0	<0.1	<0.1	<0.1	0.2	**<0.1**
Total B/h	**2.6**	**21.1**	**24.4**	**30.5**	**29.9**	**10.4**	**25.6**	**35.7**	**21.8**

4.16 Across the survey season, the highest relative activity rate recorded was for common pipistrelle, at an average of 14.2 B/h (B = 17975) followed by soprano pipistrelle (4.8 B/h) with 90.0% of all the recorded passes identified as bats from the Pipistrellus genus. The next most frequently recorded species were *Myotis* sp. with 1.8 B/h (B = 2328) and noctule (0.2 B/h). There were also 45 long-eared bat *Plecotus* sp. passes recorded, with six passes for lesser horseshoe bat, two for greater horseshoe bat, three for serotine *Eptesicus serotinus* and just one Nathusius' pipistrelle *Pipistrellus nathusii* pass.

4.17 The data presented in Table 11 indicates that overall bat activity dropped from spring (April and May; 43.0 B/h) to summer (June - August; 19.1 B/h) and again in autumn (September and October 11.4 B/h). The pattern of activity was the same for all species of bats except long-eared bat sp. which increased from <0.1 to 0.1 B/h from spring to summer, and serotine and Nathusius' pipistrelle which were only recorded in the spring and autumn respectively.

Table 11: Number of passes (B) and relative activity (B/h) of bats at each detector location.

Detector number	Spring (April-May)		Summer (June-August)		Autumn (September-October)		Total
	B	**B/h**	**B**	**B/h**	B	B/h	
D1	75	1.6	341	4.0	86	1.4	2.6
D2	1240	26.3	2333	27.3	547	8.8	21.1
D3	3252	87.1	1021	11.9	258	4.1	24.4
D4	1508	79.2	2390	27.9	1198	19.2	30.5
D5	2546	62.0	710	17.9	895	15.4	29.9
D6	184	7.4	659	16.6	439	7.5	10.4
D7	1542	37.5	1707	42.9	312	5.4	25.6
D8	2501	60.9	112	4.7	1778	30.5	35.7
Total	**12848**	**43.0**	**9273**	**19.1**	**5513**	**11.4**	**21.8**

Distribution of Bats

4.20 The highest activity levels came from three detectors that each recorded 29.9-35.7 B/h as follows:

- D5 (29.9 B/h) - located at the corner of a patch of woodland to the west of the Survey Site. The large majority of passes were from common pipistrelle bats (20.7 B/h). Two of the six lesser horseshoe bat passes were recorded at this location, as was one of two greater horseshoe bat passes. The highest *Myotis* activity (5.0 B/h) was recorded at this location.
- D4 (30.5 B/h) - located at the south corner of the Survey Site in trees along a stream corridor. High activity levels of common (13.4 B/h) and soprano (13.0 B/h) pipistrelle bats were recorded, as well as two of the six lesser horseshoe bat passes were recorded at this location.
- D8 (35.7 B/h) – located on the corner of woodland surrounding the National Grid Gas compressor station to the west of the Survey Site. High levels of activity were recorded from common (22.7 B/h) and soprano (9.5 B/h) pipistrelle bats. One of two greater horseshoe bat passes was recorded.

Myotis bats

4.21 In total, 2,328 *Myotis* sp. passes were recorded at an average rate of 1.8 B/h. *Myotis* bats were recorded at all of the static locations and during every deployment. Higher activity rates were recorded in the spring (4.0 B/h) than the summer (0.9 B/h) with a slight increase again in autumn (1.4 B/h).

4.22 Higher levels of activity were recorded in the south of the Survey Site than the north (2.8 B/h and 1.0 B/h, respectively). The highest relative activity was recorded at D5 (5.0 B/h), in the most southerly part of the Survey Site.

4.23 The nocturnal activity of *Myotis* bats showed that passes were typically being recorded first by detectors at around 40 minutes after sunset, with a peak around one hour after sunset and consistent activity throughout the night until around 40 minutes before sunrise.

Noctule bats

4.24 In total, 228 Noctule passes were recorded at an average rate of 0.2 B/h. Noctule bats were recorded at all of the static locations. Higher activity rates were recorded in the spring (0.5 B/h) which then dropped away during the summer (0.1 B/h) with a further drop in autumn (<0.1 B/h).

4.25 Higher levels of activity were recorded in the south of the Survey Site compared to the north (0.2 B/h and 0.2 B/h, respectively). The highest relative activity was recorded at D3 and D6 (0.3 B/h), along the eastern side of the Survey Site.

4.26 The nocturnal activity of Noctule bats showed that passes were typically being recorded first by detectors at around 20 minutes after sunset, with three calls in total recorded before sunset, and a peak in activity around 40 minutes after sunset followed by consistently low activity throughout the night until around 20 minutes before sunrise.

Leisler's and Serotine bats

4.27 In total four Leisler's bat and three serotine bat passes were recorded on the Survey Site, with an additional 24 passes that were identified as either Leisler's bat or serotine.

4.28 Leisler's bat passes were recorded at detector numbers D5 and D6, in the west and north-east of the Survey Site respectively. Serotine passes were recorded at detectors D3 and D8, in the woodland in the east of the Survey Site and the woodland around the Gas Compressor Station in the west respectively. All passes of Leisler's bat / serotine occurred at detector D8.

4.29 All of the bat passes were recorded within the first 60 minutes after sunset with the exception of one Leisler's bat pass and one Leisler's bat / serotine pass which were both recorded in the middle of the night.

Pipistrelle bats

4.30 This section covers common, soprano and Nathusius' pipistrelles and also any pipistrelle calls that could have been from either species (see Appendix 2). In total, 17,975 common pipistrelle passes were recorded (14.2 B/h), with 6,019 soprano pipistrelle (4.8 B/h), and a total of 772 unidentified pipistrelle passes (0.6 B/h); 97% of all pipistrelle calls were therefore recorded to species level. Common and soprano pipistrelle bats were recorded from all detectors during every deployment. Much higher activity rates were recorded for common pipistrelle in the spring (29.6 B/h) than the summer (12.2 B/h) and autumn (11.4 B/h). This was also true for soprano pipistrelle, with 7.4 B/h in spring, 5.3 B/h in summer and 2.7 B/h in autumn. Only one Nathusius' pipistrelle pass was recorded, during the autumn at D8 (in the south east of the Survey Site).

4.31 Higher levels of common and soprano pipistrelle activity were recorded in the south of the Survey Site than the north (25.5 B/h and 12.9 B/h, respectively). The highest relative activity for common pipistrelle was recorded at D8 (22.7 B/h). For soprano pipistrelle highest relative activity was at D4 (13.0 B/h), the only location at which soprano pipistrelle levels nearly matched common pipistrelle, along the eastern side of the Survey Site.

4.32 The nocturnal activity of pipistrelle bats showed that passes were typically being recorded first by detectors at around 20 minutes after sunset, with a peak from 40 to 80 minutes after sunset. There was constant activity recorded throughout the night until around 20 minutes before sunrise, with a secondary peak around 60 to 40 minutes before sunrise.

Long-eared bat sp.

4.33 In total, 45 long-eared bat sp. passes were recorded at an average rate of 0.04 B/h. Long-eared bat sp. were recorded at low levels at all of static locations, with a peak activity level of 0.1 B/h at D1. A higher number of passes were recorded in the summer (31 passes) than the autumn (13 passes) and the spring when only one pass was recorded.

4.34 Long-eared bat sp. was recorded at all detectors with peak activity levels at D1 and D3, both on the western side of the Survey Site next to woodland.

Horseshoe bats

4.35 Six lesser horseshoe bat passes were recorded across four detector locations, D3, D4, D5 and D7, located in the centre of the Survey Site. Four of these passes were recorded in spring, with one in the summer and one in autumn. A single pass was recorded from D3 on 18 June, with two passes recorded from D4 on 25 April, single passes recorded on 18 and 19 May from D5 and a further single pass recorded at D7 on 20 September. Bat passes were recorded between 1-1.5 hours after sunset or 55 minutes – 1.5 hrs before sunrise in spring and summer, and in the middle of the night (23:45) in autumn.

4.36 Two greater horseshoe bat passes were recorded at detector locations D5 and D8 during the middle of the night in July and September respectively.

Bat Roost Surveys

Internal and External Building Inspection

4.37 The results of the building inspection are included in Table 12, which shows the category assigned to each building. Full descriptions of the buildings are included in Appendix 3 and Photographs of each building in Appendix 4.

Table 12: Potential of the surveyed buildings to support roosting bats.

Building Number	Bat roost potential	Brief description	Key features and evidence of use by bats
Building 1	Moderate	Detached house.	A number of missing slates and gaps under ridge tiles offer potential for roosting bats. No signs of use by bats were observed. There was no access available to the roof void.
Building 2	Moderate	Detached house.	A number of missing slates and gaps under ridge tiles offer potential for roosting bats. No signs of use by bats were observed. There was no access available to the roof void.
Building 3	Negligible	Corrugated iron barn, used as horse stable.	No potential roost features or signs of use by bats were observed.
Building 4	Confirmed roost	Stone built stable block	Numerous roosting opportunities and access points under missing slate, through broken windows, gaps above door frames. A scattering of long-eared bat, pipistrelle and lesser horseshoe bat droppings were found in the store rooms, with no piles of droppings found anywhere.
Building 5	Moderate	Terraced housing	Some missing tiles, lifted lead flashing and access to boxed eaves due to damage could be used by bats. No signs of use by bats were observed. There was no access available to the roof void.
Building 6	Negligible	Corrugated iron barn, used as horse stable and machinery store.	No potential roost features or signs of use by bats observed.
Building 7	Low	Brick outbuilding with corrugated roof.	The cavity wall may be accessible through broken vents. No signs of use by bats were observed.
Building 8	Confirmed	Single storey brick barn	Multiple fly-in opportunities to both

	roost	with second story tower at the northern end.	storeys. Small piles of long-eared bat and pipistrelle droppings found in both first and second storey at the north of the building.
Building 9	Negligible	Breeze block shed with corrugated roof.	No potential roost features or signs of use by bats observed.
Building 10	Confirmed roost	Brick out-house, single room, no doors or windows. Flat concrete roof.	Missing bricks allow access to the cavity wall in a number of places. Two pipistrelle droppings were found on the floor.
Building 11	Moderate	Derelict stone cottage, two distinct standing walls, no roof.	Walls are very exposed. Some roosting opportunities between the stone, and gaps into a rubble filled wall. No signs of use by bats were observed.

4.38 None of the buildings will be affected by the Project and therefore no further survey has been carried out on the buildings.

Internal and External Tree Inspection

Preliminary Ground Level Inspection of Trees

4.39 A total of 33 trees were identified during the preliminary ground level inspection of trees as having potential bat roosting features. The details of each tree are recorded in Table 13 below with their locations shown in Figure 3a, Appendix 1.

4.40 All but four of the trees that were identified were further assessed during the roped access survey (see below).

Roped Access Survey of Trees

4.41 A total of 29 trees were climbed using ladders or rope access. Four trees were inaccessible or unsafe to climb. Table 13 includes descriptions of the potential roosting features and the BCT category (see Table 1) assigned to each tree following the roped access survey.

Table 13: Categorization of trees assessed during preliminary ground level survey and subsequently during roped access survey.

Tree	Grid Reference	Species	Bat Roost Feature	Evidence of bats	Potential	BCT Category
T1	SN 65384 02528	Oak	Ivy - Extensive ivy cover on stem with lifted plates	None	Moderate	1
T2	SN 65249 01932	Birch	Decay in dying tree - Cavity- small hollows on both stems	None	Negligible	3
T3	SN 65249 01916	Birch	Woodpecker rot hole	None	Moderate	1
T4	SN 65340 01850	Oak	Two splits in large limbs	Unconfirmed dropping	High	1*
T5	SN 65451 01405	Birch	Single rot hole in trunk	None	Moderate	1
T6	SN 65471 01413	Birch	Single rot hole in trunk	None	Moderate	1
T7	SN 65398 01677	Oak	Thick ivy and hollow trunk near ground level	None	Low	2
T8	SN 64862 01980	Oak	Splits in small limbs	None	Moderate	1
T9	SN 65170 02031	Oak	Split limb - Single feature with high potential	None	Moderate	1
T11	SN 64722 02068	Oak	2 woodpecker holes	None	High	1*
T10	SN 64703 02063	Oak	Single cavity at base of trunk	None	Low	2
		Oak	Split in branch	None		
T12	SN 64844 02030	Oak	Split in trunk	None	Low	2
		Oak	Split limb	None		
T13	SN 64843 02034	Oak	Dense ivy	None	Low	2
T14	SN 64843 02040	Alder	Rot hole and Woodpecker hole	Unconfirmed droppings	High	1*
T15	SN 64857 01978	oak	Rot hole - hollow trunk	None	Moderate	1

Tree	Grid Reference	Species	Bat Roost Feature	Evidence of bats	Potential	BCT Category
T16	SN 64868 01915	Oak	Woodpecker rot hole in trunk	None	Moderate	1
T17	SN 64987 01560	Birch	Thick stem ivy	None	low	2
T18	SN 64994 01468	Ash	Rot hole in trunk	None	low	3
		Ash	Hollow limb	None		
T19	SN 65513 02439	Oak	Decay in canopy - one cavity with potential	None	Moderate	1
		Oak	Cavity in main stem	None		
		Oak	Split / hollow limb	None		
T20	SN 65632 02412	Oak	Slit in main stem	None	Low	2
		Oak	Rot hole /hollow	None		
T22	SN 65620 01318	Willow	Broken trunk	None	Low	2
T23	SN 65506 01089	Oak and nearby rowan	Rot holes in limbs	None	High	1*
T24	SN 65460 01068	Oak	Dense ivy plate lifted from trunk	None	Low	2
T25	SN 65112 01204	Oak	Hollow at base, cut limb.	None	Low	2
T26	SN 64979 01428	Rowan	Cavity in dead limb	None	Moderate	1
T27	SN 65147 01494	dead Oak	Standing dead wood	None	Low	2
		dead Oak	Hollows in trunk	None		
		dead Oak	Hollow Branch	None		
T28	SN 65061 01605	Oak	Large rip out scar with possible fissures behind scar regrowth	None	Moderate	1
T30	SN 64863 01925	S. Birch	Branch rip out scar with upwards leading cavity	None	None	3
T31	SN 64825 02000	Oak	Rot hole in split	None	Low	2
T32	SN 64190 00698	Elm	Small plates of lifted bark	None	Low	2
T33	SN 64387 00771	Oak	Small snapped branch	None	none	3
T34	SN 64418 00785	Oak	Crack at base of overhanging branch	None	none	3
T35	SN 64448 00798	Birch	Two woodpecker holes	None	Moderate	1

Emergence/re-entry surveys

4.42 Additional survey was considered necessary for a total of eight trees within the updated Survey Site boundary. The location and category assigned to each of these trees is shown in Figure 3b, Appendix 1. Details of the emergence and re-entry surveys are shown in Table 14 below. Photographs of each tree are included in Appendix 5.

Table 14: Details of the emergence / re-entry surveys of potential tree roosts. (GL – Gareth Lang, RT - Rachel Taylor, CMC – Caitlin McCann, NL – Niall Lusby).

Tree	Date	Emergence / re-entry	Time	Surveyor	Weather conditions
T3	21/08	Emergence	20:15-22:10	CMC	START: Wind F2 NW, 100% cloud, light rain, 12.2˚C FINISH: Wind F1 NW, 50% cloud, no rain, 13.2˚C
T4	12/08	Emergence	20:28-22:20	CMC, RT	START: Wind F2 NE, 90% cloud, light rain, 14˚C FINISH: Wind F2 NE, 50% cloud, no rain, 12.8˚C
	29/08	Re-entry	04:15-06:30	RT, NL	START: Wind F1-2 NW, 50% cloud, no rain, 14.4˚C FINISH: Wind F1-2 NW, 60% cloud, no rain, 13.7˚C
T5	13/08	Re-entry	04:00-06:15	RT	START: Wind F0-1, 50% cloud, no rain, 9.8˚C FINISH: Wind F0-1, 10% cloud, no rain, 10.7˚C
	28/08	Emergence	20:00-21:45	GL	START: Wind F1-2 NW, 60% cloud, no rain, 16.3˚C FINISH: Wind F1-2 NW, 40% cloud, no rain, 15˚C
T6	13/08	Re-entry	04:00-06:15	CMC	START: Wind F0-1, 50% cloud, no rain, 9.8˚C FINISH: Wind F0-1, 10% cloud, no rain, 10.7˚C
T9	21/08	Emergence	20:15-22:10	RT	START: Wind F1-2 NW, 60% cloud, no rain, 16.3˚C FINISH: Wind F1-2 NW, 40% cloud, no rain, 15˚C
T23	21/08	Emergence	20:15-22:10	GL	START: Wind F2 NW, 100% cloud, light rain, 12.2˚C FINISH: Wind F1 NW, 50% cloud, no rain, 13.2˚C
	29/08	Re-entry	04:15-06:30	GL	START: Wind F1-2 NW, 50% cloud, no rain, 14.4˚C FINISH: Wind F1-2 NW, 60% cloud, no rain, 13.7˚C
T32	22/08	Re-entry	04:15-06:15	RT	START: Wind F0-1, 0% cloud, no rain, 12.2˚C FINISH: Wind F0-1, 90% cloud, no rain, 11.8˚C
	28/08	Emergence	20:00-21:45	RT	START: Wind F1-2 NW, 60% cloud, no rain, 16.3˚C FINISH: Wind F1-2 NW, 40% cloud, no rain, 15˚C
T35	22/08	Re-entry	04:15-06:15	CMC	START: Wind F0-1, 0% cloud, no rain, 12.2˚C FINISH: Wind F0-1, 90% cloud, no rain, 11.8˚C

	28/08	Emergence	20:00-21:45	NL	START: Wind F1-2 NW, 50% cloud, no rain, 14.4˚C FINISH: Wind F1-2 NW, 60% cloud, no rain, 13.7˚C

4.43 No bats were recorded emerging or re-entering the potential tree roosts during the surveys.

5 References

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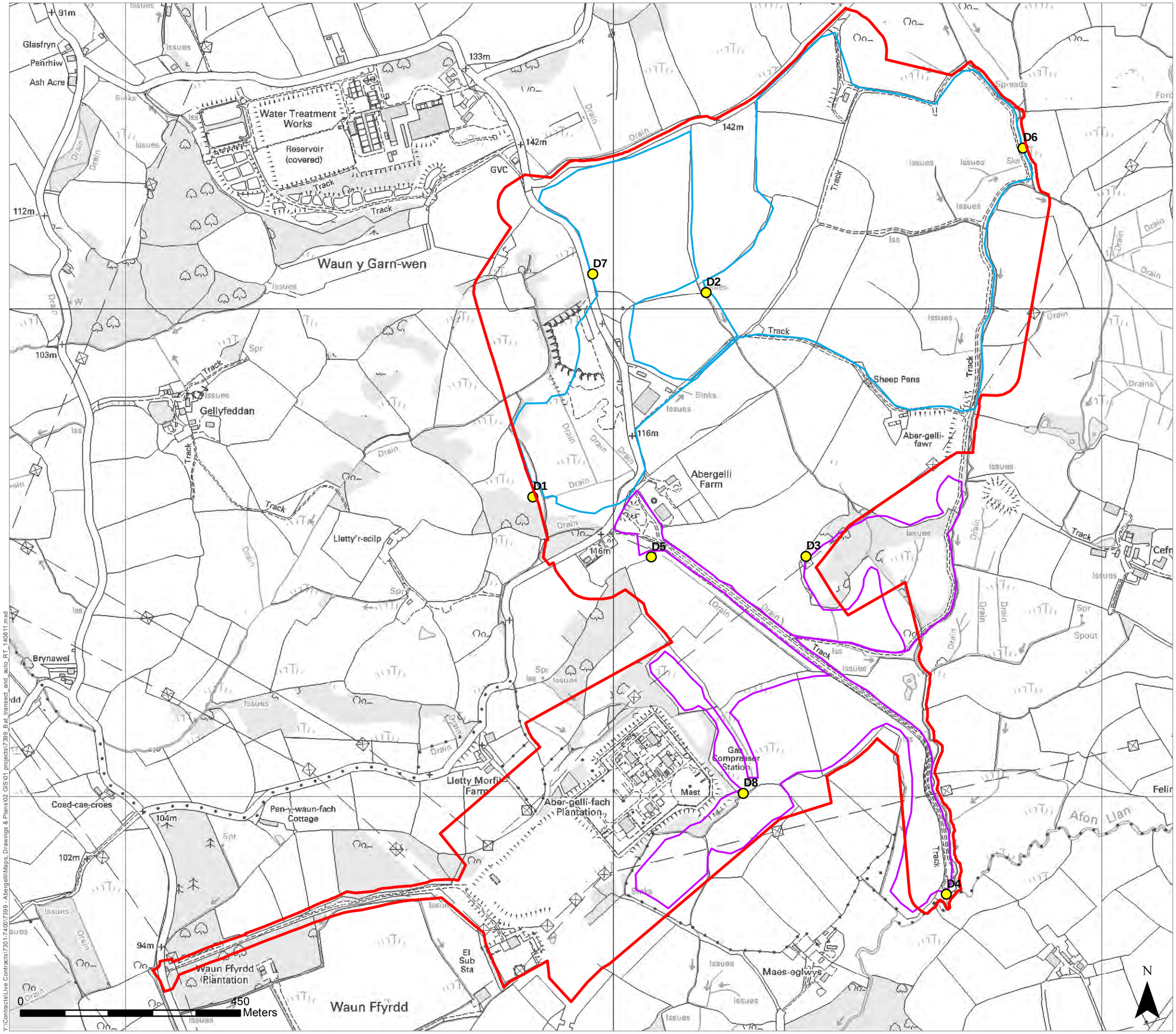
Appendix 1: Figures



LEGEND

- Survey Site boundary
- Bat detector locations
- North Transect
- South Transect

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Figure 1 - Bat transect route and automated detector locations

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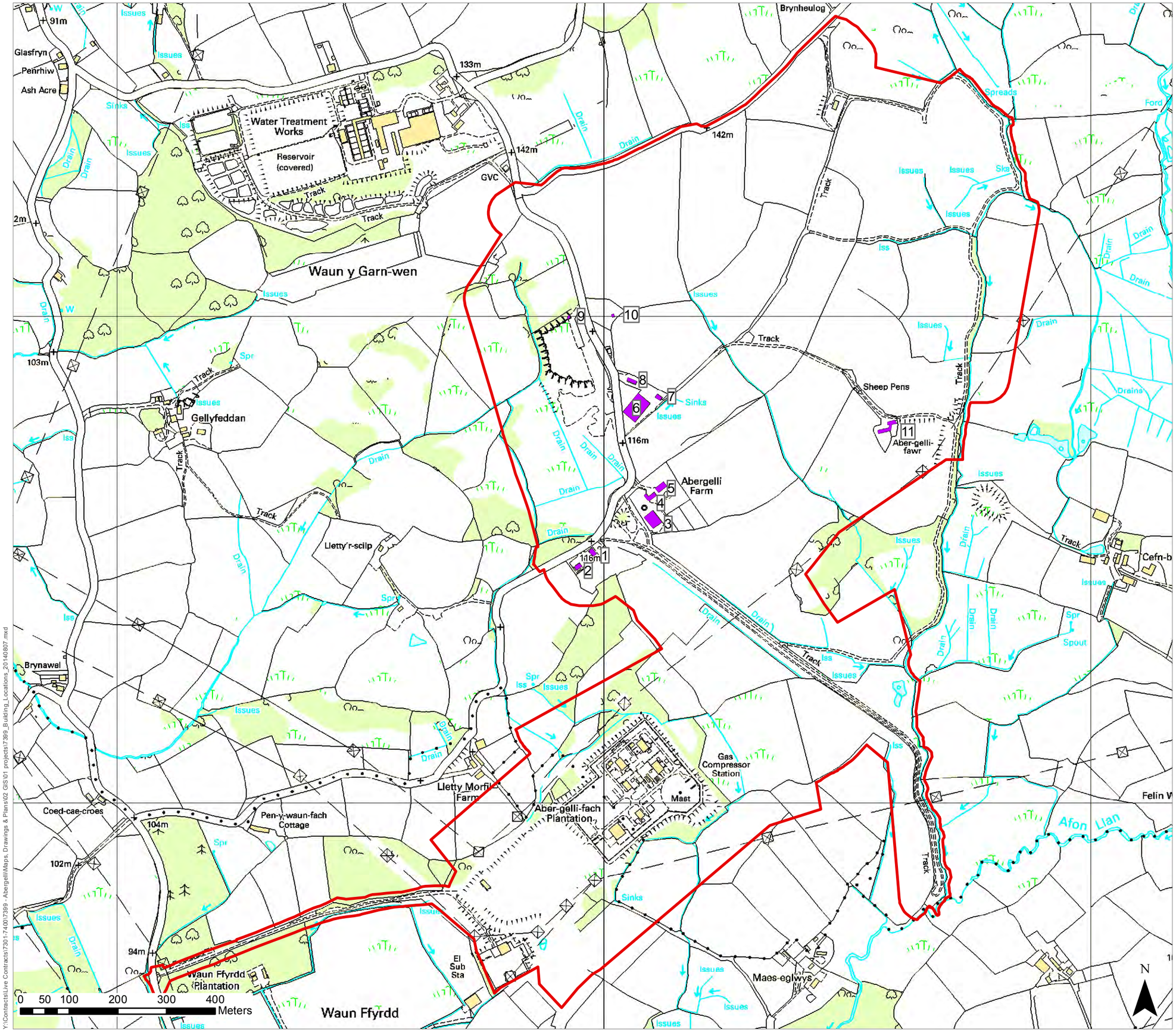

LEGEND

Survey Site Boundary

Buildings with potential for roosting bats

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Figure 2 - Buildings with potential for roosting bats and re□uirement for further survey

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LEGEND

Survey Site Boundary

Potential Tree Roost - BCT Category

- 1
- 1
- 2
- 3

0 50 100 200 300 400 Meters

N

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Figure 3a - Potential tree roost locations within accessible areas of the Survey Site

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LEGEND

Amended Survey Site boundary

Potential Tree Roost - BCT Category

- 1*
- 1
- 2

T9
T3
T4
T5
T6
T23
T35
T32

Water Treatment Works
Reservoir (covered)
Waun y Garn-wen
Gellyfeddan
Lletty'r-scilp
Sheep Pens
Aber-gelli-fawr
Abergelli Farm
Lletty Morfil Farm
Gas Compressor Station
Mast
Aber-gelli-fach Plantation
Pen-y-waun-fach Cottage
Coed-cae-croes
Waun Ffyrdd Plantation
El Sub Sta
Maes-eglwys
Waun Ffyrdd

0 45 90 180 270 360 Meters

N

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Figure 3b - Potential tree roost locations where emergence / re-entry surveys were carried out'

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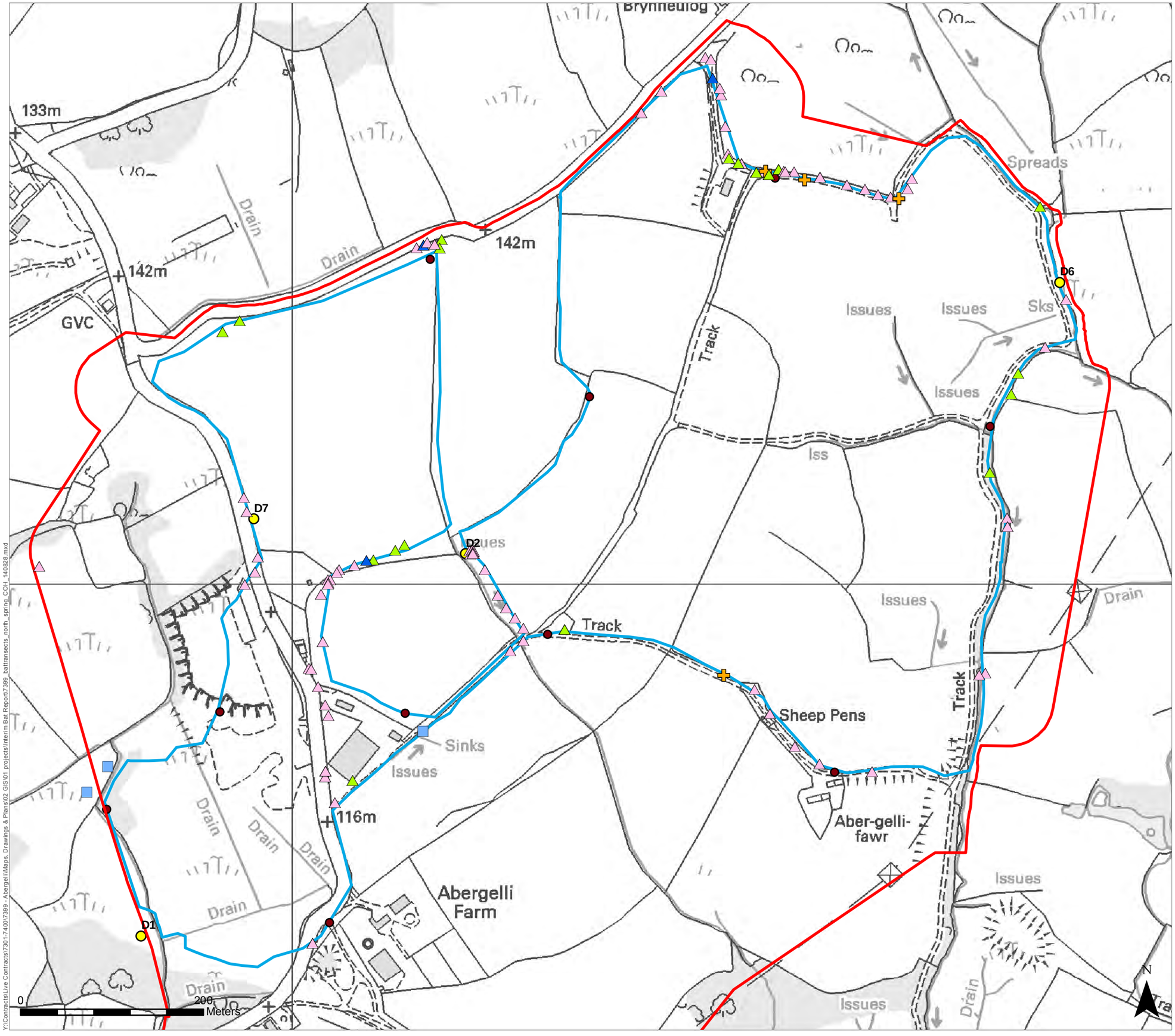

LEGEND

- Survey Site boundary
- Bat detector locations
- Stopping Points
- North Transect

Bat observations

- Common pipistrelle
- Soprano pipistrelle
- Common □Soprano pipistrelle
- Noctule
- Myotis species

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PROJECT TITLE
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Figure 4a - Number of passes plotted along northern walked transect. Spring 2014 □April-May□

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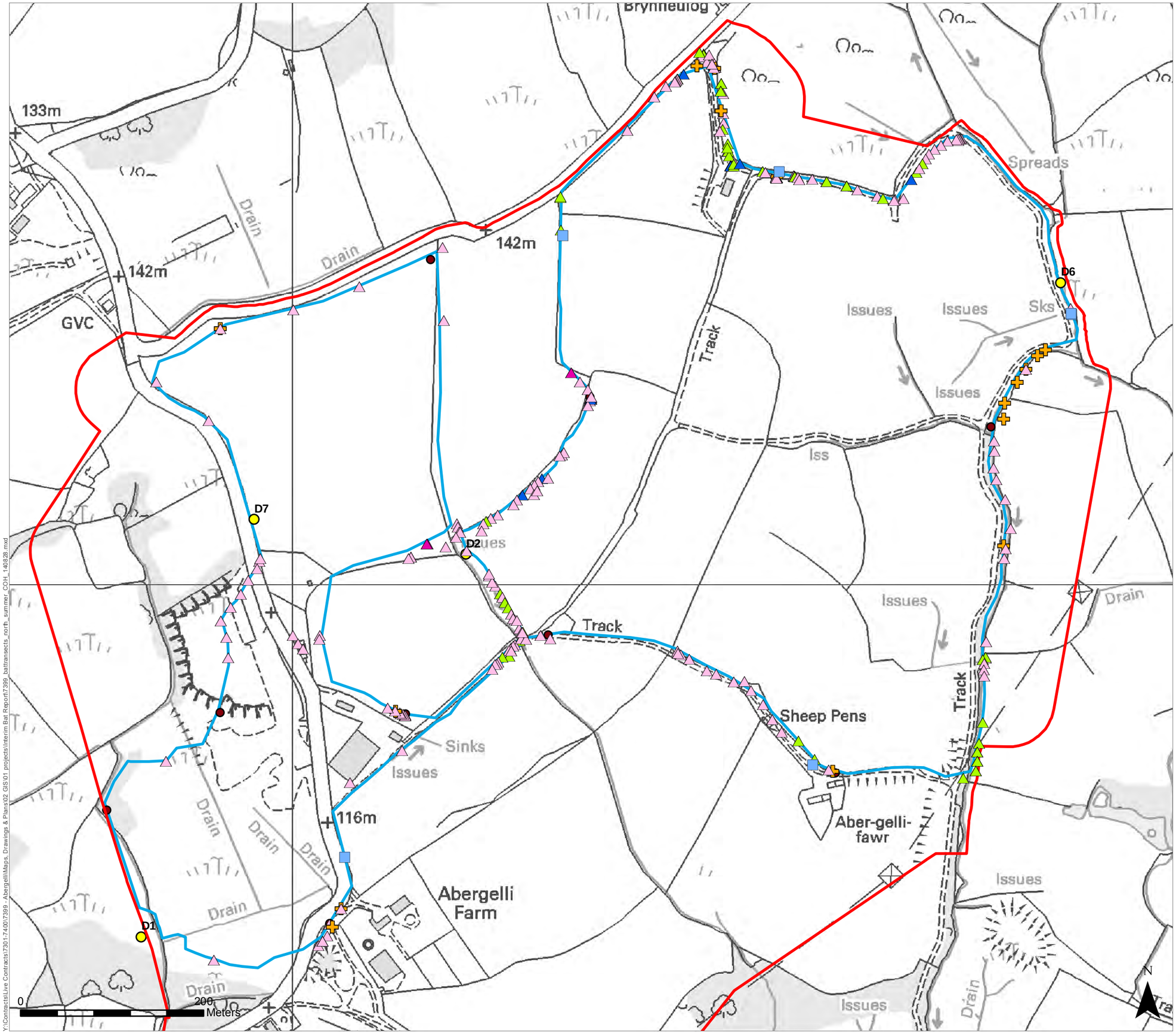

LEGEND

- Survey Site boundary
- Bat detector locations
- Stopping Points
- North Transect

Bat observations

- Common pipistrelle
- Soprano pipistrelle
- Common □Soprano pipistrelle
- Common □Nathusius□ pipistrelle
- Noctule
- Myotis species

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PROJECT TITLE
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DRAWING TITLE
Figure 4b - Number of passes plotted along northern walked transect. Summer 2014 □June-August□

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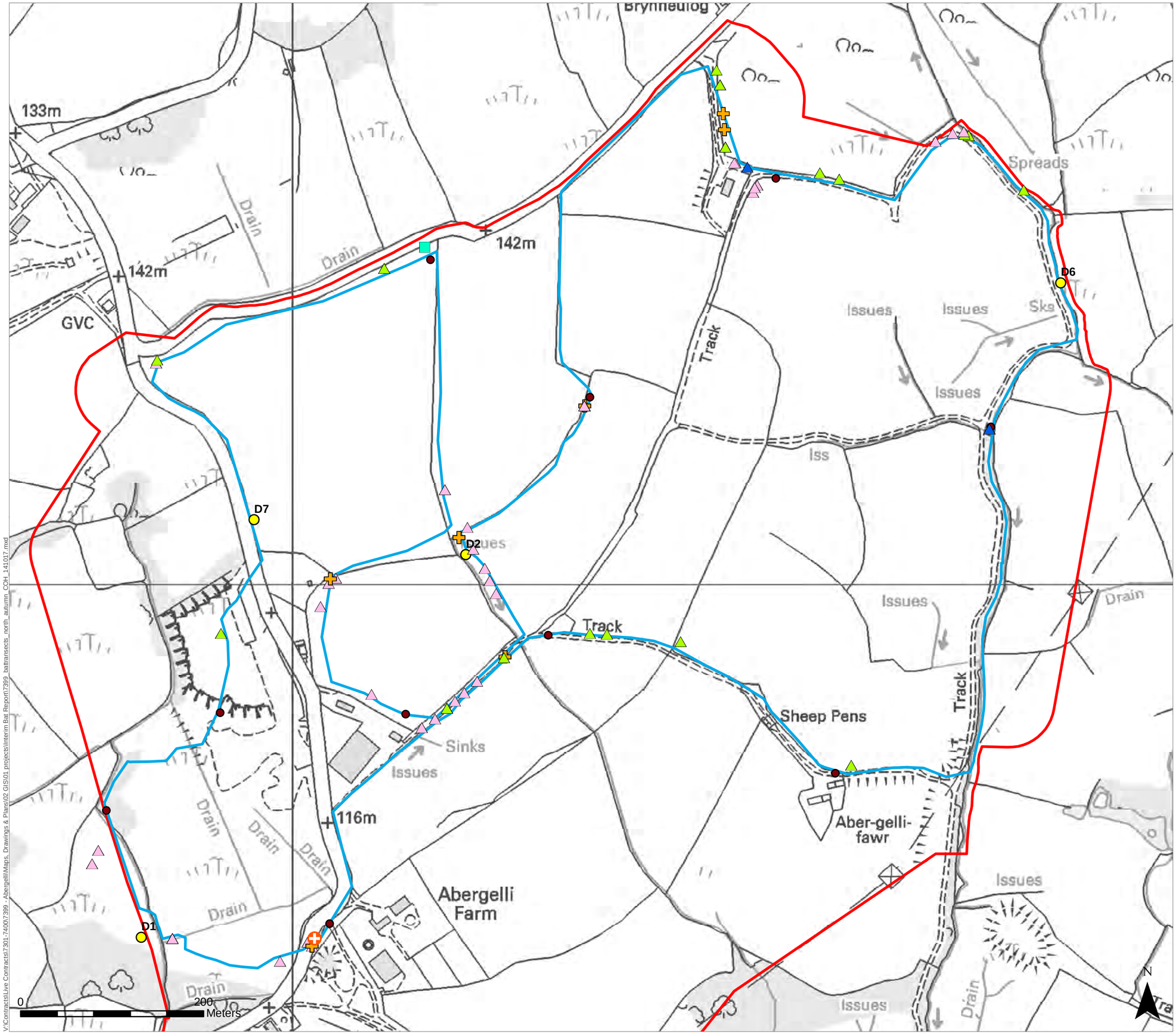

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LEGEND

- Survey Site boundary
- Bat detector locations
- Stopping Points
- North Transect

Bat observations

- Long eared bat sp.
- Common pipistrelle
- Soprano pipistrelle
- Common / Soprano pipistrelle
- Noctule / Leisler's bat
- Myotis species

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PROJECT TITLE

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DRAWING TITLE

Figure 4c - Number of passes plotted along northern walked transect. Autumn 2014 (September-October)

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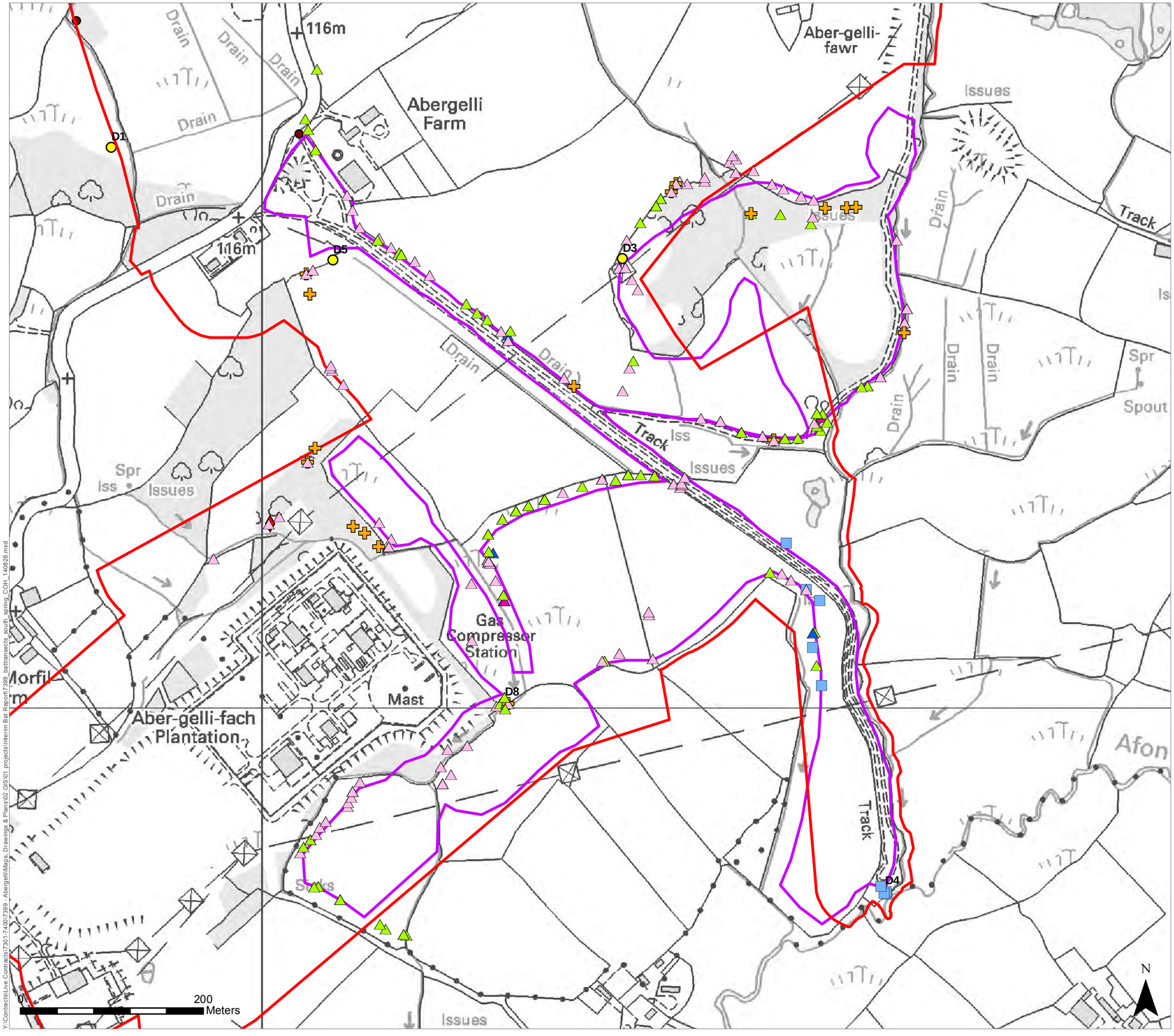

LEGEND

- Survey Site boundary
- Bat detector locations
- Stopping Points
- South Transect

Bat observations

- Common pipistrelle
- Soprano pipistrelle
- Common □Soprano pipistrelle
- Common □Nathusius□ pipistrelle
- Noctule
- Myotis species

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PROJECT TITLE
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DRAWING TITLE
Figure 5a - Number of passes plotted along southern walked transect. Spring 2014 □April-May□

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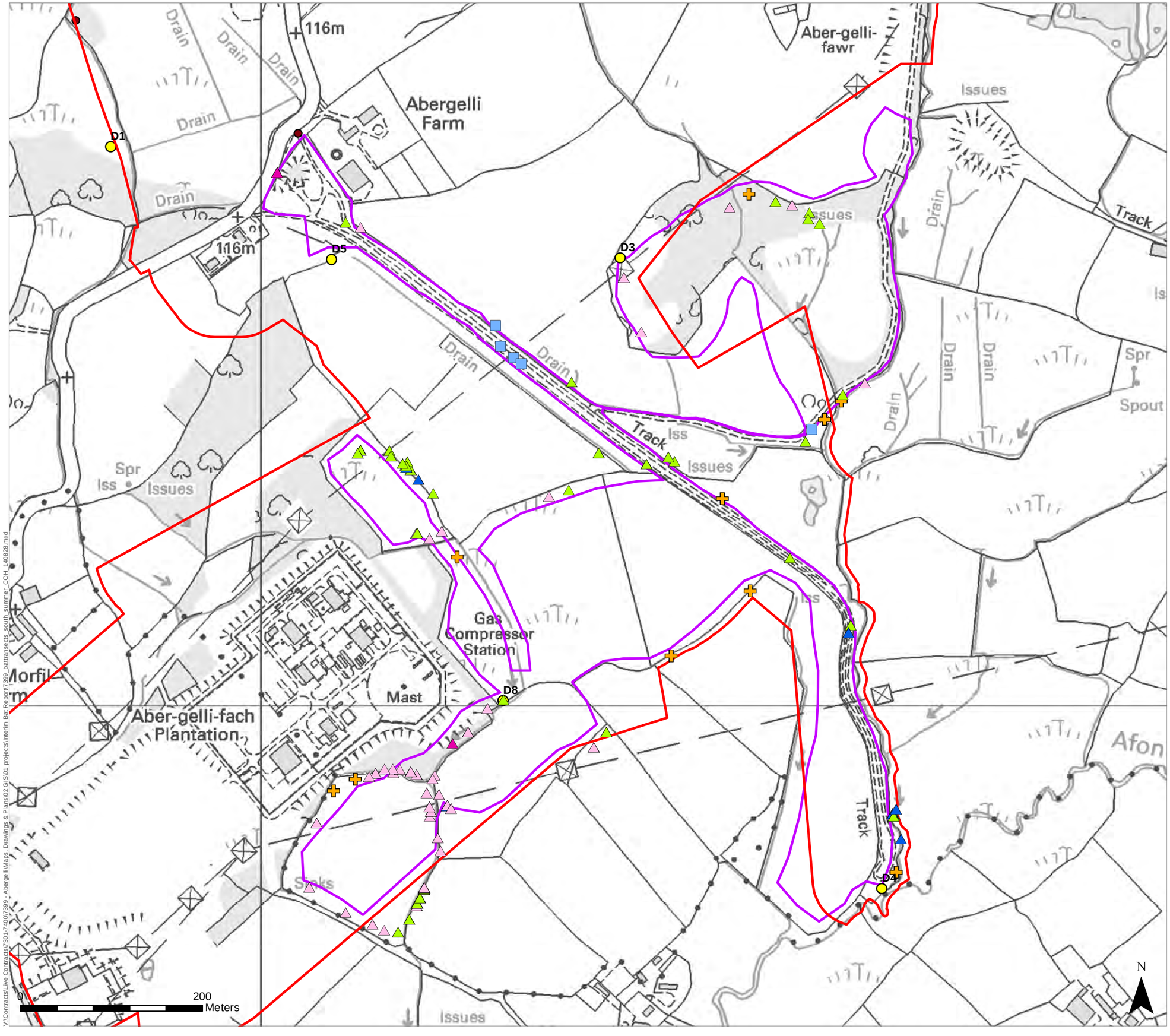

LEGEND

- Survey Site boundary
- Bat detector locations
- Stopping Points
- South Transect

Bat observations

- Lesser horseshoe bat
- Common pipistrelle
- Soprano pipistrelle
- Common / Soprano pipistrelle
- Common / Nathusius' pipistrelle
- Noctule
- Myotis species

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PROJECT TITLE

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Figure 5b - Number of passes plotted along southern walked transect. Summer 2014 (June-August)

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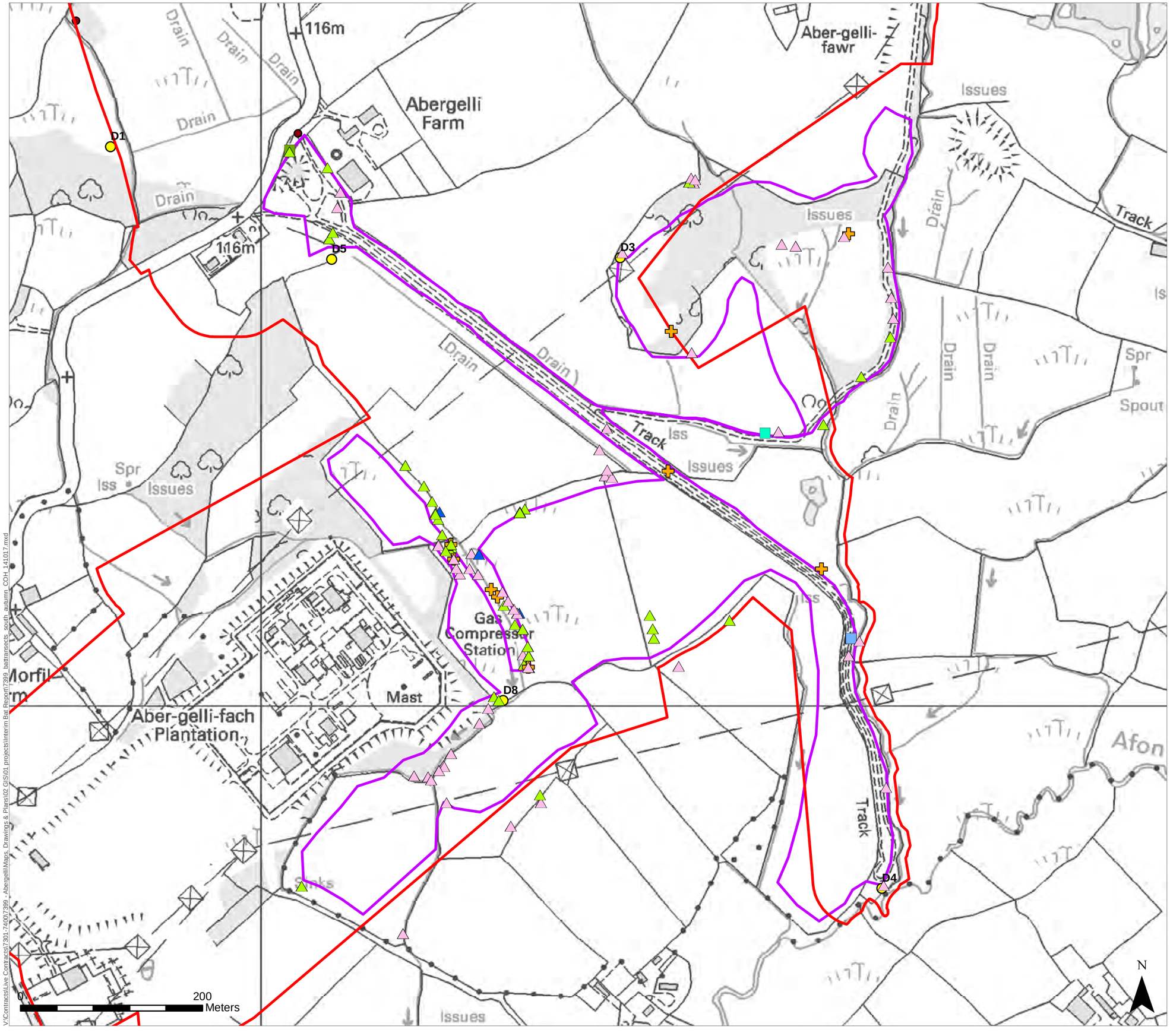

LEGEND

- Survey Site boundary
- Bat detector locations
- Stopping Points
- South Transect

Bat observations

- Leisler's bat
- Noctule
- Common pipistrelle
- Soprano pipistrelle
- Common / Soprano pipistrelle
- Noctule / Leisler's bat
- Myotis species

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PROJECT TITLE

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Figure 5c - Number of passes plotted along southern walked transect. Autumn 2014 (September-October)

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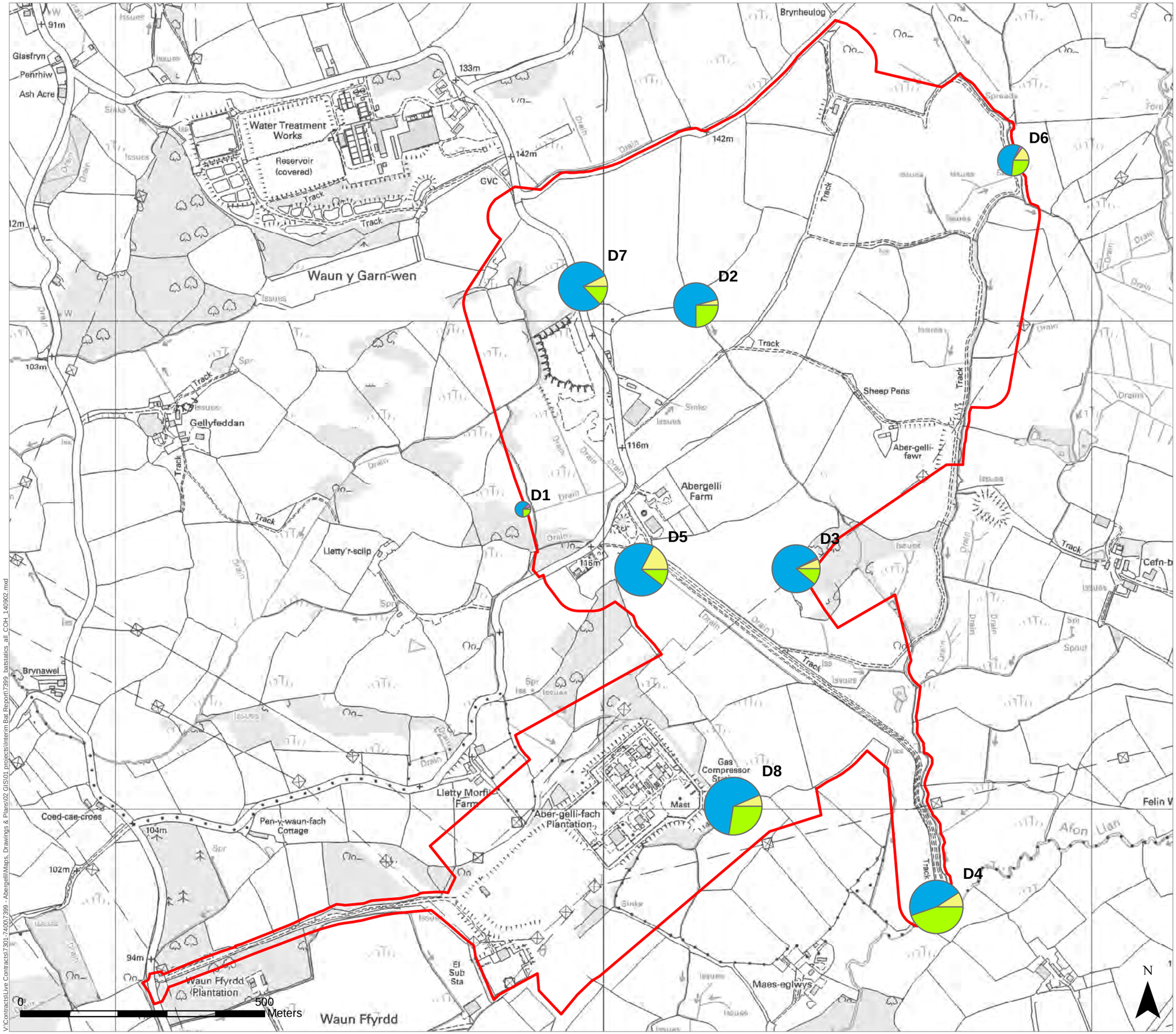

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LEGEND

- Survey Site boundary
- Relative acitivy (b/h) at automated locations
- *Myotis* species
- Noctule
- Common pipistrelle
- Soprano pipistrelle

Circle size proportional to B/h

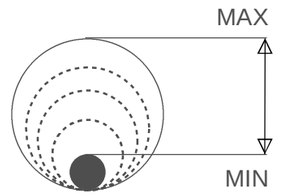

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Figure 6 - Proportion of bat activity (by species) at automated survey locations in 2014

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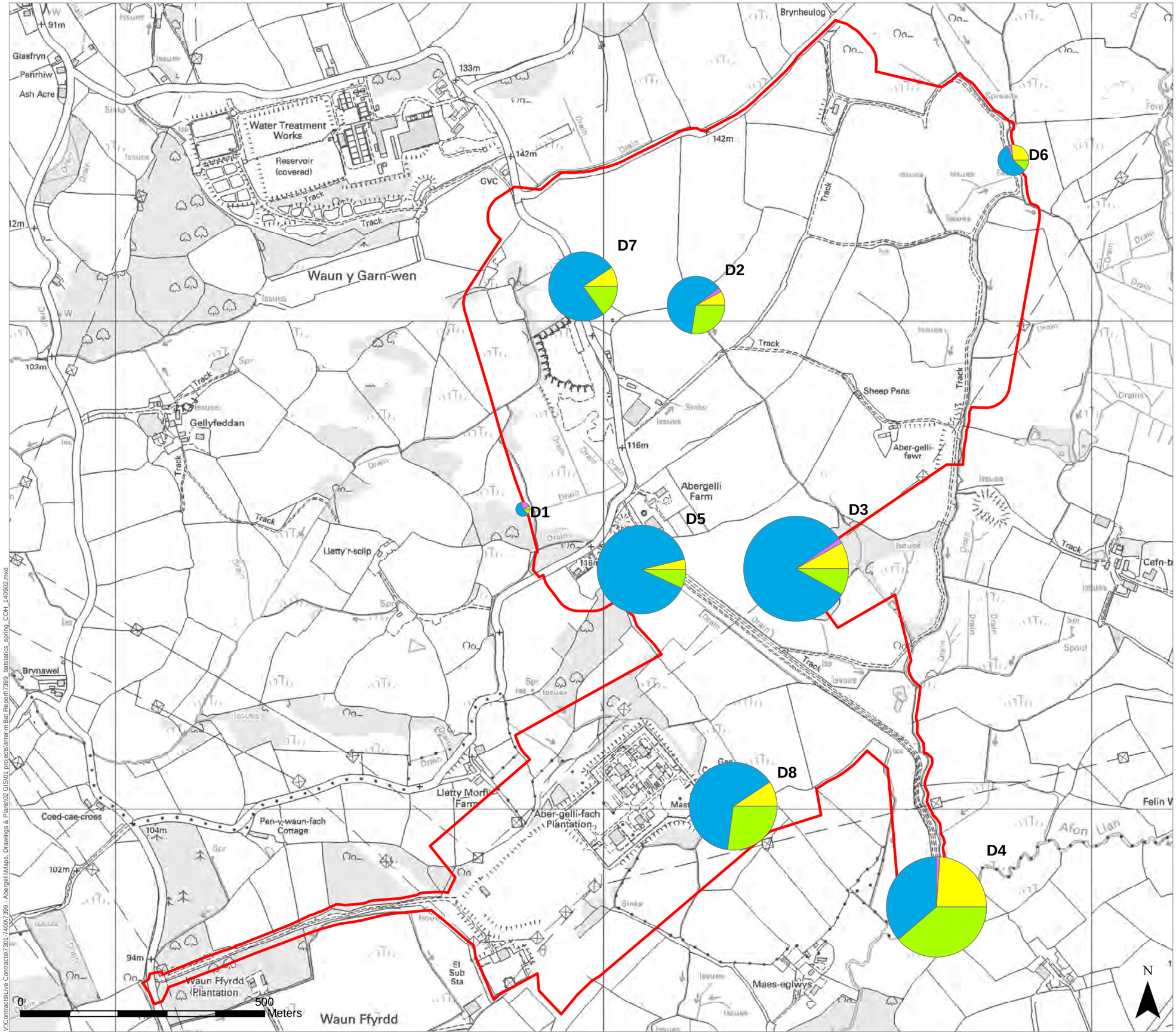

LEGEND

- Survey Site boundary
- Relative acitivy (b/h) at automated locations
- *Myotis* species
- Noctule
- Common pipistrelle
- Soprano pipistrelle

Circle size proportional to B/h

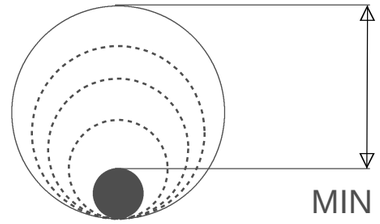

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Figure 7 - Proportion of bat activity (by species) at automated survey locations in Spring 2014 (April-May)

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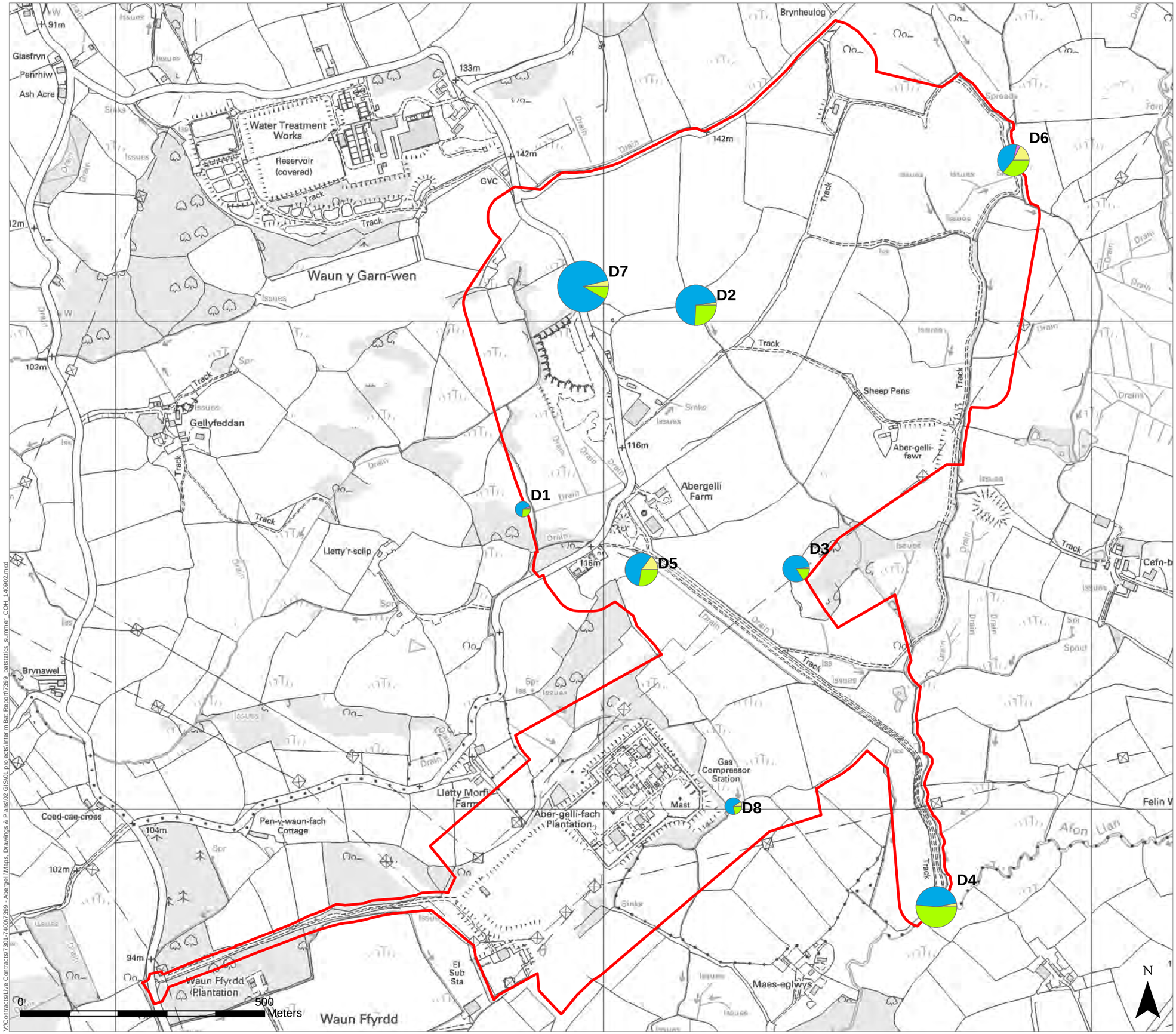

LEGEND

- Survey Site boundary
- Relative acitivy (b/h) at automated locations
- *Myotis* species
- Noctule
- Common pipistrelle
- Soprano pipistrelle

Circle size proportional to B/h

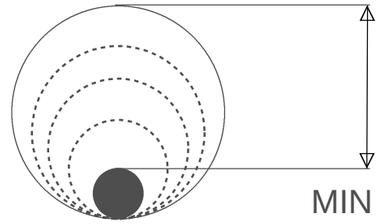

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Figure 8 - Proportion of bat activity (by species) at automated survey locations in Summer 2014 (June-August)

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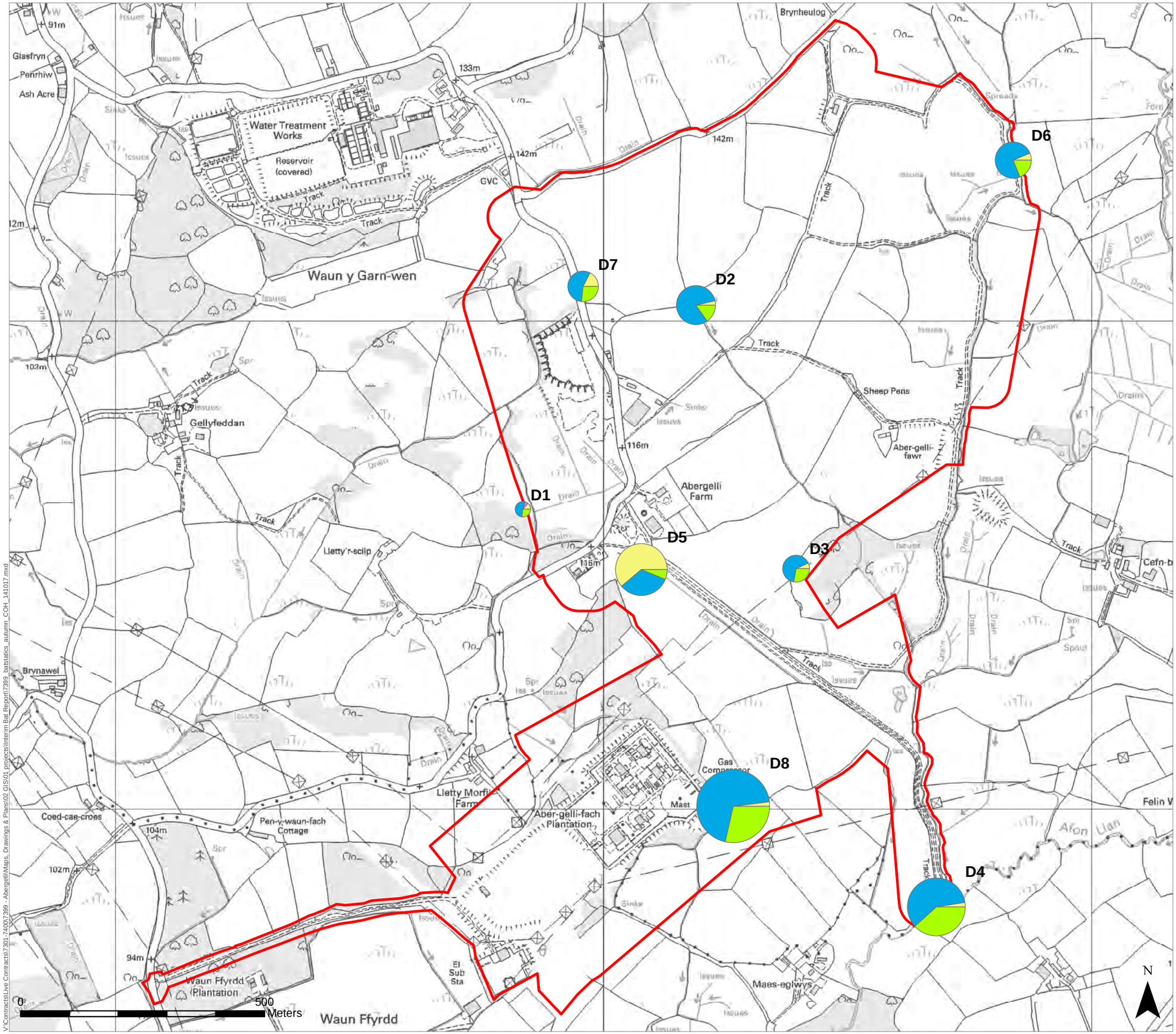

LEGEND

- Survey Site boundary
- Relative acitivy (b/h) at automated locations
- *Myotis* species
- Noctule
- Common pipistrelle
- Soprano pipistrelle

Circle size proportional to B/h

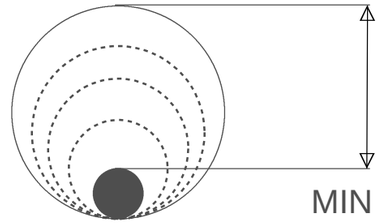

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Figure 9 - Proportion of bat activity (by species) at automated survey locations in Autumn 2014 (September-October)

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Appendix 2: Materials and Data Analysis

Use of Bat Detectors

The bat detectors used for automated surveys were Wildlife Acoustics SM2Bat and SM2Bat+. These are 16-bit full-spectrum bat detectors with internal storage and computing power that allows the unit to be used as a remote fixed-point detector. Recording is triggered by ultrasound, such as bat calls, in the vicinity of the detector, and any bat calls are stored as sound files on an internal SD card.

SM2 detectors were placed in water-proof boxes connected by a 10 m cable to an omnidirectional Wildlife Acoustics SMX-US microphone. The microphones were attached to a telescopic pole at 3.5 m above ground level on, and angled at 45° to the ground to allow water to run off, as recommended by the manufacturers.

For walked transect surveys and emergence/re-entry surveys, surveyors used two different bat detectors on each survey to supplement visual observations: a Batbox Duet detector for listening to bat calls from the combined heterodyne/frequency division output and an Anabat (SD1 or SD2) detector or Wildlife Acoustics Echo Meter 3 (EM3) for recording calls for subsequent identification.

Assessment of data from bat detectors

The likelihood of detecting bats acoustically depends on the propagation of sound through air, the characteristics of bat calls, and the way sound is received and processed by the bat detector. Recent unpublished collaborative research by BSG Ecology and Bristol University has shown that bat detectors detect calls from some species of bats at greater distances than others. In general, bats with calls that can be detected over greater distances are larger bats which use calls that are both high amplitude and low frequency such as the noctule and the most difficult to detect are those which use low amplitude calls, such as the brown long-eared bat and barbastelle, or high frequencies, such as horseshoe bats (Rhinolophus spp.). Table 1 shows the mean frontal detection range of SM2 detectors for echolocation calls from UK bat species based on research undertaken by BSG Ecology in collaboration with Bristol University.

Table 1: Estimated mean frontal detection ranges for selected bat species using SM2 detectors at standard 'field' settings and converting to zero-crossing recordings.

Species	Mean Frontal Detection Range (m)
Noctule	47
Soprano pipistrelle	17
Myotis sp.[5]	6
Long-eared bat	4
Lesser horseshoe bat	5

Data Analysis

Bat Call Identification

Recorded bat calls were analysed using Analook software to confirm the identity of the bats present. Where possible, the bat was identified to species level. For species of long-eared bats records were not identified to species level due to the overlapping call parameters of each species but were assumed to refer to brown long-eared bats. It is unlikely that grey long-eared bat (*Plecotus austriacus*) occurs in Swansea, given the species' known distribution and rarity (Harris & Yalden, 2008). Species of the genus *Myotis*[6] were grouped together as many of the species have overlapping call parameters, making species identification problematic (BCT, 2012).

For Pipistrelle species the following criteria, based on measurements of peak frequency, were used to classify calls:

Common pipistrelle	≥42 and <49 kHz
Soprano pipistrelle	≥51 kHz
Nathusius' pipistrelle	<39 kHz

[5] Refers to any bat species of the genus *Myotis*.

[6] This genus includes several regularly occurring species in the UK that include, Natterer's bat, Daubenton's bat *Myotis daubentonii*, Brandt's bat *Myotis brandtii*, whiskered bat and Bechstein's bat *Myotis bechsteinii*.

Common pipistrelle / Soprano pipistrelle ≥49 and <51 kHz

Common pipistrelle / Nathusius' pipistrelle ≥39 and <42 kHz

Bat calls which could not be ascribed to any of these categories were not used in the analysis.

Calculation of relative activity

The SM2 detectors were configured to record above the level of ambient noise, such as from wind or rain, and set to define a bat pass (B) as a call note of >2ms which is separated from another by more than one second.

AnalookW (Version 3.8, 2010) software was used for all analysis of bat calls. It enables analysis of the relative activity of different species of bats by counting the number of bat passes (B) recorded within a unit of time – hour (h) was used. More than one pass of the same species was counted within a sound file if multiple bats were recorded calling simultaneously. During analysis of sound files, it was possible to estimate the minimum number of bats recorded on individual sound files but not whether consecutive sound files had recorded, for example, a number of individual bats passing as they commute to a feeding habitat or one bat calling repeatedly as it flies up and down the edge of forestry. Although relative abundance cannot be estimated from this analysis, the number of bat passes does reflect the relative importance of a feature/habitat to bats by assigning a level of bat activity that is associated with that feature, regardless of the type of activity.

Analysis by sunset-sunrise times

As part of the analysis of nocturnal patterns of behaviour for bats the data were split into discrete time periods relating to their proximity to sunset or sunrise. The time categories (time codes: TC) were as follows:

TC 0 = before sunset

TC 1 = 0-20 min after sunset

TC 2 = 20-40 min after sunset

TC 3 = 40-60 min after sunset

TC 4 = 60-80 min after sunset

TC 5 = 80-100 min after sunset

TC 6 = 100-120 min after sunset

TC 7 = Middle of night (varies across seasons)

TC 8 = 120-100 min before sunrise

TC 9 = 100-80 min before sunrise

TC 10 = 80-60 min before sunrise

TC 11 = 60-40 min before sunrise

TC 12 = 40-20 min before sunrise

TC 13 = 20-0 min before sunrise

For each of these categories B/h was calculated to allow a comparison between the activity level recorded in different time periods and TC7 was corrected to allow for variation in night length throughout the survey season.

Appendix 3: Building Descriptions

Internal/External inspection

The building layouts and referencing as described in the following section is illustrated in Appendix 1: Figures. In order to assist with the building descriptions, each building has been given a letter/number combination identifier.

B1

This is a two storey domestic property approximately 40-50 years old. It sits east to west on the Survey Site, with footprint dimensions 20 m x 8 m. The roof is constructed from hanging slate tiles and has a pronounced pitch, with boxed-in eaves on the gable ends. There are sections of lead flashing around the chimneys and eaves. There are opportunities for bat roosting in the following external features:

- Under gaps in the eaves where boxed in sections have sagged or are broken;
- Under lead flashing;
- Under broken or missing hanging slate tiles; and
- In space under ridge tiles.

No internal inspection of this building was undertaken as it is currently inhabited and access was not granted.

The building is considered to have moderate bat roosting potential. Although there are a number of features with potential to be used as bat roosts, there is no evidence that it is currently being utilised as a roost.

N.B. A shed in close proximity to B1 is constructed of wood cladding and has an open soffit into its roof space under felt. Owing to its high exposure and well-lit features, it was also deemed to have low potential for bat roosting potential.

B2

This property is a two storey domestic abode, approximately 40-50 years old but sitting 90° N of B1. This is an identical build to B1 but varies in specific features for roosting potential. There are opportunities for bat roosting in the following external features:

- Under broken or missing hanging slate tiles on south facing roof and water heater to the east side of the property;
- Under lead flashing around entrance, on the roof and gable ends;
- Under lifted ridge tiles where lifted; and
- In gaps between boxed eaves and flashing.

No internal inspection of this building was undertaken as it is currently inhabited and access was not granted.

The building is considered to have moderate bat roosting potential. Although there are a number of features with potential to be used as bat roosts, there is no evidence that is currently being utilised as a roost.

B3

This building is a corrugated metal framed agricultural building, its footprint dimensions are approximately 30 mx20 m and it is situated on the south side of the Survey Site at the top of a track leading to a gallops track. The building is single storey with lower block curtain walling and with low profile metal sheet on the upper side of the walls and roof. It is currently being utilised as a stable for horses.

Although there is lead flashing below the corrugated metal roof, upon internal inspection, an exposed interior with a lack of suitable roosting features means this building is considered to have negligible bat roosting potential. The building was however, considered to have some feeding potential.

B4

This is a stable block of stone, a solid wall construction, one storey tall. The roof is pitched with felt lined hanging tiles concluding in boxed eaves. There is considerable over hang in the boxed eaves. On internal inspection of the building there is a false ceiling made of plywood.

- Room with partition and false ceiling, very dark;
- Gaps above door frames;

- Cracks in existing stable walls;
- Space between breeze block gable ends (roof); and
- Several open windows (1m in width, opening 1ft wide) and garage doors often ajar.

B4 is a confirmed roost. There were stains and droppings (pipistrelle sp., long-eared bat sp. and lesser horseshoe) found upon internal investigation in one room of the stable block, and the majority of the building lends itself to roosting and feeding potential.

B5

This is a two storey terraced house approximately 50-60 years old. The roof is constructed from hanging slate tiles and has a pronounced pitch, with boxed-in eaves on the gable ends. There are sections of lead flashing around the chimneys and eaves. There are opportunities for bat roosting in the following external features:

- Under gaps in the eaves where boxed in sections have sagged or are broken;
- Under lifted lead flashing;
- Under broken or missing hanging slate tiles; and
- In space under ridge tiles.

No internal inspection of this building was undertaken as it is currently inhabited and access was not granted.

The building is considered to have moderate bat roosting potential. Although there are a number of features with potential to be used as bat roosts, no signs of roosts were found.

B6

This building is a corrugated metal framed agricultural building with lower block curtain walling and with low profile metal (and some plastic) sheet on the upper side of the walls and roof. The building is currently being utilised as storage for farm equipment such as disused vehicles & tools and hay bales. The footprint dimensions are roughly 30 m x 20 m and it is one storey tall. The area behind the hay bales at the far end of the building which is being used as stables for several horses could not be accessed for further investigation.

No evidence of bats roosting was found during the internal/external search and no potential roost features were identified. Therefore this building is considered to have negligible potential for roosting bats.

B7

This is a single storey brick outbuilding with a corrugated metal roof. The building has several small vents and cavity walls. There are opportunities for bat roosting in the following features:

- Accessible cavity walls through external vents.

No evidence of bat roosting was found during the internal/external search and therefore this building is considered to have low potential for roosting bats.

B8

This building is comprised of three sections. The first two are part of the original structure which is over 100 years old (est. 1900) and is constructed from brick walls with a corrugated, pitched metal roof with a series of fly ins and open access points on the roof apex. There is also a second storey tower on the north end of the building. The far north section is a single storey porta cabin style building approximately 4 m x 2 m with open windows and doors. There are opportunities for bat roosting in the following features:

- Gaps under the corrugated metal roof;
- In the stone vents/access points at the apex of the structure;
- In the series of lead flashing found around the top of the tower portion of the main brick building;
- Multiple fly-in opportunities in both storeys; and
- In the tower block, historic roost evidence, several small piles of disintegrated droppings, identified as long-eared bat *Plecotus auritus* droppings and at least one Pipistrelle sp. in both first and second storeys.

B8 is a confirmed roost. There were droppings from at least two bat species found upon internal investigation of both storeys and the majority of the building lends itself to roosting and feeding potential.

B9

This building is a single storey breeze block shed of recent build with a footprint of 3 m x 3 m. The building has solid walls and a flat corrugated metal roof. No evidence or potential or actual roost points were noted upon internal or external investigation.

Owing to the lack of signs and potential roosting features this building is considered to have negligible bat roosting potential.

B10

This property is a single storey, one-room brick outbuilding with footprint dimensions of 4 m x 3 m. The building has no doors or windows and the roof is concrete and flat with the internal ceiling exhibiting cracks and fissures. The brick walls are cavity walls with many missing bricks and openings. Although there is no door, there is an east facing entrance. Upon internal investigation two Pipistrelle sp. droppings were found on the floor. There are opportunities for bat roosting in the following features:

- Cavity walls with missing bricks;
- East facing entrance, fly-in;
- Cracked ceiling; and
- Also, bat droppings found in building.

This building is a confirmed roost owing to the discovery of bat droppings and a variety of optimal features for roosting potential.

B11

This is a derelict stone cottage over 100 years old. Its footprint dimensions are 15 m x 10 m. There are two distinct standing walls and there is no roof remaining. The walls are rubble filled and many stones are missing. There are opportunities for bat roosting in the following features:

- Missing stones leading to rubble filled internal wall.

Because the structure sits in a cluster of trees and has some notable roosting features, this building is considered to have moderate roosting potential.

Appendix 4: Photographs of Buildings



Photograph 1: Buildings 1 and 2. These houses are the same design.



Photograph 2: Building 3.



Photograph 3: Building 3.



Photograph 4: Building 4.



Photograph 5: Building 4.



Photograph 6: Building 5.



Photograph 7: Building 6.



Photograph 8: Building 7.



Photograph 9: Building 7.



Photograph 10: Building 8 – tower.



Photograph 11: Building 8 – droppings in tower.



Photograph 12: Building 8 – ground floor.



Photograph 13: Building 9.



Photograph 14: Building 9.



Photograph 15: Building 10.



Photograph 16: Building 10.



Photograph 17: Building 11.



Photograph 18: Building 11 – Wall structure.

Appendix 5: Photographs of Trees

Photograph 1: Tree 3.



Photograph 2: Tree 4.



Photograph 3: Tree 5.



Photograph 4: Tree 6



Photograph 5: Tree 9.



Photograph 6: Tree 23.



Photograph 7: Tree 32



Photograph 8: Tree 35.



Appendix 3.9

Dormouse Survey Report

Abergelli Power Project
Dormouse Survey Report

Abergelli Power Limited
May 2018

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1. Introduction

1.1 Introduction

1.1.1 AECOM was commissioned to undertake a suite of ecological survey work to inform the Abergelli Power Project (the "Project").

1.1.2 The Project Site is located near to the village of Felindre, Swansea, as shown in Figure 1, and the central grid reference for the Project Site is SN65280143. A full description of the development is provided in Chapter 3 (Project and Site Description) of the Environmental Statement (ES).

1.1.3 The Preliminary Ecological Appraisal Report (ES Appendix 8.1) identified that surveys for hazel dormouse *Muscardinus avellanarius* hereafter called 'dormouse' or 'dormice', were required at the Project Site.

1.1.4 This baseline report describes the status of dormouse within the dormouse survey area and makes initial indications of potential effects and outlines initial recommendations for further surveys, mitigation and enhancement.

1.1.5 The dormouse survey area encompasses all suitable and accessible areas of woodland, hedgerows and scrub within proximity of and within the Project Site boundary, as shown on Figure 1 and Figure 2.

1.1.6 Previous surveys have been undertaken by BSG Ecology which are presented in the ES Appendix 8.15.

a) Objectives of the Study

1.1.7 The objectives of this study were:

- To identify any designated nature conservation sites within or in the vicinity of the Project Site boundary that have the potential to support dormouse;
- To identify any known records and/or populations of dormouse in the vicinity of the Project Site boundary;
- To record and map evidence of dormouse activity;
- To make a population estimate of dormouse within the Project Site;
- To make an initial ecological assessment of the Project Site in respect to dormouse;
- To highlight any initial potential ecological constraints in respect to dormouse;
- To outline further survey work that may be required; and,
- To make initial suggestions for mitigation, compensation and enhancement of the natural features identified within the Project Site in respect to dormouse.

1.2 Legislation

1.2.1 The dormouse is a fully protected species under both United Kingdom and European law. It is also included in the Environment Act (Wales) 2016 Section 7 List as a species of principal importance. This is a brief summary of the legislation and is not to be regarded as a definitive legal opinion. When dealing with individual cases, the client is advised to consult the full texts of the relevant legislation and obtain further legal advice.

1.2.2 The dormouse was given partial protection under the Wildlife and Countryside Act (WCA) 1981. Schedule 5 of this Act was amended in 1988 making it a fully protected species. Protection is also afforded by Schedule 2 of the Conservation (Natural Habitats &c.) Regulations 1994, making the dormouse a European Protected Species. These two pieces of legislation operate in parallel, although there are some small differences in scope and wording.

1.2.3 The WCA 1981 transposes into UK law the Convention on the Conservation of European Wildlife and Natural Habitats (commonly referred to as the 'Bern Convention'). The 1981 Act has been amended several times, most recently by the Countryside and Rights of Way ((CRoW)) Act 2000, which added 'or recklessly' to Section 9(4)(a) and (b). Dormice are listed on Schedule 5 of the 1981 Act, and are therefore subject to the provisions of Section 9, which makes it an offence to:

- Intentionally kill, injure or take a dormouse ((Section 9(1)));
- Possess or control any live or dead specimen or anything derived from a dormouse ((S 9(2))) (unless it can be shown to have been legally acquired);
- Intentionally or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection by a dormouse ((S 9(4)(a))); and,
- Intentionally or recklessly disturb a dormouse while it is occupying a structure or place which it uses for that purpose ((S9(4)(b))).

1.2.4 The Conservation (Natural Habitats &c.) Regulations (known as the Habitats Regulations) transpose into UK law Council Directive 92/43/EEC of 21st May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora (often referred to as the 'Habitats ((and Species)) Directive'). Dormice are listed on Annex IV ('European Protected Species') of the Directive meaning that member states are required to put in place a system of strict protection as outlined in Article 12; this is done through inclusion on Schedule 2 of the Regulations. Regulation 39 makes it an offence to:

- Deliberately capture or kill a dormouse (Regulation 39(1)(a));
- Deliberately disturb a dormouse (R. 39(1)(b));
- Damage or destroy a breeding site or resting place of a dormouse (R. 39(1)(d)); and/or,
- Keep, transport, sell or exchange, or offer for sale or exchange a live or dead dormouse or any part of a dormouse (R. 39(2)).

1.3 Quality Assurance

1.3.1 This survey and subsequent report was undertaken in line with AECOM's Integrated Management System (IMS). Our IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the international standards BS EN ISO 9001:2008 and 14001:2004 and BS OHSAS 18001:2007. In addition, our IMS requires careful selection and monitoring of the performance of all sub-consultants and contractors.

1.3.2 All AECOM Ecologists who worked on this project are members of (at the appropriate level) the Chartered Institute of Ecology and Environmental Management (CIEEM) and follow their code of professional conduct (CIEEM, 2013) when undertaking ecological work.

2. Methodology

2.1 Desk study

2.1.1 The objective of the desk study is to review the existing information available in the public domain concerning species and habitats to identify the following:

- Internationally and nationally designated sites for dormouse, up to 2 km from the Site using the Multi Agency Geographic Information for the Countryside (MAGIC) website (NE, 2017);
- Dormouse records and records of locally designated sites for dormouse up to 2 km from the Site, using the South East Wales Biodiversity Records Centre (SEWBReC);
- Dormouse within the Section 7 list of Principal Importance for Conservation of Biological Diversity in Wales;
- Ancient Semi-Natural Woodland (ASNW), Plantation on Ancient Woodland Site (PAWS), Restored Ancient Woodland Site (RAWS) or Ancient Woodland Site of Unknown category (AWSU) within or adjacent to the Project Site using Ancient Woodland Inventory 2011 dataset downloaded from the Lle website (WG and NRW, 2017);
- Local knowledge of dormouse species and habitats from the County Ecologist;
- Local knowledge of dormouse species and habitats from the South Wales Mammal Group (SWMG) and,
- Features of ecological interest surrounding the Project Site, nearby areas of ecological interest and features connecting these habitats (hedgerows, watercourses, railway lines) using aerial photographs and Ordnance Survey (OS) maps.

2.1.2 The reports of previous surveys undertaken by BSG Ecology were provided by the client and were reviewed.

2.2 Dormouse Survey

2.2.1 Dormouse surveys were undertaken paying due regard to the Dormouse Conservation Handbook (Bright, *et al*., 2006). Nest survey tubes (n=129) were installed on 24 and 25 May 2017 in suitable habitat as shown in Figure 2. The survey tubes were retrieved on 20 November 2017.

2.2.2 Bright, *et.al*. (2006) provides guidance on survey effort requirements, using an Index of Probability of finding dormice present in nest tubes in any one month. The Index of Probability is based on using 50 nest tubes as a standard. A copy of The Index of Probability scores is provided in Table 1.1.

2.2.3 Chanin and Woods (2003) recommend that assumed absence of dormice should not be based on a Search Effort Score of less than 20. The Search Effort Score is calculated by adding the Index of Probability scores for the months in which the survey was undertaken. For example using the values in Table 2.1. If all surveys were undertaken in all months the Search Effort Score would be 25.

Table 2.1 Index of Probability of Finding Dormice Present in Nest Tubes

Month	Index of Probability
April	1
May	4
June	2
July	2
August	5
September	7
October	2
November	2

Table taken from Bright et al., 2006.

2.2.4 Tubes were inspected in June, August, September October and November 2017 (see Section 1.5 in Limitations) for any presence of dormouse and any signs, particularly for recently constructed nests. One licensed dormouse surveyor was present during all visits. Tube inspection was undertaken using flashlight or by sliding the nest tube trays open. Survey dates and personnel are given in Table 2.2.

Table 2.2 Survey Dates and Survey Personnel

Survey date	Survey Personnel
26 June 2017	Ben Walsh Licence Holder
2 August 2017	Ben Walsh Licence Holder
29 August 2017	Ben Walsh Licence Holder
29 September 2017	Ben Walsh Licence Holder

Survey date	Survey Personnel
17 October 2017	Ben Walsh Licence Holder
20 November 2017	Ben Walsh Licence Holder and Sam Braine Assistant Ecologist

2.2.5 Using Table 2.1, the Search Effort Score for the 2017 dormouse surveys meets the minimum score of 20. As the minimum score has been met and considering that the number of tubes used for the surveys is greater than the minimum of 50 used to calculate the Index of Probability score, the survey provides a robust assessment of presence or likely absence of dormouse in the survey area.

2.3 Limitations

2.3.1 Biological records can be received from a wide variety of sources and may or may not be comprehensive and accurate. However, if assessed in conjunction with a survey, they can contribute to a robust ecological assessment of a site.

2.3.2 Following best practice guidelines (Bright, *et al.*, 2006) the best time to set out dormouse tubes is in March and it is best to leave dormouse tubes out for an entire season from March onwards, for checking in November. However this could not be achieved as access to the suitable areas for dormouse nest tube deployment was not granted until late May 2017 and time constraints of the Project meant that they could not be left for an entire season. However, the tubes were deployed and surveyed within suitable survey months and will still be suitable to determine the presence or absence of dormice within the Project Site. Furthermore, Chanin and Woods (2003) identified that the length of time tubes are deployed is less important than the time of year. Leaving them out from early March to the end of November will give the highest probability of detecting dormice if they are present. With a minor peak of tube use in May and a more substantial one in August and September, it would be best to ensure that tubes are installed no later than April and finally checked no earlier than October. As an absolute minimum they recommend that tubes are installed before the end of July and finally checked after the end of September. Given the evidence above and meeting the minimum Search Effort Score of 20, the deployment of the nest tubes in May is not deemed to be a significant limitation. A survey was not undertaken in July. Instead, two surveys were undertaken in August; one at the beginning of the month and one at the end of the month. Therefore, this is not deemed to be a significant limitation.

2.3.3 On 26 June 2017 not all the tubes could be located due to extensive vegetation cover; 93 tubes were checked on this occasion, on all other occasions all of the tubes were checked. On 29 August 2017 three tubes had to be repositioned as they had fallen. On 29 September three tubes had to be repositioned as they had fallen. On 17 October 2017 it was noted that one of the tubes had fallen and snapped in half. These incidents are not deemed to be a significant limitation.

3. Baseline Environment

3.1 Desk Study Results

3.1.1 The designated habitats, sites and features within proximity to the Project Site are listed in Table 1.3 below.

Table 3.1 Desk Study Results

Designation / Feature	Description
Nationally and Internationally Designated Sites for Dormice within 2 km	There are no national or international designated sites for dormice within 2 km.
Locally Designated Sites within 2 km	The AECOM PEA did not identify any locally designated sites for dormice within 2 km (ES Appendix 8.1).
Dormice Records from the last 10 years within 2 km	No records of dormice were returned from SEWBReC within the last 10 years (ES Appendix 8.1).
Priority Species – Listed on The Environment Act (Wales) 2016 Section 7	Dormouse is listed on the Wales Section 7 list.
Surrounding Land Use	The Project Site is located to the north of Junction 46 of the M4 Motorway close to the village of Felindre, Swansea. The Project Site has agricultural fields to the east, south and north. Areas of woodland are located to the south, east and west of the Site. Areas of the National Grid Power Station with associated roads and buildings are partially within and adjacent to the Project Site boundary. A water treatment works is located in the north west outside of the Project Site boundary.
Previous Surveys undertaken by BSG Ecology	The client provided AECOM with the reports of previous surveys undertaken in 2014 by BSG Ecology within the Site (ES Appendix 8.15). The Site boundary included within these reports is different to the 2017 Project Site boundary. It was noted that the 2017 Project Site boundary is smaller than the red line boundary used by BSG Ecology in 2014. However, the current Project Site boundary is within the same area as the 2014 red line boundary provided to BSG Ecology and therefore the surveys undertaken would have captured the current Project Site area. The 2014 BSG Ecology Dormouse Report did not identify any dormice or evidence of dormice in the 2014 survey period. A total of 143 tubes were deployed across the months of May and June 2014, and checked on six occasions between the months of June and November (ES Appendix 8.15).

3.2 Dormouse Survey Results

3.2.1 No dormice or evidence of dormice was identified during the surveys.

3.2.2 One wood mouse *Apodemus sylvaticus* in a nest was identified in tube 49 on 29 August 2017.

3.2.3 One wood mouse nest was identified in tube 49 on 29 September 2017.

3.2.4 One wood mouse in a nest was identified in tubes 64 and 111 and one wood mouse nest was identified in tube number 81 on 17 October 2017.

3.2.5 One wood mouse nest was identified in tube 65 on 20 November 2017.

4. Conclusions and Recomendations

4.1.1 No dormice or evidence of dormice have been identified within the Project Site.

4.1.2 Given the negative results of the field surveys from 2017, the negative results of the BSG Ecology surveys from 2014 (ES Appendix 8.15), and the lack of records from SEWBReC of dormouse from within 2 km it is likely that dormouse is absent from the Project Site.

4.1.3 A full assessment of required further surveys has been made during EcIA and will be reported in the ES. At this stage it is anticipated that no further surveys will be required for dormouse.

4.2 Recommendations for Mitigation

4.2.1 A full series of recommendations for further surveys and mitigation at construction and operation has been undertaken for the EcIA and will be reported in the ES. At this stage a European Protected Species Licence (EPSL) for dormice is not required and no recommendations are required for mitigation as dormice are considered likely absent from the Project Site.

4.3 Recommendations for Biodiversity Enhancement

4.3.1 A full series of recommendations for biodiversity enhancement has been made during the EcIA and reported in the ES. At this stage the following preliminary recommendations have been made for general biodiversity enhancements:

- Maintain connectivity within the landscape by avoiding the severance of tree lines, woodland edges, hedgerows and dense scrub; and,
- Improve the connectivity of the Project Site by planting new hedgerows, infilling current gaps in hedgerows with whips and creating green corridors. It is recommended to use native species.

5. References

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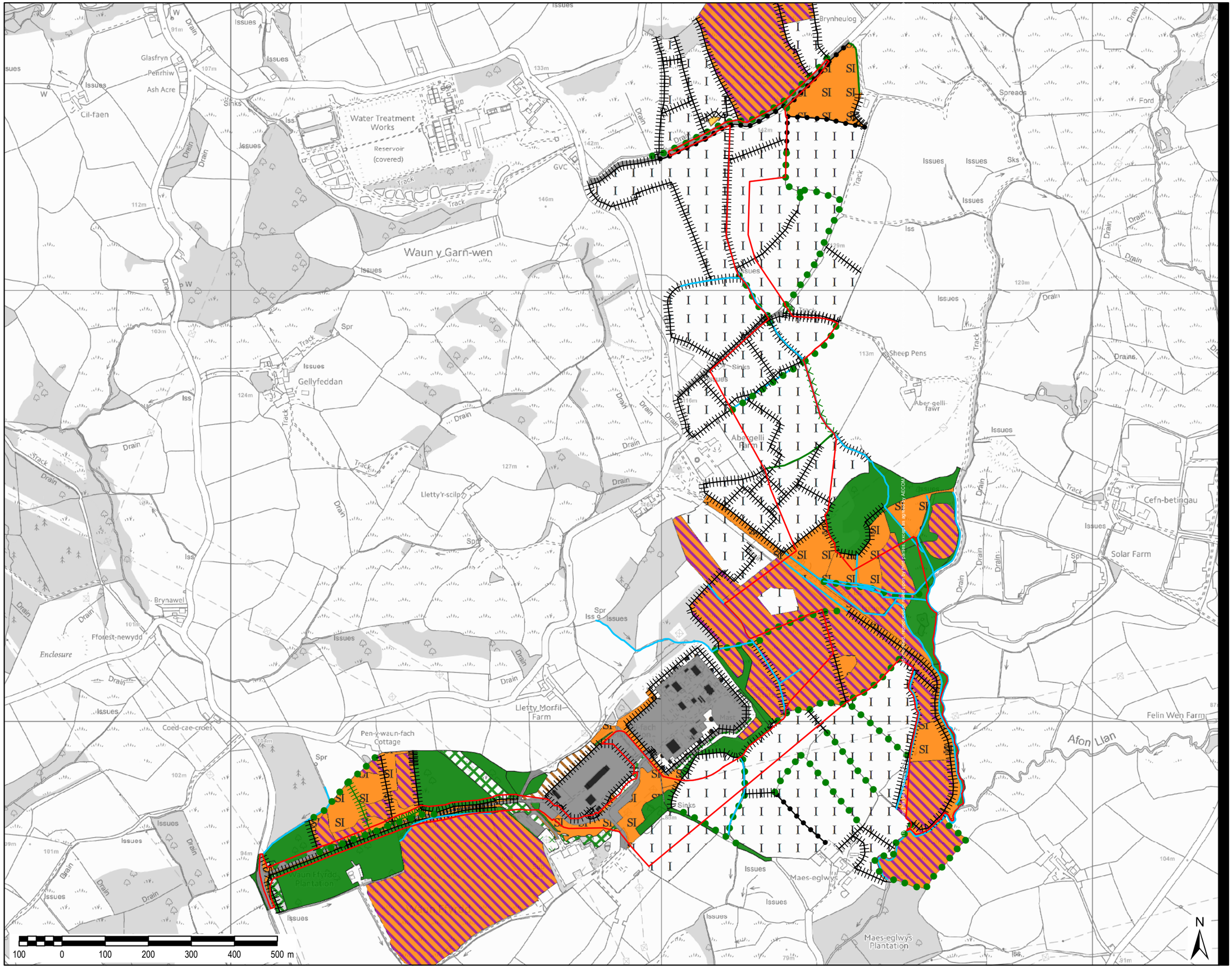
Figure 1 Phase 1 Habitat Map



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Project Site Boundary

Phase 1 Habitat Linear Features

- Scrub - Scattered
- Row of trees - broadleaved
- Running Water
- Intact Hedge - Species-Poor
- Defunct Hedge - Species-Poor
- Hedge with Trees - Native Species-Rich
- Hedge with Trees - Species-Poor
- Fence
- Earth Bank

Phase 1 Habitat Areas

- Broadleaved woodland - semi-natural
- Broadleaved woodland - plantation
- Dense/Continuous scrub
- Scattered scrub
- Semi-improved - neutral grassland
- Improved grassland
- Marsh/marshy grassland
- Tall ruderal - herb and fern
- Dry heath/acid grassland mosaic
- Buildings
- Bare ground
- Hard standing

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PHASE 1 HABITAT MAP

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FIGURE 1			005
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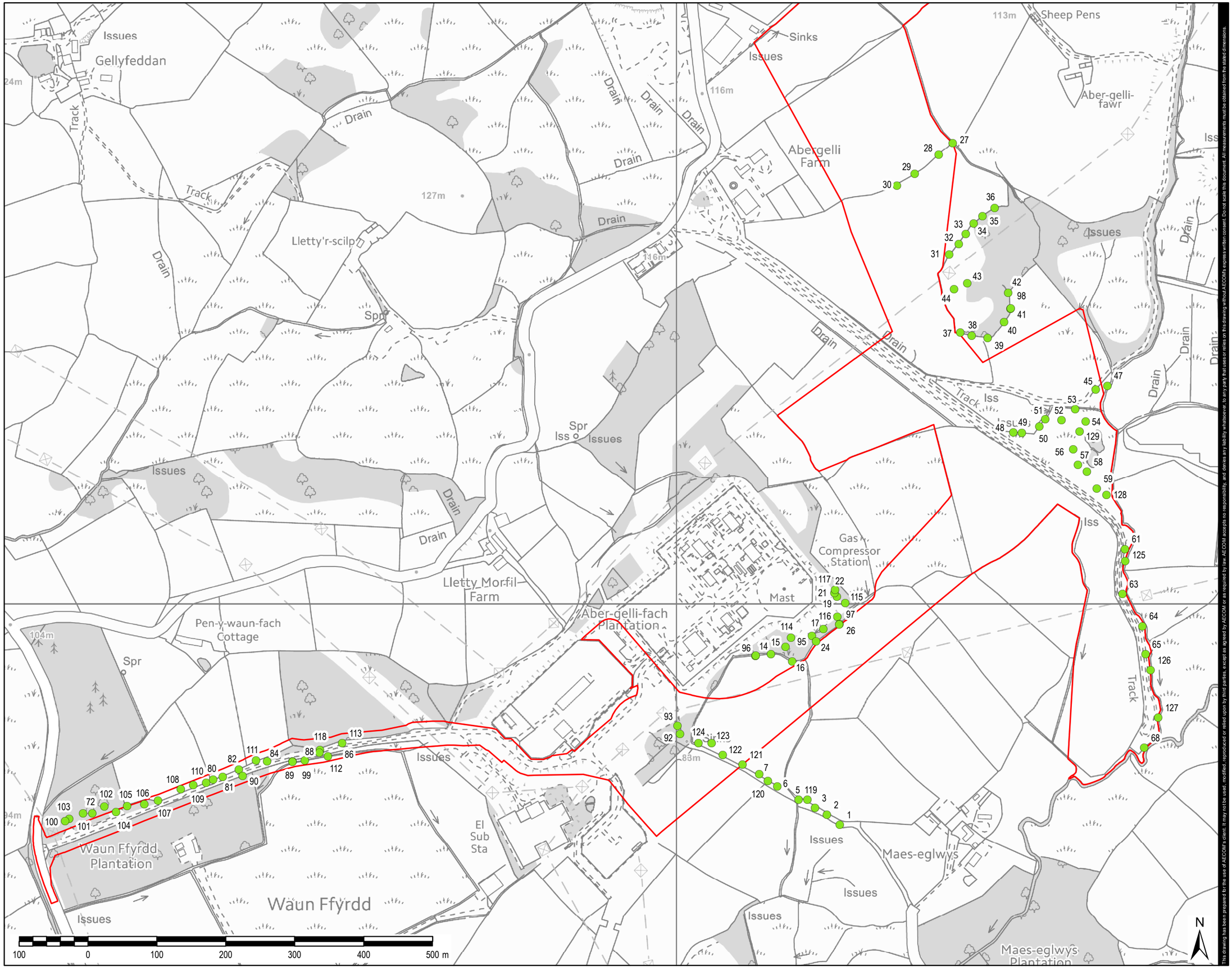
Figure 2 Dormouse Tube Locations



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Project Title:

ABERGELLI POWER PROJECT

Client:

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LEGEND

- Project Site Boundary
- Dormouse Tube Locations

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DORMOUSE TUBE LOCATIONS

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FIGURE 2	002

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Appendix 3.10

Otter and Water Vole Survey Report

Abergelli Power Project
Otter and Water Vole Survey Report

Abergelli Power Limited
May 2017

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FIGURES

Figure 1.1: Otter and Water Vole Survey Area and Survey Results

1. Introduction

1.1 Introduction

1.1.1 AECOM was commissioned to undertake a suite of ecological survey work to inform the Abergelli Power Project (the "Project").

1.1.2 The Project Site is located near to the village of Felindre, Swansea, as shown in Figure 1.1, and the central grid reference for the Site is SN 6528 0143. A full description of the Project is provided in Chapter 3: Project and Site Description of the Environmental Statement.

1.1.3 The Preliminary Ecological Appraisal Report (Appendix 8.1) identified that surveys for otter *Lutra lutra* and water vole *Arvicola amphibius* were required at the Project Site.

1.1.4 This baseline report outlines the presence of otter and water vole within the otter and water vole survey area and outlines initial recommendations for further surveys, mitigation and enhancement.

1.1.5 The otter and water vole survey area encompasses all suitable and accessible watercourses within the Project Site boundary and within a 100 m radius from the Project Site boundary, as shown on Figure 1.1.

1.1.6 Previous surveys have been undertaken by BSG Ecology and supported the 2014 ES Ecology Chapter which are presented in the ES Appendix 8.14.

1.2 Objectives of the Survey

1.2.1 The objectives of this survey were:

- To identify any designated nature conservation sites within or in the vicinity of the Project Site boundary that have the potential to support otter and water vole;
- To identify any known records and/or populations of otter or water vole in the vicinity of the Project Site boundary;
- To record and map evidence of otter and water vole;
- To make an initial ecological assessment of the Project Site boundary in respect to otter and water vole;
- To highlight any initial potential ecological constraints in respect to otter and water vole;
- To outline further survey work that may be required; and,
- To make initial suggestions for mitigation, compensation and enhancement of the natural features identified on the within the Project Site boundary in respect to otter and water vole.

1.3 Legislation

a) Otter Legislation

1.3.1 Otters are a European Protected Species under The Conservation of Habitats and Species Regulations 2010 (as amended), known as the 'Habitats Regulations', making it an offence to:

- deliberately capture, injure or kill an otter;
- deliberately disturb an otter; and
- damage or destroy a breeding site or resting place of an otter.

1.3.2 Disturbance is defined as that which is likely to impair their ability:

- to survive, to breed or reproduce, or to rear or nurture their young, or
- in the case of animals of a hibernating or migratory species, to hibernate or migrate; or
- to affect significantly the local distribution or abundance of the species to which they belong.

1.3.3 Under the Wildlife and Countryside Act 1981(as amended) it is illegal to:

- intentionally or recklessly disturb any otter while it is occupying a structure or place which it uses for shelter or protection;
- intentionally or recklessly obstructs access to any structure or place used by an otter for shelter or protection; and,
- sell, offer or expose for sale any otter.

1.3.4 A Natural Resources Wales licence would be required for any works likely to constitute an offence in respect to otters.

b) Water Vole Legislation

1.3.5 The water vole is listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), for which the following are offences:

- Intentional killing, injuring or taking;
- Intentionally or recklessly damaging/destroying a place of shelter/protection;
- Intentionally or recklessly disturbing an animal in its place of shelter/protection;
- Intentionally or recklessly obstructing access to its place of shelter/protection; and,
- Possession (live or dead, including derivatives), sale and offering for sale.

1.4 Quality Assurance

1.4.1 This survey and subsequent report was undertaken in line with AECOM's Integrated Management System (IMS). Our IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the international standards BS EN ISO 9001:2008 and 14001:2004 and BS OHSAS 18001:2007. In addition, our IMS requires careful selection and monitoring of the performance of all sub-consultants and contractors.

1.4.2 All AECOM Ecologists who worked on this Project are members of (at the appropriate level) the Chartered Institute of Ecology and Environmental Management (CIEEM) and follow their code of professional conduct (CIEEM, 2013) when undertaking ecological work.

2. Methodology

2.1 Desk study

2.1.1 The objective of the desk study is to review the existing information available in the public domain concerning species and habitats to identify the following:

- Internationally and nationally designated sites for otter and water vole, up to 2 km from the Site using the Multi Agency Geographic Information for the Countryside (MAGIC) website (www.magic.gov.uk);
- Otter and water vole records and records of locally designated sites for otter and water vole up to 2 km from the Site, using the South East Wales Biodiversity Records Centre (SEWBReC);
- The Section 7 list of Principal Importance for Conservation of Biological Diversity in Wales was reviewed for inclusion of otter and water vole; and,
- Aerial photographs and Ordnance Survey (OS) maps were reviewed to identify features of ecological interest surrounding the Site, nearby areas of ecological interest and features connecting these habitats (hedgerows, watercourses, railway lines).

2.1.2 The reports of previous surveys undertaken by BSG Ecology were provided by the client and were reviewed.

2.2 Otter Survey

2.2.1 The Phase 1 Habitat map (Appendix 8.1) and OS mapping were used to identify watercourses within the Project Site boundary and within a 100 m radius of the Project Site boundary.

2.2.2 Surveys for otter were conducted by AECOM ecologists on 18 July 2017 under suitable weather conditions. A detailed visual search of the watercourses within the otter survey area was undertaken.

2.2.3 Searches for otter activity were undertaken following guidance provided in Monitoring the otter *Lutra lutra* (Chanin and Smith, 2003). The survey methodology involved recording all evidence of otter activity, which is detailed below.

- Holt entrances – holes characteristically in river banks or under tree roots at river edges.
- Couch – typically an above-ground nest-like structure used as a resting place;
- Footprints – five toes which arch around the front of a large pad. In soft ground claw marks and webs between toes may show. Often seen in sand or soft mud deposits along rivers and under river bridges;
- Otter trails through vegetation – otters use the same routes within their territory to access rivers, so the paths are usually worn leading down the banks to the

river and may have a ‘slide’ at the end of well-worn mud as they slide into the water;

- Spraint – found in prominent locations adjacent or along a river, for example on tree stumps, large rocks and ledges under bridges. Sometimes otters may build a ‘castle’ of soft mud or sand along a river to spraint on top of. Spraints are made up of clearly visible fish bones and scales, with some other small bones, fur, feather and insect fragments sometimes present. Fresh spraint is usually black, tarry and sticky. It has a distinctive sweet-musky odour, which is not unpleasant;
- Anal jelly – a jelly-like secretion that smells strongly of otter and can vary in colour from pale brown, greenish to amber; and
- Other signs – for example, occasionally remains of dead otters can be seen on roads.

2.3 Water Vole Survey

2.3.1 The Phase 1 Habitat map (Appendix 8.1) and OS mapping were used to identify watercourses within the Project Site boundary and with a 100m radius of the Project Site boundary.

2.3.2 Surveys for water vole were conducted by AECOM ecologists on two separate visits on the 28th June 2017 and 29th September 2017. This is to allow for variations in habitat suitability across the season and because water voles are increasingly being shown to utilise different areas at different times of year. A detailed visual search of the watercourses within the water vole survey area was undertaken.

2.3.3 The survey methodology used was in accordance with the Water Vole Conservation Handbook (Strachan and Moorhouse, 2011). This consisted of identifying the extent and distribution of water vole through searches of both banks (where possible) of watercourses for field signs indicating recent activity (i.e. feeding stations and latrines), as well as signs of past and potentially present activity (i.e. burrows). Where conditions allowed, a surveyor walked in the watercourse channel to check for field signs along the water’s edge.

2.3.4 The survey methodology involved recording all evidence of water vole activity, which is detailed below.

- Faeces – these are 8 – 12mm long and 4 – 5mm wide, with a smooth ‘tic tac’ like shape, varying in colour from green to black, and odourless with a putty-like texture;
- Latrines – found throughout the territory, often comprising a pile of flattened droppings, with fresh droppings on top, used to mark range boundaries or favoured spots close to burrows;
- Feeding stations – comprise a neat pile of chewed feeding remains, often comprising lengths of vegetation up to 10cm long, showing the marks of the two large incisors;
- Burrows – these are typically wider than they are high, with a diameter of 4 – 8cm, and are usually located along the water’s edge;

- Lawns – around burrows there is often an area of grazed vegetation, surrounded by taller vegetation, these are most often produced when the female is nursing young;
- Nests – these comprise a large ball of shredded material, often woven into the bases of rushes and reeds, and are normally found in areas where the water table is high, such as wetlands;
- Footprints – as with other rodents, the footprints of the fore foot, show four toes in a star arrangement, with the hind foot showing five toes. The size of footprints for the hind foot is 26-34mm; and,
- Runways – these are low tunnels within the vegetation, often adjacent to the water's edge; and

2.3.5 The presence of water vole can also be confirmed by sightings and from the characteristic 'plop' of the water vole entering the water, which acts as a warning to other voles.

2.3.6 Latrines are indicators of territorial behaviour, which in turn generally correlates with water vole breeding activity. For the presentation of water vole distribution data, sections of the ditch where latrines were identified would be illustrated as "Breeding Activity", and sections of the ditch where evidence other than latrines was identified would be illustrated as "Non-Breeding Activity".

2.4 Limitations

2.4.1 Biological records can be received from a wide variety of sources and may or may not be comprehensive and accurate. However, if assessed in conjunction with a survey, they can contribute to a robust ecological assessment of a site.

2.4.2 There was heavy rain the night before the second survey on the 29th September 2017 which had the potential to wash away spraint or faeces evidence.

2.4.3 Two watercourses (Afon Llan and a tributary of the Afon Llan) were not accessible at the time of survey due to dense vegetation obscuring the view of the banks, and land access permissions. These watercourses were partially viewed and were assessed as having suitability to support both species. There is potential for signs of both species to have gone unrecorded.

3. Baseline Environment

3.1 Desk Study Results

3.1.1 The designated habitats, sites and features within proximity to the Project Site are listed in Table 1.1 below.

Table 3.1: Desk Study Results

Designation / Feature	Description
Nationally and Internationally Designated Sites within 2 km	There are no national or international sites designated for otter or water vole within 2 km of the Project Site boundary.
Locally Designated Sites within 2 km	There are no local sites designated for otter or water vole within 2 km of the Project Site boundary.
Otter and water vole Records from the last 10 years within 2 km	There are two records of otter approximately 1km south of the Project Site boundary one located between the Afon Llan and Nant y Gors watercourses and one from the Afon Llan. There are no records of water vole from with 2 km.
Priority Species – Listed on The Environment Act (Wales) 2016 Section 7	Otter and water vole are both listed in the Environment Act (Wales) 2016 Section 7.
Surrounding Land Use	The Site is located to the north of Junction 46 of the M4 Motorway close to the village of Felindre, Swansea. The Site has agricultural fields to the east, south and north. Areas of woodland are located to the south, east and west of the Site. Afon Llan runs adjacent the southern Site boundary. Areas of the National Grid Power Station with associated roads and buildings are partially within and adjacent to the Site boundary. A water treatment works is located in the north-west outside of the Site boundary.
Ponds within 500m	OS mapping shows 25 Ponds within 500m of the Site Boundary, three of these (Ponds 16, 22 and 23) are within the Site boundary: • Ponds 1 – 8: Located near to wastewater treatment works approximately 350m west. Connected to the Site via woodland and grassland. Outside of the otter and water vole survey area; • Ponds 9, 10 and 21: Located approximately 350m east and connected to the north-east tip of the road boundary via grassland. Outside of the otter and water vole survey area; • Pond 11: Approximately 210m west of the Site boundary and connected to the Site via grassland and scrub. Outside of the otter and water vole survey area; • Ponds 12 – 14 and 18: Located approximately 450m east and connected to the Site via woodland and grassland. Outside of the otter and water vole survey area; • Pond 15: Located approximately 130m north and connected to the Site via woodland and grassland. Outside of the otter and water vole survey area; • Pond 16: Within the Site boundary, dry during the Phase 1

Designation / Feature	Description
	Habitat Survey. Not suitable for otter or water vole as dry; • Pond 17: Located approximately 200m west and connected to the Site via woodland, grassland and scrub. Outside of the otter and water vole survey area; • Ponds 19a and 19b: Approximately 400m north and connected to the Site via grassland. Outside of the otter and water vole survey area; • Pond 20: Approximately 450m north, connected to the Site via grassland. This pond was identified as dry in 2017. Outside of the otter and water vole survey area; • Pond 22: Within the Site Boundary. Included within the otter and water vole survey area; • Pond 23: Within the Site Boundary and identified during the Phase 1 Habitat Survey.. Included within the otter and water vole survey area ; and, • Pond 24: Approximately 150m north within the garden of Pen-y-Waun Fach Cottage. The pond is connected to the Site via grassland and woodland. Outside of the otter and water vole survey area.
Previous Surveys undertaken by BSG Ecology	An otter spraint was identified during the previous surveys (ES Appendix 8.14), the location of which is approximately 500m east of the Project Site boundary and the watercourse on which it was found flows through the Project Site. Holes, that were likely to be mammal burrows, were observed. The holes have the right dimensions to allow use by water voles but did not show signs of current occupation. No latrines, footprints or grazing lawns were observed during the survey (ES Appendix 8.14).

4. Otter and Water Vole Survey Results

4.1.1 The results of the otter and water vole survey are given in Table 1.2, Table 1.3 and Table 1.4. Figure 1.1 shows the watercourses and ponds surveyed, their suitability to support otter and water vole and the reference numbers listed below as part of the survey notes. Photographs (Plates) referenced, can be found below Table 1.4.

Table 4.1: Otter and Water Vole Survey Results – Culverts, Mammal Burrows, Mammal Trails,Spraints

Number	Notes
1	Push under likely used by fox or badger.
2	Culvert.
3	On watercourse 43: burrows; no evidence of current occupancy; could be water vole or brown rat. Water level too high in September to be suitable.
4	Couch-type hole, extends back 0.5m; no worn muddy trail leading to/from entrance, but vegetation is trampled. Plate 1.1.
5	Spraints and a possible otter footprint identified on Pond 19 during the great crested newt surveys in May 2017. Outside of otter survey area. Plate 1.2.

Table 4.2: Otter and Water Vole Survey Results – Mammal Trails

Number	Notes
1	Mammal trail, moderately well-used.
2	Mammal trail.

Table 4.3: Otter and Water Vole Survey Results – Watercourse Features

Watercourse Feature	Potential	Notes
1	Unsuitable	Unsuitable for otter, although it has water vole potential (rushes & steep bank) it is completely isolated and was dry during the survey; no fish; overgrown next to photovoltaic farm.
2	Unsuitable	Accessible by livestock and had no banks, and no food sources; low water level (1cm) during the survey, and is likely to dry. Leads to culvert under road. Plate 1.3.
3	Unsuitable	No banks; livestock can access; low water level.
4	Unsuitable	Partially shaded, with no banks; livestock can access; low water level. Section to south fences with heavy bramble and tree cover; steep tall banks; no food sources.
5	Unsuitable	Dry at northern 1/3; heavily shaded; access impeded by bramble; wet for southern 2/3rds but 1 cm – 5 cm deep.
6	Suitable	Suitable for otters only. Steep, shaded banks; unsuitable for water vole; water up to 5cm deep; some commuting

Watercourse Feature	Potential	Notes
		potential for otter or couch creation, but limited; no food source.
7	Not accessible	Not accessible, very dense vegetation; steep-sided stream/ravine. Unlikely to be suitable for water vole due to lack of food source.
8	Unsuitable	Very densely vegetated and shallow stream.
9	Not accessible	Unable to survey.
10	Suitable	Suitable for otters only, not water vole; dense vegetation and shaded.
11	Suitable	Suitable for otters only; unsuitable for water vole ; some commuting potential for otter or couch creation, but limited; no food source. Heavily shaded by dense woodland, not always accessible/viewable. Plate 1.4.
12	Suitable	Suitable for otters only. Wooded, heavily shaded; unsuitable for water vole; some commuting potential for otter or couch creation, but limited; no food source.
13	Not accessible	Unable to survey.
14	Suitable	Suitable for otters only. Heavily shaded, dense vegetation - woodland; running water; some commuting potential for otter or couch creation; unsuitable for water vole.
15	Not accessible	Not fully accessible, viewed from west end only. Wide watercourse, deep water. Dense vegetation in some areas; good otter potential for foraging, commute and holt/couch creation. Burrows; no evidence of current occupancy; could be water vole or brown rat. . Plate 1.5.
16	Unsuitable	Heavily shaded; little/no water; no food sources.
17	Unsuitable	Heavily shaded, shallow and narrow; no food sources.
18	Unsuitable	Heavily shaded, shallow and narrow; no food sources.
19	Unsuitable	Heavily shaded, shallow and narrow; no food sources.
20	Unsuitable	Completely shaded drain.
21	Unsuitable	Almost dry drain.
22	Unsuitable	Heavily shaded, shallow <1cm water, rocky banks; no food sources. Viewed from the National Grid access road.
23	Not accessible	No land access agreement in place.
24	Not accessible	No land access agreement in place.
25	Unsuitable	Heavily shaded and shallow; unsuitable for otter or water

Watercourse Feature	Potential	Notes
		vole.
26	Unsuitable	Dry; unsuitable for otter or water vole.
27	Suitable	Suitable for otters only. Low water quality, lots of brown algae; livestock can access; some limited commuting potential for otter- sub-optimal.
28	Suitable	Suitable for otters only. Fenced; wooded and shaded; some commuting potential for otter and couch creation; unsuitable for water vole. Majority not viewable due to woodland.
29	Suitable	Suitable for otter commuting only; unsuitable for water vole.
30	Unsuitable	Shallow ditch.
31	Unsuitable	Heavily shaded ditch.
32	Unsuitable	Dry at the time of survey.
33	Suitable	Soft rush abundant, steep muddy banks; shallow water July (10cm max); no fish; limited water vole potential; otter unlikely.
34	Suitable	Suitable for otters only. Ditch dry in July; wet in September and suitable for occasional commuting otter only.
35	Suitable	Suitable for otters only. Ditch dry in July; wet in September and suitable for occasional commuting otter only.
36	Suitable	Suitable for otters only. Suitable for occasional commuting otter only.
37	Unsuitable	Peat cutting.
38	No watercourse	Dry, no watercourse.
39	Unsuitable	Pooling of water into field at western end, no ditch along rest of boundary.
40	Unsuitable	Heavily shaded, shallow water, no food resources.
41	Suitable	Suitable for otters only, unsuitable for water vole; dense vegetation and shaded.
42	Unsuitable	Heavily shaded woodland, unsuitable for water vole; some commuting potential for otter or couch creation, but limited; no food source. No access due to vegetation.
43	Suitable	Wide watercourse, deep water. Dense vegetation in some areas; good otter potential for foraging, commute and holt/couch creation. Burrows; no evidence of current occupancy; could be water vole or brown rat. ; unfenced sheep either side will reduce suitability.
44	Unsuitable	No potential.
45	Suitable	Suitable for otters and water vole in the less shaded areas;

Watercourse Feature	Potential	Notes
		wooded and reasonably deep water.
46	Not accessible	Unable to survey.

Plate 4.1: Photographs of couch-type hole (Feature 1)





Plate 4.2: Photographs of spraints and a possible otter footprint from May 2015 (Feature 5)







Plate 4.3: Photographs of Watercourse Feature 2, unsuitable for otter and water vole







Plate 4.4: Photographs of Watercourse Feature 11, suitable for otter and unsuitable for water vole





Plate 4.5: Photographs of Watercourse Feature 15, suitable for otter and limited suitability for water vole





5. Conclusions

5.1 Otter

5.1.1 A total of thirteen watercourses within the otter survey area were suitable for supporting commuting otter and two watercourses were suitable for supporting foraging otter, holt and couch creation. One potential couch was identified with a trampled vegetation track leading to it which suggested occasional use by a mammal. Two mammal tracks were identified; these may have been fox or another mammal. No spraints, holts, footprints, anal jelly or other signs were identified during the surveys.

5.1.2 Due to the confirmed presence of otter upstream from the Project Site in 2015 and the presence of spraints and a footprint from a nearby pond in May 2017 it can be concluded that otters are still active in the locality. As such it is likely that otters use the suitable watercourses (numbers 10, 11, 12, 14, 15, 41, 43 and 45) within the otter survey area and Project Site boundary for occasional forging, commuting, resting and holt creation (although no evidence of holts was identified during the survey).

5.2 Water Vole

5.2.1 Four watercourses that had potential for supporting water vole were recorded within the water vole survey area (15, 43, 46 and 48). Two of these (15 and 45) had limited potential for water vole due to the relative isolation of these watercourses within the landscape (i.e. not connected to watercourses with potential to support water vole). However, it should be noted that some watercourses could not be adequately surveyed due to dense vegetation and therefore signs may have been missed. Burrows suitable for water vole were found (watercourses 15 and 43) but there was no evidence of current occupancy. It was therefore not possible to determine if the burrows had been excavated by brown rat or water vole. There were no records of water vole from SEWBReC, and it appears likely that water vole are absent from the water vole survey area.

5.3 Recommendations

a) Recommendations for Further Surveys

5.3.1 A full assessment of required further surveys has been made during EcIA and reported in the ES. At this stage the following recommendations have been made:

- Due to the time that would have elapsed between the otter and water vole survey and the proposed construction start date it is recommended that a pre-construction survey for otters and water voles is undertaken on suitable watercourses to check for activity or any newly created holts or couches, or burrows. The survey will focus on watercousres and water bodies likely to be impatcted by the propsed works.

b) Recommendations for Mitigation

5.3.2 A full series of recommendations for mitigation at construction and operation has been undertaken for the EcIA and reported in the S. Further recommendations may be made as a result of the outcome of the pre-construction survey. At this stage the following key recommendations have been made:

- An exclusion area of 100 m will be established around any newly identified otter holts and resting places prior to works commencing and further advice will be sought from Natural Resources Wales.
- An exclusion area of 10 m will be established around any newly identified owater vole burrows prior to works commencing and further advice will be sought from Natural Resources Wales.
- Access to open-water habitats must be safeguarded at all times; effects to newly identified established otter paths and traditional routes between such areas (such as field drains) during the construction phase should be minimised.
- Habitat loss should be compensated – particularly key habitat types for the species.
- A buffer should be in place during construction to prevent pollution and/or run off into the watercourses/water bodies.

c) Recommendations for Biodiversity Enhancement

5.3.3 A full series of recommendations for biodiversity enhancement has been made during the EcIA and reported in the ES. Further recommendations may be made as a result of the outcome of the pre-construction survey. At this stage the following precautionary recommendations have been made:

- Habitat restoration or enhancement works.

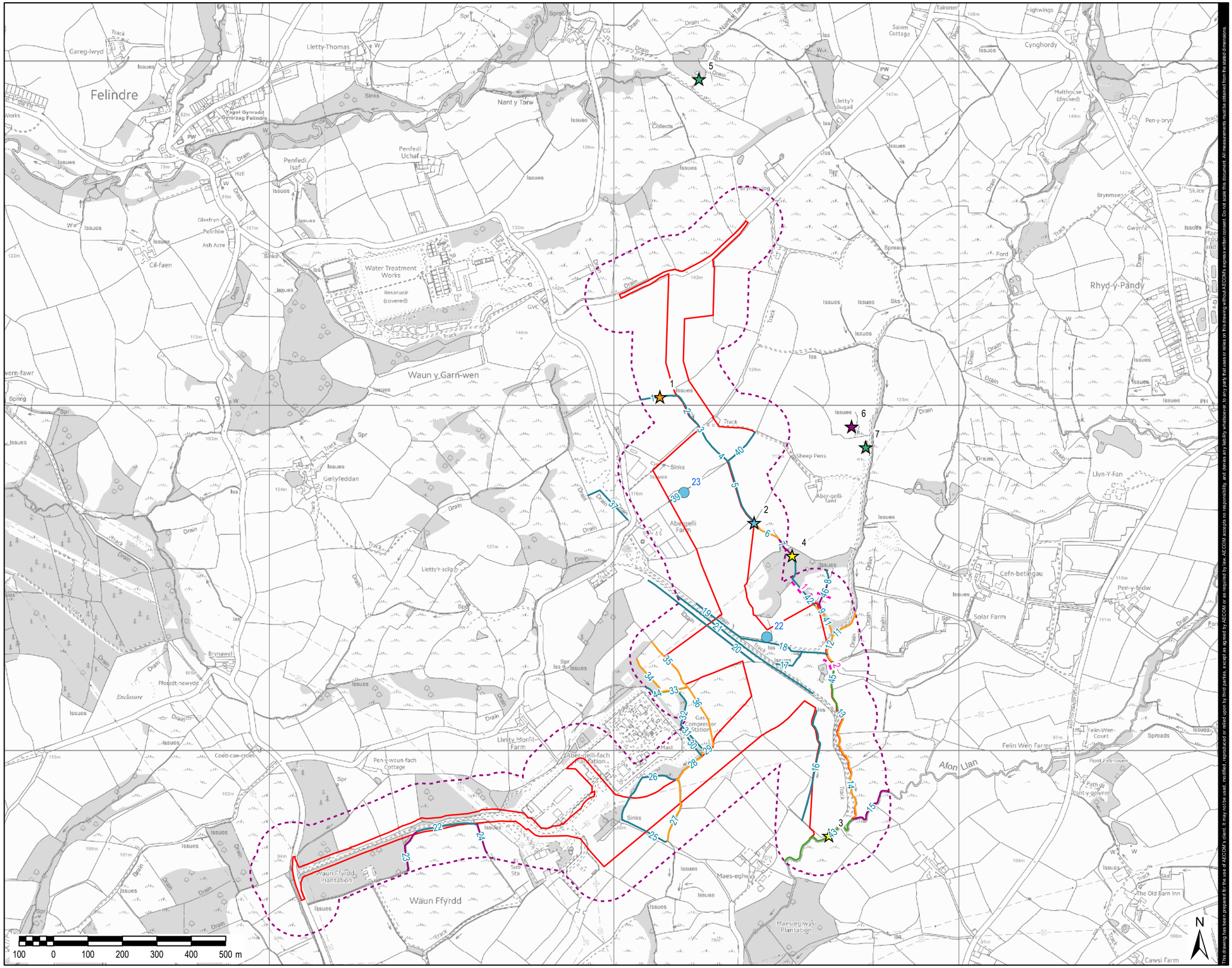
6. References

Chanin and Smith (2003). Monitoring the otter *Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series No 10. Peterborough, English Nature.

CIEEM (2013) Code of Professional Conduct. Chartered Institute of Ecology and Environmental Management, Hampshire.

Strachan, R. and Moorhouse, T. (2011). Water Vole Conservation Handbook. Third Edition. Wildlife Conservation Research Unit (WildCRU), Oxon.

Figure 1.1 Otter and Water Vole Survey Area and Survey Results



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Project Title:

ABERGELLI POWER PROJECT

Client:

ABERGELLI POWER LTD.

LEGEND

- Ponds
- Culvert
- Mammal Burrow
- Mammal Trail
- Otter Holt/Resting Place
- Spraint
- Not accessible
- Suitable
- Suitable - Otter Only
- Unsuitable
- Mammal Trail
- Otter and Water Vole Survey Area
- Project Site Boundary

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OTTER AND WATER VOLE SURVEY

Scale at A3: 1:10,000

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FIGURE 1.1			002
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GM	CC	CA	02/05/18

Appendix 3.11

Badger Survey Report (Confidential)

REMOVED

Appendix 3.12

Arboriculture Survey Report 2014

PARSONS BRINCKERHOFF

November 2014

ABERGELLI POWER PROJECT

BS5837 ARBORICULTURE SURVEY REPORT

Abergelli Power Ltd

Applicant Reference: 287521A

PINS Reference: EN010069

Regulation: EIAR & r5(2)(a)

Abergelli Power Project

BS5837 Arboriculture Survey Report

Applicant Reference: 287521A
PINS Reference: EN010069
Regulation: EIAR & r5(2)(a)

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Appendices
Appendix A – Tree Survey Schedule
Appendix B – BS5837 2012: Table 1
Appendix C – BS5837 2012: Figure 2
Appendix D – BS5837 2012: Tree Constraints Plan

1 INTRODUCTION

1.1 Overview

1.1.1 Parsons Brinckerhoff has been commissioned by Abergelli Power Ltd (ALP) to undertake a BS5837: 2012 "Trees in Relation to Design Demolition and Construction – recommendations" (BS5837) arboriculture survey in relation to the proposed 299MW gas-fired 'peaking' plant at Abergelli Farm Felindre, near Swansea (hereafter referred to as 'the Project').

1.2 Context

1.2.1 The Arboriculture Survey Report is required in support of an application for Development Consent as an Appendix to the Environmental Statement (ES) for the Project.

1.3 Purpose

1.3.1 The purpose of this report is to assess all qualifying trees, groups of trees, hedges and woodland (individuals with a stem diameter of at least 75mm measured at 1.5m above ground level) within the survey areas (identified as "project site" within the Tree Constraints Plan at appendix D)and those where the Root Protection Areas (RPA) may be affected by the Project as defined in BS5837

1.3.2 Parsons Brinckerhoff Ltd carried out the BS5837 Arboriculture Survey between 17th and 19th September 2014 and on 18th November 2014.

1.4 Planning and Legislative Context

1.4.1 This report has been carried out in accordance with the most recently published (30th April 2012) BS5837 which updates the previous BS5837 of 2005 by:

- Taking account of current practice regarding planning for the management, protection and planting of trees in the vicinity of structures, and for the protection of structures near trees;
- Updating the guidance in relation to building regulations; and
- Recognising the contribution that trees make to climate change adaptation.

1.4.2 Trees are a material consideration in the UK planning system, and existing trees are an important factor on construction sites, whether on or near the working areas. BS 5837 2012 Arboriculture reports are intended to assist decision-making, by ensuring consideration is given

to existing and proposed trees in the context of design, demolition and construction.

1.4.3 The primary source of protection afforded to trees is through the application of Tree Preservation Orders (TPO) as part of the Town and Country Planning (Tree Preservation) (England) Regulations 2012 which came into effect on April 6th 2012. There are two offences under this Act:

- in contravention of tree preservation regulations: cut down, uproot or wilfully destroy a protected tree; or to damage, top or lop it wilfully in such a manner as to be likely to destroy it; or to cause and permit any such activity; and
- to carry out any other works in contravention of tree preservation regulations.

1.4.4 It has been confirmed that there are no tree preservation orders with the survey site.

1.4.5 In recent years greater weight has been added to the protection of ancient and veteran trees within our landscape. This is reflected in the recent update to Planning Policy Wales which states “Ancient and Semi Natural woodlands are irreplaceable habitats of high biodiversity value which should be protected from development that would result in significant damage” (paragraph 5.2.9).

1.4.6 The Forestry Act of 1967 requires any person wishing to fell trees to apply for a felling licence before those works are undertaken. There are many exemptions to this requirement that often reflect good forest and woodland management and other exemptions that may be reasonably expected such as dead, diseased or dangerous trees. Exemptions are also afford to works required to facilitate planning consent

2 METHODOLOGY

2.1 Survey

2.1.1 The trees on the survey site qualifying for survey were inspected and classified, by a competent arboriculture consultant with regard to BS5837. The trees were classified in accordance with BS5837: 2012 tree quality assessment categories A, B, C and U, as set out in Table 1 and 2 of the British Standard. Qualifying trees are defined as individual trees with a stem diameter of at least 75 mm measured at 1.5 m above ground level.

2.1.2 All trees within the survey site were inspected from ground level using the Visual Tree Assessment (VTA) method. VTA assessment is a non-invasive method for ascertaining the physiological and structural condition of trees. The method requires the use of a Thor 10 nylon acoustic mallet, and a wire probe.

2.1.3 The VTA was undertaken on the above ground portion of the trees. No aerial inspection, sampling, or excavations for the purpose of soil or root analysis were undertaken. Binoculars were used to inspect the upper parts of the tree canopy from ground level, if required.

2.1.4 To allow the assessment of trees on site to be completed in a practicable way and to best reflect the tree population on site, where trees formed groups either aerodynamically, through mutual support or by forming a screen or other such feature they have been recorded as such. This is a widely used method and is supported by Section 4.4.2.3 of BS 5837: 2012.

2.2 Survey Limitations

2.2.1 Trees are large dynamic organisms, influenced by a variety of environmental variables, whose health and condition can change rapidly. Due to the changeable nature of trees and other site and environmental considerations which may influence the trees, this report, and any recommendations made within it are valid for a period of 12 months from the date of the site survey (November 2014).

2.2.2 Although comments and recommendations on the safety of particular trees may have been made, this survey is not a tree hazard assessment and should not be used as such.

2.2.3 Any management recommendations have been made in accordance with BS 3998: 2010 “Tree Works – Recommendations” and industry best practice. Works have been recommended in accordance with any statutory obligations owed by the land owners or occupiers.

2.2.4 All areas have the potential to support protected species. This survey did not include an ecological survey of the vegetation and habitat areas.

3 RESULTS

3.1 Overview

3.1.1 None of the trees within the survey site were found to be of such poor condition that urgent remedial work was required.

3.1.2 The hedge recorded as part of this survey was not made the subject of detailed assessment for their importance in relation to the Hedgerow Regulations.

3.2 Site Context

3.2.1 Many of the trees within the survey site were of reasonable but not outstanding quality. Due to the relatively low hedges and open field systems mature trees are locally prominent in the landscape.

3.2.2 The following features were recorded during the survey and recorded in the Tree Survey Schedule in Appendix A and plotted on the Tree Constraints Plan in Appendix D:

- Woodlands 1 and 2;
- Groups 1 to 6;
- Hedge 1; and
- Trees 922 to 924.

3.2.3 Where access was not possible, trees were listed as A to C. These trees were not tagged and stem diameters were estimated using neighbouring trees as a reference.

3.3 Notable Features

3.3.1 Woodland 1 is designated as Ancient Woodland and a Site of Importance for Nature Conservation (SINC). It is relatively open woodland with birch as the dominant species in most areas. Many of the birch trees are in full maturity and will start to decline over the next 20 to 30 years. This is due to the fungal pathogen *Piptoporus betulinus* (birch strop fungi) which is dormant in birch trees for most of their life becoming active when the tree suffers a wound or bark lesion. The fruiting body of this fungi is clearly visible on many of the birch within this woodland. It is important to note that the decline of the birch within the woodland is not a sign of ill health or poor quality within the woodland. The decline of the birch will make way for the oak and ash within the woodland to succeed and form woodland with greater longevity.

3.3.2 Woodland 2 to the south of the National Grid Access Road is designated as Ancient Woodland and a SINC. However, it is of relatively low quality with the oldest individuals within the woodland being no more than 80 or 90 years old and the majority being under 50 years old. The woodland would benefit from management and creation of a more structured woodland edge.

3.3.3 The trees to the north of the National Grid Access Road at this location (within Group 1) are also located within Ancient Woodland and a SINC. They are of greater quality individually than those within the Woodland 2 and when considered as parts of the hedge form a linear feature providing connectivity east to west. The existing National Grid Access Road extends in places to almost 2 m under the saplings, bramble and leaf litter that has accumulated at the edge of the clear area.

3.3.4 Many of the individual trees on site such as those within groups 5 and 6 have grown from former hedge lines or are formed from outgrown hedge trees. Browsing by horses has caused bark damage in some areas.

3.3.5 Groups 3, 4 and 6 will require pruning and in some cases minor felling to allow construction traffic pass safely without causing damage to the vehicles or vegetation. Pruning should be carried out in accordance with Section 154 of the Highway Act 1980 to a height of 5.2m above the carriage way. These works are not considered to be a significant impact.

4 CONCLUSION

4.1.1 The presence of trees on the Project Site is not considered to be an obstruction to the Project. Careful consideration of trees at all stages of the development process will ensure that existing trees of high retention value are retained and protected throughout the Project. Suitable mitigation for any tree loss should be designed into the Project from the outset.

4.1.2 The Tree Constraints Plan (TCP), in Appendix D, will be used as a tool to inform the Project design, the practicalities of implementing the Project throughout construction and the final landscaping / mitigation planting.

4.1.3 Table 1 of BS 5837 (shown in Appendix B) defines Category C trees as “Trees of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150mm”. With this point in mind, Category C trees can potentially be removed if suitable justification is given and appropriate mitigation provided.

4.1.4 British Standard 5837 provides a specification for protective fencing as shown in Appendix C. Although this fencing is perfectly suitable for individual significant trees it is not always practical for large areas of fencing. With this in mind it is recommended that for large areas fencing constructed of wooden post and netting with appropriate signage may be used.

APPENDIX A

TREE SURVEY SCHEDULE

APPENDIX B

BS5837 2012: TABLE 1

Table 1 **Cascade chart for tree quality assessment**

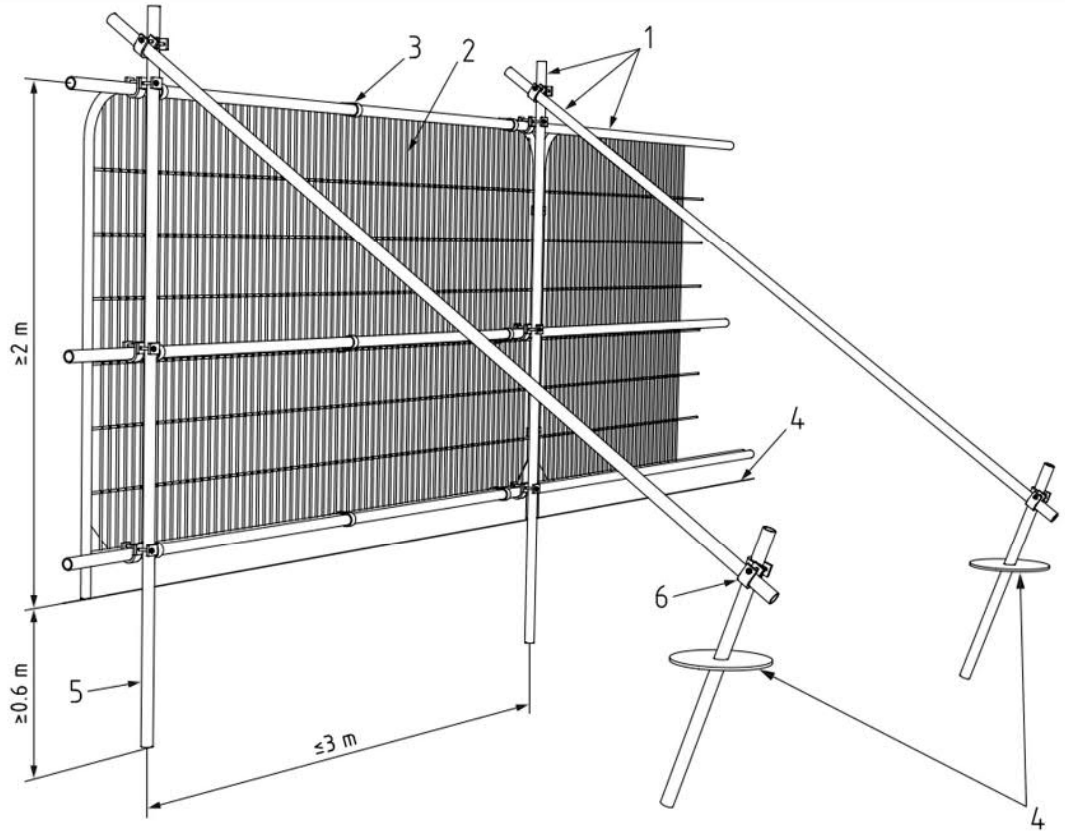
Category and definition	Criteria (including subcategories where appropriate)			Identification on plan
Trees unsuitable for retention (see Note)				
Category U Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years	• Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other category U trees (e.g. where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning) • Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline • Trees infected with pathogens of significance to the health and/or safety of other trees nearby, or very low quality trees suppressing adjacent trees of better quality *NOTE Category U trees can have existing or potential conservation value which it might be desirable to preserve; see **4.5.7**.*			See Table 2
	1 Mainly arboricultural qualities	**2 Mainly landscape qualities**	**3 Mainly cultural values, including conservation**	
Trees to be considered for retention				
Category A **Trees of high quality** with an estimated remaining life expectancy of at least 40 years	Trees that are particularly good examples of their species, especially if rare or unusual; or those that are essential components of groups or formal or semi-formal arboricultural features (e.g. the dominant and/or principal trees within an avenue)	Trees, groups or woodlands of particular visual importance as arboricultural and/or landscape features	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (e.g. veteran trees or wood-pasture)	See Table 2
Category B **Trees of moderate quality** with an estimated remaining life expectancy of at least 20 years	Trees that might be included in category A, but are downgraded because of impaired condition (e.g. presence of significant though remediable defects, including unsympathetic past management and storm damage), such that they are unlikely to be suitable for retention for beyond 40 years; or trees lacking the special quality necessary to merit the category A designation	Trees present in numbers, usually growing as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality	Trees with material conservation or other cultural value	See Table 2
Category C **Trees of low quality** with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150 mm	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories	Trees present in groups or woodlands, but without this conferring on them significantly greater collective landscape value; and/or trees offering low or only temporary/transient landscape benefits	Trees with no material conservation or other cultural value	See Table 2

4.1.5

APPENDIX C

BS5837 2012: FIGURE 2

Figure 2 **Default specification for protective barrier**



Key

1 Standard scaffold poles
2 Heavy gauge 2 m tall galvanized tube and welded mesh infill panels
3 Panels secured to uprights and cross-members with wire ties
4 Ground level
5 Uprights driven into the ground until secure (minimum depth 0.6 m)
6 Standard scaffold clamps

APPENDIX D

BS5837 2012: TREE CONSTRAINTS PLAN

APPENDIX A

TREE SURVEY SCHEDULE

Tree	Species	Height	Diameter	RPA	N	S	E	W	1st Branch	Canopy Ht	Age	Years	Category	Observation /Recommendations
G1	Oak, Ash, Thorn, Hazel, Holly, Willow, Birch, Sycamore	15	250	3	>	>	>	>	0	0	Mature	40+	B2	Access track to sub station through group, Occasional Buddleia, reasonable quality with good clearance over road.
W1	Birch, Oak, Ash,	15	400	4.8	>	>	>	>	2	20	Mature	40+	B2	Reasonably open woodland with predominantly Birch. Most trees at 4m apart. Some evidence of burrowing animals.
G2	Oak, Willow, Ash, Thorn	10	200	2.4	>	>	>	>	0	0	Mature	40+	B2	Predominantly hedge with elements of a scrubby group to the West.
G3	Oak, Ash Sycamore, Hazel, Thorn	20	500	6	>	>	>	>	0	0	Mature	40+	C2	This group consist of various mature trees adjacent to the existing access track. The trees are of average quality individually but are more significant in their amenity value to the local setting. No obvious sign of significant defect was noted at the time of survey but there was some evidence of browsing by horses. several Ash and Oak and
G4	Oak, Thorn, Willow,	12	300	3.6	>	>	>	>	0	0	Mature	40+	B2	Group of relatively minor trees and scrub bordering the existing access track. The loss of these trees would not be considered significant.
G5	Oak, Birch, Holly, Rowan	15	300	3.6	>	>	>	>	0	3	Mature	40+	B2	Grown out hedge atop a stop bank, average quality. Gappy in places.
G6	Oak, Thorn, Ash	10	250	3	>	>	>	>	0	4	Mature	40+	B2	Roadside group either side of minor road. Trees atop earth bank adjoining arable land to the south and scrub to the north, no obvious sign of significant defect. Should not be effected by proposed Project.
T922	Oak	7	225	2.7	3	5	6	3	3	4	Mature	20+	C2	Dense ivy throughout low vigour, atop roadside bank.
T923	Oak	7	300	3.6	5	5	5	5	2	2	Mature	40+	B2	Tag on post No obvious sign of significant defect.
T924	Holly	8	200	2.4	5	6	3	3	0	0	Mature	40+	C2	Grown from former hedge planting, browsed at base, multi-stem tree.
G7	Oak, Sycamore, Ash	22	450	5.4	>	>	>	>	0	0	Mature	40+	B2	Remnant woodland edge. Non inspected in detail due to access issues at the time of survey. Provides partial screen between arable land and existing sub.
H1	Oak, Ash	15	400	4.8	>	>	>	>	0	0	Mature	40+	B2	Trees of various quality within field boundary, some browsing damage from horses. Stem diameter is average estimate only.
A	Oak	18	400	4.8	8	7	9	9	5	10	Mature	40+	B2	TREE IS 7M FROM BOUNDARY FENCE
B	PINE	20	500	6	5	7	4	3	6	15	Mature	40+	B2	TREE IS 5M FROM BOUNDARY FENCE
C	ASH	20	600	7.2	8	6	4	4	10	15	Early-Mature	40+	B2	TREE I2M FROM BOUNDARY FENCE
W2	Pine, Oak, Willow, Sycamore, Hazel, Birch	20	400	4.8	>	>	>	>	0		Early-Mature	40+	B2	Average but not outstanding, most growth roughly 50 years old with a few individuals reaching 90yrs.

APPENDIX B

BS5837 2012: TABLE 1

Table 1 **Cascade chart for tree quality assessment**

Category and definition	Criteria (including subcategories where appropriate)			Identification on plan
Trees unsuitable for retention (see Note)				
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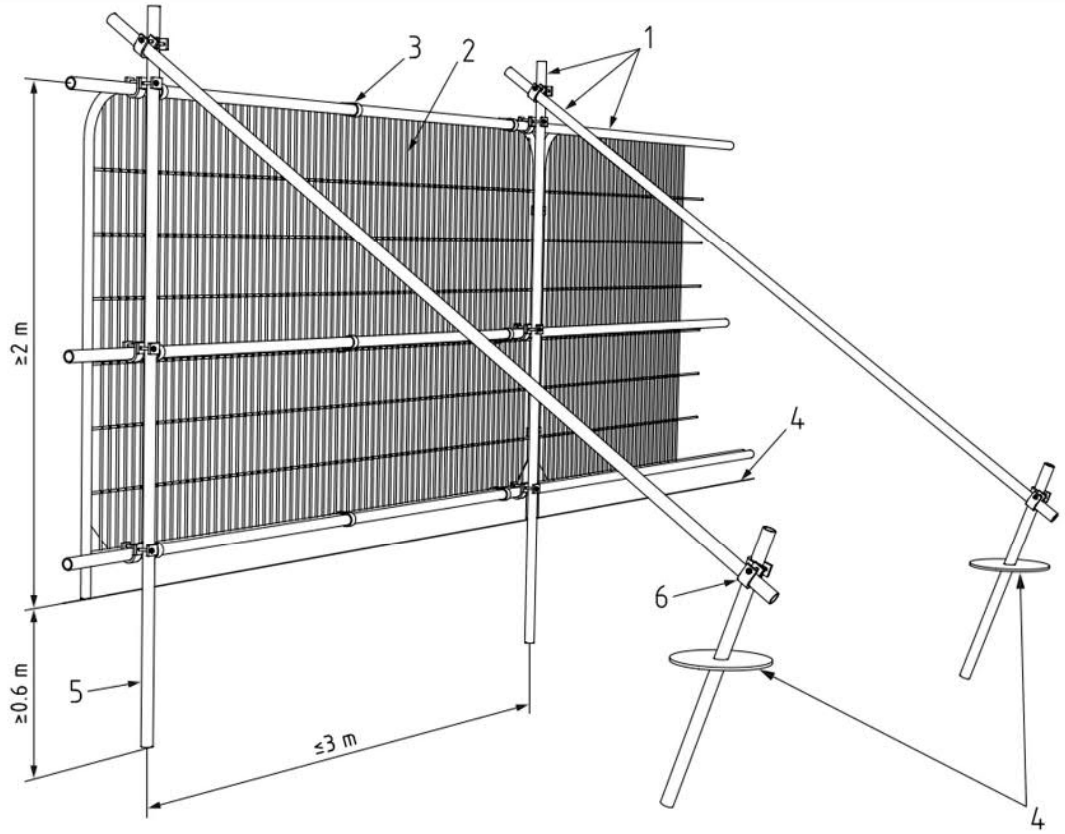
Category C **Trees of low quality** with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150 mm	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories	Trees present in groups or woodlands, but without this conferring on them significantly greater collective landscape value; and/or trees offering low or only temporary/transient landscape benefits	Trees with no material conservation or other cultural value	See Table 2

APPENDIX C

BS5837 2012: FIGURE 2

Figure 2 **Default specification for protective barrier**



Key

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3 Panels secured to uprights and cross-members with wire ties
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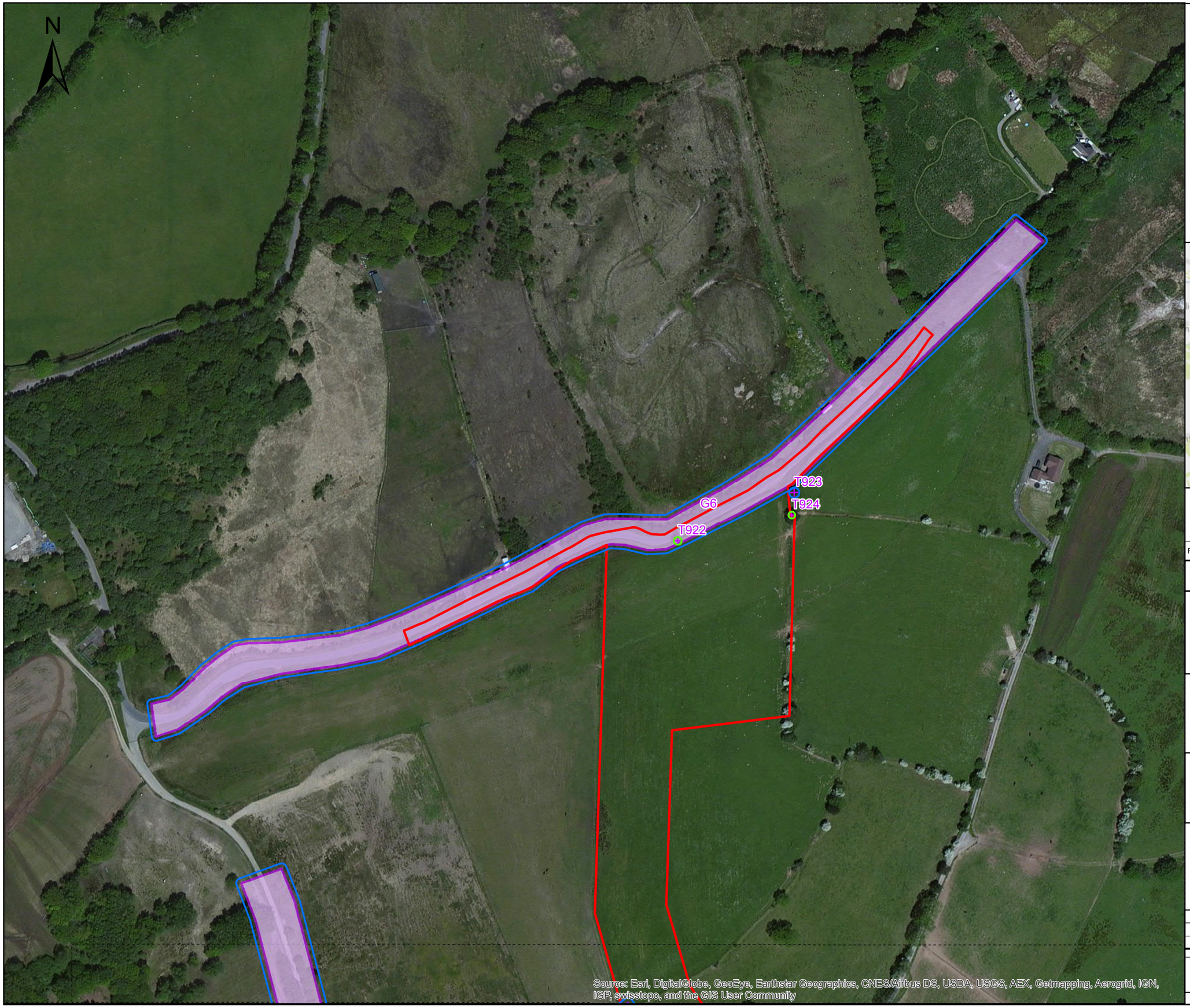
6 Standard scaffold clamps

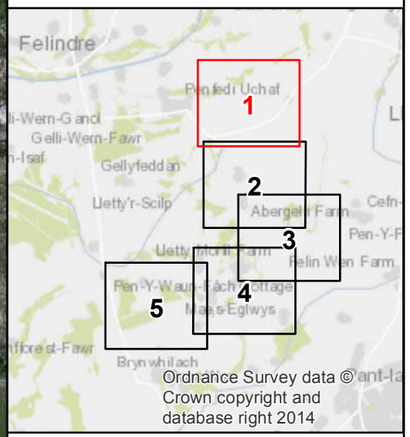
APPENDIX D

BS5837 2012: TREE CONSTRAINTS PLAN



Project Site
Permanent Access Road Land-take
Temporary Access Road Land-take
Surveyed Tree
Surveyed Hedge
Surveyed Tree Area

Root Protection Area Category Grading
B2
C2



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Project Site
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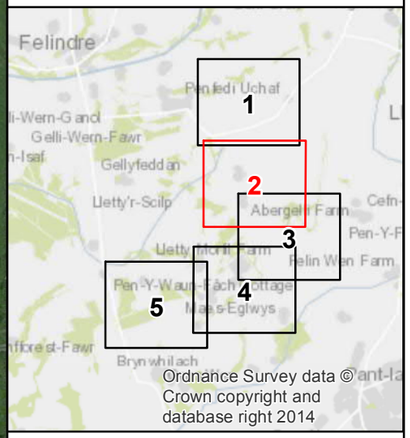
Temporary Access Road Land-take
Surveyed Tree
Surveyed Hedge
Surveyed Tree Area
Root Protection Area Category Grading
B2
C2



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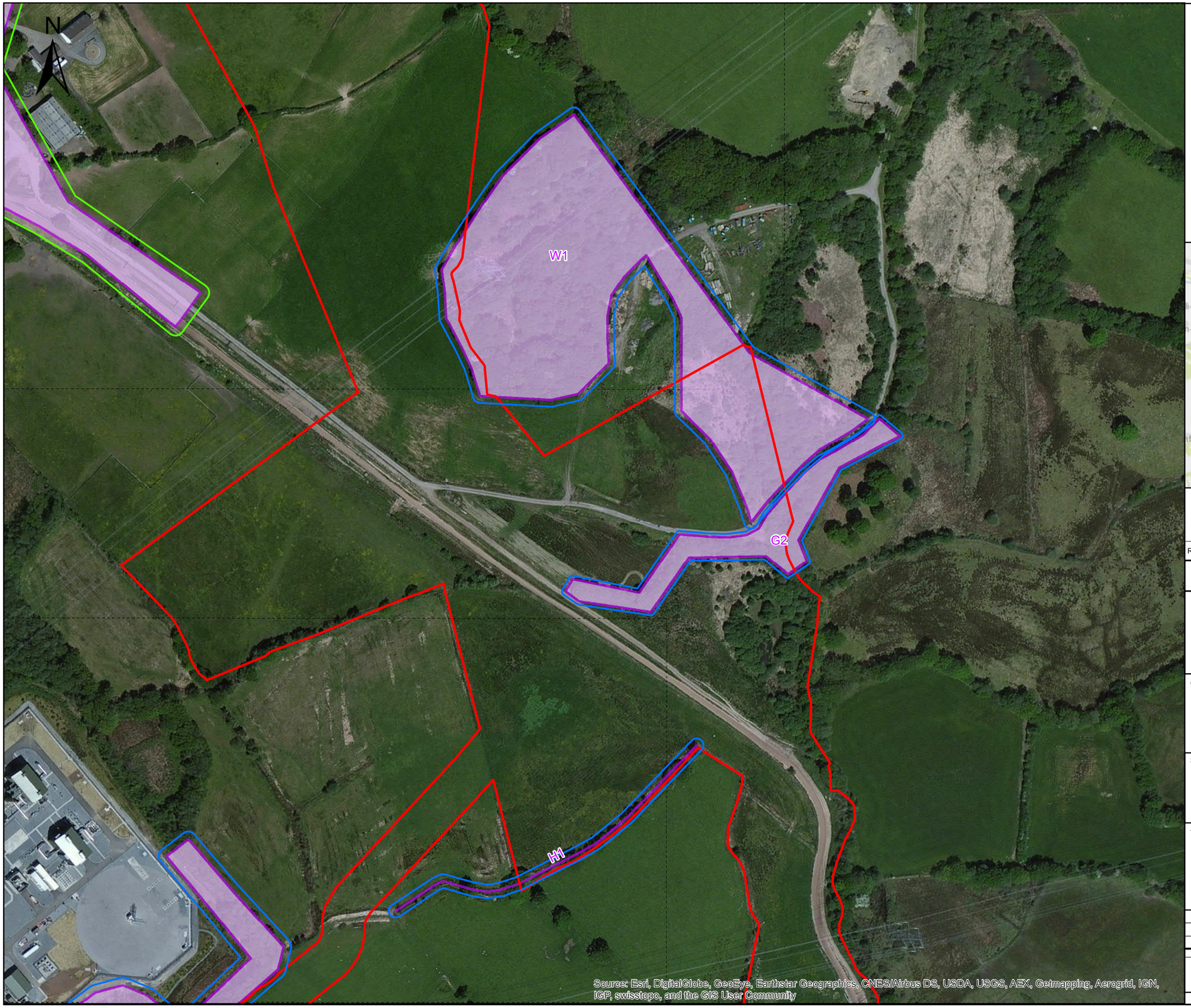

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Surveyed Tree Area

Root Protection Area Category Grading
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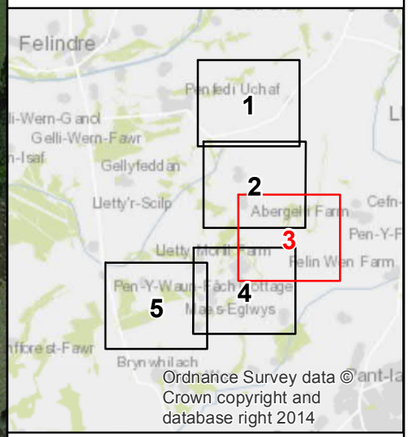
C2



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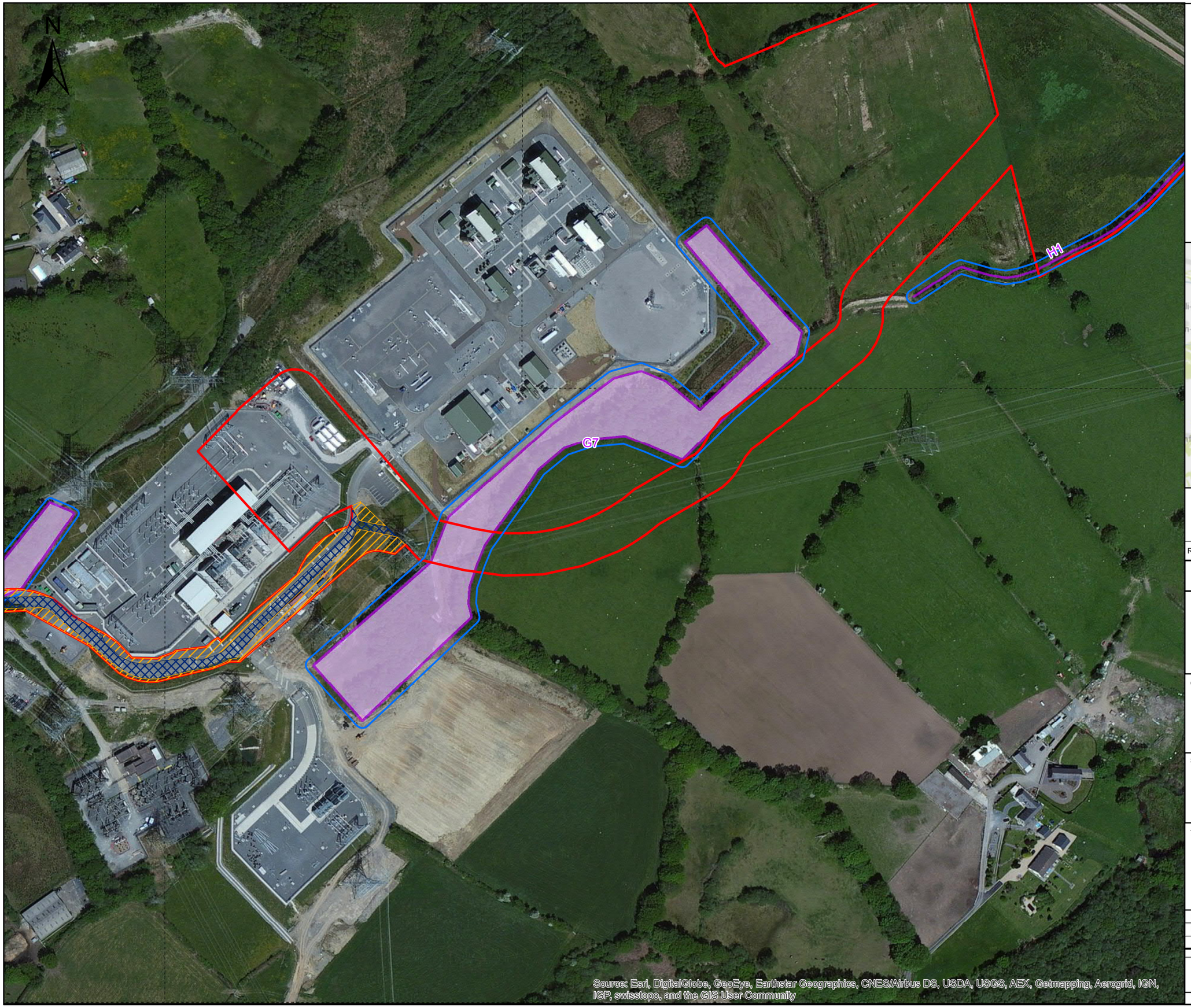

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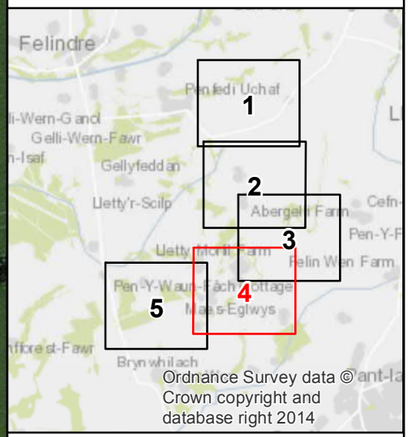

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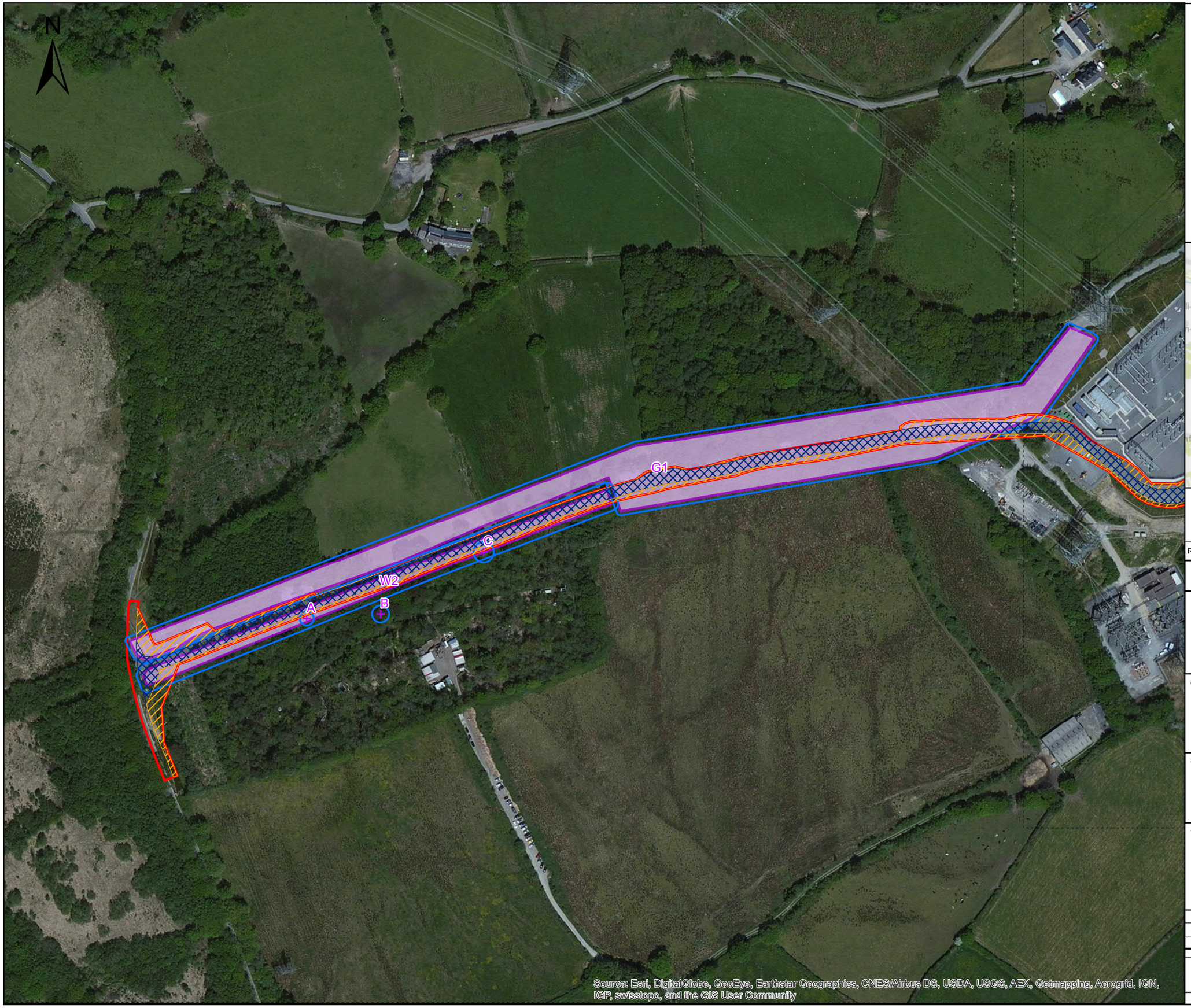

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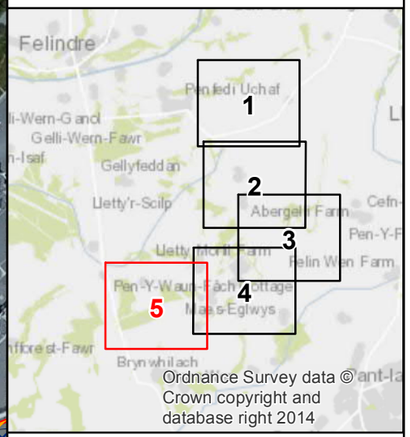

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Appendix 3.13

Preliminary Ecological Appraisal 2014

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Abergelli Power Project

Preliminary Ecological Appraisal

BSG | ecology

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Client	Stag Energy
Job	Abergelli Power Project
Report title	Preliminary Ecological Appraisal
Draft version/final	FINAL
File reference	7399_R_Phase 1_non-confidential_APPR(4)_180614

	Name	**Position**	**Date**
Originated	Anna Gundrey	Senior Ecologist	05 March 2014
Reviewed	Matthew Hobbs	Principal Ecologist	06 March 2014
Reviewed	Jim Fairclough	Principal Ecologist	07 March 2014
Approved for issue to client	Matthew Hobbs	Principal Ecologist	07 March 2014
Issued to client	Matthew Hobbs	Principal Ecologist	07 March 2014
Amended	Matthew Hobbs	Principal Ecologist	20 March 2014
2nd Issue to client	Matthew Hobbs	Principal Ecologist	20 March 2014
Updated	Anna Gundrey	Senior Ecologist	28 May 2014
3rd Issue to client	Matthew Hobbs	Principal Ecologist	02 June 2014
Updated	Anna Gundrey	Senior Ecologist	09 June 2014
4th Issue to client	Matthew Hobbs	Principal Ecologist	10 June 2014
Amended	Matthew Hobbs	Principal Ecologist	18 June 2014
5th issue to client	Matthew Hobbs	Principal Ecologist	18 June 2014

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1 Summary

1.1 Abergelli Power Limited (APL) is promoting a new Power Generation Plant on agricultural land within Abergelli Farm north of Swansea in the City and County of Swansea (approximately at National Grid Reference 265284, 201431).

1.2 The Power Generation Plant would operate as a Simple Cycle Gas Turbine (SCGT) peaking plant and would be designed to provide an electrical capacity of up to 299 Megawatts (MW). It would be fuelled by natural gas, supplied by a new underground gas pipeline connecting the Power Generation Plant to the existing National Grid Gas (NGG) National Transmission System (NTS).

1.3 BSG Ecology has been appointed as the ecological consultant to undertake a preliminary ecological appraisal, which includes a desk study and Extended Phase 1 Habitat Survey. This preliminary survey will inform the subsequent need for further, targeted surveys of protected and otherwise notable species and habitats.

1.4 The preliminary ecological survey has identified two European designated sites within 10km, five statutory designated sites for ecology (four Sites of Special Scientific Interest (SSSIs) and one Local Nature Reserve (LNR)) within 5km, and twenty-three non-statutory designated Sites of Importance for Nature Conservation (SINC) within 2km of the Survey Site boundary. Three of the SINCs are partially within the Survey Site boundary, and a further two are adjacent. Much of the woodland on the Survey Site is also designated as Ancient Woodland. Direct impacts on SINCs and Ancient Woodland within and close to the Survey Site boundary could occur, depending on the final layout of the Power Generation Plant.

1.5 Three Section 42[1] habitats ('lowland mixed deciduous woodland', 'purple moor-grass and rush pasture' and 'ponds') are present within the Survey Site.

1.6 There is habitat in the Survey Site that has the potential to support European Protected Species (EPS) including bats, great crested newts *Triturus cristatus*, dormouse *Muscardinus avellanarius* and otter *Lutra lutra*. There are also habitats suitable for nationally protected species such as reptiles and water voles *Arvicola amphibius*. Information on badgers is contained in a confidential version of this report.

1.7 The following surveys are recommended to inform the ecology baseline chapter of the Environmental Statement and full details are provided in Section 5:

- Extended Phase 1 habitat survey of inaccessible land at the south-west end of the Survey Site and new land that has been identified since the survey was carried out – an access route to the west of the site.
- A National Vegetation Classification (NVC) botanical survey of marshy grassland and woodland that may be affected within the Survey Site as well as any areas identified as SINCs within or adjacent to the site;
- A survey of invasive plant species within the Survey Site;
- Roped access survey of trees identified as having potential to support bat roosts and internal and external building inspections, where trees/buildings may be affected directly or indirectly by the Project. Inspection surveys should include surveys for barn owls. Subsequent dusk emergence / dawn return to roost surveys should be undertaken if roosting potential or evidence of roosting is found;
- Bat activity surveys including walked transects and automated bat detector surveys;
- A survey for otter and water vole along water courses within the Survey Site;
- Dormouse surveys in areas of woodland and scrub within the Survey Site;

[1] Species referred to within The Natural Environment and Rural Communities Act 2006 (NERC 2006) as species of principal importance for the conservation of biodiversity in Wales which are listed on the Natural Resources Wales website. The Welsh Assembly Government must take steps to "further the conservation" of these species under Section 42 of the NERC ACT 2006.

- Great-crested newt surveys of all accessible ponds up to 250m from the Survey Site;
- Reptile surveys on suitable habitat across the Survey Site;
- A walkover breeding bird survey of all of the Survey Site plus a 50m buffer;
- Invertebrate surveys of woodland and marshy grassland for *Lepidoptera* (notably moths and marsh fritillary butterfly *Euphydryas aurinia*) and *Coleoptera* (beetles) within the Survey Site; and
- Invertebrate surveys of freshwater habitats (ponds and watercourses) may be needed where these habitats are to be affected within the Survey Site.

2 Introduction

Site Description

2.1 The Phase 1 Habitat Survey Site (hereafter referred to as the 'Survey Site'), in which the Project would be located, consists of approximately 150 ha of pastoral farmland primarily grazed by horses. The Survey Site is contained within the red line boundary shown in Figure 1 and is centred at National Grid Reference 265284, 201431. The nearest town is Felindre, which is located approximately 2 km to the north of the Survey Site, with Swansea approximately 5 km to the south.

2.2 The Survey Site is largely agriculturally improved pasture with several areas of marshy grassland, particularly in the north, south and north-western ends of the Survey Site. The fields are bounded by fences, running along the line of defunct hedgerows, and often accompanied by ditches. There is a block of broadleaved woodland on the eastern boundary of the Survey Site and areas around the marshy grassland to the west of the Survey Site, and around Felindre Gas Compressor Station and the two National Grid 400kV electrical substations that lie at the south-west end of the Survey Site. The habitats in the surrounding landscape are similar to those within the Survey Site boundary – a mixture of improved and marshy grassland interspersed with occasional patches of woodland.

2.3 The Survey Site boundary is shown on Figures 1a, 1b, 2a and 2b (photographs of the Survey Site are found in Appendix 2).

Description of Project

2.4 APL is promoting a new Power Generation Plant within Abergelli Farm. The Power Generation Plant would operate as a Simple Cycle Gas Turbine (SCGT) peaking plant and would be designed to provide an electrical capacity of up to 299 Megawatts (MW). It would be fuelled by natural gas, supplied by a new underground gas pipeline connecting the thermal generating station to the existing National Grid Gas (NGG) National Transmission System (NTS).

2.5 BSG Ecology has been appointed as the ecological consultant to undertake a preliminary ecology survey, which includes a desk study and Extended Phase 1 Habitat Survey. This preliminary ecological survey will inform the subsequent need for further, targeted surveys of protected and otherwise notable species and habitats. These baseline surveys will be included in an appendix to an ecology chapter of an Environmental Statement, which is presently intended for submission, as an integral part of the Development Consent Order (DCO) Application.

Aims of Study

2.6 BSG Ecology was commissioned to undertake a preliminary ecological appraisal of the Survey Site within which the Project would be located. The main aims of this report are to:

- present the findings of the desk study and site surveys;
- assess the potential for the Survey Site to support protected or otherwise notable species;
- set out the legislative and/or policy protection afforded to any habitats present or any species potentially associated with the Survey Site; and
- provide recommendations for any further surveys necessary to inform a subsequent ecology chapter for an Environmental Statement for the site.

3 Methods

Desk Study

3.1 Existing ecological information for the Survey Site and its surrounding area was requested from the South East Wales Biodiversity Records Centre (SEWBReC). Information on European designated sites was requested from within 10 km with information on national statutory designated sites was requested covering the Survey Site and land up to 5 km from the Survey Site boundary and information regarding non-statutory designated sites and records of protected[2] or notable species (particularly those identified as priority or Section 42 species and/or of local conservation importance or LBAP[3] species) was requested covering the Survey Site and land up to 2 km from the Survey Site boundary. Information on locally designated Sites of Importance for Nature Conservation (SINC) within 2 km of the Survey Site boundary was requested from the Swansea Council Ecologist. In addition, on-line resources including the Multi Agency Geographic Information for the Countryside (MAGIC, www.magic.gov.uk) website and aerial photography of the area were also reviewed.

Field Survey

Phase 1 Habitat Survey

3.2 The initial field survey was undertaken by Anna Gundrey MCIEEM and Matthew Hobbs MCIEEM on 24 February 2014. The Project Site boundary and therefore the Survey Site was subsequently extended after a design review, and a second field survey was carried out by Stephanie Boocock MCIEEM on 14 April 2014 of the additional area. Habitats within the Survey Site, and up to at least 50m from the Survey Site boundary, were identified and described following standard JNCC Phase 1 Habitat Survey methodology as detailed in the Phase 1 Habitat Survey Handbook (JNCC, 2010). This uses a system of codes to describe different habitat types based on the dominant vegetation present, which are recorded by means of habitat maps and target notes. All plant names in this report follow The New Flora of British Isles (Stace, 2010).

3.3 The survey was extended to give particular consideration to the potential of the habitats present to support protected species or species of local conservation importance; recorded as incidental information as part of the target notes.

3.4 It should be noted that species lists derived from the target notes are not necessarily an exhaustive inventory of all species occurring at a site. They are intended to illustrate the character of habitats present, general species richness of a particular area, and draw attention to any species that may be considered uncommon or unusual.

3.5 Weather conditions during both surveys were clear and largely dry.

Habitat Suitability Index

3.6 During the February field survey a Habitat Suitability Index (HSI) assessment (Oldham *et al*., 2000) of all ponds/water bodies within a 500m radius of the Survey Site (where access was possible) was undertaken. In the case of this survey, a wider buffer than 250m was used because of the high number of ponds within 250 and 500m of the Survey Site. The additional information collected is useful to provide context of how ponds within or in proximity to the Survey Site may connect with habitat available for newts in the surrounding landscape, and also to give greater confidence to the assessment carried out on each pond.

3.7 Information on the physical features and characteristics of each pond were collected in order to allow a great crested newt Habitat Suitability Index (HSI) score to be derived for each pond by applying the scoring system developed by the Herpetological Conservation Trust (HCT, 2008). The suitability index is calculated by allocating scores to features associated with each pond; these

[2] Wildlife and Countryside Act 1981 Schedules 1, 5 & 8; Conservation of Habitats and Species Regulations 2010; Protection of Badgers Act.
[3] Those listed under Local Biodiversity Action Plans for Swansea.

include features such as size, quality of surrounding habitat and presence of fish. These scores are then used to calculate the overall HSI for each pond as a number between 0 and 1, with 0 being the least suitable and 1 being the most suitable. The HSI score allows each pond to be placed in one of five categories defining its suitability for great crested newts as follows:

- <0.5 = poor
- 0.5 – 0.59 = below average
- 0.6 – 0.69 = average
- 0.7 – 0.79 = good
- >0.8 = excellent

Tree Assessment

3.8 All the trees on site were examined for their potential to support roosting bats, graded according to the scale provided in the Bat Conservation Trust survey guidelines (Hundt, 2012), and summarised in Table 1 below. Those that were rated Category 2 and above were described and their locations recorded on a GPS.

Table 1: Bat tree survey categories

Category	Description
1*	Tree with multiple highly suitable features for bats. Potential to support large numbers of bats.
1	Tree with some definite suitable features and potential to support low numbers of bats.
2	No obvious potential although tree is of a size and age that elevated surveys may reveal suitable cracks and crevices. Or, tree supports some limited features for bats.
3	No potential

Limitations to Methods

3.9 Although records secured through the desk study and supplied by third parties provide useful background information for initial ecological assessment, they often comprise individual records supplied by members of the public or are the result of ad hoc surveys. The data trawl information can therefore help to inform the likelihood of a particular species being present in the area, but should not be relied upon to definitively determine presence or absence of individual species.

3.10 The first site visit was undertaken at a sub-optimal time of year (February) for a survey of this type, being outside the main growing season, when the greatest variety of plants is in evidence. However the habitats on site are readily identifiable to an experienced botanist, and those that require further survey work in order to confirm their quality have been identified. In addition, a robust assessment of the Survey Site's potential to support protected species could also be made. Therefore, it is considered that the timing of the survey in this instance is not a significant constraint with regard to the findings of this assessment. The second survey on the 14th April was undertaken at a time when most plant species are evident and was less constrained in this respect.

3.11 Most parts of the Survey Site were accessed and surveyed. Some of the ponds outside of the Survey Site could not be accessed (see Figures 2a and 2b) as they were located on private land and access was denied to a number of them. Ponds within 250-500m of the Survey Site, where accessible, were inspected to gather contextual information and enough have been inspected to allow suitable additional background information to be gathered.

3.12 The extreme south-west end of the Survey Site could not be surveyed as the land here is in a separate ownership and access had not been granted by land owners at the time of survey. The route of the access track (that leads west to the B4489) was added to the Survey Site boundary after the April Phase 1 visit, so this was also not included in the survey. A recommendation has been made below to survey the remainder of the Survey Site as soon as access has been granted.

4 Results and Interpretation

4.1 In this section the results of the desk study and fieldwork are brought together. The implications of these results are then considered.

4.2 Figures 1a (the northern part of the site) and 1b (the southern part of the site) illustrate the results of the extended Phase 1 habitat survey. Numbers on the map and in the text below can be cross-referenced with Target Notes (TN) in Appendix 1. Photographs of the site can be found in Appendix 2. Figures 2a (the northern part of the site) and 2b (the southern part of the site) illustrate areas of the site that support, or have the potential to support, protected species.

Designated Sites

Statutory

4.3 There are two Special Areas of Conservation (SAC)[4] designated under the EC Habitats Directive within 10km. One of these, Camarthen Bay and Estuaries SAC, has has been afforded multiple designations and is referred to under the umbrella term European Marine Site (EMS)[5] which comprises the SAC, and is also split into two Special Protection Areas (SPA)[6] and two Ramsar Wetlands of International Importance (Ramsar)[7] the details of each designation are provided below. There are also four statutory protected Sites of Special Scientific Interest (SSSI) and one Local Nature Reserve (LNR) within 5km of the Survey Site. These are described in Table 2 below.

Table 2: Statutory designated sites within 5km of the Survey Site and European sites within 10 km.

Site name	Grid ref.	Distance and direction from site	Reason for Designation
Carmarthen Bay and Estuaries SAC	SS357991	7.2km W	Annex I habitats (primary reason for selection) – 'Sandbanks which are slightly covered by sea water all the time', 'Estuaries', 'Mudflats and sandflats not covered by water at low tide', 'Large shallow inlets and bays', '*Salicornia* and other annuals colonising mud and sand', 'Atlantic salt meadows. Annex II species (primary reason for selection) – twaite shad *Allosa fallax*. Annex II species (qualifying feature) – sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alos alosa* and otter.
Burry Inlet SPA and Ramsar (within the boundary of the SAC above)		9.7km WSW	This area is designated as a SPA and Ramsar site due to its internationally important assemblage of wintering birds with qualifying populations of wintering oystercatcher *Haematopus ostralegus*,and northern pintail *Anas acuta* (SPA) and additionally of common redshank *Tringa totanus*, and red knot *Calidris canuta* (Ramsar).
Crymlyn Bog SAC and Ramsar (contiguous boundaries)	SS694947	7.3 km SE	Annex I habitats (primary reason for selection) – 'Transition mires and quaking bogs', 'Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*' ', Annex I habitats (qualifying feature) – Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*,*Alnion incanae*, *Salicion albae*). The site is selected as Ramsar as it supports a substantial population of the nationally-rare slender cotton-grass *Eriophorum gracile*, and

[4] Special Areas of Conservation (SACs) are strictly protected sites designated under the EC Habitats Directive. Article 3 of the Habitats Directive requires the establishment of a European network of important high-quality conservation sites that will make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended).

[5] The term 'European Marine Site' (EMS) (as defined by the Habitats Regulations) refers to those marine areas that area both Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). For management advice see http://www.severnestuary.net/asera/docs/Regulation%2033%20Advice.pdf

[6] Special Protection Areas (SPAs) are strictly protected sites classified in accordance with Article 4 of the EC Birds Directive, which came into force in April 1979. They are classified for rare and vulnerable birds (as listed on Annex I of the Directive), and for regularly occurring migratory species.

[7] Ramsar sites are wetlands of international importance designated under the Ramsar Convention.

			a rich invertebrate fauna including many rare and highly localised species. The site also suports 199 vascular plant species including 17 regionally-uncommon and one nationally rare species.
Glais Moraine SSSI	SN696005	4 km E	Designated for its geological interest.
Nant Y Crimp SSSI	SN623015	2.5 km W	Designated for its wet pastures, species-rich neutral grasslands and semi-natural woodland, which are host to several uncommon plant species. In addition, there is a colony of marsh fritillary butterfly on site.
Penllergaer Railway Cutting SSSI	SS622998	2.8 km NW	Designated for its geological interest.
Penplas Grasslands SSSI	SS634979	3.2 km NW	Designated for the eight different grassland types that have been identified on the site, including three types of purple moor-grass pasture, two of rush pasture, fen meadow, acid grassland and damp heath. Notable plant species recorded at Penplas include petty whin *Genista anglica* and royal fern *Osmunda regalis.*
Cadle Heath LNR	SS627966	4.5 km NW	Designated for wet heath, species-rich grassland, ponds, scrub and woodland. There is also a significant colony of wood bitter vetch.

4.4 Glais Moraine SSSI and Penllergaer Railway Cutting SSSI are both designated for their geological interest, which is unlikely to be impacted upon by the Project and will therefore not be considered further in this report.

Non-statutory

4.5 There are 23 Sites of Interest for Nature Conservation (SINC) within 2 km of the Survey Site. These are described in Table 3 below and their locations are shown on Figure 3. Three SINCs lie partially within the Survey Site boundary. Rhyd-Y-Pandy Valley Grasslands is a large SINC, which includes three fields that lie within the north-east corner of the Survey Site. Warn Garn Wen is also an extensive SINC which includes the marshy grassland that lies within the western boundary of the Survey Site. Llety Morfil SINC is a collection of three areas of ancient woodland with some areas of marshy grassland, that includes the woodland on the eastern boundary of the site and at the south-west end of the Survey Site.

4.6 There are two SINCs located adjacent to the boundary. Rhos Fawr SINC is a block of land immediately to the north of the Site boundary, and Felindre Grasslands SINC lies adjacent to the southern tip of the proposed access route.

4.7 Most of the woodland within the Survey Site is also designated as Ancient Woodland (See Figure 3).

Table 3: Non-statutory sites within 2km of the Survey Site. Citations for some of the SINC sites are not yet available and will be added when they are.

Site name	Grid ref.	Distance and direction from site	Site Description
Waun Garn Wen	SN645012	Onsite	Purple moor grass and rush pasture, wet woodland, scrub and watercourse habitats. Section 42 invertebrates and birds recorded.
Llety –Morfil	SN644006	Onsite	Wet and ancient semi-natural woodland, purple moor grass and rush pasture, and scrub habitats. Section 42 invertebrate species recorded.

Rhyd-Y-Pandy Valley and Grasslands	SN661022	Onsite	Wet woodland and woodland with assemblage of ancient woodland indicator species, scrub, purple moor grass and rush pasture, lowland meadow, neutral grassland, scrub, reed bed and water course habitats. Section 42 bird species recorded.
Rhos Fawr	SN652029	Adjacent N	Woodland containing assemblage of ancient woodland indicator species, scrub, purple moor grass and rush pasture, neutral grassland habitats. Section 42 bird species recorded.
Felindre Grasslands	SS638998	Adjacent SW	Wet woodland and lowland mixed deciduous woodland, purple moor grass and rush pasture and scrub habitats. Section 42 birds and invertebrates recorded.
Llangefelach Common SINC	SS648994	1.3 km SW	Common cotton grass *Eriophorum angustifolium*, ragged-robin *Lychnis flos-cuculi* , western gorse *Ulex gallii*, various orchid species, tormentil *Potentilla erecta* and whorled caraway *Carum verticillatum* are present along with adder, common lizard and slow worm.
Lower and Upper Lliw Reservoirs SINC	SN653035	1 km N	The lower and upper Lliw reservoirs are surrounded by a mosaic of habitats including bracken, scrub, broadleaved woodland and lowland acid grassland.
Cwm Nant-Ddu		2 km NW	Data not yet received
Middle Lliw		1 km NW & W	Data not yet received
Cilfaen	SN641021	0.5 km W	Wet woodland and woodland containing ancient woodland assemblage, and purple moor grass and rush pasture habitat.
Cefn Forest Stream	SS635997	1 km SW	Range of woodland types. Lowland meadow, heath and fen. Purple moor grass and rush pasture, ponds and watercourses.
Penllegaer Forest	SS627005	1 km SW	Range of woodland types. Purple moor grass and rush pasture, reedbeds watercourses. Section 42 birds and invertebrates recorded.
Penllegaer to Llangefelch Tunnel and Railway Line	SS632996	1 km S	Range of woodland types. Purple moor grass and rush pasture, scrub and watercourses. Section 42 birds recorded.
M4 Corridor		1.5 km S	Data not yet received
Mynydd Bach Common	SS652978	2km S	Woodland scrub and purple moor grass and rush pasture habitats.
Pant Lasau	SN652004	0.25 km S	Woodland, scrub, purple moor grass and rush pasture, and water course habitats
Middle Llan	SN659009	0.5 km S	Watercourse habitat
Cwm Rhydceinw to Birchgrove Railway		1.5 km SE	Data not yet received

Mynydd Gelli-wasted	SN677016	1.5 km E	Woodland, scrub, heath, purple moor grass and rush pasture habitats.
Ynysforgan Wood	SN677002	2 km SE	Ancient woodland habitat.
Lougher to Penllegaer Railway Line		2 km SW	Data not yet received
Banc Darren Fawr		2 km N	Data not yet received
Cwm Clydach		2 km NE	Data not yet received

Habitats

4.8 The Survey Site is roughly an 'L' shape, with the majority of the Survey Site running approximately north-south and the foot of the 'L' branching off to the south-west around either side of Felindre Gas Compressor Station and the two National Grid 400kV electrical substations. The topography drains the land to the south with the highest elevation in the Survey Site along the northern boundary (approximately 140m above ordnance datum (aod). The land slopes away to the south and the lowest elevation is around the Felindre Gas Compressor Station and the two National Grid 400kV electrical substations (approximately 80m aod). The land is predominantly pastoral farmland, mostly agriculturally improved but with significant areas of marshy grassland. The fields are grazed by horses and sheep and are largely bounded by fences with occasional trees, scrub and one defunct hedgerow. There are numerous water courses on site, mostly in the form of ditches along field boundaries, but also four streams; one which runs along the eastern boundary of the Survey Site; another that runs north-west from the woodland in the eastern part of the site; a stream that runs through the marshy grassland to the west; and another around Felindre Gas Compressor Station and the two National Grid 400kV electrical substations. There is a small woodland on the eastern boundary of the Survey Site and the land around Felindre Gas Compressor Station and the two National Grid 400kV electrical substations is also largely wooded. There are also copses and stands of mature trees around the edges of the marshy grassland in the north-western part of the site, as well as along field boundaries in the northern part of the site.

Improved grassland

4.9 The majority of the land on site is agriculturally improved grassland (Photo 1, 2a). This was all grazed short when surveyed, and consists of abundant perennial rye-grass *Lolium perenne*, and varying quantities of common grassland herbs such as white clover *Trifolium repens,* common mouse ear *Cerastium fontanum*, and dandelion *Taraxacum fontanum* agg.

Marshy grassland

4.10 There are marshy grassland fields at TN3, TN3a, TN4a, TN5, TN9a, TN13a and TN21a and a block of marshy grassland at the southern end of the Survey Site. Although all fit within the same Phase 1 category, the habitats in these fields vary across the Survey Site. The field at TN3 (Photo 2) had a short, close-grazed sward when surveyed. It has numerous tussocks of soft rush *Juncus effusus* and frequent sedge species. These include common sedge *Carex.nigra* and glaucous sedge *C. flacca*. Other species noted include creeping bent *Agrostis stolonifera*, a cinquefoil *Potentilla* sp., creeping buttercup *Ranunculus repens* and sharp-flowered and/or jointed rush *Juncus actutiflorus* / *J. articulatus*.

4.11 The field at TN5 (Photo 3) was also grazed extremely short, when surveyed, to the point where individual species are difficult to distinguish. Soft rush is frequent, along with purple-moor grass *Molinia caerulea,* sheep's fescue *Festuca ovina* and a sedge species (not possible to identify to

species level). Heather *Calluna vulgaris* and bilberry *Vaccinium myrtillus* plants are occasional and there are patches of sphagnum moss *Sphagnum* sp. present.

4.12 The fields marked TN3a, TN4a and TN13a, are wet semi-improved grassland, with marshy species such as lesser spearwort *Ranunculus flammula*, sedges, soft rush and water figwort *Scrophularia aquatica*.

4.13 The fields marked TN20 all have over 25% soft rush which places them in the 'marshy grassland' category, but the intervening grassland is agriculturally improved, with abundant perennial rye-grass and frequent white clover. The fields marked TN21 and TN22 (Photo 4) have a much higher cover of soft rush - approximately 75% in TN21 and 100% in TN22 and intervening species are more typical of wet grassland, such as creeping bent *Agrostis stolonifera*, creeping buttercup and Yorkshire fog *Holcus lanatus*.

4.14 Areas of purple-moor grass dominated vegetation, which also falls into the 'marshy grassland' category are present at TN14 (Photo 5), TN9a and TN21a where the purple moor grass is dominant with very occasional cross-leaved heath *Erica tetralix* and heather plants in evidence and scattered willow *Salix* sp. scrub. At TN9a additional species recorded include soft rush, bracken, common haircap moss *Polytrichum commune*, unidentified sphagnum moss, heather, cross-leaved heath and bilberry along the margins with some birch and willow regeneration in small scattered copses. TN21a (Photo 4a) is a large field which is superficially similar to that at TN9a but appears to have been managed. Purple moor-grass is not as dominant with numerous patches of bare earth and young ling and cross-leaved heath plants. In addition hare's-tail cotton grass *Eriphorum vaginatum*, (Photo 1a) deergrass *Trichophorum germanicum* and lousewort *Pedicularis* sp. are common.

Semi-improved Grassland

4.15 The field to the south of the woodland at TN10 appears to be slightly less agriculturally improved, having a lower cover of perennial rye-grass, and a wider range of grasses such as Yorkshire fog, crested dog's tail *Cynosurus cristatus* and creeping and common bent *Agrostis capillaris*. The field is nevertheless species-poor. There are also two species-poor semi-improved fields in the north-east corner of the site (TN3a, TN13a, Photo 3a).

Woodland and scrub

4.16 There is a block of broadleaved woodland along the eastern boundary of the Survey Site at TN10. The western end is on a hill, and is dry with widely-spaced trees and a grazed grassland ground flora including species such as Yorkshire fog, common mouse-ear and creeping buttercup. The trees here are small to medium-stemmed with very little understory, and include birch *Betula pendula*, crab-apple *Malus sylvestris*, holly *Ilex aquifolium* and pedunculate oak *Quercus robur*. The hill slopes down steeply to the east, where a stream delineates a lower, wetter area of woodland. Here the tree species composition is similar but the understorey is much thicker with bramble predominating. On wetter areas, where the bramble thins out, carpets of opposite-leaved golden-saxifrage *Chrysosplenium oppositifolium* are present. There are also extensive areas of purple moor-grass dominated ground flora with sphagnum moss species also present.

4.17 To the north of this woodland there is a thin strip of deciduous woodland running along the banks of a stream running north to south at TN42. The species composition includes occasional birch, willow, ash and holly. There is an understory made up largely of gorse with bramble scrub and soft rush grading into improved grassland to the east.

4.18 Another relatively extensive area of broad-leaved woodland is present at the south-west end of the Survey Site around Felindre Gas Compressor Station and the two National Grid 400kV electrical substations. This forms a strip to the south and a more continuous block to the north of Felindre Gas Compressor Station and the two National Grid 400kV electrical substations. The woodland is generally quite wet, with alder *Alnus glutinous* and willow species frequent along with pedunculate oak, birch and holly. The trees are growing close together and are generally small-stemmed and straggly. The understorey is dense bramble and ground flora was largely absent when surveyed, although where the woodland opens out, for example around the margins of Felindre Gas Compressor Station and the two National Grid 400kV electrical substations, soft-rush dominated marshy grassland is present.

4.19 There are also patches of deciduous woodland around the edges of the marshy grassland on the block of land to the west of the road that runs through the Survey Site. At TN6a there is a small wooded spur with tree species including oak, birch, holly, hawthorn and an understorey dominated by brambles and including ivy *Hedera helix*, creeping bent, Yorkshire fog, soft rush, hard fern *Blechnum spicant*, scaly male fern *Dryopteris affinis*, and bracken *Pteridium aquilinum*. AtTN23a there is a wooded copse comprised of young birch and willow with an understorey of bramble scrub. The ground flora incudes nettle, lady fern *Athyrium filix-femina,* scaly male fern *Dryopteris affinis* and wood false brome *Brachypodium sylvaticum*. A continuous area of scrub is present to the south of the woodland at TN10 and around the pond at TN15. These areas are quite wet and include willow species (including grey and goat willow *Salix cinerea, S. caprea*), alder and bramble. At TN15 the scrub merges into stands of purple moor grass that are present around the pond. There are also blocks of scrub to the south of Abergelli Farm, along the stream that runs along the eastern boundary, at the northernmost point of the Survey Site, and within the marshy grassland to the west. Scattered scrub (mostly common gorse *Ulex europaeus*) is present along some fence lines, and there is a bramble scrub-covered bund at TN4.

4.20 Many of the trees within the Survey Site are along site boundaries and are remnant hedgerow stools, as described in the section below.

Boundary features

4.21 All boundaries on site are fences, except one length of species-poor hedgerow running north of Abergelli Farm. The fences often run along the line of defunct hedges (Photo 1). These generally take the form of a degraded stone-faced hedge banks, with occasional small sections of overgrown hedge. The overgrown hedges include mature standard trees, large coppice stools and clumps of bramble and gorse scrub. Species present include pedunculate oak, holly, birch, ash *Fraxinus excelsior,* hazel *Corylus avellana* and hawthorn *Crataegus monogyna*.

4.22 Some of the fields on site have overgrown margins where the vegetation is less trampled and grazed along the fence line. For example the northern boundary of the improved field to the north of the field marked TN3 has a ditch lined with purple moor-grass and gorse, and further east along this boundary fence bracken is frequent. The western boundary of the field marked TN22 has purple moor-grass and heather growing along the fence.

Water Courses

4.23 There are numerous small water courses within the Survey Site. These are mostly ditches along field boundaries (TN22a, Photo 5a), but there is also some larger streams. The block of marshy grassland to the west is criss-crossed by numerous ditches, which were largely dry or with marshy bases when visited in April. There is also a stream that runs through this block of land – this is shaded by flanking woodland, with a stone bed and shallow banks. Another stream (Photos 8, 9 and 6a) runs south-east through the Survey Site and splits into smaller tributaries through the woodland at TN10. There are also small watercourses present around the margin of Felindre Gas Compressor Station and the two National Grid 400kV electrical substations. All features that were visited in February had flowing water, reflecting a period of prolonged wet weather preceding the survey. Aquatic vegetation is not apparent in any of the water courses, but marginal vegetation includes frequent soft rush, occasional purple moor-grass and scattered gorse and bramble.

Water Bodies

4.24 There are four water bodies within the Survey Site. The pond at TN15 (Pond17 – see 4.39) is approximately 10m in diameter, shallow, and completely covered in an unidentified sedge species. It has a small tree-covered island in the centre. The pond is ringed by small willow and alder trees. The surrounding vegetation is dominated by purple moor-grass with occasional heather and cross-leaved heath plants, with densely growing small trees and scrub (grey willow, bramble and alder). A small pond immediately to the south is shown on OS maps. This was not apparent amongst the scrub, but there were small patches of standing water (including wheel ruts) within purple moor grass in this area.

4.25 A small pond is present at TN19 (P18 – see 4.39) adjacent to an electricity pylon. The pond is approximately circular and 5m in diameter. It is in woodland and completely surrounded by small saplings. There was no evidence of marginal or emergent aquatic vegetation when surveyed.

4.26 Two ponds are also present immediately to the west of TN30a (Ponds 11 and 12). Pond 12 is approximately 10m in diameter, open and unshaded with both aquatic and marginal vegetation present. It appears to be an extension of two field drains that meet at this point. Pond 11 is a small wet depression containing no vegetation.

Invasive Species

4.27 Japanese knotweed *Fallopia japonica* was noted on at least two locations on the block of land to the west of the road that runs through the site. At Target Note 15a several stands of the species were noted on an embankment to a large raised area. At Target Note 18a a stand of the species was noted on a bend in the stream. There are also several stands of this species growing on the edge of the road that leads into Abergelli Farm from the west. These extend just beyond the western site boundary and into the Survey Site.

4.28 Himalayan balsam *Impatiens glandulifera* was also noted in two areas. Abundant seedlings of the species were noted in the wooded copse at Target Note 23a and on an area of deciduous woodland at Target Note 28a.

Protected Species and Species of Conservation Importance

4.29 This section presents the protected species records provided by SEWBReC along with any evidence of the species, or potential for it to be present gathered during the field survey. Where relevant it also evaluates the potential for the Survey Site to support Section 42 species identified within the desk study area. The legislation and policy relevant to each species or species group is described in Appendix 6.

Bats

4.30 There were 126 bat records provided by SEWBREC from the 2 km radius search area. Of these the majority were recorded during bat transects carried out to inform a separate unrelated development proposal, named 'Felindre development site in the records' approximately 1 km to the south west of the Survey Site boundary.

4.31 The bat species recorded from the desk study include brown long-eared bat *Plecotus auritus*, common pipistrelle *Pipistrellus pipistrellus*, Natterer's bat *Myotis nattereri*, noctule *Nyctalus noctula*, and whiskered bat *Myotis mystacinus*. There were also unidentified *Pipistrellus* sp. and records where the bat species was not specified.

4.32 There are four bat roosts amongst the records provided. The closest of these is a record of 50 unspecified bat species 1.8 km to the south-east of the Survey Site at Ynystawe, Swansea from 1992. The next closest is a night / feeding roost of an unspecified species 1.9 km south west of the Survey Site boundary in Tredegar-Fawr farm buildings from 1998. A record of a roost of 87 whiskered bats also comes from approximately 1.9 km to the north west of the Survey Site boundary in Felindre, Swansea from 1993. The fourth record is a roost of 70 bats of unspecified species, 2.5 km to the south east of the Survey Site in Ynysforgan, Swansea from 1993.

4.33 There are a number of buildings associated with Abergelli Farm that fall within the Survey Site. These are all situated along the road that runs between the Water Treatment Works to the north of the Survey Site and Felindre Gas Compressor Station and the two National Grid 400kV electrical substations to the south. Abergelli Farm consists of a rendered brick-built building (Photo 26) with a tiled pitched roof. It has overhanging eaves with wooden soffits. The associated stable block (Photo 27) is of the same construction with an 'L'-shaped footprint. Opportunities for roosting bats are fairly limited as the buildings appear to be in good condition, although gaps in the woodwork around the eaves would allow entry into the soffits.

4.34 At TN4 is a small concrete bunker (Photo 31) within an area of waste land. It is formed of 2 m high brick walls with a flat roof formed from concrete sleepers. There is an open doorway on the south elevation and a 30 cm x 30 cm hole at the top of the west-facing wall. This has some potential to support roosting bats.

4.35 Immediately to the north (Photo 29) and south (Photo 28) of Abergelli Farm are large barns constructed of corrugated metal and asbestos. Potential for roosting bats in these buildings is low.

There are also two brick-built sheds with corrugated metal/asbestos pitched roofs (Photo 30) adjacent to the northern barn which may have greater potential to support bats, having some gaps in the brickwork that could allow entry in to the buildings.

4.36 Further south, to the south of TN25a, is a pair of houses set within plots of hard-standing and amenity grassland. These are newly built and in good condition with no opportunities for roosting bats.

4.37 There are 21 trees on or within 50 m of the Survey Site that have the potential to support roosting bats. Of these two have been classed as Category 1 (with definite suitable features that may support larger roosts of bats – see Table 1), and the remainder are Category 2 (with some limited roost features – see Table 1). The locations of the trees (T1-21) are illustrated in Figures 2a and 2b and full details of the trees are provided in Appendix 3.

4.38 The northern end of the Survey Site offers limited foraging and commuting potential for bats. The boundaries are fences and short sections of remnant hedgerows and the fields are closely grazed. The block of marshy grassland, woodland and scrub to the west of the road that runs through the Survey Site, and the wooded stream that runs along the eastern boundary offer more potential, and both areas have good wooded connections with a network of hedgerows, tree-lines and marshy pastures off-site. The damp wooded area around Felindre Gas Compressor Station and the two National Grid 400kV electrical substations at the south-west end of the Survey Site also offers foraging potential and connects to off-site blocks of woodland to the north and south that may be good habitat for bats.

4.39 It is concluded that the Survey Site is likely to have moderate value for bats. There are a few potential roosting opportunities, and some areas (woodland and marshy grassland) of the Survey Site which offer foraging opportunities, but the Survey Site as a whole does not have good linear commuting features and the majority of the habitats (tightly grazed improved grassland) are of low foraging value.

Great crested newt

4.40 There were no records for great crested newts provided by SEWBREC within 2 km of the Survey Site.

4.41 Nineteen ponds have been identified within 500 m of the Survey Site boundary with the aid of aerial photographs and OS maps. Of these, two were identified within the Survey Site boundary (Pond 17 turned out to be a single pond when surveyed) and eight within 250 m of the Survey Site. An additional two on-site ponds (Ponds 11 and 12) were found during a reptile survey on 21 May 2014 in the marshy grassland in the north-west of the Survey Site that had not previously been seen during any other survey, as well as one within 100 m of the Survey Site boundary during the first February Phase 1 survey (Pond 18). An HSI assessment was carried out on the seven ponds that were accessible within 500 m of the Survey Site boundary during the first Phase 1 survey visit. This included the two on-site ponds (P17 and P18); one pond within 100 m of the Survey Site boundary (P16); and the remainder are those ponds within 500 m of the Survey Site boundary for which access was possible (P07, P08, P09 and P10). Figures 2a and 2b shows which ponds were surveyed and which were inaccessible, either on private land or not accessible given the presence of horses[8].

4.42 Table 4 below summarises the results of the HSI, and Appendix 4 gives more detailed results.

[8] The landowner requested that we do not access fields with horses in for our own safety.

Table 4: HSI Results

Pond	HSI	Value for great crested newts
P07	0.67	Average
P08	0.77	Good
P09	0.47	Poor
P10	0.64	Average
P16	0.66	Average
P17 on site	0.61	Average
P18 on site	0.53	Below average

4.43 The Survey Site lies in a part of the country where the distribution of great crested nested newts is patchy, with the species largely absent to the west of the Survey Site. Whilst this might reduce the probability that great crested newts would be present on site, it does not rule out their presence. There are a number of ponds in and around the Survey Site, and suitable habitat for newts in their terrestrial phase, including old hedge banks, marshy grassland and woodland within the Survey Site. Those ponds surveyed, whilst most did not have a 'good' or 'excellent' HSI score, do have potential to provide breeding habitat for great crested newts and the possible presence of the species on site should be considered further. In addition the cluster of inaccessible ponds within the grounds of the water treatment works (to the north-west of the Survey Site) are likely to be of similar 'good' quality as Pond 08 (which was visible through the gate).

Dormouse

4.44 SEWBReC did not provide any records of dormouse *Muscardinus avellanarius*. The woodland areas on the eastern boundary, at the south-west end and within the marshy grassland in the north-west of the Survey Site do not provide optimum dormouse habitat although they are suitable for the species. Most of the woodland consists of relatively immature trees with little hazel understorey, limited foraging opportunities for this species and a lack of connectivity in the canopy. However, these areas of woodland have good connections to a complex of woodland and thick hedgerows to the west, south and east, and consequently could potentially form part of a wider network of dormouse-supporting habitat. There are a number of recent examples of dormouse occurring in sub-optimal habitat, such as coniferous plantation and species-poor hedges, in south and mid-Wales and their presence should not be ruled out if the habitat is sub-optimal but still has clear potential to support the species, as in this case.

4.45 Figures 2a and 2b illustrate which areas of the Survey Site have the highest potential to support dormouse.

Otter

4.46 There are a number of water courses on site, most of which are ditches, but also a small stream running from north-west to south-east along the centre and eastern flank of the Survey Site and through the woodland in the centre of the Survey Site. SEWBReC provided 32 records of otter within the 2 km search radius, all recorded between 1991 and 2013. The closest record to the Survey Site is 0.5 km to the south west from the River Llan. At its closest point the River Llan is approximately 0.3 km south of the southern Survey Site boundary, and it links to the Survey Site via the stream running through the woodland in the centre of the Survey Site. None of the water courses on site are likely to provide good foraging opportunities because of their size, but they may offer lying up sites for otter, and it is possible that individuals might use the water courses to commute along from time to time.

Water Vole

4.47 No evidence of water voles was noted along the water courses on site when surveyed in February and April, although February is a time of low activity for the species, when field signs may not be evident. The water courses that were visited in February all had flowing water in them when

surveyed, following a prolonged period of extremely wet weather during the winter. It is likely that many of these are usually dry or hold only a small amount of water and this was confirmed during the April survey. As such they do not provide good habitat for water voles. The stream that runs along the eastern boundary of the site; however, does provide suitable habitat for water vole, particularly at TN41-43. At TN43, a number of vole tunnels and holes were seen along the western side of the bank in long tussocks of grass, although it was not possible to ascertain which species had made them.

4.48 Water voles have been present in the vicinity: SEWBReC provided three records of water vole from the River Llan approximately 1.9 km from the Survey Site boundary, all from 1996. This River is hydrologically linked to the Survey Site (see otter section above), so it is possible, if any of the water courses retain water, particularly those linked to the River Llan, that water voles could be present on site.

Reptiles

4.49 There were 12 records of reptiles provided by SEWBReC, between 1998 and 2010. These included records of all the common reptile species: adder *Vipera berus*, grass snake *Natrix natrix*, common lizard *Zootoca vivipara,* and slow worm *Anguis fragilis*. The closest record is of a common lizard, approximately 0.8 km to the west of the Survey Site boundary. Most records are from the south-west side of tinplate workings near to Bryn Whilach Farm, approximately 1 km to the southwest of the Survey Site boundary.

4.50 There are several areas of the Survey Site that provide suitable habitat for common reptile species (see Figures 2a and 2b). This includes areas of marshy grassland to the south of the Survey Site, mounds of wood to the south of the woodland at TN10 (Photo 11), scrubby woodland fringes (Photo 12) and overgrown field margins either along remnant hedge banks or ditch banks. In addition a common lizard was seen during the April Phase 1 survey in the marshy grassland area in the north-west of the site and this area is particularly suitable for reptiles providing high quality habitat for foraging, sheltering and basking.

Badger

4.51 Information on badgers is provided in a confidential version of this report.

Birds

4.52 During the Phase 1 survey a number of common woodland and farmland bird species were recorded and these are listed in Appendix 5. The trees and woodland on site may provide nesting habitat for a range of common bird species. The marshy grassland on site could also provide nesting habitat for ground-nesting bird species. The Survey Site does not appear to be of particular importance for wintering birds with no notable aggregations of common species or any rarer species recorded during the walkover survey, except for a red kite *Milvus milvus* seen in flight over the Survey Site (see below) in both February and April.

4.53 SEWBReC provided a number of records of ground nesting birds in the search area. These included records for Eurasian curlew *Numenius arquata*, northern lapwing *Vanellus vanellus* and skylark *Alauda arvensis*. The closest of these records are located at the tinplate workings site near to Bryn Whilach Farm, approximately 1 km to the southwest of the Survey Site boundary. There was one record of curlew, located at the Lliw reservoir, 1 km north of the Survey Site boundary.

Schedule 1 Birds

4.54 SEWBReC provided 21 records of barn owl *Tyto alba*. The closest of these records is 0.7 km to the west of the Survey Site boundary from 1997, with the nearest breeding record 3 km to the south west near Penllergaer Woods in 2000. It is possible that some of the farm buildings within the Survey Site may support breeding barn owl, although no trees were found that appear, from a ground level inspection, to have sufficiently large cavities to support nesting barn owls. The marshy fields at the southern end of the Survey Site, although probably sub-optimal, could provide habitat for field vole *Microtus agrestis* (a preferred prey species) given the thick, tussocky structure of some parts of the sward. The marshy grassland in the north-west of the Survey Site provides

optimal foraging habitat for barn owls due to its extensive areas of tussocky grassland that may support breeding field voles *Microtus agrestis*, their preferred prey species.

4.55 A red kite was noted circling above the field at TN3 and also over Abergelli Farm. Red kites generally breed in valley woodlands of which there is extensive habitat to 2-3 km to the east and west of the Survey Site. It is considered likely that the Survey Site is part of a much wider area of potential foraging habitat for the species. SEWBReC provided 54 records for red kite between 1999 and 2013.

Terrestrial Invertebrates

4.1 SEWBReC provided 40 records of Section 42 terrestrial invertebrate species. The species recorded are marsh fritillary, dingy skipper *Erynnis tages*, narrow-bordered bee hawk-moth *Hemaris tityus*, and small pearl-bordered fritillary *Boloria selene*. Twenty-nine of the records are of marsh fritillary; the closest of these is located approximately 0.7 km west of the Survey Site boundary in 2009. This location also contains the closest of the four dingy skipper records, as well as the closest of the five small pearl-bordered fritillary records and the only narrow-bordered bee hawk-moth record.

4.2 The marshy grassland to the west provides suitable habitat for marsh fritillaries, although the food plant devil's-bit scabious *Succisa pratensis* was not noted in any quantity during the April survey. Of the other Section 42 species recorded from the desk study, suitable habitat is present for narrow-bordered bee hawk-moth *Hemaris tityus*, which largely relies on devil's bit scabious, like marsh fritillary. For dingy skipper, there are few areas of bare ground, where this species prefers to bask and no areas where its usual food plant, bird's foot trefoil *Lotus corniculatus*, is found in any quantity. Small pearl-bordered fritillary is reliant on violets (*Viola* spp.) as its foodplant and violets have not been recorded during either Phase 1 survey (the April survey was well timed to record them in flower). It is unlikely that either of these latter two species is present.

4.3 Other habitats that may be suitable for diverse assemblages of terrestrial invertebrates include the areas of broad-leaved ancient woodland at Target Note 10, for example, which represents a fairly extensive area of semi-natural habitat that may be important for terrestrial invertebrates, particularly *Lepidoptera* (notably moths) and beetles (*Coleoptera*); which are both strongly represented in wooded habitats.

Aquatic Invertebrates

4.4 No records of Section 42 aquatic invertebrate species were provided by SEWBReC, and it is unlikely that any of the ponds on or close to the site support unusual or diverse assemblages of aquatic invertebrates.

5 Recommendations

5.1 For the purposes of this report it has been assumed at this stage that direct impacts will potentially occur across the Survey Site, and that indirect impacts will need to be considered beyond this, within the 'zone of influence' that will vary dependent on the receptor (habitat, protected species, designated site) concerned. The recommendations presented below are based on preliminary assumptions of the potential impacts and the corresponding requirement to confirm presence / absence, and where present the distribution and abundance of protected and otherwise notable species or habitats that may occur within the Survey Site and a zone of influence surrounding it.

Statutory Designated Sites

5.2 Nant Y Crimp SSSI, Penplas Grasslands SSSI and Cadle Heath LNR are located within 5 km of the Survey Site boundary. These sites are designated for their habitat interest and as all are over 2 km from the Survey Site, direct impacts resulting from the development are considered unlikely. Nant Y Crimp SSSI also has a colony of marsh fritillary butterflies. The larval food plant (devil's-bit scabious) for this species was found in small patches in the western area of marshy grassland during the Phase 1 survey, so this species may be present. However this assessment will need to be reviewed once a botanical survey (see below) of the western block of marshy grassland has been carried out.

Habitat Regulations Assessment

5.3 Consultation with the Planning Authority, Natural Resources Wales and PINS will determine the requirement for a screening exercise (under the Habitat Regulations) that considers the proximity of potentially sensitive ecological receptors (notably European protected sites, but potentially extended to SSSIs) within a search area that may extend to or beyond a 5 km radius of the Survey Site (for example, Camarthen Bay and Estuary SAC, Crymlyn Bog SAC, SPA and Ramsar, and Burry Inlet SPA and Ramsar all lie within 10 km of the Survey Site), and whether these could be affected by CO, NO_X and NO_2 emissions as well as nitrogen and acid deposition.

5.4 The requirement for further surveys or desk based investigation will be determined following review of the scoping opinion (and consultation) on this matter.

Non-statutory Designated Sites

5.5 Three SINCs lie partially within the site boundary and could therefore be directly affected by the proposed development. Indirect impacts could also potentially occur on those sites lying adjacent or close to the boundary.

5.6 The woodland on site that falls within Llety-Morfil SINC and the southern part of Waun Garn Wen SINC is also designated as Ancient Woodland and as such is irreplaceable. Direct impacts on this resource may therefore also occur as a result of the proposals.

Habitats

5.7 The marshy grasslands within the Survey Site potentially qualify as a Section 42 habitat 'purple moor-grass and rush pastures'. The area to the west of Abergelli Farm is also a SINC. These habitats require a NVC botanical survey at an appropriate time of year (June/July) to establish their ecological value and inform the level of mitigation required to compensate if they are to be lost or modified as a consequence of the Project. The marshy grassland in the north-west of the site is potentially of high ecological value, and this needs to be confirmed through botanical and other Phase 2 survey work. The semi-improved grasslands in the north-east corner of the site, whilst not having obvious high botanical value, are included within a larger SINC. As such it is recommended that a botanical survey is carried out on these areas to establish their value in the wider context of the SINC, and therefore the likely mitigation that would be required for their loss.

5.8 'Lowland mixed deciduous woodland' is also a Section 42 habitat. The woodland on site all falls into this category and the majority of the resource also falls within a SINC and is designated as

Ancient Woodland. A botanical survey of these areas in spring/early summer when the ground flora is in evidence would allow an evaluation of their ecological value to be made.

5.9 There are no other habitats on site of high intrinsic ecological value. The improved grassland habitat is common and widespread in south Wales and of minimal ecological value. In addition, all (bar one species poor example) of the hedgerows on the Survey Site are defunct.

Invasive species

5.10 Japanese knotweed and Himalayan balsam have both been noted on the Survey Site. It is recommended that a walkover survey of the Survey Site is carried out once access is available to all areas, including the proposed access route to map all locations where these species are growing. This should be done within the period June - July when both species are most in evidence.

5.11 If work is to take place in any areas where these species are present, a Management Plan will need to be drawn up detailing the methods that will be used to remove these species under controlled conditions as detailed by the Environment Agency (The Knotweed Code of Practice 2003 and guidance on Environment Agency website).

Protected Species and Species of Conservation Importance

Bats

Trees and Buildings

5.12 Twenty one trees within the Survey Site have been identified as having potential to support roosting bats. If these trees are to be removed or modified, it is recommended that a roped-access tree survey is carried out in order to confirm whether any of the features initially identified support roosting bats or have the potential to do so. Where the potential for bats to roost in the tree is confirmed then emergence/re-entry (at dusk and/or dawn) survey may need to be carried out to confirm the likely use of the tree by roosting bats, and the status of any roost present. If a bat roost is confirmed, either through emergence/re-entry survey or through roped-access survey a European Protected Species (EPS) Licence is likely to be required before the tree can be felled.

5.13 It is recommended that all buildings to be directly or indirectly affected by the Project (if any) should be inspected for signs of roosting bats and features with the potential to support roosting bats, where access allows.

5.14 If signs of roosting bats or features with the potential to be used by roosting bats are identified during these inspection surveys, further survey in the form of dusk emergence/ dawn re-entry surveys may be required. The level of survey effort required will depend on the potential that the building or tree has been assigned in these initial inspection surveys. These further surveys (if required) should be undertaken in accordance with current best practice guidance (Hundt, 2012) at a time of year when breeding roosts may be present (i.e. between mid-May and mid-August).

Activity Survey

5.15 The areas of marshy grassland, woodland and streams on site potentially provide good foraging habitat for bats. It is recommended that bat activity surveys are carried out in order to inform an assessment of the Survey Site's value for bats and to guide the evolution of the Project and mitigation accordingly. Following the guidance provided in Hundt (2012), this would involve two walked transect routes (given the size of the Survey Site) carried out monthly between April and October, as specified in the guidelines. An automated survey using four static bat detectors (two per transect route) recording for at least three nights would also be carried out. Rather than deploying detectors at four locations every month, it is recommended that surveys are carried out at four locations for three months and another four locations for the other four months so that half the locations would be surveyed in April, June, August and October and the other four in May, July and September. This would increase the spatial coverage of the Survey Site but ensure that sampling was undertaken at each location in spring, summer and autumn to allow a robust seasonal comparison to be made.

Great Crested Newt

5.16 The presence of four ponds on site with several more in the vicinity of the Survey Site, and the occurrence of suitable terrestrial habitat on site indicate that great crested newts could potentially be using the Survey Site. This should be established through further targeted survey work.

5.17 Section 5.4 of the GCN Mitigation Guidelines (English Nature, 2001) recommends that:

"*For a common situation, where a plot of land containing a pond is proposed for development, the pond itself should be surveyed, and other ponds up to 500m away should also be checked, if it is thought likely that great crested newt populations centred on these ponds would be affected by changes to the plot*."

5.18 Natural England guidance(2001) is further developed in the GCN Method Statement which states that:

'*The decision on whether to survey depends primarily on how likely it is that the development would affect newts using those ponds. For developments resulting in permanent or temporary habitat loss at distances over 250m from the nearest pond, carefully consider whether a survey is appropriate….. normally appropriate only when all of the following conditions are met*:

1. maps, aerial photos, walk-over surveys or other data indicate that the pond(s) has potential to support a large great crested newt population,

2. the footprint contains particularly favourable habitat, especially if it constitutes the majority available locally,

3. the development would have a substantial negative effect on that habitat, and

4. there is an absence of dispersal barriers.'

5.19 The second piece of guidance, which supersedes the first, specifies that all four conditions should be met for surveys to be required of ponds beyond 250m of the Survey Site boundary. In this case, condition 1. is not met as there is no indication from desk study data or the HSI assessment that any of the ponds is likely to support a large population of GCN or that they provide particularly suitable habitat (condition 2.) with no ponds within 250m of the Survey Site recording better than an 'average' score on the HSI assessment.

5.20 As a consequence, it is recommended that all ponds within 250m (not 250-500m) would need to be further surveyed. This would initially involve four surveys within the period mid-March to mid-June to establish presence/absence (with at least two surveys during mid-April to mid-May), with an additional two surveys (six in total) required to estimate population size if newts are found during the first four surveys.

Dormouse

5.21 If the woodland on the Survey Site is to be removed, damaged or significantly modified, it is recommended that dormouse surveys are carried out with the aim of establishing whether the species is present on site, and therefore whether a EPS Licence will be required before woodland can be cleared or significantly modified. It is recommended undertaking a dormouse survey, following methods based on those prescribed in best practice guidance (Bright *et al*. 2006). The surveys will involve the use of dormouse boxes in areas of woodland and nest tubes in cluttered environments where boxes cannot be used. The survey will be designed to detect the presence or absence of dormice rather than to provide an abundance estimate or monitor a population of the species. Surveys would be carried out monthly during April-November.

Otter and Water Vole

5.22 Otter usage of the Survey Site is likely to be occasional although there are suitable resting/lying up places present along the eastern stream corridor within the Survey Site. Mitigation measures to avoid potential killing or injury to individuals during the construction and decommissioning phases should be considered, for example covering open workings overnight.

5.23 A survey for water voles along the banks of the water courses on site should be carried out as a precautionary measure to establish whether the species is likely to be present on site and to design mitigation accordingly. This would involve one visit and should be carried out ideally in spring when field signs are likely to be most in evidence but the vegetation has not grown up to obscure them. It will also be possible to carry out additional checks for signs of otter at the same time as the water vole survey, for completeness. The survey would be carried out in accordance with best practice guidelines (Chanin (2003) and Strachan *et al*., (2011), respectively).

Reptiles

5.24 A reptile survey should be carried out on the Survey Site to establish the presence/absence of reptiles, the species present and the approximate population size. The survey will be conducted using artificial refuges (e.g. roofing felt and tin) to aid in the detection of reptiles and assessment of their distribution and abundance, following good practice guidance, including that set out in the Herpetofauna Worker's Manual (Gent & Gibson, 2003) and Reptile Survey Guidance (Froglife, 1999). This requires a minimum of seven visits conducted at an appropriate time of year (either spring/early summer and/or late summer/early autumn) during suitable weather conditions.

Badger

5.25 Information on badgers is provided in a confidential version of this report.

Breeding Birds

5.26 Breeding bird surveys of the Survey Site should be carried out with the aim of establishing the ecological value of the breeding bird population and to inform mitigation measures. Farmland birds (occurring both within the Survey Site and a buffer of up to 50m) would be the main target of the survey. Territory mapping surveys based on the British Trust for Ornithology's Common Bird Census (CBC) methodology will be undertaken. These would be conducted on three occasions during the breeding season. It is recommended that an initial visit is carried out in mid-April, followed by additional visits in May and June.

5.27 The Phase 1 survey was partly conducted in winter with an experienced ornithologist (Matt Hobbs) part of the survey team. As there was no evidence of notable aggregations of common species or habitat that may support rarer species it is considered that there is no justification for carrying out targeted wintering bird surveys.

Barn owls

5.28 It is recommended that all buildings and mature trees on site to be directly or indirectly affected by the Project (if any) should be inspected for signs of roosting or nesting. Signs to be searched for include: nest debris, barn owl pellets, white splashes from barn owl droppings and live or dead barn owls themselves (Barn Owl Trust, 2012). Barn owl roost inspections can be conducted all year round.

Terrestrial Invertebrates

5.29 The block of marshy grassland to the west, provides potential habitat for marsh fritillary butterflies due to the presence of their food plant, devil's-bit scabious. As such a survey of adults during late May/June and also the larval webs should be carried out in mid-August to mid-September. Both surveys would involve walking transects over the marshy grassland, the former noting adult marsh fritillary butterflies and the latter checking all patches of the food plant for larval webs and larvae and following standard methods[9].

5.30 The woodland at Target Note 10, for example represents a fairly extensive area of semi-natural habitat that may be important for terrestrial invertebrates; which are both strongly represented in wooded habitats. If the woodland at TN10 is to be affected by the Project it is proposed that further survey will be appropriate that targets both *Lepidoptera* (notably moths) and beetles (*Coleoptera*).

[9] http://www.ukbms.org/Downloads/UKBMS%20Ng2%20-%20Marsh%20Frit%20Webs%20guidance%20notes.pdf

A moth survey should also be undertaken of the marshy grassland area in the north-west of the site.

5.31 Survey of *Lepidoptera* should involve two night-time moth surveys to be undertaken in late spring and mid-summer. Trapping using Skinner or Robinson moth traps fitted with mercury vapour bulbs is most suitable in terms of attracting an extensive and variable moth fauna. Lights should be switched on at dusk and remain lit until dawn the following day. The traps should be checked periodically throughout the night to log any new arrivals. Any species hard to identify from external markings alone, and those requiring further confirmation, should be retained and dissected if necessary to ascertain their identity with the use of a stereoscopic microscope.

5.32 For beetles, a method should be developed that follows Natural England (ISIS) protocol (Drake et al., 2007) to sample beetle assemblages directed at woodland habitats, via hand searches, sweep netting and pitfall trapping. To align with the *Lepidoptera* surveys, this can be undertaken in late spring/early summer and mid/late summer/early autumn. Subsequent laboratory identification will be required for many of the specimens collected.

5.33 Analysis of the results should use the ISIS protocol to determine whether any broad or specialist assemblage types of *Lepidoptera* and / or *Coleoptera* are present. Consideration should also be given to any rare, scarce or nationally threatened species present, including Section 42 species.

Aquatic Invertebrates

5.34 On the assumption that watercourses will be affected by the Project, it may be appropriate to undertake an assessment of water quality, compliant with the Water Framework Directive (WFD). A main aim of the WFD is to prevent deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters. The requirement for such an assessment would be driven in consultation with Natural Resources Wales. Should such an assessment be required it may be appropriate to assess the ecological quality and surface water chemistry of watercourses to be affected.

5.35 To determine ecological quality kick-sampling for aquatic invertebrates should be undertaken at selected locations along the ditch / stream, and the Biological Monitoring Working Party (BMWP) score applied to inform an assessment of water quality and species present. This survey is best undertaken in spring or autumn in swift flowing waters, or in summer in stationary ditches or those with a slow flow. All macro-invertebrates should be identified to species level in order to determine the presence of any scarce or nationally notable species.

5.36 To determine water chemistry status a single water sample should be extracted at three locations; within the Survey Site and upstream and downstream of this. Samples should be dispatched to a UKAS accredited laboratory for subsequent analysis, to cover a standard range of parameters including: Biological Dissolved Oxygen, Total Suspended Solids, nutrient composition (e.g. nitrite as nitrogen, total oxidised nitrogen, total ammoniacal nitrogen, total phosphorus), hardness, calcium, alkalinity, conductivity and pH.

5.37 The condition of the watercourse can subsequently be analysed by recording and comparing the aggregated number of taxa, and average score per taxon from the sampling points along the watercourse within, upstream and downstream from the Survey Site. The statistical model (RICT) developed for WFD classification would be used to calculate the Ecological Quality Ratio (EQR) that compares observed with expected results for a watercourse of the same type. The EQR is then used to identify the Biological Status of the watercourse which is separated into five bands (Bad to High) required by the WFD.

5.38 It may also be necessary to undertake invertebrate surveys of any ponds that are likely to be affected by the development proposals. These are likely to involve surveys of aquatic beetles in June and August

Un-surveyed Land

5.39 There are a number of small parcels of land that have not yet been surveyed in the southern part of the site. These are indicated on Figure 1b and will be surveyed once access has been arranged. The Phase 1 report will be updated once these surveys are complete.

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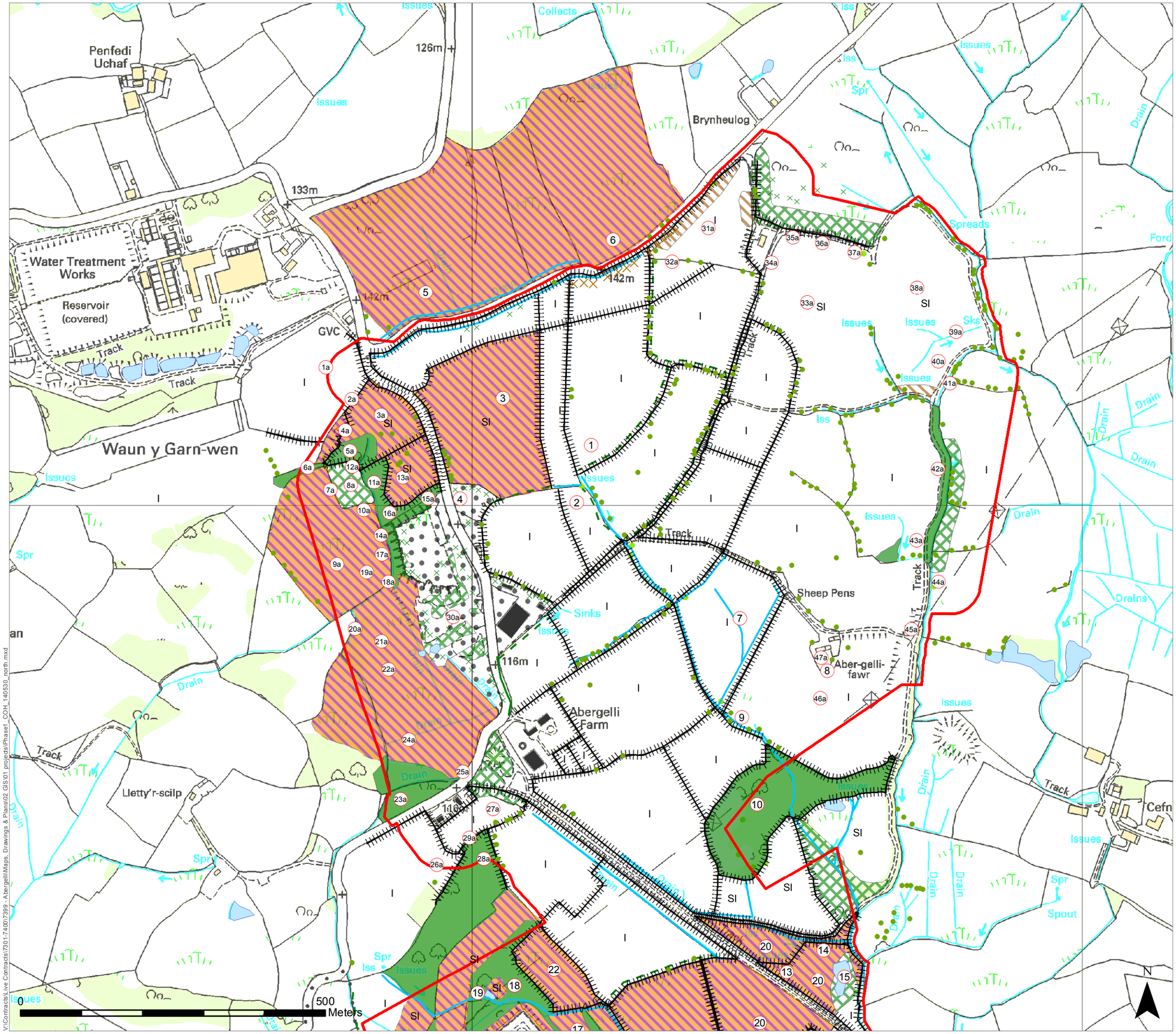
MAGIC: www.magic.gov.uk


Penfedi Uchaf
126m
133m
Water Treatment Works
Reservoir (covered)
Track
Track
GVC
142m
142m
Waun y Garn-wen
Issues
Brynheulog
Collects
Issues
Spr
Drain
Spreads
Ford
Issues
Issues
Sks
Track
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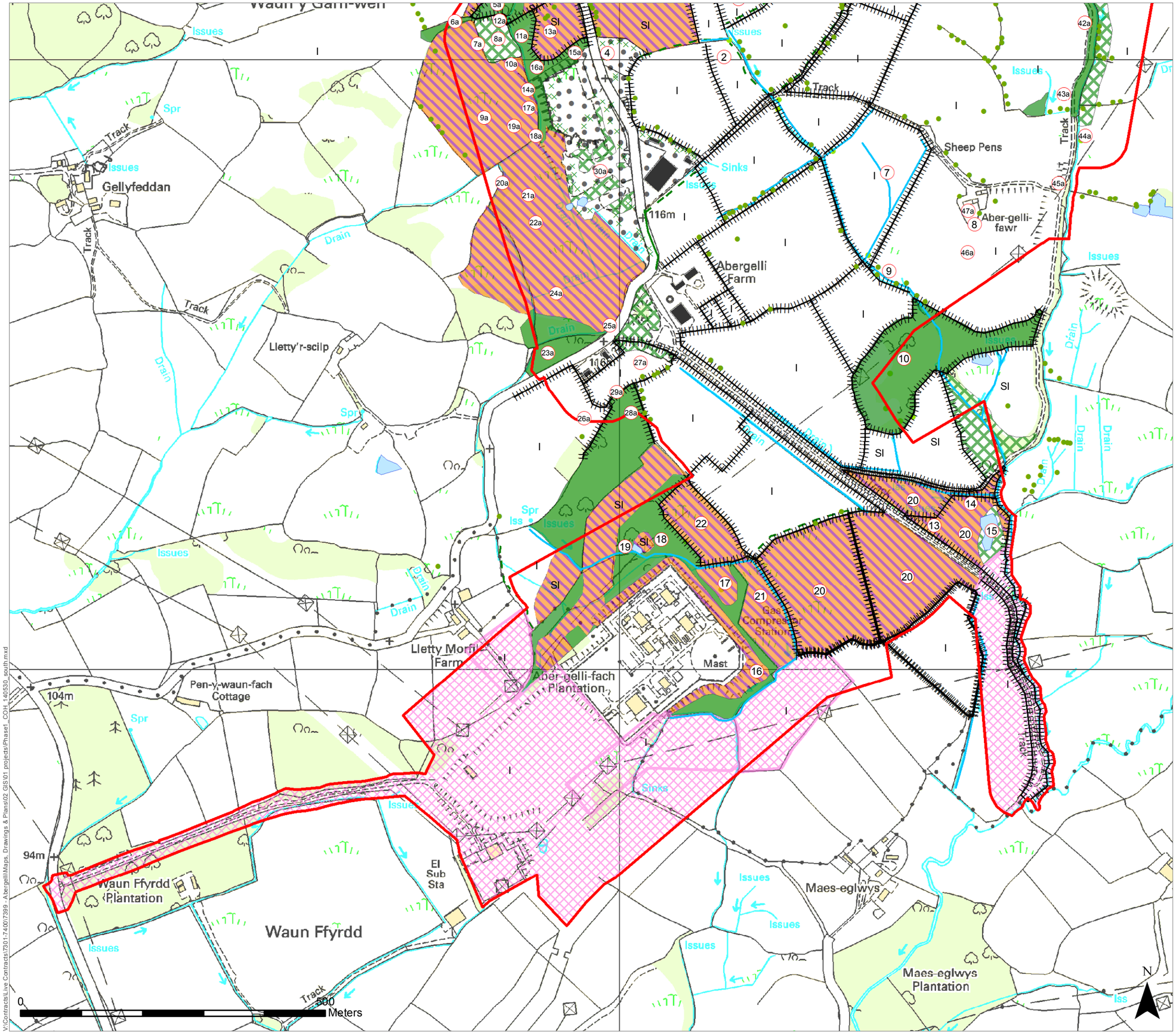

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LEGEND

- Site boundary
- Target notes
- Broadleaved woodland
- Dense scrub
- I — Improved grassland
- Marshy grassland
- SI — Semi-improved grassland
- Tall ruderal
- Bare ground
- Not surveyed
- Buildings
- Standing water
- Water course
- Species-poor intact hedge
- Species-poor defunct hedge
- Fence
- Scattered scrub
- Broadleaved tree
- Bracken

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PROJECT TITLE
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DRAWING TITLE
Figure 1b - Phase 1 Habitat Survey South

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DRAWN: COH APPROVED: MH STATUS: FINAL

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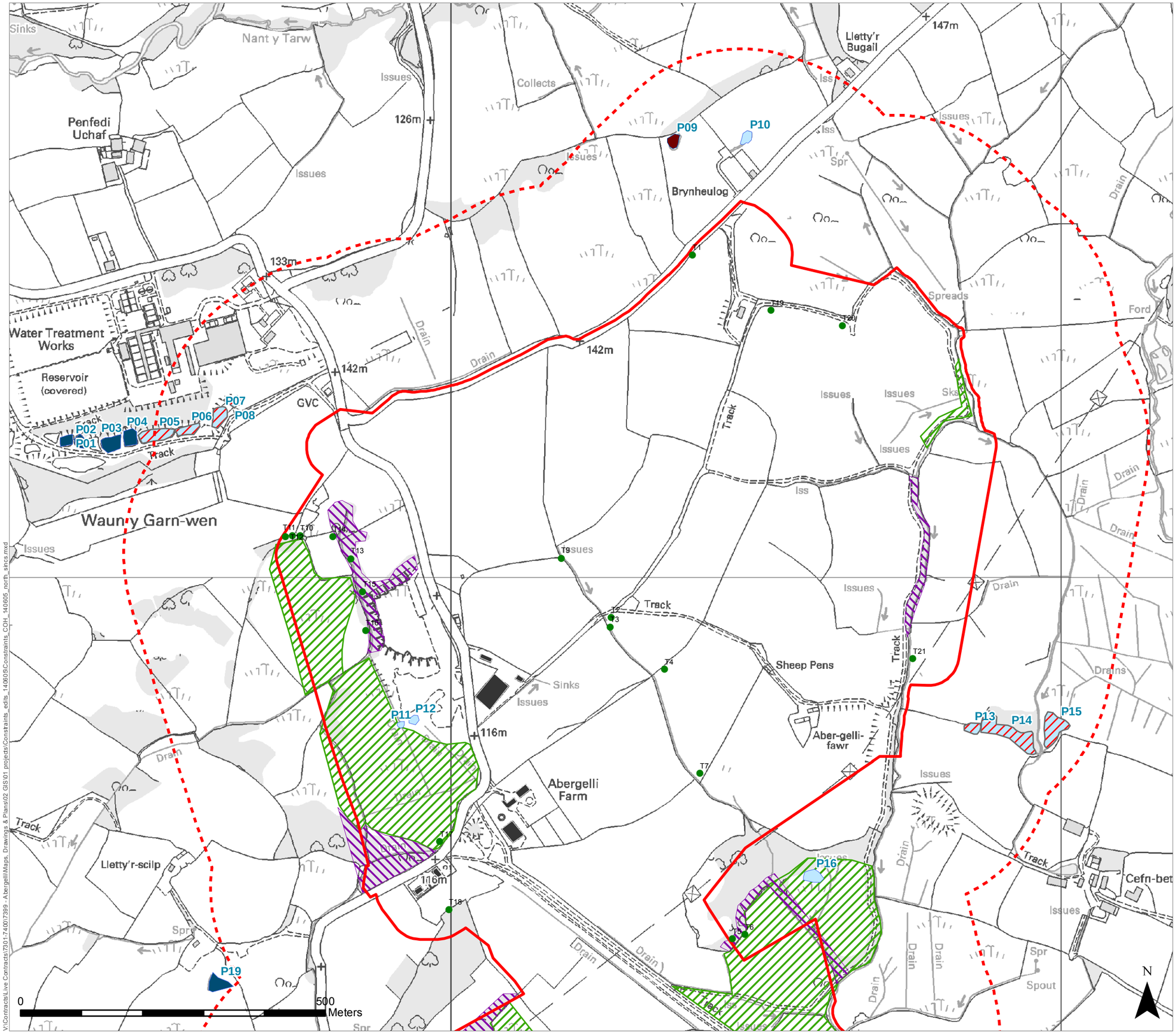

LEGEND

- Site boundary
- 250m buffer of survey site

Great crested newts

- Pond within 250m of Survey Site that should be surveyed for GCN
- Ponds within 250m of the Survey Site for which access was denied
- Ponds within 250m of the Survey Site that are unsuitable for amphibians
- Ponds within 250-500m of the Survey Site

Bats

- Buildings with potential to support roosting bats
- Trees with potential to support roosting bats

Dormice

- Areas with highest potential to support dormice

Reptile Potential

- Areas with highest potential to support reptiles

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PROJECT TITLE
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Figure 2a - Ecological Constraints Map North

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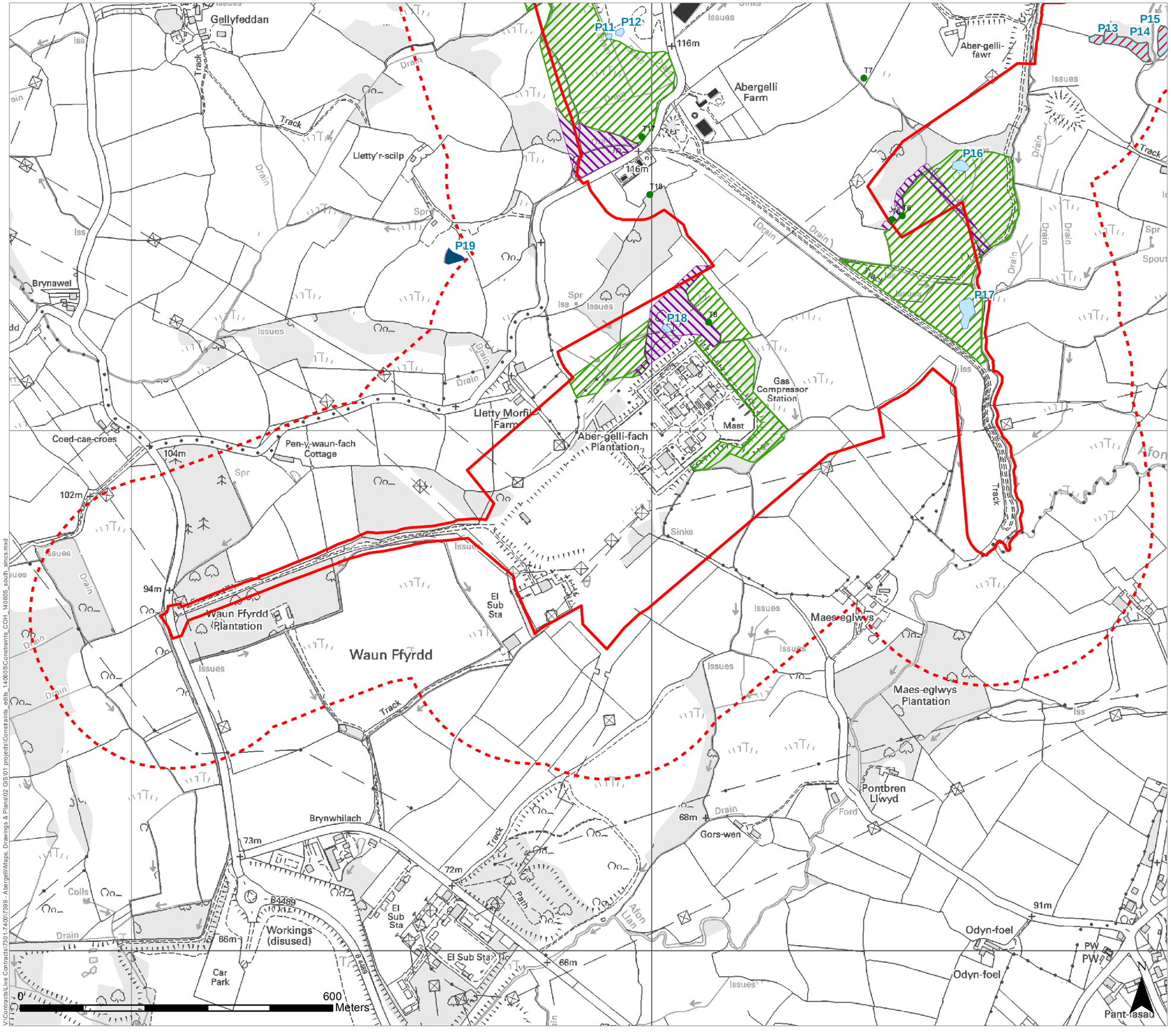

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LEGEND

- Site boundary
- 250m buffer of survey site

Great crested newts

- Pond within 250m of Survey Site that should be surveyed for GCN
- Ponds within 250m of the Survey Site for which access was denied
- Ponds within 250m of the Survey Site that are unsuitable for amphibians
- Ponds within 250-500m of the Survey Site

Bats

- Buildings with potential to support roosting bats
- Trees with potential to support roosting bats

Dormice

- Areas with highest potential to support dormice

Reptile Potential

- Areas with highest potential to support reptiles

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Figure 2b - Ecological Constraints Map South

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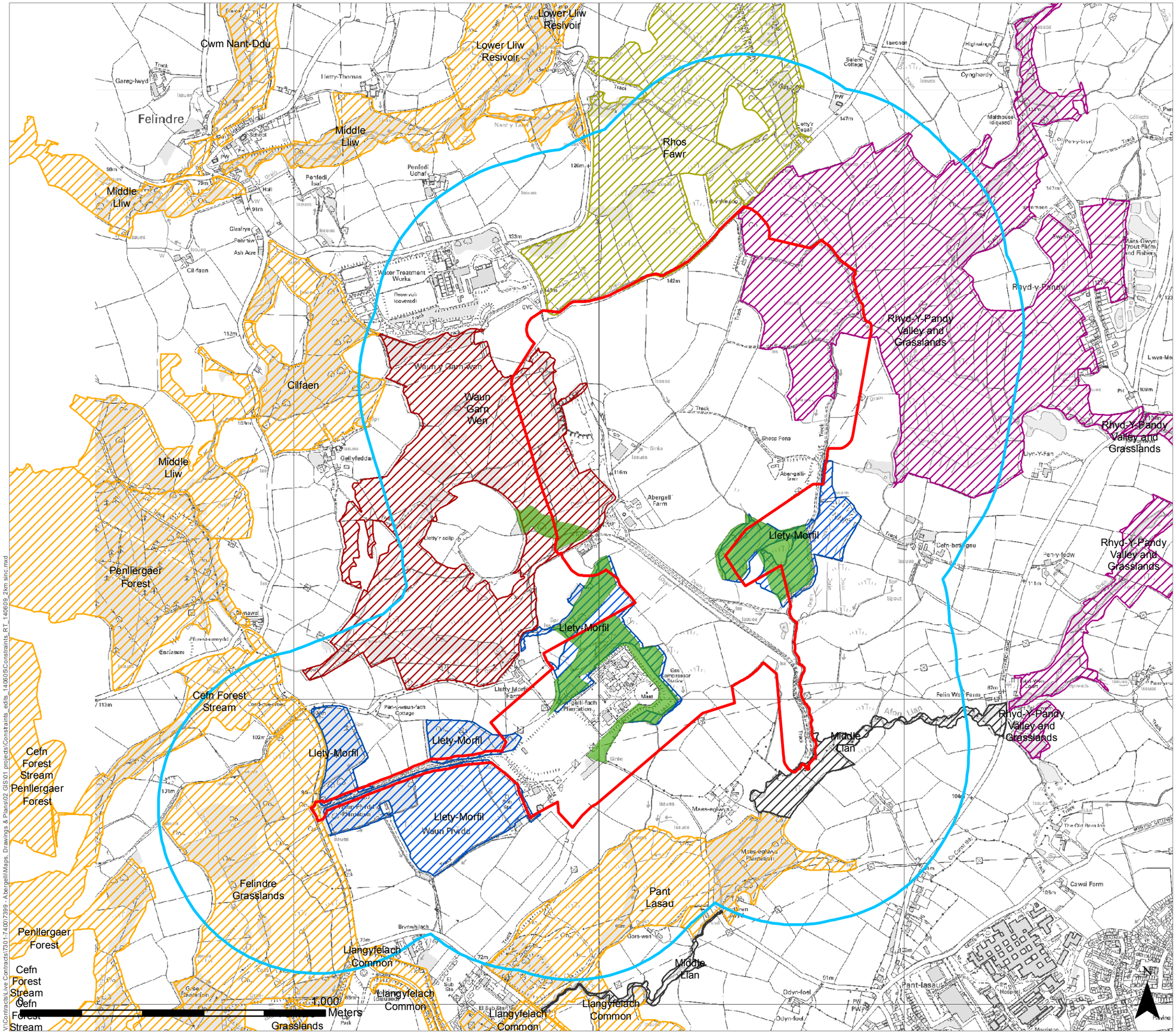

LEGEND

Site boundary

500m radius from site boundary

Site of Importance for Nature Conservation (SINC)

SINC: Llety-Morfil

SINC: Middle Llan

SINC: Rhos Fawr

SINC: Rhyd-Y-Pandy Valley and Grasslands

SINC: Waun Garn Wen

Other SINC location

Ancient Woodland

Ancient Woodland

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Figure 3 - SINC and Ancient Woodland map

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Appendix 1: Target Notes

February Survey

1. A spring running into a wet ditch. The ditch has a muddy base with sweet-grass *Glyceria* sp. and soft rush the dominant plant species. Frog spawn was present.

2. A wet ditch fenced on either side. The ditch meets a spring which runs into it flowing southwards. The ditch has steeply sloping grassy banks, is open and unshaded with great willow herb *Epilobium hirstum* and soft rush present. A newly planted hedge runs along the south side – gapping up a defunct hedge. Also, occasional large coppices of holly were recorded.

3. Marshy grassland with abundant soft rush. The sward is grazed very short by horses. Frequent patches of sedge species were recorded including common sedge and glaucous sedge. Other species noted include sharp-flowered rush and/or jointed rush (difficult to separate in winter and when closely grazed), cinquefoil species, daisy and creeping bent.

4. A small concrete bunker with wasteland area. The concrete bunker is formed of 2m high brick walls with a flat roof formed from concrete sleepers. There is an open doorway on the south elevation and a 30cm x 30cm hole at the top of the west-facing wall. No evidence of bats was recorded. The surrounding land is compacted course aggregate which is becoming colonised with common grassland species. There is an earth bund around the south-east and north-east boundary, topped with dense bramble and gorse scrub.

5. An area of marshy grassland which is very closely grazed. Occasional heather and bilberry plants and patches of sphagnum moss were recorded. Purple moor grass is frequent and forms dominant tussocks at the north end of the field. Other species include sheep's fescue and a sedge species.

6. An area of marshy grassland dominated by soft rush. The field was not entered as it is outside the ownership boundary, but inspection from the roadside suggests that rushes are interspersed with agriculturally improved grassland.

7. A wet ditch running through the middle of the field containing fast flowing water with orange discolouration. The ditch is overgrown with bramble and joins another ditch on its eastern boundary, which is lined with purple moor grass, greater willowherb, and soft rush. The surrounding field is agriculturally improved with patches of soft rush.

8. A derelict stone farmhouse with only the bottom halves of walls still present. Patches of rubble and overgrown vegetation are present, which may provide good habitat for reptiles.

9. A stream lined with trees, which is fast-flowing with a stony substrate.

10. An area of broadleaved woodland. The western end is on a hill, which slopes steeply down to the east. This end (delineated by a stream running north-south) is dry with widely spaced trees and a grazed grassland ground flora (Yorkshire fog, common mouse-ear, and creeping buttercup were the most prominent species) and very little understorey was noted. The eastern end is much wetter, with carpets of opposite-leaved golden-saxifrage, extensive areas of purple moor-grass dominated ground flora with some sphagnum moss species. The understorey is thicker here and is predominantly bramble. Tree species include birch, crab-apple, holly and pedunculate oak. Most specimens are small-medium in size.

11 and 12. These Target Notes relate to evidence of badger activity and are provided in a confidential version of this report. They are also omitted from Figures.

13. A ditch along a line of small-medium trees (beech, holly, pedunculate oak) and a fence. Bilberry is growing along the fence.

14. A marshy grassland field with abundant soft rush tussocks. The area indicated by this target note is dominated by purple moor-grass with occasional cross-leaved heath and scattered small trees/scrub.

15. A shallow pond (less than 10cm deep), approximately 10m in diameter, completely covered in a sedge species (only dead leaves were evident so identification was not possible) and with a small tree-covered island in the centre. The pond is ringed by small trees. The surrounding vegetation includes purple moor-grass with occasional heather and cross-leaved heath and densely growing small trees and scrub (willow species, bramble and alder. A small pond immediately to the south is shown on OS maps. This consisted of small patches of standing water (including wheel ruts) within marshy (rushes, purple moor grass) vegetation.

16. A strip of land around the gas station, which is higher than the surrounding land. There is a gravel strip immediately surrounding the boundary fence then a steep slope covered in soft-rush dominated grassland. At the base of the slope is a mosaic of marshy rush-dominated grassland with dense bramble scrub and wet

woodland. The woodland consists of closely spaced, small and straggly trees composed largely of holly, pedunculate oak, birch, willow and alder.

17. A patch of marshy grassland almost totally dominated by soft rush. Small patch of bulrush were found towards centre of field. The field is surrounded by encroaching scrub and straggly woodland.

18. An area of wet woodland with dense bramble understorey. The species present and structure are as for Target Note 16. Wet underfoot.

19. A small pond within woodland fed by a stream. No emergent/marginal vegetation was in evidence and the pond is surrounded by small saplings.

20. Marshy grassland fields consisting of more than 25% soft rush. The intervening grassland is agriculturally improved, including perennial rye-grass *Lolium perenne*, common mouse-ear and white clover *Trifolium repens*.

21. An area of marshy grassland with approximately 75% soft rush cover. The intervening grassland is semi-improved.

22. An area of marshy grassland almost totally dominated by soft rush. The western boundary fence has heather and purple moor-grass growing along it.

April Survey

1a Improved grassland with short sward grazed by horses. Access to field restricted by presence of horses. Species observed from track include creeping thistle *Cirsium arvense*, perennial rye-grass, broad-leaved dock *Rumex obtusifolius* and creeping bent.

2a Species-poor hedge with hawthorn *Crataegus monogyna* and willow *Salix* sp., grading into old bank boundary with overgrown hedge with oak *Quercus* sp. and holly *Illex aquifolium* and drainage ditch along north side.

3a Semi-improved marshy grassland with very short sward, grazed by horses. Species recorded include soft rush *Juncus effusus*, Yorkshire fog *Holcus lanatus*, perennial rye-grass, creeping buttercup *Ranunculus repens,* silverweed *Potentilla anserina*, white clover *Trifolium repens*, dandelion *Taraxacum officinale* agg.., ribwort plantain *Plantago lanceolata*, lesser spearwort *Ranunculus flammula*, mouse-ear-hawkweed *Pilosella officinarum*, unidentified sedges *Carex* spp.

4a Marshy grassland with small copse of willow, oak and birch *Betula* sp., fenced off from horses with head of spring in centre. Potential for terrestrial phase amphibians and reptiles in sunny hedgebank and refugia provided by piles of dead wood and nesting birds in trees. Species recorded include common bent Agrostis capillaris, Yorkshire fog, soft rush, creeping bent, sweet grass *Glyceria* sp., wavy bittercress *Cardamine flexuosa*, creeping buttercup, curled dock *Rumex crispus*, broad-leaved willowherb *Epilobium montanum*, bird's-foot-trefoil *Lotus corniculatus*, lady fern *Athyrium felix-femina*.

5a Area of dense bramble *Rubus fruticosus* agg. scrub and willow regeneration immediately beneath power lines which links to wooded spur to west and marshy grassland copse to east.

6a Small wooded spur with tree species including oak, birch, holly, hawthorn with an understorey dominated by brambles and including ivy *Hedera helix*, creeping bent, Yorkshire fog, soft rush, hard fern *Blechnum spicant*, scaly male fern *Dryopteris affinis*, and bracken *Pteridium aquilinum*.

7a Bank feature delineating boundary of small field (see 8) with birch and willow regeneration and mature oak to southern end. Ground flora dominated by bracken and bramble with bluebell *Hyacinthoides non-scripta* and bilberry *Vaccinium myrtillus* to south.

8a Small field dominated by bramble scrub with bracken, broad-leaved willowherb and soft rush. Grades into copse of birch and willow regeneration to east with ephemeral ditch along south and east boundaries.

9a Large field of wet dwarf shrub heath, dominated by purple moor grass *Molinia caerulea* with soft rush, bracken, common haircap moss *Polytrichum commune*, unidentified sphagnum moss *Sphagnum* sp., ling *Calluna vulgaris*, cross-leaved heath *Erica tetralix* and bilberry along margins. Some birch and willow regeneration in small scattered copses.

10a Badger snuffle holes and intermittent trails.

11a Mature oak.

12a Mature alder *Alnus glutinosa*.

13a Semi-improved grassland with high proportion of herbs and low proportion of grass. Species recorded include soft rush, ribwort plantain, mouse-ear-hawkweed, dandelion, daisy *Bellis perennis*, self-heal *Prunella vulgaris*, white clover, creeping buttercup, broad-leaved willowherb, bird's-foot-trefoil, common mouse-ear *Cerastium fontanum*, yarrow *Achillea millefolium*, marsh thistle *Cirsium palustre* and with lesser spearwort, water figwort *Scrophularia aquatica* and horsetails *Equisetum* sp. in the southern corner.

14a Wooded stream corridor with oak, hawthorn, birch and occasional alder. Understorey dominated by bramble scrub.

15a Embankment of large raised area with mature trees on banks. Northern side with young willow, hawthorn, birch, elder *Sambucus nigra*, rowan *Sorbus aucuparia* and semi-mature / mature oak. Ground flora dominated by brambles but with hart's-tongue fern *Asplenium scolopendrium*, lady fern, hard fern, scaly male fern, unidentified polypody fern *Polypodium* sp., common nettle *Urtica dioica* and dog's mercury *Mercurialis perennis*. Several stands of Japanese knotweed Fallopia japonica identified.

16a Mature oak tree.

17a Mature oak tree.

18a Wooded stream corridor with willow and elder and intermittent bramble scrub. Species recorded include common nettle, broad-leaved willowherb, horsetails, water figwort, soft rush, hard fern, bracken, angelica *Angelica sylvestris*, herb Robert *Geranium robertianum* and pendulous sedge *Carex pendula*. Stand of Japanese knotweed at bend in stream.

19a Stand of bramble scrub within willow and birch regeneration with damp substrate supporting reed canary grass *Phalaris arundinacea*. Lots of piles of dead wood.

20a Irrigation ditch, occasional young birch and willow with purple moor-grass, soft rush and bracken. Ditch dry.

21a Large field superficially similar to 9a but appears to have been managed. Purple moor-grass not as dominant, lots of bare earth and young ling and cross-leaved heath plants. In addition hare's-tail cotton grass *Eriphorum vaginatum*, deergrass *Trichophorum germanicum* and lousewort *Pedicularis* sp.

22a Field drain holding water with common reed *Typha latifolia*, broad-leaved pondweed *Potamogeton natans* and water-plantain *Alisima plantago-aquatica*. Common lizard *Lacerta vivipara* directly observed on bank of ditch.

23a Wooded copse comprised of young birch and willow with understorey of bramble scrub and ground flora comprising common nettle, lady fern, scaly male fern, wood false brome *Brachypodium sylvaticum*. Himalayan balsam *Impatiens glandulifera* seedlings abundant. There is also a ditch with very shallow, ponded, oily water with no aquatic vegetation.

24a Drainage ditch holding water, and with dense stands of sphagnum moss in bottom of ditch. Steep sides with ling, cross-leaved heath and purple moor-grass.

25a Birch.

26a Improved grassland with very short sward, grazed by horses. Horses present, not surveyed in detail.

27a Area of partially colonised tipped spoil, being re-graded at time of survey. Bramble and willow scrub around margins / banks and horse training area to North. Species recorded in this area include bramble, gorse *Ulex europea*, curled dock, broad-leaved dock, common nettle, a brassica *Brassicaceae*, creeping thistle, colt's foot *Tussilago farfara*, foxglove *Digitalis purpurea*, wavy bittercress, bird's-foot trefoil, Yorkshire fog and white clover.

28a Area of deciduous woodland and scrub comprising occasional mature oak with hazel *Corylus avellana*, holly, birch, rowan, willow, a scrub layer of bramble and a ground flora including bluebells, hard fern, soft rush, creeping bent, common bent, a spurge *Euphorbiaceae*, wood false-brome and abundant Himalayan balsam seedlings. Area contains many piles of fallen deadwood and there is a bank feature along part of the northern boundary.

29a Mature ash *Fraxinus excelsior*.

30a Earth works with large percentage bare, waterlogged earth. In undisturbed marginal sloped areas gorse, willow and bramble scrub is present.

31a Improved grassland with very short sward, grazed by horses. Species recorded include perennial rye-grass, common bent, occasional soft rush, daisy, broad-leaved dock, mouse-ear hawkweed, white clover, dandelion, cocksfoot *Dactylis glomerata*, annual meadow grass *Poa annua* and couch grass *Elymus repens* with approximately 20% bare earth.

32a Bank field boundary with many mature but small holly trees and ground flora of grazed improved grassland.

33a Semi-improved grassland similar in composition to 38 but with very short sward, grazed by horses.

34a Stone wall / bank delineating eastern edge of domestic property.

35a Mature oak.

36a Treeline along track with mature / semi-mature oak, and scrub layer comprising gorse and bramble. There are many loose rocks and exposed tree roots with a wet ditch along the northern side fringed by soft rush. The water is ponded and shallow with no aquatic plants observed.

37a Mature oak.

38a Semi-improved grassland on a sloped field with a spring issuing in the centre. There are occasional scrub stands comprised of hawthorn, bramble, willow, gorse with common nettles and cleavers *Galium aparine*. The slope is not uniform and there are wetter areas indicated by stands of soft rush. Other species recorded include perennial rye-grass, creeping bent, common bent, Yorkshire fog, cocksfoot, creeping thistle, marsh thistle, broad-leaved dock, dandelion, daisy, yarrow, creeping buttercup.

39a Damp drainage ditch with soft rush, common reed, broad-leaved willowherb and occasional pendulous sedge. No visible standing water as vegetation very dense. Likely to be ephemeral.

40a Area where soft-rush dominant and very low percentage of grass. Herbs recorded include common sorrel *Rumex acetosa*, knotgrass *Polygonum aviculare*, common mouse-ear, creeping buttercup, wavy bitter-cress and cleavers.

41a Stream, flowing water approximately 30cm deep, good water quality, moderate flow. Bankside vegetation including lesser water-parsnip *Berula erecta*, horsetails *Equisetum* sp., reed canary-grass, angelica, broad-leaved willowherb, bramble, bracken, soft rush, common nettle, hard fern, common haircap moss, cuckoo pint and lesser celandine *Ranunculus ficaria*. Stream fringed by regenerating birch and willow scrub.

42a Tree-lined stream corridor with mature / semi-mature oak trees along Eastern edge with occasional birch, willow, ash and holly. Understory of gorse with bramble scrub and soft rush grading into improved grassland to east. Along western bank, grassland typical of wider area but with longer sward (low-density sheep-grazing) and also including sweet vernal grass *Anthoxanthum odoratum*, crested dog's tail *Cynosurus cristatus*, a fescue *Festuca* sp. and field wood rush *Luzula campestris*.

43a Large mammal slide and run to hole under bank / tree on eastern side of bank. Many vole tunnels along western side of bank in long tussocky grass.

44a Mature oak.

45a Drainage ditch and area of marshy grassland including species such as horsetails, flote-grass, lesser water-parsnip, angelica and soft rush.

46a Area of improved grassland with short sward, grazed by sheep. Contains piles of semi-colonised rubble with common nettles and gorse.

47a Curtilage of old barns containing a number of mature / dead ash trees.

Appendix 2: Photographs

Habitats

Photo 1: Improved grassland with defunct hedge.



Photo 2: Marshy grassland at TN3.



Photo 3: Marshy grassland at TN5.



Photo 4: Marshy grassland at TN22.



Photo 5: Marshy grassland at TN14.



Photo 6: Woodland at TN10.



Habitats – April Survey

Photo 1a: Hare's-tail cottongrass



Photo 2a: Improved grassland



Photo 3a: Semi-improved grassland at TN3a



Photo 4a: Marshy grassland at TN21a



Photo 5a: TN22a Field drain



Photo 6a: Stream corridor at TN42



Photo 7: Woodland at TN18.



Photo 8: Stream in woodland TN10.



Photo 9: Stream at TN9.



Ponds surveyed with HSI method

Photo 10: Pond P1 within water treatment works.



Photo12: Pond P3.



Photo 14: Pond P5.



Photo 11: Pond P1 within water treatment works.



Photo 13: Pond P4.



Photo 15: Pond P6.



Photo 16: Pond P7.



Trees with potential for roosting bats

Photo 17: T1



Photo 18: T2



Photo 19: T3



Photo 20: T4

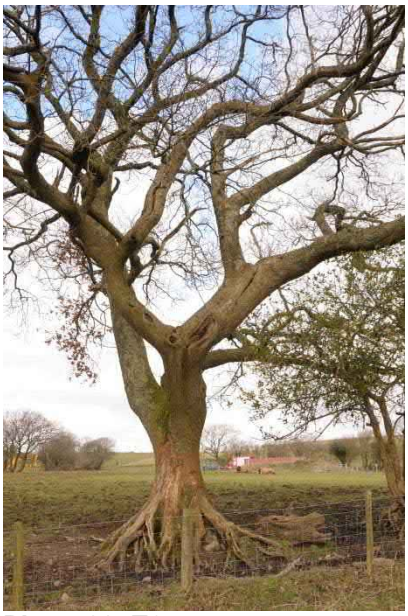

Photo 21: T5



Photo 22: T6



Reptiles – examples of suitable habitat.

Photo 24: Mounds of wood south of TN10.



Photo 25: Tussocky grassland suitable for reptiles.



Badger – images providing evidence of badgers are provided in a confidential version of this report.

Buildings

Photo 26: Abergelli Farm



Photo 27: Abergelli Farm Stables



Photo 28: Barn to south of Abergelli Farm



Photo 29: Barn to North of Abergelli Farm



Photo 30: Building adjacent to barn at Photo 4



Photo 31: Bunker at TN4



Appendix 3: Bat Tree Survey Results

6.1

ID	OSGR	Species	Category	Height	DBH (cm)	Type	Aspect	Extent	Height	Canopy	U-storey
T1	SN6539002532	Oak	2	12m	110	Extensive ivy cover on stem with lifted plates	N		4-8m	20	0
T2	SN6525601938	Birch	2	5m	40	Cavity- small hollows on both stems	E	0.4x0.2m	1-2m	0	0
T3	SN6530601421	Birch	2	8m	100	Woodpecker hole	SW		4m	0	0
T4	SN6534301853	Oak	1	10m	90	Two splits one open one less obvious	S		5 and 5 m	0	0
T5	SN6545501412	Birch	2	14m	160	Rot hole – extent unknown			4m	50	10
T6	SN6547501418	Birch	2	15m	80	Rot hole	NW	0.5m	2-3m	50	0
T7	SN6540101683	Oak	2	17m	80	Thick ivy and hollow trunk exposed	N		Throughout	0	0
T8	SN6509901209	Oak	2	17m	200	Recently cut limb has revealed rot hole within	S	0.1m	2m	50	25
T9	SN6517002031	Oak	2	15m	80	Split limb	N			0	0
1404-01	TN6 – N edge	Oak	2		30	WPH x 5	All	2-4m AGL	2-4m AGL	50	20
1401-02	TN6 – N edge	Oak	2		30	Hollow @ base	N	0.2 x 0.5	0-1m AGL	50	20
						Split in branch	?		8m AGL	50	20
1404-03	TN6 – N edge	Oak	2		100	Cavity / rot back			6m AGL		
						Split limb	E		6m AGL		
1404 - 04	TN11	Oak	2		50	Dense ivy	All	All	All	50	50
1404 -05	TN12	Alder	2		40	Hollow limb			6mAGL	50	50
1404 - 06	TN16	Oak	2		60	Multiple splits	N and E		4m AGL	50	50
1404 -07	TN17	Oak	2		40	WPH	S	10cm diameter	4mAGL	50	50
1404-07	TN 25	Birch	2		60	Dense ivy	All	All	All	50	50
1404-08	TN29	Ash	1		75	Rot hole	N		3mAGL	50	50
						Hollow limb	N		7mAGL		
1404-09	TN35	Oak	2		60	Hollow limb	N		5mAGL	50	50
						Cavity main stem	W		4mAGL		

						Split / hollow limb	W		5mAGL		
1404-10	TN37	Oak	2		40	Slit main stem	Up		6mAGL	50	50
						Rot hole /hollow	S		3mAGL		
1404-11	TN44	Oak	2		100	Dense ivy	All	All	All	50	50

Appendix 4: HSI Results

Pond	HSI	Value for great crested newts
P07	0.67	Average
P08	0.77	Good
P09	0.47	Poor
P10	0.64	Average
P16	0.66	Average
P17 on site	0.61	Average
P18 on site	0.53	Below average

Pond Ref.	Location	Pond Area M^2	Pond permanence	Water Quality	Pond Shading %	No. of waterfowl	Occurrence of fish	Pond density	Proportion of newt friendly habitat around pond within 500m – Any Barriers?	Macrophyte content (est % total of emergent and submerged macrphytes)	Notes
P08	SN6463502258	240	Never dries	Good	10	Minimal	Possible	Y	Good	30	Typha and rushes around edge. Close access not possible.
P07	SN6464602272	150	Never dries	Good	30	Minimal	Possible	Y	Good	0	Not well vegetated.
P10	SN6548702727	70	Sometimes dries	Good	5	Minimal	Possible	Y	Good	20	Small and shallow.
P09	SN6535602709	20	Annually dries	Moderate	30	Absent	No	Y	Good	0	Very shallow and unlikely to fill up – probably mostly dry.
P16	SN6558701536	25	Sometimes	Good	60	Absent	No	Y	Good	40	
P17	SN6559801237	100	Annually dries	Good	80	Absent	No	Y	Good	100	Water shallow and covered in Carex species. To south consists of patches of standing water within Molinia
P18	SN6503101199	50	Never	Moderate	100	Absent	No	Y	Moderate	0	Small pond within woodland – water dark and no aquatic vegetation in evidence.

Appendix 5: Bird species recorded during Phase 1 survey.

Latin Name	Common Name
Mallard	*Anas platyrhynchos*
Buzzard	*Buteo buteo*
Red kite	*Milvus milvus*
Woodpigeon	*Columba palumbus*
Great spotted woodpecker	*Dendrocopos major*
Meadow pipit	*Anthus pratensis*
Pied Wagtail	*Motacilla alba yarrellii*
Dunnock	*Prunella modularis*
Wren	*Troglodytes troglodytes*
Robin	*Erithacus rubecula*
Blackbird	*Turdus merula*
Song Thrush	*Turdus philomelos*
Mistle thrush	*Turdus viscivorus*
Redwing	*Turdus iliacus*
Blue Tit	*Parus caeruleus*
Great Tit	*Parus major*
Long tailed tit	*Aegithalos caudatus*
Magpie	*Pica pica*
Jackdaw	*Corvus monedula*
Carrion crow	*Corvus corone*
Rook	*Corvus frugilegus*
House sparrow	*Passer domesticus*
Chaffinch	*Fingilla coelebs*
Greenfinch	*Carduelis chloris*
Goldfinch	*Carduelis carduelis*
Reed bunting	*Emberiza schoeniclus*

Appendix 6: Summaries of Relevant Legislation, Policy and Other Instruments

National Planning Policy

6.2 Technical Advice Note (TAN) 5 provides Welsh Assembly Government advice about how the land use planning system in Wales should contribute to protecting and enhancing biodiversity and geological conservation.

6.3 It follows that the TAN provides guidance to local planning authorities on: the key principles of positive planning for nature conservation; nature conservation and Local Development Plans; nature conservation in development management procedures; development affecting protected internationally and nationally designated sites and habitats; and, development affecting protected and priority habitats and species.

6.4 Planning considerations with regard to habitats and species are of greatest relevance to the Abergelli Farm proposal. For a full account, the TAN should be referred to, but some of the key principles are summarised as follows:

i. When dealing with cases where a European protected species of plant or animal may be affected, a local planning authority needs to have regard to the requirements of the Habitats Directive in the exercise of its functions.

ii. The TAN refers to the Wildlife and Countryside Act 1981 (as amended), which makes it an offence (with certain limited exceptions and in the absence of a licence) to intentionally to kill, injure or take any wild bird, or to damage, take or destroy the nest of any wild bird whilst that nest is being built or in use, or to take or destroy its eggs. Further offences apply to species listed under Schedule 1 of the Act.

iii. The above Act also affords protection to wild animals of the species listed in Schedule 5, and to wild plants listed in Schedule 8, most of which are not European protected species. Actions that are likely to result in an offence are identified;

iv. With regard to badger, Meles meles, the TAN refers to the provisions of the Protection of Badgers Act, 1992;

v. The TAN makes reference to Sections 40 and 42 of the Natural Environment and Rural Communities Act 2006, which place a duty on the Welsh Assembly Government to have regard to the purpose of conserving biodiversity (see Section 1.10 of this report);

vi. In section 2.4 it is noted that when deciding planning applications that may affect nature conservation, local planning authorities should protect wildlife and natural features in the wider environment, with appropriate weight attached to priority habitats and species in Biodiversity Action Plans;

vii. When determining planning applications, planning authorities should ensure that all material considerations are taken into account, that decisions are informed by adequate information about the potential effects of development on nature conservation, and that the range and population of protected species is sustained;

viii. Planning applications should demonstrate a step-wise approach to avoid harm to nature conservation, minimise unavoidable harm by mitigation measures, offset residual harm by compensation measures and look for new opportunities to enhance nature conservation.

UK Post-2010 Biodiversity Framework

6.5 The Environment Departments of all four governments in the UK work together through the Four Countries Biodiversity Group. Together they have agreed, and Ministers have signed, a framework of priorities for UK-level work for the Convention on Biological Diversity. Published on 17 July 2012, the 'UK Post-2010 Biodiversity Framework' covers the period from 2011 to 2020.

6.6 Most work which was previously carried out under the UK Biodiversity Action Plan (UK BAP) is now focussed in the four countries of the UK through the new framework. The UK BAP partnership no longer operates but includes detailed Action Plans for priority habitats and species, which are still in use and of relevance. The list of priority habitats and species included within the UK BAP list is equivalent to the list of Section 42 habitats and species.

6.7 The UK BAP is supported by a series of Local Biodiversity Action Plans (LBAPs), usually set up on a local authority administrative boundary basis. Each LBAP identifies those habitats and species considered to be most important in that area (usually referred to as priority habitats and species). Commonly, an LBAP will identify a number of habitats and species for which "action plans" have been prepared. The Swansea LBAP is was created in 2005 but is unavailable as it is under review.

Wildlife Legislation

6.8 Legislation of most relevance to this assessment includes the following:

Natural Environment and Rural Communities (NERC) Act 2006

6.9 Section 40 of the Natural Environment and Rural Community Act (NERC) 2006 sets out the duty which public authorities have to conserve biodiversity. Section 40 States that: "every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity". The term Public Authority includes local authorities and local planning authorities.

6.10 Paragraph 40(3) goes on to state that "conserving biodiversity includes, in relation to a living organism or type of habitat, restoring or enhancing a population or habitat".

6.11 Paragraph 42(1) states that "the Secretary of State must, as respects Wales, publish a list of the living organisms and types of habitat which in the Secretary of State's opinion are of principal importance for the purpose of conserving biodiversity". This replaces a similar reference to the list that was found in Section 74 of the Countryside and Rights of Way Act 2000 (the CRoW Act).

The Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000)

Protection afforded to birds

6.12 Section 1 of the Wildlife and Countryside Act 1981 (WCA) prohibits the intentional killing, injuring or taking of any wild bird and the taking, damaging or destroying of the nest (whilst being built or in use) or eggs. Section 1 also prohibits disturbing any bird listed on Schedule 1 of the Act whilst at or near the nest and prohibits disturbing the dependent young of such birds.

Protection afforded to other animals

6.13 Species listed on Schedule 5 that may be of relevance to this site include GCNs, bats, otter, water vole and all species of reptiles. The places of shelter used by otter and water vole are protected, but reptiles are protected from killing and injury only.

Protection afforded to Sites of Special Scientific Interest (SSSIs)

6.14 Section 28 allows for the creation of SSSIs by the government (through Natural Resources Wales in Wales) where Natural Resources Wales (NRW) "is of the opinion that any area of land is of special interest by reason of any of its flora, fauna, geological or physiographical features."

6.15 Section 28G specifies the duty of specific public authorities (including local authorities) to further the conservation and enhancement of the features by reason of which the site is designated and also to notify NRW of operations likely to damage such features in order that NRW may consent to or refuse permission for such operations.

The Conservation of Habitats and Species Regulations 2010

6.16 The Conservation of Habitats and Species (Amendment) Regulations 2012 consolidates the various amendments that have been made to the Regulations. The original (1994) Regulations transposed the EC Habitats Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Council Directive 92/43/EEC) into national law.

6.17 "European protected species" (EPS) are those which are present on Schedule 2 of the Conservation of Habitats and Species Regulations 2010. They are subject to the provisions of Regulation 41 of those Regulations. All EPS are also protected under the Wildlife and Countryside Act 1981 (as amended). Taken together, these pieces of legislation make it an offence to:

a) Intentionally or deliberately capture, injure or kill any wild animal included amongst these species;

b) Possess or control any live or dead specimens or any part of, or anything derived from a these species;

c) Deliberately disturb wild animals of any such species;

d) Deliberately take or destroy the eggs of such an animal; or

e) Intentionally, deliberately or recklessly damage or destroy a breeding site or resting place of such an animal, or obstruct access to such a place.

6.18 For the purposes of paragraph (c), disturbance of animals includes in particular any disturbance which is likely—

a) to impair their ability—

I. to survive, to breed or reproduce, or to rear or nurture their young, or

II. in the case of animals of a hibernating or migratory species, to hibernate or migrate; or

6.19 To affect significantly the local distribution or abundance of the species to which they belong.

6.20 Although the law provides strict protection to these species, it also allows this protection to be set aside (derogated) through the issuing of licences. The licences in England are currently determined by NE for development works. In accordance with the requirements of the Regulations (2012), a licence can only be issued where the following requirements are satisfied:

a) The proposal is necessary 'to preserve public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment';

b) 'There is no satisfactory alternative'; and

c) The proposals 'will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range'.

6.21 EPS that may be relevant to this proposal include GCNs, bats, dormouse and otter.

Invasive Species Legislation

6.22 Japanese knotweed and Himalayan balsam are both listed on Part 2, Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). Section 14 of the Act states that it is an offence for a person to plant or otherwise cause to grow in the wild any species listed on Part2, Schedule 9. The Environmental Protection Act 1990 contains a number of legal provisions concerning 'controlled waste'. Any soil or plant material contaminated with Japanese knotweed that is to be discarded is classified as controlled waste.

Appendix 3.14

Otter and Water Vole Survey Report 2014

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Abergelli Power Project

Otter and Water Vole Survey Report

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1 Summary

1.1 Abergelli Power Limited (APL) is promoting a new Power Generation Plant with its associated Gas and Electricity Connections (the 'Project') on agricultural land within Abergelli Farm, north of Swansea in the City and County of Swansea (approximately at National Grid Reference 265284, 201431).

1.2 The preliminary ecological appraisal[1] identified records of otter *Lutra lutra* and water vole *Arvicola amphibius* within 2 km of the Project Site boundary, and suitable habitat to support these species within the Project Site boundary at the time of the survey (hereafter referred to as the 'Survey Site'). APL commissioned BSG Ecology to undertake an otter and water vole survey of streams and wet ditches within the 150 ha of pastoral farmland at and around Abergelli Farm in June 2014 within the Survey Site, to inform and support an application for Development Consent for the Project.

1.3 All accessible ponds, streams and wet ditches within the Survey Site boundary were surveyed for field signs of use by otter and water vole.

1.4 There are water courses on Survey Site that could provide resting places and commuting routes for otter. A single fresh spraint was recorded during the survey. This was observed on a rock in the stream that runs along the eastern boundary of the Survey Site.

1.5 Holes, that were likely to be mammal burrows, were observed at six points along two streams within the Survey Site. The holes have the right dimensions to allow use by water voles, but did not show signs of current occupation. No latrines, footprints or grazing lawns were observed during the survey.

[1] BSG Ecology (2014). Abergelli Power Project: Preliminary Ecological Appraisal.

2 Introduction

2.1 Abergelli Power Limited commissioned BSG Ecology to undertake an otter and water vole survey in May/June 2014 to inform and support an application for Development Consent for the Project described below.

Site Description

2.2 The Survey Site consists of approximately 150 ha of pastoral farmland, primarily grazed by horses. The extent of the Survey Site is shown in (Figure 1, Appendix 1) and is centred at National Grid Reference 265284, 201431. The nearest settlement is Felindre, which is located approximately 2 km to the north of the Survey Site, with Swansea approximately 5 km to the south.

2.3 The Survey Site is largely agriculturally improved pasture with several areas of marshy grassland, particularly in the north, south and north-western ends of the Survey Site. The fields are bounded by fences, running along the line of defunct hedgerows, and often accompanied by ditches. There is a block of broadleaved woodland on the eastern boundary of the Survey Site and other areas of woodland around the marshy grassland to the west of the Survey Site, and around Felindre Gas Compressor Station and the two National Grid 400 kV electrical substations that lie at the south-west end of the Survey Site. The habitats in the surrounding landscape are similar to those within the Survey Site boundary – a mixture of improved and marshy grassland interspersed with occasional patches of woodland.

2.4 There are a number of water courses within the Survey Site as described below:

- A stream corridor with small tributaries fed by springs and surface runoff along the eastern boundary of the Survey Site, which feeds into the River Llan to the south.
- A wooded stream runs along the north western boundary.
- Several small streams and wet ditches run through the woodland surrounding the Felindre Gas Compressor Station and the two National Grid 400 kV electrical substations.
- Drainage ditches border many of the pasture fields.

Description of Project

2.5 APL is promoting a new Power Generation Plant with associated Gas and Electricity Connections within Abergelli Farm. The Power Generation Plant would operate as a Simple Cycle Gas Turbine (SCGT) peaking plant and would be designed to provide an electrical capacity of up to 299 Megawatts (MW). It would be fuelled by natural gas, supplied by a new underground gas pipeline connecting Power Generation Plant to the existing National Grid Gas (NGG) National Transmission System (NTS). It would also connect to the National Grid Electrical Transmission System (NETS) via underground cable or overhead lines.

2.6 BSG Ecology has been appointed as the ecological consultant to undertake an ecology survey, which includes a desk study and Extended Phase 1 Habitat Survey as well as a range of Phase 2 surveys, including an otter and water vole survey. These baseline surveys will be included in an appendix to an ecology chapter of an Environmental Statement, which is intended for submission in support of the application for Development Consent.

Aims of Study

2.7 The aims of the otter and water vole survey within the Survey Site were to:

- Assess where water courses within the Survey Site have the potential to support otter and water vole.
- Establish the likely presence/absence of each species and, if present, their distribution throughout the relevant watercourses.

3 Methods

Desk Study

3.1 Existing ecological information for the Survey Site and the surrounding area was requested from the South East Wales Biodiversity Records Centre (SEWBReC). Information on European and nationally protected[2] species, including otter and water vole, was requested covering the Survey Site and land up to 2 km from the Survey Site boundary. In addition, on-line mapping and aerial photography of the area was also reviewed in May 2014 to identify watercourses that might be present within the Survey Site.

Scoping Survey

3.2 A Phase 1 habitat survey was carried out by BSG Ecology in February 2014 and updated in April and July 2014[3]. During the Phase 1 habitat survey it was noted that a number of watercourses within the Survey Site had the potential to support otter and water vole, although no field signs were observed. The ponds within the Survey Site were also assessed at this time, and no field signs of otter or water vole were noted.

Field Survey

3.3 The otter and water vole survey included two visits to cover water courses within the Survey Site. The first visit covered the north of the Survey Site and was conducted on 20 May 2014 by Anna Gundrey MCIEEM and Rachel Taylor ACIEEM. The second visit covered the south of the Survey Site and was conducted on 26 June 2014 by Rachel Taylor ACIEEM and Caitlin McCann. All accessible water courses were inspected for field signs of otter and water vole. In addition, Rachel Taylor ACIEEM and Caitlin McCann surveyed the ponds within the Survey Site while undertaking great crested newt *Triturus cristatus* presence/absence surveys in May 2014[4].

Otter

3.4 The otter survey was carried out on all accessible water courses within the Survey Site. Survey methods followed those recommended in Chanin (2003)[5].

3.5 The water courses, including the channel and banks, were systematically surveyed for signs of otter such as droppings ('spraints'), runs and footprints. All areas that were accessible were surveyed, and particular attention was given to suitable sprainting areas such as large, flat rocks or areas where otters were likely to leave the water course. Otter spraint can be distinguished from other mammal droppings, such as mink, by its distinctive musky smell and the presence of fish bones. Mink scats tend to be twisted in appearance and are smaller.

3.6 Signs of, or potential for, permanent dwellings ('holts') or resting places for otters were also recorded. Holts and resting places include structures such as cavities in roots of bank side trees, piles of logs or flood debris, drains and caves. Otters can also use resting places above ground in reed beds and dense scrub such as bramble *Rubus fruticosa* and blackthorn *Prunus spinosa*.

Water Vole

3.7 All water courses that were accessible were surveyed within the optimal period for finding water vole (late April to early October). This is in line with survey standards set out in The Water Vole Conservation Handbook[6]. The water courses, including the channel and banks, were

[2] Wildlife and Countryside Act 1981 Schedules 1, 5 & 8; Conservation of Habitats and Species Regulations 2010; Protection of Badgers Act.
[3] BSG Ecology (2014). Abergelli Power Project: Preliminary Ecological Appraisal.
[4] BSG Ecology (2014). Abergelli Power Project: Great Crested Newt Survey Report
[5] Chanin P (2003). *Monitoring the Otter* Lutra lutra. Conserving Natura 2000 Rivers Monitoring Series No. 10, English Nature, Peterborough.
[6] Strachan, R. & Moorhouse, T. (2006) Water Vole Conservation Handbook 2nd Ed. WildCRU, Oxford.

systematically surveyed for signs of water vole such as latrines (a communal area of droppings), feeding stations and grazed lawns, burrows (wider than high, diameter 4-8 cm), runs and footprints.

3.8 In addition, an assessment was made of whether individual water courses have potential to support water vole. The Water Vole Conservation Handbook describes favourable water vole habitat as having: wide swathes of riparian vegetation to provide both food and shelter; easily penetrable earth banks; and slow flowing, relatively deep (over 1 m) slow flowing water courses. Factors such as shallow water or over-shading by trees are generally unfavourable to water voles.

Classification of Areas Surveyed for Otter and Water Vole

3.9 Target notes (TN) were used to describe the characteristics of the water courses surveyed and to record any field signs that were observed. These were mapped (Figure 1, Appendix 1) and the target notes included (Appendix 2). In order to further illustrate the findings of the survey, the streams and ditches were categorised as follows:

3.10 **Habitat considered unsuitable for use by otter/water vole** – water courses with some or all of the following characteristics: no/low water levels; shaded; little vegetation; poached banks; no suitable resting places; no field signs of otter or water vole.

3.11 **Habitat considered suitable for use by otter/water vole** – water courses with some or all of the following characteristics: permanent flow of water; vegetation on banks; minimal shading; suitable resting places present; signs of otter/water vole.

3.12 Photographs are included showing the characteristics of water courses within the Survey Site (Appendix 3).

4 Results

Otter

Desk Study

4.1 SEWBReC provided 32 records of otter within the 2 km search radius, all recorded between 1991 and 2013. The closest record to the Survey Site is 0.5 km to the south west of the River Llan. At its closest point the River Llan is approximately 0.3 km south of the southern Survey Site boundary, within the same surface water catchment, and it links to the Survey Site via the stream running through the woodland in the centre of the Survey Site.

Field Survey

4.2 A single fresh otter spraint was found in the stream that runs along the eastern boundary of the Survey Site (see TN3, Figure 1, Appendix 1; and Appendix 2). At this point the stream is approximately 15 cm deep and with a bed of mud, gravel and rocks, the eastern bank is approximately 2 m high and sheer with over hanging trees. The western bank has an approximately 45 degree grass slope and is approximately 1.5 m high.

4.3 No other signs were observed that confirm otter presence in the other water courses within the Survey Site.

4.4 The stream that runs along the eastern boundary of the Survey Site also had deep overhangs created by the root system of the mature hedge and trees on the east bank. These have potential to be used as resting places by otter (see Figure 1, Appendix 1). However, foraging opportunities for otters are likely to be limited due to the low water levels (20-30 cm), which would make the watercourse less suitable for fish, and therefore foraging otters.

Water Vole

Desk Study

4.5 SEWBReC provided three records of water vole, within a 2 km search radius. These records were from the River Llan approximately 1.9 km from the Survey Site boundary, all from 1996. This River is in the same surface water catchment as watercourses present in the Survey Site, so it is possible that water voles could move along water courses that are linked to the River Llan (see section 4.1 above).

Field Survey

4.6 During the surveys many of the ditches that had contained water during the first Phase 1 habitat survey (in February after a very wet winter) had completely dried out by the time of the otter and water vole surveys in May and June 2014. The remaining water courses were fast running and shallow. The banks of the streams were often over-shaded with encroaching bramble and gorse or had steep, bare banks.

4.7 No field signs were observed during the surveys that clearly establish the presence of water vole. Some burrows were noted that had dimensions suitable for use by water vole and/or bank vole *Myodes glareolus* and rats, but did not exhibit signs of current use (see TNs 1. 2, 4, 5 and 7). However, no associated latrines, footprints or grazing lawns were observed at any of these locations, Figure 1, Appendix 1; Appendix 2). There was also no evidence of associated burrows below the water line, which is typical of water vole burrows. The holes were therefore considered unlikely to be used by water vole and are more likely to have been created by another species of small mammal, such as bank vole *Myodes glareolus*, or been created by water vole but subsequently abandoned.

4.8 No water vole field signs were observed at the ponds within the Survey Site during the great crested newt presence/absence surveys in May 2014[7].

Incidental Sightings

In addition to signs of otter and water vole presence recorded during the survey, some signs of badger activity were also noted and are included here for completeness. A single hole badger sett was found at TN9, with digging and a fresh latrine recorded at TN8.

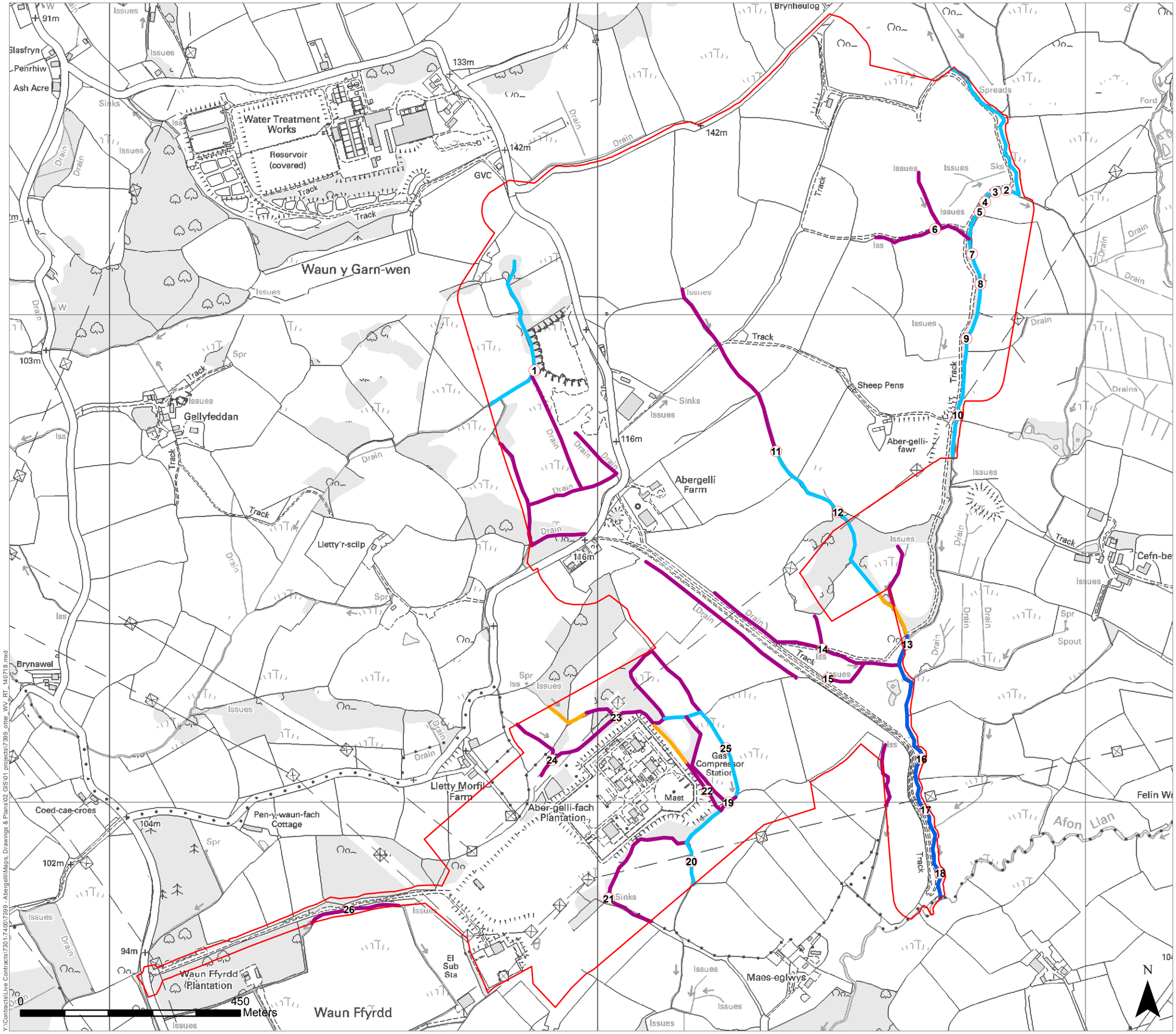
Limitations of Study

4.9 Some of the southern stretch of the stream along the eastern boundary of the Survey Site had extensive bramble and scrub along the banks, with low over-hanging branches and debris in the stream itself. This impeded the view of the surveyors along this stretch. However, a large stretch of the northern section of the same stream was also surveyed without issue, and therefore this limitation should not affect the overall results of the survey. Areas that were inaccessible, or for which the visibility was limited due to extensive scrub, are also indicated on the map (Figure 1, Appendix 1).

[7] BSG Ecology (2014). Abergelli Power Project: Great Crested Newt Survey Report.

Appendix 1: Figure 1

(see overleaf)



LEGEND

- Survey Site boundary
- Target notes

Classification of areas surveyed for otter and water vole

- Habitat considered unsuitable for use by otter / water vole
- Habitat considered suitable for use by otter / water vole
- Habitat considered suitable for use by otter but survey constrained by dense vegetation
- Inaccesible

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PROJECT TITLE
ABERGELLI POWER PLANT

DRAWING TITLE
Figure 1 - Otter and Water Vole Survey

DATE: 11.08.2014 CHECKED: MH SCALE: 1:7,500
DRAWN: RT APPROVED: JG STATUS: Final

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No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

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Appendix 2: Target Notes (TN)

Stream at TN1 - The stream is wooded, mostly shaded with shallow bramble covered banks. The stream bed is stony, water fast moving and shallow. This provides a sheltered corridor through which otter may commute, but no obvious resting places or signs of otter use were observed.

1. At TN 1 there is a vertical 1m high bare mud bank on the western side of the stream. The stream is approximately 10 cm deep at this point. There is a hole 1 m above the water which had dimensions suitable for use by water vole and/or bank vole/rat. No other field signs were observed.

To the south of TN1 is a marshy field with a network of ditches - At the time of survey (May) these ditches were dry or contained very little water and had steep banks with very little or no vegetation.

Stream at TN2 to TN10 – The stream is relatively unshaded, with a bed of mud, gravel and rocks. The water depth ranges from approximately 10 cm to 20 cm where pools form. It is fast flowing and appears clean. The eastern bank is approximately 2 m high and sheer. It is topped by a mature hedge the root system of which form a number of deep overhangs by the side of the stream. The west bank has an approximately 45 degree grassed slope.

2. A hole was found in the vertical east bank, approximately 20 cm above the waterline, which had dimensions suitable for use by water vole and/or bank vole/rat. No other field signs were observed.
3. A fresh otter spraint was found on a large, flat stone in the middle of the stream.
4. A pair of holes was found in the east bank approximately 1.5 m from the water line, which had dimensions suitable for use by water vole and/or bank vole/rat. No other field signs were observed.
5. A possible otter resting place on east bank. No otter field signs were observed. A 15 cm diameter hole was found leading into a cavity under the tree root bole, approximately 2 m above the water line. Approximately 3 m to the south of this there are three further holes, 1 m above the waterline on the eastern bank with dimensions that would allow use by water vole and/or bank vole/rat. No water vole field signs were observed.
6. Tributary of the main stream, this is a narrow brook that has dried out at its northern end. It is over shaded by scrub, no field signs for otter or water vole were observed.
7. There is a particularly deep over-hang in the east bank under a root bole. Basal rocks are moss free on top suggesting that it may be regularly accessed; however no field signs of otter were observed. This has good potential as a resting place for otter. On the west bank, above a culvert pipe that runs into the stream from the brook at TN6 there are two holes with dimensions that would allow use by water vole and/or bank vole/rat. No other field signs of water vole were observed.
8. A deep cavity in the eastern bank along the waterline good provides a potential resting place for otter. No otter field signs were observed. On the top of the west bank opposite the cavity are a number of fresh patches of badger digging and a fresh badger latrine.
9. A hole was found in the east bank 2 m above the water line; dimensions suggest that this is a badger sett. There is a mammal run into the field to the east.
10. The stream becomes very shaded at this point, and the eastern bank is largely undercut providing several potential resting places for otter. No field signs were observed.

Damp ditch/brook at TN11 to TN12 – to the north of TN11 this is a dry to damp ditch that has mainly bare banks, with some areas over-grown by bramble. It is open to horses and sheep and the land around the ditch is poached. No signs of otter or water vole were observed and this section is considered unsuitable for use by either species. To the south of TN11 the amount of water in the ditch gradually becomes greater until it forms a narrow brook, approximately 10 cm in depth.

11. The brook is very over-grown with gorse and bramble, the banks are approximately 1 m high and the water is quick moving and shallow. There is a fenced culvert 10 m to the north which is partially blocked by debris from a fallen tree on the eastern bank. No field signs of otter or water vole were observed.
12. The brook is shallow and fast moving with low grassy banks, over grown by bramble and nettle in large sections. No signs of otter or water vole were observed. South of this location the stream runs through woodland and connects to the stream along the eastern boundary of the Survey Site.

Stream at TN13 to TN18 – The southern section of the stream previously described in TN2 to TN10. The banks are lined with trees and a scrub understorey of predominantly bramble, the stream is approximately 10 cm – 20 cm deep with a rocky bed. The bank is approximately 1 – 2 m high and undercut in places. The extensive scrub impeded the surveyors' ability to access the stream, however the length was walked and notes made when a good view was available.

13. The stream is narrow, with a bare bank approximately 1 m on each side. It is encroached by bramble and gorse and is largely over shaded. No signs of otter or water vole were observed.
14. A shallow ditch extending north-west of the stream, it is dry at the northern end, the banks and low and poached by horses. The south end contains a small amount of slow moving water and is overgrown with bramble.
15. A similar ditch to TN14, this is dry to the north and the banks are poached by horses. No signs of otter or water vole were observed.
16. The stream is wide, and fast moving, approximately 10 cm in depth. The banks are approximately 1 m high and covered by bramble. There is some undercutting of the bank, although not deep enough to provide resting opportunities for otter. No signs of otter or water vole were observed.
17. The stream is narrow and fast moving, approximately 15cm deep, banks are steep and bare topped with bramble. No signs of otter or water vole were observed.
18. The stream is wide and fast flowing, approximately 20 cm deep. Root boles of trees along the western bank provide resting opportunities for otter. The eastern bank is low with a stone beach where the stream bends. No signs were observed however access was limited due to bramble and a fence on the western bank.

Ditches and stream at TN19 to TN21 – ditches run along the edge of sheep pasture, most of these are dry with bare banks. A small brook runs from the edge of the woodland through the pasture and extends south outside of the site boundary.

19. This is a dry sheep poached ditch. No signs of otter or water vole were observed.
20. A shallow brook, approximately 10cm in depth with a 50cm high grassy bank to the west and trees along the eastern bank. There are fox runs along the western side. No signs of otter or water vole were observed.
21. A nearly dry ditch, small trickle of water runs over a muddy bed. The banks are low and bare, the ditch is over shaded by trees which line each side. No signs of otter or water vole were observed.

Water courses in and around wet woodland and National Grid land at TN22 to TN26 – There are shallow ditches along the edges of the woodland, with small streams running in the interior of the woodland. The streams are approximately 10 cm deep, containing leaf litter and debris. The banks are steep with little vegetation other than nettle.

22. Very narrow, over-shaded steam with fast moving, shallow water. There is bramble encroaching on both banks. No signs of otter or water vole were observed.
23. Slow flowing woodland ditch with little water, and a large amount of leaf litter and debris. The banks are low with no vegetation. No signs of otter or water vole were observed. The ditch to the north of this point becomes inaccessible.
24. Similar to the ditch at TN23 this ditch is shallow with slow moving water and completely over shaded by the woodland, with large amounts of leaf litter. No otter or water vole signs were observed.
25. Small stream along the east edge of the field to the east of the Felindre Gas Compressor Station. Fast flowing, shallow (15 cm) with gravel and rock bed. Wide mammal run down to the stream at this point, though to be used by the sheep resident in the field. No signs of otter or water vole were observed.
26. A dry ditch at the time of survey, shaded by trees and full of leaf litter.

Appendix 3: Photographs showing characteristics of water courses within Survey Site



Photograph 1 : Damp ditch in field to the south of TN1



Photo 2: Stream along eastern boundary (TN10)



Photo 3: Dry/overgrown ditch north of TN11, arrow indicates ditch.



Photo 4: Stream south of TN12.



Photo 5: Ditch running from a field boundary into the woodland surrounding the Gas Compressor Station.



Photograph 6: Ditch in woodland north of TN 22 (taken February 2014)

Appendix 3.15

Final Dormouse Survey Report 2014

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Abergelli Power Project

Final Dormouse Survey Report

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Client	Stag Energy
Job	Abergelli Power Project
Report title	Final Dormouse Survey Report
Draft version/final	FINAL
File reference	7399_R_Dormouse_Final_APPR (2)_241114

	Name	**Position**	**Date**
Originated	Niall Lusby	Senior Ecologist	17 November 2014
Reviewed	Matt Hobbs	Principal Ecologist	18 November 2014
Approved for issue to client	Matt Hobbs	Principal Ecologist	18 November 2014
Issued to client	Matt Hobbs	Principal Ecologist	18 November 2014
Updated and 2nd issue to client	Matt Hobbs	Principal Ecologist	24 November 2014

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Nothing in this report constitutes legal opinion. If legal opinion is required the advice of a qualified legal professional should be secured.

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1 Summary

1.1 Abergelli Power Limited (APL) is promoting a new Power Generation Plant with associated Gas and Electricity Connections (the 'Project') on agricultural land within Abergelli Farm north of Swansea in the City and County of Swansea (approximately at National Grid Reference 265284, 201431).

1.2 The Preliminary Ecological Appraisal (PEA) (BSG Ecology, 2014) did not identify records of dormouse *Mucardinus avellanarius* within 2 km of the Project Site boundary, but habitat suitable for supporting dormouse was found within the Project Site boundary at the time of the Extended Phase 1 Habitat survey (referred to as the 'Survey Site').

1.3 APL commissioned BSG Ecology to undertake a presence/absence survey for dormouse in suitable woodland, hedgerow and scrub habitats within 150 ha of pastoral farmland within the Survey Site, to inform and support an application for Development Consent for the Project. The dormouse survey was undertaken between June and November 2014.

1.4 The survey did not record any dormouse in the areas surveyed. Sufficient visits were undertaken to determine the likely absence of this species from the Survey Site in line with best practice guidance for survey.

1.5 All accessible woodland, hedgerow and scrub habitats within the Survey Site boundary were included in the survey.

2 Introduction

2.1 Abergelli Power Limited (APL) commissioned BSG Ecology in May 2014 to undertake a dormouse survey to inform an application for Development Consent for the Project described below.

2.2 APL is promoting a new Power Generation Plant with its associated Gas and Electricity Connections (the 'Project') on agricultural land within Abergelli Farm, north of Swansea in the City and County of Swansea (approximately at National Grid Reference 265284, 201431).

Site Description

2.3 The Survey Site consists of approximately 150 ha of pastoral farmland, primarily grazed by horses. The extent of the Survey Site is shown in Figure 1 in Appendix 1 and is centred at National Grid Reference 265284, 201431. The nearest settlement is Felindre, which is located approximately 2 km to the north of the Survey Site, with Swansea approximately 5 km to the south.

2.4 The Survey Site is largely agriculturally improved pasture with several areas of marshy grassland, particularly in the north, south and north-western extents of the Survey Site. The fields are bounded by fences, running along the line of defunct hedgerows, and often accompanied by ditches. There is a block of broadleaved woodland on the eastern boundary of the Survey Site and other areas of woodland around the marshy grassland to the west of the Survey Site, and around Felindre Gas Compressor Station and the two National Grid electrical substations that lie at the south-west end of the Survey Site. The habitats in the surrounding landscape are similar to those within the Survey Site boundary which comprise a mixture of improved and marshy grassland interspersed with occasional patches of woodland.

Description of Project

2.5 APL is promoting a new Power Generation Plant with associated Gas and Electricity Connections within Abergelli Farm. The Power Generation Plant would operate as a Simple Cycle Gas Turbine (SCGT) peaking plant and would be designed to provide an electrical capacity of up to 299 Megawatts (MW). It would be fuelled by natural gas, supplied by a new underground gas pipeline connecting Power Generation Plant to the existing National Grid Gas (NGG) National Transmission System (NTS). It would also connect to the National Grid Electrical Transmission System (NETS) via underground cable or overhead lines.

2.6 BSG Ecology has been appointed as the ecological consultant to undertake ecology surveys, which include a desk study and Extended Phase 1 Habitat Survey as well as a range of Phase 2 surveys, including a dormouse survey. These baseline surveys will be included in an appendix to the ecology chapter of an Environmental Statement, which is intended for submission in support of the application for Development Consent.

Aims of Study

2.7 The aims of the dormouse survey were to identify whether dormouse are present in woodland, hedgerow and scrub habitats within the Survey Site boundary using standard survey methods (as specified in Section 3).

3 Methods

Desk Study

3.1 Existing ecological information for the Survey Site and its surrounding area was requested from the South East Wales Biodiversity Records Centre (SEWBReC). Information on protected[1] species, including dormouse, was requested covering the Survey Site and land up to 2 km from the Survey Site boundary. In addition, on-line mapping and aerial photography of the area were also reviewed to identify areas of suitable habitat that might be present outside of the Survey Site that could be connected to habitats within the Survey Site, or support off-site populations that maintain linkages through habitats in the Survey Site.

Scoping Survey

3.2 A Preliminary Ecological appraisal (PEA) was carried out by BSG Ecology in February 2014 and updated in April and July 2014 (BSG Ecology, 2014). As part of the PEA woodland, hedgerow and scrub habitats were assessed with regard to their suitability to support dormouse in terms of woody species diversity and structure. The connectivity of woodland habitats within the wider landscape was also considered.

Field Survey

3.3 The survey was undertaken in accordance with the best practice survey guidance as set out in English Nature's Dormouse Conservation Handbook (English Nature, 2006). Under this guidance it is stated that to determine presence/absence within a woodland that a minimum of 50 nest tubes at a spacing of 15-20 m intervals need to be put out in suitable habitats for several months, and these tubes then need to be checked monthly for indications of use by dormouse. The indications of use include finding animals in residence within the tube during the survey or finding a nest characteristic of the species. Dormouse typically make neat nests comprising tightly woven honeysuckle bark (or similar), along with green leaves, normally hazel, though other species are used. This differs from the nest of other small mammals which are typically much messier and lack a distinct structure.

3.4 Each month receives a score based on the probability of dormouse occupying the tubes in that month. For a survey to be considered valid a total of 20 or more points are required. The score per month is illustrated in Table 1 below.

[1] Wildlife and Countryside Act 1981 Schedules 1, 5 & 8; Conservation of Habitats and Species Regulations 2010; Protection of Badgers Act.

Table 1: Monthly index of probability for tube occupation.

Month	Index of Probability
April	1
May	4
June	2
July	2
August	5
September	7
October	2
November	2

3.5 A total of 143 tubes were deployed in woodland, scrub, and hedgerow habitats across the Survey Site with 110 tubes deployed in May and June. Due to difficulties in gaining access permission for the access road the deployment in this area was undertaken later in June. The tubes were deployed as follows:

- 55 tubes were deployed on 9 May 2014, the locations of which are shown in red on the Plan provided as Figure 1:
- A further 55 tubes were deployed on 4 June with the locations shown in green on Figure 1; and
- When access to the National Grid land was obtained, a further 33 tubes were deployed along the access road on 24 June. The locations of these tubes are shown in blue on Figure 1.

Limitations of study

3.6 The Survey Site was surveyed with a sufficient number and density of tubes to comply with best practice guidance on dormouse survey. Most tubes were deployed within the Survey Site between June to November inclusive, which scores 20 points under best practice guidance. 20 points is the minimum number of points required for a survey to be considered valid.

3.7 Some of the tubes (33) were not deployed until 24 June. This was due to late permission to survey the National Grid Access road margins. This led to the areas of suitable dormouse habitat adjacent to the National Grid access road being surveyed from July, rather than June. This area is a small part of the wider habitat within the Survey Site that was identified as having the potential to support dormouse. The road margins here are connected to other blocks of woodland and scrub in the western and, to a lesser extent (as habitat connections are fragmented in the middle part of the Survey Site) the eastern part of the Survey Site and are considered to be contiguous with these areas and therefore part of the same dormouse survey area. The results of the survey are clear and robust enough to conclude that dormouse is likely to be absent from the Survey Site, regardless of the lack of one month of data from a small section of the site, and this is not considered to be a significant constraint.

4 Results

Desk Study

4.1 There were no records of dormouse provided by SEWBREC within 2 km of the Survey Site.

4.2 The lack of records in the immediate surrounds of the Survey Site does not necessarily indicate the absence of dormouse. A lack of records can be due to a lack of survey, which in turn could be a based on former assumptions of dormouse habitat requirements. In recent years dormice have been recorded in habitats previously discounted as unsuitable, meaning that survey for this species in sub-optimal habitats is currently recommended.

Scoping Survey

4.3 The Survey Site was assessed for its suitability to support dormouse during the PEA survey. It was found to support numerous fragments of woodland, some of which are designated as Ancient Woodland, as well as several treelines that follow stream corridors or are remnants of former wooded areas that have been cleared historically.

4.4 The habitats within the Survey Site were assessed as being sub-optimal for dormouse for the following reasons:

- There is a very low occurrence of hazel *Corylus avellana* within the Survey Site, along with a low diversity of other woody species present on the Survey Site. Dormice typically require a variety of woody species to ensure, year round availability of food;
- Many of the woodlands have been grazed and lack a well-developed understorey, typically required by dormouse; and
- The Survey Site lacks hedgerows, with most of the field boundaries comprising post and wire fences. Some tree lines are present, where hedgerows have become defunct though a lack of active management. Some small areas of hedgerow are present along the National Grid access road and these were included in the survey. The lack of hedgerows reduces the suitability of the Survey Site as hedgerows typically serve to provide habitat linkages between small woodlands such as those found on the Survey Site and its wider surrounds.

Field Survey

4.5 The first survey was carried out on 25 June which excluded the 33 tubes put out the day before along the National Grid Access Road. The 33 tubes not included on 25 June were first surveyed on 9 July after having been left to "bed in"[2]. The second survey (on 9 July included all the tubes and was undertaken on 23rd and 24 of July. The surveys were carried out by Niall Lusby CMIEEM (licence number 53084:OTH:SA:2014) and Gareth Lang (licence number (44285:OTH:SA:2013).

4.6 The survey results are summarised in Table 2 below.

Table 2: Survey results.

Visit number	Survey Date	Tubes covered	Result	Probability index points per 50 tubes
1	25/06/14	1st and 2nd deployment	No evidence of dormouse found	June: **2 points** over 143 tubes
	9/07/14	3rd deployment	No evidence of dormouse found	
2	23/07/14 and 24/07/14	All deployments	No evidence of dormouse found	July: **2 points** over 143 tubes
3	19/08/14	All deployments	No evidence of dormouse found	August: **5 points** over 143 tubes
4	23/09/14	All deployments	No evidence of dormouse found	September: **7 points** over 143 tubes
5	16/10/14	All deployments	No evidence of dormouse found	October: **2 points** over 143 tubes
6	14/11/14	All deployments	No evidence of dormouse found	November: **2 points** over 143 tubes
Total Score				**20**

[2] Bed in – this phrase is used to describe a period of time that the tubes are left before the first survey is carried out. During this time the scent of humans disappears from the tube, and dormice are more likely to use them.

5 References

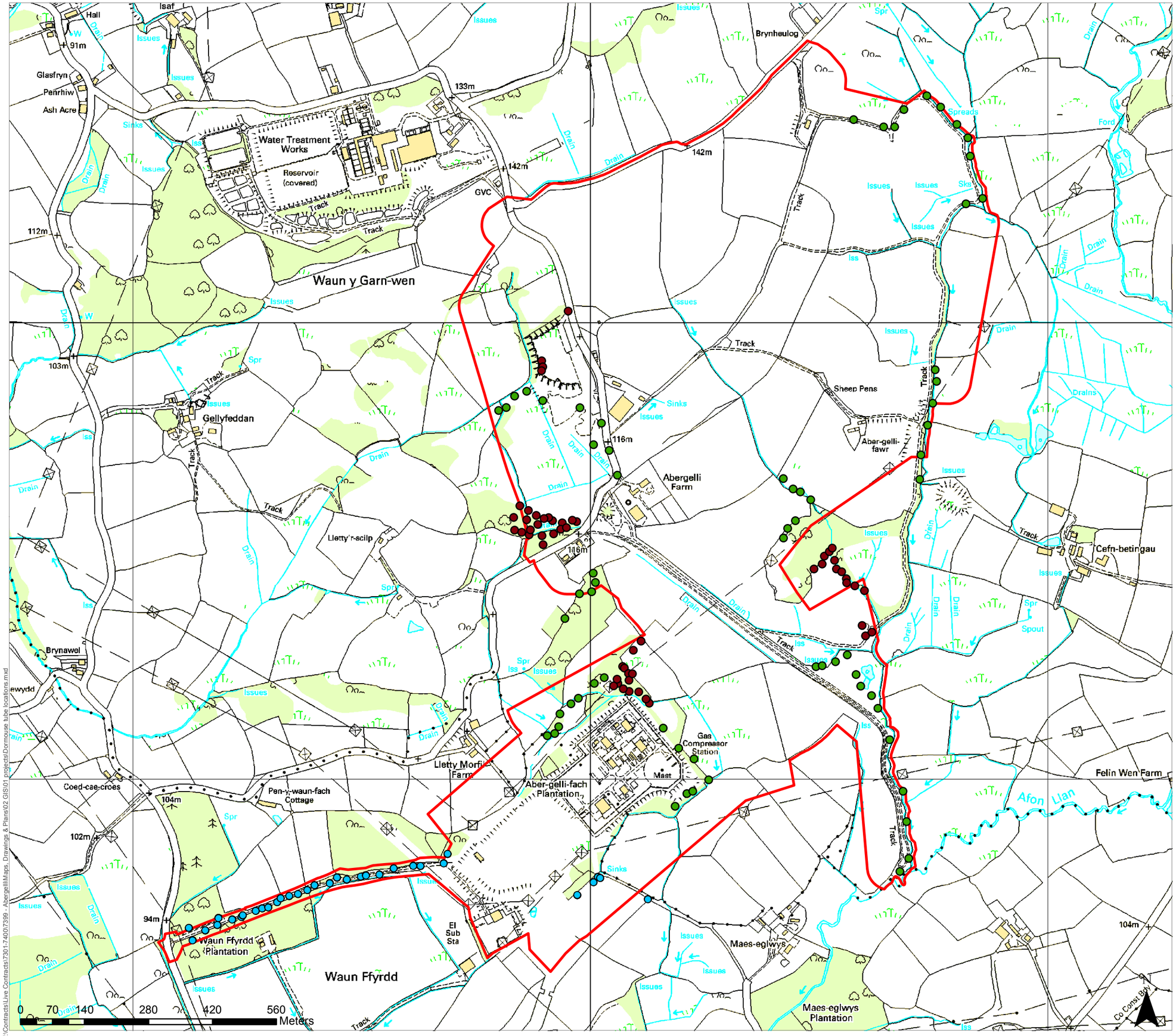
BSG Ecology (2014). Abergelli Power Project: Preliminary Ecological Appraisal.

English Nature 2006. The Dormouse Conservation Handbook (2nd edition).

Natural England (2011). Interim Natural England Advice note: Dormouse Surveys for Mitigation Licensing, Best Practice and Common Misconceptions.

Appendix 1: Figures

(overleaf)



LEGEND

- Survey Site Boundary
- Dormouse Deployment 1
- Dormouse Deployment 2
- Dormouse Deployment 3

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PROJECT TITLE
ABERGELLI POWER PLANT

DRAWING TITLE
Figure 1 - Dormouse tube locations

DATE: 17.11.2014 CHECKED: MH SCALE: 1:8,000
DRAWN: NL APPROVED: MH STATUS: FINAL

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No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

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Appendix 3.16

Breeding Bird Survey Report 2014

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Abergelli Power Project

Breeding Bird Survey Report

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Client	Stag Energy
Job	Abergelli
Report title	Breeding Bird Survey Report
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1 Summary

1.1 Abergelli Power Limited (APL) is promoting a new Power Generation Plant with its associated Gas and Electricity Connections (the 'Project') on agricultural land within Abergelli Farm north of Swansea in the City and County of Swansea (approximately at National Grid Reference 265284, 201431).

1.2 APL commissioned BSG Ecology to undertake a breeding bird survey within 150 ha of pastoral farmland at and around Abergelli Farm in 2014, to inform and support an application for Development Consent for the Power Generation Plant.

1.3 Breeding birds were surveyed by walking along field boundaries and tracks within the Survey Site at a slow pace to enable all birds detected to be located, identified and recorded. Frequent stops were made to listen and scan for singing and calling birds. The Survey Site was visited on three occasions, once during each of April, May and June. A constant search effort was employed during each survey visit, with all habitat types being approached to within approximately 50 m.

1.4 Nine bird species of principal importance for nature conservation' as referred to in S42 of the NERC Act 2006 (S42)[1] (cuckoo *Cuculus canorus*, grasshopper warbler *Locustella naevia* dunnock *Prunella modularis*, house sparrow *Passer domesticus*, linnet *Carduelis cannabina*, lesser redpoll *Carduelis cabaret*, skylark *Alauda arvensis*, song thrush *Turdus philomelos*, and tree pipit *Anthus trivialis*) were considered likely to breed on site. All nine S42 species recorded within the Survey Site are also red-listed species of conservation concern in Wales (RSPB, 2009), with the exception of dunnock (which is amber-listed). An additional seven amber-listed species, bullfinch *Pyrrhula pyrrhula*, mistle thrush *Turdus viscivorus*, meadow pipit *Anthus pratensis*, reed bunting *Emberiza schoeniclus*, common redstart *Phoenicurus phoenicurus*, whitethroat *Sylvia communis* and willow warbler *Phylloscopus trochilus* were also considered to have bred.

1.5 No territories of species listed under Schedule 1 Part 1 of the Wildlife & Countryside Act 1981 (as amended) (Schedule 1 species) were recorded, although two Schedule 1 species were recorded during the surveys, as follows. A pair of red kite *Milvus milvus* was recorded mobbing a peregrine falcon *Falco peregrinus* over the Felindre Gas Compressor Station land during survey in May. A pair of kites was also recorded flying over the eastern boundary in the northern compartment of the Survey Site during the same survey day. Given the timing of the records, and that at least one pair were recorded during survey it is likely that red kite breed locally but that the single record of peregrine referred to a transient bird. No evidence was found to suggest breeding of either species occurred within the Survey Site during 2014.

[1] The Natural Environment and Rural Communities Act 2006 (NERC 2006) required the Welsh Assembly Government (WAG), based on advice from the Countryside Council for Wales (now part of Natural Resources Wales), to identify species and habitats of principal importance for the conservation of biodiversity in Wales. Section 42 of The NERC Act requires the WAG to take steps to "further the conservation" of these species/habitats.

2 Introduction

2.1 Abergelli Power Limited (APL) commissioned BSG Ecology to undertake a breeding bird survey to inform and support an application for Development Consent for the Project described below.

Site Description

2.2 The Survey Site consists of approximately 150 ha of pastoral farmland primarily grazed by horses. The extent of the Survey Site is shown in Figure 1 and is centred at National Grid Reference 265284, 201431. The nearest settlement is Felindre, which is located approximately 2 km to the north of the Survey Site, with Swansea approximately 5 km to the south.

2.3 The Survey Site is largely agriculturally improved pasture with several areas of marshy grassland, particularly in the north, south and north-western ends of the Survey Site. The fields are bounded by fences, running along the line of defunct hedgerows, and often accompanied by ditches. There is a block of broadleaved woodland on the eastern boundary of the Survey Site and other areas of woodland around the marshy grassland to the west of the Survey Site, and around Felindre Gas Compressor Station and the two National Grid 400 kV electrical substations that lie at the south-west end of the Survey Site. The habitats in the surrounding landscape are similar to those within the Survey Site boundary – a mixture of improved and marshy grassland interspersed with occasional patches of woodland.

Description of Project

2.4 APL is promoting a new Power Generation Plant with associated Gas and Electricity Connections within the Survey Site. The Power Generation Plant would operate as a Simple Cycle Gas Turbine (SCGT) peaking plant and would be designed to provide an electrical capacity of up to 299 Megawatts (MW). It would be fuelled by natural gas, supplied by a new underground gas pipeline connecting the Power Generation Plant to the existing National Grid Gas (NGG) National Transmission System (NTS). It would also connect to the National Grid Electrical Transmission System (NETS) via underground cable or overhead lines.

2.5 BSG Ecology has been appointed as the ecological consultant to undertake an ecological survey, which includes a desk study and Extended Phase 1 Habitat Survey as well as a range of Phase 2 surveys, including a breeding bird survey. These baseline surveys will be included in an appendix to an ecology chapter of an Environmental Statement, which is intended for submission, as an integral part of the application for Development Consent.

Aims of Study

2.6 The survey work undertaken at Abergelli Farm between April and June 2014 aimed to establish:

- The number of species present on the Survey Site or the immediate surrounding habitat;
- The number of territories held by each species, and
- Whether the Survey Site or the immediate surrounding habitat is used by bird species of high conservation interest, including:
    a. Species protected under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended);
    b. Species listed on Annex 1 of the Council Directive 79/409/EEC on the Conservation of Wild Birds;
    c. Species listed in Section 42 of the Natural Environment and Rural Communities Act (NERC 2006) as species of principal importance for the conservation of biodiversity in Wales;
    d. Species listed in the Swansea Local Biodiversity Action Plan (LBAP); and

e. Species listed as having a Red or Amber population status[2] (RSPB, 2009).

[2] Seven quantitative criteria are used to assess the population status of each bird species and to categorise it on the red, amber or green list of conservation concern (species that are red-listed are of greatest conservation concern whereas those that are green-listed are not considered to be of particular conservation priority or (in a few cases) have insufficient data to be robustly categorised). Criteria considered are: global conservation status; evidence of recent decline; evidence of historical decline; an unfavourable European conservation status; rarity (in terms of breeding numbers); restricted (localised) distribution; and whether a species is considered to be of international conservation importance (featuring in the list of birds in Annex 1 of the Birds Directive 1979). When considering whether a species is added to the red or the amber list, factors such as the extent of decline and range contraction are considered.

3 Methods

Desk Study

3.1 Existing ecological information for the Survey Site and its surrounding area was requested from the South East Wales Biodiversity Records Centre (SEWBReC). Information on designated sites was requested from within 10 km for European sites, 5 km for nationally designated sites and 2 km of the Survey Site for non-statutory sites. The latter search radius was also used for information on protected[3] or notable species (particularly those identified as S42 species and/or of local conservation importance or LBAP[4] species), including birds. In addition, an initial study of on-line aerial photographs, topographical, and Ordnance Survey maps was made using web-based resources including: Where's the path?[5], Google Maps[6] and Google Earth Version 6 (Google Inc, 2010). This, together with the results from a preliminary ecological appraisal[7] carried out in February 2014 and updated in April 2014, resulted in a detailed understanding of the habitats and features on the Survey Site along with an indication of the bird community potentially present.

Field Survey

3.2 The method used was adapted from the British Trust for Ornithology (BTO) Common Bird Census (CBC) as described by Gilbert *et al.* (1998), Although eight to ten visits are usually undertaken for CBC sites being monitored over the long term, it is generally accepted that for the purposes of assessing potential environmental impacts, three visits are sufficient to describe the value of a Survey Site for breeding birds and give an approximation of the number of breeding bird territories present within a Survey Site (e.g. SNH, 2005[8]). Breeding birds were surveyed by walking along field boundaries and tracks within the Survey Site at a slow pace to enable all birds detected to be located, identified and recorded. Frequent stops were made to listen and scan for singing and calling birds. All habitat features were approached to within approximately 50 m, except in horse pasture fields. Transects were not walked across closely grazed pasture fields, as it was possible to easily view birds by scanning from field boundaries (due to the lack of vegetation and small field sizes) and to avoid disturbing horses that were kept in many of them at the time of the survey. Bird locations were mapped using standard two-letter British Trust for Ornithology (BTO) codes, and bird activity was recorded using standard BTO behaviour codes (Marchant 1983).

3.3 The breeding status of birds recorded was categorised as either 'holding territory' or 'showing other evidence of breeding'. Birds presumed to be holding territory were those recorded in song. Other evidence of breeding included observations of:

- Distraction display or injury feigning;
- Used nests or eggshells found (occupied or laid within the survey period);
- Recently fledged young or downy young;
- Adults entering or leaving a nest site in circumstances indicating an occupied nest or an adult sitting on nest;
- Adults carrying food for young or faecal sacs;
- Nest containing eggs; and
- Nest with young seen or heard.

3.4 The presence of house sparrow near a suitable nesting building was also taken as evidence for breeding in this species.

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[3] Wildlife and Countryside Act 1981 Schedules 1, 5 & 8; Conservation of Habitats and Species Regulations 2010; Protection of Badgers Act.
[4] Those listed under Local Biodiversity Action Plans for Swansea.
[5] http://mortimermaps.appspot.com/wtp3/wtp3.htm
[6] https://maps.google.co.uk/
[7] BSG Ecology (2014). Abergelli Power Project: Preliminary Ecological Appraisal.
[8] See Section 6.9.1. Although this reference describes methods appropriate for surveying at onshore wind farms this method is also appropriate for most walkover breeding bird surveys of lowland and/or farmland sites.

3.5 The results of the three breeding bird territory mapping surveys were combined to create a single map showing all birds considered to be holding territory (Figures 1a and 1b in Appendix 1). BTO codes for each species illustrated in Figure 1a and 1b are provided in Table 2 (below). Where a bird was observed in the same location during more than one survey visit, and this is judged to be the same individual bird, only one registration of that bird is shown on the map. Where more than one individual of the same species is shown in close proximity, these are individual birds seen simultaneously during a single survey. Note the locations of presumed territories do not represent specific nest locations.

3.6 The Survey Site was divided into two survey compartments due to its size; the first covered the north of the Survey Site (the land north of the gallops that runs from the houses at Abergelli Farm to the south-east corner of the Survey Site), and the second covered the south of the Survey Site (the land south of the gallops). Three survey visits were made to each compartment; one in each of late April, late May and mid-June. Table 1 below provides details of the duration and weather conditions during surveys.

Table 1: Details of breeding bird surveys.

Compartment	Date	Time	Weather conditions
North	25/04/2014	06:30 – 10:15	Wind E 1-2, cloud 8/8, dry, dull
South	25/04/2014	06:40 – 11:00	Wind E 1-2, cloud 8/8, dry, dull
North	24/05/2014	06:00 – 09:00	Wind W 1-2, cloud 6/8, dry, sunny
South	24/05/2014	07:00 – 10:00	Wind W 1-2, cloud 6/8, dry, sunny
North	19/06/2014	06:30 – 10:00	Wind NW 1-3, cloud 1/8, dry, sunny
South	19/06/2014	06:45 – 10:00	Wind NW 1-3, cloud 1/8, dry, sunny

3.7 The Felindre Gas Compressor Station and the National Grid electrical substation compounds to the south-west of the Survey Site were not entered, due to lack of access. The compounds can be viewed adequately from the fence and there is very little suitable habitat for breeding birds within these compounds. The land immediately beyond the northern and eastern Survey Site boundaries was also not entered. The surveyor(s) scanned areas of adjacent habitat by walking paths and field edges and made use of local vantage-points to record species present around the access restricted areas. This enabled the entire site to be sampled without trespassing.

3.8 In late June, all buildings within the Survey Site, with the exception of those within the National Grid compounds referred to above, were inspected for barn owl *Tyto alba* presence or other evidence of presence, such as pellets, nests, or faecal matter. The buildings were primarily visited to inspect for bat roosts and the methods are described in detail in the bat roost inspection report. Anecdotal evidence from the land owner prior to inspection suggested that none of the buildings were in use or had historically been used by barn owl. All trees within the Survey Site were also inspected from ground level for evidence of use by bats and barn owl. A sub-set of these trees were identified for further roped-access (tree-climbing) survey that involved internal and external inspection of these trees. Full details of these surveys are provided in the bat survey report.

3.9 The maps from the three visits were combined. For species where definitive evidence of breeding was not obtained, professional judgement (based on a range of factors including knowledge of habitat requirements, local status and/or repeat sightings) was used to conclude whether breeding was likely. A precautionary approach was taken, with species suspected to have bred being plotted as having done so.

Survey Limitations

3.10 It was not possible to gain access to the access road to the south-west of the Felindre Gas Compressor Station and the two National Grid 400 kV electrical substations and also the land immediately surrounding these areas during the breeding bird surveys, as shown in Figure 1b. It is unlikely that this is a significant constraint to the surveys as the areas that could not be surveyed contain similar habitats to those within the areas that were surveyed and it is unlikely that they support any additional species that are protected or notable.

4 Results

Desk Study Data

4.1 A full list of the European designated sites within 10 km, national statutory designated sites within 5 km, and non-statutory designated sites within 2 km of the Survey Site boundary is provided in the preliminary ecological appraisal. Sites that include a cited ornithological interest are described below.

Statutory Sites of Nature Conservation Importance

4.2 Carmarthen Bay and the tidal estuaries that extend from it, approximately 7.2 km west of the Survey Site, has been afforded multiple designations and is referred to under the umbrella term European Marine Site (EMS[9]) which includes the Carmarthen Bay area and Estuaries Special Area of Conservation (SAC[10]), and the Burry Inlet Special Protection Area (SPA[11]). This area also contains a Ramsar Wetland of International Importance (Ramsar[12]). The boundaries of each of these sites are not contiguous but all fall within the EMS site. The details of each designation are provided below.

4.3 The Burry Inlet SPA and Ramsar, located approximately 9.7 km west south-west of the Survey Site, is classified for large numbers of overwintering wildfowl and waders that feed in the saltmarshes and on the intertidal mud and sand.

4.4 The SPA has been classified as it supports important overwintering populations of eleven migratory species of waterfowl and an assemblage of 34,962 wintering water fowl including common shelduck *Tadorna tadorna*, Eurasian wigeon *Anas penelope*, Eurasian teal *Anas crecca*, northern pintail *Anas acuta*, shoveler *Anas clypeata*, Eurasian oystercatcher *Haematopus ostralegus*, grey plover *Pluvialis squatarola*, red knot *Calidris canutus*, dunlin *Calidris alpina alpina*, Eurasian curlew *Numenius arquata,* and common redshank *Tringa totanus*. The SPA includes extensive areas of intertidal sand and mud-flats, large sand dune systems and the largest continuous area of saltmarsh in Wales.

4.5 The spring and autumn population of common redshank, and wintering population of northern pintail, Eurasian oystercatcher, and red knot are qualifying features for the Burry Inlet Ramsar designation.

4.6 The Carmarthen Bay and Estuaries SAC, located approximately 7.2 km to the west, is designated for its 'Sandbanks which are slightly covered by sea water all the time', 'Estuaries', 'Mudflats and sandflats not covered by water at low tide', 'Large shallow inlets and bays', 'Salicornia and other annuals colonising mud and sand', and 'Atlantic salt meadows'.

Non-Statutory Sites

4.7 There are 23 Sites of Interest for Nature Conservation (SINC) within 2 km of the Survey Site. These are described in detail in the preliminary ecological appraisal. Three SINCs lie partially within the Survey Site boundary, of which two have cited ornithological interest.

4.8 Rhyd-Y-Pandy Valley Grasslands is a large SINC, which includes three fields that lie within the north-east corner of the Survey Site. The site is designated for its wet woodland and woodland with

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[9] The term 'European Marine Sites' (EMS) collectively describes Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) that are covered by tidal waters and protect some of our most important marine and coastal habitats and species of European importance.

[10] SACs are strictly protected sites designated under the EC Habitats Directive in order to conserve the 189 habitat types and 788 faunal species identified in Annexes I and II of the Directive (as amended). They do not afford protection to birds directly (although are often subject to various other designations that do have an ornithological component and often offer protection to habitats of value to a range of bird species).

[11] SPAs are internationally important sites classified in accordance with Directive 79/409/EEC on the conservation of wild birds (commonly referred to as the Bird Directive).

[12] Ramsar sites are wetlands of international importance designated under the Ramsar Convention.

assemblage of ancient woodland indicator species, scrub, purple moor grass and rush pasture, lowland meadow, neutral grassland, scrub, reed bed and water course habitats. Species of bird listed on the SINC form include sky lark, tree pipit, reed bunting, common kestrel *Falco tinnunculus*, herring gull *Larus argentatus*, red kite, house sparrow, common starling *Sturnus vulgaris*, song thrush and barn owl. It is unclear what the status of these species on the SINC is.

4.9 Warn Garn Wen is also an extensive SINC which includes the marshy grassland that lies within the western boundary of the Survey Site. The site is designated for purple moor grass and rush pasture, wet woodland, scrub and watercourse habitats. Species of bird listed on the SINC form include herring gull, lesser black-backed gull *Larus fuscus*, house sparrow, stonechat *Saxicola rubicola*, common starling and song thrush. It is unclear what the status of these species on the SINC is.

4.10 There are two SINCs located adjacent to the boundary. Rhos Fawr SINC is a block of land immediately to the north of the Survey Site boundary, and Felindre Grasslands SINC lies adjacent to the southern tip of the proposed access route. Both have cited ornithological interest.

4.11 The Rhos Fawr SINC is designated for its woodland containing an assemblage of ancient woodland indicator species, scrub, purple moor grass and rush pasture, and neutral grassland habitats. Species of bird listed on the SINC form include tree pipit and common cuckoo *Cuculus canorus.* It is unclear what the status of these species on the SINC is.

4.12 The Felindre Grasslands SINC is designated for its wet woodland and lowland mixed deciduous woodland, purple moor grass and rush pasture, and scrub habitats. Species of bird listed on the SINC form include northern goshawk *Accipiter gentilis*, tree pipit, lesser redpoll, common linnet, reed bunting, common kestrel, common snipe *Gallinago gallinago*, herring gull, house sparrow, green woodpecker *Picus viridis*, willow tit *Poecile montanus*, common bullfinch, water rail *Rallus aquaticus*, stonechat, Eurasian woodcock *Scolopax rusticola*, common starling, song thrush, barn owl, and northern lapwing *Vanellus vanellus*. It is unclear what the status of these species on the SINC is.

4.13 Two additional SINCs have cited ornithological interest. These are; Penllergaer Forest, located approximately 1 km south-west of the Survey Site, and Penllergaer to Llangyfelach Tunnel and Railway Line, located approximately 1 km south of the Survey Site.

4.14 The Penllergaer Forest SINC is designated for its range of woodland types, purple moor grass and rush pasture, reedbeds and watercourses. Species of bird listed on the SINC form include Northern goshawk, common kingfisher *Alcedo atthis*, lesser redpoll, common cuckoo, lesser spotted woodpecker *Picoides minor*, common grasshopper warbler, common crossbill *Loxia curvirostra*, red kite, house sparrow, wood warbler *Phylloscopus sibilatrix*, green woodpecker, willow tit, common bullfinch, common starling and song thrush. It is unclear what the status of these species on the SINC is.

4.15 Penllegaer to Llangyfelach Tunnel and Railway Line SINC is also designated for its range of woodland types, purple moor grass and rush pasture, scrub and watercourses. Species of bird listed on the SINC form include tree pipit, lesser redpoll, common bullfinch, and song thrush. It is unclear what the status of these species on the SINC is.

4.16 Most of the woodland within the Survey Site is also designated as Ancient Woodland.

Species Data

4.17 SEWBReC provided 21 records of barn owl. The closest of these records is 0.7 km to the west of the Survey Site boundary from 1997, with the nearest breeding record 3 km to the south west near Penllergaer Woods in 2000. The most recent record is from approximately 3.7 km north-west of the Survey Site in April 2013. An additional 5 records were provided for the last 10 years, the nearest of which was recorded in 2007, approximately 2 km south-west of the Survey Site,

4.18 A red kite was noted circling above a field in the north-west corner of the Survey Site and also over Abergelli Farm during the Phase 1 Survey in April 2014. SEWBReC provided 54 records for red kite between 1999 and 2013, the record nearest the Survey Site being approximately 150 m to the east.

4.19 SEWBReC provided a number of records of ground nesting birds in the search area. These included records for Eurasian curlew, northern lapwing and skylark. A total of 63 records of lapwing were provided from between 2000 and 2009, all south of the Survey Site. The closest of these records are located at the tinplate workings site near to Bryn Whilach Farm, approximately 1 km to the south-west of the Survey Site boundary. There was one record of curlew from 2011, located at the Lliw Reservoir, 1 km north of the Survey Site boundary.

4.20 A full list of species, returned from the data search can be found in **Table 3** in **Appendix 2**.

Breeding Bird Survey (2014)

4.21 A total of 53 species were recorded on the Survey Site during the breeding bird survey in 2014. Of these, 46 were passerines (including near-passerines) and seven non-passerines.

Breeding passerines

4.22 The bird community was passerine dominated. Those observed holding territories and considered to have bred on the Survey Site are presented in Table 2 below. A full list of species, including non-breeding birds, recorded during the breeding bird survey can be found in Table 4 in Appendix 2.

Table 2: Estimated numbers of passerine territories recorded.

Species	BTO species code	Number of territories	Other evidence of breeding[13]	S42 species	Red (R) or Amber (A) listed species
Blackbird *Turdus merula*	B.	8	6		
Blackcap *Sylvia atricapilla*	BC	10			
Bullfinch *Pyrrhula pyrrhula*	BF	4	2		A
Blue Tit *Cyanistes caeruleus*	BT	9	9		
Chiffchaff *Phylloscopus collybita*	CC	19			
Chaffinch *Fringilla coelebs*	CH	22	3		
Cuckoo *Cuculus canorus*	CK	3			R
Coal Tit *Periparus ater*	CT	1			
Dunnock *Prunella modularis*	D.	15	1		A
Goldcrest *Regulus regulus*	GC	2	1		
Grasshopper Warbler *Locustella naevia*	GH	2			R
Goldfinch *Carduelis carduelis*	GO	3	1		
Great Tit *Parus major*	GT	4	5		
House Sparrow *Passer domesticus*	HS		3		R
Linnet *Carduelis cannabina*	LI	2	1		R
Mistle Thrush *Turdus viscivorus*	M.	2			A
Meadow Pipit *Anthus pratensis*	MP	7	1		A
Nuthatch *Sitta europaea*	NH	1	2		
Lesser Redpoll *Acanthis cabaret*	LR		1		R
Robin *Erithacus rubecula*	R.	27	8		
Reed Bunting *Emberiza schoeniclus*	RB	3			A

[13] The number of territories where other evidence was found to confirm breeding is indicated. Other evidence of breeding was considered to include observations of adults carrying nesting material or food, adults being repeatedly alarmed or engaging in territorial disputes, and families including juveniles accompanied by adults. The presence of house sparrow near a suitable nesting building was also taken as evidence for breeding in this species.

Species	BTO species code	Number of territories	Other evidence of breeding[13]	S42 species	Red (R) or Amber (A) listed species
Redstart *Phoenicurus phoenicurus*	RT	6			A
Skylark *Alauda arvensis*	S.	4		□	R
Stonechat *Saxicola torquata*	SC	2	2		
Song Thrush *Turdus philomelos*	ST	18		□	R
Sedge Warbler *Acrocephalus schoenobaenus*	SW	1			
Tree Pipit *Anthus trivialis*	TP	3	2	□	R
Whitethroat *Sylvia communis*	WH	12	1		A
Wren *Troglodytes troglodytes*	WR	34			
Willow Warbler *Phylloscopus trochilus*	WW	49	2		A

4.23 Twenty eight species of passerine were noted holding breeding territories on the Survey Site. An additional two species, lesser redpoll and house sparrow, were observed showing other evidence of breeding.

4.24 No passerine species listed under Schedule 1 Part 1 of the Wildlife & Countryside Act 1981 (as amended)[14] were recorded.

4.25 Nine S42 species (cuckoo, dunnock, grasshopper warbler, house sparrow, linnet, lesser redpoll, skylark, song thrush, and tree pipit) were considered likely to breed on the Survey Site. All nine S42 species recorded within the Survey Site are also listed in the Swansea LBAP[15], and are red-listed species of conservation concern in Wales (RSPB Undated), with the exception of dunnock (which is amber-listed). An additional seven amber-listed species, bullfinch, mistle thrush, meadow pipit, reed bunting, redstart, whitethroat and willow warbler were also considered to have bred.

4.26 Willow warbler was the most abundant breeding species on the Survey Site. Large numbers of territories were also held by other passerines typical of a lowland farmland mosaic habitat including chiffchaff, chaffinch, robin and wren. Of the S42 species recorded, dunnock and song thrush were most abundant, with territories widely distributed across the Survey Site. The abundance of willow warbler, dunnock and song thrush on the Survey Site may be attributed to the relatively wide-ranging habitat preferences of these generalist species (and the tendency of the former two species to breed in scrub).

4.27 The presence of ground nesting species (skylark and meadow pipit) within the Survey Site reflects the fact that much of the Survey Site is grazed pasture. However, the distribution of these species was localised, only being recorded in the pasture fields in the north-west of the Survey Site. Other species recorded on the pasture habitat during survey in April include stonechat, for which two territories were recorded, and northern wheatear *Oenanthe oenanthe* which were likely to have been on passage and not remained to breed on site (see Incidental Records below). Stonechat and wheatear were not recorded during breeding bird surveys in May and June.

4.28 Grasshopper warbler was associated with marshy areas in the north-western part of the Survey Site which reflect the species' breeding habitat preferences. The species was only recorded during survey in April. No further records were made during dusk bat surveys or moth trap surveys carried out on the Survey Site during 2014. All registrations of cuckoo were beyond the Survey Site boundary. These were recorded near Lletty'r Bugail, approximately 300 m north of the Survey Site and at Waun y Garn-wen, and approximately 100 m west of the Survey Site, during survey in April

[14] Schedule 1 birds receive full protection under the Wildlife and Countryside Act 1981 (as amended), In addition to the protection from killing or taking that all birds, their nests and eggs have under the Act, Schedule 1 birds and their young must not be disturbed at the nest.
[15] Based on the 2005 consultation draft of the Swansea LBAP. The forthcoming replacement to this plan will be expected to reflect Section 42 Species and Habitats more closely.

and near a pond, north of Cefn-betingau, approximately 100 m east of the Survey Site during survey in May.

4.29 House sparrow colonies were recorded at the barn north of Abergelli Farm during all survey visits and at the Abergelli Farm buildings during the survey in May and June. The individual count was 26 during the visit in April, 20 during the survey in May and 18 during the survey in June. Therefore, the number of breeding pairs within the Survey Site is likely to be between nine and 13.

4.30 A family of lesser redpoll were observed in scrub bordering the marshy grassland to the west of the Survey Site during the survey in June. Two birds were also recorded in this area during the survey in April. No further evidence of breeding in this species was recorded. Observations of single individuals were made near the Felindre Gas Compressor Station and National Grid electrical substation during survey in May and June.

4.31 Three tree pipit territories were recorded during survey. These were recorded immediately south of the gallops at the centre of the Survey Site in May and around the fringes of marshy grassland in the western part of the Survey Site and in the scrub line on the north-east corner of the Survey Site in June. Tree pipit were recorded during all survey visits, with flocks of up to 14 observed over the marshy grassland in the western part of the Survey Site during survey work in May. A family of tree pipit were recorded on a field boundary in the south-east corner of the Survey Site in June. Two pairs of tree pipit were observed immediately south of the gallops at the centre of the Survey Site in June. It is likely that these records are of breeding pairs.

4.32 Indicative central territory locations are shown on **Figures 1a** and **1b** in **Appendix 1**.

Non-Passerines

4.33 Red kite were recorded during surveys in April and May. A bird was noted flying over the houses at Abergelli Farm and over the pasture in the northern part of the Survey Site during the survey in April. Two red kites were recorded mobbing a peregrine falcon over the Felindre Gas Compressor Station land during the survey in May. An apparent pair was also recorded flying over the eastern boundary in the northern compartment of the Survey Site during the same survey day. Given the timing of the records, and that at least one pair was recorded during the survey in May it is likely that red kite breed locally. However, no evidence was found to suggest breeding occurred within the Survey Site during 2014.

4.34 Red kite are listed under Schedule 1 Part 1 of the Wildlife & Countryside Act 1981 (as amended) and Annex 1 of the Council Directive 79/409/EEC on the Conservation of Wild Birds making it an offence to intentionally or recklessly disturb birds at, on or near an ‘active’ nest, or to directly threaten birds, such as deliberately kill or capture birds, destroy their nests or take their eggs.

4.35 A peregrine falcon was observed flying over the Felindre Gas Compressor Station and National Grid electrical substation during survey in May. There is limited suitable breeding habitat within the Survey Site for peregrine falcon, and therefore this species is only likely to visit the Survey Site to forage on an occasional basis. Electricity pylons within the Survey Site were scanned from the ground for the presence of peregrine (and corvid) nests. No evidence of crow nests, which are sometimes appropriated by peregrine were found. Peregrine falcon is listed under Schedule 1 Part 1 of the Wildlife & Countryside Act 1981 (as amended).

4.36 It is possible that some of the farm buildings within the Survey Site may support breeding barn owl, although no trees were found that appear, from a ground level inspection, to have sufficiently large cavities to support nesting barn owls. The marshy fields in the north-west and at the southern end of the Survey Site could provide habitat for field vole *Microtus agrestis* (a preferred prey species) given the thick, tussocky structure of some parts of the sward. There was no evidence that barn owl breed within the Survey Site, and are unlikely to have done so in the recent past due to lack of droppings in the buildings and anecdotal evidence to this effect from the landowner. No signs of barn owl presence were found during building inspections and no birds were recorded during the breeding bird surveys.

Incidental Records

4.37 Species recorded during other survey work in the bird breeding season but not recorded during breeding bird surveys are described below.

4.38 Ten male and two female wheatear were observed on the horse pasture in the northern part of the Survey Site during a bat transect recce on 24 April 2014, and were presumably transient migrant birds.

4.39 Young tawny owls *Strix aluco* were heard calling near the houses in the western part of the Survey Site during a moth survey on 16 June, with birds of unknown age heard during a second survey on 13 August 2014. This suggests that tawny owl bred on the Survey Site in 2014, presumably in the woodland block immediately to the south-west of Abergelli Farm, although much of the woodland within the Survey Site is suitable nesting habitat for this species. No further observations of tawny owl were made. A goshawk (female) was observed flying over the Survey Site at dusk on 16 June, and a sparrowhawk *Accipiter nisus*, was recorded roosting in a tree near the aforementioned houses on 13 August.

4.40 Red kite were observed flying over the marshy grassland in the western part of the Survey Site during a dormouse survey on 29 May, and near Abergelli Farm during bat transect surveys on 22 May and 17 July 2014.Single red kites flying over the Survey Site were also recorded during Phase 1 habitat surveys on 24 February 2014 and 14 April 2014.

4.41 A spotted flycatcher *Muscicapa striata* was recorded in the hedge-line near the two houses on 17 June 2014. Spotted flycatcher is a S42 species of principal importance in Wales, is listed in the Swansea LBAP and is a red-listed species of conservation concern in Wales (RSPB, 2009).

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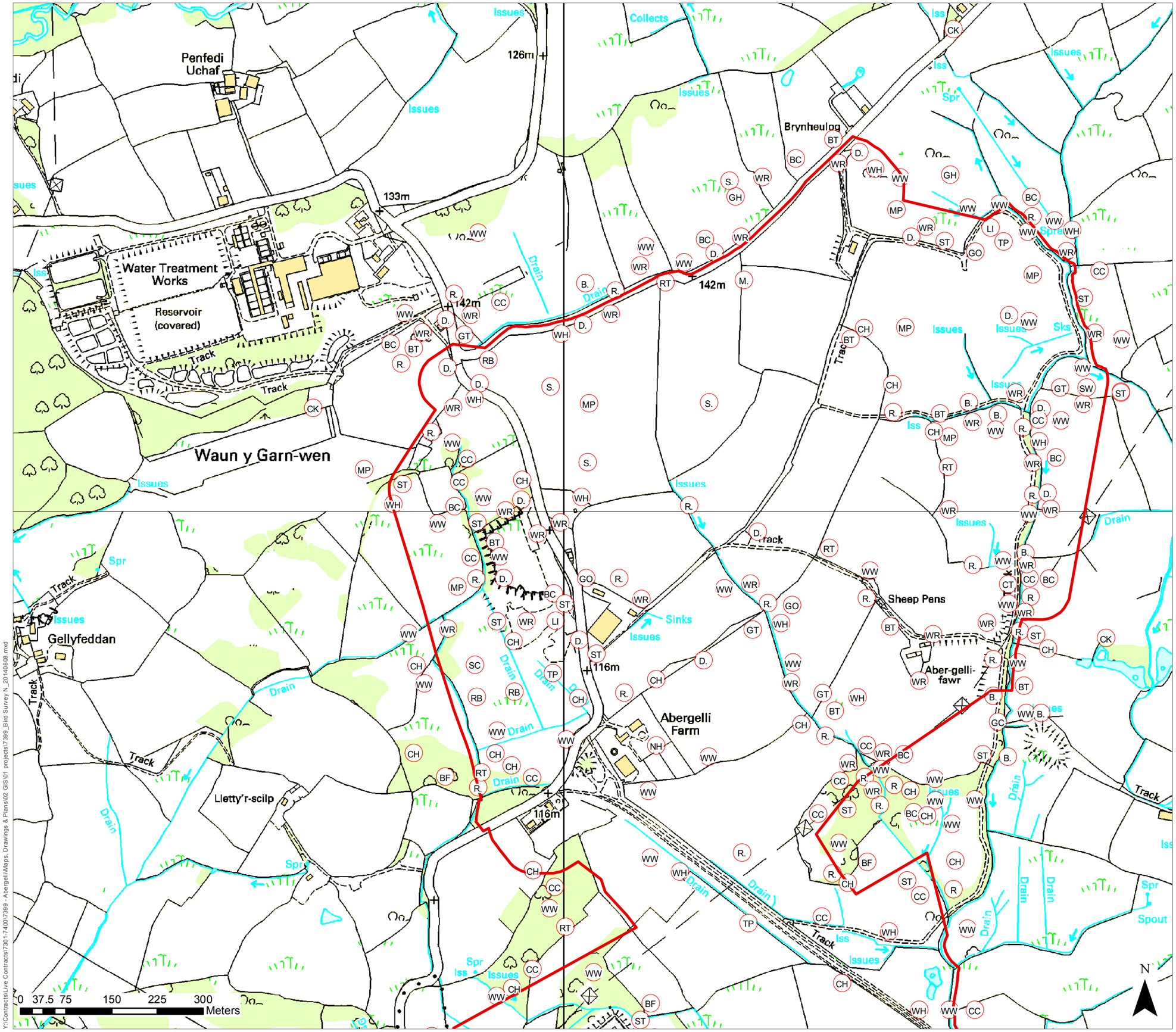
Appendix 1: Figures

(overleaf)



LEGEND

Survey Site Boundary

Breeding Bird Territories

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PROJECT TITLE

ABERGELLI BREEDING BIRD SURVEY 2014

DRAWING TITLE

Figure 1a - Breeding BirdTerritories - North

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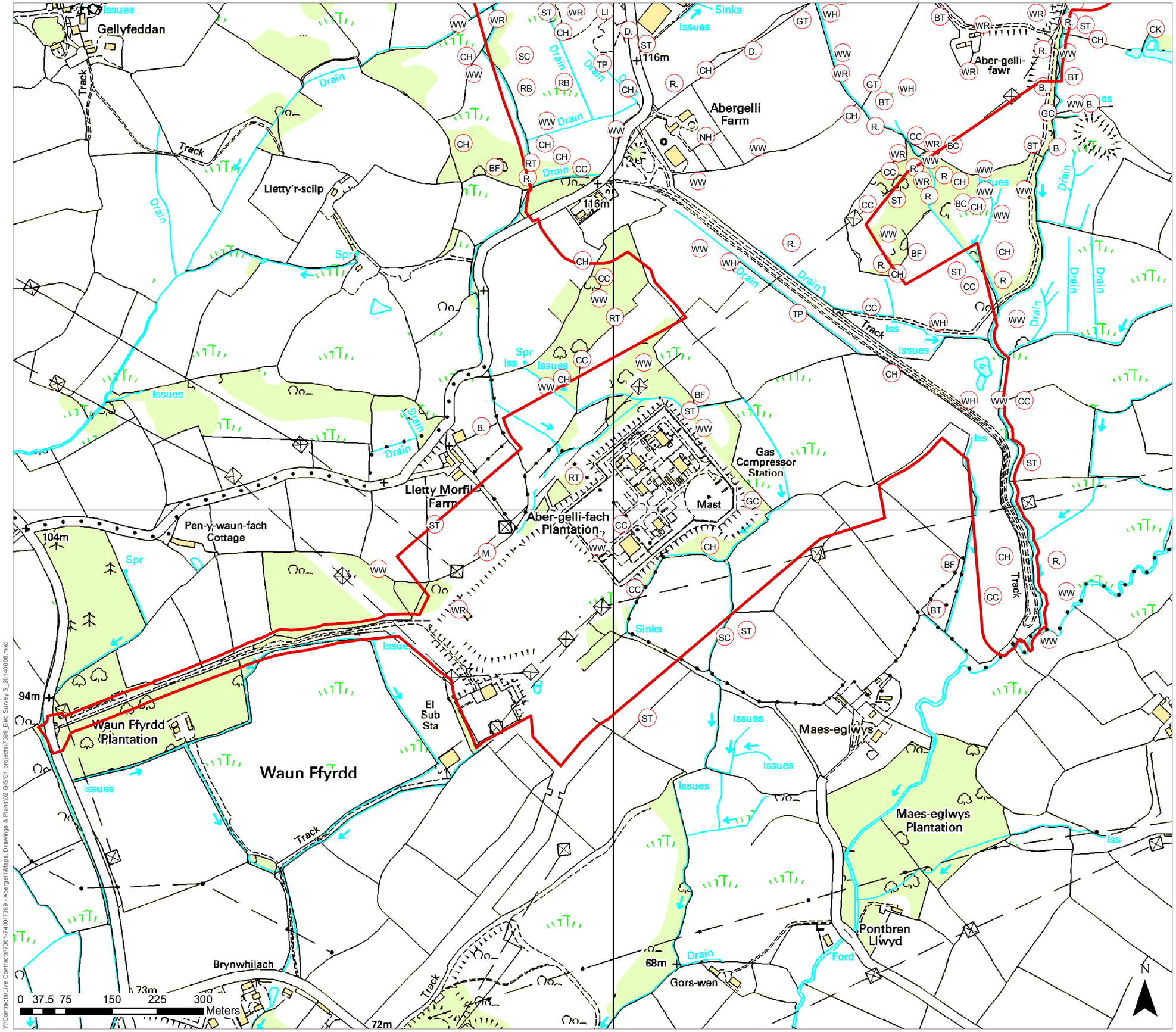

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Survey Site Boundary

Breeding Bird Territories

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ABERGELLI BREEDING BIRD SURVEY 2014

DRAWING TITLE
Figure 1b - Breeding BirdTerritories - South

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Appendix 2: Species Tables

Table 3. List of species and count of records within 2 km of the Survey Site obtained from the SEWBReC data search.

Species	Count of records
Barn Owl *Tyto alba*	21
Black-headed Gull *Chroicocephalus ridibundus*	11
Common Bullfinch *Pyrrhula pyrrhula*	94
Common Crossbill *Loxia curvirostra*	3
Common Cuckoo *Cuculus canorus*	17
Common Goldeneye *Bucephala clangula*	2
Common Grasshopper Warbler *Locustella naevia*	6
Common Kestrel *Falco tinnunculus*	22
Common Kingfisher *Alcedo atthis*	6
Common Linnet *Carduelis cannabina*	17
Common Starling *Sturnus vulgaris*	55
Corn Crake *Crex crex*	1
Eurasian Curlew *Numenius arquata*	1
Eurasian Hobby *Falco subbuteo*	1
Fieldfare *Turdus pilaris*	6
Hedge Accentor *Prunella modularis*	145
House Sparrow *Passer domesticus*	33
Lesser Redpoll *Carduelis cabaret*	22
Lesser Spotted Woodpecker *Dendrocopos minor*	4
Little Plover *Charadrius dubius*	42
Marsh Tit *Poecile palustris*	7
Merlin *Falco columbarius*	2
Northern Goshawk *Accipiter gentilis*	4
Northern Lapwing *Vanellus vanellus*	63
Osprey *Pandion haliaetus*	1
Peregrine Falcon *Falco peregrinus*	14
Pied Flycatcher *Ficedula hypoleuca*	3
Red Kite *Milvus milvus*	54
Redwing *Turdus iliacus*	45
Reed Bunting *Emberiza schoeniclus*	23
Ring Ouzel *Turdus torquatus*	1
Ringed Plover *Charadrius hiaticula*	31
Sky Lark *Alauda arvensis*	13
Song Thrush *Turdus philomelos*	140
Spotted Flycatcher *Muscicapa striata*	12
Tree Pipit *Anthus trivialis*	7
Willow Tit *Poecile montanus*	11

Species	Count of records
Wood Warbler *Phylloscopus sibilatrix*	8
Yellowhammer *Emberiza citrinella*	15

Table 4. List of all species recorded during the 2014 breeding bird surveys

Species	BTO species code	Species count			Schedule 1 species	Section 42 species	Red (R) or Amber (A) listed species
		April	May	June			
Blackbird *Turdus merula*	B.	22	29	29			
Blackcap *Sylvia atricapilla*	BC	9	6	5			
Blue Tit *Cyanistes caeruleus*	BT	20	20	26			
Bullfinch *Pyrrhula pyrrhula*	BF	8	3	5			A
Buzzard *Buteo buteo*	BZ	2	0	3			
Canada Goose *Branta canadensis*	CG	10	1	1			
Carrion Crow *Corvus corone*	C.	38	18	27			
Chaffinch *Fringilla coelebs*	CH	24	18	30			
Chiffchaff *Phylloscopus collybita*	CC	15	11	17			
Coal tit *Periparus ater*	CT	3	0	1			
Cuckoo *Cuculus canorus*	CK	3	0	1			R
Dunnock *Prunella modularis*	D.	12	6	6			A
Feral Pigeon *Columba livia*	FP	0	0	4			
Goldcrest *Regulus regulus*	GC	2	2	1			
Greenfinch *Carduelis chloris*	GF	0	0	2			
Goldfinch *Carduelis carduelis*	GO	9	10	16			
Grasshopper Warbler *Locustella naevia*	GH	2	0	0			R
Great Spotted Woodpecker *Dendrocopos major*	GS	3	1	6			
Garden Warbler *Sylvia borin*	GW	1	0	0			
Great Tit *Parus major*	GT	16	10	13			
Herring Gull *Larus argentatus*	HG	2	0	2			R
House Sparrow *Passer domesticus*	HS	34	19	22			R
Jackdaw *Corvus monedula*	JD	9	30	29			
Jay *Garrulus glandarius*	J.	4	1	1			
Lesser Black-backed Gull *Larus fuscus*	LB	2	2	1			A
Linnet *Carduelis cannabina*	LI	14	15	10			R
Magpie *Pica pica*	MG	11	23	6			
Mallard *Anas platyrhynchos*	MA	1	0	0			
Meadow Pipit *Anthus pratensis*	MP	2	12	9			
Mistle Thrush *Turdus viscivorus*	M.	3	2	12			A
Nuthatch *Sitta europaea*	NH	1	3	0			
Peregrine *Falco peregrinus*	PE	0	0	1			
Pied Wagtail *Motacilla alba*	PW	1	1	2			
Red Kite *Milvus milvus*	KT	2	0	5			A

Species	BTO species code	Species count			Schedule 1 species	Section 42 species	Red (R) or Amber (A) listed species
		April	May	June			
Redpoll (Lesser) *Carduelis cabaret*	LR	1	7	5			R
Redstart *Phoenicurus phoenicurus*	RT	3	5	8			A
Reed Bunting *Emberiza schoeniclus*	RB	3	1	1			A
Robin *Erithacus rubecula*	R.	30	24	23			
Rook *Corvus frugilegus*	RO	1	18	0			
Sand Martin *Riparia riparia*	SM	0	0	1			A
Sedge Warbler *Acrocephalus schoenobaenus*	SW	0	1	0			
Skylark *Alauda arvensis*	S.	6	6	1			R
Song Thrush *Turdus philomelos*	ST	14	19	13			R
Starling *Sturnus vulgaris*	SG	3	6	15			R
Stonechat *Saxicola torquata*	SC	2	6	6			
Swallow *Hirundo rustica*	SL	21	7	17			A
Swift *Apus apus*	SI	0	7	0			A
Tree Pipit *Anthus trivialis*	TP	19	8	18			R
Whitethroat *Sylvia communis*	WH	13	12	15			A
Willow Warbler *Phylloscopus trochilus*	WW	41	18	21			A
Woodpigeon *Columba palumbus*	WP	8	15	20			
Wren *Troglodytes troglodytes*	WR	22	26	31			
Northern wheatear *Oenanthe oenanthe*	W.	2	0	0			A

Appendix 3.17

Great Crested Newt Survey Report 2014

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Great Crested Newt Survey Report

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Job	Abergelli Power Project
Report title	Great Crested Newt Survey Report
Draft version/final	FINAL
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	Name	**Position**	**Date**
Originated	Caitlin McCann	Ecologist	18 June 2014
Reviewed	Matthew Hobbs	Principal Ecologist	10 July 2014
Approved for issue to client	Matthew Hobbs	Principal Ecologist	11 July 2014
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2nd issue to client	Matthew Hobbs	Principal Ecologist	11 August 2014
3rd issue to client	James Gillespie	Partner	29 August 2014
4th issue to client	Matthew Hobbs	Principal Ecologist	02 September 2014

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1 Summary

1.1 Abergelli Power Limited (APL) is promoting a new Power Generation Plant with its associated Gas and Electricity Connections (the 'Project') on agricultural land within Abergelli Farm north of Swansea in the City and County of Swansea (approximately at National Grid Reference 265284, 201431).

1.2 A Habitat Suitability Index (HSI) assessment for great crested newts *Triturus cristatus* (GCN) was carried out at accessible ponds as part of the preliminary ecological appraisal of the Project Site at the time of the survey (hereafter referred to as the 'Survey Site'). The results of the HSI assessment are set out in the Preliminary Ecological Appraisal (BSG, June 2014). APL subsequently commissioned BSG Ecology to undertake a presence/absence survey for GCN of ponds within 150 ha of pastoral farmland at and around Abergelli Farm in May 2014, to inform and support an application for Development Consent for the Project.

1.3 Owing to the size and nature of the Survey Site, and the lack of GCN records in the desk study search area, it was recommended that a survey for GCNs be conducted for all ponds within the Survey Site boundary and within 250 m of the Survey Site boundary. A total of five ponds were surveyed including three within the Survey Site and a further two within 250 m of the Survey Site boundary. It was not possible to access a number of ponds, which included:

- seven ponds outside of the Survey Site but within 250 m of the Survey Site boundary; and
- a further four ponds between 250m and 500m from the Survey Site boundary that formed part of a cluster of ponds, the remainder of which were within 250m of the Survey Site boundary.

1.4 The survey did not record any GCNs in the ponds surveyed, although palmate newts *Lissotriton helveticus* were recorded in three ponds and smooth newts *Lissotriton vulgaris* were recorded in two ponds. As a consequence, further surveys to establish the population size class of GCN were not necessary and were not undertaken.

2 Introduction

2.1 Abergelli Power Limited commissioned BSG Ecology to undertake a presence/absence GCN survey in May 2014 to inform and support an application for Development Consent for the Project described below.

Site Description

2.2 The Survey Site consists of approximately 150 ha of pastoral farmland primarily grazed by horses. The extent of the Survey Site is shown in Figure 1 in Appendix 1 and is centred at National Grid Reference 265284, 201431. The nearest settlement is Felindre, which is located approximately 2 km to the north of the Survey Site, with Swansea approximately 5 km to the south.

2.3 The Survey Site is largely agriculturally improved pasture with several areas of marshy grassland, particularly in the north, south and north-western ends of the Survey Site. The fields are bounded by fences, running along the line of defunct hedgerows, and often accompanied by ditches. There is a block of broadleaved woodland on the eastern boundary of the Survey Site and other areas of woodland around the marshy grassland to the west of the Survey Site, and around Felindre Gas Compressor Station and the two National Grid 400 kV electrical substations that lie at the south-west end of the Survey Site. The habitats in the surrounding landscape are similar to those within the Survey Site boundary – a mixture of improved and marshy grassland interspersed with occasional patches of woodland.

Description of Project

2.4 APL is promoting a new Power Generation Plant with associated Gas and Electricity Connections within Abergelli Farm. The Power Generation Plant would operate as a Simple Cycle Gas Turbine (SCGT) peaking plant and would be designed to provide an electrical capacity of up to 299 Megawatts (MW). It would be fuelled by natural gas, supplied by a new underground gas pipeline connecting the Power Generation Plant to the existing National Grid Gas (NGG) National Transmission System (NTS). It would also connect to the National Grid Electrical Transmission System (NETS) via underground cable or overhead lines.

2.5 BSG Ecology has been appointed as the ecological consultant to undertake an ecology survey, which includes a desk study and Extended Phase 1 Habitat Survey as well as a range of Phase 2 surveys, including presence / absence survey for GCNs. These baseline surveys will be included in an appendix to an ecology chapter of an Environmental Statement, which is intended for submission, in support of the application for Development Consent.

Aims of Study

2.6 The aims of the GCN survey were to identify whether GCNs are present in the ponds within the Survey Site and those within 250 m of the Survey Site boundary using standard survey methods (as specified in Section 3).

3 Methods

Desk Study

3.1 Existing ecological information for the Survey Site and its surrounding area was requested from the South East Wales Biodiversity Records Centre (SEWBReC). Information on protected[1] species, including GCNs, was requested covering the Survey Site and land up to 2 km from the Survey Site boundary. The National Biodiversity Network Gateway[2] was also checked for records for 1 x 1 km grid squares in which GCN records have occurred. In addition, on-line mapping and aerial photography of the area were also reviewed to identify ponds that might be present within the Survey Site and 500 m of the boundary based on recommendations made in the Natural England (formerly English Nature) GCN Mitigation Guidelines[3] (the selection of an appropriate buffer distance for survey is explained in more detail below).

Scoping (HSI) Survey

3.2 A Preliminary Ecological Appraisal was carried out by BSG Ecology in February 2014 and updated in April 2014[4]. As part of this survey, all accessible ponds within 250 m of the Survey Site were visited and assessed against the criteria of Oldham *et al*. (2000)[5]. This was to establish the likelihood of their use by GCNs using a Habitat Suitability Index (HSI), and to identify the scope of the GCN presence/absence field survey described below.

3.3 The information collected during the HSI assessment provides context of how ponds within or in proximity to the Survey Site may connect with habitat available for newts in the surrounding landscape, and also to give greater confidence to the assessment carried out on each pond.

3.4 Information on the physical features and characteristics of each pond within 250 m of the Survey Site was collected, to enable an HSI score to be derived for each pond, by applying the scoring system developed by the Herpetological Conservation Trust (HCT, 2008)[6]. Where a cluster of ponds was found (P01-P08; see Figure 1) with some ponds within 250 m of the Survey Site and some ponds beyond this distance, the intention was to carry out an HSI on all ponds within the cluster (although lack of access prevented this in this case).

3.5 The HSI is calculated by allocating scores to features associated with each pond including features such as size, quality of surrounding habitat and presence of fish. These scores are then used to calculate the overall HSI for each pond as a number between 0 and 1, with 0 being the least suitable and 1 being the most suitable. The HSI score allows each pond to be placed in one of five categories defining its suitability for GCNs as follows:

- <0.5 = poor
- 0.5 – 0.59 = below average
- 0.6 – 0.69 = average
- 0.7 – 0.79 = good
- >0.8 = excellent

3.6 In addition, there are a number of wet ditches present within the Survey Site and within 250 m of the Survey Site boundary. All of the wet ditches are narrow (<1 m width) and did not hold more than a few centimetres of water during February – June 2014 despite an exceptionally wet winter.

[1] Wildlife and Countryside Act 1981 Schedules 1, 5 & 8; Conservation of Habitats and Species Regulations 2010; Protection of Badgers Act.
[2] http://www.nbn.org.uk/
[3] English Nature (2001). The Great Crested Newt Mitigation Guidelines. English Nature, Peterborough.
[4] BSG Ecology (2014). Abergelli Power Project: Preliminary Ecological Appraisal.
[5] Oldham, R.S., Keeble, J., Swan, M.J.S., and Jeffcote, M (2000) Evaluating the Suitability of Habitat for the Great Crested Newt (*Triturus cristatus*). Herpetological Journal, Vol. 10, pp. 143-155.
[6] Herpetological Conservation Trust (HCT) (2008). Habitat Suitability Index – Guidance Notes. National Amphibian and Reptile Recording Scheme.

They are not thought to provide suitable habitat for GCNs and presence / absence surveys are not considered to be required for these waterbodies.

Field Survey

3.7 Following the initial HSI assessment (see above) four GCN survey visits were undertaken within the period mid-March to mid-June to establish presence/absence (with at least two surveys during mid-April to mid-May), with an additional two surveys (six in total) required to estimate population size if GCN were found during the first four surveys. The GCN field survey work was undertaken in 2014 and was completed in accordance with the Natural England (2001) GCN Mitigation Guidelines.

3.8 In determining the distance at which presence/absence survey of ponds would take place, Natural England guidance has been considered and an approach developed that is proportionate to the likelihood of encountering GCNs (Note that where a survey is conducted in Wales, Natural Resources Wales advise that the Natural England guidance is consulted.)

3.9 Natural England guidance on geographical limits of survey is discussed in Section 5.4 of the GCN Mitigation Guidelines which recommends that:

"*For a common situation, where a plot of land containing a pond is proposed for development, the pond itself should be surveyed, and other ponds up to 500 m away should also be checked, if it is thought likely that great crested newt populations centred on these ponds would be affected by changes to the plot*."

3.10 Natural England guidance is further developed in the GCN Method Statement[7] which states that:

"*In keeping with a proportionate and risk-based approach, surveys need reasonable boundaries. The great crested newt mitigation guidelines explain that surveys of ponds up to around 500m from the development might need to be surveyed. The decision on whether to survey depends primarily on how likely it is that the development would affect newts using those ponds. For developments resulting in permanent or temporary habitat loss at distances over 250m from the nearest pond, carefully consider whether a survey is appropriate. Surveys of land at this distance from ponds are normally appropriate when all of the following conditions are met: (a) maps, aerial photos, walk-over surveys or other data indicate that the pond(s) has potential to support a large great crested newt population, (b) the footprint contains particularly favourable habitat, especially if it constitutes the majority available locally, (c) the development would have a substantial negative effect on that habitat, and (d) there is an absence of dispersal barriers*."

3.11 The approach that has been taken for these field surveys is consistent with the above guidance and advice from Natural England. Where access was available, presence/absence surveys for GCN were carried out on all ponds within 250 m of the Project Site. The exception to this were pond clusters that are interconnected to each other (less than 250 m apart) and which therefore could be considered to be part of the same population (should GCN be found). However, no such ponds (P01-P08 and P012-P014) were accessible as shown on Figure 1. As explained in the limitations section below, it is not considered to be a significant constraint to the findings of the survey that some ponds could not be accessed.

Limitations of study

3.12 The GCN field surveys were undertaken within the recommended survey period and in suitable weather conditions apart from the torchlight survey and egg search on 19/05/2014 where heavy rain occurred leaving some ponds turbid, making survey less effective for a short period. Nevertheless, the surveys were considered to be effective despite the reduced visibility.

3.13 Two ponds (P07 and P08) located within the Water Treatment Works to the northwest of Project Site that were classified during the HSI assessment as being of 'average' or 'good' value for GCNs could not be surveyed due to access not being granted by landowners. In addition, access was not granted by landowners to Ponds P01, P02, P03, P04, P05, P06, P12, P13 and P14, which would have been surveyed for presence/absence of GCN, had access been possible.

[7] Available at www.naturalengland.org.uk/Images/wml-a14-2_tcm6-4103.xls

3.14 In considering the significance of not surveying the inaccessible ponds both within and beyond 250 m from the Project Site, it is useful to examine the results of the presence / absence surveys for those ponds that could be surveyed, as well as the results of the desk study, which places the Survey Site into a wider context (see 4.1). The presence/absence survey did not reveal the presence of GCNs in any of the five ponds surveyed, although three of the ponds supported smooth and /or palmate newts and were also thought to provide suitable habitat for GCNs. This included all ponds within the Survey Site, three of which were of 'average' suitability as derived from the Habitat Suitability Assessment. The Survey Site is on the edge of the known range of GCN and the lack of desk study records within 2 km of the Survey Site is consistent with this, as is a search of the National Biodiversity Network website where the closest record of GCN was approximately 7.5 km from the Survey Site.

3.15 The conclusion that may be drawn is that since suitable ponds within the Survey Site were not occupied by GCNs, and no GCN records have been located within 7 km of the Survey Site, it is unlikely that GCNs are present in the inaccessible ponds. Notwithstanding this, if any of the ponds that were not surveyed (most are beyond 250 m from the Survey Site) did indeed support GCNs, it is likely that they would be present in such low numbers and at a sufficient distance from the Survey Site as to be unaffected by the Project. A Natural England funded research report into trapping efficiency on sites where GCNs are present (Cresswell and Whitworth, 2004) supports this assertion. It arrives at the conclusion that very few animals were captured at distances greater than 100 m from a breeding pond. As a consequence, it is not considered to be a significant constraint to the findings of the survey that some ponds could not be surveyed.

4 Results

Desk Study

4.1 No records of GCNs within 2 km of the Survey Site were returned by SEWBReC. The closest 1 x 1 km Grid Square in which GCN records have occurred is ca. 7.5 km to the south-east of the Survey Site, near Llandarcy[8].

Scoping survey

4.2 Twelve ponds were identified within 250 m of the Survey Site boundary with the aid of aerial photographs and OS maps. Of these, two (P16 and P17) were identified within the Survey Site boundary, 10 (P05, P06, P07, P08, P09, P10, P12, P13, P14, and P15) were located within 250 m of the Survey Site and another four (P01, P02, P03, and P04) beyond 250m of the Survey Site but forming part of a cluster of ponds (with P05-P08) within the Water Treatment Works to north-west of the Survey Site. An additional on-site pond (P11) was found whilst carrying out other survey work on 21 May 2014 in the marshy grassland in the north-west of the Survey Site. An HSI assessment was carried out on the seven ponds that were accessible within 250 m of the Survey Site boundary during the first Phase 1 survey visit (in February). This included: the two on-site ponds (P16 and P17); one pond within 100 m of the Survey Site boundary (P15); and ponds within 250 m of the Survey Site boundary for which access was possible (P07, P08, P09 and P10). An HSI assessment was also carried out on P11 following its discovery in May 2014.

4.3 Figure 1 shows which ponds were surveyed and which were inaccessible on private land.

4.4 Table 1 below summarises the results of the HSI, and detailed results are provided in Appendix 3.

Table 1: HSI Results

Pond	HSI	Value for GCNs
P07	0.67	Average
P08	0.77	Good
P09	0.47	Poor
P10	0.64	Average
P11 on site	0.39	Poor
P15	0.66	Average
P16 on site	0.61	Average
P17 on site	0.53	Below average

4.5 The Survey Site lies in a part of Wales where the distribution of GCNs is patchy, with the species largely absent to the west of the Survey Site. Whilst this reduces the probability that GCNs would be present within the Survey Site, it does not rule out their presence. There are a number of ponds in and around the Survey Site, and suitable habitat for newts in their terrestrial phase, including old hedge banks, marshy grassland and woodland within the Survey Site. Accordingly, whilst the ponds surveyed did not have a 'good' or 'excellent' HSI score, they did have potential to provide breeding habitat for GCNs.

4.6 The scoping exercise concluded that surveys should be carried out on all ponds within 250 m of the Survey Site boundary, except P09, which was a small recession with a small amount of water in February and completely dry in April. In addition the cluster of inaccessible ponds within the grounds of the water treatment works (to the north-west of the Survey Site) are likely to be of similar 'good' quality as Pond 08 (which was visible through the gate) and it was concluded that surveys of this cluster of ponds (including P01, P02, P03 and P04) should also be carried out following the rationale explained in Section 3.7.

[8] https://data.nbn.org.uk/imt/#3-4.231,51.507,-3.293,51.781!091EHm!081EHm

Field Survey

4.7 GCN presence-absence surveys were carried out on Ponds P10, P11, P15, P16, and P17. P15 dried out completely between the first and second visits and was only surveyed once. The ponds within the Water Treatment Works (P01-P08), including four ponds beyond 250m from the Survey Site could not be surveyed: access to these ponds was denied on grounds of Health & Safety. In addition, access was denied to the cluster of three ponds (P12-P14) to the east of the Survey Site. The land surrounding these ponds contains Japanese Knotweed *Fallopia japonica* (an invasive species) and is subject to an exclusion and treatment programme which precludes access to third-parties due to the risk of spreading the plant.

4.8 Surveys between May 12th and May 22nd were carried out by Stephanie Boocock MCIEEM under the class licence (WML-CL08) with assistance from Caitlin McCann, Owain Waters and Rachel Taylor. For Pond 11, which was identified late during other surveys, the third and fourth visits were carried out by Matthew Hobbs MCIEEM under license number (52219:OTH:SA:2014) with assistance from Rachel Taylor and Gareth Lang. On each visit, weather conditions, including air temperature were recorded. Table 1 gives details of the surveys.

Table 1: Details of GCN surveys. BT= Bottle trapping, TL- torchlight survey, ES= Egg search, N= Netting. Surveyors: SB = Stephanie Boocock, OW= Owain Waters, RT= Rachel Taylor, CMc = Caitlin McCann, MH = Matthew Hobbs, and GL = Gareth Lang.

Visit no.	Date	Surveyors	Survey methods	*Air temp °C		Weather Conditions
				BT	TL/ES	
1	12-13/05/2014	SB + OW	BT, TL, ES	14	8-3	Showers, light wind
2	15-16/05/2014	SB + OW	BT, TL, ES	19	13	No precipitation, light wind
3	19-20/05/2014	SB + RT	BT, TL, ES	18	13	Dry during BT deployment with rain, light wind and thunder during TL/ES
4	22-23/05/2014	SB + CMc	BT, TL, ES	16.3	13	Rain during day, dry and no wind during survey.
3 (for P11)	3-4/06/2014	MH + GL	BT, TL, N	19	14	Light wind, dry.
4 (for P11)	16-17/06/2014	MH + RT	BT, TL, N	21	18	Light wind, dry.

4.9 The survey results are summarised in Table 2. Pond P15 dried out between the first and second surveys and only one survey visit to this pond was possible.

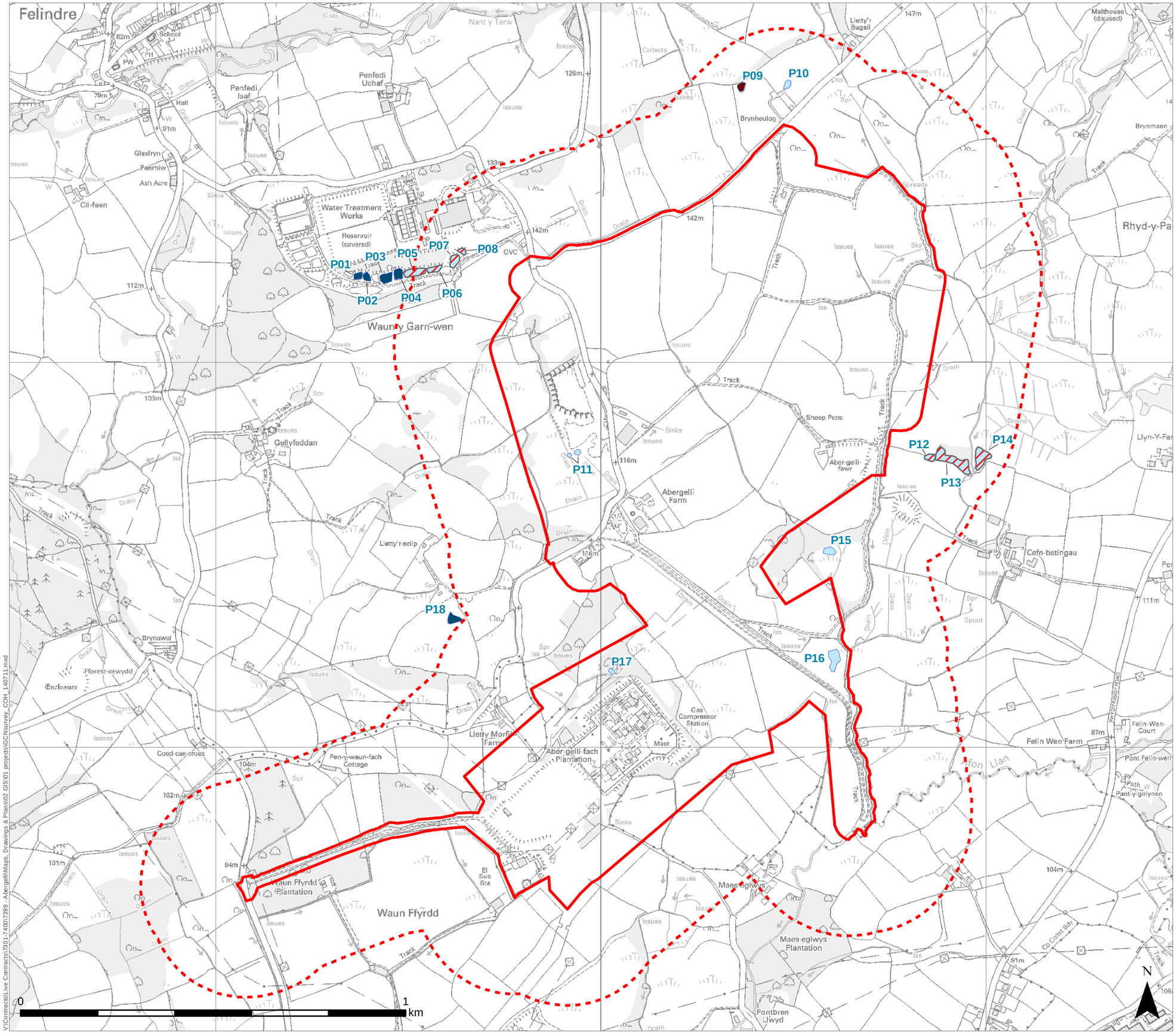
4.10 The likely absence of GCNs was established for all five ponds surveyed in 2014 the four presence / absence surveys. Additional surveys to make a population size class assessment were not required (following Natural England 2001).

Table 2: GCN survey results. Key: Tc = GCN; Lv = smooth newt; Lh = palmate newt; Lv/Lh = smooth or palmate newt; juv = juvenile; ♂ = male; ♀ = female.

Pond and	Bottle Trap				Torchlight				Egg Search			Netting			
Date of Survey	Tc	Lv	Lh	Lv/Lh	Tc	Lv	Lh	Lv/Lh	Tc	Lv/Lh		Tc	Lv	Lh	Lv/Lh
P10															
12-13/05/2014															
15-16/05/2014															
19-20/05/2014										P					
22-23/05/2014															
P11															
19-20/05/2014			4♂ 3♀					4							
22-23/05/2014			1♀				2♂	5							
3-4/06-2014			1♂					1♀						2♂	4juv , 4eft
16-17/06/2014							1♂	13♂						1♂, 2♂	
P15															
12-13/05/2014															
15-16/05/2014	Dried														
19-20/05/2014	Dried														
22-23/05/2014	Dried														
P16															
12-13/05/2014			2♂				2♂	12♀							
15-16/05/2014						2♂, 2♀									
19-20/05/2014			1♀			4♂									
22-23/05/2014			5♀, 10♂				3♂	1							
P17															
12-13/05/2014							4♂	3♀							
15-16/05/2014						6♂, 2♀									
19-20/05/2014			5♂ 2♀			4♂ 1♀									
22-23/05/2014			1♂ 2♀				2♂ 1♀	1							

Appendix 1: Figures

(overleaf)



LEGEND

- Survey Site boundary
- 250m buffer from Survey Site

Great crested newts

- Pond within 250m of Survey Site that have been surveyed for GCN
- Ponds within 250m of the Survey Site for which access was denied
- Ponds within 250m of the Survey Site that are unsuitable for amphibians
- Ponds within 250-500m of the Survey Site

BSG ecology

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PROJECT TITLE

ABERGELLI POWER PLANT

DRAWING TITLE

Figure 1: Great Crested Newt Survey Map

DATE: 11.07.2014 CHECKED: MH SCALE: 1:9,500

DRAWN: COH APPROVED: MH STATUS: FINAL

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No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

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Sources: BSG Ecology survey data, Ordnance Survey

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Appendix 2: Photographs of Ponds

Photo 1: Pond P08.



Photo 2: Pond P07.



Photo 3: Pond P10.



Photo 4: Pond P09.



Photo 5: Pond P11.



Photo 6: Pond P15.



Photo 7: Pond P16.



Photo 8: Pond P17



Appendix 3: HSI results.

Pond ref.	Location	Pond Area m^2	Pond permanence	Water Quality	Pond Shading %	No. of waterfowl	Occurrence of fish	Pond density	Proportion of newt friendly habitat around pond within 500 m – Any Barriers	Macrophyte content (est. % total of emergent and submerged macrophytes)	Notes
P07	SN6464602272	150	Never dries	Good	30	Minimal	Possible	Y	Good	0	Not well vegetated
P08	SN6463502258	240	Never dries	Good	10	Minimal	Possible	Y	Good	30	Typha and rushes around edge. Close access not possible
P09	SN6535602709	20	Annual dries	Moderate	30	Absent	No	Y	Good	0	Very shallow and unlikely to fill up- probably mostly dry
P10	SN6548702727	70	Sometimes dries	Good	5	Minimal	Possible	Y	Good	20	Small and shallow
P11	SN6494401748		Never dries	Good		Minimal	Possible	Y	Good	35	Very well vegetated
P16	SN6558701536	25	Sometimes	Good	60	Absent	No	Y	Good	40	
P17	SN6569801237	100	Annually dries	Good	80	Absent	No	Y	Good	100	Water shallow and covered in Carex species. To south consists of patches of standing water within Molinia
P18	SN6503101199	50	Never dries	Moderate	100	Absent	No	Y	Moderate	0	Small pond within woodland – water dark and no aquatic

											vegetation in evidence

Appendix 3.18

Reptile Survey Report 2014

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Abergelli Power Project

Reptile Survey Report

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Client	Stag Energy
Job	Abergelli Power Project
Report title	Reptile Survey Report
Draft version/final	DRAFT
File reference	7399_R_Reptile_APPR (3)_20-11-2014.docx

	Name	**Position**	**Date**
Originated	Niall Lusby	Senior Ecologist	30 October 2014
Reviewed	Matt Hobbs	Principal Ecologist	03 November 2014
Approved for issue to client	Matt Hobbs	Principal Ecologist	03 November 2014
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Updated and 3rd Issue to client	Matt Hobbs	Principal Ecologist	10 March 2015

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1 Summary

1.1 Abergelli Power Limited (APL) is promoting a new Power Generation Plant with its associated Gas and Electricity Connections (the 'Project') on agricultural land within Abergelli Farm, north of Swansea in the City and County of Swansea (approximately at National Grid Reference 265284, 201431).

1.2 A desk study undertaken as part of the Preliminary Ecological Appraisal (PEA) returned records of the common reptile species: adder *Vipera berus*, grass snake *Natrix natrix*, common lizard *Zootoca vivipara* and slow worm *Anguis fragilis* within 2 km of the Project Site boundary. Suitable habitat to support these species was identified within the Project Site boundary at the time of the survey (hereafter referred to as the 'Survey Site').

1.3 APL commissioned BSG Ecology to undertake a reptile survey of all suitable habitat for reptiles within the Survey Site boundary. Habitats selected for survey included marshy grassland areas, scrubby woodland edges, overgrown field margins either along remnant hedge or ditch banks.

1.4 Seven surveys visits were carried out during August and September 2014, during which the presence of common lizard and grass snake was confirmed within the Survey Site.

1.5 317 refugia were deployed in 33 ha of habitat identified as being suitable to support reptiles within the Survey Site, achieving a density of 9.6 refugia per ha. The Survey Site was split into four Areas in order to describe the distribution of reptile records

1.6 A peak count of 50 common lizard was recorded on 26 August 2014; common lizard was recorded in all areas surveyed, with highest numbers recorded in Areas 1 and 3 in the marshy grassland areas in the north-west of the Survey Site and the east of the Survey Site respectively. The presence of juveniles and gravid females confirms breeding on the Survey Site.

1.7 A peak count of five grass snake was recorded during the survey on 26 August 2014. All observations of grass snake were made in Area 3, in the marshy grassland close to the pond in the east of the Survey Site. The presence of juvenile animals suggests that a breeding population is present on the Survey Site.

2 Introduction

2.1 Abergelli Power Limited (APL) commissioned BSG Ecology to undertake a reptile survey in May/June 2014 to inform and support an application for Development Consent for the Project described below.

Site Description

2.2 The Survey Site consists of approximately 150 ha of pastoral farmland, primarily grazed by horses. The extent of the Survey Site is shown on Figures 1a and 1b, Appendix 1 as illustrated by the red line boundary. It is centred at National Grid Reference 265284, 201431. The nearest settlement is Felindre, which is located approximately 2 km to the north of the Survey Site, with Swansea approximately 5km to the south.

2.3 The Survey Site is largely agriculturally improved pasture with several areas of marshy grassland particularly in the north, south and north-western extents of the Survey Site. The fields are bounded by fences, running along the line of defunct hedgerows, and often accompanied by ditches. There is a block of broadleaved woodland on the eastern boundary of the Survey Site and other areas of woodland around the marshy grassland to the west of the Survey Site, and around Felindre Gas Compressor Station and the two National Grid 400kV electric substations that lie at the south-west end of the Survey Site. The habitats in the surrounding landscape are similar to those within the Survey Site boundary – a mixture of improved and marshy grassland interspersed with occasional patches of woodland.

Description of Project

2.4 APL is promoting a new Power Generation Plant with associated Gas and Electricity Connections within Abergelli Farm. The Power Generation Plant would operate as a Simple Cycle Gas Turbine (SCGT) peaking plant and would be designed to provide an electrical capacity of up to 299 Megawatts (MW). It would be fuelled by natural gas, supplied by new underground gas pipelines connecting the Power Generation Plant to the existing National Grid Gas (NGG) National Transmission System (NTS). It would also connect to the National Grid Electrical Transmission System (NETS) via underground cables or overhead lines.

2.5 BSG Ecology has been appointed as the ecological consultant to undertake ecology surveys, which include a PEA as well as a range of Phase 2 surveys, including a reptile survey. These baseline surveys will be included in an appendix to an ecology chapter of an Environmental Statement, which is intended for submission in support of the application for Development Consent.

Aims of Study

2.6 The aims of the reptile survey within the Survey Site were to:

- Assess where habitats within the Survey Site have the potential to support reptiles; and
- Establish the likely presence/absence of each species and, if present, their distribution within the Survey Site.

3 Methods

Desk Study

3.1 Existing ecological records for European and nationally protected[2] species, including reptiles was requested from the South East Wales Biodiversity Records Centre (SEWBReC). Records were provided for the Survey Site and a 2km buffer area beyond the Survey Site boundary. On-line mapping and aerial photography of the area was also reviewed in May 2014 to identify potential reptile habitat present within the Survey Site.

Scoping Survey

3.2 During the PEA carried out by BSG Ecology in February 2014, which was subsequently updated in April and July 2014, habitats within the Survey Site that had the potential to support common species of reptile were identified. The following areas were identified as containing habitats suitable to support reptiles:

- **Area 1**: An extensive area of marshy grassland / wet modified bog in the north-west of the Survey Site and a smaller area of road verge on the edge of semi-improved marshy grassland;
- **Area 2**: Areas of overgrown grassland, open ground and scrub as well as overgrown field margins along either remnant hedge banks or ditches in the north-east of the Survey Site;
- **Area 3**: Wood piles, overgrown banks, scrubby woodland fringes and marshy grassland areas in the east of the Survey Site, as well as dry grassland and scrub bordering the gallops in the centre of the Survey Site; and
- **Area 4**: Dry grassland and scrub along the periphery of the Felindre Gas Compressor Station and the two National Grid 400kV electric substations, as well as areas of marshy grassland on the periphery of these habitats, in the south-west extent of the Survey Site.

3.3 The areas assessed as being suitable for reptiles are shown on Figures 1a and 1b in Appendix 1.

Field Survey

3.4 The reptile survey was undertaken in accordance with best practice guidance, as set out in the Herpetofauna Worker's Manual (Gent *et al*., 2003) and guidelines for reptile survey published by Froglife (1999). A total of seven visits were made to each refugia during late August and September 2014. This period is within the optimum survey period for reptiles.

3.5 A survey was carried out to establish the likely presence/absence of each reptile species and, if present, their distribution through the Survey Site. This included the placement of 317 artificial refugia comprising of 50 x 50 cm roofing felt sections, which were placed within suitable habitats within the Survey Site (shown on Figures 1a and 1b in Appendix 1). In total approximnately 33 ha (approximately 22% of the total Survey Site area) of suitable reptile habitat was identified within the Survey Site, this means that the survey attained a refugia density of 9.6 refugia per hectare which approaches the upper limit of the guideline density of 5-10 refugia per hectare of suitable reptile habitat (Froglife, 1999).

3.6 Best practice guidance recommends that refugia are allowed to "bed in" for a minimum of one week before the survey commences. The "bedding in" period allows vegetation to die back beneath the refugia creating a close fit to the ground and allowing the development of suitable humidity and temperature conditions. It also allows time for reptiles to locate and become accustomed to the refugia. Refugia in Area 1 were deployed on 16 April 2014, and the remainder of the refugia deployed on 11 August 2014. The first survey visit was undertaken on 22 August giving a minimum bedding in period of 11 days.

3.7 During each survey, refugia were approached carefully so that any reptiles basking on top of them could be observed before they were disturbed by the surveyor. Once the

refugia had been inspected for basking reptiles, the refugia were carefully lifted and checked for any reptiles sheltering underneath.

3.8 Some areas initially assessed as being suitable for reptiles were not included in the refugia survey either due to a change in landuse such as ploughing or due to the regular grazing by horses as the presence of horses means that the refugia were at risk of trampling, with an inherant risk of injury to reptiles sheltering underneath, Figures 1a and 1b reflect this with some areas of suitable habitat not containg artificial refugia as part of the survey.

Direct Observation

3.9 The surveyors made visual searches whilst on site by slowly walking between refugia and watching for signs of movement. Any existing refugia (e.g. pieces of wood, stones) were also checked where appropriate. A supplimentary direct observation survey aims to eliminate bias towards recording those reptile species more likely to use refugia.

Reptile Survey Details

3.10 Surveys were conducted during optimum weather conditions, generally dry, with low wind, lightly overcast or hazy sunshine, and a temperature range of 9-18°C (Froglife, 1999; Gent & Gibson, 2003[1]). This temperature range includes the optimum temperature ranges for recording most of the widespread UK species of reptile (see Table 1, below).

3.11 Due to the large number of refugia and the extent of the Survey Site, surveys were often completed by two surveyors in one day or by one surveyor over two days (subsequent days where weather was permitting).

Table 1 - Survey period for widespread reptile species and associated temperature ranges. Information taken from Gent & Gibson (2003).

Common Name	Latin Name	Survey period	Optimal temperatures
Adder	*Vipera berus*	Early March – late September	8-16 °C
Grass snake	*Natrix natrix*	April – early October	12-20 °C
Common lizard	*Zootoca vivipara*	Early March – early August (adults) August – September (juveniles)	9-18 °C
Slow worm	*Anguis fragilis*	Early March – early August	9-18 °C

Limitations to Methods

3.12 The survey method is designed to identify the presence or likely absence of common reptile species and to provide an indication of the abundance of reptiles present within the Survey Site. However it is possible that the survey may have only recorded a small sample of the populations present, and that if a reptile species occurs at a low density, it may have been missed.

3.13 On two survey visits (Visit 4 on 3 September and Visit 5 on 11 September) the average temperature for the survey was slightly higher than is recommended (both averaged 18.5 °C) for surveying. It is not considered to have affected the overall result of the survey, as the common species of reptile that were recorded on site are known to bask at higher temperatures (Gent & Gibson, 2003). In addition, the numbers of reptiles recorded were similar to numbers recorded during the other surveys, with the 4th and 6th highest total counts of reptiles recorded during these surveys.

[1] Gent & Gibson (2003) recommends a temperature range of 10-17°C

4 Results

Desk Study

4.1 SEWBReC provided 12 records of reptiles, between 1998 and 2010. These included records of all the common reptile species: adder, grass snake, common lizard, and slow worm. The closest record is of a common lizard, approximately 0.8 km to the west of the Survey Site boundary. Most records are from the south-west side of the tinplate working near to Bryn Whilach Farm, approximately 1 km to the southwest of the Survey Site boundary.

Field Survey

4.2 Reptiles were recorded during refugia checks and visual searches on site. Details of the timing of surveys and weather conditions are provided in Table 2.

Table 2 – Details of Reptile Surveys

Visit No.	Area surveyed	Date	Surveyors*	Average Air Temperature (°C)	Average Wind Speed (Beaufort)	Average Cloud Cover (Oktas)
1a	1,2,3	21/08/2014	CMc	15.1	2-3	7
1b	4	22/08/2014	CMc + RT	13.4	1	5
2	all	26/08/2014	CMc + RT	17.1	2	2-3
3	all	28/08/2014	CMc + GL	17.2	2	2-3
4	all	03/09/2014	GL + NL	18.5	1	3
5a	1,4	05/09/2014	CMc	17.6	3	3
5b	2,3	11/09/2014	CMc	18.5	0	0
*6a	3,4	09/09/2014	GL	16.5	0	0
C6b	1,2	10/09/2014	GL	15.0	2	0
a7a	2,4	12/09/2014	CMc	17.0	1	1-2
i 7b	1,3	15/09/2014	CMc	17.7	0	1

t

*Caitlin McCann MSc (CMc), Gareth Lang GCIEEM (GL), Niall Lusby MCIEEM (NL) and Rachel Taylor ACIEEM (RT).

4.3 A summary of the survey results is provided in Table 3 below and the full results are presented in Appendix 2. The locations where reptiles were recorded is presented in Figures 1a and 1b in Appendix 1. Two common species of reptile were recorded at the Survey Site; common lizard and grass snake. No other reptile species were recorded. The majority of records were associated with artificial refugia and where direct observation of reptiles were made during the surveys, the closest refugia number was used to indicate the sighting location.

Common Lizard

4.4 A total of 163 adult and juvenile common lizard observations were recorded during the seven survey visits, with a peak count of 50 recorded during the second visit on 26 August 2014 (Survey No. 2).

4.5 Area 1 was surveyed with 38 refugia and the highest numbers of common lizard were recorded from this area, with 58 recorded over the seven visits, and a peak count of 22 on 28 August 2014 (Survey No. 3). All of these records were from the extensive area of marshy grassland / wet modified bog with no observations of any reptiles made along the road verge also included in Area 1.

4.6 Area 2 was surveyed with 65 refugia and a total of 36 common lizard observations were recorded during the seven visits, with a peak count of 15 on 28 August 2014 (Survey No. 3). The animals recorded were fairly evenly distributed across the habitats included in this area, although most records were from the eastern half of this area.

4.7 Area 3 was surveyed with 89 refugia and a total of 51 common lizard observations were recorded during the seven survey visits with a peak count of 23 on 26 August 2014 (Survey No. 2). The majority of the records were from the marshy grassland on the eastern boundary of the Survey Site, with occasional records along the gallops track.

4.8 Area 4 was surveyed with 125 refugia and a total of 18 common lizard observations were recorded during the seven surveys with a peak count of seven on 26 August 2014 (Survey No. 2).

4.9 During the course of the survey both male and female common lizard were recorded with some of the females being gravid, which confirms that there is a breeding population present on the Survey Site.

Grass snake

4.10 In total ten observations were recorded for grass snake during the course of the survey with a peak count of five recorded on 26 August 2014 (Survey No. 2). All observations of grass snake were made in Area 3 in the marshy grassland close to the pond.

4.11 Juvenile grass snake were recorded along with adults which is suggestive that a breeding population is present on the Survey Site, however as grass snake are a wide ranging species and the location of the animals recorded on site was close to the Survey Site boundary; the presence of juveniles does not necessarily confirm that breeding takes place on site.

Other species

4.12 Common toad *Bufo bufo* was found across the Survey Site with a total of 51 records made for this species and a peak count of 17 recorded on 28 August 2014 (Survey No. 3).

4.13 Common frog *Rana temporaria* was recorded once on 26 August 2014 (Survey No. 2). Large numbers of recently emerged juvenile common frog were observed during the refugia collection on 16 September 2014. These sightings were made in the areas of marshy grassland and were not associated with the artificial refugia.

Table 3: Numbers of reptiles and amphibians recorded during each survey.

	Common Lizard					**Grass Snake**					**Other**	
Survey no.	Male	Female	Adult (no sex)	Juvenile	Adult Total	Male	Female	Adult (no sex)	Juvenile	Adult Total	Toad	Frog
1a and 1b	1	1	0	21	2	0	0	0	0	0	10	0
2	7	9	4	30	20	0	0	2	3	2	14	1
3	3	5	0	40	8	0	0	1	3	1	17	0
4	1	3	1	4	5	0	0	0	0	0	9	0
5a and 5b	2	5	0	11	7	0	0	1	0	1	0	0
6a and 6b	0	1	1	1	2	0	0	0	0	0	1	0
7a and 7b	1	3	0	8	4	0	0	0	0	0	0	0
Total	**15**	**27**	**6**	**115**	**48**	**0**	**0**	**4**	**6**	**4**	**51**	**1**

5 References

Frog*life* (1999) Advice Sheet 10: Reptile Survey. An introduction to planning, conducting and interpreting surveys for snake and lizard conservation. Frog*life*, Suffolk

BSG Ecology (2014). Abergelli Power Project: Preliminary Ecological Appraisal.

Gent, T and Gibson, S (2003) *Herpetofauna Workers' Manual*. JNCC, Peterborough.

Appendix 1: Figures

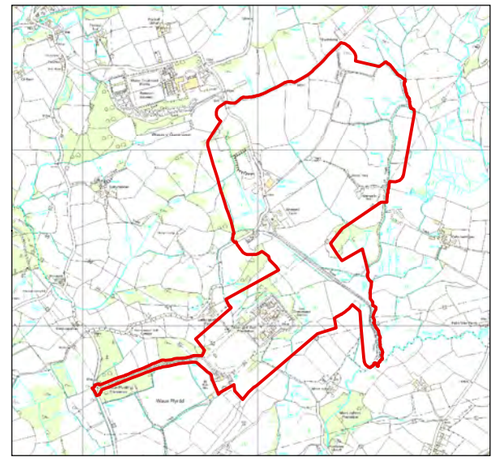
(Overleaf)

LEGEND

- Survey site boundary
- 1a — Reptile survey area
- Area of habitat most suitable for reptiles

Reptile mats

- Common lizard recorded
- No reptile presence recorded



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PROJECT TITLE
ABERGELLI POWER PROJECT

DRAWING TITLE
Figure 1a: Reptile Survey Results - North

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DRAWN: COH APPROVED: MH STATUS: FINAL

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Sources: BSG Ecology survey data

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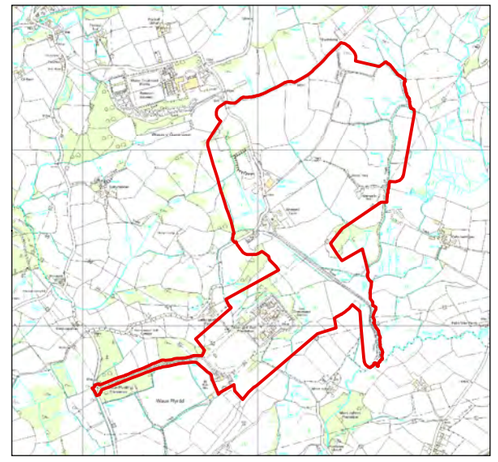
N

LEGEND

- Survey site boundary
- 1a — Reptile survey area
- Area of habitat most suitable for reptiles

Reptile mats

- Common lizard recorded
- Grass snake recorded
- Common lizard and grass snake recorded
- No reptile presence recorded



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PROJECT TITLE
ABERGELLI POWER PROJECT

DRAWING TITLE
Figure 1b: Reptile Survey Results - South

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DRAWN: COH APPROVED: MH STATUS: FINAL

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Sources: BSG Ecology survey data

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Appendix 2: Reptile Survey Results

Full Survey Results

Visit	Surveyor	Date	Mat No.	Area	Time	Species	No.	M/F/J/or 'Adult'
1a	CMc	21/08/2014	227	2	10:44 - 11:55	Common lizard	1	J
1a	CMc	21/08/2014	205	2	10:44 - 11:55	Common lizard	3	J
1a	CMc	21/08/2014	36	1	12:17 - 13:40	Common lizard	1	M
1a	CMc	21/08/2014	37	1	12:17 - 13:40	Common lizard	2	J, M
1a	CMc	21/08/2014	31	1	12:17 - 13:40	Common lizard	2	J
1a	CMc	21/08/2014	30	1	12:17 - 13:40	Common lizard	2	J, F
1a	CMc	21/08/2014	29	1	12:17 - 13:40	Common lizard	1	J
1a	CMc	21/08/2014	27	1	12:17 - 13:40	Common lizard	1	J
1a	CMc	21/08/2014	26	1	12:17 - 13:40	Common lizard	1	J
1a	CMc	21/08/2014	25	1	12:17 - 13:40	Common lizard	1	J
1a	CMc	21/08/2014	24	1	12:17 - 13:40	Common lizard	1	J
1a	CMc	21/08/2014	101	3	15:20 - 15:59	Common lizard	1	J
1a	CMc	21/08/2014	100	3	15:20 - 15:59	Common lizard	1	J
1a	CMc	21/08/2014	104	3	15:20 - 15:59	Common lizard	1	J
1a	CMc	21/08/2014	105	3	15:20 - 15:59	Common lizard	2	J
1a	CMc	21/08/2014	110	3	15:20 - 15:59	Common lizard	1	J
1a	CMc	21/08/2014	112	3	15:20 - 15:59	Common lizard	1	J
1a	CMc	21/08/2014	95	3	15:20 - 15:59	Common lizard	1	J
2	CMc	26/08/2014	35	1	10:37	Common lizard	3	J
2	CMc	26/08/2014	28	1	10:52	Common lizard	3	F
2	CMc	26/08/2014	26	1	10:54	Common lizard	2	J
2	CMc	26/08/2014	25	1	10:59	Common lizard	1	F
2	CMc	26/08/2014	24	1	11:01	Common lizard	1	J
2	CMc	26/08/2014	23	1	11:03	Common lizard	1	Adult
2	CMc	26/08/2014	127	3	11:49	Common lizard	1	J
2	CMc	26/08/2014	116	3	11:54	Common lizard	1	J
2	CMc	26/08/2014	95	3	11:56	Common lizard	1	M
2	CMc	26/08/2014	95	3	11:56	Grass Snake	1	J
2	CMc	26/08/2014	94	3	11:58	Common lizard	1	J
2	CMc	26/08/2014	115	3	11:59	Common lizard	1	Adult
2	CMc	26/08/2014	113	3	12:03	Grass Snake	1	Adult
2	CMc	26/08/2014	112	3	12:04	Common lizard	4	J
2	CMc	26/08/2014	111	3	12:05	Common lizard	1	J
2	CMc	26/08/2014	110	3	12:07	Common lizard	1	J
2	CMc	26/08/2014	109	3	12:09	Common lizard	1	M
2	CMc	26/08/2014	105	3	12:13	Grass Snake	1	Adult
2	CMc	26/08/2014	104	3	12:14	Grass Snake	1	J
2	CMc	26/08/2014	102	3	12:17	Common lizard	1	J
2	CMc	26/08/2014	93	3	12:31	Common lizard	1	J
2	CMc	26/08/2014	89	3	12:37	Common lizard	2	1 M, 1 F
2	CMc	26/08/2014	86	3	12:40	Common lizard	1	M
2	CMc	26/08/2014	83	3	12:43	Grass Snake	1	J

Visit	Surveyor	Date	Mat No.	Area	Time	Species	No.	M/F/J/or 'Adult'
2	CMc	26/08/2014	81	3	12:45	Common lizard	1	M
2	CMc	26/08/2014	68	3	12:51	Common lizard	2	J
2	CMc	26/08/2014	58	3	13:12	Common lizard	1	J
2	CMc	26/08/2014	56	3	13:20	Common lizard	1	J
2	CMc	26/08/2014	39	1	13:31	Common lizard	1	J
2	CMc	26/08/2014	165	4	14:05	Common lizard	1	J
2	CMc	26/08/2014	167	4	14:07	Common lizard	1	J
2	CMc	26/08/2014	139	4	14:32	Common lizard	2	F
2	CMc	26/08/2014	184	2	16:09	Common lizard	2	F
2	CMc	26/08/2014	219	2	16:19	Common lizard	1	M
2	CMc	26/08/2014	214	2	16:22	Common lizard	1	J
2	CMc	26/08/2014	215	2	16:23	Common lizard	1	J
2	CMc	26/08/2014	195	2	16:41	Common lizard	1	J
2	CMc	26/08/2014	193	2	16:43	Common lizard	1	J
2	CMc	26/08/2014	205	2	16:52	Common lizard	1	J
2	CMc	26/08/2014	206	2	16:55	Common lizard	1	J
2	CMc	26/08/2014	272	4	16:55	Common lizard	1	Adult
2	CMc	26/08/2014	274	4	16:58	Common lizard	1	Adult
2	CMc	26/08/2014	275	4	17:00	Common lizard	1	M
3	CMc	28/08/2014	175	4	12:26	Common lizard	1	F
3	CMc	28/08/2014	178	4	12:31	Common lizard	3	J
3	CMc	28/08/2014	181	4	12:40	Common lizard	1	J
3	CMc	28/08/2014	224	2	12:51	Common lizard	2	J
3	CMc	28/08/2014	228	2	12:59	Common lizard	1	M
3	CMc	28/08/2014	229	2	13:01	Common lizard	1	J
3	CMc	28/08/2014	234	2	13:15	Common lizard	1	J
3	CMc	28/08/2014	223	2	13:34-14:13	Common lizard	1	F
3	CMc	28/08/2014	221	2	13:34-14:13	Common lizard	1	J
3	CMc	28/08/2014	214	2	13:34-14:13	Common lizard	1	J
3	CMc	28/08/2014	213	2	13:34-14:13	Common lizard	1	J
3	CMc	28/08/2014	193	2	13:34-14:13	Common lizard	1	J
3	CMc	28/08/2014	76	3	14:15-14:54	Common lizard	1	J
3	CMc	28/08/2014	101	3	15:01-16:20	Common lizard	3	J
3	CMc	28/08/2014	99	3	15:01-16:20	Common lizard	1	J
3	CMc	28/08/2014	104	3	15:01-16:20	Grass snake	1	J
3	CMc	28/08/2014	105	3	15:01-16:20	Grass snake	1	J
3	CMc	28/08/2014	109	3	15:01-16:20	Common lizard	1	J
3	CMc	28/08/2014	110	3	15:01-16:20	Common lizard	1	J
3	CMc	28/08/2014	112	3	15:01-16:20	Grass snake	1	Adult
3	CMc	28/08/2014	95	3	15:01-16:20	Common lizard	1	J
3	CMc	28/08/2014	95	3	15:01-16:09	Grass snake	1	J
3	CMc	28/08/2014	23	1	17:01 - 17:40	Common lizard	3	J
3	CMc	28/08/2014	24	1	17:01 - 17:40	Common lizard	2	J
3	CMc	28/08/2014	25	1	17:01 - 17:40	Common lizard	4	J
3	CMc	28/08/2014	26	1	17:01 - 17:40	Common lizard	1	F
3	CMc	28/08/2014	28	1	17:01 -	Common lizard	1	M

Visit	Surveyor	Date	Mat No.	Area	Time	Species	No.	M/F/J/or 'Adult'
					17:40			
3	CMc	28/08/2014	31	1	17:01 - 17:40	Common lizard	3	J x2, F
3	CMc	28/08/2014	35	1	17:01 - 17:40	Common lizard	2	J
3	CMc	28/08/2014	37	1	17:01 - 17:40	Common lizard	2	J
3	CMc	28/08/2014	38	1	17:01 - 17:40	Common lizard	2	F
3	CMc	28/08/2014	34	1	17:01 - 17:40	Common lizard	2	J
3	RT	28/08/2014	235	4	11:20-12:20	Common lizard	1	M
3	RT	28/08/2014	280	4	11:20-12:20	Common lizard	1	J
3	RT	28/08/2014	282	4	11:20-12:20	Common lizard	1	J
4	GL	03/09/2014	272	4	10:30	Common lizard	1	J
4	GL	03/09/2014	275	4	10:35	Common lizard	1	Adult F
4	GL	03/09/2014	305	4	10:55	Common lizard	1	Adult F
4	GL	03/09/2014	108	3	11:33	Common lizard	1	Adult M
4	GL	03/09/2014	99	3	11:55	Common lizard	1	J
4	NL	03/09/2014	232	2	11:55-17:00	Common lizard	1	J
4	NL	03/09/2014	233	2	11:55-17:00	Common lizard	1	J
5a	CMc	05/09/2014	25	1	8:00-13:00	Common lizard	1	J
5a	CMc	05/09/2014	26	1	8:00-13:00	Common lizard	2	J
5a	CMc	05/09/2014	28	1	8:00-13:00	Common lizard	1	Adult F
5a	CMc	05/09/2014	35	1	8:00-13:00	Common lizard	1	J
5a	CMc	05/09/2014	37	1	8:00-13:00	Common lizard	1	J
5a	CMc	05/09/2014	272	4	8:00-13:00	Common lizard	1	Adult F
5a	CMc	05/09/2014	275	4	8:00-13:00	Common lizard	1	Adult M
5a	CMc	05/09/2014	281	4	8:00-13:00	Common lizard	1	J
5b	CMc	11/09/2014	181	2	13:30-17:00	Common lizard	1	J
5b	CMc	11/09/2014	229	2	13:30-17:00	Common lizard	1	J
5b	CMc	11/09/2014	232	2	13:30-17:00	Common lizard	1	Adult M
5b	CMc	11/09/2014	193	2	13:30-17:00	Common lizard	1	Adult F
5b	CMc	11/09/2014	76	3	13:30-17:00	Common lizard	1	J
5b	CMc	11/09/2014	75	3	13:30-17:00	Common lizard	1	Adult F
5b	CMc	11/09/2014	99	3	13:30-17:00	Common lizard	1	J
5b	CMc	11/09/2014	104	3	13:30-17:00	Common lizard	1	J
5b	CMc	11/09/2014	105	3	13:30-17:00	Grass snake	1	Adult
5b	CMc	11/09/2014	95	3	13:30-17:00	Common lizard	1	J
6a	GL	09/09/2014	56	3	12:10	Common lizard	1	J
6b	GL	10/09/2014	33	1	09:45	Common lizard	1	A
6b	GL	10/09/2014	183	2	11:15	Common lizard	1	F
7a	CMc	12/09/2014	242	4	08:00-	Common lizard	1	F

Visit	Surveyor	Date	Mat No.	Area	Time	Species	No.	M/F/J/or 'Adult'
					13:00			
7a	CMc	12/09/2014	236	4	08:00-13:00	Common lizard	1	J
7b	CMc	15/09/2014	112	3	13:00-17:00	Common lizard	2	J
7b	CMc	15/09/2014	101	3	13:00-17:00	Common lizard	1	M
7b	CMc	15/09/2014	95	3	13:00-17:00	Common lizard	1	F
7b	CMc	15/09/2014	22	1	13:00-17:00	Common lizard	1	J
7b	CMc	15/09/2014	25	1	13:00-17:00	Common lizard	1	J
7b	CMc	15/09/2014	26	1	13:00-17:00	Common lizard	3	J
7b	CMc	15/09/2014	27	1	13:00-17:00	Common lizard	1	F

Appendix 3.19

Invasive Plant Species Survey Report

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Abergelli Power Project

Invasive Plant Species Survey Report

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Client	Stag Energy
Job	Abergelli Power Project
Report title	Invasive Plant Species Survey Report
Draft version/final	FINAL
File reference	7399_InvasiveSpecies_APPR (4)_011014.docx

	Name	**Position**	**Date**
Originated	Niall Lusby	Senior Ecologist	23 July 2012
Reviewed	Jim Gillespie	Partner	28 July 2014
2nd Draft	Niall Lusby	Senior Ecologist	28 July 2014
Approved for issue to client	Jim Gillespie	Partner	15 August 2014
Issued to client	Jim Gillespie	Partner	15 August 2014
2nd issue to client	Matt Hobbs	Principal Ecologist	02 September 2014
3rd issue to client	Matt Hobbs	Principal Ecologist	08 September 2014

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3 Methods 5
4 Results 6
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1 Summary

1.1 Abergelli Power Limited (APL) is promoting a new Power Generation Plant with its associated Gas and Electricity Connections (the 'Project') on agricultural land within Abergelli Farm, north of Swansea in the City and County of Swansea (approximately at National Grid Reference 265284, 201431).

1.2 The preliminary ecological appraisal[1] identified that invasive species of plants, as listed under Part II of Schedule 9 of the Wildlife and Countryside Act (WCA), 1981 (as amended) (specifically Japanese Knotweed *Fallopia japonica* and Himalayan balsam *Impatiens glandulifera*), are present on the Survey Site in a number of areas. The report recommended that a detailed survey to map the distribution of any invasive species should be carried out to inform any management measures that would need to be implemented to remove or control the spread of these species during the construction and operation of the Project.

1.3 APL commissioned BSG Ecology to undertake an invasive survey of streams and wet ditches within the 150 ha of pastoral farmland at and around Abergelli Farm in June 2014 within the Survey Site, to inform and support an application for Development Consent for the Project.

1.4 The Survey Site was surveyed in July 2014 by an ecologist from BSG Ecology. All accessible areas of the Survey Site were walked with areas of dense scrub assessed from the perimeter of the scrub, and the presence of five species included under Part II were recorded within the Survey Site: Japanese knotweed, Himalayan balsam, rhododendron *Rhododendron ponticum,* floating pennywort *Hydrocotyle ranunculoides* and montbretia *Crocosmia x crocosmiiflora.*

1.5 Of the five species Himalayan balsam and Japanese knotweed were the most widespread within the Survey Site.

[1] BSG Ecology (2014). Abergelli Power Project: Preliminary Ecological Appraisal.

2 Introduction

2.1 APL commissioned BSG Ecology to undertake an invasive species survey in May 2014 to inform and support an application for Development Consent for the Power Generation Plant.

Site Description

2.2 The Survey Site consists of approximately 150 ha of pastoral farmland, primarily grazed by horses. The extent of the Survey Site is shown in Figure 1 in Appendix 1 and is centred at National Grid Reference 265284, 201431. The nearest settlement is Felindre, which is located approximately 2 km to the north of the Survey Site, with Swansea approximately 5 km to the south.

2.3 The Survey Site is largely agriculturally improved pasture with several areas of marshy grassland, particularly in the north, south and north-western ends of the Survey Site. The fields are bounded by fences, running along the line of defunct hedgerows, and often accompanied by ditches. There is a block of broadleaved woodland on the eastern boundary of the Survey Site and other areas of woodland around the marshy grassland to the west of the Survey Site, and around Felindre Gas Compressor Station and the two National Grid 400 kV electrical substations that lie at the south-west end of the Survey Site. The habitats in the surrounding landscape are similar to those within the Survey Site boundary – a mixture of improved and marshy grassland interspersed with occasional patches of woodland.

Description of Project

2.4 APL is promoting a new Power Generation Plant with associated Gas and Electricity Connections within Abergelli Farm. The Power Generation Plant would operate as a Simple Cycle Gas Turbine (SCGT) peaking plant and would be designed to provide an electrical capacity of up to 299 Megawatts (MW). It would be fuelled by natural gas, supplied by a new underground gas pipeline connecting Power Generation Plant to the existing National Grid Gas (NGG) National Transmission System (NTS). It would also connect to the National Grid Electrical Transmission System (NETS) via underground cable or overhead lines.

2.5 BSG Ecology has been appointed as the ecological consultant to undertake an ecology survey, which incorporates a desk study and Extended Phase 1 Habitat Survey as well as a range of Phase 2 surveys, including a survey for invasive species. The methods and results of baseline surveys will be provided as appendices to an ecology chapter of an Environmental Statement, which is intended for submission, in support of the application for Development Consent.

Background to Survey

2.6 For the purposes of this survey, invasive plant species are defined as those species of non-native plants included in part II of Schedule 9 of the WCA 1981 (as amended).

2.7 Since its creation in 1981, part II of Schedule 9 of the WCA (as amended) 1981, pertaining to invasive plants, has undergone many revisions, to the extent that the original four species has now been expanded to include over 30 invasive plant species.

2.8 The Phase 1 survey of the Survey Site was carried out in three phases, in February 2014 and updated in April 2014, and July 2014. The timing of the first two surveys during the winter and early spring meant that the presence of some of the Schedule 9 species was missed as the vegetative parts of the plants (growing above ground) can be absent during the colder months of the year, with the plant persisting, over winter, below ground as rhizomes or lying dormant in the seed bank. Because of this it was recommended in the Phase 1 survey report that a dedicated invasive species survey should be undertaken within the main botanical survey season (May to September) to attempt to map the distribution and extent of Schedule 9 species within the Survey Site.

Aims of Study

2.9 The aim of the survey is to confirm the presence and identify the locations of species of plant included under Schedule 9 of the WCA (as amended) 1981.

3 Methods

3.1 No standard method exists for invasive plant species survey; and the survey was based on an ecological walkover survey approach, whereby all accessible areas of the Survey Site were walked by the surveyor in daylight hours, with a visual search for the target species undertaken.

3.2 Particular focus was also given to areas where the target species were most likely to be found, for example water courses, areas of disturbed ground and tracks where imported material may have been used or where fly-tipping or movements of vehicles or machinery could have led to the spread of these species.

3.3 Where found to be present, the species and location were recorded using a handheld GPS. The locations of individual plants, small clusters and large clusters of plants found during the walkover survey are provided in Figure 1. The locations are representative and do not necessarily provide mapping of the exact extent of each species or the precise location of each individual plant.

Limitations of Study

3.4 The scale of the Survey Site and the presence of dense areas of scrub or woodland understorey in some areas mean that it is possible that small stands or individual plants of invasive species could have been missed during the walkover survey. In addition, the presence of horses in some fields restricted access to some areas of the Survey Site although these areas were assessed using binoculars and it is likely, given the heavily grazed nature of these fields, that most invasive plant species would have been visible using binoculars. It is considered that the majority of the Survey Site was surveyed adequately and that overall the distribution of invasive species across the Survey Site has been mapped accurately.

3.5 The mapping produced in support of the report is based on point locations taken using a handheld GPS device which is subject to varying degrees of accuracy depending on satellite coverage and other factors. Further to this the GPS locations recorded were for the main aggregation of each plant species at each location. Each point therefore does not represent full coverage of the species at each point. Any invasive plant management plan should take account of this with up to date, detailed surveying by a qualified land surveyor undertaken to provide accurate extents of species coverage. The distribution of each invasive plant species will, inevitably, change from year to year to a greater or lesser extent and these locations should be re-checked as necessary.

4 Results

4.1 Five species of plant included on Part II of Schedule 9 of the WCA 1981 were recorded during the survey: Japanese knotweed; Himalayan balsam; rhododendron; floating pennywort; and montbretia. The locations and extents of these species are shown on Figure 1.

4.2 The most frequently recorded species were Japanese knotweed and Himalayan balsam.

4.3 Japanese knotweed was found to be strongly associated with roads and trackways on the Survey Site as well as the area of inert landfill in the north-west half of the Survey Site. This perennial species is typically spread through the movement of contaminated soils or through spreading of vegetative parts through flailing of hedges or movement of other machinery.

4.4 Himalayan balsam is an annual plant that is typically found in wetter habitats, although it will tolerate drier conditions. It is strongly associated with woodland, stream corridors and ditches across the Survey Site.

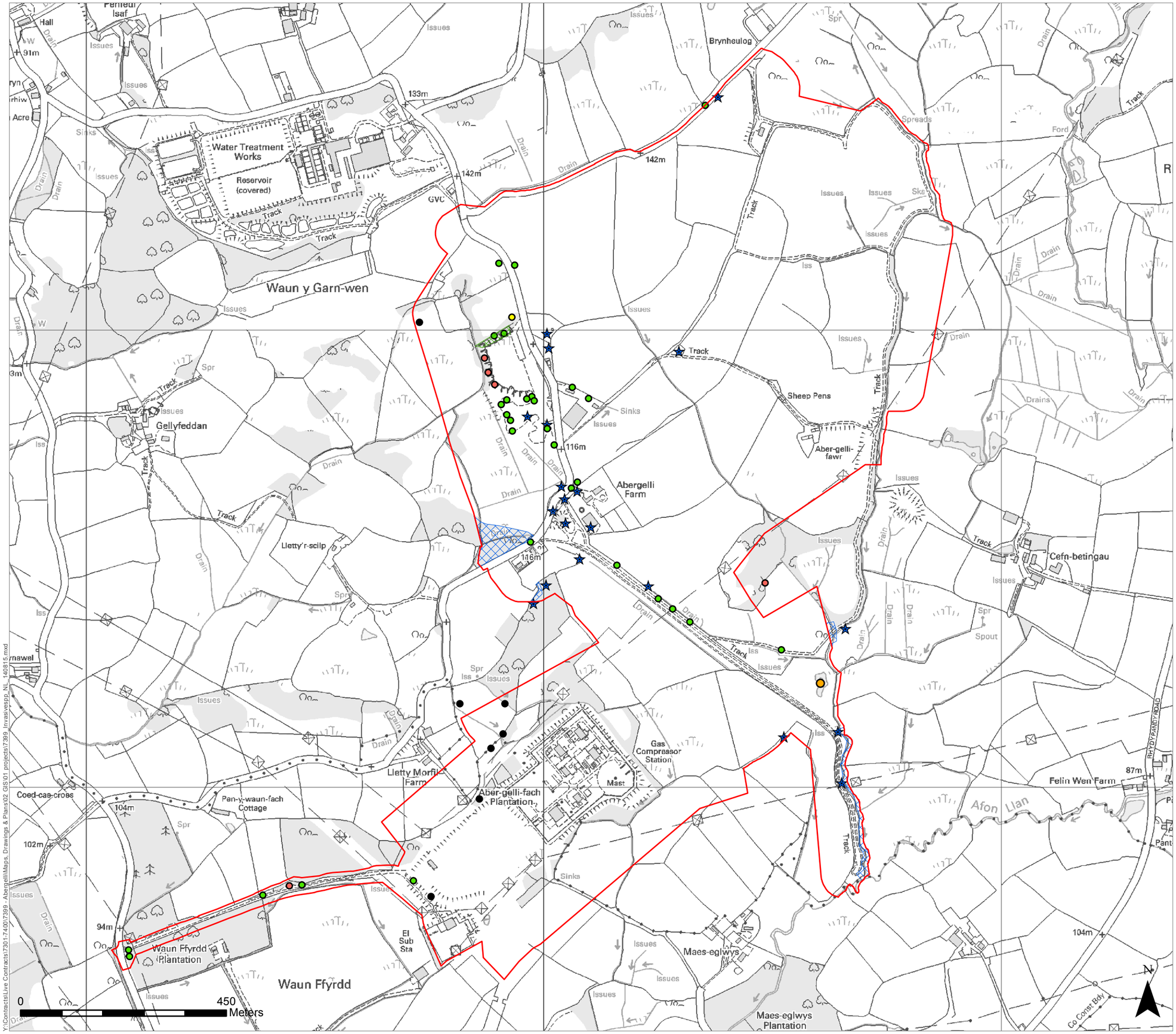
4.5 Rhododendron is restricted to woodlands with a small patch occurring in the marshy grassland area in the north-west of the Survey Site. Montbretia was recorded in two locations alongside roads, which is a typical location for this species to be found in given that it is often spread from the fly tipping of garden waste.

4.6 Floating pennywort was found in one of the Survey Site ponds in the south-east of the Survey Site[2].

[2] Pond 16 as referred to in the great-crested newt survey report.

Appendix 1: Figures

(overleaf)



LEGEND

Survey site boundary

Larger area of invasive species

Himalayan Balsam

Japanese knotweed

Small area of invasive species

Floating Pennywort

Himalayan Balsam

Japanese knotweed

Montbrecia

Montbrecia and Japanese knotweed

Rhodendron

BSG | ecology

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PROJECT TITLE

ABERGELLI POWER PLANT

DRAWING TITLE

Figure 1 - Invasive Plant Species Survey

DATE: 22.07.2014 CHECKED: MH SCALE: 1:8,000

DRAWN: RT APPROVED: JG STATUS: Final

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APPENDIX 8.12 - SPECIES SPECIFIC LEGISLATION

1.1 Badgers

1.1.1 Badgers are protected under the Protection of Badgers Act (1992) on animal welfare grounds rather than nature conservation value. It is an offence to wilfully take, kill, injure or ill-treat a badger, or possess a dead badger or any part of a badger. Under the Act their setts are also protected against obstruction, destruction or damage.

1.2 Otters

1.2.1 Otters are fully protected under Schedule 2 of the Habitats Regulations which define “European protected species of animals” and also receive partial protection under the WCA.

1.2.2 Taken together the Act and Regulations make it illegal to: deliberately kill, injure, capture, disturb otters (whether in a resting place or not); damage, destroy or obstruct access to a resting place used by an otter; possess or transport an otter or any part of an otter, unless acquired legally; sell, barter or exchange or advertise for such purposes an otter

1.2.3 Activities that could result in impacts on otters should be modified to avoid/minimise the likelihood of an impact occurring in the first instance. If impacts are unavoidable then the works may need to be carried out under a European Protected Species development licence, granted under the Habitats Regulations.

1.2.4 Otters are also a Species of Principal Importance in Wales as identified under Section 42 of the NERC Act 2006.

1.3 Water voles

1.3.1 Water voles are fully protected under the WCA. It is an offence to possess, control or sell water voles or to intentionally or recklessly kill, injure or take water voles. It is also an offence to intentionally or recklessly damage, destroy or obstruct access to a place that water voles use for shelter or protection or disturb water voles whilst using such a place. No licensing regime exists for development activities that may result in an infringement of the legislation.

1.3.2 Current guidance from NRW states that where development activities may result in unavoidable impacts on water voles, developers will need to be confident that their activities are “the incidental result of an otherwise lawful operation”, and that all steps that could reasonably be taken to avoid, minimise, mitigate and (if necessary) compensate for impacts have been taken.

1.4 Dormice

1.4.1 Dormice are protected under the WCA (in respect of section 9(4)(b) and (c) and (5) only) and are listed in Schedule 2 of the Habitats Regulations. Under the current legislation it is illegal to intentionally or deliberately kill, injure or capture dormice, deliberately disturb dormice (whether in a nest or not); or to damage, or destroy dormouse breeding sites or resting places.

1.4.2 Any activity that would result in a contravention of the above legislation would likely require a European Protected Species (EPS) licence from the relevant statutory body (NRW).

1.5 Bats

1.5.1 All native UK bat species are protected by UK law under Schedule 5 and 6 of the WCA, and under Schedule 2 of the Habitats Regulations. It is illegal to deliberately capture, injure or kill a bat or to intentionally or recklessly disturb bats. It is also illegal to damage, destroy or intentionally or recklessly obstruct access to a breeding or resting place used by a bat. Under Part 2 of the Habitats Regulations, SACs can be designated to further protect barbastelle (Barbastella barbastellus), Bechstein's (Myotis bechsteinii), lesser horseshoe (Rhinolophus hipposideros) and greater horseshoe bats (Rhinolophus ferrumequinum).

1.5.2 Several species of bats are listed under Section 42 of the NERC Act 2006 as Species of Principal Importance. Species include the greater horseshoe bat, lesser horseshoe bat, barbastelle, common pipistrelle (Pipistrellus pipistrellus), soprano pipistrelle (Pipistrellus pygmaeus), noctule (Nyctalus noctula), Bechstein's bat and brown long-eared bat (Plecotus auritus). Furthermore, five bat species (common pipistrelle, barbastelle, Bechstein's bat, greater horseshoe bat, lesser horseshoe bat) are listed as priority species in the Swansea BAP.

1.6 Breeding birds

1.6.1 All birds, their nests and eggs are protected by the WCA. It is an offence to intentionally kill, injure, or take any wild bird, or take or destroy an egg of any wild bird. It is also an offence to damage or destroy the nest of any wild bird (whilst being built, or in use).

1.6.2 Birds listed under Schedule 1 of the WCA are afforded additional protection with regard to intentional or reckless disturbance while nest building, or at a nest containing eggs or young, and disturbance of the dependent young of such a bird is also an offence away from the nest.

1.7 Great crested newts

1.7.1 GCN are fully protected under Schedule 2 of the Habitats Regulations, and receive partial protection under the WCA Schedule 5. It is illegal to deliberately capture, injure or kill GCN, to intentionally disturb GCN or to otherwise disturb them in their place of shelter, or to deliberately take or destroy the eggs of GCN. It is also illegal to damage, destroy or intentionally or recklessly obstruct access to a breeding site or resting place used by GCN. All life stages of GCN are afforded the same level of protection. The legislation also makes it an offence to possess, transport, sell or exchange, or offer to sell or exchange GCN.

1.8 Reptiles

1.8.1 The four common reptile species, adder, grass snake (Natrix natrix), common lizard and slow worm, are protected under Schedule 5 of the Wildlife and Countryside Act (1981, as amended) against intentional killing, injuring and trade. All species of reptile are listed as Species of Principal Importance in Wales.

1.8.2 The natural range of the rarer species (smooth snake (Coronella austriaca) and sand lizard (Lacerta agilis) does not include this part of South Wales, and thus they are not considered further in this assessment. Sand lizard is listed as priority species under the Swansea BAP (coastal areas).

1.9 Terrestrial and Aquatic Invertebrates

1.9.1 The WCA lists around 70 invertebrate species on Schedule 5 with various levels of protection according to the rarity of the species. Species with full protection under the Act include the marsh fritillary butterfly, southern damselfly, mole cricket, fairy shrimp, medicinal leech and freshwater pearl mussel, amongst many others. Three invertebrate species are protected under the Conservation of Habitats and Species Regulations (2010, as amended) large blue butterflies, Fisher's estuarine moths and little whirlpool ramshorn snails. Section 42 of the NERC Act (2006) also lists several invertebrate species as species of principal importance in Wales.

Appendix 3.20

Hedgerow Survey

Abergelli Power Project
Hedgerow Survey
Report

Abergelli Power Limited
July 2018

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1. Hedgerow Survey Report

1.1 Introduction

1.1.1 AECOM was commissioned to undertake a suite of ecological survey work to inform the Abergelli Power Project (the “Project”), and support the Environmental Statement (ES).

1.1.2 The Project Site is located near to the village of Felindre, Swansea, as shown in Figure 1, and the central grid reference for the Project Site is SN65280143. A full description of the development is provided in ES Chapter 3 (Project and Site Description).

1.1.3 The Preliminary Ecological Appraisal (PEA) Report (ES Appendix 8.1) identified that a hedgerow survey, in accordance with the Hedgerow Regulations, 1997, was required at the Project Site.

1.1.4 This report describes the status of hedgerows within the Project Site, makes an assessment of potential effects and provides recommendations for further work and mitigation.

1.1.5 The survey was undertaken on all hedgerows within the Project Site, as shown on Figure 1.

a) Objectives of the Study

1.1.6 The objectives of this study were:

- To assess hedgerows which are located entirely or partially within the Project Site in accordance with the Hedgerow Regulations, 1997 Ecological Criteria and to determine which are classified as 'Important'; and,
- To make recommendations for mitigation and further work that may be required in relation to permissions.

1.2 Background to the Protection of Hedgerows

1.2.1 The Defra Hedgerow Survey Handbook (2007) defines a hedgerow as '*any boundary line of trees or shrubs over 20 m long and less than 5 m wide at the base, provided that at one time the trees or shrubs were more or less continuous. It includes an earth bank or wall only where such a feature occurs in association with a line of trees or shrubs. This includes 'classic' shrubby hedgerows, lines of trees, shrubby hedgerows with trees and very gappy hedgerows (where each shrubby section may be less than 20 m long, but the gaps are less than 20 m*)'.

1.2.2 Hedgerows are a defining character of the landscape and are important for agriculture, archaeology, ecology and culture (Defra, 2007). They assist in preventing soil erosion and water run-off, controlling livestock and providing shelter, but also are an important habitat for many globally threatened and rapidly declining species (Defra, 2007).

1.3 Legislation and Policy

1.3.1 Several statutes relate to the protection of hedgerows and are summarised in Table 1.1 below.

Table 1.1: Legislation relating to Hedgerows

Legislation/Policy	Description
Hedgerow Regulations 1997	The Hedgerow Regulations (1997) make provision for the protection of important hedgerows in England and Wales. The regulations affect hedgerows which are 20 m or more in length, or connected at both ends to another hedgerow of any length. They relate to hedgerows which are on, or adjoining land used for the following purposes: agriculture or forestry; the breeding or keeping of horses, ponies or donkeys; common land; village greens; and SSSIs (they do not include hedges that are attached to, or marking the boundaries of a private house). It is an offence to intentionally or recklessly remove or cause or permit another person to remove a hedgerow or intentionally or recklessly remove, or cause or permit another person to remove, a hedgerow which is the subject of a hedgerow retention notice.
The Wildlife and Countryside Act 1981 (as amended)	The Wildlife and Countryside Act 1981 (as amended) is the principal mechanism for the legislative protection of wildlife in Great Britain. This legislation is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and (partially) the Birds Directive and the Habitats Directive are implemented in the UK. The Countryside and Rights of Way Act 2000 has strengthened this legal protection (see below).
Convention on Biological Diversity and the Countryside and Rights of Way Act 2000	The Countryside and Rights of Way Act 2000 provides a statutory framework for biodiversity conservation. The Act places a duty on Government Departments and the National Assembly for Wales to have regard for the conservation of biodiversity and maintain lists of species and habitats for which conservation steps should be taken or promoted, in accordance with the Convention on

Legislation/Policy	Description
	Biological Diversity. Schedule 9 of the Act amends SSSI provisions of the Wildlife and Countryside Act 1981, including provisions to change SSSIs and providing increased powers for their protection and management. The provisions extend powers for entering into management agreements; place a duty on public bodies to further the conservation and enhancement of SSSIs; increases penalties on conviction where the provisions are breached; and introduce a new offence whereby third parties can be convicted for damaging SSSIs. Schedule 12 of the Act amends the species provisions of the Wildlife and Countryside Act 1981, strengthening the legal protection for threatened species. The provisions make certain offences 'arrestable' and create a new offence of reckless disturbance. The UK Biodiversity Action Plan (BAP) was published in 1994, and was the UK Government's response to the Convention on Biological Diversity (CBD), which the UK signed up to in 1992. It provides the framework for fulfilling the UK's responsibilities towards the Convention on Biological Diversity. Conservation of biodiversity (the variety of life on earth) is an essential element of sustainable development.
Environment (Wales) Act 2016	The Environment (Wales) Act puts in place the legislation needed to plan and manage Wales' natural resources in a more proactive, sustainable and joined-up way. Part 1 relates to the sustainable management of natural resources. This ensures that the way in which the use of and the impacts on natural resources do not result in long term decline. The aim is to sustainably manage natural resources in a way and rate that meets the needs of present and current generations without compromising the needs of future generations. The Act also contains at Section 7, a duty for the Welsh Ministers to prepare and publish a list of the living organisms and types of habitat which in their opinion are of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales.

1.3.2 This is a brief summary of the legislation and is not to be regarded as a definitive legal opinion. When dealing with individual cases, the client is advised to consult the full texts of the relevant legislation and obtain further legal advice.

a) The Hedgerow Regulations 1997

1.3.3 The Hedgerow Regulations 1997 (HM Government, 1997) provide a series of comprehensive assessments to identify 'Important' hedgerows. To qualify as 'Important' under the Regulations, the hedgerow must comply with the following list of criteria:

- It must have a continuous length of or exceeding 20 m;
- Has a continuous length of less than 20 m, but meets another hedgerow (by intersection or junction) at each end; and
- It must be more than 30 years old.

1.3.4 In addition to the above criteria, to be deemed 'Important', a hedgerow must meet one or more of the following criteria:

i. Archaeological

- Marks a pre-1850 parish or township boundary;
- Incorporates an archaeological feature;
- Is part of or is associated with an archaeological site;
- Marks the boundary of, or is associated with, a pre-1600 estate or manor; or
- Forms an integral part of the a pre-Parliamentary enclosure field system.

ii. Ecological

- Contains certain categories of species of birds, animals or plants listed in the Wildlife and Countryside Act 1981 (as amended) or Joint Nature Conservation Committee publications (JNCC);
- Includes:
  - at least seven woody species; on average, in a 30 m length; or
  - at least six woody species; on average, in a 30 m length and has at least three associated features (see list below); or
  - at least six woody species, on average, in a 30 m length, including a black poplar; large-leaved lime, small-leaved lime or wild service tree; or
  - at least five woody species, on average, in a 30 m length and has at least four of the associated features listed below;
  - at least 4 woody species, on average, in a 30 m length; is adjacent to a bridleway, footpath, road used a public path, or a byway open to all traffic and includes and has at least two or more of the associated features listed below.

Associated Features

- A bank or wall for at least half the length of the hedgerow;
- Less than 10% gaps;
- On average, at least one standard tree per 50 m of hedgerow;
- A ditch for at least half the length of the hedgerow;
- At least three woodland species from a list of 57 woodland plants (as defined in Schedule 2 of the Regulations) within 1 m of the hedgerow;

- Connections scoring four or more points, where connection with a hedgerow counts as one, a broad-leaved woodland or pond counts as two;
- A parallel hedgerow within 15 m.

1.3.5 The hedgerow surveys conducted as described in this report only assess hedgerows present with the Project Site against the Ecological Criteria as listed above. Archaeology Criteria of Hedgerow Regulations 1997, 'Important Hedgerows' have not been considered.

1.4 Hedgerow Removal

1.4.1 If under the Hedgerow Regulations 1997 the hedgerow is not 'Important', the Local Planning Authority (LPA) cannot refuse permission to remove the hedgerow. If the hedgerow is 'Important', the LPA will decide if the circumstances justify removal of an 'Important' hedgerow. Unless satisfied that removal is justified, the LPA must refuse permission and issue a hedgerow retention licence.

1.4.2 However, under The Hedgerow Regulations 1997, the removal of any hedgerow to which the Regulations apply is permitted if it is required for carrying out development for which planning permission has been granted. Therefore, it may not be necessary to have to seek permission specifically to remove the hedgerow.

1.5 Quality Assurance

1.5.1 This survey and subsequent report was undertaken in line with AECOM's Integrated Management System (IMS). Our IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the international standards BS EN ISO 9001:2015 and 14001:2004 and BS OHSAS 18001:2007. In addition, our IMS requires careful selection and monitoring of the performance of all sub-consultants and contractors.

1.5.2 All AECOM Ecologists who worked on this project are members of (at the appropriate level) the Chartered Institute of Ecology and Environmental Management (CIEEM) and follow their code of professional conduct (CIEEM, 2017) when undertaking ecological work.

1.6 Hedgerow Survey Methodology

a) Initial Scope Assessment

1.6.1 The scope of the hedgerow survey work was informed by the PEA which was conducted in 2017 (ES Appendix 8.1). Field boundaries were mapped in accordance with the JNCC (2010) Phase 1 habitat codes; including the mapping of boundaries as species rich or species poor; defunct and intact hedgerows (with or without trees).

b) Field Survey

1.6.2 Hedgerows which were located within the Project Site were surveyed in April 2018.

1.6.3 Hedgerow surveys were undertaken paying due regard to the methodology as outlined in the Hedgerow Survey Handbook (Defra, 2007). A set of parameters were recorded for each hedgerow covering hedgerow type, connections, characteristics (length, height, width), shape, associated features, integrity, trees, non-native species, woody species, ground flora species and hedgerow management.

1.6.4 As per the Hedgerow Regulation 1997, where lengths of hedgerows were between 100 m and 200 m two 30 m sections were surveyed and the totals of the woody and woodland ground flora plants were averaged.

1.6.5 The field survey collated information to assess the Ecological Criteria of the Hedgerow Regulations 1997. A photograph of each hedgerow surveyed was taken and the extent of the hedgerow was marked onto field survey plans.

c) Hedgerow Assessment – Ecological Criteria

1.6.6 The ecological data gained during the field survey was assessed against the Ecological Criteria of the Hedgerow Regulations 1997 to ascertain which of the hedgerows could be classified as ‘Important’.

d) Archaeological Desk Study – Archaeological Criteria

1.6.7 No assessment of the archaeological importance of the hedgerows was made as part of this Important hedgerow assessment.

1.7 Survey Limitations

1.7.1 Whilst the hedgerow survey was not undertaken at the most optimal time of the year (optimal survey period is May and June), all woody species and associated features were easily identifiable and due to some early season warm weather the woodland ground flora was present at the time of survey.

1.7.2 It was not possible to access the land in which Hedgerow C was located. As such the survey was conducted from a gateway next to the hedgerow to the south using binoculars. It was not possible to record the woodland ground flora; however, the hedgerow supported a sufficient number of woody species to classify it as an ‘Important’ hedgerow without relying on the woodland ground flora.

1.7.3 There are deemed to be no significant limitations to the hedgerow survey.

1.8 Hedgerow Survey Results

1.8.1 Figure 1 shows the hedgerows within the Project Site that were subject to hedgerow surveys and whether they are 'Important' or not 'Important' under Ecological Criteria (Hedgerow Regulations, 1997).

1.8.2 A total of three hedgerows were present within the Project Site and were subject to survey. Two were classed as 'Important' and the full results are given in Table 1.2.

Table 1.2 Hedgerow Survey Results

Hedge ID	Summary of Woody Species Recorded within 30 m section	Total/Average Number of Woody Species	Summary of Woodland Species Recorded within 30 m section	Total/Average Number of Woodland Species	Additional Ecological Qualifiers – Associated Features PROW = Public Right of Way	Ecological Justification in accordance with The Hedgerow Regulations, 1997	'Important' Hedgerow?
A	Section 1 Hazel, rose, rowan, oak, beech, holly. Section 2 Holly, hazel, elder, oak, rose, birch, willow, rowan, guelder rose.	7.5	Section 1 Wood sorrel, blubell, broadbuckler fern, enchanter's nightshade. Section 2 Broadbuckler fern, herb robert, enchanter's nightshde, hard fern, wood avens.	4.5	Gaps<10%; Hedge bank	At least 7 woody species, 2 associated features	Yes
B	Section 1 Rose, willow, elder, blackthorn, hazel, ash, hawthorn, rowan. Section 2 Hawthorn, blackthorn, holly, oak.	6	Section 1 Bluebell. Section 2 Broad-buckler fern.	1	Standard tree/50 m; Hedge bank.	At least 6 woody species, 2 associated features	No
C	Holly, gorse, willow, hazel, elder, oak, hawthorn.	7	Not able to access to assess.	Not possible to assess.	Standard tree/50 m; Ditch; Hedge bank.	At least 7 woody species, 2 associated features	Yes

1.9 Hedgerow Survey Conclusions

1.9.1 Three hedgerows were present within the Project Site and were scoped in for requiring an Important hedgerow survey during the PEA. Three hedgerows were assessed under Ecological Criteria (Hedgerow Regulations, 1997).

1.9.2 Two of the three hedgerows within the Project Site fulfil the Ecological Criteria for being 'Important' under the Hedgerow Regulations (1997).

1.10 Potential Effects

1.10.1 'Important' hedgerows will be partially removed. Hedgerow A will be severed to facilitate the construction of a Gas Connection and Hedgerow B will be partially removed to facilitate the widening of a section of the Access Road.

1.11 Recommendations

1.11.1 If planning permission is granted then the hedgerows classified as 'Important' can be removed without further permission (Hedgerows A and C, as shown on Figure 1).

1.11.2 New species rich hedgerow planting is proposed as well as reinstatement of any hedgerow removed during construction of the Project. Further details are provided in the Outline Landscape and Ecology Mitigation Strategy (ES Appendix 3.4).

1.11.3 Indicative typical species will include the following:

- *Acer campestre* (field maple);
- *Corylus avellana* (hazel);
- *Crataegus monogyna* (hawthorn);
- *Rosa canina* (dog rose);
- *Viburnum opulus* (guelder rose);
- *Prunus spinosa* (blackthorn);
- *Sorbus aucuparia* (rowan);
- *Ilex aquifolium* (holly); and,
- *Lonicera periclymenum* (honeysuckle).

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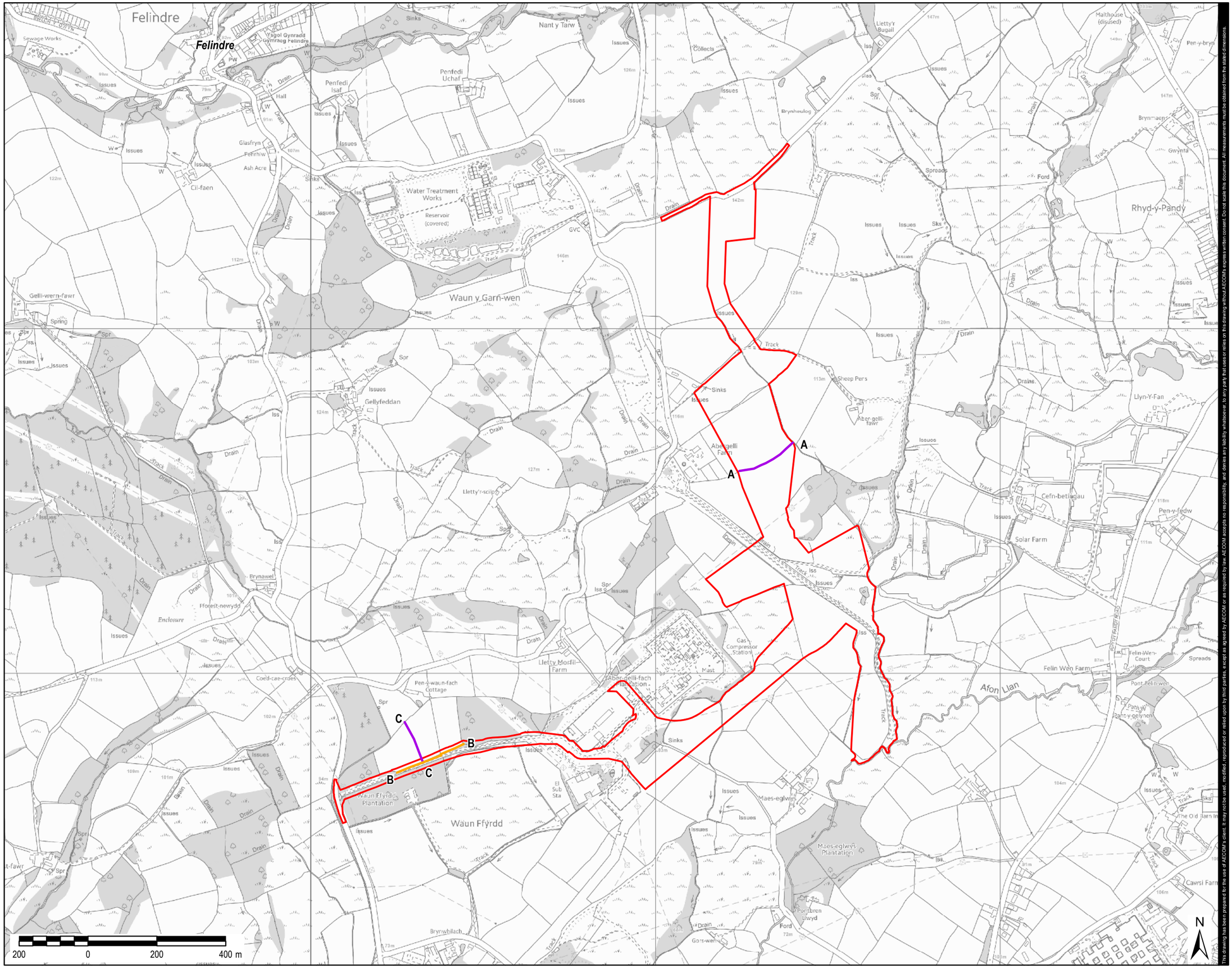
Figure 1 Hedgerow Survey Locations and Results



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Project Site Boundary

Hedge Importance

- Important
- Not-Important

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Appendix 4.1

Flood Consequence Assessment



Abergelli Power Project

Flood Consequence Assessment

Abergelli Power Limited

May 2018

Quality information

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Revision History

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1. Executive Summary

1.1.1 This report presents the findings of a Flood Consequence Assessment (FCA) undertaken by AECOM Limited on behalf of Abergelli Power Limited. This FCA has been prepared to inform and support the Development Consent Order (DCO) application for a new Open Cycle Gas Turbine (OCGT) peaking power generating station, Electrical Connection and Gas Connection north of Swansea, Wales.

1.1.2 The Project will be located within the largely undeveloped rural site approximately 3km to the north of the city of Swansea, approximately 1 km southeast of Felindre and to the east of the existing Felindre Compressor Gas Station. The Project Site extends to approximately 30.8 hectares (ha).

1.1.3 The Project Site is located within the Afon Llan catchment and is bounded and crossed by a series of small watercourses/drainage ditches which are fed by issues and springs throughout the catchment. All watercourses discharge into the Afon Llan at the southern reaches perimeter of the Project Site. The Afon Llan links with the Afon Lliw and the River Loughor, which discharges into Carmarthen Bay.

1.1.4 This FCA has been prepared following consultation with Natural Resources Wales (NRW) and City and Council of Swansea (CCS) and conforms to the requirements of *'Technical Advice Note 15 (TAN15): Development and Flood Risk'* (July 2004) and the Welsh Government's accompanying Development Advice Maps (DAMs). NRW fluvial and surface water flood maps have been used to inform the assessment of flood risk.

1.1.5 The Project is considered 'Highly Vulnerable' under the development criteria in TAN15. A review of the DAMs shows that a small area of the Generating Equipment Site is located within DAM Zone B. A small area at the southern boundary of the Project Site is within DAM Zone C2 however no building, development or construction activities are proposed within this area. The majority of the Project Site is located within DAM Zone A and is considered acceptable for development.

1.1.6 TAN15 requires that all potential flood sources that could affect the developable areas of the Project Site be considered. An initial assessment of flood risk to and from the Project Site from all sources shows:

- There is no risk of tidal flooding;
- The risk of fluvial flooding is considered to be negligible from Afon Llan and low from ordinary watercourses/land drainage to small areas of the Generating Equipment Site and Access Road;
- The risk of surface water flooding is considered to be medium to high for small areas of the Generating Equipment Site, Access Road and Gas Connection however the majority of the site is considered to be at low risk;
- The risk of sewer flooding is considered to be negligible;
- The risk of groundwater flooding is considered to be low; and
- There is no risk of flooding from artificial sources.

1.1.7 TAN15 requires taking into account the potential impact of climate change over the lifetime of the development to ensure a safe and secure living and/or working environment. Following consultation with CCS it was agreed that a 1% Annual Exceedance Probability (AEP) +20% Climate Change allowance was used to assess the flood attenuation requirements.

1.1.8 It was identified the main flood risk to the Project Site is from surface water runoff and fluvial flooding from ordinary watercourse in small areas of the Generating Equipment Site. Therefore an Outline Drainage Strategy (Appendix E) has been prepared to manage surface water at the Project Site and flood mitigation measures have been proposed to reduce flood risk to and from the Project Site.

1.1.9 During construction works a Construction Environment Management Plan (CEMP) will incorporate measures to prevent an increase in flooding. It is expected that this will include new temporary and/or permanent drainage ditches, silt traps, settlement lagoons and monitoring of flow routes along the eastern perimeter of the Project Site.

1.1.10 During operation flood mitigation measures have been proposed that include raised ground and finished floor levels, permanent cut off ditches, maintenance of overland flow routes across the whole Project Site and particularly at the eastern extent of the Generating Equipment Site, an easement to the existing Welsh Water Water Main that traverses the Generating Equipment Site, suitably sized culverts beneath the Access Road and safe access and egress routes for all site workers.

1.1.11 The Outline Drainage Strategy (Appendix E) outlines the implementation of SuDS methods including swales and attenuation storage to manage surface water on and off the Project Site. Prior to a Ground Investigation it is assumed that the possibility of infiltration will be limited. Therefore to mitigate the increase in impermeable area due to the Project, flood attenuation storage areas for the Generating Equipment Site, Access Road Maintenance Compound and Above Ground Installation (AGI) are proposed to attenuate and release surface water to local watercourses at the existing greenfield runoff rates up to and including the 1% AEP + 20% Climate Change event.

1.1.12 The Project may have some impact on flood flows and flood storage associated with the local watercourse at the south eastern extent of the Generating Equipment Site where raising of ground levels are proposed. The impact on flood storage and conveyance will be mitigated by the formalisation of an overland flow route along the eastern extent of the Generating Equipment Site. With the formalisation of the overland flow path it is anticipated that, combined with the steep catchment, any loss of storage and impact on conveyance will be minimal. Minor changes to the flood routes within the rural area are not considered to increase flood risk to third parties.

1.1.13 Through implementation of mitigation measures outlined in this document and in the outline drainage design it is considered by AECOM that this development is acceptable under TAN15 guidance.

2. Introduction

2.1 Background

2.1.1 This report presents the findings of a Flood Consequence Assessment (FCA) undertaken by AECOM Limited on behalf of Abergelli Power Limited. This FCA has been prepared to inform and support the Development Consent Order (DCO) application for a new Open Cycle Gas Turbine (OCGT) peaking power generating station, Electrical Connection and Gas Connection north of Swansea, Wales.

2.2 The Project

2.2.1 The Project comprises an OCGT peaking power generating station, fuelled by natural gas and capable of providing a rated electrical output of up to 299 Megawatts (MW), a new Access Road to the Generating Equipment Site, a new Gas Connection to bring natural gas to the Generating Equipment site from the National Transmission System and a new Electrical Connection to export power from the Generating Equipment to the National Grid Electricity Transmission System (NETS).

2.2.2 The Project will be located within the largely undeveloped rural site approximately 3 km to the north of Swansea (Appendix A, Figure A1) and will extend across an area of approximately 30.8 hectares (ha).

2.3 The Purpose and Structure of this Document

2.3.1 According to TAN 15[1], highly vulnerable development (i.e. a power station) is not permitted within Development Advice Map (DAM) Zone C2 (Section 5). They are, however, acceptable in DAM Zone A and DAM Zone B where fluvial / tidal flooding is considered to be less of an issue. In the Section 42 consultation response, NRW requested that an FCA was undertaken. This was to assess the potential flood consequences associated with the Afon Llan and ordinary watercourses to and from the Project. A FCA has therefore been undertaken to determine the risks of flooding that could result from the Project and subsequent appropriate flood risk mitigation measures required.

2.3.2 The aim of the FCA is to assess flood consequences to and from the Project. Where appropriate, mitigation measures have been identified to manage flood consequences in line with planning guidance in order to support the DCO application for elements of the Project. In order to meet this aim the following scope of the FCA was undertaken:

- Collection and review of existing flood risk data including topographic data, surface water drainage, Natural Resources Wales information (Appendix C), development plans and CCS Flood Risk Management Plan;
- Assessment and interpretation of available information to identify potential sources of flood risk including groundwater, surface water and infrastructure failure; and,
- Review of the Project design in light of the identified flood risks and identification of measures, where necessary, that would manage any residual flood risk to the Project Site to acceptable levels.

[1] Welsh Government. Technical Advice Note 15: Development and Flood Risk. 2004.

2.4 Data sources/References

2.4.1 The baseline conditions for the Project Site have been established through a desk study and via consultation with NRW and CCS. This consultation is outlined in more detail within Chapter 9: Water Resources of the PEIR. This information has been utilised to inform the assessment made within the FCA. The data collected during the course of this assessment is described in Table 2.1

Table 2-1: Received Data

Purpose	Data Description	Comments
Identification of hydrological features	1:25,000 Ordnance Survey (OS) mapping	Identified the position of the Project Site with respect to local hydrological features
Identification of existing flood risk	2m LiDAR topographic survey of the Project Site	Provides existing site and surrounding levels as a Digital Terrain Map (DTM)
	NRW DAM	Identifies areas suitable for development with respect to existing flood risk
	NRW Indicative Flood Zone Map	Identifies fluvial/tidal inundation extents and historical flooding
	NRW Updated Flood Map for Surface Water (UFMfSW)	Identifies existing surface water flood risk and overland flow routes
	CCS Strategic Flood Consequence Assessment (SFCA)	
	CCS Preliminary Flood Risk Assessment (PFRA)	Assess the flood risk across the Project Site. Includes flood risk from fluvial/tidal sources, sewers overland flow and groundwater
	Swansea Flood Risk Management Plan	
	CCS Local Flood Risk Management Strategy	
	Consultation with CCS	Historical flood records, flood risk from ordinary watercourses and overland flow and requirements for work near and on ordinary watercourses
	Consultation with NRW	Historical flood records, modelled flood water levels and associated data for the Afon Llan
	British Geological Survey records (internet)	Provides details of geology and hydrogeology in the vicinity of the Project Site.
	Utility Plan including Dŵr Cymru	Identifies flood risk from artificial

	Welsh Water Water Main	sources
Identification of historical flooding	CCS SFCA CCS PRFA	Gives details of historical flooding
Details of the Project	Draft Engineering Concept Design and layout drawings	Provides layout of the Project
Surface water drainage	OS Mapping SFCA	Identifies existing site drainage, public drainage systems near the Project Site and details of existing surface water runoff from the Project Site
	Outline Drainage Strategy for the Project Site (2017)	Conceptual drainage strategy outlining surface water will be managed at the Project Site

2.5 Site Visit and Consultation

2.5.1 A site visit was undertaken on 8th November 2017 to assess the local topography and local drainage network. Observations made during this site visit have been used to inform this FCA.

2.5.2 Consultation with respect to the requirements of this FCA has been undertaken with the following key stakeholders between September and November 2017:

- NRW; and
- CCS

2.5.3 Consultation with Dŵr Cymru Welsh Water was undertaken in 2014 during the scoping process. Further consultation is expected during the DCO consultation process during 2018. Information provided by Dŵr Cymru Welsh Water regarding the capacity of the Water Main through the Project Site is considered to be current and up to date as no major upgrade has taken place within the intervening period. In addition, further investigations are ongoing to determine the location and depth of the Water Main and these will be provided in the DCO Application. However these investigations are not expected to influence the conclusion of the FCA.

3. Project Site and Surrounding Area

3.1 Existing Site

3.1.1 The Project Site (red outline in Figure A1, Appendix A) is located on predominately open agricultural land approximately 2 km north of Junction 46 on the M4, approximately 3 km to the north of Swansea, approximately 1km southeast of Felindre and 1.4 km north of Llangyfelach

3.1.2 The Project Site area is approximately 30.8 ha (Figure A2, Appendix A).

3.2 Topography

3.2.1 Ground levels at the Project Site vary from approximately 146 m AOD at the highest point in the north-west corner at Rhyd-y-pandy Road to approximately 80 m AOD along the southern perimeter, with ground levels generally falling in a southerly and south easterly direction. The land within the Generating Equipment Site is at approximately 90 m AOD (Figure B1, Appendix B).

3.2.2 The Felindre Gas Compressor Station located to the north of the new section of the Access Road is built upon raised ground at a level of approximately 87 m AOD. This is between 5-8 m above the ordinary watercourse to the south.

3.3 Local Water Features

3.3.1 Figure B2 (Appendix B) shows the main local water features in the vicinity of the Project Site. A more detailed description of the local drainage network within each area of the Project Site can be found in Figure B3 Appendix B.

3.3.2 The Project Site is bound and crossed by a series of small watercourses/drainage ditches which are fed by issues and springs throughout the catchment. All watercourses discharge into the Afon Llan at the southern perimeter of the Project Site. The Afon Llan links with the Afon Lliw and the River Loughor, which discharges into Carmarthen Bay.

Main River

3.3.3 The Afon Llan flows in a south westerly direction along the southern perimeter of the Project Site. This watercourse is designated Main River and falls under the jurisdiction of NRW. Observations from the site visit show that the watercourse is approximately 4-5 m wide at the top of bank and 0.8-1.0 m deep from channel bottom to top of bank along the southern boundary of the Project Site. The water depth of the Afon Llan on the day of the site was estimated to be approximately 0.3 m deep.

3.3.4 The Afon Llan floodplain consists of arable and pasture fields. The Generating Equipment Site is located approximately 300 m to the north of the watercourse and approximately 6 m above the bank level of Afon Llan.

Ordinary Watercourses

3.3.5 A series of ordinary watercourses drain into the Afon Llan at the southern perimeter of the Project Site. An ordinary watercourse is a watercourse that is not designated as 'Main River' and can include rivers, streams, ditches, drains cuts, culverts, dikes sluices, sewers through which water passes. The largest of the ordinary watercourses flows in a southerly direction (Figure B3, Appendix B) along the east perimeter of the Project Site (Stream A). Observations made during the November 2017 site visit estimate that Stream A has a channel width of approximately 1.5-2.0 m at the top of bank and is approximately 1.0 m high from the channel bed to top of bank. A water depth of approximately 0.3 m was observed on the site visit.

3.3.6 Stream A has a relatively steep gradient from the north east of the Generating Equipment Site down to the Afon Llan floodplain as it falls from approximately 89 m AOD to 76 m AOD across 620 m (gradient of approximately 1 in 50) which is considered to be relatively steep for a watercourse.

3.3.7 A second ordinary watercourse (Stream B) flows south-westerly along the eastern boundary of the Felindre Gas Compressor Station and crosses the proposed Access Road before entering the Afon Llan approximately 0.9 km to the south west (Figure B3, Appendix B). This watercourse has been diverted along existing field boundaries and site observations estimate the channel to be 1.5 m wide at the top of bank and 0.4-0.5 m high from the channel bed to the top of bank. A water depth of 0.3 m in Stream B was observed during the site visit.

Land Drains and Drainage Ditches

3.3.8 A number of land drains and small drainage ditches cross the Project Site and outfall to the local watercourse network and eventually the Afon Llan. These primarily follow existing field boundaries and trackways and are generally ephemeral in nature.

3.3.9 A drainage ditch passes through the centre of the proposed Generating Equipment Site (Stream C) and outfalls into Stream A to the south east (Figure B2, Appendix B). This drains a small catchment area (approximately 0.1 km^2) to the north of the Generating Equipment Site and during the site visit a water depth of 0.1 m was observed in the ditch.

3.3.10 A second drainage ditch flows across the proposed path of the Gas Connection to the north of the Generating Equipment Site (Steam D) and outfalls in to Stream A to the south east (Figure B2, Appendix B). The drainage ditch has been diverted and is approximately 1 m wide at the top of bank and 0.3 m high from the channel bed to top of bank. A very low flow was observed during the site visit with most of the flow coming from a small leaking waterpipe servicing the surrounding fields. The watercourse flows away from Abegelli Farm and Abergelli Solar Farm at the location of the proposed Gas Connection crossing.

Ponds and Other Sources

3.3.11 Two heavily vegetated ponds are located within the Generating Equipment Site. As a result of restricted access and high groundwater table, in the area the extent of these ponds could not be verified.

3.3.12 The Afon Lliw and Lower Lliw Reservoir are located approximately 2.1 km to the north of the Generating Equipment Site within a neighbouring topographic catchment. As such neither reservoir is considered to be a flood risk to the Project Site and they are therefore not considered further in this report.

3.3.13 A series of surface water outfalls were noted from the Felindre Gas Compressor Station that flow into the aforementioned ordinary watercourse (Stream B).

Existing Flood Defence Structures

3.3.14 There are no flood defence structures within the vicinity of the Project Site.

3.4 Geology and Soil

3.4.1 A review of the British Geological Survey (BGS) online mapping[2] data indicates that the Project Site is underlain by bedrock of the Grovesend Formation, comprising mudstone, siltstone and sandstone (Figure B4, Appendix B). Superficial deposits across the Project Site are quite variable however the Generating Equipment Site is predominately underlain by Peat with the surrounding site comprising of mainly Till and Glaciofluvial sand and gravel deposits (Figure B5, Appendix B). No ground investigations to date have been undertaken to verify the depth of these superficial deposits.

3.4.2 The superficial glaciofluvial deposits and the bedrock geology are both classified as Secondary A Aquifers. Secondary A Aquifers are defined as '*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers*.'

3.4.3 The superficial glacial till deposits are classed as Unproductive Strata, defined as 'rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow'.

3.4.4 The Landmark Envirocheck report (2017)[3] has identified no groundwater abstraction licences associated with the Project Site. There is only one licence located within 100 m of the Project Site boundary, recorded 56 m to the north-east for a well at Abergelli Farm, licence number 22/59/4/0027 dated February 1993, for general farming and domestic use.

3.4.5 A review of the Cranfield University/National Soil Resources Institute Soilscapes website[4] has found that that there are two main soil types across the Project Site which indicates the following:

- The Generating Equipment Site and the AGI compound are characterised by slowly permeable soils with a peaty surface and are considered to have impeded drainage; and
- The rest of the Project Site is characterised by freely draining loamy soils.

[2] • BGS (British Geological Survey), Geology of Britain Viewer (1974). Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html. Accessed November 2017
[3] Landmark Information Group Envirocheck Report (reference 142844199_1_1 dated 13 October 2017).
[4] http://www.landis.org.uk/soilscapes/ - Accessed November 2017

3.4.6 Observations made during the site visit in November 2017 support the slow permeability of the Generating Equipment Site where ponding of surface water was observed throughout. This would support the inference that there is limited potential for infiltration of surface water within the area.

3.5 Surrounding Area

General

3.5.1 The area surrounding the Project Site is, at present, predominantly rural in character, although there is Felindre Park and Share facility to the south and a substantial amount of utility infrastructure in the area, some of which crosses the Project Site (see Figure B6, Appendix B). Most notable is the Water Water Main that traverses the site from the north west to south east (Section 3.5.3) and electricity pylons associated with the Substation.

3.5.2 Other features of the area include public footpaths, bridleways and tracks located in and around the Project Site, linking it to the wider area.

Felindre Water Treatment Works

3.5.3 The Felindre Water Treatment Works is situated approximately 1.4 km to the north west of the Generating Equipment Site. A 1.68 m diameter Water Main flows in a south easterly direction through the Generating Equipment Site, generally following the line of the existing farm trackway (Figure B6, Appendix B). The pipeline is owned by Welsh Water who has advised that typically a 30 m easement (15 m either side of the pipeline) is required to be kept clear of construction. A 60 m easement has been shown on the layout due to uncertainty over the accuracy and digitisation of the archive drawings (Appendix C, C1,C2 and C3). Further investigations into the location and depth of the Water Main are ongoing.

Felindre Gas Compressor Station

3.5.4 The Access Road is bound to the north by the Felindre Gas Compressor Station and is approximately 400 m to the west of the Generating Equipment Site. The main site is at an elevation of approximately 87 m AOD and lies 5-8m above the fields to the south.

3.5.5 During the site visit it was observed that number of small cut-off ditches drain the perimeter of the Felindre Gas Compressor Station and outfall in to the drainage network to the south.

Solar Farm

3.5.6 Cefn Betingau Solar Park and Abergelli Solar Farm are located to the east of Project Site. A further two Solar Farms are located in the vicinity at Rhyd-y-pandy and Abergelli Farm.

4. The Project

4.1 The Project

4.1.1 The Project comprises a OCGT peaking power generating station, fuelled by natural gas and capable of providing a rated electrical output of up to 299 Megawatts (MW), a new Access Road to the Generating Equipment Site, a new Gas Connection to bring natural gas to the Generating Equipment site from the National Transmission System and a new Electrical Connection to export power from the Generating Equipment to the National Grid Electricity Transmission System (NETS).

4.1.2 Figure C1 in Appendix C shows an overview of the key areas within the Project Site. A detailed view of each element can be found within Figure C2 in Appendix C.

4.1.3 The Project consists of the following elements:

- **Power Generation Plant:** An Open Cycle Gas Turbine (OCGT) peaking power generating station, fuelled by natural gas and capable of providing a rated electrical output of up to 299 Megawatts (MW). The Power Generation Plant comprises:
- **Generating equipment** including one Gas Turbine Generator with one exhaust gas flue stack and Balance of Plant (BOP) (together referred to as the 'Generating Equipment') which are located within the 'Generating Equipment Site';
- An **Access Road** to the Generating Equipment Site from the B4489 which lies to the west, formed by upgrading an existing access road between the B4489 junction and the Swansea North Substation (the Substation) and constructing a new section of access road from the Substation to the Generating Equipment Site; and
- A temporary construction compound for the storage of materials, plant and equipment as well as containing site accommodation and welfare facilities, temporary car parking and temporary fencing (the **Laydown Area**). There will be two Laydown areas and a small area within the southern Laydown Area will be retained permanently for the **Maintenance Compound**.
- **Ecological Mitigation Area** – area for potential reptile translocation and ecological enhancement.
- Permanent parking and drainage to include: a site foul, oily water and surface water drainage system.
- The **Gas Connection** will be in the form of a new above ground installation (AGI) and underground gas pipeline connection (the Pipeline). This is to bring natural gas to the Generating Equipment from the National Transmission System. The Pipeline will follow an approximate north-south route corridor, between the National Transmission System south of Rhyd-y-pandy Road and the Generating Equipment Site.
- **Electrical Connection:** This is an underground electrical cable to export power from the Generating Equipment to the National Grid Electricity Transmission System (NETS). The proposed route of the Electrical Connection will be alongside the Access Road.

4.1.4 The Project has a current design and operational life of 25 years. During this period, on-going assessment of the condition of the electricity market and energy mix would be undertaken to assess whether to 're-power' or decommission.

5. Policy Context

5.1 National Policy

5.1.1 Overarching National Policy Statement for Energy (NPS EN-1)

5.1.2 According to the policy[5], an assessment of the existing baseline conditions regarding water quality, water resources and physical characteristics of the water environment is required where a proposed project is likely to have effects on the water environment.

5.1.3 The NPS EN – 1 also sets the requirement for additional pollution control measures that must be considered for all activities that discharge to the water environment and recommends that the Secretary of State (SoS) gives increased weight in its decision making to impacts on the water environment that would have an adverse effect on the achievement of the objectives of the WFD.

5.1.4 National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (NPS EN – 4)

5.1.5 The NPS EN-4[6] Part 2 Section 2.22.2 recognises that "constructing pipelines creates corridors of surface clearance and excavation that can potentially affect watercourses, aquifers, water abstraction and discharge points, areas prone to flooding and ecological receptors. Pipeline impacts could include inadequate or excessive drainage, interference with groundwater flow pathways, mobilisation of contaminants already in the ground, the introduction of new pollutants, flooding, disturbance to water ecology, pollution due to silt from construction / demolition and disturbance to species and their habitats".

5.1.6 The NPS EN-4 states that where the project is likely to have effects on water resources or water quality, an assessment of the impacts should be provided in line with Section 5.15 of EN-1. The SoS should be satisfied that the impacts on water quality and resources are acceptable in accordance with Section 5.15 of EN-1.

National Policy Statement for Electricity Networks Infrastructure (NPS EN-5)

5.1.7 NPS EN-5 requires consideration of adaption to climate change particularly from the increased risk of flooding to the resilience of some of the sites infrastructure and should be covered in the FCA.

Planning Policy Wales 2016

5.1.8 Planning Policy Wales 2016 is supplemented by TAN15 and incorporates sustainable development into the planning system which can be adhered to. It requires every local planning authority to have produced a Local Development Plan (LDP) superseding the Unitary Development Plan (UDP).

[5] Department of Energy & Climate Change. Overarching National Policy Statements for Eenergy infrastructure. London: The Stationery Office,(EN-1) July 2011.
[6] Department of Energy and Climate Change. National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4). July 2011.

TAN15 (2004)

5.1.9 TAN15 provides guidance which supplements the policy set out in Planning Policy Wales (PPW)[7] in relation to development and flooding. A precautionary framework is set out which advises caution in respect of new development in areas at high risk of flooding and this is used as a guide for planning decisions. The overall aim of the precautionary framework is to direct new development away from those areas that have a high risk of flooding; and development will only be justified in these areas if it meets the criteria and tests specified in this guidance.

5.1.10 TAN15 also requires provision for future changes in flood risk are considered. Therefore the predicted future impacts of climate change should be accounted for within the FCA where they can be anticipated.

5.1.11 The operation of the precautionary framework is governed by DAMs made up of three zones (Table 5-1) which are used to trigger the appropriate planning test and definitions of vulnerable developments. The DAMs are based on the best available information considered adequate to determine when flood risk needs to be taken into consideration with future development.

Table 5-1: Flood Zone Designations *(source: TAN 15)*

Flood Zone	Definition	Use within the precautionary framework
A	Little or no risk of fluvial/ tidal flooding	Justification test is not applied and do not need to consider further
B	Areas known to have flooded historically evidenced by sedimentary deposits.	Used as part of the precautionary approach to indicate where site levels should be checked against the extreme (0.1% annual probability) flood. No need to consider flood risks further if site levels are greater than the extreme flood level
C	Based on NRW extreme flood outline (0.1% annual probability)	Indicates that flooding issues should be considered as an integral part of the decision making by the application of the justification test, including FCA
C1	Areas of Zone C which are developed and served by significant infrastructure, including flood defences	Indicates that development can take place subject to the application of the justification test, including acceptability of consequences
C2	Areas of Zone C without significant flood defence infrastructure	Indicates that only 'less vulnerable' development should be considered, subject to the application of the justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered.

5.1.12 The precautionary framework identifies the vulnerability of different land uses to flooding, and classifies proposed uses accordingly as detailed in Table 5-2. This is because certain flooding consequences may not be acceptable for particular development types

[7] Welsh Government (2016) Planning Policy Wales, Edition 9 (November, 2016);

Table 5-2: Development Categories *(source: TAN 15)*

Development Category	Use within the precautionary framework
Emergency Services	Hospitals, ambulance stations, fire stations, police stations, coastguard stations, command centres, emergency depots and buildings used to provide emergency shelter in time of flood.
High vulnerable development	All residential premises (including hotels and caravan parks), public buildings (e.g. schools, libraries, leisure centres), especially vulnerable industrial development (e.g. power stations, chemical plants, incinerators), and waste disposal sites.
Less vulnerable development	General industrial, employment, commercial and retail development, transport and utilities infrastructure, car parks, mineral extraction sites and associated processing facilities, excluding waste disposal sites.

5.1.13 Table 5-2 highlights that a power station development is classified as 'Highly Vulnerable'; Project Site is located within DAM Zone C2, Zone B and Zone A (Appendix D, D1).

5.1.14 According to TAN15 new development should be directed away from Zone C and towards more suitable land in Zone A, otherwise to Zone B, where river or tidal flooding will be less of an issue. In Zone C there are a number of tests that need to be applied for certain types of development, however highly vulnerable development (i.e. power generation) and Emergency Services should not be permitted in Zone C2. All other development should only be permitted within Zones C1 and C2 if determined by the planning authority to be justified in that location, satisfying the tests within the TAN 15 document.

5.1.15 As shown in Figure D1, Appendix D, there is a small area on the southern perimeter of the Project Site that lies within DAM Zone C2, and therefore is not suitable for highly vulnerable development. No development is proposed in this area.

5.1.16 A small portion of the south eastern corner of the Generating Equipment Site is located within DAM Zone B and the majority of the site is within DAM Zone A, which under TAN15 is considered appropriate for 'highly vulnerable' development as long as all sources of flood risk have been considered. This FCA addresses these risks with mitigation proposed where necessary.

5.2 Regional Policy

5.2.1 Western Wales River Basin Management Plan (RBMP) 2015

5.2.2 The purpose of the RBMP is to protect and improve the water environment in the Western Wales River Basin District (RBD). The plan includes; classification of water bodies; summary of Programme of Measures to achieve statutory objectives and statutory objectives for water bodies

5.3 Local Policy

5.3.1 Swansea City Council Unitary Development Plan (UDP) 2008

5.3.2 The CCS UDP was adopted on 10th November 2008 and it is stated on the CCS website that this is the most up to date Development Plan covering the authorities' administrative area and is used in the determination of planning applications.

5.3.3 Policy EV35: Surface water run-off, and Policy EV36: Development and Flood Risk, are the relevant policies in CCS Unitary Development Plan. Policy EV35 affects developments that will lead to additional surface water run-off or cause a reduction of the quality of surface water run-off, and encourages SuDS implementation wherever practical to counteract this. Policy EV36 only allows new development within flood risk areas if developers can justify the location by proving the flooding consequences associated with the development are acceptable. Until the adoption of the Local Development Plan this is considered the most up to date Development Plan covering the authorities' administrative area.

5.3.4 Swansea City Council Local Development Plan 2017

5.3.5 The Project Site is located entirely within the CCS and so must comply with local planning policy and strategy.

5.3.6 The council submitted the Swansea Local Development Plan 2010-2025 (the LDP) to the Ministers of the Welsh Government for independent examination on 28 July 2017. The Plan '*provides a clear planning framework to address key issues facing the County, providing certainty and the basis for efficient planning decisions. Its policies and proposals will enable the delivery of sustainable development, and ensure that social, economic, environmental and cultural well-being goals are all suitably balanced in the decision making process so that the right development occurs in the right place*'

5.3.7 The LDP adopts a sustainable approach to flood risk by avoiding vulnerable development occurring within flood hazard areas. Policy RP4 Avoidance of Flood Risk states that development will not be permitted if it causes an increase to flooding on or off site.

5.4 Evidence Base

5.4.1 Strategic Flood Consequence Assessment

5.4.2 CCS developed a Level 1 Strategic Flood Consequence Assessment (SFCA)[8] in 2010 that provides an overview of flood risk from all sources and provides developers and other interested parties with guidance on flood risk and issues associated with flooding.

5.4.3 The Level 1 SCFA does not identify any historic flooding within the vicinity of the Project Site or highlight any specific flood risk to the Project Site.

5.4.4 CCS developed a Level 2 SFCA[9] in 2012 that provides a more detailed appraisal of flood risk to Local Development Plan Candidate Sites to assess their suitability.

5.4.5 The Felindre area, located to the west of the Project Site, is highlighted for Mixed Used Major Development and includes six land parcels for development consideration. The Project Site is located to the east of these land parcels and should be considered within context of this development.

[8] Scott Wilson. City & County of Swansea Council – Stage 1 Strategic Flood Consequence Assessment. 2010
[9] URS. City and County of Swansea – Strategic Flood Consequence Assessment stage 2. Plymouth, 2012

Local Flood Risk Management Strategy

5.4.6 In 2013, CCS developed a Local Flood Risk Management Strategy (LFRMS)[10], this document highlights the responsibilities of CCS as Lead Local Flood Authority (LLFA) with respect to flooding from surface water, ordinary watercourses and groundwater. This report also outlines the strategy objectives of CCS to manage flood risk.

Flood Risk Management Plan 2015

5.4.7 CCS developed a Flood Risk Management Plan (FRMP)11 which provides an overview of the flood risk in Swansea and detailed objectives for reducing flood risk in community areas which have been identified as being at significant flood risk.

5.4.8 The Project Site is situated within the Mawr Community and is not located within a Flood Risk Area as described within the FRMP. Borough wide measures from the CCS Flood Risk Management Strategy apply and there are no specific requirements for the Project Site.

[10] City and County of Swansea Local Flood Risk Management Strategy.2013 Available online: http://www.swansea.gov.uk/floodstrategy
[11] City and County of Swansea. Flood Risk Management Plan 2015. Swansea, 2015

6. Sources of Flooding and Flood Risk

6.1 Overview

6.1.1 TAN15 requires that all potential flood sources that could affect the Project be considered. This chapter primarily focuses on the fluvial and surface water flood risk posed to the Project Site location, but also considers the flood risk posed to the Project Site from other sources.

6.2 Tidal

6.2.1 Tidal flood sources include both the sea and estuaries. The assessment of tidal flood risk takes into account the sites distance from the Severn Estuary (approximately 9 km) and minimum ground levels on site (approximately 75 m AOD). This assessment identifies that there is no tidal flood risk posed to the Project and is therefore not considered further within this FCA.

6.3 Fluvial

6.3.1 The Project Site is bound by Afon Llan (Main River) to the south and an unnamed watercourse (Stream A) to the east. A series of small watercourses and land drains cross the Project Site (Stream B and Stream C) with a number of issues and sinks present within the vicinity of the Project Site.

Main River

6.3.2 The NRW DAM Maps[12] (See Figure D1, Appendix D) identify that the majority of the Project Site is located within DAM Zone A (little or no risk of fluvial flooding) whilst a small proportion of the Generating Equipment Site is located within DAM Zone B (areas known to have flooded historically evidenced by sedimentary deposits). A small area of the southern portion of the Project Site is located within DAM Zone C2 (Areas of Zone C without significant flood defence infrastructure) and is associated with the Afon Llan floodplain. This part of the Project Site is a proposed water compatible Ecological Mitigation Area (Figure C1, Appendix C) and is therefore not considered to be affected by or impact upon the floodplain.

6.3.3 A review of the NRW Fluvial Flood Map (Figure D2, Appendix D) indicates that the area south of the Generating Equipment Site is located within Flood Zone 3 (the extent of a flood from rivers with a 1% (1 in 100) chance or greater of happening in any given year) and coincides with the DAM Zone C2 extent. The majority of the Project Site is located within Flood Zone 1 with negligible risk of flooding from rivers (Figure D2, Appendix D).

6.3.4 The CCS Level 1 SCFA and Level 2 SFCA indicate that there has been no recorded historical fluvial flooding within the Project Site or within 1km of the Project Site. Further consultation with NRW and CCS shows that there has been no recorded flooding from fluvial sources on or near the Project Site since the production of the SFCAs.

6.3.5 Modelled river levels for the Project Site and surrounding area were requested from NRW, however it was stated that a “1D Steady State HECRAS catchment wide model created in 2007. This model is well out of date and the results would not be suitable for use in an FCA”.

[12] Lle Geo-Portal. Development Advice Map. 2017. (Online) Available from: http://lle.gov.wales/map#m=-3.159,51.47832,8&b=europa&l=328h;329h;330; (Accessed November 2017)

6.3.6 In the absence of suitable modelled flood levels, a review of the existing LiDAR data shows that the Generating Equipment Site is elevated at its lowest point to approximately 6 m above the flood plain of Afon Llan and located approximately 300 m from the current Flood Zone 3 extent. In conclusion, it is considered that there is negligible fluvial flood risk to the Project from Afon Llan due to the distance from the flood plain and the higher elevation of the site and the floodplain.

Local Ordinary Watercourses and Land Drains

6.3.7 Section 3.3 provides a summary of the local ordinary watercourses and drainage ditches. Ordinary watercourses fall under the jurisdiction of CCS and land drainage is the responsibility of the riparian owner.

6.3.8 CCS has confirmed that there are no recorded historical flooding events from ordinary watercourses within the vicinity of the Project Site primarily due to the rural nature and size of the local watercourse network.

6.3.9 The ordinary watercourses and land drains flowing through the Project Site are not included within the NRW DAM or Flood Maps. There are no modelled flood water levels for any of the identified ordinary watercourses or drainage ditches. However, given the steep topography, relatively small channel dimensions and ephemeral nature of some of the drainage ditches it has been assumed that the risk of fluvial flooding is low, with ditches only holding water in higher return period storm events or when the groundwater level are raised.

6.3.10 In the absence of modelled flood levels for ordinary watercourses, a review of the NRW Updated Flood Map for Surface Water (UFMfSW) was undertaken. This dataset provides a high level assessment of flood risk from surface water and provides an indication of primary overland flow paths and likely locations of ponding. This therefore provides a coarse indication of the direction of out of bank flood flow routes.

6.3.11 The UFMfSW shows that there are two main overland flow routes passing across the Project Site from the high ground in the north to the Afon Llan in the south (Figure D3, Appendix D). The mapping indicates that the part of the Generating Equipment Site, located within DAM Zone B, lies at the confluence of several local watercourses and drains and may be at risk of flooding should the watercourse overtop in the 3.3% AEP event. However, given the size of watercourse observed during the site visit, steepness of the catchment and size of the floodplain downstream it is considered that the risk of fluvial flooding from ordinary watercourse is low.

6.3.12 It is likely that the greatest fluvial flood risk to the Project Site will be during the construction phase when there will be the culverting/bridging of Stream C (Access Road) and diversion of Stream B (Generating Equipment Site) and Stream D (Gas Connection). Flood risk mitigation measures to reduce this risk will be outlined within the CEMP and are discussed in Section 8.2.

6.3.13 The AGI area is not located near any watercourses and therefore the risk of flooding from fluvial sources is negligible.

6.3.14 The Pipeline and Electrical Connection, once constructed, will be underground and not at risk of flooding from fluvial sources.

6.3.15 In conclusion, it is considered that there is negligible flood risk to the Project from Afon Llan due to the distance from the modelled flood plain and the difference in elevation of the Project Site and the floodplain. Flood risk from ordinary watercourse is considered to be low given the size of watercourse observed during the site visit, steepness of the catchment and size of the receiving floodplain downstream.

6.4 Overland Flow

6.4.1 Overland flow results from rainfall that fails to infiltrate the surface. This is exacerbated where the permeability of the ground is low due to the type of soil and geology (such as clayey soils) or urban development. Surface water flow may also occur in areas where steep topography can rapidly convey water that has failed to penetrate the surface or where the ground may already be saturated.

6.4.2 It has been identified in Section 3.4 that part of the Project Site and surrounding area is characterised by low permeable soils. It is likely therefore that rainfall during extreme events will be unable to effectively infiltrate into the ground and convey overland flow towards the Afon Llan.

6.4.3 CCS holds no records of surface water flooding within the vicinity of the Project Site.

6.4.4 A review of the UFMfSW indicates that the land adjacent to the local drains and watercourses, predominately Stream A (Generating Equipment Site) and Stream B (Access Road), have areas that are at a high risk of surface water flooding (3.3% AEP). The majority of the Project Site is considered to be at very low risk ((0.1% AEP) for Surface Water). Figure D3, Appendix D shows the key flow paths across the Project Site.

6.4.5 As described in Section 3.2 the Project Site is reasonably steep, sloping in a south easterly and southerly direction towards the Afon Llan floodplain. It is expected that overland flow from the upland areas of the Project Site would follow this natural topography away from the Project Site with only very localised ponding. The existing trackway to the west of the Generating Equipment Site conveys water to the south east away from the Project Site through minor land drains.

6.4.6 Flood risk from surface water is likely to be greatest during construction when the temporary diversion of overland flow routes is required for the construction of the Access Road and Gas Connection and permanent diversion of Stream B for the Generating Equipment Site. Flood mitigation measures are outlined in Section 8.2.

6.4.7 It is concluded that based on the UFMfSW small sections of the Generating Equipment Site, Access Road and Gas Connection are at a medium to high risk of flooding from overland flow. However the majority of the Project Site is considered to be at low risk of flooding from overland flow.

6.5 Sewer Flooding

6.5.1 Flooding can occur as a result of infrastructure failure, e.g. blocked sewers or failed pumping stations. Sewer flooding can occur when the system surcharges due to the volume or intensity of rainfall exceeding the capacity of the sewer, or if the system becomes blocked by debris or sediment.

6.5.2 The Project Site is located within an undeveloped area where there is limited known sewerage infrastructure. Flood risk from sewer sources is considered very low and therefore not considered further in this FCA.

6.6 Groundwater

6.6.1 Groundwater flooding occurs where groundwater levels rise above ground surface levels. The geology has a major influence on where this type of flooding takes place; it is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

6.6.2 The CCS PFRA, Level 1 and Level 2 SFCA's state there are no recorded flood events from groundwater sources within the CCS region. The FRMP indicates that there is a low risk of groundwater flooding across the CCS region.

6.6.3 A review of the BGS Area susceptible to groundwater flooding map within the Landmark Envirocheck Report (2017) indicates the lower areas of the Project Site and Generating Equipment Site are considered to have potential for groundwater flooding at the surface. Observations made during the site visit indicate that the water table was high within the Generating Equipment Site.

6.6.4 Due to the steep local topography at the Project Site, it is likely that any groundwater reaching the surface would be conveyed to the south east away from the Generating Equipment Site. This was observed during the site visit, as small issues were conveyed in ruts and drainage ditches along the trackway at the west of the Generating Equipment Site. Therefore by maintaining any existing flow paths during construction and operation the risk of ponding will be limited.

6.6.5 Based upon the evidence, there is potential for groundwater flooding at the surface however given the local topography and proposed ground levels above the groundwater flood risk is considered to be low.

6.7 Artificial Sources

6.7.1 Artificial sources include flood risk from sources such as storage areas and reservoirs.

6.7.2 The Afon Lliw and Lower Lliw reservoir are located approximately 2 km to the north of the Project Site within a neighbouring topographic catchment. A review of the NRW Reservoir Flood Risk Map shows that there is no risk of flooding from a breach to the reservoirs and as such is not considered further within this FCA.

6.8 Summary

6.8.1 In summary the following flood risk for the Project Site:

- There is no risk of tidal flooding;
- The risk of fluvial flooding is considered to be negligible from Afon Llan and low from ordinary watercourses/land drainage to small areas of the Generating Equipment Site and Access Road;
- The risk of surface water flooding is considered to be medium to high for small areas of the Generating Equipment Site, Access Road and Gas Connection however the majority of the Project Site is considered to be at low risk;
- The risk of sewer flooding is considered to be negligible;
- The risk of groundwater flooding is considered to be low; and
- There is no risk of flooding from artificial sources.

7. Climate Change

7.1 General

7.1.1 TAN15 requires that it is necessary to take account of the potential impact of climate change over the lifetime of the development to ensure a safe and secure living and/or working environment.

7.1.2 Welsh Government published updated climate change guidance in December 2016[13] . The guidance indicates that climate change is likely to have an impact on river flows, sea levels, rainfall intensity, wave height and wind speed.

7.1.3 Details of the methods and justifications for calculating the projected climate change allowances can be found on the Welsh Government website and will not be replicated in this document.

7.2 Peak River Flows

7.2.1 The peak river flow allowances show the anticipated changes to peak flow by river basin district. The Project Site is located within the West Wales river basin district and Table 7-1 shows the peak river flow allowances.

Table 7-1: Climate change allowances for the West Wales River Basin District[14]

West Wales	Total potential change anticipated by 2020s	Total potential change anticipated by 2050s	Total potential change anticipated by 2080s
Upper end estimate	25%	40%	75%
Change factor/central estimate	15%	25%	30%
Lower end estimate	5%	10%	15%

7.2.2 The lifetime of the development is considered to be a minimum of 25 years and through correspondence with NRW it is agreed that the Central estimate for the Total potential change anticipated by the 2050's (25%) can be used in this assessment. The period described as the 2050's is not defined within the Welsh Government Climate Change Guidance (2016). However, within the Environment Agency Climate Change Allowances[15] (2016) it is stated for the Dee and Severn River Basin Districts that the period, 2050's, is defined as 2040-2069. Therefore this assessment is considered representative for a design life up to 2069.

[13] Welsh Government. CL-03-16 - Climate change allowances for Planning purposes. Cardiff 2016,
[14] Adapted from Table 1 Welsh Government. Guidance for Flood Consequence Assessments – Climate Change Allowances. Cardiff 2016,
[15] Environment Agency , Flood risk assessments: climate change allowances. London 2016

7.3 Peak Rainfall Intensity

7.3.1 Increased rainfall affects river levels, land and drainage systems. Table 7-2 shows the anticipated changes in extreme rainfall intensity in small and urban catchments based upon English guidelines. At the time of writing no specific Welsh Government guidance was available and so this is considered the most up to date peak rainfall allowances.

Table 7-2: Peak rainfall intensity allowance[16]

Climate Change Allowance Band	Total potential change anticipated by 2020s	Total potential change anticipated by 2050s	Total potential change anticipated by 2080s
Upper Central	10%	20%	40%
Central	5%	10%	20%

7.3.2 It was agreed through correspondence with CCS and NRW that the Upper Central estimate for the Total potential change factor anticipated by 2050's should be used in this assessment. As described in Section 7.2.2 this assessment is considered representative for a design life up to 2069.

7.4 Impact of Climate Change on Flooding Sources

Fluvial

7.4.1 The effect of climate change on peak river flow and consequently on flood levels within Afon Llan is unlikely to increase the flood risk from fluvial sources to the Project Site given the present distance and elevation distance from the watercourse.

Overland Flow

7.4.2 Climate change must be taken into account when considering surface water runoff generated by the development site. The increase in rainfall intensity will result in increased surface water runoff rates and volumes. Therefore the drainage systems associated with the development must be designed to accommodate the climate change allowances in compliance with TAN15.

7.4.3 To accommodate increased surface water volumes peak runoff from the development will be attenuated up to and including the 1% + 20% Climate Change AEP event using onsite storage. All cut off ditches and culverts will be designed to a similar standard to ensure no increased flood risk to the Project Site from overland flow. Section 8.3 and Appendix E outline how surface runoff will be managed on the Project Site.

[16] Adapted from Table 2 Environment Agency. Flood risk assessments: climate change allowances. 2016. Available from https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Groundwater

7.4.4 The predicted increase in wetness of winters and the intensity of storm events as a result of climate change could impact the groundwater level fluctuations at the Project Site and possibly increase the fluctuations of the groundwater table. This may therefore increase the likelihood of groundwater emergence and the potential for groundwater flooding to impact the development.

7.4.5 Once constructed, the Project will be largely covered by hard standing, which reduces infiltration and the likelihood of localised groundwater flooding reaching the surface. Cut off trenches along the northern and western perimeter of the Project Site will intercept any overland flow as a result of increased ground water levels and discharge in to the attenuation storage and local watercourse.

7.4.6 It is therefore anticipated that the risk from groundwater sources will remain low and not increase significantly as a result of climate change.

8. Flood Risk Management Measures

8.1 General

8.1.1 It has been demonstrated within Section 6 that the main flood risk to the Project Site is from surface water runoff and fluvial flooding from ordinary watercourse during construction operation and decommissioning, which therefore forms the basis for this assessment. This chapter identifies the flood risk management measures required to mitigate against the flood risk which has been identified in accordance with TAN15 requirements.

8.2 Flood Risk Management Measures

8.2.1 An Outline Drainage Strategy (Appendix E) has been prepared to manage surface water flood risk to and from the Project Site and is provided within Appendix E. The surface water drainage system proposed adopts the principles within The SuDS Manual – CIRIA 753[17] and industry best practice and is describe further in Section 8.3.

8.2.2 The following key measures to mitigate flood risk to the Project Site during construction will be implemented to reduce flood risk to the Project Site:

Construction

8.2.3 Construction activities associated with the Project intercept a number of overland flow routes as discussed in Section 6.4 which is most notable at the Access Road, Generating Equipment Site and Gas Connection. Given that the highest flood risk for the Project is from surface water and/or ordinary watercourse flooding mitigation measures are focussed on managing and mitigating risks to the temporary works as well as not increasing flood risk off site.

8.2.4 During construction, pollution prevention guidelines will be followed by the contractor.

8.2.5 The proposed works involve new crossings, diversions and temporary diversions of local watercourses. Any proposed works to the watercourses require Land Drainage Consent from CCS and must be granted before any works can take place. Diversion and crossing of local watercourses have been kept to a minimum within the Project design.

8.2.6 A Construction Environmental Management Plan (CEMP) will incorporate measures to prevent an increase in flooding during construction works. It is expected that the CEMP will include provisions such as:

- New temporary and/or permanent drainage ditches to prevent uncontrolled surface runoff of contaminated water;
- Silt traps within drainage ditches to reduce the flow of suspended solids from the Project Site;
- Settlement lagoons and/or proprietary settlement tanks as required to reduce the flow of suspended solids from site;
- Suitable layout of the construction site and application of suitable management techniques to prevent runoff from stockpiles directly ion to the watercourse; and
- Monitoring of overland flow routes along the eastern extent of the Generating Equipment Site to ensure minimal impedance of flow routes.

[17] CIRIA. The SuDS Manual (C753). London 2015

Operation

8.2.7 To ensure the ongoing operation of the Project, an Outline Drainage Strategy has been prepared (Section 8.3) to manage foul, oily and surface water from the Project Site and flood risk mitigation measures have been proposed.

8.2.8 The following measures will be implemented to ensure the operation of the Project is protected:

Raised Ground and Finished Floor Levels

8.2.9 Ground levels across the Generating Equipment Site will be raised to provide three platform terraces for the development. Indicative proposed site levels are provided within Figures C3 and Figure C4, Appendix C, which demonstrate that the Generating Equipment will be at a proposed level of 89.3 m AOD and 86.8 m AOD whilst the attenuation storage area terrace will be at a proposed elevation of 84.0 m AOD. The indicative proposed levels are approximately 2 m above higher than the existing south east corner of the Project Site, which is currently at the highest risk of flooding. It is anticipated that the raised levels will be sufficiently resilient to future climate change levels given the steep topography of the site and size of the floodplain.

8.2.10 The north east corner of the Generating Equipment Site will be within a cutting below the existing ground levels. In this area potential overland flow and or watercourse overtopping will be managed by either localised earth mounding and/or a suitably sized cut off ditch (see below).

8.2.11 As an additional measure the finished floor levels In the Generating Equipment Site will be 0.15 m above the site road crown level with plant plinths 0.3 m above the site level. This will reduce the Power Generation Plant vulnerability to flooding.

Cut off ditches/watercourses

8.2.12 To prevent inundation of the Generating Equipment Site from surface runoff down the hillside, cut off drainage ditches will be placed around the uphill Generating Equipment Site perimeter. The location of these cut of ditches are located within Appendix E. These new drainage ditches will be designed to divert surface runoff around the Generating Equipment Site and return downstream back to the original drainage ditches/watercourse. The final design of the cut off ditches will be completed at detailed design however they should be designed to adequately accommodate the 1% + 20% Climate Change AEP flows.

8.2.13 It is proposed the existing watercourse, Stream C, is diverted around the northern and western perimeter of the Generating Equipment Site. The final sizing of the diverted watercourse will be undertaken at the detailed design stage however based upon based on a catchment area of circa 13,100 m^2, pessimistic runoff coefficient of 0.60 and rainfall intensity of 45 mm/hr [based on M100-1hr storm it is estimated that the upper end flows will be approximately 100 l/s. As noted in Section 8.2.10 this may be extended around to the east of the Project Site to protect the cutting platform.

8.2.14 The permanent cut-off ditches require Land Drainage Consent from CCS before construction can take place.

Maintenance of Overland Flow Routes

8.2.15 It has been demonstrated that there is an existing overland flow route that crosses the eastern extent of the Generating Equipment Site which, in areas, is considered to be medium to high risk of flooding. Part of this overland flow route falling on the Generating Equipment Site will be accommodated by the onsite drainage that includes attenuation storage for surface runoff from the Project Site (Section 8.3). However, as there is land raising at the Generating Equipment Site some of this overland flow route will be diverted along the eastern extent of the Project Site. In order to maintain this overland flow path it is proposed that the eastern boundary of the Generating Equipment Site is kept clear and formalised to encourage water downslope and away from the development towards the undeveloped area to the south. This will also provide the easement required by CCS for maintenance access to the watercourse.

Welsh Water - Water Main Easement

8.2.16 The Dŵr Cymru Welsh Water Water Main that crosses the site will have an easement of a minimum of 30 m as required by Welsh Water. The proposed site layout (Appendix C, C1 and C2) indicates that a 60 m easement has been provided due to uncertainty of the accuracy and digitisation of archive drawings. Further investigations are currently being carried out to identify the location and depth of the Water Main prior to detailed design so adequate easement can be provided for.

8.2.17 The ground levels will be maintained within the Water Main easement area. This will provide a flood flow path in the event of a Water Main rupture away from the elevated Generating Equipment Site which should be able to accommodate the understood flows of 1.2-1.7 m^3/s. The combination of the easement, general topographic slope to the south and elevation of Generating Equipment Site Plant means that the flood risk from the unlikely rupture of the Water Main will be negligible.

Access Road Culverts

8.2.18 The Access Road leading west from the Generating Equipment Area crosses a small field drain, Felindre Gas Compressor Station surface water drainage ditch and an ordinary watercourse (Stream B). It is assumed in outline design that a culvert will be used to convey flow beneath the road (Appendix E) to prevent the Access Road from flooding. Whilst this is proposed as a culvert, other techniques such as bridging could be incorporated into the design.

8.2.19 Culvert crossings will be designed to allow for flow up to and including the 1% AEP + 20% Climate Change Allowance to ensure there is no impedance of flow. For more extreme events the overland flow will pass over the road to the south along the natural fall of the topography.

8.2.20 To mitigate against the risk of blockage it is proposed that a twin culvert arrangement and/or trashscreen is implemented which will allow for the continued flow of water beneath the Access Road in the event that one culvert is blocked.

8.2.21 It is noted that Land Drainage Consent must be granted by CCS prior to any works on Ordinary Watercourses.

Safe Access and Egress Route

8.2.22 During flood events it is proposed that suitable access and egress routes are provided the details of which are subject to detailed design. As a minimum, safe pedestrian access/egress routes should be provided and where possible vehicular routes should be accommodated in to the design.

Decommissioning

8.2.23 It is recommended that a detailed Decommissioning Environmental Management Plan will be prepared at a later date to identify required measures to prevent pollution during this phase of the development, based on the detailed decommissioning plan.

8.2.24 The mitigation measures for decommissioning will be similar to those identified for construction.

8.3 Surface Water Management

8.3.1 An Outline Drainage Strategy (Appendix E) has been developed for the Project for the disposal of foul, oily and surface water from the Project to assist with planning and detailed drainage design phases (Appendix E).

8.3.2 The Project will increase the impermeable area at the Project Site through the construction of hard standing and buildings. Without suitable mitigation measures this is likely to increase the surface water runoff rates and volumes that leave the Project Site compared to the existing greenfield conditions. The Outline Drainage Strategy (Appendix E) therefore identifies mitigation measures such as attenuation storage, swales and infiltration strips to manage any increase in surface water runoff as a result of the Project.

8.3.3 An increase in impermeable area is only applicable to the Generating Equipment Site and Maintenance Compound, Access Road and AGI Compound. The Pipeline and Electrical Connection will be below ground and will not increase the impermeable area at the Project Site.

8.3.4 The main elements of the strategy are as follows:

- The Project Site drainage system will be designed to prevent flooding of the Project Site during the 3.33% AEP and maintain greenfield runoff rates off site up to and including the 1% AEP + 20% Climate Change event;
- Where possible, the site will be designed to drain by infiltration;
- Pending a Ground Investigation (at detailed design stage) it is assumed that drainage by infiltration will not be possible and therefore all site surface water runoff will be attenuated up to an including the 1% AEP + 20% Climate Change event and discharged to the local watercourse network at the greenfield runoff rate;
- The Access Road will generally have a constant cross fall and no longitudinal fall. Where possible, roadside swales and infiltration drains will be used to remove and convey any standing water in to the surface water drainage system;
- The AGI area will drain to a small attenuation area and discharge into the nearest local watercourse at the greenfield runoff rate.

8.3.5 It is not proposed to connect existing road drainage systems into the new surface water drainage system. Existing road drainage systems along the access road to the west of the Felindre Gas Compressor Station will be maintained

8.3.6 The surface water drainage design will be subject to detailed design which will be undertaken after granting of the DCO

8.4 Flood Attenuation Storage

8.4.1 Due to local ground conditions and high groundwater it is unlikely that the proposed surface water drainage system will be able to infiltrate into the ground. This will be confirmed by a Ground Investigation prior to detailed design. As such a worst case scenario has been assumed where all surface runoff from the Project Site will be attenuated in order to mimic the equivalent greenfield runoff rates for events up to the 1%AEP +20% Climate Change event.

8.4.2 It is proposed that attenuation storage is required for the Generating Equipment Site, Maintenance Compound, AGI compound and the Access Road. A full explanation of the sizing calculation and location of the attenuation areas is included within the Outline Drainage Strategy in Appendix E.

8.4.3 Table 8.1 demonstrates the preliminary calculated greenfield runoff rates using the IH124 method[18] and required attenuation storage for each area of the Project Site for the 1%+20% Climate Change event. It can be seen that the largest attenuation storage of approximately 2018m^3 is required for the Generating Equipment Site.

[18] Institute of Hydrology. Report No.124 Flood Estimation for small catchments. Wallingford. 1994

Table 8-1: Greenfield Runoff Rates and Attenuation Storage Requirements[19]

Area of Site	Impermeable Area (ha)	Greenfield Runoff Rate (l/s)	Required Attenuation Storage (m3)
Generating Equipment Site	1.976	13.6	2018
Maintenance Compound	0.2708	2.05	304.3
Access Road	0.306	2.31	343.9
AGI Compound	0.27	1.61	109.5

8.4.4 Through the implementation of attenuation storage it is considered that the Project will not increase surface runoff from the Project Site up to and including the 1% AEP + 20% Climate Change event.

[19] Adapted from Tables 4.3-1 to 4.3-4 WSP. Outline Drainage Strategy, Abergelli Power Ltd. Manchester, 2017

9. Off Site Impacts and Residual Risk

9.1 Impact to third party property/land

9.1.1 The flood risk to third parties has been assessed in accordance with TAN15. The following possible flood risk impacts have been identified:

- Loss of ordinary watercourse flood storage at the Project Site;
- Impact on overland flow routes and conveyance;
- Damage of Dŵr Cymru Welsh Water Water Main
- Increase surface runoff (see Section 8);

9.1.2 The area of the Project Site that is located within Afon Llan floodplain will not involve any built development or any land raising. Therefore this will not affect the storage of the Afon Llan floodplain.

9.1.3 The Project may have some impact on flood flows and flood storage associated with the local watercourse at the south eastern extent of the Generating Equipment Site where raising of ground levels are proposed (Figure C3 and C4, Appendix C). The impact on flood storage and conveyance will be mitigated by the formalisation of an overland flow route along the eastern extent of the Generating Equipment Site. This will allow any flow to pass around the site to the south, away from the Cefn Betingau Solar Park and towards the Afon Llan floodplain. Furthermore, the creation of suitably sized cut-off drainage ditches will provide additional storage during large events. With the formalisation of the overland flow path it is anticipated that, combined with the steep catchment, any loss of storage and impact on conveyance will be minimal. Minor changes to the flood routes within the rural area are not considered to increase flood risk to third parties.

9.1.4 During construction of the Gas Connection there may be a temporary diversion of the existing drainage ditch to the north of the Generating Equipment Site. Abergelli Farm House and Abergelli Solar Farm are located at a higher elevation than the watercourse at this location and will therefore not be affected by any temporary diversion.

9.1.5 During construction and operation there is a very low risk that the Dŵr Cymru Welsh Water Water Main could accidentally be damaged causing water to flow across the Project Site. A Ground Penetrating Radar (GPR) survey will be completed in January 2018 to identify the exact location and depth of the Water Main and protective provisions will be employed during both phasesto ensure any works around the Water Main are strictly controlled. Dŵr Cymru Welsh Water require a 30m easement around the Water Main and the proposed design includes a 60m easement. The land naturally drains to the south east between the laydown area and Generating Equipment Site following existing drainage ditches. It is anticipated that the large easement and existing drainage ditch network could adequately convey water towards the south east away from the Project Site and towards the Afon Llan,

9.1.6 The Outline Drainage Strategy (Appendix E) and mitigation measures highlighted in Section 8.2 demonstrate that the impact on increased surface runoff will be negligible.

9.1.7 It has been concluded that there will be negligible impact to third parties from the Project through the implementation of the necessary mitigation measures described in this FCA.

10. Conclusions and Recommendations

10.1.1 Based upon the NRW flood maps, it has been demonstrated in Figure D1, Appendix D that part of the southern extent of the Project Site is located with TAN15 Flood Zone C2 (areas of the floodplain without significant flood defence infrastructure, based on the NRW extreme flood outline, equal to or greater than 0.1% (fluvial or tidal)). As part of the Project design this area will not involve any built development or land raising and will therefore not impact upon the floodplain or be affected by flooding.

10.1.2 Under TAN15 highly vulnerable development (i.e. power stations) must be located out of Flood Zone C2, preferably in Flood Zone A and if this is not possible Flood Zone B. A small area of the Generating Equipment Site is located within Flood Zone B whilst the majority of the Project is located within Flood Zone A (Figure D1, Appendix D). Under TAN15, this is considered acceptable development provided flood risk from all sources has been considered.

10.1.3 To understand the flood risk to the Project Site and impact of the Project to the surrounding area an assessment of all sources of flooding has been undertaken and flood mitigation measures proposed.

10.1.4 Flood risk to the Project was assessed as follows:

- There is no risk of tidal flooding;
- The risk of fluvial flooding is considered to be negligible from Afon Llan and low from ordinary watercourses/land drainage to small areas of the Generating Equipment Site and Access Road;
- The risk of surface water flooding is considered to be medium to high for small areas of the Generating Equipment Site, Access Road and Gas Connection however the majority of the site is considered to be at low risk;
- The risk of sewer flooding is considered to be negligible;
- The risk of groundwater flooding is considered to be low; and,
- The risk of flooding from artificial sources is considered to be negligible.

10.1.5 The most likely flood risk to the Project Site has been identified as surface water flooding and localised ordinary watercourse flooding. Therefore mitigation measures have been included within the Project design to reduce the overall risk of flooding to low.

10.1.6 An Outline Drainage Strategy has been proposed to control surface water runoff from the project site to reduce any of site impact up to and including the 1% AEP +20% Climate Change event. Flood attenuation storage is proposed for all impermeable areas on the Generating Equipment Site, Access Road, Maintenance Compound and AGI.

10.1.7 Through implementation of mitigation measures outlined in this document and in the outline drainage design it is considered that this development is acceptable under TAN15 guidance.

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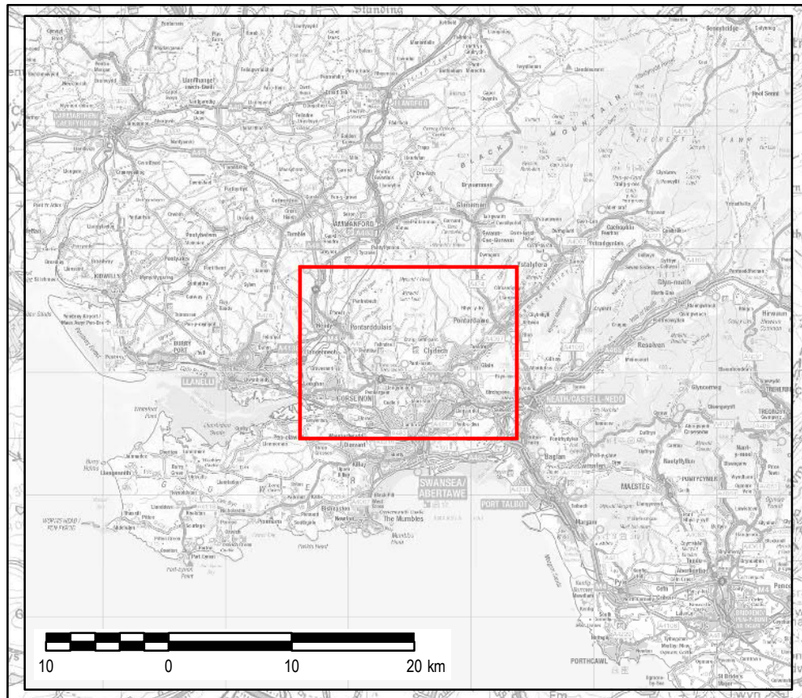
Appendix A – Project Site

A.1 Location Plan



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

Project Site boundary

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APPENDIX A
LOCATION PLAN

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Drawing No:			Rev:
FIGURE A1			001
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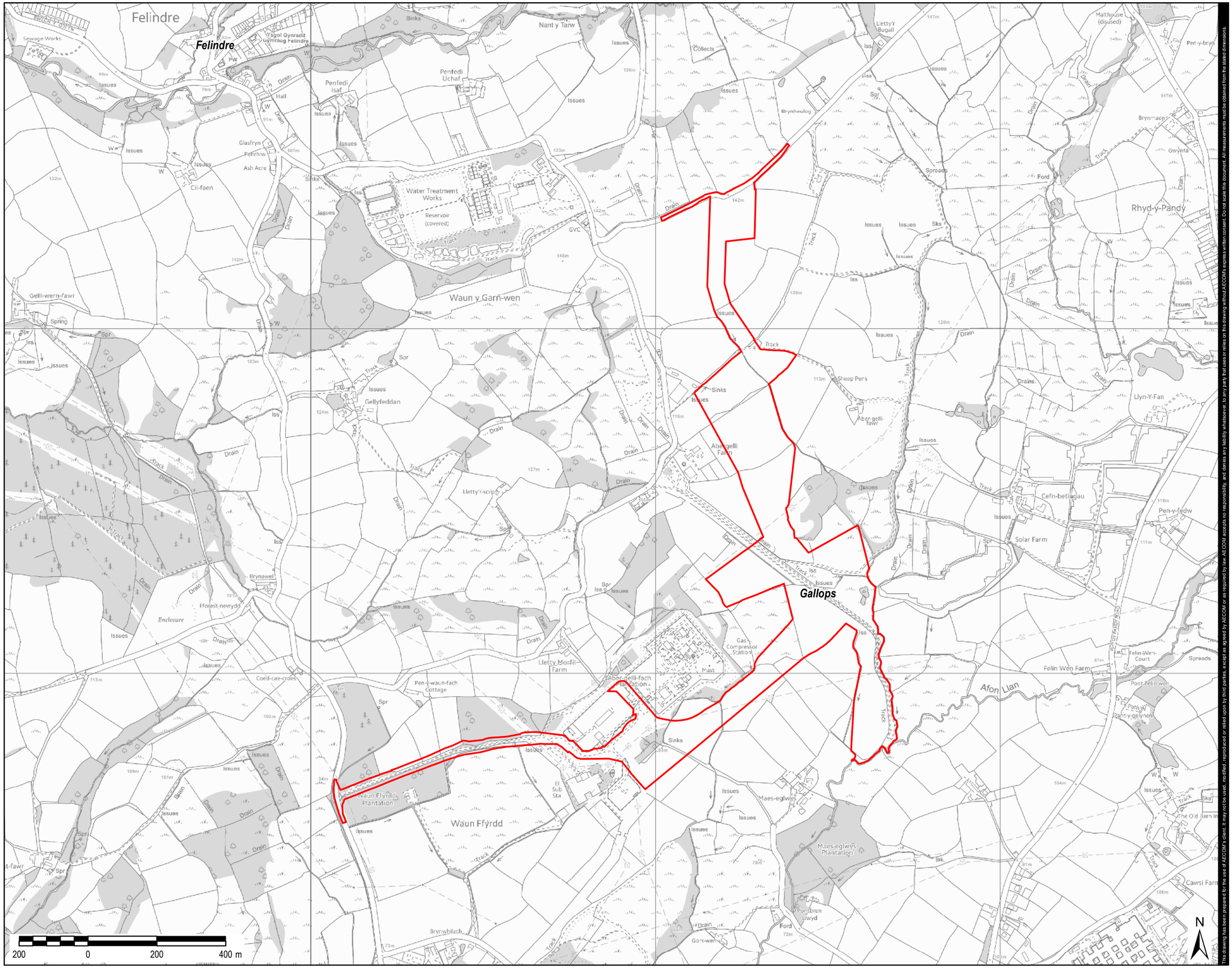
A.2 Project Site



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LEGEND

Project Site boundary

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APPENDIX A
PROJECT SITE

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FIGURE A2			001
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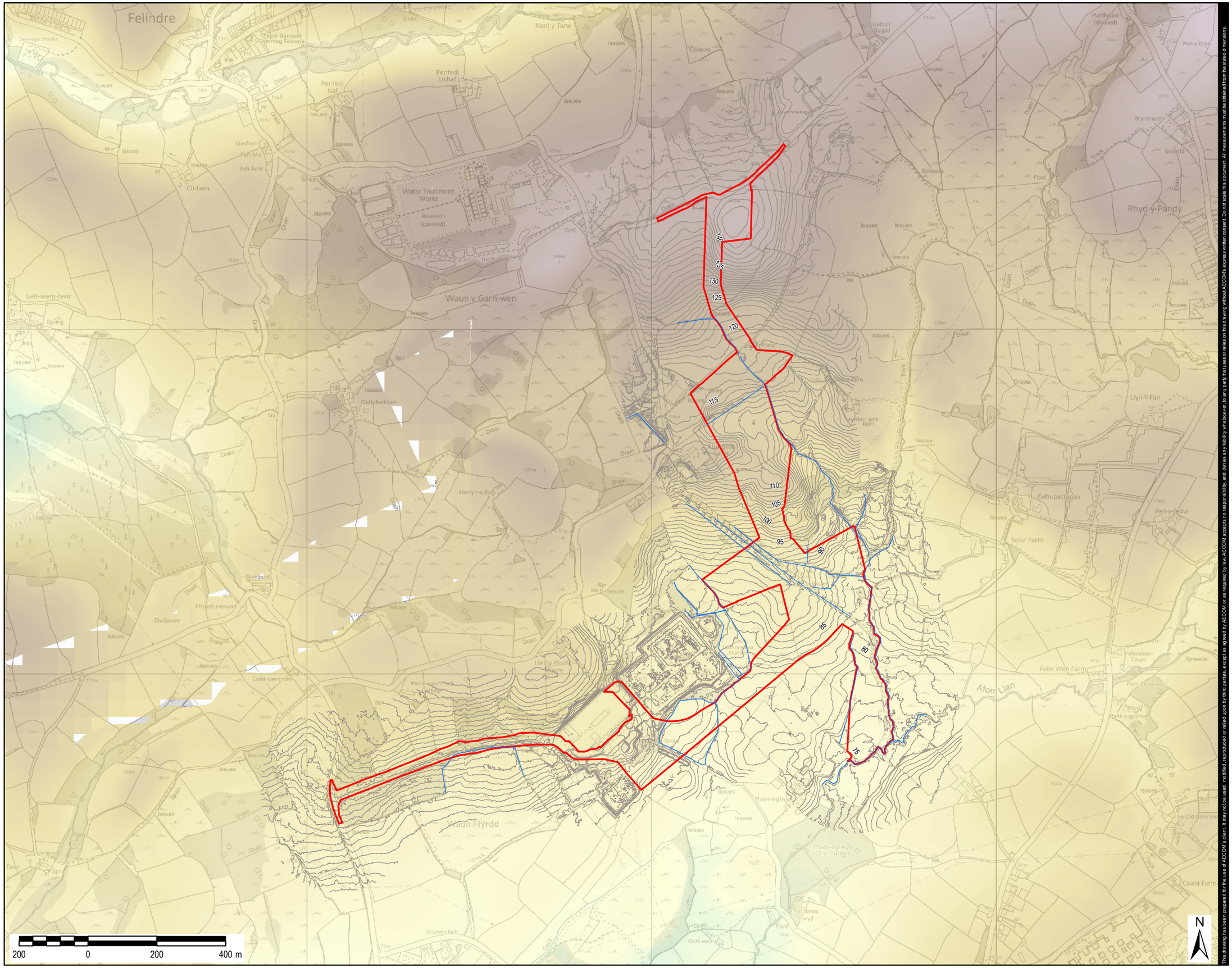
Appendix B – Site and Surrounding Area

B.1 Existing Site Levels



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Project Site boundary
- 1m Contour
- Watercourses

Topography

- 191m AOD
- 161m AOD
- 131m AOD
- 101m AOD
- 71m AOD
- 42m AOD

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APPENDIX B
EXISTING SITE LEVELS

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FIGURE B1			001
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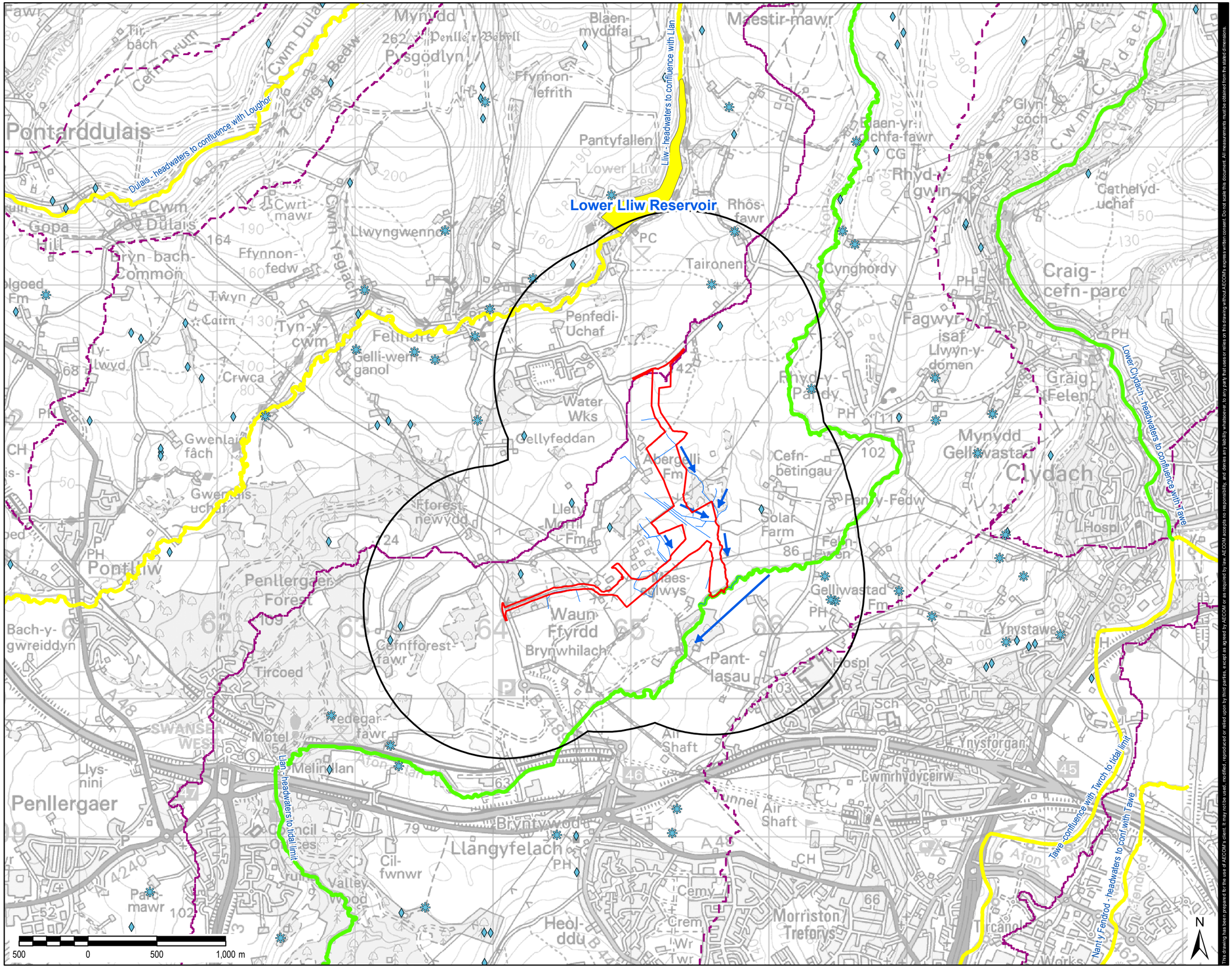
B.2 Surface Water Bodies



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Project Site Boundary
- 1 km Buffer
- Wells
- Springs
- Surface Water

WFD Lakes

- Moderate

WFD Rivers

- Good
- Moderate
- WFD SW Catchments

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APPENDIX B
SURFACEWATER BODIES

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B.3 Local Watercourses

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ABERGELLI POWER PROJECT

Client:

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A Drax Group company

LEGEND

- Project Site Boundary
- Generating Equipment SIte
- Above Ground Installation
- Access Road
- Electrical Connection (400kV Cable)
- Gas Connection
- Laydown Area
- Maintenance Compound
- Watercourses

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APPENDIX B
LOCAL WATERCOURSES

Scale at A3: 1:8,000

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FIGURE B3			005
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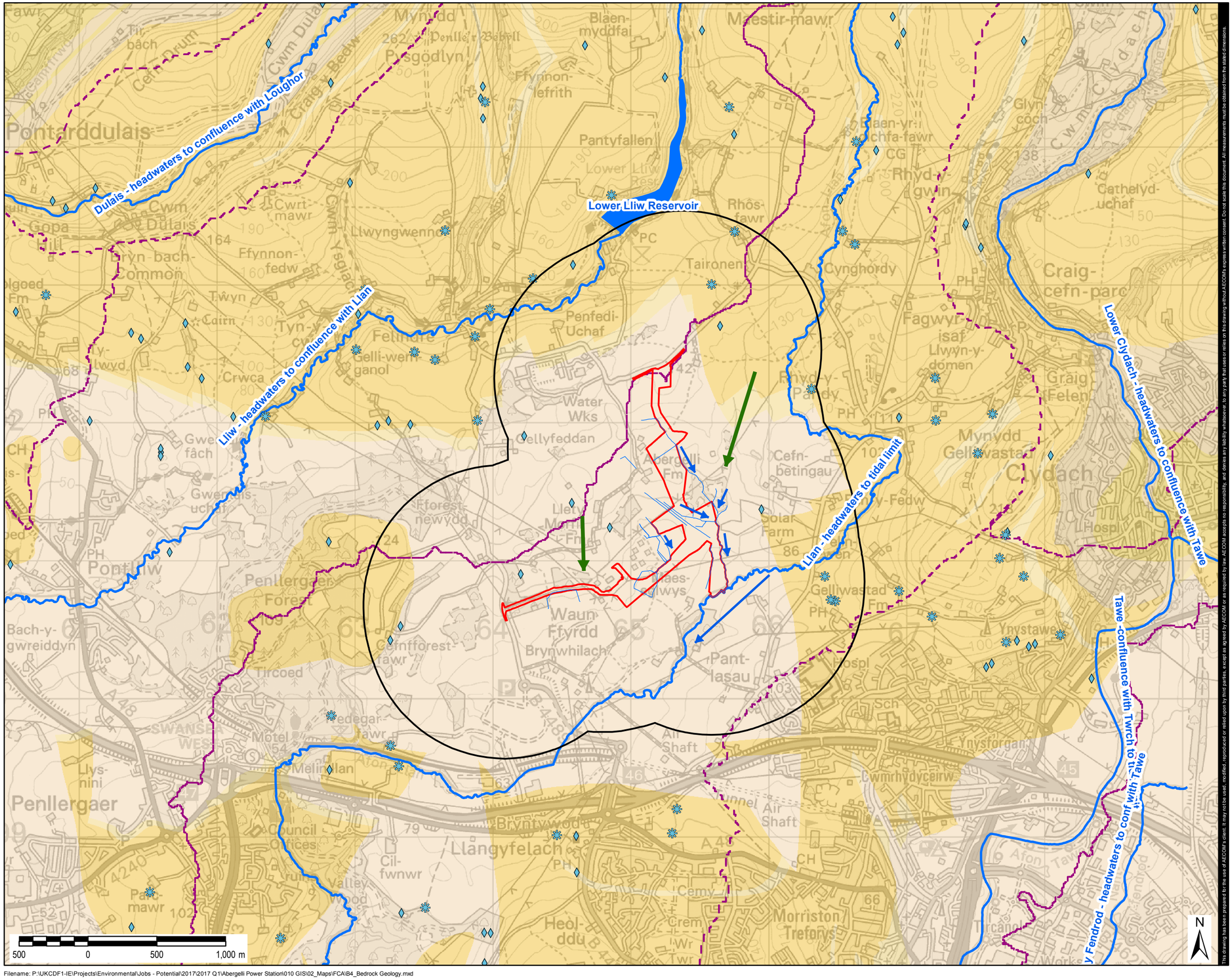
B.4 Bedrock Geology



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Project Site Boundary
- 1 km Buffer
- Wells
- Springs
- WFD Rivers
- WFD Lakes
- Other Watercourses

Inferred Water Flow Direction

- Groundwater
- Surface Water

Bedrock Geology

- Grovesend Formation
- Swansea Member Sandstone
- Swansea Member Mudstone Siltstone Sandstone

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APPENDIX B
BEDROCK GEOLOGY

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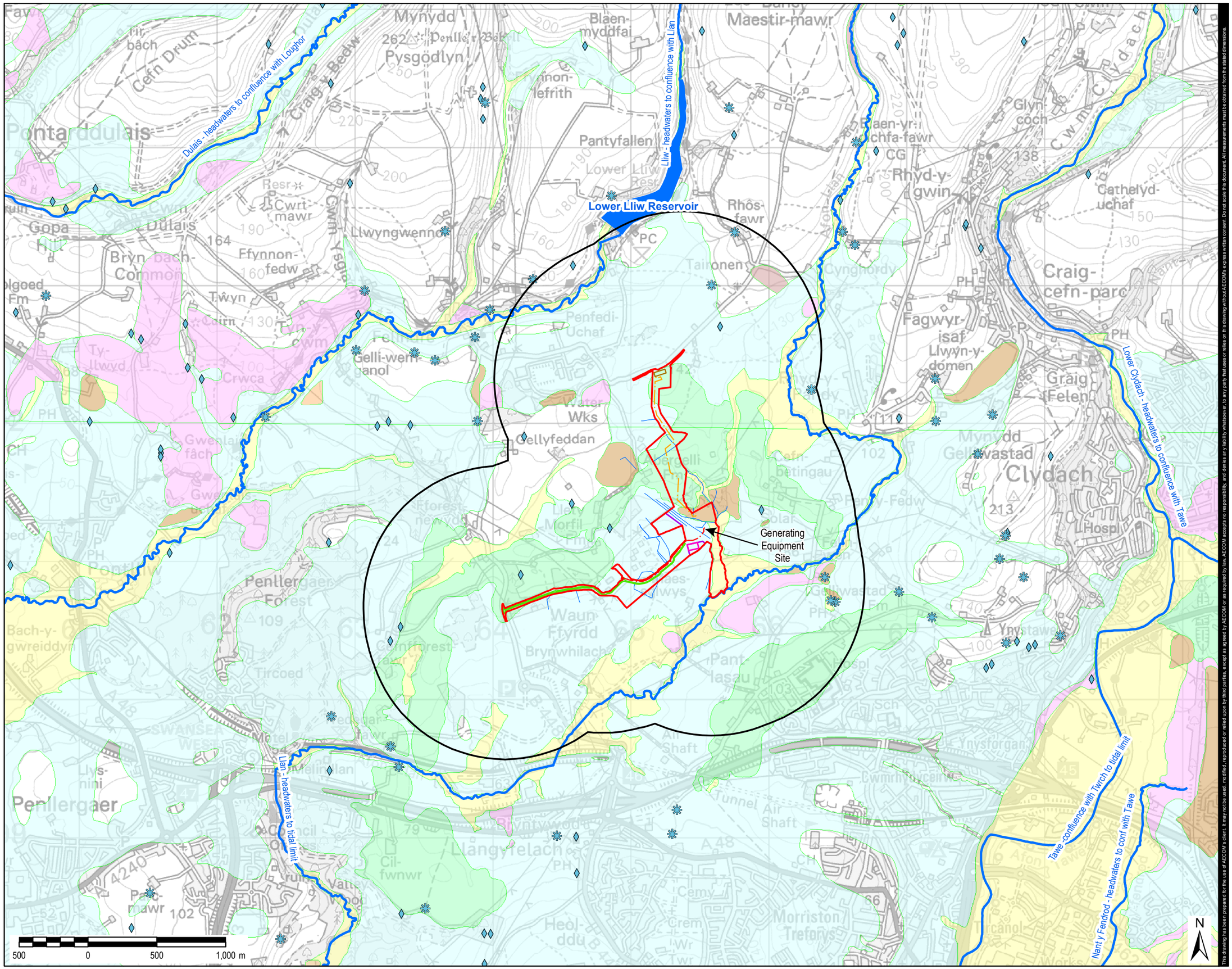
B.5 Superficial Geology



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Project Site Boundary
- Above Ground Installation
- Access Road
- Electrical Connection (400kV Cable)
- Gas Connection
- Laydown Area
- Maintenance Compound
- 1 km Buffer
- Wells
- Springs
- WFD Rivers
- WFD Lakes

Superficial Geology

- Till
- Glacial Deposits
- Glaciolfluvial Deposits
- Alluvium
- Peat

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APPENDIX B
SUPERFICIAL GEOLOGY

Scale at A3: 1:25,000

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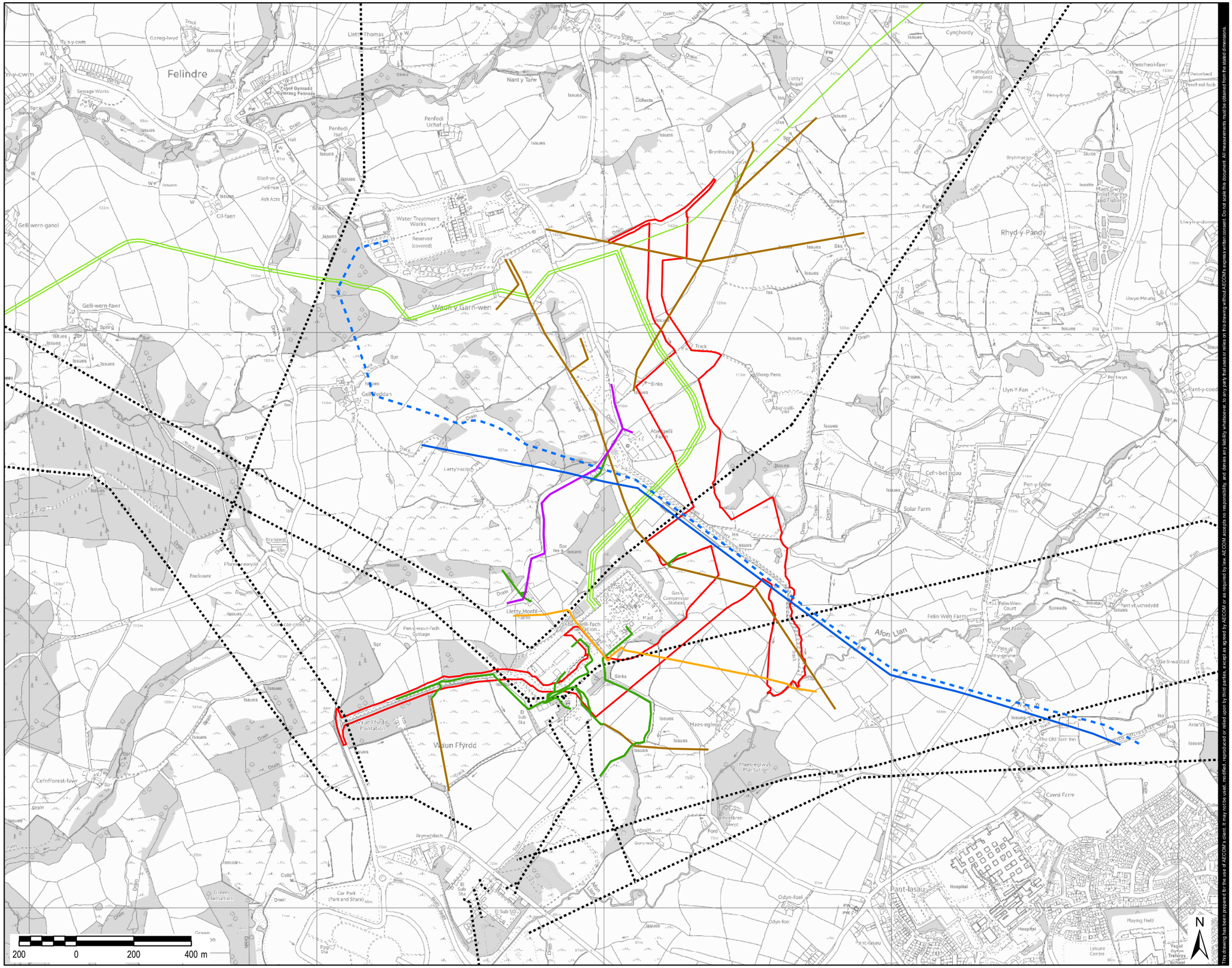
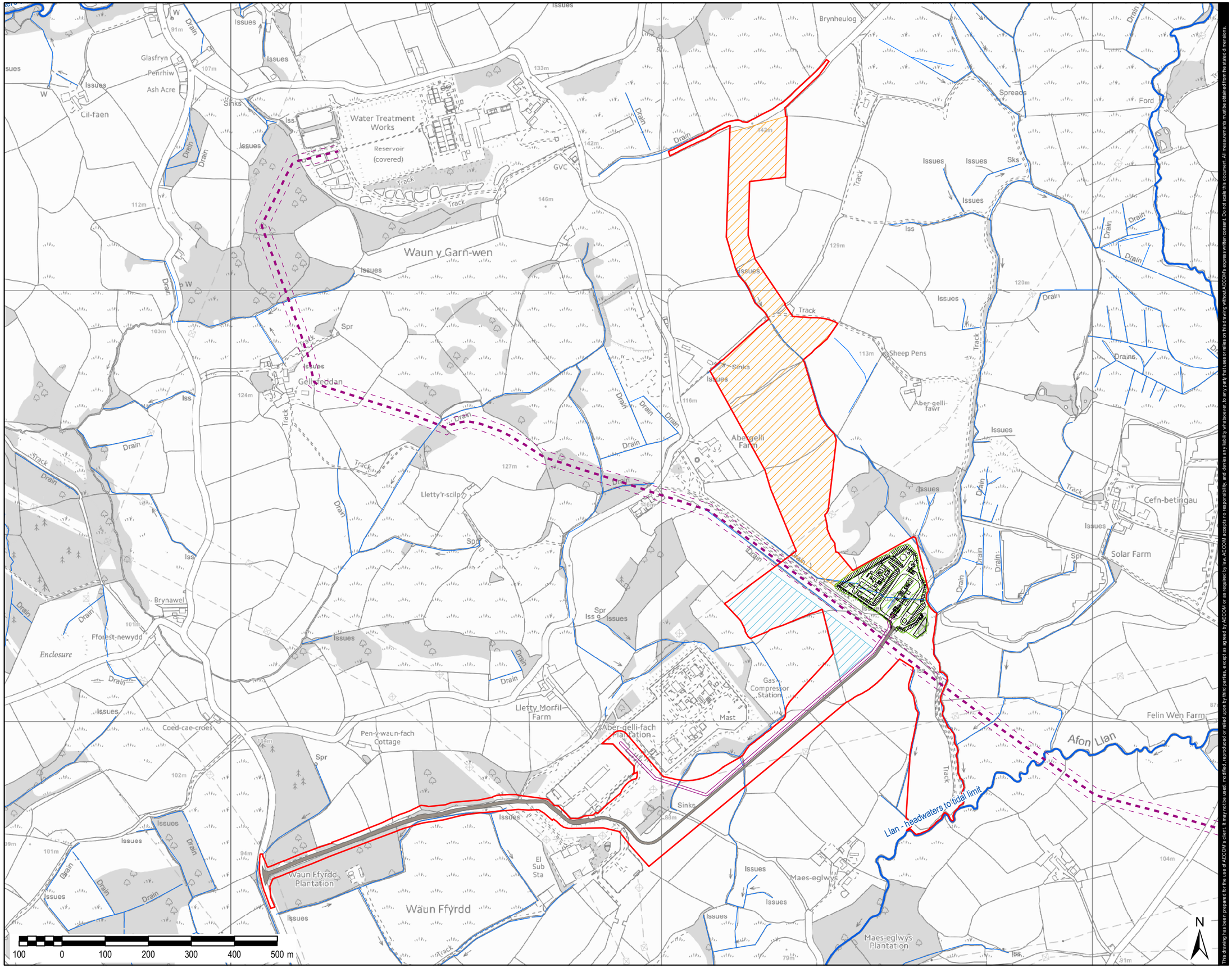
B.6 Utilities


Felindre
Nant y Tarw
Penfedi Uchaf
Penfedi Isaf
Water Treatment Works
Reservoir (covered)
Waun y Garn-wen
Gelli-wern-ganol
Gelli-wern-fawr
Gelli Feddan
Sheep Pens
Abergelli Farm
Abergelli Power Station
Gas Compressor Station
Llety Morfil Farm
Waun Ffyrdd Plantation
Waun Ffyrdd
Maes-eglwys Plantation
Maes-eglwys
Rhyd-y-Pandy
Cefn-betingau
Solar Farm
Felin Wen Farm
Afon Llan
Pant-lasau
Hospital
Odyn-foel
Cawsi Farm
The Old Barr Inn
Cefnforest-fawr
Car Park (Park and Share)
Green Plantation
Enclosure
Cynchordy
Llwyn-Meurig
Ffynnon-wen
Pen-y-bryn
Brynheulog
Llwyn-yr-dorner
Penrheol-fawr
Penrheol-fach
Maes Gwyn Trout Farms and Fishery
Pen-y-waun-fach Cottage
Llety'r-sgubor
Llety'r-sgubor
Llety'r-nsclod
Llety'r-sgubor
Llety'r-sgubor
Llety'r-sgubor

Appendix C – Project

C.1 Site Layout



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Project Site Boundary
- Electrical Connection (400 kV)
- Gas Connection
- Generatting Equipment Site
- Access Track
- Laydown Area
- Watercourses
- Generating Equipment SIte
- Water Main

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APPENDIX C
SITE LAYOUT PLAN

Scale at A3: 1:8,000

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FIGURE C1				005
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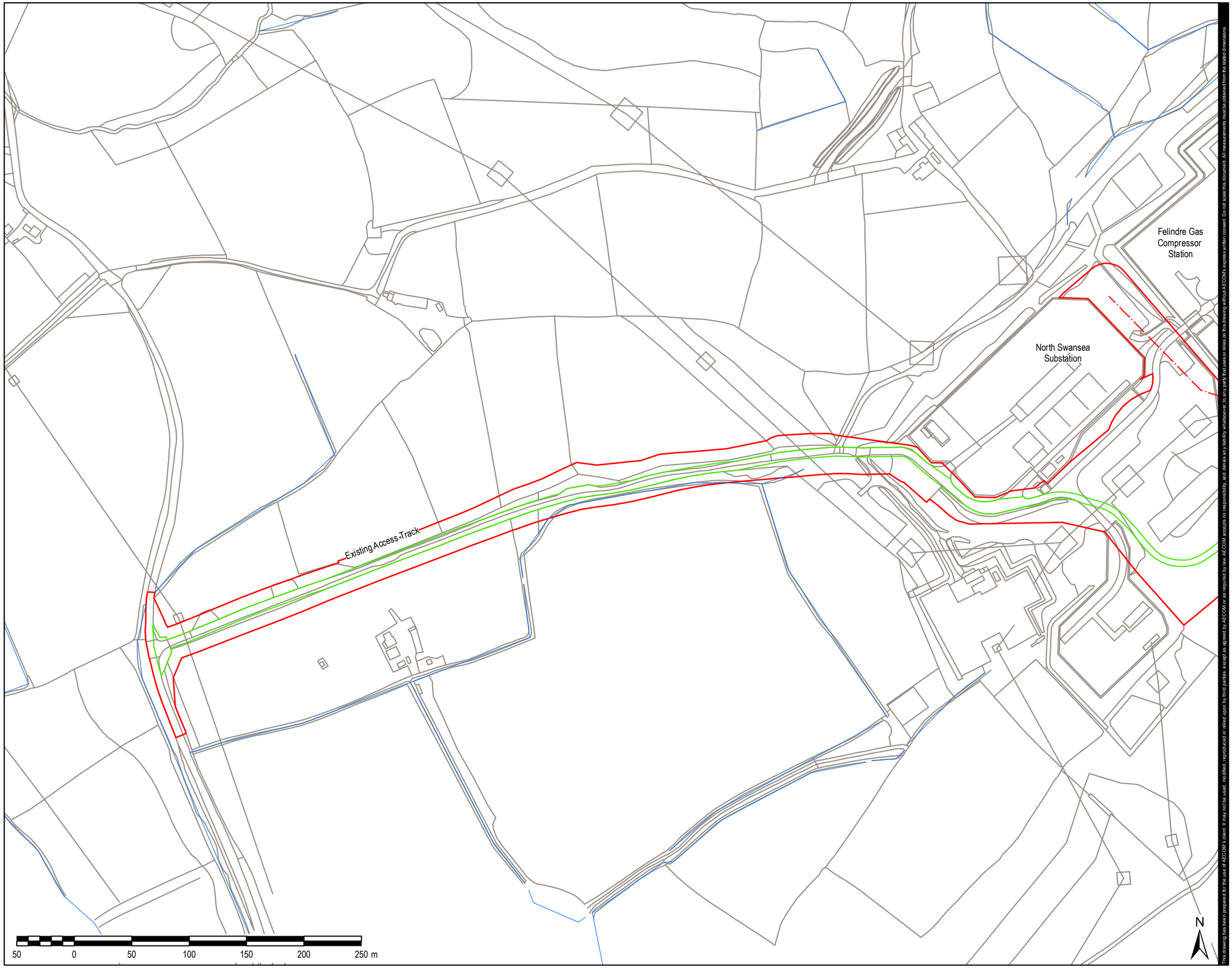
C.2 Works Plan



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Project Title:

ABERGELLI POWER PROJECT

Client:

LEGEND

- Project Site Boundary
- Access Road
- Electrical Connection (400kV Cable)
- Watercourses

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APPENDIX C
WORKS PLANS KEY PLAN AND WORKS SHEET 1 OF 3

Scale at A3: 1:3,000

Drawing No:			Rev:
FIGURE C2			005
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GM	CC	CA	02/05/18

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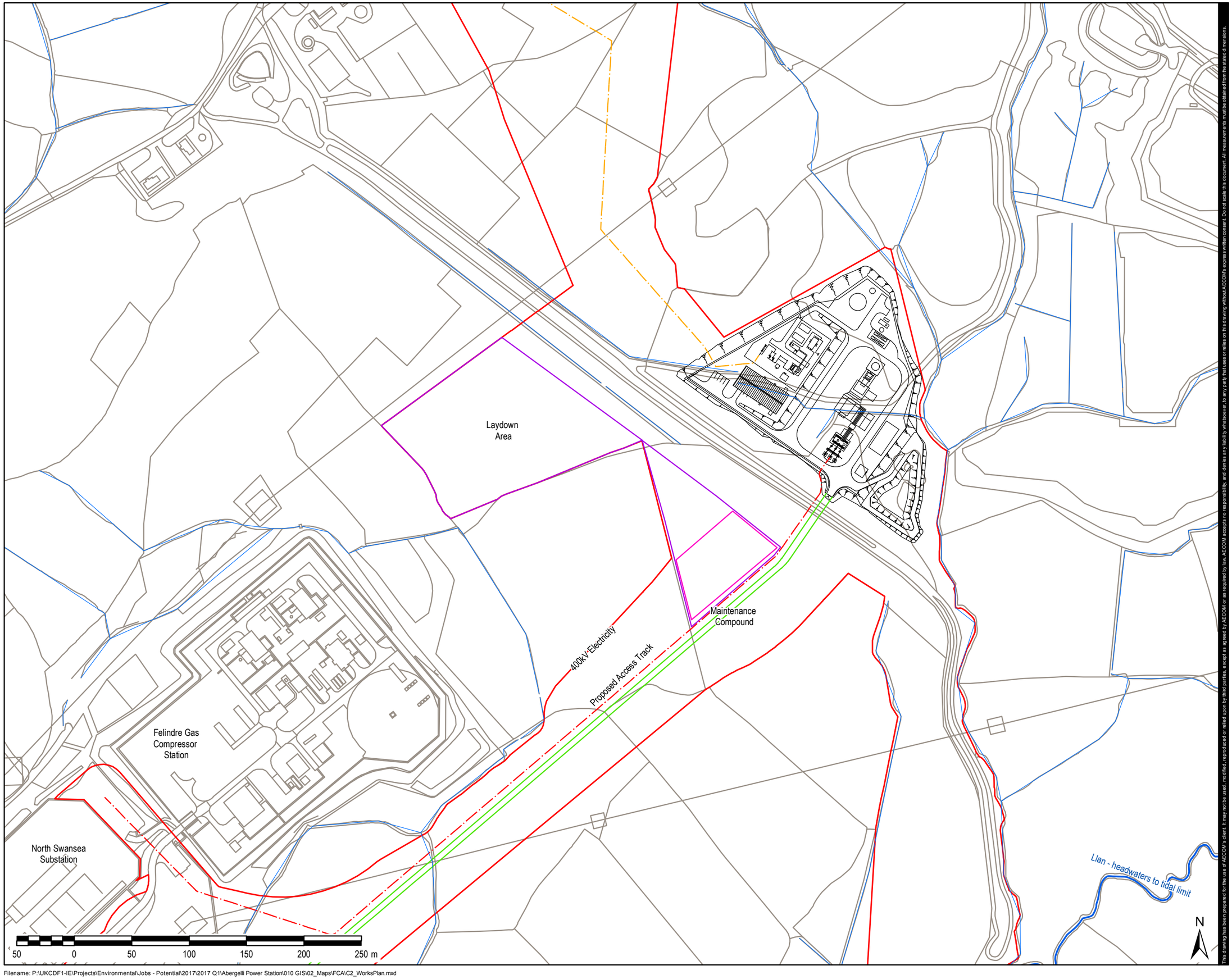

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Project Site Boundary
- Generating Equipment SIte
- Access Road
- Electrical Connection (400kV Cable)
- Gas Connection
- Laydown Area
- Maintenance Compound
- Watercourses

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60542910

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APPENDIX C
WORKS PLANS KEY PLAN AND WORKS SHEET 2 OF 3

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Drawing No:	Rev:
FIGURE C2	005

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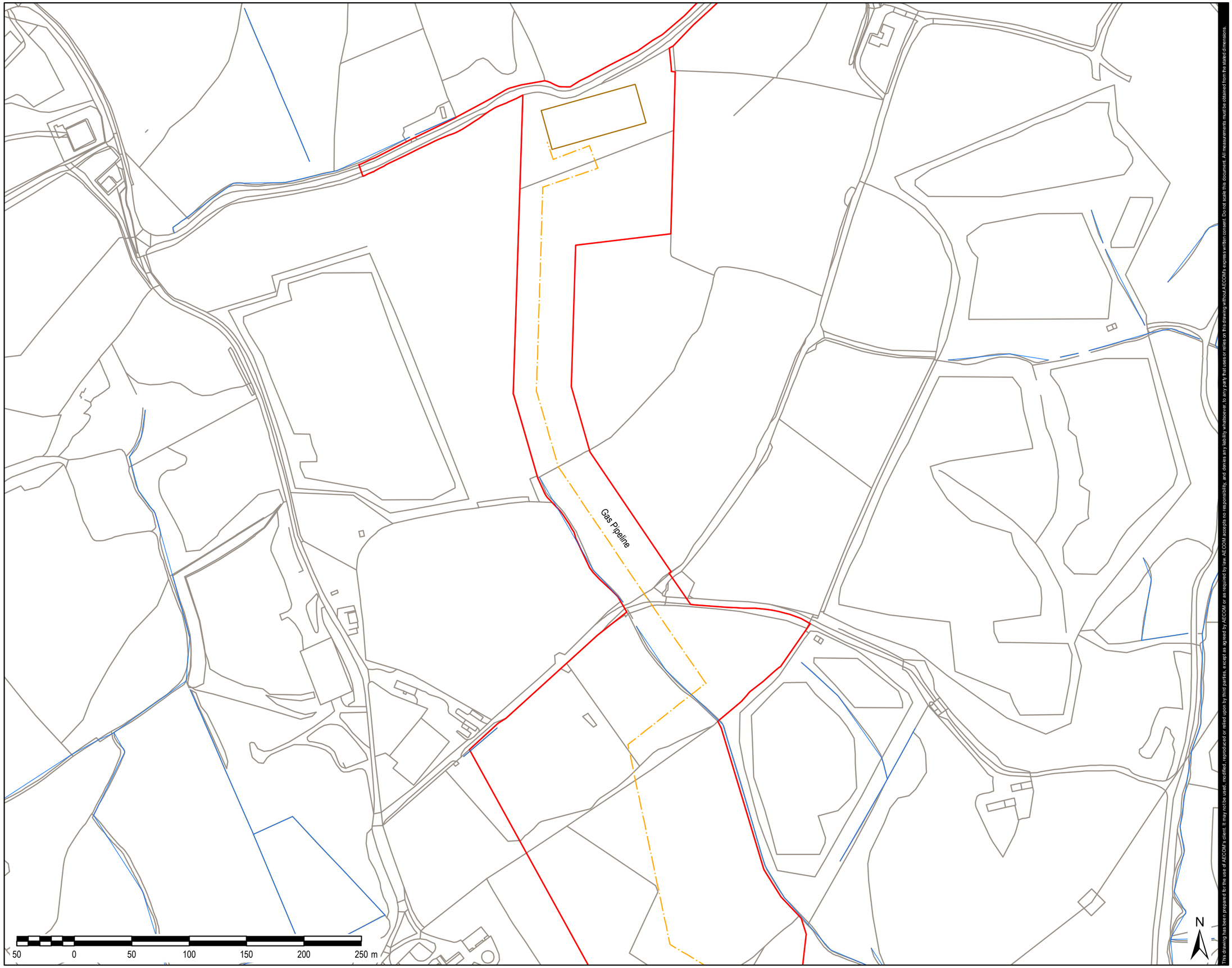

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Project Site Boundary
- Above Ground Installation
- Gas Connection
- Watercourses

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AECOM Internal Project No:

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Drawing Title:

APPENDIX C
WORKS PLANS KEY PLAN AND WORKS SHEET 3 OF 3

Scale at A3: 1:3,000

Drawing No:				Rev:
FIGURE C2				005
Drawn:	**Chk'd:**	**App'd:**	**Date:**	
GM	CC	CA	02/05/18	

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Revision: C
Drawing Number: FIGURE 2
Project Number: 70034053

N

LEGEND
- ORDER LAND
- ORDER LIMITS
- ACCESS ROAD

RAW/FIRE WATER TANK
DEMIN WATER TANK
EMERGENCY GENERATOR
NATURAL GAS RECEIVING STATION
DIESEL TANK
EMERGENCY ACCESS
TANKER UNLOADING STATION
EXHAUST STACK
CONTROL ROOM/ OFFICE/WORKSHOP
GAS TURBINE GENERATOR
TRANSFORMER
FIN FAN COOLERS
SITE FENCE
GATE HOUSE
ATTENUATION POND
MAINTENANCE COMPOUND - 0.3 ha
Drain
Track
FB
Chy
Gas Compressor Station
Tanks
Mast

20 0 20 40 60 80 100m
ORIGINAL SCALE 1:1000

NOTES:
* INFORMATION TAKEN FROM WEST GLAMORGAN WATER BOARD RECORD DRAWINGS No. 112/4/1/12A DATED 1969

Rev	Date	Description	By	Chk	App
C	10/05/2018	UPDATED IN LINE WITH CLIENT COMMENTS	SPS	SJS	IMG
B	03/04/2018	LEGEND UPDATED	SPS	SJS	IMG
A	16/02/2018	FIRST ISSUE	JPW	SJS	IMG

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Client: Abergelli power, A Drax Group company

Site/Project:
ABERGELLI POWER PROJECT

Title:
INDICATIVE LAYOUT GENERATING EQUIPMENT Reg5(2)(o) DOCUMENT REFERENCE 2.6

Drawn: JPW		Checked: SJS	
Designed: IMG		Approved: IMG	
Date: 16/02/2018	Scale: 1:1000	A1	Sheet: 1 OF 1
Project Number: 70034053	Drawing Number: FIGURE C3		Revision: C

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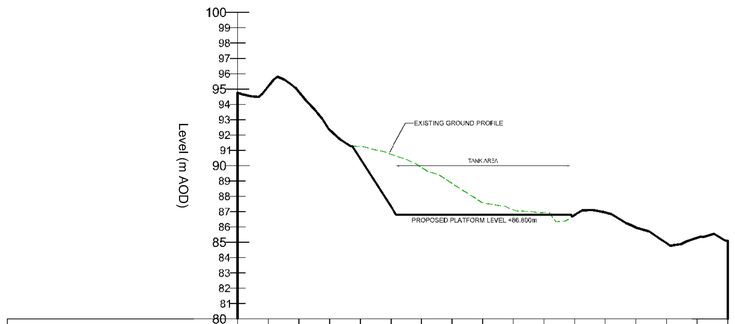
File Name: \\uk.wsgroup.com\central data\Projects\70034053\xx\70034053 - Abergelli Power Concept Update\Layouts\1 Current\Figure2.6\Option B\Figure 2.dwg



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Existing Levels	94.756	95.186	94.819	92.355	91.258	90.738	89.883	88.840	87.577	87.116	86.845	86.788	86.950	85.968	84.950	85.293	85.101	85.101

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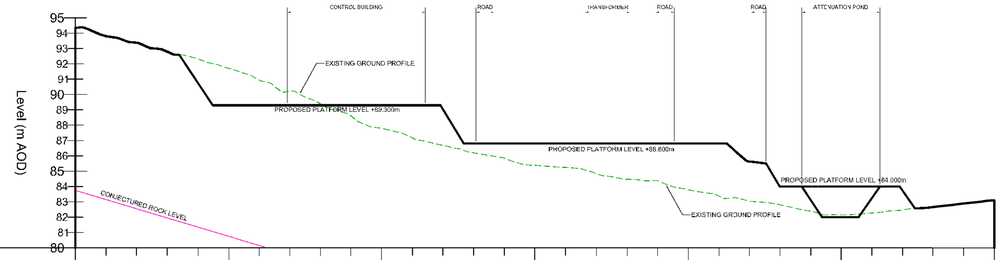

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SECTION 2
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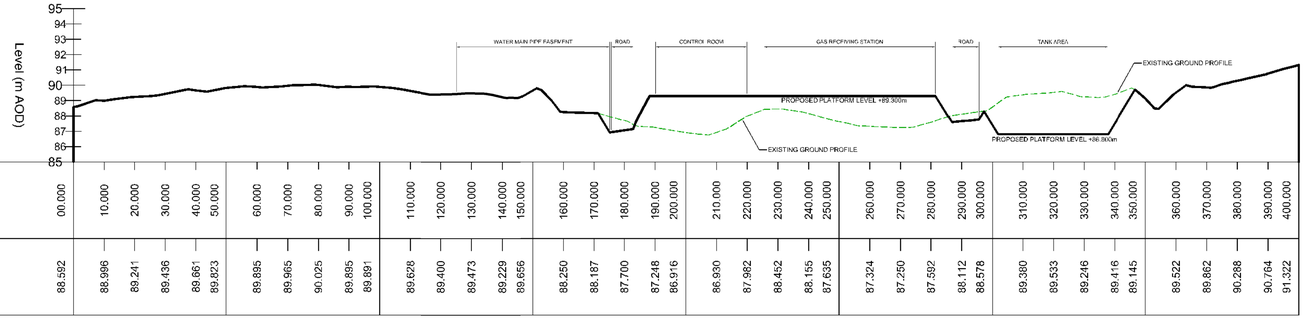

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Existing Levels	88.592	88.998	89.241	89.436	89.661	89.823	89.895	89.965	90.025	89.895	89.891	89.628	89.400	89.473	89.229	89.656	88.250	88.187	87.700	87.248	86.916	86.930	87.982	88.452	88.155	87.635	87.324	87.250	87.592	88.112	88.578	89.380	89.533	89.246	89.416	89.145	89.522	89.862	90.288	90.764	91.322

SECTION 4
SCALE: H 1:500,V 1:100. DATUM: 85.000

NOTES:

1. DRAWING TO BE READ IN CONJUNCTION WITH DRAWINGS 287521B-PBP-G-0017 TO 0020.
2. EXISTING GROUND LEVELS TAKEN FROM THE ABERGELLI DTM.

Rev	Date	Description	By	Chk	App
D	10/11/17	ATTENUATION POND AREA REVISED & MINOR DISPLAY AMD	CM	IMG	IMG
C	30/06/17	REVISED FOR NEW LAYOUT	DW	SS	SS
B	27/02/15	REVISED FOR NEW LAYOUT	RS	ME	ME
A	28/11/14	INITIAL ISSUE FOR COMMENTS	RS	ME	ME

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Client: Abergelli power

Site/Project: ABERGELLI SCGT

Title: FIGURE C4
CONCEPTUAL DESIGN SECTIONS

Drawn: RS		Checked: MAE	
Designed: RS		Approved: MAE	
Date: 19/03/2015	Scale: AS SHOWN A1	Sheet:	
Project Number: 287521B-PBP	Drawing Number: G-0020	Revision: D	

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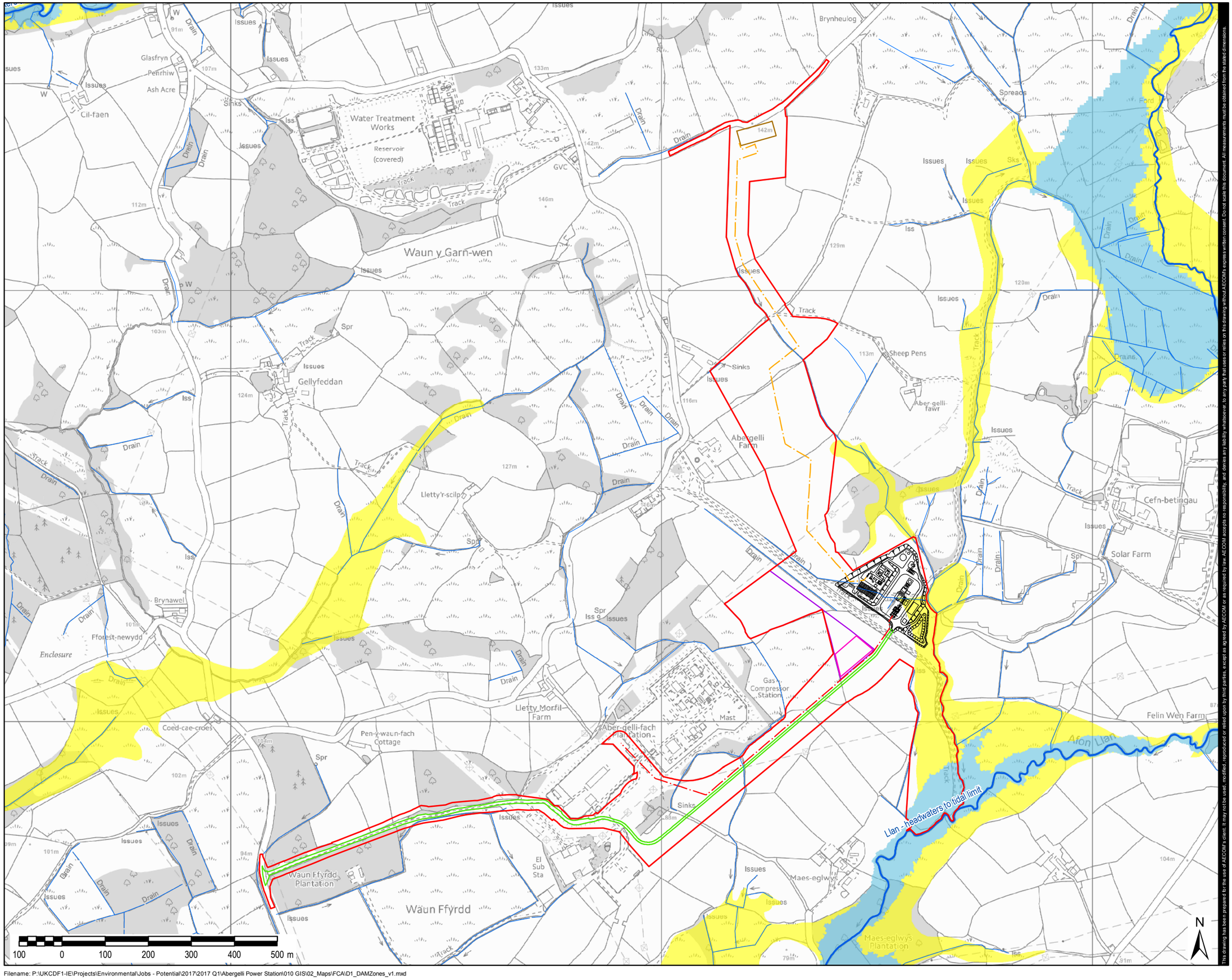
File Name: \\uk.wspgroup.com\central data\Projects\70034xx\70034053 - Abergelli Power Concept Update\Ground Elevation Work\2017 Ground Elevation Work\2017 Ground Elevation Work\Conceptual Design Bulk Earthworks 0017 0018 0019 0020 rev D13 20171110.dwg

Appendix D – NRW Data

D.1 DAM Zones



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Project Title:

ABERGELLI POWER PROJECT

Client:

LEGEND

- Project Site Boundary
- Watercourses
- Generating Equipment SIte
- Above Ground Installation
- Access Road
- Electrical Connection (400kV Cable)
- Gas Connection
- Laydown Area
- Maintenance Compound
- Development Advice Map - Zone B
- Development Advice Map - Zone C2

Data is adapted from the NRW Development Advice Maps available from https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en

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APPENDIX D DEVELOPMENT ADVICE ZONES

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FIGURE D1			005
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D.2 Fluvial Flood Map

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Client:

Abergelli power
A Drax Group company

LEGEND

- Project Site Boundary
- Watercourses
- Generating Equipment SIte
- Above Ground Installation
- Access Road
- Electrical Connection (400kV Cable)
- Gas Connection
- Laydown Area
- Maintenance Compound
- Flood Zone 3
- Flood Zone 2

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APPENDIX D
FLUVIAL FLOOD MAP

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100 0 100 200 300 400 500 m

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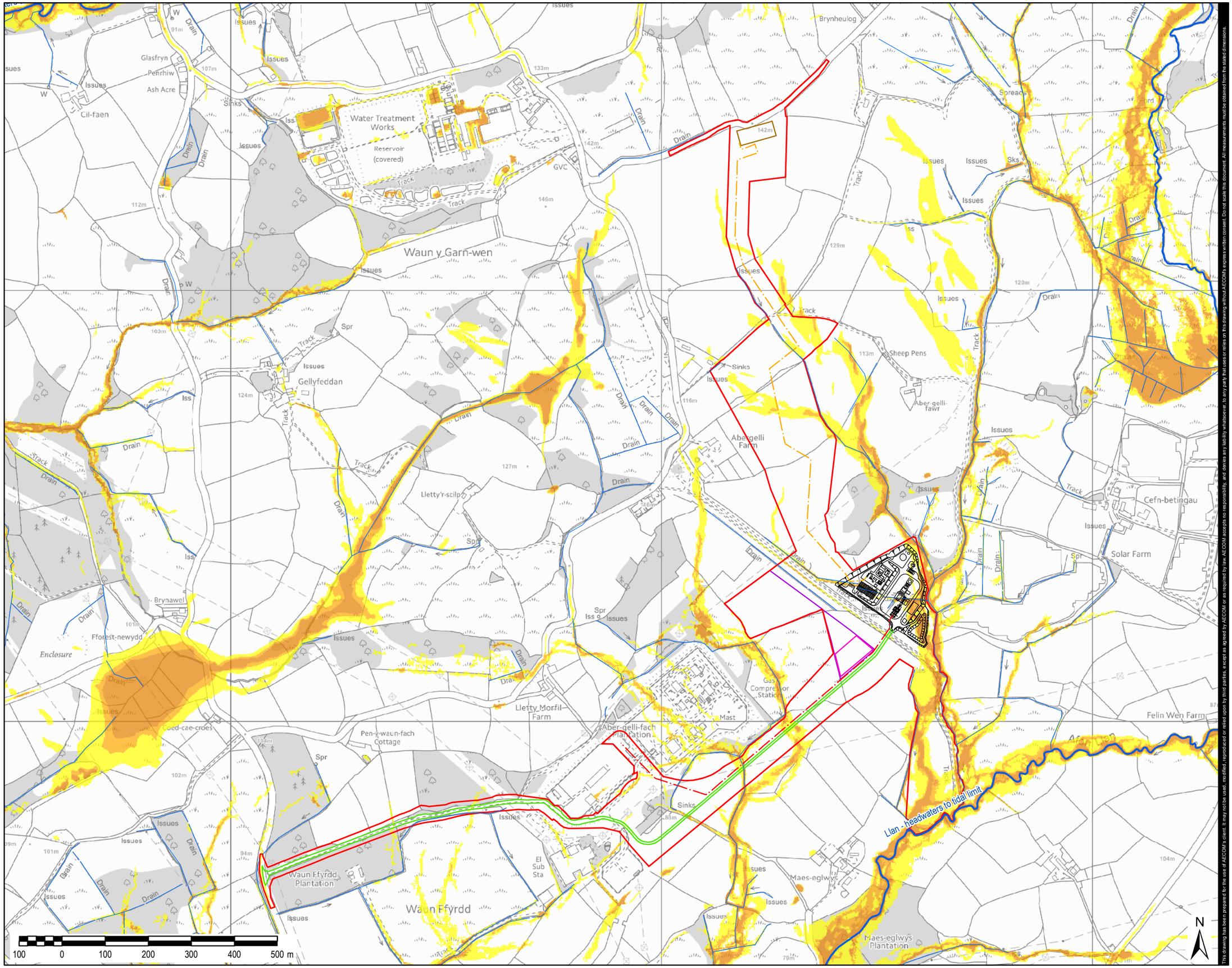
D.3 Flood Map



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LEGEND

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- Watercourses
- Generating Equipment SIte
- Above Ground Installation
- Access Road
- Electrical Connection (400kV Cable)
- Gas Connection
- Laydown Area
- Maintenance Compound
- Flood Extent - 1 in 30 years
- Flood Extent - 1 in 100 years
- Flood Extent - 1 in 1000 years

Data is adapted from the NRW Fluvial and Surface Water Flood Map available from https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en'

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APPENDIX D
UPDATED FLOOD MAP FOR SURFACE WATER

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE D3			005
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Appendix E – Outline Drainage Strategy

OUTLINE DRAINAGE STRATEGY

ABERGELLI POWER LTD

OCTOBER 2017

OUTLINE DRAINAGE STRATEGY

Abergelli Power Ltd.

Type of document (draft)

Project no: 70034053
Date: October 2017

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QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks	Initial Issue	Final Issue	Final for submission	Update to suit revised site layout
Date	January 2015	February 2015	March 2015	October 2017
Prepared by	Richard Smith	Richard Smith	Richard Smith	Chris Moore
Signature				
Checked by	Mark Eccleshare	Mark Eccleshare	Mark Eccleshare	Ignacio Martin Garcia
Signature				
Authorised by	Ryan Broughton	Ryan Broughton	Ryan Broughton	
Signature				
Project number	287521B	287521B	287521B	70034053
Report number				
File reference				

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3.2 OILY WATER DRAINAGE PROPOSAL 7

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SURFACE WATER DRAINAGE PHILOSOPHY 8

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APPENDICES

APPENDIX A GENERATING EQUIPMENT AREA – DRAINAGE CATCHMENT AREAS

1 EXECUTIVE SUMMARY

The following report presents an outline strategy for disposal of foul, oily and surface water from the proposed Abergelli Power Project to assist with planning and detailed drainage design phases. Indicative storm water attenuation requirements are defined to demonstrate design compliance with UK environmental regulations for new developments and assist with site spatial planning.

2 PROJECT BACKGROUND

2.1 SCOPE OF THIS REPORT

This conceptual Project Site drainage strategy outlines the proposal for managing the surface water, oily water and waste water drainage systems at the proposed Abergelli Power Project.

External flood risk to the Project Site is outside the scope of this report and will be addressed separately.

2.2 SITE DESCRIPTION

The Project Site (approximate UK National Grid Reference SN 65477 01290) is located on open land approximately 2 km north of Junction 46 on the M4, to the north of Swansea and approximately 1 km southeast of Felindre, 760 m west of Llwyncelyn and 1.4 km north of Llangyfelach. Refer to Figures 2.2-1 to 2.2-3 inclusive below.



Figure 2.2-1 Site location (1)

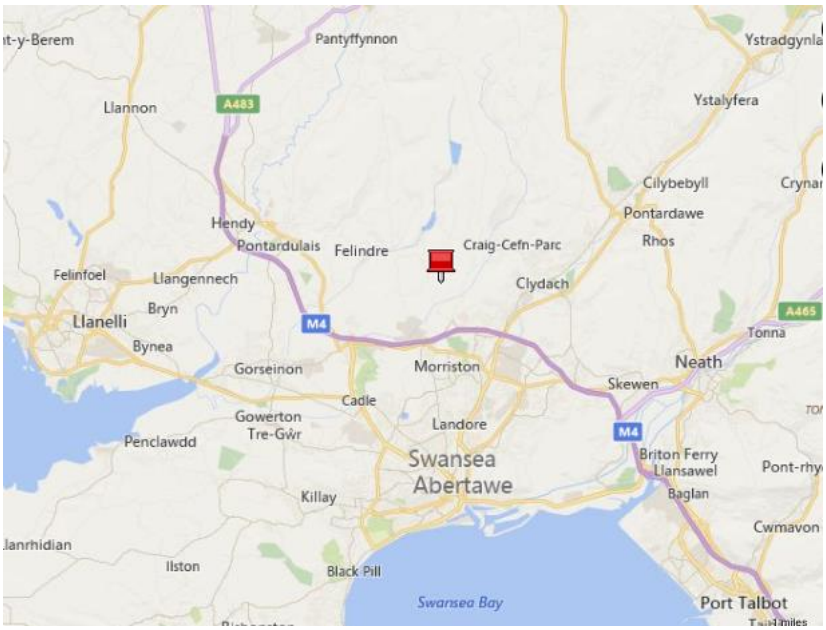

Figure 2.2-2 Site Location (2)



Figure 2.2-3 Site Location (3)

The current land use is predominantly agricultural, with sheep and horse grazing. The western extent of the Project Site encompasses parts of National Grid's 'Swansea North' electrical substation (comprising a 400kV and 132kV substation) and the existing access road leading to the substation and Felindre Gas Compressor Station from the B4489.

The Project Site is accessed from Junction 46 of the M4. From the M4 vehicles would travel north via the B4489, with the Project Site therefore accessed from the west utilising the existing

National Grid junction and access road from the B4489 (which is to be widened to accommodate abnormal loads and is part of the Access Road) and then via land following the southern boundary of the Felindre Gas Compressor Station before crossing over agricultural land immediately west of the Generating Equipment Site.

The Project Site is roughly 'L' shaped (in reverse). Ground levels at the Project Site vary from approximately 146 m above ordnance datum (AOD) at the highest point in the north-west corner at Rhyd-y-Pandy Road to approximately 80 m AOD along the southern perimeter, with ground levels generally falling in a southerly and south easterly direction. The land within the Generating Equipment Site is at approximately 90 m AOD.

There are no residential dwellings located within the boundary of the Project Site. Most of the Project Site is improved grassland but there are areas of marshy grassland in the south eastern part of the Generating Equipment Site. There are parts of a Site of Importance for Nature Conservation (SINC) within the Project Site (Lletty Morfil SINC). The woodland present within the Project Site is designated as Ancient Woodland (a mixture of restored and semi-natural woodland).

Within the Project Site there are springs, with their associated streams and drainage ditches which discharge into the Afon Llan (See Figures 2-4 to 2-7 inclusive). The Afon Llan links with the Afon Lliw and the River Loughor, which discharges into the Bristol Channel.

The Generating Equipment Site is located primarily within fields used for grazing, bounded by a mixture of drainage ditches, fencing and poor quality hedgerows with substantial gaps in them. The Generating Equipment Site and Laydown Area are both crossed by a soft surface horse training track known as 'the gallops', which runs diagonally north-west to south-east. A block of broadleaved woodland, classified as Ancient Woodland, and a Site of Importance for Nature Conservation (SINC) lie to the east. There are also further blocks of Ancient Woodland, also classified as SINCs, to the west surrounding Swansea North Substation, Felindre Gas Compressor Station and the existing access road leading to these facilities from the B4489.

The proposed gas supply pipeline will follow an approximate north-south route corridor, as shown in Figures 2-4 & 2-6, between the National Transmission System south of Rhyd-y-Pandy Road and the Generating Equipment Site. The Pipeline corridor varies between 50 m and 200 m in width, depending on the working area required during construction. The maximum area of the Gas Connection Site during construction is approximately 13 Ha. Once construction is completed, the route corridor will reduce to 10 m wide, reflecting the width of the easement surrounding the Pipeline required for maintenance and to ensure safety. The Pipeline crosses grazing fields bounded by a number of poor quality hedgerows (with gaps) and/or fence lines, one Public Right of Way, and two drainage ditches. The Pipeline avoids the small deciduous copse to the north of the Generating Equipment Site, part of which is classified as Ancient Woodland and a SINC.

The Electrical Connection will follow a route corridor of approximately 30 m in width during construction. The Electrical Connection route coincides with the Access Road for approximately 500 m of the route length. The maximum site area for the Electrical Connection during construction is 3 ha. It will be located to the southwest of the Generating Equipment Site passing through grass fields and following the southern boundary of the Gas Compressor Station, passing through an area classified as Ancient Woodland and a SINC, before entering National Grid's Swansea North Substation.

The geology of the site is characterised by boulder clay and the underlying Grovesend Beds, Upper Carboniferous sandstones and thin coals; overlain by glacial sand and gravel, alluvium and peat. The geology is overlain by raw grey and brown soils.

The land within the power generation plant site is approximately 90 m Above Ordnance Datum (AOD), generally sloping at 1:25 downwards in a southerly direction.

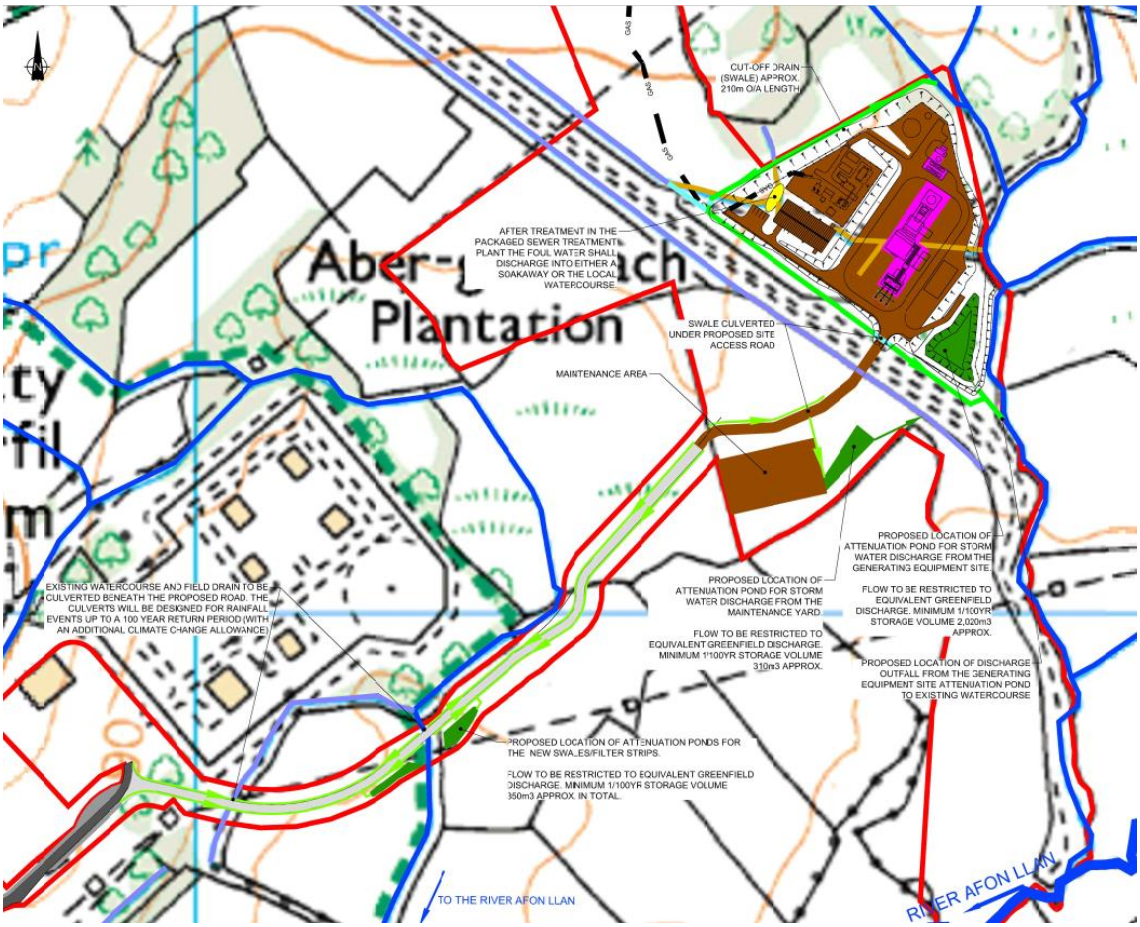

Figure 2-4 Plan showing nearby drains and watercourse to the site (Central section)

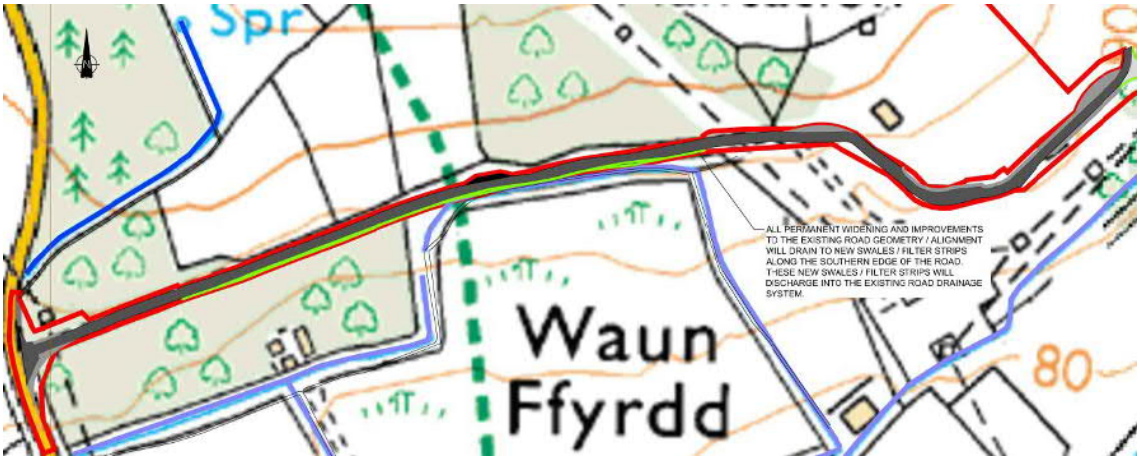

Figure 2-5 Plan showing nearby drains and watercourse to the site (West section)

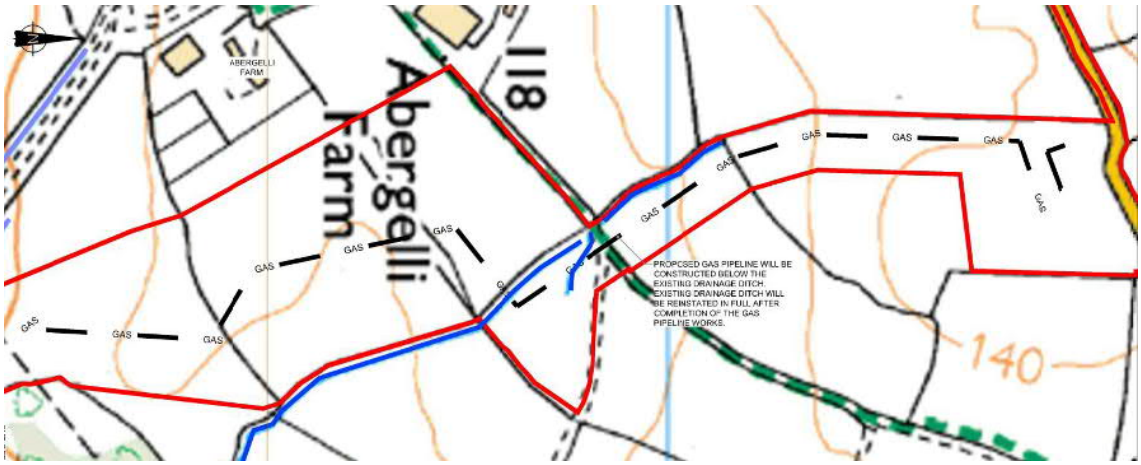

Figure 2-6 Plan showing nearby drains and watercourse to the site (North section)

KEY:

- EXISTING WATERCOURSE
- EXISTING FIELD DRAIN
- EXISTING ROAD
- EXISTING FIELD DRAIN TO BE REMOVED
- PROPOSED IMPERMEABLE OR SEMI-IMPERMEABLE SITE AREAS WILL BE DRAINED TO THE SURFACE WATER DRAINAGE SYSTEM
- PROPOSED FIELD DRAINS
- PROPOSED ATTENUATION PONDS FOR THE SITE SURFACE WATER DRAINAGE SYSTEM
- PROPOSED SWALE / FILTER STRIP
- PROPOSED IMPERMEABLE SITE AREAS WILL BE DRAINED TO THE OILY WATER DRAINAGE SYSTEM
- PROPOSED LOCATIONS FOR FOUL WATER SYSTEM PACKAGED SEWAGE TREATMENT PLANT
- PROPOSED EXISTING ROAD WILL BE UPGRADED - EXISTING DRAINAGE ARRANGEMENTS WILL BE RETAINED
- PROPOSED ROAD WILL BE DRAINED TO NEW SWALES/FILTER STRIPS
- PROJECT SITE BOUNDARY

Figure 2-7 Key for Figures 1 to 3

3 DRAINAGE STRATEGY

3.1 FOUL WATER DRAINAGE PROPOSAL

The Generating Equipment Site incorporates welfare facilities which will require a site foul water drainage system. The site is remote and it is believed it will be unfeasible to connect to a public sewer. The provision of a cesspool, composting or chemical toilets has not been considered due to Natural Resources Wales preferences, maintenance requirements and staff comfort. As a result there are two options for the foul water drainage system:

1. A foul water drainage system that will drain to a septic tank within the site. The water from septic tank would then discharge into an onsite drainage field.
2. A foul water drainage system that will drain to a package sewage treatment plant within the site. The processed water from this treatment plant would then discharge into an onsite drainage field or nearby watercourse.

Option 2 is likely to be the preferred option for ease of maintenance and environmental criteria.

The selected foul water drainage system will be positioned away from any areas at risk of flooding.

Site foul water drainage systems shall be designed and constructed in accordance with Part H of the UK Building Regulations 2010. Any septic tank or package treatment plant shall be situated a minimum of 10 metres from habitable buildings. We suggest the most appropriate siting of the sewage treatment plant is in the area to the northwest of the accommodation building (immediately northeast of the car parking area) in order to satisfy the aforementioned separation requirement and allow ease of vehicular access for maintenance.

The proposed location of the sewage treatment plant is indicated in Figure 2-4. The most appropriate outfall location would seem to be to the proposed drainage swale running along the southwest boundary of the Generating Equipment Site.

3.2 OILY WATER DRAINAGE PROPOSAL

An oily water drainage system will be required to receive surface water from potentially contaminated oil retaining areas and prevent contaminated water being discharged from the site. The following areas and activities have been identified as potential sources of oil contamination:

- → Oil filled transformers
- → Lubrication systems for the Generating Equipment
- → Oil/fuel storage
- → Vehicle hard-standings used for the unloading of oil/fuel

In the event of a spillage all designated oil retaining areas (e.g. oil filled transformers and oil storage areas) will be designed to contain at least 110% of the stored oil plus an allowance for fire-fighting water/foam. Rainwater will be removed from oil retaining areas by an automatic pump to the oily water drainage system. The automatic pumps will be designed to automatically shut down in the event that a major oil spillage is detected in order to prevent large quantities of oil entering the oily water drainage system.

Rainwater drainage from oily water areas will pass through a Class 1 Full Retention Oil Separator (as defined in BS EN 858) to remove residual traces of oil before discharging into the site surface water drainage system. The Oil Separator shall be sized to suit the oily water catchment area and will be fitted with an alarm to indicate when the integral oil coalescer requires maintenance.

Oily water drainage shall be designed in accordance with National Grid Technical Specification 2.20 'Oil Containment at Electricity Substations and Other Operational Sites' or similar approved. Outline oily water drainage areas for the Generating Equipment Site are indicated in Figure 2-4.

3.3 SURFACE WATER DRAINAGE PROPOSAL

SURFACE WATER DRAINAGE PHILOSOPHY

The surface water drainage system will be required to adequately drain the Project Site and prevent any significant flooding for the maximum design rainfall event of 100 year return period. The surface water drainage system will adopt the principles of The SuDS Manual – CIRIA C697.

To prevent inundation of the Generating Equipment Site from surface runoff down the hillside, cut off drainage ditches will be placed around the uphill Generating Equipment Site perimeter. These new drainage ditches will be designed to divert surface runoff around the Generating Equipment Site and return downstream back to the original drainage ditches/watercourse.

Where possible the new platform (levels and surfacing) will be designed so they naturally drain by infiltration into the surrounding ground. Where this is not economically possible or presents an unsatisfactory risk of flooding to the site, infiltration drains will be installed into the new platforms. All infiltration drains will connect to the surface water drainage system.

It is not expected that it will be possible to connect the surface water drainage system to an infiltration basin due to the presumed predominantly clayey ground and high groundwater level in places. This will be confirmed when the Ground Investigation surveys are carried out. For the purposes of this drainage strategy, a worst case is assumed. Instead the discharged flow of water at the site boundary from the surface water drainage system will be attenuated in order to mimic the equivalent greenfield runoff flow for events up to the 100 year return period event (with climate change allowance). The flow will be attenuated using suitably sized attenuation pond(s) with downstream flow restriction. The resulting equivalent greenfield runoff will discharge to existing nearby watercourses. The attenuation pond(s) shall be sited to prevent flooding of operational areas in the event of an extreme rainfall event in excess of the 100 year return period.

The Gas Connection comprises a buried pipeline and AGI. The Pipeline will not give rise to an increase in impermeable area within the Project Site and impact upon the surface water run-off regime.

The only permanent above ground structure associated with the gas connection is the Above Ground Installation (AGI) at the point of connection to the National Transmission System. The AGI consists of 2N^{o} 30m by 30m compounds and is proposed to drain to a soakaway.

Proposed new bituminous Power Generation Plant Site roads will generally have a constant crossfall with no longitudinal fall. Where possible, roadside swales and infiltration drains will be used to remove and convey any standing water into the surface water drainage system. Where there are space constraints, or there is an elevated risk of contamination, the new roads will be kerbed and drain via road gullies into the surface water drainage system.

Construction laydown areas and a maintenance yard are proposed to the west of the Generating Equipment Area on the opposite side of the water main easement. We understand both laydown and maintenance areas require granular finish (i.e. crushed rock pavement construction) at commencement of construction in the Generating Equipment Area. The maintenance yard will be

retained on completion of construction, however the laydown areas will be returned to grassland As a result, the construction laydown area runoff is omitted from calculations for permanent construction runoff and it shall be considered in the CEMP only (refer to Section 3.5).

Culverts to route existing field drains under the proposed Access Road have been assumed in the outline design, however, other techniques such as bridges could also be used. These culverts or crossings will be designed for events up to the 100 year return period. It is expected that drainage of the new section of Access Road will be via roadside swales. Swales will discharge to existing watercourses via flow restriction device and piped outlets as necessary to approximate equivalent greenfield runoff flows from the proposed road area.

A section of access road crosses the water main easement. At the time of writing, the form of this crossing is unknown. The access road is likely to be raised due to restrictions on excavation within the easement zone. In this case this section of road is likely to be formed on an embankment above the easement (a causeway) or, if surcharge loading of the easement zone is unacceptable, on a suspended bridge deck. Surface water runoff from the grassland/pasture area to the north and upslope of the raised access road shall be allowed to passively drain through the causeway due to installation of open pipes / culverts at regular spacings for the former option. A suspended bridge structure would permit surface water runoff to flow unimpeded in the latter option. We would expect any temporary drainage requirements during construction of a raised access road to be addressed in the CEMP (refer to Section 3.5).

It is not proposed to connect existing road drainage systems into the new surface water drainage system. Existing road drainage systems along the existing section of Access Road will be maintained or modified to reflect any widening.

PROPOSED SUDS MANAGEMENT TRAIN

For purposes of this study it is assumed that the sensitivity of receiving watercourses is ‘Medium’. In accordance with Table 3.3 of the ‘SuDS Manual’ (CIRIA, 2007) there shall be a minimum of three SUDS management train techniques for drainage of runoff from general site development areas:

1. TRAPPED GULLIES / FILTER DRAINS

As described above, where possible all proposed new bituminous road drainage will be collected via roadside swales or infiltration drains. Where required the new platforms will be drained via a filter drain. The swales and filter drains will be designed to minimise the ingress of sediment into the drainage network. All new swales and drains on the Generating Equipment Site will discharge into the proposed attenuation ponds and then the existing watercourses.

2. ATTENUATION

The primary purpose of the attenuation pond is storage and gradual release of storm water runoff, however it will have secondary benefits in terms of water treatment. The pond geometry will be selected to promote settlement of any remaining suspended sediment from inflow as the pond widens and flow velocity decreases towards its outfall. Furthermore, in the unlikely accidental event of entry of pollutants from site activities to the surface water drainage system, the attenuation pond provides access for water quality sampling and retention of pollutants via closure of a valve within the outfall manhole prior to remediation.

Periodic maintenance of the attenuation pond and its surrounding area will be required by the Generating Equipment Site operator in order to remove significant silt deposits and

control vegetation. Suitable provision shall be made in the layout and levels of the pond area to permit access by off-road vehicles to allow this maintenance to take place.

3. SWALE

The final measure within the SUDS system will be a drainage swale between the attenuation pond and the un-named tributary of the Afon Llan (subject to agreement with City and Council of Swansea). The swale will be incorporated into the landscaping and be of a vegetated design to provide further filtering measures for any particles that have passed through the previous control techniques.

Drainage from roads only requires application of two treatment train components. Therefore, the proposed site access road will be drained via swales that shall provide storage attenuation with controlled discharge, approximating to pre-development greenfield runoff, to existing watercourses.

OUTLINE SIZING OF SITE ATTENUATION

Refer to Section 4 of this report for calculation of outline storage volume requirements.

3.4 SITE FLOOD RISK

The risk to the Project Site by flooding from external sources is outside the scope of this report and is therefore not evaluated further herein.

Buildings, plant and equipment within the site will be elevated above the surrounding platform level to avoid inundation by minor surface water flooding in the event of local drainage failure or extreme rainfall events in excess of the 100 year return design event.

As a minimum a raised pedestrian access route will be provided to and within the site to provide for safe access and egress during a flood.

3.5 SURFACE WATER DRAINAGE STRATEGY DURING CONSTRUCTION

Surface water drainage during construction will be developed by the contractor and detailed in the Construction Environmental Management Plan (CEMP). At this stage it is expected that the CEMP will include provisions such as:

- New temporary and /or permanent drainage ditches to prevent uncontrolled surface runoff of contaminated water
- Silt traps within drainage ditches to reduce the flow of suspended solids from site.
- Settlement lagoons and / or proprietary settlement tanks as required to reduce the flow of suspended solids from site.
- Suitable layout of the construction site and application of suitable management techniques to prevent runoff from stockpiles directly into watercourses.

4 OUTLINE ATTENUATION REQUIREMENTS – PERMANENT CONSTRUCTION

4.1 SCOPE

The following figures are based on permanent construction only. Runoff and attenuation from temporary construction hardstanding (e.g. construction laydown) and similar shall be considered by the Contractor in the CEMP (refer to Section 3.5).

4.2 RAINFALL & RUNOFF

Site-specific rainfall has been derived using the HR Wallingford Flood Studies Report (FSR) for the 100 year return storm with a range of storm durations for purposes of attenuation design. This data is presented in Table 4.2-1 below. Note that a Climate Change factor of 120% has been applied to the FSR calculated rainfall depths. This is in accordance with the upper bound figure stated in Table 2 of the UK Environment Agency's publication 'Flood risk assessments: climate change allowances' (February 2016) for the period 2040 to 2069. The design life of the Abergelli Power Project is 25 years.

Storm Event	M100-1 hour	M100-2 hours	M100-6 hours	M100-10 hours	M100-24 hours	M100-48 hours
M5-60 Rainfall (mm/hr)	19	19	19	19	19	19
Required duration, D (mins)	60	120	360	600	1440	2880
Ratio M5-60:M5-2day	0.24	0.24	0.24	0.24	0.24	0.24
Factor Z1	1.0	1.3	2	2.4	3.4	4.4
M5-D (mm)	19	24.7	38	45.6	64.6	83.6
Required storm return (Years)	100	100	100	100	100	100
Factor Z2	2.022	2.022	2.022	2.022	2.022	2.022
M100-D Basic Rainfall (mm)	38.4	49.9	76.8	92.2	130.6	169.0
Areal reduction factor	0.96	0.97	0.98	0.98	0.99	1
Climate change growth factor	1.2	1.2	1.2	1.2	1.2	1.2
Total Design Rainfall (mm)	44.3	58.1	90.4	108.4	155.2	202.8
Design Rainfall Intensity (mm/hr)	44.3	29.1	15.1	10.8	6.5	4.2

Table 4.2-1 Site-specific rainfall calculations

Permanent site construction areas have been subdivided by category for purposes of runoff calculation. Subdivision of the Equipment Generating Area is shown on drawing 70034053-SK-C-001 in Appendix A. A runoff coefficient has been allocated to each area type for determining the proportion of rainfall that is converted to runoff. The permanent site area and runoff coefficients are presented in Table 4.2-2. The chosen runoff coefficients represent the impermeability of the area categories within the limits of 0.0 (no runoff) to 1.0 (100% of rainfall is converted to runoff)

and are benchmarked against equivalent values from industry publications. Note that the runoff coefficients contain implicit allowances for minor ponding to ground surface during high intensity rainfall events.

	Basic Area by Category (m^2)				Assumed Runoff Coeff.	Equivalent Impermeable Area (m^2)		
	Generating Equipment Area	Access Rd Extn	Maint-enance Yard	Total Site		Generating Equipment Area	Access Rd Extn	Maint-enance Yard
Building Roofs	1825	0	0	1825	1.00	1825	0	0
Roads & Car Parking	4478	3600	0	8078	0.85	3806	3060	0
Oily Water Areas	985	0	0	985	0.95	936	0	0
General Site Areas***	14239	0	3385	14239	0.80	11391	0	2708
Total	21527	3600	3385	25127		17958	3060	2708
				Equivalent Lumped Runoff Coefficient		0.834	0.850	0.800

Table 4.2-2 Permanent Site Areas and Associated Runoff Coefficients

*Note *** - Assumed gravelled / granular surface finish*

Runoff volumes are determined by multiplication of the rainfall depths by the equivalent impermeable areas (the 'Rational Method').

4.3 ATTENUATION VOLUMES

GREENFIELD RUNOFF

Greenfield equivalent runoff rates are calculated individually for the permanent site area using the procedure recommended in Institute of Hydrology report 124 'Flood Estimation for Small Catchments' and 'Preliminary Rainfall Runoff Management for Developments' (EA / DEFRA, 2005). See Table 4.3-1 below. Site soil type and annual average rainfall is derived from HR Wallingford's Flood Studies Report.

	Site Area		
	Main Area	Access Rd Extn	Maintenance Yard
Hydrological Region	9	9	9
Soil Type	3	3	3
SPR	0.37	0.37	0.37
SOIL	0.4	0.4	0.40
SAAR (mm/year)	1600	1600	1600
Impermeable Area (Ha)	1.796	0.306	0.2708
IH 124 Reference Area (Ha)	50.0	50.0	50.0
Reference Area Greenfield Runoff (L/s)	377.9	377.9	377.9
Site Area Greenfield Runoff (L/s)	13.6	2.31	2.05

Table 4.3-1 Greenfield Runoff Equivalent

STORAGE REQUIREMENTS

Outline attenuation requirements for the Generating Equipment Area, Access Road Extension and Maintenance Yard areas are shown below in Tables 4.3-2, 4.3-3 and 4.3-4 respectively. Storage volumes include a 25% increase to account for effects of varying pressure head – discharge relationship upon initial filling of attenuation pond until the constant target discharge rate is achieved.

Time from Storm Commencement (mins)	Storm Event					
	M100-1 hour	M100-2 hour	M100-6 hour	M100-10 hour	M100-24 hour	M100-48 hour
0	0.0	0.0	0.0	0.0	0.0	0.0
5	77.8	49.3	23.1	15.2	7.0	2.8
10	155.6	98.5	46.2	30.4	14.0	5.6
15	233.3	147.8	69.3	45.6	21.0	8.4
30	466.7	295.5	138.6	91.1	42.0	16.9
60	933.4	591.0	277.1	182.3	84.1	33.8
120	872.3	1182.1	554.3	364.5	168.2	67.5
240	750.2	1059.9	1108.6	729.1	336.4	135.1
360	628.0	937.8	1662.9	1093.6	504.6	202.6
600	383.7	693.5	1418.6	1822.6	840.9	337.7
1440	0.0	0.0	563.6	967.7	2018.2	810.5
2880	0.0	0.0	0.0	0.0	552.5	1621.0
Maximum	933.4	1182.1	1662.9	1822.6	**2018.2**	1621.0

Table 4.3-2 Generating Equipment Area Attenuation Requirements

Time from Storm Commencement (mins)	Storm Event					
	M100-1 hour	M100-2 hour	M100-6 hour	M100-10 hour	M100-24 hour	M100-48 hour
0	0.0	0.0	0.0	0.0	0.0	0.0
5	12.9	8.4	3.9	2.6	1.2	0.5
10	25.8	16.8	7.9	5.2	2.4	1.0
15	38.7	25.2	11.8	7.8	3.6	1.4
30	77.4	50.4	23.6	15.5	7.2	2.9
60	154.8	100.7	47.2	31.1	14.3	5.8
120	144.4	201.4	94.4	62.1	28.7	11.5
240	123.6	180.6	188.9	124.2	57.3	23.0
360	102.8	159.8	283.3	186.3	86.0	34.5
600	61.2	118.2	241.7	310.6	143.3	57.5
1440	0.0	0.0	96.0	164.9	343.9	138.1
2880	0.0	0.0	0.0	0.0	94.1	276.2
Maximum	154.8	201.4	283.3	310.6	**343.9**	276.2

Table 4.3-3 Access Road Extension Attenuation Requirements

Time from Storm Commencement (mins)	Storm Event					
	M100-1 hour	M100-2 hour	M100-6 hour	M100-10 hour	M100-24 hour	M100-48 hour
0	0.0	0.0	0.0	0.0	0.0	0.0
5	11.4	7.4	3.5	2.3	1.1	0.4
10	22.8	14.9	7.0	4.6	2.1	0.8
15	34.2	22.3	10.4	6.9	3.2	1.3
30	68.5	44.6	20.9	13.7	6.3	2.5
60	137.0	89.1	41.8	27.5	12.7	5.1
120	127.8	178.3	83.6	55.0	25.4	10.2
240	109.4	159.8	167.2	109.9	50.7	20.4
360	91.0	141.4	250.7	164.9	76.1	30.6
600	54.1	104.6	213.9	274.8	126.8	50.9
1440	0.0	0.0	85.0	145.9	304.3	122.2
2880	0.0	0.0	0.0	0.0	83.3	244.4
Maximum	137.0	178.3	250.7	274.8	**304.3**	244.4

Table 4.3-4 Maintenance Yard Attenuation Requirements

5 CONCLUSION & RECOMMENDATIONS

The guidance within this report should be used as a basic methodology for development of the detailed Abergelli site foul, oily water and storm water drainage design in accordance with the appropriate design codes and standards.

Appendix A

N

CUT-OFF DRAIN (SWALE)

RAW/FIRE WATER TANK

DEMIN WATER TANK

EMERGENCY GENERATOR

NATURAL GAS RECEIVING STATION

DIESEL TANK

OIL SEPARATOR LOCATION

EMERGENCY ACCESS

FPL +89.300m AOD

FPL +86.800m AOD

CONTROL ROOM/ OFFICE/WORKSHOP

GAS TURBINE GENERATOR

EXHAUST STACK

TANKER UNLOADING STATION

OIL SEPARATOR LOCATION

TRANSFORMER

FIN FAN COOLERS

SWALE

GATE HOUSE

SITE FENCE

POND INLET LOCATION

CULVERT

FPL +84.000m AOD

ATTENUATION POND (2020m^3 MIN CAPACITY; 2.0m DEEP APPROX.)

PLANNING BOUNDARY

POND OUTFALL LOCATION

EXISTING WATERCOURSE

GENERATING SITE SURFACE WATER OUTFALL

60m WATER MAIN EASEMENT

KEY TO COLOURED HATCH

- BUILDINGS (1,825m^2)
- ROADS & CAR PARKING (4,478m^2)
- OILY WATER AREAS (985m^2)
- GENERAL SITE AREAS (14,239m^2)
- WATER MAIN EASEMENT ZONE

wsp

TITLE:
ABERGELLI POWER
GENERATING EQUIPMENT SITE
RUNOFF CATCHMENT AREAS

FIGURE No:
70034053-SK-C-001

File name C:\USERS\CHRISTOPHER.MOORE\DOCUMENTS\WSP-PB\ABERGELLI POWER LTD\DRAINAGE AREAS 20171012 WIP.DWG, printed on 13 October 2017 16:56:47, by Moore, Chris

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Appendix 4.2

Water Framework Directive (WFD) Screening Assessment

Water Framework Directive (WFD) Screening Assessment

Abergelli Power Project

Abergelli Power Ltd.

Project Reference: Abergelli WFD

60542910

10 May 2018

Quality information

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1. Introduction

1.1 Background

AECOM has prepared this Water Framework Directive (WFD) Screening Assessment on behalf of Abergelli Power Limited (APL) as part of the Environmental Statement (ES) for the proposed Abergelli Power Project hereafter referred to as 'the 'Project'.

This WFD Screening Assessment has been prepared in response to comments received from Natural Resources Wales (NRW) to the 2014 and 2018 PEIR. This WFD Screening Assessment is contained as an Appendix to the ES and specifically to supplement the Water Quality and Resources Chapter (Chapter 9) of the ES and should, therefore, be read together with this chapter.

The Project Site is situated on open land located approximately 2 km north of junction 46 of the M4 within the administrative area of the City and County of Swansea Council (CCS). The central grid reference for the site is SN 6528 0143 and the location of the Project Site is shown in Figure 1-1. A detailed Project description is provided in **Chapter 3: Project and Site Description**.

This Preliminary WFD Assessment Screening Assessment aims to identify the relevant WFD groundwater and surface water bodies located in the proximity of the Project Site and to undertake an assessment on the WFD features identified which could potentially be impacted by the Project.

1.2 Legislative Context

The Water Framework Directive (WFD) aims to protect and enhance the quality of the water environment across all European Union (EU) member states. It takes a holistic approach to the sustainable management of water by considering the interactions between surface water (including transitional and coastal waters, rivers, streams and lakes), groundwater and water-dependent ecosystems. Further details of the WFD are set out in sections 9.3.3, 9.5 and 9.8 of the Water Quality and Resources Chapter of the ES.

Under the WFD, 'water bodies' are the basic management units and are defined as all or part of a river system or aquifer. These water bodies form part of a larger 'river basin districts' (RBD), for which 'River Basin Management Plans' (RBMPs) are developed by EU member states and environmental objectives are set. RBMPs are produced every six years, in accordance with the river basin management planning cycle. Summary documents for the second cycle of plans were published by Natural Resources Wales (NRW) in December 2015, whilst water body objectives and measures were updated in 2017.

The WFD requires all EU member states to classify the current condition or 'status or potential' of surface and groundwater bodies and to set a series of objectives for maintaining or improving conditions so that water bodies maintain or reach 'good status or potential' during the next river basin management planning cycle. NRW is the competent authority for implementing the WFD in Wales. As part of its role, NRW must consider whether proposals for new developments have the potential to:

- Cause a deterioration of a water body from its current status or potential; and/ or
- Prevent future attainment of good status or potential where not already achieved.

As a result, new developments that have the potential to impact on current or predicted WFD status are required to assess their compliance against the WFD objectives of the potentially affected water bodies.

1.3 Structure of this report

Section 2 of this report, provides a summary of the WFD screening process. While Section 3 provides information on the current WFD status of water bodies that have the potential to be impacted by the Project. The no deterioration assessment methodology is described in Section 4.2 and the WFD Assessment is provided in Section 5.

2. WFD Screening

Screening has identified four WFD surface water bodies and two WFD groundwater bodies of relevance located in proximity to the Project Site (i.e. within a 1km buffer set around the Project Site). The water bodies are listed in Table 2-1 and the locations are presented in Figure 2-1 with the exception of Burry Inlet Channel, a downstream surface water body, which is located approximately 7 km southwest of the Project Site.

Table 2-1: WFD water bodies located within the study area

Type	WFD Classification	Waterbody Name / ID	Location
Surface Water Body	River	Afon Llan – headwaters to tidal limit (GB110059032070)	Located on the southern edge of the Project Site boundary, flow is to the southwest towards Burry Inlet Channel (Estuary).
	River	Lliw - headwaters to confluence with Llan (GB110059032100)	Located approximately 800m northwest from the most northern edge of Project Site, flows is southwest towards Burry Inlet Channel (Estuary).
	Lake	Lower Lliw Reservoir (GB31041177)	On line reservoir on the Lliw located approximately 1 km north of the most northern edge of the Project Site boundary.
	Transitional	Burry Inlet Channel (GB531005913500)	Estuary located approximately 7 km southwest of Project Site, located downstream of Llan and Lliw rivers.
Groundwater Body	Groundwater	Carmarthen Carboniferous Coal Measures (GB41002G200600)	Groundwater body immediately underlying the Project Site.
	Groundwater	Swansea Carboniferous Coal Measures (GB41002G201000)	Groundwater body located approximately 800 m southeast from the southern edge of the Project Site boundary.

With consideration of the construction and operational phases of the Project and taking into account the mitigation embedded within the Project's design (as detailed in Chapter 3: Project Site and Description) it is considered in professional judgement that of the WFD water bodies identified in Table 2-1, only the Afon Llan River body (GB11059032100) and Carmarthen Carboniferous Coal Measures (GB41002G200600) should be carried through into the WFD Screening Assessment. It is considered that the water bodies screened out before the assessment are very unlikely to be impacted by the Project. Justifications for their exclusion are included in Table 2-2.

Table 2-2: Screening of WFD water bodies located within the study area

Type	WFD Classification	Waterbody Name / ID	Inclusion in Assessment	Justification
Surface Water Body	River	Llan – headwaters to tidal limit (GB110059032070)	**Yes**	The Project Site is located within the catchment of the Llan. Drains and springs located on or in close proximity to the Project Site flow to the south and are directly linked to this water body.
	River	Lliw - headwaters to confluence with Llan (GB110059032100)	*No*	The Project Site is not in close proximity and is located in a different river catchment (Llan); therefore the water body is very unlikely to be impacted by the Project.
	Lake	Lower Lliw Reservoir (GB31041177)	*No*	The Project Site is not in close proximity and is located in a different river catchment (Llan); therefore the water body is very unlikely to be impacted by the Project.

Type	WFD Classification	Waterbody Name / ID	Inclusion in Assessment	Justification
	Transitional	Burry Inlet Channel (GB531005913500)	*No*	The water body is located over 7 km downstream of the Project Site and is therefore very unlikely to be impacted.
Groundwater Body	Groundwater	Carmarthen Carboniferous Coal Measures (GB41002G200600)	**Yes**	The Project Site immediately overlies the groundwater body. Springs and drains identified nearby may be linked; preliminary assessment required to consider potential impacts of the Project to groundwater.
	Groundwater	Swansea Carboniferous Coal Measures (GB41002G201000)	*No*	The Project Site is not located in proximity and is in a different catchment; therefore the water body is very unlikely to be impacted by the Project.

3. Water Body Status

3.1 Background to Surface Water Body Status

3.1.1.1 Under the WFD, surface water body status is classified on the basis of chemical and ecological status or potential. Ecological status is assigned to surface water bodies that are natural and considered by the NRW not to have been significantly modified for anthropogenic purposes. Ecological potential is assigned to artificial and man-made water bodies (such as canals), or natural water bodies that have undergone significant modification; these are termed Heavily Modified Water Bodies (HMWBs). The term 'ecological potential' is used as it may be impossible to achieve good ecological status because of modification for a specific use, such as navigation or flood protection. The ecological potential represents the degree to which the quality of the water body approaches the maximum it could achieve. The worst case classification is assigned as the overall surface water body status, in a 'one-out all-out' system. This system is summarised below in Figure 3-1.

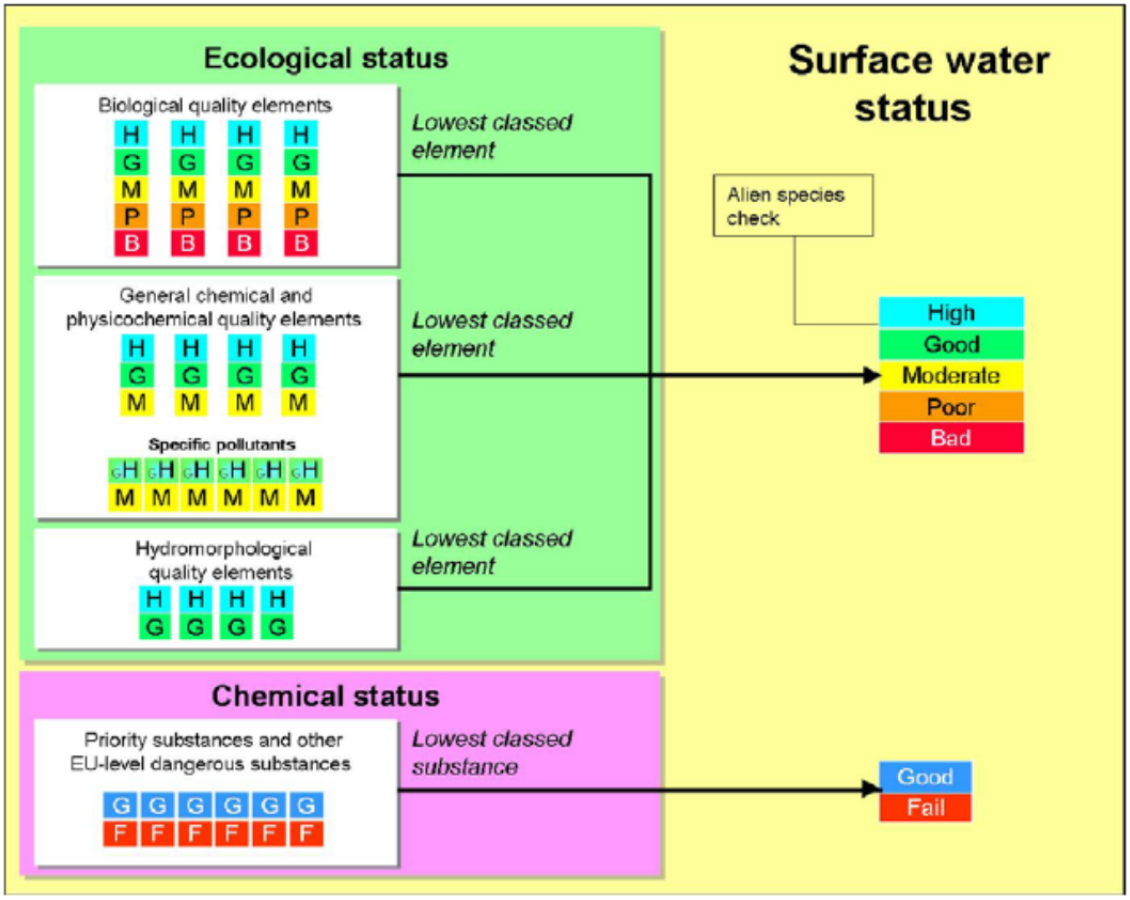

Figure 3-1. WFD classification elements for surface water body status (Environment Agency, 2015)

3.1.2 Chemical Status

3.1.2.1 Chemical status is defined by compliance with environmental standards for chemicals that are priority substances and/or priority hazardous substances, in accordance with the Environmental Quality Standards Directive (2008/105/EC). This is assigned on a scale of good or fail. Surface water bodies are only monitored for priority substances where there are known discharges of these pollutants; otherwise surface water bodies are reported as being at good chemical status.

3.1.3 Ecological Status or Potential

3.1.3.1 Ecological status or potential is defined by the overall health or condition of the watercourse. This is assigned on a scale of High, Good, Moderate, Poor or Bad, and on the basis of four classification elements or 'tests' (Environment Agency, 2013), as follows:

- Biological: This test is designed to assess the status indicated by a biological quality element such as the abundance of fish, invertebrates or algae and by the presence of invasive species. The biological quality elements can influence an overall water body status from Bad through to High.
- Physico-chemical: This test is designed to assess compliance with environmental standards for supporting physicochemical conditions, such as dissolved oxygen, phosphorus and ammonia. The physicochemical elements can only influence an overall water body status from Moderate through to High.
- Specific pollutants: This test is designed to assess compliance with environmental standards for concentrations of specific pollutants, such as zinc, cypermethrin or arsenic. As with the physico-chemical test, the specific pollutant assessment can only influence an overall water body status from Moderate through to High.
- Hydromorphology: For natural, non-HMWBs, this test is undertaken when the biological and physico-chemical tests indicate that a water body may be of High status. It specifically assesses elements such as water flow, sediment composition and movement, continuity, and structure of the habitat against reference or 'largely undisturbed' conditions. If the hydromorphological elements do not support High status, then the status of the water body is limited to Good overall status. For artificial or HMWBs, hydromorphological elements are assessed initially to determine which of the biological and physico-chemical elements should be used in the classification of ecological potential. In all cases, assessment of baseline hydromorphological conditions are an important factor in determining possible reasons for classifying biological and physico-chemical elements of a water body as less than Good, and hence in determining what mitigation measures may be required to address these failing water bodies.

3.2 Relevant Surface Water Bodies and Status

3.2.1.1 There is one surface water body to be considered in the WFD assessment: the river water body of the Afon Llan (Water body ID GB110059032070). The water body encompasses the headwaters of the river to the tidal limit and flows in a general south-westerly direction in proximity of the Project. The Llan flows into the Burry Inlet Channel transitional water body (estuary) which is not considered to be affected by the Project given that it is located more than 7 km downstream. Information on the Llan water body has been taken from the 2015 Western Wales River Basin Management Plan (NRW, 2015) and summarised as follows:

- The overall objective of the surface water body is Good by 2015 (and to remain so).
- Objective is Good with respect to chemical quality and quantity.
- Objective is Good with respect to ecological quality and quantity.

3.2.1.2 The Natural Resources Wales Watch Water Gallery[1] (NRW website, accessed November 2017) indicates that under the latest 2015 assessment (Cycle 2) the status of the Llan is 'good' and therefore the objective in the RBMP has been met. A summary of the 2009 Cycle 1 and 2015 Cycle 2 assessment is reproduced in Table 3-1.

Table 3-1: Llan Surface water body assessments in 2009 Cycle 1 and 2015 Cycle 2

Parameter		Llan - headwaters to tidal limit	
		2009	2015
Water Body ID		GB110059032070	
Water Body Area		41.26 km^2	
Water Body Type		River	
Hydromorphological Designation		Not designated artificial or heavily modified	
Overall Status		Moderate	Good
Ecological Status		Moderate	Good
Chemical Status		DNRA	Good
Biological Elements	Macrophytes and phytobenthos	-	Good
	Invertebrates	Good	Good
	Fish	Moderate	Good
Supporting Elements	Ammonia (Physio-Chemical)	High	High
	Dissolved Oxygen	High	High
	pH	High	High
	Phosphate	High	High
	Temperature	High	High
	Copper	High	Good
	Zinc	High	-
	Specific Pollutants (Annex 8)	High	High
Hydromorphological Supporting Elements	Hydrological Regime	Supports Good	Supports Good
	River Continuity (Flow)	Pass	Pass
	Morphology	Supports Good	Supports Good

3.3 Background to Groundwater Body Status

3.3.1.1 Under the WFD, groundwater body status is classified on the basis of quantitative and chemical status. Status is assessed primarily using data collected from the NRW monitoring network; therefore, the scale of assessment means that groundwater status is mainly influenced by larger scale effects such as significant abstraction or widespread/ diffuse pollution. The worst case classification is assigned as the overall groundwater body status, in a 'one-out all-out' system. This system is summarised in Figure 3-2.

3.3.2 Quantitative Status

3.3.2.1 Quantitative status is defined by the quantity of groundwater available as baseflow to watercourses and water-dependent ecosystems, and as 'resource' available for use as drinking water and other consumptive purposes. This is assigned on a scale of Good or Poor, and on the basis of four classification elements or 'tests' as follows:

- **Saline or other intrusions:** This test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition,

[1] Natural Resources Wales website, accessed November 2017 at http://waterwatchwales.naturalresourceswales.gov.uk/en/

as a result of groundwater abstraction is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.

- **Surface water:** This test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the ecological status of associated surface water bodies.
- **Groundwater Dependent Terrestrial Ecosystems (GWDTEs):** This test is designed to identify groundwater bodies where groundwater abstraction is leading to "significant damage" to associated GWDTEs (with respect to water quantity).
- **Water balance:** This test is designed to identify groundwater bodies where groundwater abstraction exceeds the "available groundwater resource", defined as the rate of overall recharge to the groundwater body itself, as well as the rate of flow required to meet the ecological needs of associated surface water bodies and GWDTEs.

3.3.3 Chemical Status

3.3.3.1 Chemical status is defined by the concentrations of a range of key pollutants, by the quality of groundwater feeding into watercourses and water-dependent ecosystems and by the quality of groundwater available for drinking water purposes. This is assigned on a scale of Good or Poor, and on the basis of five classification elements or 'tests' as follows:

- **Saline or other intrusions:** This test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition, as a result of groundwater abstraction is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.
- **Surface water:** This test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the chemical status of associated surface water bodies.
- **Groundwater Dependent Terrestrial Ecosystems (GWDTEs):** This test is designed to identify groundwater bodies where groundwater abstraction is leading to "significant damage" to associated GWDTE's (with respect to water quality).
- **Drinking Water Protected Areas (DrWPAs):** This test is designed to identify groundwater bodies failing to meet the DrWPA objectives defined in Article 7 of the WFD or at risk of failing in the future.
- **General quality assessment:** This test is designed to identify groundwater bodies where widespread deterioration in quality has or will compromise the strategic use of groundwater.

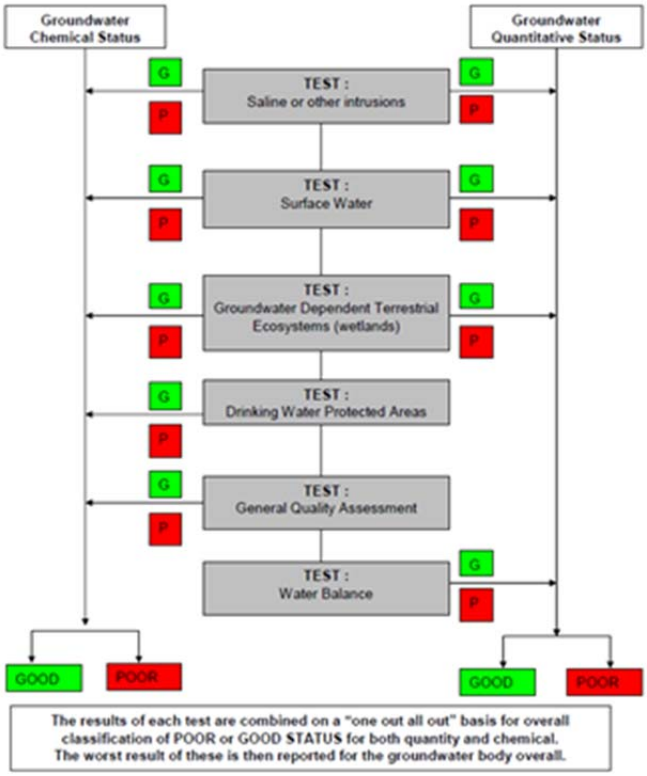

Figure 3-2. WFD Classification Elements for Groundwater Body Status (Environment Agency, 2015)

3.4 Relevant Groundwater Bodies and Status

3.4.1.1 There is one groundwater body to be considered in the WFD assessment: the Carmarthen Carboniferous Coal Measures (ID: GB41002G200600). Information on the status of this water body is available from the 2015 Western Wales River Basin Management Plan (NRW, 2015) and summarised as follows:

- The overall objective of the groundwater body is Poor by 2015 (technically infeasible – no known technical solution available due to legacy metal mine contamination).
- The 2015 Cycle 2 Quantitative Status is Good.
- The 2015 Cycle 2 Qualitative Status is Poor.

3.4.1.2 The Natural Resources Wales Watch Water Gallery[2] (NRW website, accessed November 2017) indicates that under the latest 2015 assessment (Cycle 2) the status of the Carmarthen Carboniferous Coal Measures is 'poor'. A summary of the 2009 Cycle 1 and 2015 Cycle 2 assessment is reproduced in Table 3-2.

Table 3-2: Carmarthen Carboniferous Coal Measures Groundwater body assessments in 2009 Cycle 1 and 2015 Cycle 2

Parameter	Carmarthen Carboniferous Coal Measures	
	2009	2016
Water Body ID	GB41002G200600	
Water Body Area	547.95 km^2	
Water Body Type	Groundwater	
Protected Area Designation	Drinking Water Projected Area, Special Areas of Conservation	
Overall Status	Poor	Poor

[2] Natural Resources Wales website, access November 2017 at http://waterwatchwales.naturalresourceswales.gov.uk/en/

Parameter		Carmarthen Carboniferous Coal Measures	
		2009	2016
Quantitative Status		Good	Good
Chemical Status		Poor	Poor
Quantitative Elements	Saline or other intrusions	Good	Good
	Surface Water	Good	Good
	Groundwater Dependent Terrestrial Ecosystems (GWDTEs)	Good	Good
	Water Balance	Good	Good
Chemical Elements	Saline or other intrusions	Good	Good
	Surface Water	Poor	Poor
	GWDTEs	Good	Good
	Drinking Water Protected Areas (FrWPAs)	Good	Good
	General Chemical Test	Good	Good

4. Assessment Methodology

4.1 Introduction

4.1.1.1 Proposed developments that have the potential to impact on current or predicted WFD status are required to assess their compliance against the objectives defined for potentially affected water bodies. As part of its role, NRW must consider whether proposals for new developments have the potential to:

- Cause a deterioration of a water body from its current status or potential; and/ or
- Prevent future attainment of Good status (or potential where not already achieved).

4.2 No Deterioration Assessment

4.2.1 Defining 'No Deterioration'

4.2.1.1 'No deterioration' was defined by the Environment Agency in its Position Paper (Environment Agency, 2013). Steps are required to prevent deterioration of the ecological status, ecological potential and chemical status of surface water and the qualitative status and quantitative status of groundwater.

4.2.1.2 Originally deterioration was defined by the Environment Agency as deterioration from one status class to a lower one, however following a ruling by the Court of Justice of the European Union (CJEU) in July 2015 (C-461/13), this has been redefined. The CJEU ruling clarified that:

- “deterioration of the status” of the relevant water body includes a fall by one class of any **element** of the “quality elements“ even if the fall does not result in the a fall of the classification of the water body as a whole;
- ‘Any deterioration’ in quality elements in the lowest class constitutes deterioration; and
- Certainty regarding a project’s compliance with the Directive is required at the planning consent stage; hence, where deterioration ‘may’ be caused, derogations under Article 4.7 of the WFD are required at this stage.

4.2.1.3 While deterioration within a status class does not contravene the requirements of the WFD, (except for Drinking Water Directive parameters in drinking water protected areas), the WFD requires that action should be taken to limit within-class deterioration as far as practicable. For groundwater quality, measures must also be taken to reverse any environmentally significant deteriorating trend, whether or not it affects status or potential.

4.2.1.4 The no deterioration requirements are applied independently to each of the elements that come together to form the water body classification as required by Annex V of the Water Framework Directive and Article 4 of the Groundwater Daughter Directive.

- **Surface water:** To manage the risk of deterioration of the biological elements of surface waters, the no deterioration requirements are applied to the environmental standards for the physico-chemical elements, including those for the Moderate/Poor and Poor/Bad boundaries.
- **Groundwater:** The no deterioration requirements are applied to each of the four component tests for quantitative status and the five component tests for chemical status. The no deterioration requirement may not apply to elements at High status and elements at High status may be permitted to deteriorate to Good status, provided that:
  - The water body’s overall status is not High;
  - The RBMP has not set an objective for the water body of High status;
  - The objectives and requirements of other domestic or European Community legislation are complied with; and
  - Action is taken to limit deterioration within High or Good status or potential classes as far as practicable.

4.2.1.5 The no deterioration baseline for each water body is the status that is reported in Tables 3-1 and 3-2.

4.2.2 Surface Water No Deterioration Assessment

4.2.2.1 Table 4-1 presents the matrix used to assess the effect of the Project on surface water status or potential class. It ranges from a major beneficial effect (i.e. a positive change in overall WFD status) through no effect to deterioration in overall status class. The colour coding used in Table 4-1 is applied to the spreadsheet assessment in Table 4-2.

Table 4-1. Surface Water Assessment Matrix

Effect	Description/criteria	Outcome
Major beneficial	Impacts that taken on their own or in combination with others have the potential to lead to the improvement in the ecological status or potential of a WFD quality element for the entire waterbody	Increase in status of one or more WFD element giving rise to a predicted rise in status class for that waterbody.
Light Blue - Minor /localised beneficial	Impacts when taken on their own or in combination with others have the potential to lead to a minor localised or temporary improvement that does not affect the overall WFD status of the waterbody or any quality elements	Localised improvement, no change in status of WFD element
Green (no impact)	No measurable change to any quality elements.	No change
Yellow -Localised/ temporary adverse effect	Impacts when taken on their own or in combination with others have the potential to lead to a minor localised or temporary deterioration that does not affect the overall WFD status of the waterbody or any quality elements. Consideration will be given to habitat creation measures.	Localised deterioration, no change in status of WFD element when balanced against mitigation measures embedded in the Project.
Orange -adverse effect on class of WFD element	Impacts when taken on their own or in combination with others have the potential to lead to the deterioration in the WFD status class of one or more biological quality elements, but not in the overall status of the waterbody. Consideration will be given to habitat creation measures.	Decrease in status of WFD element when balanced against positive measures embedded in the Project.
Red – adverse effect on overall WFD class of waterbody	Impacts when taken on their own or in combination with others have the potential to lead to the deterioration in the ecological status or potential of a WFD quality element, which then lead to a deterioration of status/potential of waterbody.	Decrease in status of overall WFD waterbody status when balanced against positive measures embedded in the Project.

4.2.3 Groundwater No Deterioration Assessment

4.2.3.1 Table 4-2 presents the matrix used to assess the effect of the Project on groundwater status class. It ranges from a beneficial effect but no change in status to deterioration in overall status class. The colour coding used in Table 4-2 is applied to the spreadsheet assessment in Appendix A.

Table 4-2. Groundwater Assessment Matrix

Magnitude of Impact of Project Element on WFD Element i.e. in individual cells	Effect on WFD Element within the assessment boundary i.e. at end of row	Effect on Status of WFD element at the Groundwater Body Scale
Impacts lead to beneficial effect	Combined impacts have the potential to have a beneficial effect on the WFD element.	Improvement but no change to status of WFD element
No measurable change to groundwater levels or quality.	No measurable change to WFD elements.	No change and no deterioration in status of WFD element
Impacts when taken on their own have the potential to lead to a minor localised or temporary effect	Combined impacts have the potential to lead to a minor localised or temporary adverse effect on the WFD element.	Combined impacts have the potential to lead to a minor localised or temporary effect on the WFD element. No change to status of WFD element and no significant deterioration at groundwater body scale.
Impacts when taken on their own have the potential to lead to a widespread or prolonged effect.	Combined impacts have the potential to have an adverse effect on the WFD element.	Combined impacts have the potential to have an adverse effect on the WFD element, resulting in significant deterioration but no change in status class at groundwater body scale.
Impacts when taken on their own have the potential to lead to a significant effect.	Combined impacts in combination with others have the potential to have a significant adverse effect on the WFD element.	Combined impacts in combination with others have the potential to have an adverse effect on the WFD element AND change its status at the groundwater body scale

4.3 Future Status Objectives

4.3.1.1 RBMPs are used to outline water body pressures and the actions that are required to address them. The future status objective assessment considers the ecological potential of a surface water body and the mitigation measures that defined the ecological potential. Assessments in this project are based on mitigation measures defined in the 2015 RBMP. Information on WFD measures available from the NRW website (accessed November 2017[3]) have also been reviewed. The assessment considers whether the Project has the potential to prevent the implementation or impact the effectiveness of the defined measures.

[3]Natural Resources Wales website, access November 2017 at http://waterwatchwales.naturalresourceswales.gov.uk/en/

5. Water Framework Directive Compliance Assessment

5.1 General Approach and Project Assumption

5.1.1.1 The WFD compliance assessment uses a spreadsheet tool to assess the effects of the Project on each of the WFD elements (biological, physico-chemical and hydromorphological surface water elements, and quantitative and chemical groundwater elements).

5.1.1.2 Both the surface water assessment and the groundwater assessment examine the potential effects of the Project, which includes the Power Generation Plant, and Gas and Electricity Connections. The works plans are shown in Figure 3.2 of the ES.

5.1.1.3 The Power Generation Plant in summary will comprise the Generating Equipment, Laydown Area and Access Road. The Generating Equipment will be an OGCT designed to operate where there is a surge in demand and a stack. An existing Access Road will be upgraded between the B4489 and the Swansea North Substation and a new Access Road constructed between the Substation and the Generation Equipment Site.

5.1.1.4 The Gas Connection will be a new above ground installation and approximately 1.4 km of underground pipeline to connect to the existing high pressure National Transmission System. The Electrical Connection will comprise elements to enable power to be exported via underground cable to the Substation of approximately 900 m in length. As the Project Site is remote a foul water drainage system will either drain to a septic tank or a package treatment plant, and will discharge onsite or to a nearby watercourse. A surface water drainage system incorporating drainage ditches will perimeter the Project Site and prevent ponding. Attenuation ponds will maintain greenfield runoff flows with emergency overflow.

5.1.1.5 Key assumptions for the assessment are as follows:

- **Ground Works:** It is assumed that ground works will comprise excavation and levelling for foundations, piling (if required) and laying of Gas and Electric Connections and erection of the Generating Equipment.
- **Dewatering:** It is assumed that no groundwater dewatering is required as part of the Project.
- **Outline Construction Environmental Management Plan (CEMP):** It is assumed that suitable plans will be put in place through the Outline CEMP (secured in the development consent order) in order to reduce risks to the environment.
- **Surface Water Run-off:** It is assumed that drainage from the Project will not have an impact on surface water run-off (and therefore water quality) into the Llan WFD water body.

5.1.1.6 For surface water, the potential effects identified are as a result of:

- Noise and vibration during construction of foundations and piling during the construction phase;
- Temporary land-take during the construction phase;
- Pollution due to discharges or spillages during the construction phase;
- Scour during the construction phase;
- Temporary diversion of tributary drains during construction phase;
- Permanent land take during the operational phase; and
- Permanent diversion of tributary drains during operation.

5.1.1.7 For groundwater, the potential effects identified are as a result of:

- Pollution due to discharges or spillages during the construction phase;
- Piling and below ground working causing mobilisation of contaminants during the construction and operational phases; and

- Damming of groundwater flow behind sheet piles (decreasing groundwater contributions and potentially mobilising contamination).

5.1.1.8 Appendix A contains the surface water and groundwater assessments where the above potential effects are considered. The colour coded system referred to in Table 4-1 and Table 4-2 is used to give a visual impression of the compliance assessment.

5.2 No Deterioration Assessment

5.2.1 Llan – headwaters to tidal limit

5.2.1.1 The Project is located in proximity to tributary drains of the Afon Llan River with only the southern edge of the Project Site outline in proximity of the Afon Llan WFD body.

5.2.1.2 There is the potential for localised effects from land take and scour as a result of construction close to tributary drains which may cause a loss of habitat. However, this is unlikely to be significant at waterbody scale and it is considered that habitats will recover naturally. The impacts are not expected to be significant at water body scale and the system would recover naturally.

5.2.1.3 There is the potential for localised temporary impacts on water quality in the Llan from the mobilisation of contaminated sediment or groundwater into surface water through piling below ground workings. The impact is not expected to increase at the waterbody scale and any impacts are likely to be minor and localised on the tributary drains. Should any unforeseen water quality issues be identified during future ground investigations, which are likely to follow the granting of planning permission , further mitigation measures will be embedded into the design to limit any adverse impacts on the surface water body.

5.2.1.4 The Outline CEMP will mitigate potential impacts on the Afon Llan from spillages during construction.

5.2.1.5 There is potential for minor impacts on habitat, water quality and hydromorphology as a result of diversion of tributary drains during the construction and operation phases. Any impacts are likely to be localised to the tributary drains and are not expected to be significant at the water body scale.

5.2.1.6 Therefore, overall the Project is not expected to result in significant deterioration or change in surface water body status.

5.2.2 Carmarthen Carboniferous Coal Measures

5.2.2.1 The Project is not anticipated to involve dewatering, which limits the potential construction impacts of the Project on the groundwater body. There is believed to be potential for contamination with respect to land quality, although the potential to impact the WFD status of the groundwater body is minor as the impacts will be localised especially given the likely presence of low permeability superficial deposits. Should any unforeseen water quality issues be identified during future ground investigations, which are likely to follow the granting of planning permission, further mitigation measures will be embedded into the design to limit any adverse impacts on the groundwater body.

5.2.2.2 Any proposed piling and below ground working may have the potential to reduce groundwater contributions to surface water or dependent ecosystems. However, it is not expected that the interaction between groundwater-and surface water is a key driver given the likely low permeability superficial deposits in the study area. Therefore, piling and below ground activities are no anticipated to have a measurable impact on the status of the groundwater body throughout the construction and operational phases.

5.2.2.3 The Outline CEMP will mitigate potential adverse impacts on the Carmarthen Carboniferous Coal Measures groundwater body from spillages during construction.

5.2.2.4 Overall, the Project is not expected to result in significant deterioration or change in groundwater body status.

5.3 Future Good Status

5.3.1.1 The status objective for the Llan water body as reported within the 2015 RBMP is Good by 2015, therefore the objective is currently met. The focus of the NRW programme of measures is to prevent deterioration of status in all water bodies which is assessed in Section 5.2.

5.3.1.2 The objective of the Carmarthen Carboniferous Coal Measures is Poor by 2015. This objective is classified as less than Good by 2027 in the 2015 RBMP (a less stringent objective) because a Good objective is technically infeasible due to legacy metal mine contamination.

5.3.1.3 At present there are no local targeted measures within the catchments to maintain or achieve improvements to the status of the water bodies. National Measures set by NRW in the 2015 RBMP to achieve the objectives of the plan relate to:

- Physical Modifications;
- Management of pollution from sewage and waste water;
- Management of pollution from towns, cities and transport;
- Changes to natural flow and levels of water;
- Managing invasive non-native species;
- Managing pollution from rural areas;
- Managing the impacts of acidification;
- Managing pollution from mines.

5.3.1.4 Based on the above information it is not considered that any of the aspects of the Project will prevent the WFD objectives from being achieved.

6. Conclusion

6.1.1.1 The WFD assessment indicates that, based on the current understanding of the Project, there is potential for minor localised effects on the Afon Llan River surface water body. However, it has been assessed that it is unlikely that the Project will cause any significant deterioration or change in water body status or prevent attainment, or potential to achieve, future good status.

6.1.1.2 The WFD assessment indicates that there is potential for minor temporary or localised effects on the Carmarthen Carboniferous Coal Measures groundwater body. However, it has been assessed that it is unlikely that the Project will cause any significant deterioration or change in water body status or prevent attainment, or potential to achieve, the WFD objectives.

6.1.1.3 No further assessment of WFD is recommended given that no significant deterioration or change in water body status is expected based on the current understanding.

7. References

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Appendix A Water Framework Directive Assessment Sheets

Formal WFD Assessment: Carmarthen Carboniferous Coal Measures

Risk screening of potential to cause deterioration of current WFD status

	Groundwater	Scheme Elements	Abergelli Power Station - Power Generation Plant including temporary construction compound, access road and new gas and electric connections			Overall impact	Further WFD Assessment or Mitigation (to retain or promote good status)
	GB41002G200600	Phase (Construction / Operation)	Construction	Construction & Operation	Operation		
	Carmarthen Carboniferous Coal Measures	Identified quantitative impacts	Pollution from Spillages	Piling and below ground working causing mobilisation of contamination	Damming of groundwater flow behind piles or foundations (decreasing groundwater contributions and potentially mobilising contamination)		
Quantitative Elements	**1.Saline or other intrusions.** To identify groundwater bodies where the intrusion of poor quality water as a result of groundwater abstraction is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.	Predicted change to status elements	N/A (no dewatering anticipated)	Construction of piling and foundations could potentially cause intrusion of poor quality water although impacts considerd to be unlikely given low permeability superficial deposits underlying the site.	Piling and foundations could potentially cause intrusion of poor quality water although impacts considerd to be unlikely given low permeability superficial deposits underlying the site.	Potential localised minor impacts not considered signficant at water body scale.	Impact unlikely to be be significant at water body scale. Assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	2. Surface water. To assess the impact of groundwater abstractions on the ecological status of surface water bodies.		N/A (no dewatering anticipated)	N/A (no dewatering anticipated)	Possible minor loss of groundwater baseflow from piling close to tributary drains and springs. Impacts considered unlikely given presence of low permeability superficial deposits.	Potential localised minor impacts not considered signficant at water body scale.	Impact unlikely to be be significant at water body scale. Assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	3. Groundwater Dependent Terrestrial Ecosystems (GWDTE's). To assess the impact of groundwater abstractions on the condition of GWDTE'S.		N/A (no dewatering anticipated)	N/A (no dewatering anticipated)	Possible minor loss of contributions from groundwater to Sites of Importance for Nature Conservation and Anscient Woodland which may be groundwater dependent. Impacts considered unlikely given prescence of low permeability superficial deposits.	Potential localised minor impacts not considered signficant at water body scale.	Impact unlikely to be be significant at water body scale. Assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	4. Water balance. To identify groundwater bodies where abstractions exceed the available resource.		N/A (no dewatering anticipated)	N/A (no dewatering anticipated)	N/A (no dewatering anticipated)	N/A (no dewatering)	None required
Chemical Quality	**1. Saline or other intrusions.** To identify groundwater bodies where the intrusion of poor quality water as a result of groundwater abstraction is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.		N/A (no dewatering anticipated)	Construction of piling and foundations could potentially cause intrusion of poor quality water although impacts considerd to be unlikely especially given low permeability superficial deposits underlying the site.	Piling and foundations could potentially cause intrusion of poor quality water although impacts considerd to be unlikely given low permeability superficial deposits underlying the site.	Potential localised minor impacts not considered signficant at water body scale.	Impact unlikely to be be significant at water body scale. Assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	2. Surface water. To assess the impact of groundwater on the chemical and ecological status of surface water bodies.		CoCP and best practice for design, construction and operations reduce risks to water quality. No measureable change to element anticipated	Potential for below ground workings to encounter any contaminated ground that may be present. Overall minor potential for contamination to impact WFD status especially given lower permeability superficial deposits underlying the site.	Possible minor loss of baseflow although considered to be unlikely given low permeability superficial deposits. Water quality likely to be dominated by runoff from upstream catchment.	Potential localised minor impacts not considered signficant at water body scale.	Impact unlikely to be be significant at water body scale. Assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	3. GWDTE's. To assess the impact of nutrient concentrations in groundwater (primarily phosphates) on GWDTE's.		CoCP and best practice for design, construction and operations reduce risks to water quality. No measureable change to element anticipated	Potential for below ground workings to mobilse contaminated ground to Sites of Important for Nature Conservation and Anscient Woodland which may be groundwater dependent. Overall minor potential for contamination to impact WFD status especially given lower permeability superficial deposits underlying the site.	Potential for below ground structures to mobilse contaminated ground to Sites of Important for Nature Conservation and Anscient Woodland which may be groundwater dependent. Impacts considered unlikely given low permeabilty deposits.	Potential localised minor impacts not considered signficant at water body scale.	Impact unlikely to be be significant at water body scale. Assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	4. Drinking Water Protected Areas (DrWPAs). To identify groundwater bodies failing to meet the DrWPA objectives defined in Article 7 of the WFD or at risk of failing in the future.		CoCP and best practice for design, construction and operations reduce risks to water quality. No measureable change to element anticipated	Potential for below ground workings to encounter contaminated ground. Overall minor potential for contamination to impact WFD status especially given lower permeability superficial deposits underlying the site.	Potential for below ground workings to encounter contaminated ground. Overall minor potential for contamination to impact WFD status especially given lower permeability superficial deposits underlying the site.	Potential localised minor impacts not considered signficant at water body scale.	Impact unlikely to be be significant at water body scale. Assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	5. General quality assessment. To identify groundwater bodies where widespread deterioration in quality has or will compromise the strategic use of groundwater.		CoCP and best practice for design, construction and operations reduce risks to water quality. No measureable change to element anticipated	Potential for below ground workings to encounter contaminated ground. Overall minor potential for contamination to impact WFD status especially given lower permeability superficial deposits underlying the site.	Potential for below ground workings to encounter contaminated ground. Overall minor potential for contamination to impact WFD status especially given lower permeability superficial deposits underlying the site.	Potential localised minor impacts not considered signficant at water body scale.	Impact unlikely to be be significant at water body scale. Assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.

Formal WFD Assessment: Llan - Headwaters to Tidal Limit

Risk screening of potential to cause deterioration of current WFD Ecological status

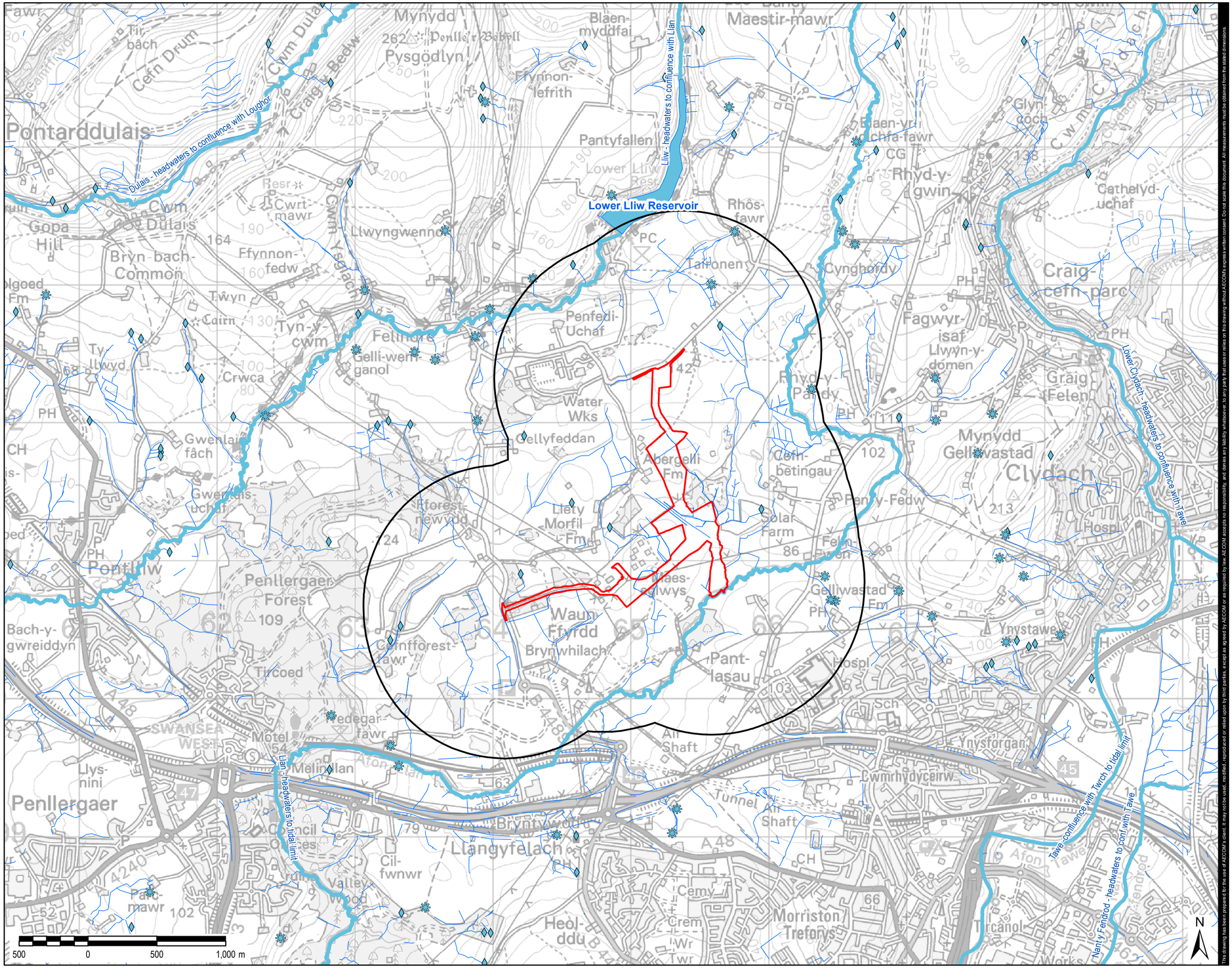
	River	Scheme Elements	Abergelli Power Station - Power Generation Plant including temporary construction compound, access road and new gas and electric connections							Overall impact	Further WFD Assessment or Mitigation (to retain or promote good status)
	GB110059032070	Phase (Construction / Operation)	Construction	Construction	Construction	Construction	Construction	Operation	Operation		
	Llan - headwaters to tidal limit	Identified quantitative impacts	Noise and vibration from foundations and piling	Temporary landtake	Pollution due to discharges	Scour	Diversion of tributary drains	Permanent landtake	Diversion of tributary drains		
WFD classification elements	Macrophytes and phytobenthos - combined	Predicted change to status elements (green = none, amber = possiby, red = likely)	Insensitive to impact. No measureable change to element anticipated	Possible temporary effects from construction close to tributary drains due to the loss of habitat during works on the bankside. This is unlikely to be significant at the waterbody scale and likely to recovery naturally.	Possible minor impact where works close to tributary drains including below ground workings may possibly mobilise contaminated sediments into the tributary drains. Unlikely to affect the status at a water body scale following implimentation of CoPC / CEMP.	Potential for increase in scour caused by works close to or from diversion of tributary drains may affect ecological habitats. Unlikely to be significant at water body scale.	Diversion of tributary drains will result in loss of habitat on tributary drains which are likely to be temporary. Impacts considered unlikely to be significant at the water body scale.	Landtake will be mean some loss of habitat in proximity of the tributary drains although unlikely to be significant at the water body scale.	No significant impact anticipated	Potential localised impacts, but no deterioration anticipated.	Although impact unlikely to be be significant at water body scale, assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	Macroinvertebrates		Insensitive to impact. No measureable change to element anticipated	Possible temporary effects from construction close to tributary drains due to the loss of habitat during works on the bankside. This is unlikely to be significant at the waterbody scale and likely to recovery naturally.	Possible minor impact where works close to tributary drains including below ground workings may possibly mobilise contaminated sediments into the tributary drains. Unlikely to affect the status at a water body scale following implimentation of CoPC / CEMP.	Potential for increase in scour caused by works close to or from diversion of tributary drains may affect ecological habitats. Unlikely to be significant at water body scale.	Diversion of tributary drains will result in loss of habitat on tributary drains which are likely to be temporary. Impacts considered unlikely to be significant at the water body scale.	Landtake will be mean some loss of habitat in proximity of the tributary drains although unlikely to be significant at the water body scale.	No significant impact anticipated	Potential localised impacts, but no deterioration anticipated.	Although impact unlikely to be be significant at water body scale, assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	Fish		Possible temporary effects from construction close to tributary trains. Mitigation may include construction only within non-migratory periods.	Possible temporary effects from construction close to tributary drains due to the loss of habitat during works on the bankside. This is unlikely to be significant at the waterbody scale and likely to recovery naturally.	Possible minor impact where works close to tributary drains including below ground workings may possibly mobilise contaminated sediments into the tributary drains. Unlikely to affect the status at a water body scale following implimentation of CoPC / CEMP.	Potential for increase in scour caused by works close to or from diversion of tributary drains may affect ecological habitats. Unlikely to be significant at water body scale.	Diversion of tributary drains will result in loss of habitat on tributary drains which are likely to be temporary. Impacts considered unlikely to be significant at the water body scale.	Landtake will be mean some loss of habitat in proximity of the tributary drains although unlikely to be significant at the water body scale.	No significant impact anticipated	Potential localised impacts, but no deterioration anticipated.	Although impact unlikely to be be significant at water body scale, assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.

Physico-Chemical status

Supporting Elements	**Ammonia (Physio-Chemical)**	Predicted change to status elements (green = none, amber = possiby, red = likely)	No measureable change to element anticipated	No measureable change to element anticipated	Possible minor impact where removal or topsoil and works close to tributary drains including below ground workings may possibly mobilise contaminated sediments into the tributary drains. Unlikely to affect the status at a water body scale following implimentation of CoPC / CEMP.	Possible minor impact where scour caused by works close to or from diversion of tributary drains may possibly mobilise contaminated sediments.	Possible minor impacts caused mobilisation of sediments during realignment works on tributary drains. Unlikely to affect the status at a water body scale following implimentation of CoPC / CEMP.	No measureable change to element anticipated as new construction is not expected to increase surface water run-off following implimentation of drainage plan.	No measureable change to element anticipated.	Implementation of CoCP and Best Practice Measures during construction and operation will ensure potential impacts to water quality are limited to temporary, spatially limited and/or minor impacts in relation to the overall size of the water body. No deterioration of status anticipated	Although impact unlikely to be be significant at water body scale, assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	Dissolved Oxygen		No measureable change to element anticipated	No measureable change to element anticipated							
	pH		No measureable change to element anticipated	No measureable change to element anticipated							
	Phosphate		No measureable change to element anticipated	No measureable change to element anticipated							
	Temperature		No measureable change to element anticipated	No measureable change to element anticipated							
	Copper		No measureable change to element anticipated	No measureable change to element anticipated							
	Zinc		No measureable change to element anticipated	No measureable change to element anticipated							
	Specific Pollutants (Annex 8)		No measureable change to element anticipated	No measureable change to element anticipated							

Hydromorphological status

Hydromorphological Elements	Quantity and dynamics of river flow	Predicted change to status elements (green = none, amber = possiby, red = likely)	No measureable change to element anticipated	No measureable change to element anticipated	No measureable change to element anticipated	No measureable change anticipated	Potential for minor impact during construction and limited to tributary drains. Unlikely to be sinificant impact at the water body scale.	No measureable change anticipated	Potential for minor impact on tributary drains. Unlikely to be significant impact at the water body scale.	Potential localised impacts, but no deterioration anticipated.	Although impact unlikely to be be significant at water body scale, assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	Connection to Groundwater		No measureable change to element anticipated	No measureable change to element	Possible minor impact where foundations or piling into groundwater may possibly mobilise contaminated sediments into the tributary drains and springs. Unlikely to affect the status at a water body scale.	Construction of foundations and piling in proximity to tributary drains and springs may have possible minor impact. Unlikely to be significant at water body scale.	Potentially minor loss of baseflow in tributary drains and flow from springs although unlikely to be significant on water body scale.	New foundations or piling may have possible minor impact on connection between groundwater and surface water in vicinity of tributary drains and springs but unlikely to be significant on water body scale.	Potentially minor loss of baseflow in tributary drains although unlikely to be significant on water body scale.	Potential localised impacts, but no deterioration anticipated.	Although impact unlikely to be be significant at water body scale, assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	River continuity		Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	River depth and width variation bed		No measureable change to element anticipated	There is potential for minor impacts due to changes in local hydraulics and substrate transport caused by temporary land take which is likely to recover naturally. Unlikely to be significant at waterbody scale.	No measureable change to element anticipated	No measurable change to element anticipated	Potential for minor impact during construction and limited to tributary drains. Unlikely to be sinificant impact at the water body scale.	No measureable change anticipated	No measureable change anticipated	Potential localised impacts, but no deterioration anticipated.	Although impact unlikely to be be significant at water body scale, assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	Structure and substrate of river bed		No measureable change to element anticipated	There is potential for minor impacts due to changes in local hydraulics and substrate transport caused by temporary land take which is likely to recover naturally. Unlikely to be significant at waterbody scale.	No measureable change to element anticipated	Potentially increased scour caused by works close to or from diversion of tributary drains although likely to recovery naturally. Unlikely to be significant on water body scale.	Potential for minor impact during construction and limited to tributary drains. Unlikely to be sinificant impact at the water body scale.	No measureable change anticipated	No measureable change anticipated	Potential localised impacts, but no deterioration anticipated.	Although impact unlikely to be be significant at water body scale, assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.
	Structure of riparian zone		No measureable change to element anticipated	There is potential for minor impacts due to changes in local hydraulics and substrate transport caused by temporary land take which is likely to recover naturally. Unlikely to be significant at waterbody scale.	No measureable change to element anticipated	Potentially increased scour caused by works close to or from diversion of tributary drains although likely to recovery naturally. Unlikely to be significant on water body scale.	Potential for minor impact during construction and limited to tributary drains. Unlikely to be sinificant impact at the water body scale.	Landtake in proximity of tributary drains may have minor detrimental impacts compared to existing conditions, however unlikely to be any significant impact at the waterbody scale.	Diverson of tributary drains may have minor detrimental impacts compared to existing conditions, however unlikely to be any significant impact at the waterbody scale.	Potential localised impacts, but no deterioration anticipated.	Although impact unlikely to be be significant at water body scale, assessment to be confirmed when further detailed information (e.g. detailed design, detailed drainage strategy, ground investigation, risk assessments and surveys) is available.



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Project Site Boundary
- 1 km Buffer
- Wells
- Springs
- WFD Rivers
- Other Watercourses
- WFD Lakes

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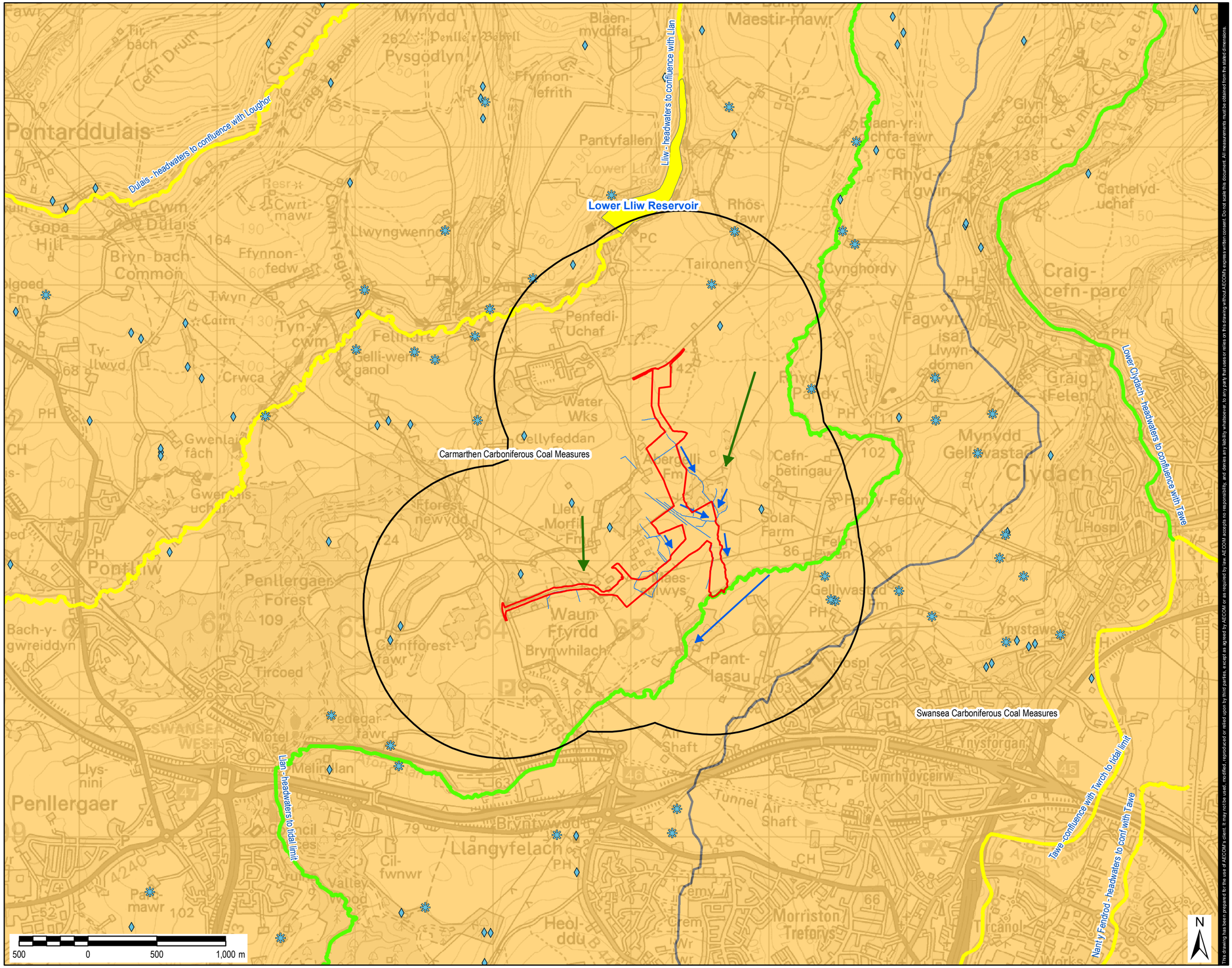

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Project Site Boundary
- 1 km Buffer
- Wells
- Springs

Inferred Water Flow Direction

- Groundwater
- Surface Water

WFD Lakes

- Moderate

WFD Rivers

- Good
- Moderate

WFD Groundwater Bodies

- Poor

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WFD WATER BODIES

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Appendix 5

Noise Survey Report

Abergelli Power Project

Noise Survey Report

Abergelli Power Limited

6 March 2018

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
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1. Introduction

This report describes a sound survey undertaken at noise sensitive receptors around the Abergelli Power Project site (hereafter referred to as the 'Project Site') on behalf of Abergelli Power Limited. The purpose of the survey was to provide baseline noise information, which will be used to inform an Environment Statement (ES) for the proposed Abergelli Power Station.

The 2018 Preliminary Environmental Impact Report (PEIR) Noise Assessment was based on a noise survey conducted by a previous consultant in 2014. It was considered that the scope of the previous survey had been too limited to provide fully representative data for the Project Site and that a more detailed, up to date survey would be required for the ES.

The survey was conducted following the background sound levels determination requirements of BS 4142:2014 *Measurement and assessment of industrial and commercial sound*. The following sections fulfil the reporting requirements of that standard.

A glossary of acoustics terminology is provided in Appendix A.

2. Baseline Survey

2.1 Site Description

The Project Site is situated in a rural area to the south east of Abergelli Farm. The Project Site is surrounded by agricultural land and scattered farms in all directions, with small clusters of housing. To the south is the M4 motorway corridor at a distance of approximately 1 km. Road traffic noise from the surrounding local roads and M4 motorway, and noise from farming activities were the dominant sources in the area.

Figure 1 below locates the Noise Sensitive Receptors around the Project Site.

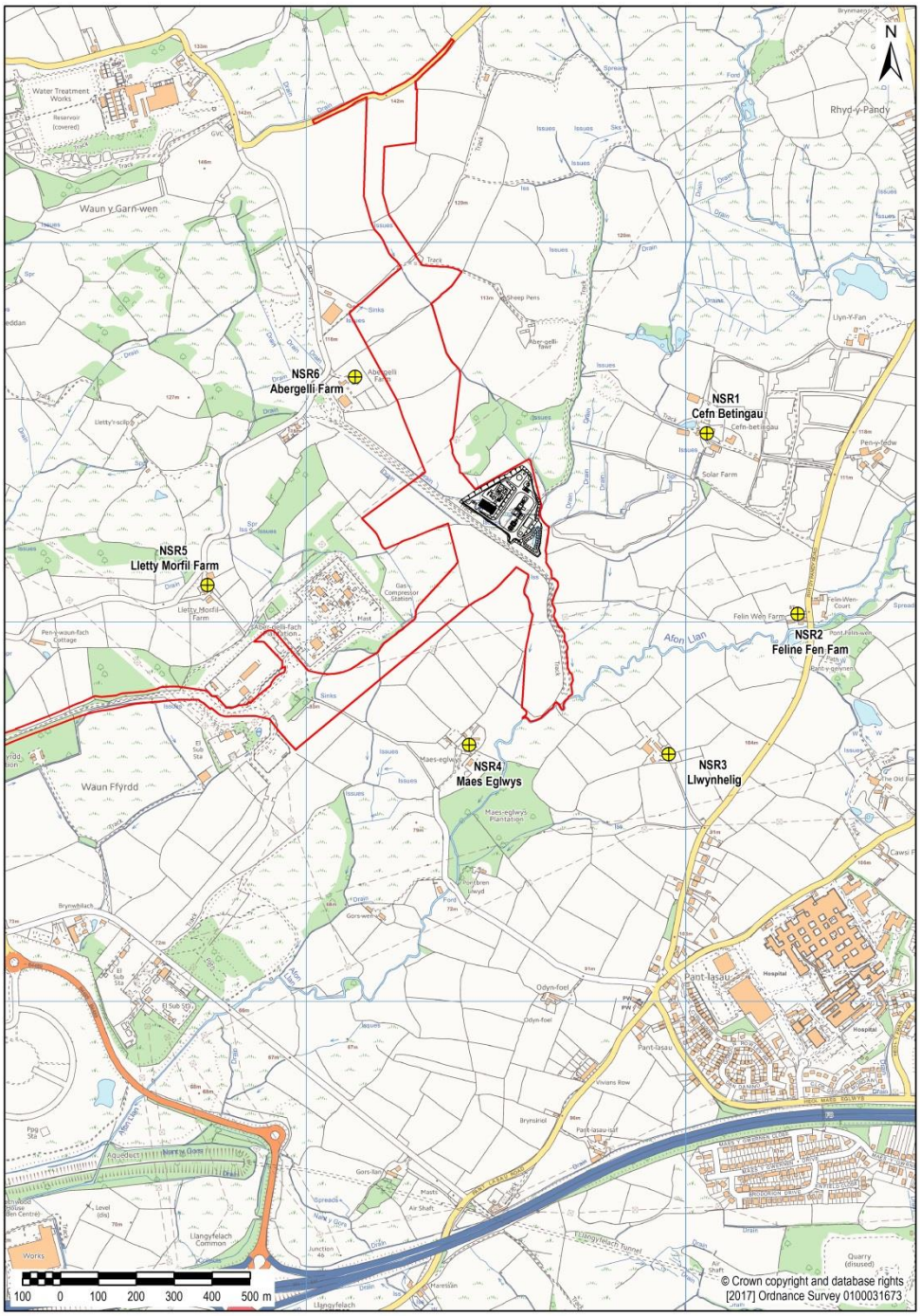


Figure 1. Map of the NSRs surrounding the Project Site

2.2 Noise Sensitive Receptors

Six Noise Sensitive Receptors (NSRs) were identified for the project. On this occasion access was only possible to use four of these for the detailed survey. However the four locations monitored covered all compass directions around the Project Site.

The NSRs are listed in Table 1 below.

Table 1. Noise Sensitive Receptors

NSR	Name of NSR
1	Cefn Betingau Farm
4	Maes Eglwys
5	Lletty Morfil Farm
6	Abergelli Farm

2.3 Subjective impressions of noise sources

Descriptions of noise sources heard on site at the measurement locations are included in Table 2 below. As well as noise sources being observed at the time of set-up and collection of the loggers, each of the sites was attended around 01:00 on 21st February to determine the noise sources during the night-time period.

In general, during the daytime, the noise climate had audible contributions from the following sources:

M4 motorway traffic noise, low but audible, a distant rotary engine noise, possibly a drone (as advised by the property owner of NSR 6), animal noises including wild birds, hens and far cattle, and wind through the trees.

Table 2. Noise sources

NSR Location	Day / Night	
1 – Cefn Betingau Farm	Day	Distant rotary engine noise. M4 motorway traffic noise, low but audible. Bird noise and cattle noises heard from the nearby area. On collection there was additional noise from farm activities as well as a low frequency plant hum which started up around 10:00.
	Night	Low level plant hum. Road traffic was audible to both the south and the east. Very quiet site.
4 - Maes Eglwys	Day	M4 motorway traffic noise and rotary engine noise low but audible. On collection dogs were barking at the nearby property.
	Night	Low level plant hum, accompanied by a low level continuous tone. Very faint traffic noise. Water could be heard flowing along the nearby Afon Llan river. Quiet site.
5 - Lletty Morfil Farm	Day	On site hen noise and dogs barking. Wind rustled through the trees. Distant M4 traffic and rotary engine noises heard, low but audible. On collection a low level plant hum could be heard.
	Night	Low level plant hum. Distant M4 traffic noise, low but audible. Very quiet site.
6 - Abergelli Farm	Day	Wind rustled through the trees. Birds heard in nearby trees. Dogs barking in the distance. Distant M4 traffic and rotary engine noises heard, low but audible. Rotary engine noise, advised to be a drone, low but audible.
	Night	Low level plant hum. Distant road traffic noise heard. Very quiet site.

2.4 Measurement Locations

On this occasion access was only possible to monitor four of the NSRs. The four locations monitored covered all directions around the Project Site. The measurement locations are listed in Table 3 below.

Table 3. Noise Sensitive Receptors, measurement locations and distance to Generating Equipment Site

NSR	Name of NSR	Measurement Location	Distance to Generating Equipment Site
1	Cefn Betingau Farm	At the end of the back garden	410
4	Maes Eglwys	In the field adjacent to the front of The Old Barn at Maes Eglwys	560
5	Lletty Morfil Farm	In the back garden of the main building	680
6	Abergelli Farm	Secured to a tree near to the row of residences on the farm	420

The unattended logger measurement locations were chosen in agreement with the property owners. The monitoring location setup for each NSR is shown is Figures 2 to 5 below.



Figure 2. Monitoring location at NSR 1 - Cefn Betingau Farm



Figure 3. Monitoring location at NSR 4 - The Old Barn, Maes Eglwys



Figure 4. Monitoring location at NSR 5 - Lletty Morfil Farm



Figure 5. Monitoring location at NSR 6 - Abergelli Farm

2.5 Sound Measuring System

The equipment used at each of the monitoring locations is listed below in Table 4.

Table 4. Noise measurement equipment

NSR	Equipment	Equipment Type	Serial Number
1	Rion NL-52	Integrating Sound Level Meter – Unattended Logger	00620964
4	B&K 2250	Integrating Sound Level Meter – Unattended Logger	2827270
5	Rion NL-52	Integrating Sound Level Meter – Unattended Logger	00821105
6	Rion NL-52	Integrating Sound Level Meter – Unattended Logger	01143556
-	Norsonic 1251	Sound Calibrator	34393

These instruments are all within calibration and calibration certificates can be provided on request.

The sound level meters at NSRs 1, 5 and 6 were mounted on a stainless steel pole, and the sound level meter at NSR 4 was mounted on a tripod. All were at a height of approximately 1.2 m from the ground and wind shields were used. There were no vertical reflecting surfaces within 3.5 m of the measurement locations.

2.6 Operational Test

The sound level meters and associated microphones were field calibrated at the beginning and end of their respective measurement periods in accordance with recommended practice. No significant drift in calibration was observed during the measurement periods. The accuracy of the calibrator can be traced to the National Physical Laboratory Standards.

2.7 Weather conditions

Weather conditions during the survey were within the parameters set out in BS 4142 and had no adverse effect on the levels measured.

Weather data for local weather stations was obtained from public sources for the duration of the survey. Wind speeds were generally below 5 m/s throughout the survey. During the day, the temperature ranged between 1

and 11 degrees with an average of 7 degrees Celsius, and during the night it ranged between 1 and 7 with an average of 5 degrees Celsius. There were no significant periods of rain.

The favourable wind conditions for gathering suitable data at each NSR are stated in the first half of Tables 5 and 6 below which details the downwind direction and range necessary for use in the assessment for both the day and night-time periods. Periods with downwind conditions for each receptor are shown in green.

Table 5. Daytime wind conditions at each NSR

Session		Wind		NSR Location			
		Average Direction (°)	Speed Range (m/s)	1	4	5	6
Downwind direction (°)				225	45	90	135
Wind direction range				165	345	30	75
				285	105	150	195
Date and Session Average weather							
16/02/2018	Friday	180	<5				
17/02/2018	Saturday	240	<5				
18/02/2018	Sunday	130	<5				
19/02/2018	Monday	300	<5				
20/02/2018	Tuesday	360	5+				

Table 6. Night-time wind conditions at each NSR

Session		Wind		NSR Location			
		Average Direction (°)	Speed Range (m/s)	1	4	5	6
Downwind direction (°)				225	45	90	135
Wind direction range				165	345	30	75
				285	105	150	195
Date and Session Average weather (for following morning)							
16/02/2018	Friday	270	<5				
17/02/2018	Saturday	170	<5				
18/02/2018	Sunday	115	<5				
19/02/2018	Monday	240	~0				
20/02/2018	Tuesday	300	<5				
21/02/2018	Wednesday	360	<5				

2.8 Date and Time of Measurement

Unattended logged measurements were made between the afternoon of Thursday 15th February and the morning of Wednesday 21st February 2018 at each of the NSR locations. They were chosen as being representative of the background levels at that NSR.

The background sound levels were measured in general accordance with the methodology set out in BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142). In addition, measurements were in general accordance with BS 7445-2:1991 'Description and measurement of environmental noise, Part 2: Guide to the acquisition of data pertinent to land use' which defines parameters, procedures and instrumentation required for noise measurement and analysis.

2.9 Measurement time intervals

All measurements were made over 5 minute logging periods.

2.10 Background sound level

BS 4142 states gives guidance on how a representative background sound level can be derived from a sound measurement data set.

Section 8.1.1 states that background sound level should be determined in "*weather conditions that are representative or comparable to the weather conditions when the specific sound occurs".* The propagation of sound from outdoor sources is significantly influenced by the weather. In particular the propagation down wind of a source can be 10 to 15 dB greater than that upwind. The prediction methodology used to derive the specific sound level for the proposed power station (based on ISO 9613) assumed downwind conditions for each receptor. Therefore the predicted specific sound levels will only occur at each receptor when that receptor is downwind of the source. Representative background sound levels must therefore by measured in similar conditions. Therefore, for each receptor the data set was filtered so that only measurements sessions were the average wind direction was within a 120° arc (60°s each side) of the downwind condition.

Section 8.1.4 states that the data set should be analysed statistically to obtain a representative value. It clearly states that the lowest measured level should not be taken as representative. Therefore, after filtering for wind direction as described above the mean and modal values of the remaining results for each receptor were obtained. Both of these are presented in the results section of this report. They were generally with one or two dB of each other.

The modal value was selected as representative for each receptor.

The full survey results for the day and night-time periods are given below in Tables 7 and 8.

Table 7. Daytime survey results

		NSR Location			
Data	**Type**	**1**	**4**	**5**	**6**
L_{AF90}	Filtered data mean	42	35	41	41
	Filtered data mode	40	36	43	40
	Value in previous report (ex PB)	*41*	*40*	*39*	*40*
	Representative value in site context	**40**	**36**	**43**	**40**
	Change	-1	-4	4	0
L_{Aeq}	Filtered overall	46	43	54	47
	Value in previous report (ex PB)	*49*	*51*	*42*	*41*
	Representative value in site context	**46**	**43**	**54**	**47**
	Change	-3	-8	12	6

Table 8. Night-time survey results

		NSR Location			
Data	**Type**	**1**	**4**	**5**	**6**
L_{AF90}	Filtered data mean	34	33	37	36
	Filtered data mode	34	35	38	36
	Value in previous report (ex PB)	*25*	*37*	*40*	*28*
	Representative value in site context	**34**	**35**	**38**	**36**
	Change	9	-2	-2	8
L_{Aeq}	Filtered overall	40	38	40	39

Data	Type	NSR Location 1	4	5	6
	Value in previous report (ex PB)	*28*	*47*	*40*	*28*
	Representative value in site context	**40**	**38**	**40**	**39**
	Change	12	-9	0	11

Graphs of the full set of data results for each NSR are provided in Appendix B.

2.11 Comparison with Previous Survey Results

The assessments in the 2018 PEIR were based upon the results of a brief survey undertaken in 2014. The 2014 survey was so brief that the number of measurements for each location was small and it was not possible to undertake any statistical analysis to derive representative values for the background and residual sound levels. As a result, the levels used in the 2018 PEIR were subject to specific conditions and noise sources present during the brief measurement period and did not give a representation of the full range of appropriate conditions and sources.

The assessment made using that data are summarised in Table 9 below.

Table 9. Assessment summary based on 2014 survey

	Location 1	4	5	6
Daytime *background sound level* (L_{AF90})	41	40	39	40
Daytime *residual sound level* (L_{Aeq})	49	51	42	41
Night time *background sound level* (L_{AF90})	25	37	40	28
Night time *residual sound level* (L_{Aeq})	28	47	40	28
Predicted power station *specific sound level* (L_{Aeq})	35	32	29	34
Rating level (+3 dB character correction)	38	35	32	36
Daytime BS 4142 comparison	**-3**	**-5**	**-7**	**-4**
Compliance with daytime BS4124 criterion (+5 dB)	Y	Y	Y	Y
Night time BS 4142 comparison	**13**	**-2**	**-8**	**8**
Compliance with night time BS4124 criterion (+5 dB)	N	Y	Y	N
Daytime *ambient sound level* (L_{Aeq} with power station)	49	51	42	42
Daytime residual to ambient change	0	0	0	1
Night time *ambient sound level* (L_{Aeq} with power station)	**36**	**47**	**40**	**35**
Night time residual to ambient change	8	0	0	7
Compliance with night time WHO ambient sound criterion (45 dB L_{Aeq} outdoors)	Y	N*	Y	Y

* *Non compliance due to residual sound sources not power station operation – power station non contributory*

The completion of the detailed survey and the resulting statistically derived representative levels allow a more robust assessment to be made. The results are show in Table 10.

Table 10. Assessment summary based on February 2018 detailed survey

	Location			
	1	4	5	6
Daytime *background sound level* (L_{AF90})	40	36	43	40
Daytime *residual sound level* (L_{Aeq})	46	43	54	47
Night time *background sound level* (L_{AF90})	34	35	38	36
Night time *residual sound level* (L_{Aeq})	40	38	40	39
Predicted power station *specific sound level* (L_{Aeq})	35	32	29	34
Rating level (+3 dB character correction)	38	35	32	36
Daytime BS 4142 comparison	**-2**	**-1**	**-11**	**-4**
Compliance with daytime BS4124 criterion (+5 dB)	Y	Y	Y	Y
Night time BS 4142 comparison	**4**	**0**	**-6**	**0**
Compliance with night time BS4124 criterion (+5 dB)	Y	Y	Y	Y
Daytime *ambient sound level* (L_{Aeq} with power station)	46	43	54	47
Daytime residual to ambient change	0	0	0	0
Night time *ambient sound level* (L_{Aeq} with power station)	**41**	**39**	**40**	**40**
Night time residual to ambient change	1	1	0	1
Compliance with night time WHO ambient sound criterion (45 dB L_{Aeq} outdoors)	Y	Y	Y	Y

* *Non compliance due to residual sound sources not power station operation – power station non contributory*

The tables show that the predicted plant levels noise comply with the limits derived from both B 4142 and WHO.

2.12 The potential impact of uncertainty

There are several potential sources of uncertainty in the result obtained. These are listed in Table 11 along with the measures taken to mitigate them.

Table 11. Sources of uncertainty

Source	Mitigation
Effects of wind due to wind generated noise	The survey period was selected with low predicted windspeeds. Weather information was noted at the time of set-up and collection, and public weather sources were used so that measurements affected by unsuitable wind conditions could therefore be excluded.
Effects of wind on propagation of background sound sources	Survey period chosen at a time of low wind speed (<5 m/s). Weather information was noted at the time of set-up and collection, and historic weather data was obtained so that measurements affected by unsuitable wind conditions could therefore be excluded. Attendance at site for the setup and collection of the noise monitors, and during the night-time period allowed observations of noise sources in the area.
Possibility of unrepresentative activities contributing to background sound	Study of site prior to survey and drive-around inspection before and after survey indicated no major road or rail disruption or major construction projects in the area. Undertaking survey over a longer and continuous period gave a fuller picture of the general levels of activity.
Uncertainties in measurement procedure	Minimised by following standard procedure (BS 4142).

Appendix A Glossary of Acoustic Terminology

This document provides a layperson's explanation of the acoustics terms that commonly appear in reports. It is not intended to give full scientific definitions and explanations or go into detail on how and why things are as they are. Some obsolete terms and abbreviations have been included as they still appear in documents from time to time.

Many words have more specific meanings when used in acoustics than in every-day language.	
sound	is used to describe the physical phenomenon of the transmission of energy through gaseous or liquid media via rapid fluctuations in pressure.
level	used solely to describe values measured in decibels
loudness	is the human perception of the level of sound
noise	has no strict definition and is often used interchangeably with sound however it is usually taken to mean unwanted sound
index	a value based on the mathematical processing of raw data
indicator	a value used to indicate the likelihood of a particular response of effect eg. $L_{10,18hr}$ is an index based on statistical processing of sound pressure data that is used as an indicator for road traffic noise response.
weighted	values modified to reflect sensitivities at particular frequencies.
directivity	the amount by which a source radiates more sound in one direction than another.
decibels dB	The decibel is not a true measurement unit nor is it exclusive to acoustics. The decibel is a logarithmic ratio of two values of a variable. Decibels are used because they can represent very wide ranges of ratios (from trillionths and billionths to billions and trillions) with a small range of decibel values. Decibels can be used to represent measured values by using a known reference value in the ratio. When using decibels to measure something it is therefore important to specify what variable is actually being measured and what reference level has been used. This is done by adding a reference value statement in the form "dB re x units", where the units indicate the variable being measured and x is the reference value. Decibels are used in acoustics because the human ear responds to sound in a logarithmic way and the quantities measured in acoustics vary over wide ranges. However, decibels are used in acoustics to measure several different things which it is important not to confuse with each other. To avoid confusion there is a notation system that identifies what a decibel value is for. The notations take the form of an italic capital letter and some subscript characters. The capital identifies the general type of value and the subscripts give specific details of what is being represented. L_{xxx} denotes a level (ie a value measured in dB by comparison with a reference value); D_{xxx} denotes a difference between two levels; R_{xxx} denotes a rating (or index), which is measure of the generalised acoustic performance of a material or construction based on a difference between two levels; C_{xxx} denotes a correction (or constant) Of these only those with *L* notations require a reference value statement. Those with *D* or *R* notations are effectively ratios of two measured values not one measured value and a reference value and those with *C* notations are not based on reference values at all. A reference value statement therefore has no meaning when describing *D*, *R* and *C* decibels. Because decibels are logarithmic they have to be added, subtracted, multiplied, divided and averaged using different techniques from normal numbers.
Sound Pressure Level L_p obsolete – SPL	This is the basic measure of how much sound there is at a given location. It is a measure of the size of the pressure fluctuations in the air that we perceive as sound. Sound Pressure Level is expressed in decibels with a reference level of 20 μPa (L_p in dB re 20 μPa)

Sound Power Level L_W obsolete – SWL	This is the total amount of sound produced by a source. It cannot be measured directly but it can be calculated from Sound Pressure Level measurements in known conditions. It can be used to predict the Sound Pressure Level at any point. Sound Power Level is expressed in decibels with a reference level of 1 pW (L_W in dB re 1 pW). In the US a reference of 100 fW is sometimes used
Pitch, frequency tonal sound broadband sound impulsive sound frequency analysis	The sound we perceive can have different characteristics. These can range from low-pitched hums to high-pitched squeals and impulsive sounds. In engineering acoustics the word frequency rather than pitch tends to be used when describing the characteristics of a sound. The unit of frequency is the Hertz (Hz), which is the number of pressure fluctuations per second. Any sound can be defined by its frequency content. Some sounds comprise just one discrete frequency (tonal sounds). Others are distributed over wide frequency ranges (broad band sound). Impulsive sounds are made up short pulses of high frequency components. Sources often produce all of these types of sound at the same time. There are different ways of analysing and displaying the frequency content of a sound: Octave Band Analysis – is the simplest method. The audible range of frequencies is divided into 10 bands. Third-Octave Band Analysis – more detailed with 30 bands Narrow Band Analysis – 12th Octave (120 bands), 24th Octave (240), Fast Fourier (FFT) Analysis – a high resolution technique that can give extremely detailed information on frequency content
A-weighting L_A or L_{pA}, L_{WA}, obsolete – dBA, dB(A) similar – C-weighting L_C or L_{pC}, L_{WC}	The human ear does not sense all frequencies of sound equally. Our sensitivity is at a maximum at around 2 kHz and steadily decreases above and below. Below 20 Hz and above about 20 kHz we can't hear at all. Within its operating limits a precision measurement microphone measures all frequencies the same so the output it produces does not reflect what we would actually hear. The A-weighting is an electronic filter that matches the response of a sound level meter to that of the human ear. When A-weighted the Sound Pressure Level L_p becomes L_{pA} (or L_A) and the Sound Power Level L_W becomes L_{WA}. It used to be common to identify that a level was A-weighted by writing dB(A) or dBA instead of dB. These terms are now obsolete and should not be used as they conflict with other, non-acoustic, uses of decibels The response of the human ear varies depending on how loud the sound is. A-weighting matches the response of a sound level meter to human hearing at low levels (~ 40-90 dB). For higher levels there are other weightings the most common of which is the C-weighting.

Different types of decibels commonly used in acoustics

L_p L_{pA} (or L_A) L_{AF}, L_{AS}	*The instantaneous sound pressure level* (L_p) *The A-weighted instantaneous sound pressure level* (L_{pA} or L_A) This is the root mean square size of the pressure fluctuations in the air. This level can fluctuate wildly even for seemingly steady sounds. To make sound level meters easier to read the values on the display are smoothed or damped out. This is effectively done by taking a rolling average of the previous 0.125 s (FAST time constant) or the previous 1 s (SLOW time constant). The letters F or S are added to the subscripts in the notation to indicate when the FAST or SLOW time constant has been used. These are often omitted but it is good practice to include them.
L_{max} L_{Amax} L_{AFmax} L_{min} , L_{Fmin}	*The maximum instantaneous sound pressure level* (L_{max}), *The A-weighted maximum instantaneous sound pressure level* (L_{Amax}) *The A-weighted maximum instantaneous sound pressure level with a FAST time constant* (L_{AFmax}). This is the highest instantaneous sound pressure level reached during a measurement period. The opposite of the L_{max} is the *minimum instantaneous sound pressure level* or L_{min} etc. It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.

$L_{N,T}$ $L_{AN,T}$ $L_{AFN,T}$ N = %age value, 0-100 T = measurement time eg. L_{A90}, L_{A10}, $L_{AF90,\ 5\ min}$	*The percentage exceedence sound pressure level ($L_{N,T}$),* *The A-weighted percentage exceedence sound pressure level ($L_{AN,T}$), the A-weighted percentage exceedence sound pressure level with a FAST time constant ($L_{AFN,T}$).* This is the sound pressure level exceeded for *N*% of time period *T*. eg. If an A-weighted level of x dB is exceeded for a total of 6 minutes within one hour, the level will have been above x dB for 10% of the measurement period. This is written as $L_{A10,1hr}$ = x dB. L_{A0} (the level exceeded for 0 % of the time) is equivalent to the L_{Amax} and L_{A100} (the level exceeded for 100 % of the time) is equivalent to the L_{Amin}. It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.
$L_{eq,T}$ $L_{Aeq,T}$ T = measurement time eg. $L_{Aeq,5min}$	The *equivalent continuous sound pressure level over period T ($L_{eq,T}$),* *The A-weighted equivalent continuous sound pressure level over period T ($L_{Aeq,T}$).* This is effectively the average sound pressure level over a given period. As the decibel is a logarithmic quantity the L_{eq} is not a simple arithmetic mean value. The L_{eq} is calculated from the raw sound pressure data. It is not appropriate to include a reference to the FAST and SLOW time constants in the notation

Appendix B Results

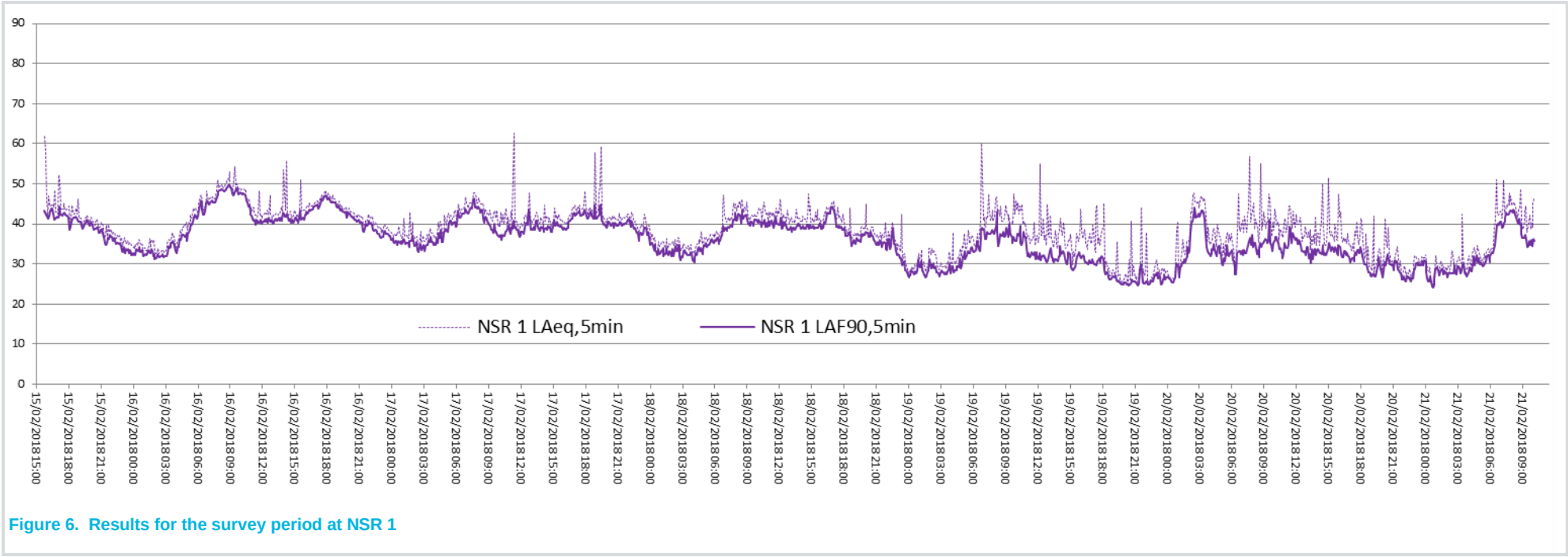


Figure 6. Results for the survey period at NSR 1

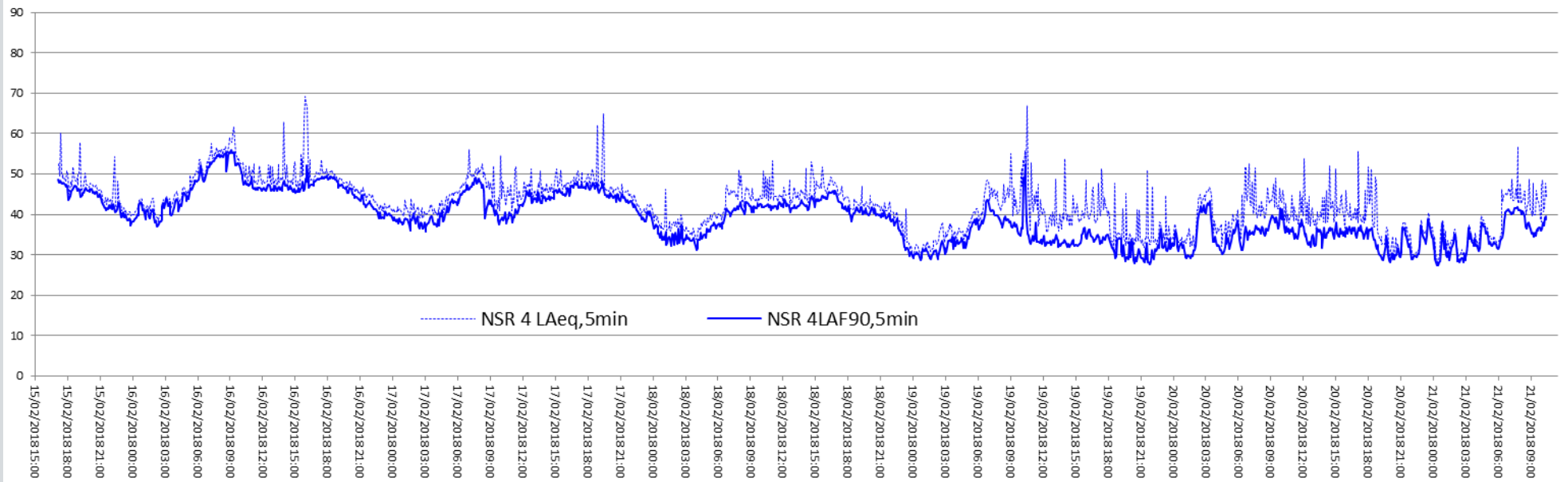


Figure 7. Results for the survey period at NSR 4

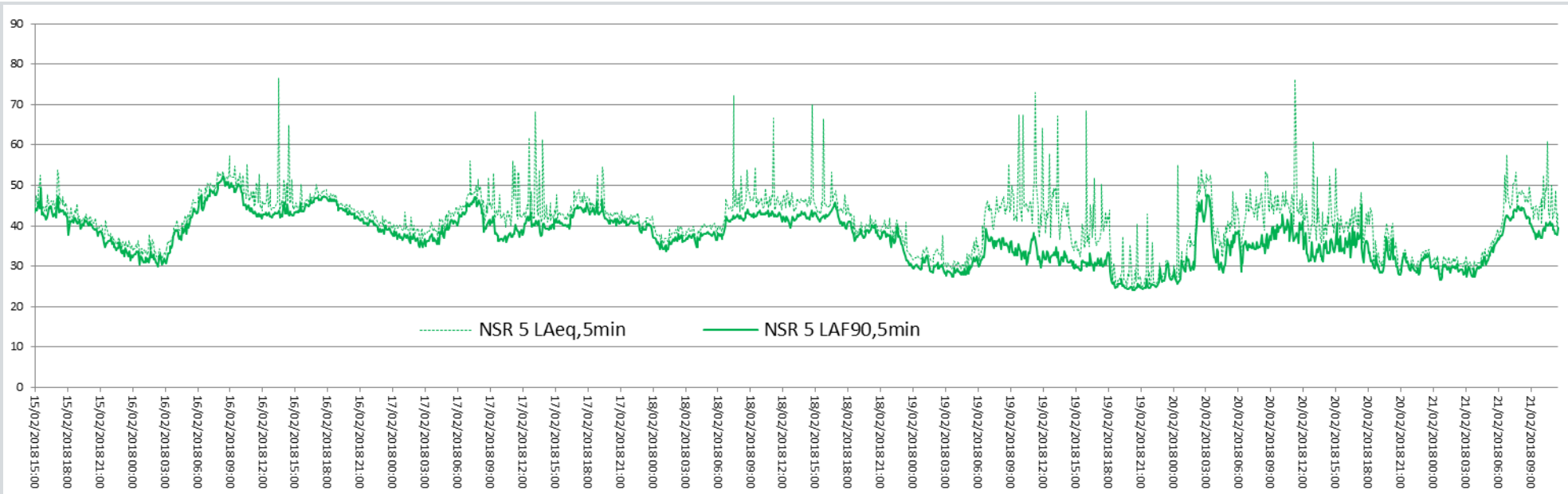


Figure 8. Results for the survey period at NSR 5

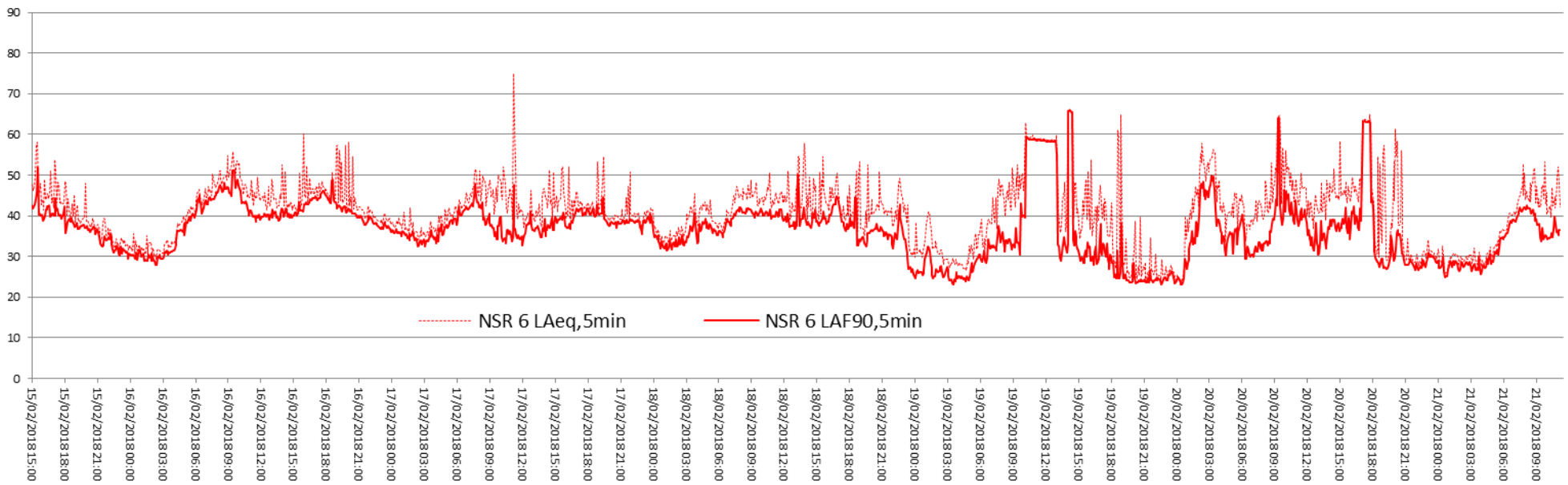


Figure 9. Results for the survey period at NSR 6

aecom.com

Appendix 6

Cultural Heritage Gazetter

Appendix 6: Heritage Gazetteer

Five digit IDs with a letter suffix (w) are Primary Record Numbers (PRNs) recorded in the GGAT HER. Five or six digit IDs without a letter suffix are National Primary Record Numbers (NPRNs) of the NMR, as supplied by the RCAHMW. Numbers preceded by the letters 'LB' are Listed Building numbers, whilst those prefixed by the letters 'GM' are Scheduled Ancient Monuments. AB numbers are IDs assigned during the assessment.

Table 1: Historic assets within the 1 km Study Area

ID	Name	Description	Value	NGR	Period	Status
01005w, 408270	Maes Eglwys, Llangyfelach	A 17th century end-entry house with stairs in outshut. Features include straight cut beams, first floor fireplace corn drying kiln, trusses with both notch-jointed collars and collarless. A bakehouse with loft lies adjacent to house.	Low	SN65430069	Post-medieval	Non-designated asset
03017.0w	Bryn Whilach Colliery	Appears on OS Map 1879 as Bryn-whilach pit (coal). There is an associated engine, engine house, chimney, shaft, buildings and rails. On OS Map 1899 there does not appear to be much development. The engine house and shaft are still named and buildings and the rails remain. On OS Map 1919 the colliery is not named and the shaft is now called an old coal pit. The rails and most of the buildings are gone as well. On OS Map 1949 all that remains is part of a chimney and spoil tips.	Low	SN64500020	Post-medieval	Non-designated asset
01341w	Quarry, Llangyfelach	This site comprises a Post-Medieval quarry situated within Llangyfelach. The 3rd edition OS map depicts the area as an 'Old Gravel Pit' within the Bryn-whilach Plantation. No further information is currently available.	Low	SN64910030	Post-medieval	Non-designated asset
01349w	Quarry, Mawr	A quarry situated within Mawr. First	Low	SN65030160	Post-medieval	Non-designated asset

ID	Name	Description	Value	NGR	Period	Status
		identified on 1896-97 OS mapping, the asset is depicted as an 'Gravel Pit'.				
01525w	Pen Y Fedw / Pen Vedw	Village shown on Rees' 1932 map of South Wales and the Borders in the 14th Century.	Low	SN664014	Post-medieval	Non-designated asset
01527w, 421383	Y Felin Wen	This site comprises a Post-Medieval Mill entitled 'Y Felin Wen' situated within the community of Mawr. The 3rd edition OS map depicts the area as a flour mill with two rectangular structures and one smaller ancillary structure. No further information is currently available.	Low	SN663010	Post-medieval	Non-designated asset
03017.0w	Mineral Railway	This site comprises a Post-Medieval Mineral railway entitled 'Mineral Railway situated within the community of Llangyfelach. No further information is currently available.	Low	SN64500020	Post-medieval	Non-designated asset
AB01	Site of Abergelli-fawr	Site of an extensive farmstead first identified on 2":1 mile maps of Glamorgan and Monmouthshire (1812-14) as two rectangular earlier origins. The buildings have been completely demolished and the plot remains empty.	Low	SN6556201787	Post-medieval	Non-designated asset
AB02	Site of Abergelli-face	Site of an extensive farmstead first identified on the Map of Glamorgan (1799), indicating it may have earlier origins. The complex may have been completely demolished and replaced with two modern buildings.	Low	SN6512301636	Post-medieval	Non-designated asset
AB03	Field boundary	First identified 2":1 mile maps of Glamorgan and Monmouthshire (1812-14, indicating it may have earlier origins. The feature was substantially altered during construction of a recent gas pipeline, and although some of the original earthwork	Low	SN6502901606 to SN6509001553	?Medieval/ Post-medieval	Non-designated asset

ID	Name	Description	Value	NGR	Period	Status
		still survives, the boundary is predominantly now a modern fence line.				
AB04	Field boundary	Sinuous north/south aligned field boundary. It comprises a stone and earth bank with mixed species small tree growth. First identified 2":1 mile maps of Glamorgan and Monmouthshire (1812-14), indicating it may have earlier origins.	Low	SN 6517002049 to SN6526101916	Possibly Medieval/ Post-medieval	Non-designated asset
80607	Abergelli Colliery and associated tramway	Standing remains of colliery buildings located 50m north of Abergelli-fact (HA29). First identified on 1935-1938 OS mapping.	Medium	SN6506801818	Modern	Non-designated asset

Table 2: Scheduled Monuments within the 5 km Study Area

SAM Ref	Name/Location	NGR	Distance from Project Site
GM371	Morris Castle, Landore	SS 65969640	4.80 km
GM299	Llangyfelach Cross Base, Llangyfelach	SS 6463498929	1.60 km
GM596	Penllergaer Orchideous House, Penllergaer	SS 6262498796	2.60 km
GM353	Ring Cairn on Tor Clawdd	SN 6703506299	5 km
GM308	Earthwork near Fforest Newydd	SN 63630155	1.35 km
GM380	Ring Cairn on Craig Fawr, Mawr	SN 6286206634	5 km
GM202	Mynydd Pysgodlyn Round Barrow, Mawr	SN 6351104819	4.50 km
GM201	Pant-y-Ffa Round Cairn, Mawr	SN 6184002706	3.50 km
GM439	Cae Castell Rhyndwyclydach	SN 6941504737	5 km
GM497	Clydach Upper Forge, Clydach	SN 68690197	3.20 km
GM410	Remains of Astronomical Observatory at Penllergaer	SS 6226499096	3.3 km

Table 3: Listed buildings within the 5 km Outer Study Area

LB Ref	Grade	Name/Location	NGR	Distance from Project Site
11208	II	Circular Pigsty at Beili Gras	SN6069503859	5 km
11210	II*	The Water Mill / Melin Felindre	SN6374802732	2.70 km
11211	II	Allt-y-fanog	SN6958303868	4.85 km
11719	II	Former annealing building of former Beaufort tinplate works	SS6712897057	4.20 km
11736	II	Seion Chapel, Clase Road (Ne Side)	SS6715398074	3.40 km
11737	II	Philadelphia Chapel Inc. Attached Chapel House (No 14 Morris St) And Attached Sunday School	SS6704497557	3.75 km
11738	II	Former Police Station	SS6695397520	3.75 km
11740	II	Wernfadog, Monmouth Place	SN6724100099	2 km
11741	II	Danbert House (Former Employment Exchange), Morfydd Street (N Side)	SS6704397695	3.70 km
11742	II	Morfydd Street Bridges And Boundary Wall To Davies Street	SS6712997689	3.70 km
11743	II	War Memorial In Morriston Park. Vicarage Road	SS6645398352	2.80 km
11744	I	Capel Tabernacl, Woodfield Street (E Side)	SS6695397818	3.55 km
11745	II	Church of St John	SS6693297668	3.70 km
15856	II	House, Martin Street, (E Side)	SS6695397516	3.75 km

LB Ref	Grade	Name/Location	NGR	Distance from Project Site
19983	II	Tredegar Fawr	SS6329099720	2 km
19984	II	Lofted Pigsty at Tredegar Fawr	SS6325099742	2 km
22085	II	Caersalem Newydd Baptist Chapel	SS6521397318	3.50 km
22087	II*	Capel Gellionnen (Gellionnen and Graig Unitarian Church)	SN7007004150	5.40 km
22088	II	Capel Calfaria	SN6897101238	3.40 km
26137	II	Boundary Post	SS6531198859	1.90 km
26235	II*	Church of St David and St Cyfelach	SS6461098970	1.85 km
26236	II*	Tower of Church of St David and St Cyfelach	SS6463398934	1.90 km
26237	II	Boundary Post	SS6537798861	1.90 km
26238	II	Cefn Fforest Fawr	SN63240045	1.80 km
26256	II	Pont Lliw Mill	SN6094000800	3.90 km
26257	II	Penderi Fawr Farmhouse including attached cowhouse	SS6190199587	3.30 km
26258	II	Gwenlais-uchaf	SN6184501552	3.10 km
26259	II	Barn at Gwenlais-uchaf	SN6183101566	3.10 km
26496	II	Bryn-rhos	SS6205897707	4.30 km
26497	II	North farmyard range at Bryn-rhos	SS6206197743	4.30 km
26498	II	West farmyard range at Bryn-rhos	SS6204697727	4.30 km
26499	II	East farmyard range at Bryn-rhos	SS6207497726	4.30 km
26500	II*	The Equatorial Observatory, Penllergare	SS6226099094	3.20 km
81058	II	Bridge over Lower Clydach below Glynmeithrim Uchaf	SN6846305875	5.50 km
81060	II	Cottage attached to Bryn Elim	SN6756303177	2.9 km
81065	II	Llety Thomas	SN 6422503015	2.10 km
81067	II	Valve tower at Upper Lliw reservoir with bridge and bridge abutment	SN6604805937	4.70 km
82317	II	Piers and railings at Calfaria Baptist Chapel	SN6895901258	3.40 km
82318	II	Church of Saint John the Baptist	SN6939001343	3.80 km
82322	II	Church of Saint Mary	SN6898601298	3.40 km
82323	II	Swansea Canal aqueduct over the Lower Clydach River	SN6891701171	3.40 km
82327	II	Iron Footbridge over the Swansea Canal	SN6897501216	3.40 km

LB Ref	Grade	Name/Location	NGR	Distance from Project Site
82328	II	Milestone on S side of High Street	SN6934301363	3.75 km
82329	II	Milestone on NE side of Vardre Road	SN6924701583	3.70 km
82330	II	Statue of Sir Ludwig Mond	SN6956901395	4 km
82331	II	Manor Park Country House	SN7012401422	4.50 km
82379	II	Church of Saint Samlet	SS6856897779	4.50 km

Table 4: Conservation Areas within the 5 km Study Area

Name/ID	NGR	Distance from Project Site
Morriston – CA013	SS 66933 97682	3.70 km
Llansamlet – CA027	SS 68543 97916	4.40 km

Table 5: Registered Historic Parks and Gardens within the 5 km Study Area

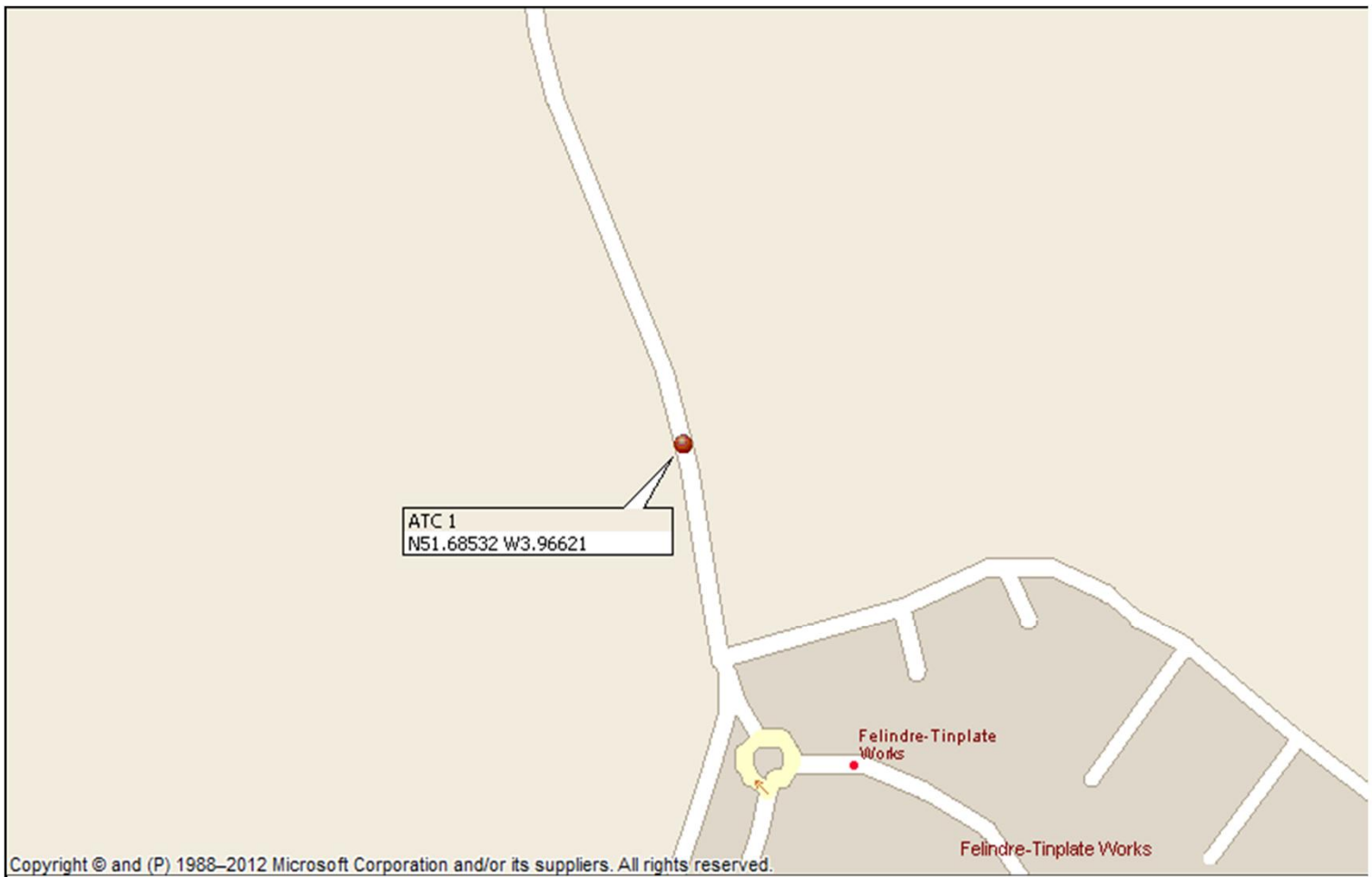
Registered Historic Parks and Gardens	NGR	Distance from Project Site
GM 54 – Penllergaer Grade II	SS 6261198211	3.50 km
GM 60 – Cwmgelli Cemetery Grade II	SS 6561996502	4.30 km
GM 75 – Parc Llewelyn Grade II	SS 6688897391	3.80 km

Appendix 7.1

Traffic Survey

Client:	Parsons Brinkerhoff
Project:	Abergelli Power Station
Job Number	C0738
Start Date:	16-Oct-14
Site No.	1
Road	B4489
Location:	Felindre Tinplate works, Swansea
Directions	Northbound Southbound

1. B4489 - Felindre Tinplate works, Swansea



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Job Number	C0738
Client:	Parsons Brinkerhoff
Project:	Abergelli Power Station
Location:	Felindre Tinplate works, Swansea
Site No.	1
Road	B4489
Start Date	16-Oct-14
Direction	Northbound Southbound

Vehicle Class Summary

M'Cycle & P'Cycle	1%
Cars	87%
LGV	11%
OGV1 & PSV	1%
OGV2	0%



	Northbound						Southbound						Combined					
	M'Cycle & P'Cycle	Cars	LGV/PSV 2Axle	OGV1/PSV 3Axle	OGV2	Total	M'Cycle & P'Cycle	Cars	LGV/PSV 2Axle	OGV1/PSV 3Axle	OGV2	Total	M'Cycle & P'Cycle	Cars	LGV/PSV 2Axle	OGV1/PSV 3Axle	OGV2	Total
00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
00:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00:45	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:45	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
02:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:30	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
03:45	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
04:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
04:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30	0	0	0	0	0	0	0	1	0	0	0	2	0	1	0	0	0	2
05:45	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1
06:00	0	0	0	0	0	0	0	2	0	0	0	2	0	2	0	0	0	2
06:15	0	1	0	0	0	1	1	3	0	0	0	4	1	4	0	0	0	5
06:30	0	2	0	0	0	2	0	3	0	0	0	4	0	5	0	0	0	6
06:45	0	1	0	0	0	2	0	4	0	0	0	4	0	6	0	0	0	6
07:00	0	2	1	0	0	3	0	6	1	0	0	7	0	8	1	0	0	10
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07:30	0	6	1	0	0	7	0	12	1	0	0	13	0	18	2	0	0	20
07:45	0	7	0	0	0	8	0	19	2	0	0	21	0	27	2	1	0	29
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09:15	0	5	2	0	0	7	0	7	1	0	0	8	0	12	3	0	0	15
09:30	0	4	1	0	0	5	0	5	1	0	0	6	0	9	2	0	0	12
09:45	0	4	0	0	0	5	0	7	1	0	0	9	0	12	2	0	0	14
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19:45	0	2	0	0	0	2	0	2	0	0	0	3	0	4	0	0	0	5
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Total	7	400	50	2	2	461	5	428	54	6	2	494	12	827	104	8	4	955

Sky High
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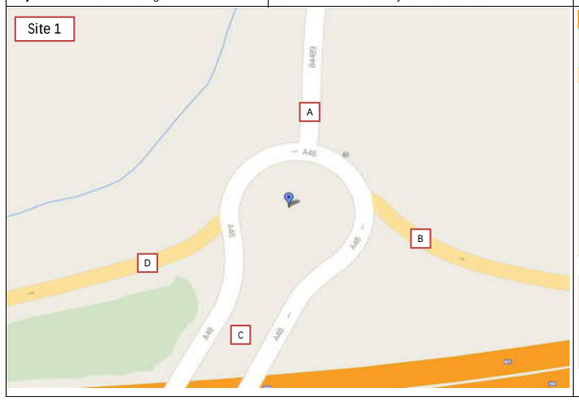
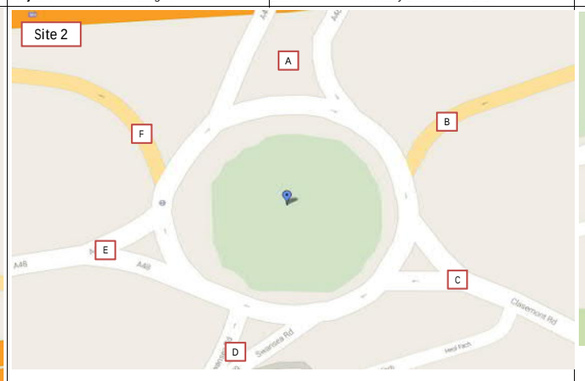
Client :	Parsons Brinckerhoff	**Site plan for :**	1
Project :	C0738 Abergelli	**Date :**	Thursday 16th October 2014



Sky High
Count On Us

Client :	Parsons Brinckerhoff	**Site plan for :**	2
Project :	C0738 Abergelli	**Date :**	Thursday 16th October 2014



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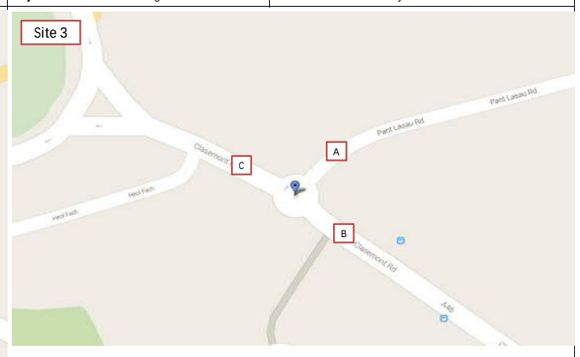
Count On Us

Client :	Parsons Brinckerhoff	**Site plan for :**	3
Project :	C0738 Abergelli	**Date :**	Thursday 16th October 2014



Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 1
Date: Thursday 16th October 2014

Entry : Arm A

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Destination : Arm D							Arm Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
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07:30	0	0	0	0	0	0	0	2	2	0	0	0	0	4	12	1	0	0	2	0	15	0	0	0	0	0	0	0	19
07:45	0	0	0	0	0	0	0	6	1	0	0	0	0	7	10	3	1	0	1	0	15	0	0	0	0	0	0	0	22
1 Hr	0	0	0	0	0	0	0	17	6	0	0	0	0	23	29	4	1	0	6	0	40	0	0	0	0	0	0	0	63
08:00	0	0	0	0	0	0	0	6	3	0	0	0	0	9	26	4	0	0	2	0	32	0	0	0	0	0	0	0	41
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08:45	0	0	0	0	0	0	0	1	0	0	0	0	0	1	16	1	0	0	1	0	18	0	0	0	0	0	0	0	19
1 Hr	0	0	0	0	0	0	0	14	3	0	0	0	0	17	85	10	1	0	6	0	102	0	0	0	0	0	0	0	119
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09:30	0	0	0	0	0	0	0	2	0	1	0	0	0	3	3	2	0	0	2	0	7	0	0	0	0	0	0	0	10
09:45	0	0	0	0	0	0	0	3	1	1	0	0	0	5	3	0	1	0	2	0	6	0	0	0	0	0	0	0	11
1 Hr	0	0	0	0	0	0	0	9	3	2	0	0	0	14	12	6	2	0	7	0	27	0	0	0	0	0	0	0	41
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1 Hr	0	0	0	0	0	0	0	15	8	3	0	0	0	26	24	3	1	1	0	0	29	0	0	0	0	0	0	0	55
13:00	0	0	0	0	0	0	0	3	0	0	0	0	1	4	10	1	0	0	0	0	11	0	0	0	0	0	0	0	15
13:15	0	0	0	0	0	0	0	4	1	0	0	0	0	5	9	2	1	1	0	0	13	0	0	0	0	0	0	0	18
13:30	0	0	0	0	0	0	0	2	1	0	0	0	0	3	10	2	0	0	0	0	12	0	0	0	0	0	0	0	15
13:45	0	0	0	0	0	0	0	2	0	0	0	0	0	2	3	4	0	0	2	0	9	0	0	0	0	0	0	0	11
1 Hr	0	0	0	0	0	0	0	11	2	0	0	0	1	14	32	9	1	1	2	0	45	0	0	0	0	0	0	0	59
14:00	0	0	0	0	0	0	0	5	0	0	0	0	0	5	7	0	0	0	0	0	7	0	0	0	0	0	0	0	12
14:15	0	0	0	0	0	0	0	7	1	0	0	0	0	8	7	3	0	0	2	0	12	0	0	0	0	0	0	0	20
14:30	0	0	0	0	0	0	0	6	3	0	0	0	0	9	10	6	0	0	1	0	17	0	0	0	0	0	0	0	26
14:45	0	0	0	0	0	0	0	4	3	1	0	0	0	8	9	1	1	0	2	0	13	0	0	0	0	0	0	0	21
1 Hr	0	0	0	0	0	0	0	22	7	1	0	0	0	30	33	10	1	0	5	0	49	0	0	0	0	0	0	0	79
15:00	0	0	0	0	0	0	0	4	2	1	0	0	0	7	9	1	1	0	1	0	12	0	0	0	0	0	0	0	19
15:15	0	0	0	0	0	0	0	6	0	0	0	0	1	7	3	0	0	0	1	0	4	0	0	0	0	0	0	0	11
15:30	0	0	0	0	0	0	0	16	2	0	0	0	0	18	26	1	0	0	2	0	29	0	0	0	0	0	0	0	47
15:45	0	0	0	0	0	0	0	11	2	0	0	0	0	13	17	3	0	0	1	0	21	0	0	0	0	0	0	0	34

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 1
Date: Thursday 16th October 2014

1 Hr	0	0	0	0	0	0	0	37	6	1	0	0	1	45	55	5	1	0	5	0	66	0	0	0	0	0	0	0	111
16:00	0	0	0	0	0	0	0	14	1	1	0	0	0	16	13	5	0	0	2	0	20	0	0	0	0	0	0	0	36
16:15	0	0	0	0	0	0	0	11	0	0	0	0	0	11	8	2	1	0	0	0	11	0	0	0	0	0	0	0	22
16:30	0	0	0	0	0	0	0	13	0	0	0	0	0	13	23	3	0	0	2	0	28	0	0	0	0	0	0	0	41
16:45	0	0	0	0	0	0	0	21	0	0	0	0	0	21	11	1	0	0	1	0	13	0	0	0	0	0	0	0	34
1 Hr	0	0	0	0	0	0	0	59	1	1	0	0	0	61	55	11	1	0	5	0	72	0	0	0	0	0	0	0	133
17:00	0	0	0	0	0	0	0	27	2	0	0	0	0	29	21	5	0	0	2	0	28	0	0	0	0	0	0	0	57
17:15	0	0	0	0	0	0	0	11	0	0	0	0	0	11	15	2	0	0	1	1	19	0	0	0	0	0	0	0	30
17:30	0	0	0	0	0	0	0	11	1	0	0	0	0	12	11	3	0	0	1	0	15	0	0	0	0	0	0	0	27
17:45	0	0	0	0	0	0	0	18	1	0	0	0	0	19	25	0	0	0	2	0	27	0	0	0	0	0	0	0	46
1 Hr	0	0	0	0	0	0	0	67	4	0	0	0	0	71	72	10	0	0	6	1	89	0	0	0	0	0	0	0	160
18:00	0	0	0	0	0	0	0	8	0	0	0	0	0	8	22	1	0	0	1	0	24	0	0	0	0	0	0	0	32
18:15	0	0	0	0	0	0	0	7	0	0	0	0	0	7	18	0	0	0	1	0	19	0	0	0	0	0	0	0	26
18:30	0	0	0	0	0	0	0	6	0	0	0	0	0	6	11	1	0	0	1	0	13	0	0	0	0	0	0	0	19
18:45	0	0	0	0	0	0	0	5	0	0	0	0	0	5	21	2	0	0	0	0	23	0	0	0	0	0	0	0	28
1 Hr	0	0	0	0	0	0	0	26	0	0	0	0	0	26	72	4	0	0	3	0	79	0	0	0	0	0	0	0	105
Total	0	0	0	0	0	0	0	299	44	12	1	0	2	358	505	83	13	2	46	1	650	0	0	0	0	0	0	0	1008

Entry : Arm B

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Destination : Arm D							Arm
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Totals
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 1
Date: Thursday 16th October 2014

	Arm A							Arm B							Arm C							Arm D							
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Entry : Arm C

	Arm A							Arm B							Arm C							Arm D							
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	10	0	0	0	1	0	11	74	19	2	0	0	0	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	106
07:15	16	2	0	0	1	0	19	58	18	2	0	0	1	79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98
07:30	27	2	0	0	2	0	31	90	14	3	0	3	1	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	142
07:45	43	2	0	0	1	0	46	76	12	5	2	1	1	97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	143
1 Hr	96	6	0	0	5	0	107	298	63	12	2	4	3	382	0	0	0	0	0	0	0	0	0	0	0	0	0	0	489
08:00	42	6	1	0	2	0	51	78	13	2	0	0	0	93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	144

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 1
Date: Thursday 16th October 2014

08:15	29	2	1	0	1	0	33	73	4	4	1	0	0	82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	115
08:30	41	0	0	0	2	0	43	74	6	2	0	1	1	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	127
08:45	30	2	1	0	2	0	35	58	6	2	0	3	0	69	1	0	0	0	0	0	1	0	0	0	0	0	0	0	105
1 Hr	142	10	3	0	7	0	162	283	29	10	1	4	1	328	1	0	0	0	0	0	1	0	0	0	0	0	0	0	491
09:00	13	4	1	0	1	0	19	41	6	0	0	1	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67
09:15	13	3	0	0	2	0	18	36	10	4	2	1	0	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71
09:30	20	3	1	0	1	0	25	38	7	0	0	1	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71
09:45	13	1	0	0	2	0	16	49	10	3	2	5	0	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85
1 Hr	59	11	2	0	6	0	78	164	33	7	4	8	0	216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	294
10:00	2	1	2	0	1	0	6	34	14	3	0	2	0	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59
10:15	7	0	0	0	0	0	7	35	8	0	1	0	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51
10:30	8	2	0	0	0	0	10	36	4	5	1	0	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56
10:45	4	1	2	0	0	0	7	43	3	4	4	2	0	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63
1 Hr	21	4	4	0	1	0	30	148	29	12	6	4	0	199	0	0	0	0	0	0	0	0	0	0	0	0	0	0	229
11:00	2	0	0	0	0	0	2	47	7	5	1	0	0	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62
11:15	4	1	0	1	0	0	6	47	9	4	0	1	0	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67
11:30	5	0	0	0	0	0	5	37	7	6	0	1	0	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56
11:45	5	2	0	0	0	0	7	44	11	7	1	1	1	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72
1 Hr	16	3	0	1	0	0	20	175	34	22	2	3	1	237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	257
12:00	6	2	1	0	0	0	9	49	6	3	1	0	0	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68
12:15	6	1	0	1	0	1	9	58	7	2	0	0	0	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76
12:30	8	2	0	0	0	0	10	60	8	3	0	0	0	71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81
12:45	9	2	0	0	0	0	11	48	7	1	3	1	0	60	1	0	0	0	0	0	1	0	0	0	0	0	0	0	72
1 Hr	29	7	1	1	0	1	39	215	28	9	4	1	0	257	1	0	0	0	0	0	1	0	0	0	0	0	0	0	297
13:00	9	2	0	0	0	0	11	58	5	1	2	0	1	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78
13:15	7	0	1	0	0	0	8	63	6	5	0	0	1	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	83
13:30	2	2	0	0	0	0	4	59	6	3	0	1	0	69	0	1	0	0	0	0	1	0	0	0	0	0	0	0	74
13:45	8	6	1	0	0	0	15	35	11	7	2	2	0	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72
1 Hr	26	10	2	0	0	0	38	215	28	16	4	3	2	268	0	1	0	0	0	0	1	0	0	0	0	0	0	0	307
14:00	2	0	0	0	1	0	3	68	10	3	1	0	0	82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85
14:15	7	0	0	0	1	0	8	78	10	8	1	0	0	97	1	0	0	0	0	0	1	0	0	0	0	0	0	0	106
14:30	11	3	0	0	1	0	15	92	14	2	0	0	0	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	123
14:45	4	2	0	0	1	0	7	92	11	4	1	1	0	109	0	1	0	0	0	0	1	0	0	0	0	0	0	0	117
1 Hr	24	5	0	0	4	0	33	330	45	17	3	1	0	396	1	1	0	0	0	0	2	0	0	0	0	0	0	0	431
15:00	6	0	0	0	2	0	8	128	8	2	4	0	0	142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150
15:15	8	3	0	1	1	0	13	143	12	2	0	0	0	157	1	0	0	0	0	0	1	0	0	0	0	0	0	0	171
15:30	4	1	0	0	2	0	7	152	9	3	2	3	0	169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	176
15:45	10	1	1	0	1	0	13	131	7	1	0	1	0	140	1	0	0	0	0	0	1	0	0	0	0	0	0	0	154
1 Hr	28	5	1	1	6	0	41	554	36	8	6	4	0	608	2	0	0	0	0	0	2	0	0	0	0	0	0	0	651
16:00	4	0	1	0	1	0	6	171	14	1	0	0	1	187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193
16:15	7	1	0	0	1	0	9	140	13	3	1	0	0	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166
16:30	6	3	1	0	2	0	12	167	10	1	2	0	0	180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	192
16:45	5	4	0	0	1	0	10	152	13	2	1	1	0	169	0	1	0	0	0	0	1	0	0	0	0	0	0	0	180
1 Hr	22	8	2	0	5	0	37	630	50	7	4	1	1	693	0	1	0	0	0	0	1	0	0	0	0	0	0	0	731
17:00	9	2	0	0	1	0	12	168	14	0	1	0	0	183	0	0	0	0	0	0	0	0	0	0	0	0	0	0	195
17:15	10	1	1	0	2	0	14	152	8	2	1	0	0	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	177
17:30	7	2	0	0	1	0	10	134	8	2	0	0	0	144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	154
17:45	13	2	0	0	2	0	17	97	3	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 1
Date: Thursday 16th October 2014

1 Hr	39	7	1	0	6	0	53	551	33	4	2	0	0	590	0	0	0	0	0	0	0	0	0	0	0	0	643
18:00	13	1	0	0	3	0	17	80	3	1	0	0	0	84	0	0	0	0	0	0	0	0	0	0	0	0	101
18:15	11	0	0	0	1	1	13	93	7	1	1	0	0	102	0	0	0	0	0	0	0	0	0	0	0	0	115
18:30	8	1	0	0	1	0	10	59	7	2	0	0	0	68	0	0	0	0	0	0	0	0	0	0	0	0	78
18:45	3	1	0	0	0	0	4	48	1	0	2	0	0	51	0	0	0	0	0	0	0	0	0	0	0	0	55
1 Hr	35	3	0	0	5	1	44	280	18	4	3	0	0	305	0	0	0	0	0	0	0	0	0	0	0	0	349
Total	537	79	16	3	45	2	682	3843	426	128	41	33	8	4479	5	3	0	0	0	0	8	0	0	0	0	0	0	5169

Entry : Arm D

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Destination : Arm D							Arm Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	4	0	0	0	0	0	4	0	0	0	0	0	0	0	82	5	2	0	0	0	89	0	0	0	0	0	0	0	93
07:15	4	1	0	0	0	0	5	0	0	0	0	0	0	0	87	6	6	0	0	0	99	0	0	0	0	0	0	0	104
07:30	11	3	0	0	0	0	14	0	0	0	0	0	0	0	99	2	2	0	1	1	105	0	0	0	0	0	0	0	119
07:45	9	3	0	0	0	0	12	0	0	0	0	0	0	0	116	12	4	0	2	0	134	0	0	0	0	0	0	0	146
1 Hr	28	7	0	0	0	0	35	0	0	0	0	0	0	0	384	25	14	0	3	1	427	0	0	0	0	0	0	0	462
08:00	15	2	1	0	0	0	18	0	0	0	0	0	0	0	96	9	3	0	0	1	109	0	0	0	0	0	0	0	127
08:15	11	0	0	0	0	0	11	0	0	0	0	0	0	0	110	12	1	0	1	1	125	0	0	0	0	0	0	0	136
08:30	10	3	0	0	0	0	13	0	0	0	0	0	0	0	105	7	4	0	1	0	117	0	0	0	0	0	0	0	130
08:45	9	1	0	0	0	0	10	0	0	0	0	0	0	0	119	12	7	1	0	0	139	0	0	0	0	0	0	0	149
1 Hr	45	6	1	0	0	0	52	0	0	0	0	0	0	0	430	40	15	1	2	2	490	0	0	0	0	0	0	0	542
09:00	10	2	1	0	0	0	13	0	0	0	0	0	0	0	73	7	1	0	0	2	83	0	0	0	0	0	0	0	96
09:15	10	1	2	0	0	0	13	0	0	0	0	0	0	0	47	5	2	0	0	0	54	0	0	0	0	0	0	0	67
09:30	13	1	2	0	0	0	16	0	0	0	0	0	0	0	47	0	0	0	0	0	47	0	0	0	0	0	0	0	63
09:45	5	0	1	0	0	0	6	0	0	0	0	0	0	0	34	7	1	1	0	0	43	0	0	0	0	0	0	0	49
1 Hr	38	4	6	0	0	0	48	0	0	0	0	0	0	0	201	19	4	1	0	2	227	0	0	0	0	0	0	0	275
10:00	3	0	0	0	0	0	3	0	0	0	0	0	0	0	39	7	2	0	0	0	48	0	0	0	0	0	0	0	51
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	4	1	0	0	0	43	0	0	0	0	0	0	0	43
10:30	2	2	0	0	0	0	4	0	0	0	0	0	0	0	38	5	5	0	0	0	48	0	0	0	0	0	0	0	52
10:45	0	0	1	0	0	0	1	0	0	0	0	0	0	0	26	6	1	0	0	0	33	0	0	0	0	0	0	0	34
1 Hr	5	2	1	0	0	0	8	0	0	0	0	0	0	0	141	22	9	0	0	0	172	0	0	0	0	0	0	0	180
11:00	0	0	1	0	0	0	1	0	0	0	0	0	0	0	38	8	1	0	0	0	47	0	0	0	0	0	0	0	48
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	4	4	0	0	1	41	0	0	0	0	0	0	0	41
11:30	3	3	3	0	0	0	9	0	0	0	0	0	0	0	27	4	0	1	0	0	32	0	0	0	0	0	0	0	41
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	6	3	0	0	0	41	0	0	0	0	0	0	0	41
1 Hr	3	3	4	0	0	0	10	0	0	0	0	0	0	0	129	22	8	1	0	1	161	0	0	0	0	0	0	0	171
12:00	0	1	0	1	0	0	2	0	0	0	0	0	0	0	40	7	1	0	0	0	48	0	0	0	0	0	0	0	50
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	4	0	0	0	0	32	0	0	0	0	0	0	0	32
12:30	1	0	0	0	0	0	1	0	0	0	0	0	0	0	46	4	2	0	0	0	52	0	0	0	0	0	0	0	53
12:45	5	1	0	0	0	0	6	0	0	0	0	0	0	0	31	2	2	0	0	0	35	0	0	0	0	0	0	0	41
1 Hr	6	2	0	1	0	0	9	0	0	0	0	0	0	0	145	17	5	0	0	0	167	0	0	0	0	0	0	0	176
13:00	1	0	0	0	0	0	1	0	0	0	0	0	0	0	34	8	1	0	0	0	43	0	0	0	0	0	0	0	44
13:15	2	1	0	0	0	0	3	0	0	0	0	0	0	0	43	5	1	0	0	0	49	0	0	0	0	0	0	0	52
13:30	4	0	0	0	0	0	4	0	0	0	0	0	0	0	38	5	2	0	0	0	45	0	0	0	0	0	0	0	49
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	12	2	0	0	0	49	0	0	0	0	0	0	0	49
1 Hr	7	1	0	0	0	0	8	0	0	0	0	0	0	0	150	30	6	0	0	0	186	0	0	0	0	0	0	0	194

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 1
Date: Thursday 16th October 2014

14:00	1	0	0	0	0	0	1	0	0	0	0	0	0	0	54	3	2	0	0	0	59	0	0	0	0	0	0	0	60
14:15	1	2	1	0	0	0	4	0	0	0	0	0	0	0	34	8	3	0	0	0	45	0	0	0	0	0	0	0	49
14:30	6	0	3	0	0	0	9	0	0	0	0	0	0	0	24	5	1	1	1	0	32	0	0	0	0	0	0	0	41
14:45	3	0	1	0	0	0	4	0	0	0	0	0	0	0	51	2	0	0	0	1	54	0	0	0	0	0	0	0	58
1 Hr	11	2	5	0	0	0	18	0	0	0	0	0	0	0	163	18	6	1	1	1	190	0	0	0	0	0	0	0	208
15:00	4	0	0	0	0	0	4	1	0	0	0	0	0	1	30	5	4	0	0	0	39	0	0	0	0	0	0	0	44
15:15	3	1	0	0	0	1	5	0	0	0	0	0	0	0	54	7	3	0	0	0	64	0	0	0	0	0	0	0	69
15:30	2	0	0	0	0	0	2	0	0	0	0	0	0	0	60	3	3	1	0	0	67	0	0	0	0	0	0	0	69
15:45	7	1	1	0	0	0	9	0	0	0	0	0	0	0	41	3	0	0	2	0	46	0	0	0	0	0	0	0	55
1 Hr	16	2	1	0	0	1	20	1	0	0	0	0	0	1	185	18	10	1	2	0	216	0	0	0	0	0	0	0	237
16:00	1	1	1	0	0	0	3	0	0	1	0	0	0	1	39	8	0	0	0	0	47	0	0	0	0	0	0	0	51
16:15	5	0	0	0	0	0	5	0	0	0	0	0	0	0	55	4	1	0	1	0	61	0	0	0	0	0	0	0	66
16:30	2	0	0	0	0	0	2	0	0	0	0	0	0	0	45	6	0	0	0	1	52	0	0	0	0	0	0	0	54
16:45	2	0	0	0	0	0	2	0	0	0	0	0	0	0	57	10	1	0	1	0	69	0	0	0	0	0	0	0	71
1 Hr	10	1	1	0	0	0	12	0	0	1	0	0	0	1	196	28	2	0	2	1	229	0	0	0	0	0	0	0	242
17:00	5	1	0	0	0	0	6	0	0	0	0	0	0	0	72	12	2	0	0	0	86	0	0	0	0	0	0	0	92
17:15	0	1	0	0	0	0	1	0	0	0	0	0	0	0	80	11	1	0	0	0	92	0	0	0	0	0	0	0	93
17:30	1	1	0	0	0	0	2	1	0	0	0	0	0	1	66	6	1	0	0	0	73	0	0	0	0	0	0	0	76
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65	9	1	0	0	0	75	0	0	0	0	0	0	0	75
1 Hr	6	3	0	0	0	0	9	1	0	0	0	0	0	1	283	38	5	0	0	0	326	0	0	0	0	0	0	0	336
18:00	3	1	0	0	0	0	4	0	0	0	0	0	0	0	64	10	3	0	0	0	77	0	0	0	0	0	0	0	81
18:15	1	0	0	0	0	0	1	0	0	0	0	0	0	0	59	5	2	0	0	0	66	0	0	0	0	0	0	0	67
18:30	4	0	0	0	0	0	4	0	0	0	0	0	0	0	44	6	1	0	0	0	51	0	0	0	0	0	0	0	55
18:45	2	2	0	0	0	0	4	0	0	0	0	0	0	0	52	2	0	0	0	0	54	0	0	0	0	0	0	0	58
1 Hr	10	3	0	0	0	0	13	0	0	0	0	0	0	0	219	23	6	0	0	0	248	0	0	0	0	0	0	0	261
Total	185	36	19	1	0	1	242	2	0	1	0	0	0	3	2626	300	90	5	10	8	3039	0	0	0	0	0	0	0	3284

ORIGIN SUMMARY

	Origin : Arm A							Origin : Arm B							Origin : Arm C							Origin : Arm D							Origin Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	7	2	0	0	2	0	11	0	0	0	0	0	0	0	84	19	2	0	1	0	106	86	5	2	0	0	0	93	210
07:15	9	1	0	0	1	0	11	0	0	0	0	0	0	0	74	20	2	0	1	1	98	91	7	6	0	0	0	104	213
07:30	14	3	0	0	2	0	19	0	0	0	0	0	0	0	117	16	3	0	5	1	142	110	5	2	0	1	1	119	280
07:45	16	4	1	0	1	0	22	0	0	0	0	0	0	0	119	14	5	2	2	1	143	125	15	4	0	2	0	146	311
1 Hr	46	10	1	0	6	0	63	0	0	0	0	0	0	0	394	69	12	2	9	3	489	412	32	14	0	3	1	462	1014
08:00	32	7	0	0	2	0	41	0	0	0	0	0	0	0	120	19	3	0	2	0	144	111	11	4	0	0	1	127	312
08:15	32	4	1	0	1	0	38	0	0	0	0	0	0	0	102	6	5	1	1	0	115	121	12	1	0	1	1	136	289
08:30	18	1	0	0	2	0	21	0	0	0	0	0	0	0	115	6	2	0	3	1	127	115	10	4	0	1	0	130	278
08:45	17	1	0	0	1	0	19	0	0	0	0	0	0	0	89	8	3	0	5	0	105	128	13	7	1	0	0	149	273
1 Hr	99	13	1	0	6	0	119	0	0	0	0	0	0	0	426	39	13	1	11	1	491	475	46	16	1	2	2	542	1152
09:00	8	5	0	0	2	0	15	0	0	0	0	0	0	0	54	10	1	0	2	0	67	83	9	2	0	0	2	96	178
09:15	2	1	1	0	1	0	5	0	0	0	0	0	0	0	49	13	4	2	3	0	71	57	6	4	0	0	0	67	143
09:30	5	2	1	0	2	0	10	0	0	0	0	0	0	0	58	10	1	0	2	0	71	60	1	2	0	0	0	63	144
09:45	6	1	2	0	2	0	11	0	0	0	0	0	0	0	62	11	3	2	7	0	85	39	7	2	1	0	0	49	145
1 Hr	21	9	4	0	7	0	41	0	0	0	0	0	0	0	223	44	9	4	14	0	294	239	23	10	1	0	2	275	610
10:00	10	1	3	0	1	0	15	0	0	0	0	0	0	0	36	15	5	0	3	0	59	42	7	2	0	0	0	51	125

Sky High
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10:15	10	0	1	0	0	0	11	0	0	0	0	0	0	0	42	8	0	1	0	0	51	38	4	1	0	0	0	43	105
10:30	7	5	1	0	0	0	13	0	0	0	0	0	0	0	44	6	5	1	0	0	56	40	7	5	0	0	0	52	121
10:45	7	2	0	0	0	0	9	0	0	0	0	0	0	0	47	4	6	4	2	0	63	26	6	2	0	0	0	34	106
1 Hr	34	8	5	0	1	0	48	0	0	0	0	0	0	0	169	33	16	6	5	0	229	146	24	10	0	0	0	180	457
11:00	4	1	0	0	0	0	5	0	0	0	0	0	0	0	49	7	5	1	0	0	62	38	8	2	0	0	0	48	115
11:15	5	2	1	0	0	0	8	0	0	0	0	0	0	0	51	10	4	1	1	0	67	32	4	4	0	0	1	41	116
11:30	6	2	0	0	0	0	8	0	0	0	0	0	0	0	42	7	6	0	1	0	56	30	7	3	1	0	0	41	105
11:45	9	2	2	1	0	0	14	0	0	0	0	0	0	0	49	13	7	1	1	1	72	32	6	3	0	0	0	41	127
1 Hr	24	7	3	1	0	0	35	0	0	0	0	0	0	0	191	37	22	3	3	1	257	132	25	12	1	0	1	171	463
12:00	3	3	1	1	0	0	8	0	0	0	0	0	0	0	55	8	4	1	0	0	68	40	8	1	1	0	0	50	126
12:15	10	2	0	0	0	0	12	0	0	0	0	0	0	0	64	8	2	1	0	1	76	28	4	0	0	0	0	32	120
12:30	13	3	0	0	0	0	16	0	0	0	0	0	0	0	68	10	3	0	0	0	81	47	4	2	0	0	0	53	150
12:45	13	3	3	0	0	0	19	0	0	0	0	0	0	0	58	9	1	3	1	0	72	36	3	2	0	0	0	41	132
1 Hr	39	11	4	1	0	0	55	0	0	0	0	0	0	0	245	35	10	5	1	1	297	151	19	5	1	0	0	176	528
13:00	13	1	0	0	0	1	15	0	0	0	0	0	0	0	67	7	1	2	0	1	78	35	8	1	0	0	0	44	137
13:15	13	3	1	1	0	0	18	0	0	0	0	0	0	0	70	6	6	0	0	1	83	45	6	1	0	0	0	52	153
13:30	12	3	0	0	0	0	15	0	0	0	0	0	0	0	61	9	3	0	1	0	74	42	5	2	0	0	0	49	138
13:45	5	4	0	0	2	0	11	0	0	0	0	0	0	0	43	17	8	2	2	0	72	35	12	2	0	0	0	49	132
1 Hr	43	11	1	1	2	1	59	0	0	0	0	0	0	0	241	39	18	4	3	2	307	157	31	6	0	0	0	194	560
14:00	12	0	0	0	0	0	12	0	0	0	0	0	0	0	70	10	3	1	1	0	85	55	3	2	0	0	0	60	157
14:15	14	4	0	0	2	0	20	0	0	0	0	0	0	0	86	10	8	1	1	0	106	35	10	4	0	0	0	49	175
14:30	16	9	0	0	1	0	26	0	0	0	0	0	0	0	103	17	2	0	1	0	123	30	5	4	1	1	0	41	190
14:45	13	4	2	0	2	0	21	0	0	0	0	0	0	0	96	14	4	1	2	0	117	54	2	1	0	0	1	58	196
1 Hr	55	17	2	0	5	0	79	0	0	0	0	0	0	0	355	51	17	3	5	0	431	174	20	11	1	1	1	208	718
15:00	13	3	2	0	1	0	19	0	0	0	0	0	0	0	134	8	2	4	2	0	150	35	5	4	0	0	0	44	213
15:15	9	0	0	0	1	1	11	0	0	0	0	0	0	0	152	15	2	1	1	0	171	57	8	3	0	0	1	69	251
15:30	42	3	0	0	2	0	47	0	0	0	0	0	0	0	156	10	3	2	5	0	176	62	3	3	1	0	0	69	292
15:45	28	5	0	0	1	0	34	0	0	0	0	0	0	0	142	8	2	0	2	0	154	48	4	1	0	2	0	55	243
1 Hr	92	11	2	0	5	1	111	0	0	0	0	0	0	0	584	41	9	7	10	0	651	202	20	11	1	2	1	237	999
16:00	27	6	1	0	2	0	36	0	0	0	0	0	0	0	175	14	2	0	1	1	193	40	9	2	0	0	0	51	280
16:15	19	2	1	0	0	0	22	0	0	0	0	0	0	0	147	14	3	1	1	0	166	60	4	1	0	1	0	66	254
16:30	36	3	0	0	2	0	41	0	0	0	0	0	0	0	173	13	2	2	2	0	192	47	6	0	0	0	1	54	287
16:45	32	1	0	0	1	0	34	0	0	0	0	0	0	0	157	18	2	1	2	0	180	59	10	1	0	1	0	71	285
1 Hr	114	12	2	0	5	0	133	0	0	0	0	0	0	0	652	59	9	4	6	1	731	206	29	4	0	2	1	242	1106
17:00	48	7	0	0	2	0	57	0	0	0	0	0	0	0	177	16	0	1	1	0	195	77	13	2	0	0	0	92	344
17:15	26	2	0	0	1	1	30	0	0	0	0	0	0	0	162	9	3	1	2	0	177	80	12	1	0	0	0	93	300
17:30	22	4	0	0	1	0	27	0	0	0	0	0	0	0	141	10	2	0	1	0	154	68	7	1	0	0	0	76	257
17:45	43	1	0	0	2	0	46	0	0	0	0	0	0	0	110	5	0	0	2	0	117	65	9	1	0	0	0	75	238
1 Hr	139	14	0	0	6	1	160	0	0	0	0	0	0	0	590	40	5	2	6	0	643	290	41	5	0	0	0	336	1139
18:00	30	1	0	0	1	0	32	0	0	0	0	0	0	0	93	4	1	0	3	0	101	67	11	3	0	0	0	81	214
18:15	25	0	0	0	1	0	26	0	0	0	0	0	0	0	104	7	1	1	1	1	115	60	5	2	0	0	0	67	208
18:30	17	1	0	0	1	0	19	0	0	0	0	0	0	0	67	8	2	0	1	0	78	48	6	1	0	0	0	55	152
18:45	26	2	0	0	0	0	28	0	0	0	0	0	0	0	51	2	0	2	0	0	55	54	4	0	0	0	0	58	141
1 Hr	98	4	0	0	3	0	105	0	0	0	0	0	0	0	315	21	4	3	5	1	349	229	26	6	0	0	0	261	715
Total	804	127	25	3	46	3	1008	0	0	0	0	0	0	0	4385	508	144	44	78	10	5169	2813	336	110	6	10	9	3284	9461

DESTINATION SUMMARY

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 1
Date: Thursday 16th October 2014

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Destination : Arm D							Dest
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Totals
07:00	14	0	0	0	1	0	15	78	21	2	0	0	0	101	85	5	2	0	2	0	94	0	0	0	0	0	0	0	210
07:15	20	3	0	0	1	0	24	63	19	2	0	0	1	85	91	6	6	0	1	0	104	0	0	0	0	0	0	0	213
07:30	38	5	0	0	2	0	45	92	16	3	0	3	1	115	111	3	2	0	3	1	120	0	0	0	0	0	0	0	280
07:45	52	5	0	0	1	0	58	82	13	5	2	1	1	104	126	15	5	0	3	0	149	0	0	0	0	0	0	0	311
1 Hr	124	13	0	0	5	0	142	315	69	12	2	4	3	405	413	29	15	0	9	1	467	0	0	0	0	0	0	0	1014
08:00	57	8	2	0	2	0	69	84	16	2	0	0	0	102	122	13	3	0	2	1	141	0	0	0	0	0	0	0	312
08:15	40	2	1	0	1	0	44	80	4	4	1	0	0	89	135	16	2	0	2	1	156	0	0	0	0	0	0	0	289
08:30	51	3	0	0	2	0	56	74	6	2	0	1	1	84	123	8	4	0	3	0	138	0	0	0	0	0	0	0	278
08:45	39	3	1	0	2	0	45	59	6	2	0	3	0	70	136	13	7	1	1	0	158	0	0	0	0	0	0	0	273
1 Hr	187	16	4	0	7	0	214	297	32	10	1	4	1	345	516	50	16	1	8	2	593	0	0	0	0	0	0	0	1152
09:00	23	6	2	0	1	0	32	44	7	0	0	1	0	52	78	11	1	0	2	2	94	0	0	0	0	0	0	0	178
09:15	23	4	2	0	2	0	31	37	11	4	2	1	0	55	48	5	3	0	1	0	57	0	0	0	0	0	0	0	143
09:30	33	4	3	0	1	0	41	40	7	1	0	1	0	49	50	2	0	0	2	0	54	0	0	0	0	0	0	0	144
09:45	18	1	1	0	2	0	22	52	11	4	2	5	0	74	37	7	2	1	2	0	49	0	0	0	0	0	0	0	145
1 Hr	97	15	8	0	6	0	126	173	36	9	4	8	0	230	213	25	6	1	7	2	254	0	0	0	0	0	0	0	610
10:00	5	1	2	0	1	0	9	37	15	3	0	2	0	57	46	7	5	0	1	0	59	0	0	0	0	0	0	0	125
10:15	7	0	0	0	0	0	7	41	8	1	1	0	0	51	42	4	1	0	0	0	47	0	0	0	0	0	0	0	105
10:30	10	4	0	0	0	0	14	37	5	6	1	0	0	49	44	9	5	0	0	0	58	0	0	0	0	0	0	0	121
10:45	4	1	3	0	0	0	8	46	4	4	4	2	0	60	30	7	1	0	0	0	38	0	0	0	0	0	0	0	106
1 Hr	26	6	5	0	1	0	38	161	32	14	6	4	0	217	162	27	12	0	1	0	202	0	0	0	0	0	0	0	457
11:00	2	0	1	0	0	0	3	48	8	5	1	0	0	62	41	8	1	0	0	0	50	0	0	0	0	0	0	0	115
11:15	4	1	0	1	0	0	6	48	9	5	0	1	0	63	36	6	4	0	0	1	47	0	0	0	0	0	0	0	116
11:30	8	3	3	0	0	0	14	38	7	6	0	1	0	52	32	6	0	1	0	0	39	0	0	0	0	0	0	0	105
11:45	5	2	0	0	0	0	7	50	11	8	2	1	1	73	35	8	4	0	0	0	47	0	0	0	0	0	0	0	127
1 Hr	19	6	4	1	0	0	30	184	35	24	3	3	1	250	144	28	9	1	0	1	183	0	0	0	0	0	0	0	463
12:00	6	3	1	1	0	0	11	50	9	4	1	0	0	64	42	7	1	1	0	0	51	0	0	0	0	0	0	0	126
12:15	6	1	0	1	0	1	9	61	9	2	0	0	0	72	35	4	0	0	0	0	39	0	0	0	0	0	0	0	120
12:30	9	2	0	0	0	0	11	64	10	3	0	0	0	77	55	5	2	0	0	0	62	0	0	0	0	0	0	0	150
12:45	14	3	0	0	0	0	17	55	8	3	3	1	0	70	38	4	3	0	0	0	45	0	0	0	0	0	0	0	132
1 Hr	35	9	1	2	0	1	48	230	36	12	4	1	0	283	170	20	6	1	0	0	197	0	0	0	0	0	0	0	528
13:00	10	2	0	0	0	0	12	61	5	1	2	0	2	71	44	9	1	0	0	0	54	0	0	0	0	0	0	0	137
13:15	9	1	1	0	0	0	11	67	7	5	0	0	1	80	52	7	2	1	0	0	62	0	0	0	0	0	0	0	153
13:30	6	2	0	0	0	0	8	61	7	3	0	1	0	72	48	8	2	0	0	0	58	0	0	0	0	0	0	0	138
13:45	8	6	1	0	0	0	15	37	11	7	2	2	0	59	38	16	2	0	2	0	58	0	0	0	0	0	0	0	132
1 Hr	33	11	2	0	0	0	46	226	30	16	4	3	3	282	182	40	7	1	2	0	232	0	0	0	0	0	0	0	560
14:00	3	0	0	0	1	0	4	73	10	3	1	0	0	87	61	3	2	0	0	0	66	0	0	0	0	0	0	0	157
14:15	8	2	1	0	1	0	12	85	11	8	1	0	0	105	42	11	3	0	2	0	58	0	0	0	0	0	0	0	175
14:30	17	3	3	0	1	0	24	98	17	2	0	0	0	117	34	11	1	1	2	0	49	0	0	0	0	0	0	0	190
14:45	7	2	1	0	1	0	11	96	14	5	1	1	0	117	60	4	1	0	2	1	68	0	0	0	0	0	0	0	196
1 Hr	35	7	5	0	4	0	51	352	52	18	3	1	0	426	197	29	7	1	6	1	241	0	0	0	0	0	0	0	718
15:00	10	0	0	0	2	0	12	133	10	3	4	0	0	150	39	6	5	0	1	0	51	0	0	0	0	0	0	0	213
15:15	11	4	0	1	1	1	18	149	12	2	0	0	1	164	58	7	3	0	1	0	69	0	0	0	0	0	0	0	251
15:30	6	1	0	0	2	0	9	168	11	3	2	3	0	187	86	4	3	1	2	0	96	0	0	0	0	0	0	0	292
15:45	17	2	2	0	1	0	22	142	9	1	0	1	0	153	59	6	0	0	3	0	68	0	0	0	0	0	0	0	243
1 Hr	44	7	2	1	6	1	61	592	42	9	6	4	1	654	242	23	11	1	7	0	284	0	0	0	0	0	0	0	999

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 1
Date: Thursday 16th October 2014

16:00	5	1	2	0	1	0	9	185	15	3	0	0	1	204	52	13	0	0	2	0	67	0	0	0	0	0	0	0	280
16:15	12	1	0	0	1	0	14	151	13	3	1	0	0	168	63	6	2	0	1	0	72	0	0	0	0	0	0	0	254
16:30	8	3	1	0	2	0	14	180	10	1	2	0	0	193	68	9	0	0	2	1	80	0	0	0	0	0	0	0	287
16:45	7	4	0	0	1	0	12	173	13	2	1	1	0	190	68	12	1	0	2	0	83	0	0	0	0	0	0	0	285
1 Hr	32	9	3	0	5	0	49	689	51	9	4	1	1	755	251	40	3	0	7	1	302	0	0	0	0	0	0	0	1106
17:00	14	3	0	0	1	0	18	195	16	0	1	0	0	212	93	17	2	0	2	0	114	0	0	0	0	0	0	0	344
17:15	10	2	1	0	2	0	15	163	8	2	1	0	0	174	95	13	1	0	1	1	111	0	0	0	0	0	0	0	300
17:30	8	3	0	0	1	0	12	146	9	2	0	0	0	157	77	9	1	0	1	0	88	0	0	0	0	0	0	0	257
17:45	13	2	0	0	2	0	17	115	4	0	0	0	0	119	90	9	1	0	2	0	102	0	0	0	0	0	0	0	238
1 Hr	45	10	1	0	6	0	62	619	37	4	2	0	0	662	355	48	5	0	6	1	415	0	0	0	0	0	0	0	1139
18:00	16	2	0	0	3	0	21	88	3	1	0	0	0	92	86	11	3	0	1	0	101	0	0	0	0	0	0	0	214
18:15	12	0	0	0	1	1	14	100	7	1	1	0	0	109	77	5	2	0	1	0	85	0	0	0	0	0	0	0	208
18:30	12	1	0	0	1	0	14	65	7	2	0	0	0	74	55	7	1	0	1	0	64	0	0	0	0	0	0	0	152
18:45	5	3	0	0	0	0	8	53	1	0	2	0	0	56	73	4	0	0	0	0	77	0	0	0	0	0	0	0	141
1 Hr	45	6	0	0	5	1	57	306	18	4	3	0	0	331	291	27	6	0	3	0	327	0	0	0	0	0	0	0	715
Total	722	115	35	4	45	3	924	4144	470	141	42	33	10	4840	3136	386	103	7	56	9	3697	0	0	0	0	0	0	0	9461

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 2
Date: Thursday 16th October 2014

Entry : Arm A

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Destination : Arm D							Destination : Arm E							Destination : Arm F							Arm Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78	4	0	0	2	0	84	7	1	2	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	87	3	5	0	1	0	96	4	2	1	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93	2	2	0	3	1	101	18	1	0	0	0	0	19	1	0	0	0	0	0	1	0	0	0	0	0	0	0	121
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	107	8	5	0	1	0	121	16	5	0	0	2	0	23	1	1	0	0	0	0	2	0	0	0	0	0	0	0	146
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	365	17	12	0	7	1	402	45	9	3	0	2	0	59	2	1	0	0	0	0	3	0	0	0	0	0	0	0	464
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111	9	2	0	2	2	126	14	1	0	0	0	0	15	4	0	1	0	0	0	5	2	0	0	0	0	0	2	148
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	122	7	2	0	1	1	133	14	9	0	0	0	0	23	1	1	0	0	0	0	2	0	0	0	0	0	0	0	158
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	2	4	0	3	0	118	12	5	0	0	0	0	17	0	1	0	0	0	0	1	0	0	0	0	0	0	0	136
08:45	1	0	0	0	0	0	1	0	0	0	0	0	0	0	117	11	4	1	1	0	134	15	2	4	0	0	0	21	1	0	0	0	0	0	1	0	0	0	0	0	0	0	157
1 Hr	1	0	0	0	0	0	1	0	0	0	0	0	0	0	459	29	12	1	7	3	511	55	17	4	0	0	0	76	6	2	1	0	0	0	9	2	0	0	0	0	0	2	599
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	8	1	0	2	2	79	10	5	0	0	0	0	15	2	0	0	0	0	0	2	2	0	0	0	0	0	2	98
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	3	2	0	1	0	48	8	1	1	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58
09:30	1	1	0	0	0	0	2	0	0	0	0	0	0	0	39	4	0	0	2	0	45	10	4	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	4	0	0	2	0	35	8	3	0	0	0	0	11	1	0	0	0	0	0	1	0	0	2	0	0	0	2	49
1 Hr	1	1	0	0	0	0	2	0	0	0	0	0	0	0	176	19	3	0	7	2	207	36	13	1	0	0	0	50	3	0	0	0	0	0	3	2	0	2	0	0	0	4	266
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	2	1	0	1	0	36	11	5	3	0	0	0	19	0	0	0	0	0	0	0	1	0	2	0	0	0	3	58
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	4	1	0	0	0	36	12	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	7	4	0	0	0	44	9	1	1	0	0	0	11	0	2	0	0	0	0	2	0	0	0	0	0	0	0	57
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	2	1	0	0	0	28	4	5	0	0	0	0	9	0	0	0	0	0	0	0	1	0	0	0	0	0	1	38
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	121	15	7	0	1	0	144	36	11	4	0	0	0	51	0	2	0	0	0	0	2	2	0	2	0	0	0	4	201
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	4	1	0	0	0	33	11	4	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	4	2	0	0	0	32	11	3	1	0	0	0	15	1	0	1	0	0	1	3	0	0	0	0	0	0	0	50
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	1	0	1	0	1	27	5	3	0	0	0	0	8	1	1	0	0	0	0	2	3	0	0	0	0	0	3	40
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	3	4	0	0	0	36	4	4	0	0	0	0	8	0	0	0	0	0	0	0	1	3	0	0	0	0	4	48
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	107	12	7	1	0	1	128	31	14	1	0	0	0	46	2	1	1	0	0	1	5	4	3	0	0	0	0	7	186
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	5	1	1	0	0	41	8	1	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	2	0	0	0	0	29	6	1	0	0	0	0	7	0	1	0	0	0	0	1	3	0	0	0	0	0	3	40
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	4	2	0	0	0	54	10	1	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	3	1	0	0	0	34	6	0	0	0	0	0	6	0	0	1	0	0	0	1	3	1	1	0	0	0	5	46
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139	14	4	1	0	0	158	30	3	0	0	0	0	33	0	1	1	0	0	0	2	6	1	1	0	0	0	8	201
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	5	1	0	0	0	39	10	4	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	5	2	0	0	0	39	14	1	0	0	0	0	15	1	0	0	0	0	0	1	6	0	0	0	0	0	6	61
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	7	1	0	0	0	45	8	0	1	0	0	0	9	3	0	0	0	0	0	3	2	0	0	0	0	0	2	59
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	7	2	0	2	0	49	7	5	0	0	0	0	12	1	0	0	0	0	0	1	1	2	0	0	0	0	3	65
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	140	24	6	0	2	0	172	39	10	1	0	0	0	50	5	0	0	0	0	0	5	9	2	0	0	0	0	11	238
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0	2	0	0	0	48	7	2	0	0	0	0	9	3	0	0	0	0	0	3	3	2	0	0	0	0	5	65
14:15	0	2	0	0	0	0	2	0	0	0	0	0	0	0	34	8	1	0	2	0	45	2	0	0	0	0	0	2	2	0	2	0	0	0	4	2	2	0	0	0	0	4	57
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	3	1	0	2	0	34	5	4	0	0	0	0	9	0	0	0	0	0	0	0	2	2	0	1	0	0	5	48
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	1	0	0	2	1	52	14	1	0	0	0	0	15	1	0	0	0	0	0	1	0	0	1	0	0	0	1	69
1 Hr	0	2	0	0	0	0	2	0	0	0	0	0	0	0	156	12	4	0	6	1	179	28	7	0	0	0	0	35	6	0	2	0	0	0	8	7	6	1	1	0	0	15	239
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	4	2	0	1	0	32	7	1	1	0	0	0	9	3	0	1	0	0	0	4	2	1	0	0	0	0	3	48
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	3	3	0	1	0	53	18	3	0	0	0	0	21	1	0	0	0	0	0	1	0	0	0	0	0	0	0	75
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	2	3	0	2	0	67	19	1	0	1	0	0	21	4	1	0	0	0	0	5	1	0	0	0	0	0	1	94
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	3	0	0	1	0	49	12	0	0	0	2	0	14	2	0	0	0	0	0	2	2	1	0	0	0	0	3	68
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	176	12	8	0	5	0	201	56	5	1	1	2	0	65	10	1	1	0	0	0	12	5	2	0	0	0	0	7	285
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	4	0	0	2	0	41	9	5	0	0	0	0	14	3	1	0	0	0	0	4	6	1	0	0	0	0	7	66
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	3	2	0	1	0	51	18	4	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	7	0	0	2	0	48	24	2	0	0	0	1	27	1	0	0	0	0	0	1	2	1	0	0	0	0	3	79
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51	8	0	0	1	0	60	15	4	1	0	1	0	21	1	0	0	0	0	0	1	2	0	0	0	0	0	2	84
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	170	22	2	0	6	0	200	66	15	1	0	1	1	84	5	1	0	0	0	0	6	10	2	0	0	0	0	12	302
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65	9	0	0	2	0	76	19	7	2	0	0	0	28	1	0	0	0	0	0	1	10	0	0	0	0	0	10	115
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	8	0	0	1	1	69	29	4	1	0	0	0	34	1	0	0	0	0	0	1	6	1	0	0	0	0	7	111
17:30	0	0	1	0	0	0	1	0	0	0	0	0	0	0	55	3	0	0	1	0	59	12	3	0	0	0	0	15	3	1	0	0	0	0	4	7	3	0	0	0	0	10	89
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	5	1	0	2	0	62	22	0	0	0	0	0	22	6	5	0	0	0	0	11	6	0	0	0	0	0	6	101
1 Hr	0	0	1	0	0	0	1	0	0	0	0	0	0	0	233	25	1	0	6	1	266	82	14	3	0	0	0	99	11	6	0	0	0	0	17	29	4	0	0	0	0	33	416
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	6	1	0	2	0	68	26	4	2	0	0	0	32	4	0	0	0	0	0	4	0	0	0	0	0	0	0	104
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52	4	1	0	1	0	58	22	1	1	0	0	0	24	3	0	0	0	0	0	3	2	0	0	0	0	0	2	87
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	4	1	0	1	0	48	12	4	0	0	0	0	16	1	0	0	0	0	0	1	0	0	0	0	0	0	0	65
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	2	0	0	0	0	49	20	1	0	0	0	0	21	3	0	0	0	0	0	3	6	0	0	0	0	0	6	79
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	200	16	3	0	4	0	223	80	10	3	0	0	0	93	11	0	0	0	0	0	11	8	0	0	0	0	0	8	335
Total	2	3	1	0	0	0	6	0	0	0	0	0	0	0	2442	217	69	3	51	9	2791	584	128	22	1	5	1	741	61	15	6	0	0	1	83	84	20	6	1	0	0	111	3732

Entry : Arm B

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Destination : Arm D							Destination : Arm E							Destination : Arm F							Arm Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	2	0	0	0	0	0	2	0	0	0	0	0	0	0	116	2	0	0	0	0	118	16	3	1	0	0	0	20	12	2	0	1	0	0	15	3	0	0	0	0	0	3	158
07:15	8	1	0	0	0	0	9	0	0	0	0	0	0	0	123	1	1	0	1	0	126	29	5	0	0	0	0	34	12	1	0	0	0	0	13	0	0	0	0	0	0	0	182

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 2
Date: Thursday 16th October 2014

07:30	12	2	0	0	0	0	14	0	0	0	0	0	0	0	102	5	1	0	3	1	112	41	16	2	1	1	0	61	21	1	0	0	0	0	22	0	0	0	0	0	0	0	209
07:45	14	2	0	0	0	0	16	0	0	0	0	0	0	0	70	8	3	0	2	0	83	43	7	1	0	0	0	51	19	10	2	1	1	0	33	0	0	0	0	0	0	0	183
1 Hr	36	5	0	0	0	0	41	0	0	0	0	0	0	0	411	16	5	0	6	1	439	129	31	4	1	1	0	166	64	14	2	2	1	0	83	3	0	0	0	0	0	3	732
08:00	22	0	0	0	0	0	22	0	0	0	0	0	0	0	77	3	2	0	0	0	82	56	6	3	1	1	0	67	37	4	0	0	0	0	41	0	0	0	0	0	0	0	212
08:15	18	0	0	0	0	0	18	0	0	0	0	0	0	0	82	0	0	0	0	0	82	29	4	1	0	2	0	36	33	3	2	0	0	0	38	0	0	0	0	0	0	0	174
08:30	28	1	0	0	0	0	29	0	0	0	0	0	0	0	93	8	1	0	1	0	103	33	10	2	0	0	0	45	43	7	1	2	0	0	53	0	1	0	0	0	0	1	231
08:45	15	1	0	0	0	0	16	0	0	0	0	0	0	0	76	4	0	0	2	0	82	32	6	0	0	0	0	38	38	8	2	2	0	0	50	2	0	0	0	0	0	2	188
1 Hr	83	2	0	0	0	0	85	0	0	0	0	0	0	0	328	15	3	0	3	0	349	150	26	6	1	3	0	186	151	22	5	4	0	0	182	2	1	0	0	0	0	3	805
09:00	9	0	1	0	0	0	10	0	0	0	0	0	0	0	77	3	4	0	0	0	84	44	4	1	0	0	0	49	20	4	1	1	0	0	26	0	0	0	0	0	0	0	169
09:15	3	3	0	0	0	0	6	0	0	0	0	0	0	0	51	6	5	0	0	0	62	18	2	2	0	1	0	23	14	0	0	1	1	0	16	2	0	0	0	0	0	2	109
09:30	9	2	1	0	0	0	12	0	0	0	0	0	0	0	35	5	1	0	1	0	42	29	0	2	0	0	0	31	6	4	1	1	0	0	12	0	0	0	0	0	0	0	97
09:45	5	0	1	0	0	0	6	0	0	0	0	0	0	0	28	3	3	0	0	0	34	11	3	2	0	0	0	16	5	5	2	1	0	0	13	1	0	0	0	0	0	1	70
1 Hr	26	5	3	0	0	0	34	0	0	0	0	0	0	0	191	17	13	0	1	0	222	102	9	7	0	1	0	119	45	13	4	4	1	0	67	3	0	0	0	0	0	3	445
10:00	0	0	1	0	0	0	1	0	0	0	0	0	0	0	21	4	3	0	0	0	28	6	3	1	0	2	0	12	1	0	2	0	0	0	3	0	0	0	0	0	0	0	44
10:15	4	0	0	0	0	0	4	0	0	0	0	0	0	0	20	4	1	0	0	0	25	21	4	2	0	0	0	27	3	3	0	2	0	0	8	1	0	0	0	0	0	1	65
10:30	1	0	0	0	0	0	1	0	0	0	0	0	0	0	30	5	5	0	1	0	41	18	8	1	0	0	0	27	6	1	3	2	0	0	12	0	0	0	0	0	0	0	81
10:45	0	1	2	0	0	0	3	0	0	0	0	0	0	0	24	3	2	0	0	0	29	11	5	1	1	0	0	18	4	1	1	2	0	0	8	1	0	0	0	0	0	1	59
1 Hr	5	1	3	0	0	0	9	0	0	0	0	0	0	0	95	16	11	0	1	0	123	56	20	5	1	2	0	84	14	5	6	6	0	0	31	2	0	0	0	0	0	2	249
11:00	1	1	0	0	0	0	2	0	0	0	0	0	0	0	25	1	3	0	0	1	30	9	2	2	0	1	0	14	4	0	1	1	0	0	6	0	0	0	0	0	0	0	52
11:15	3	0	0	0	0	0	3	0	0	0	0	0	0	0	19	2	1	0	0	0	22	14	6	1	1	0	0	22	5	0	1	0	0	0	6	1	0	0	0	0	0	1	54
11:30	5	0	0	0	0	0	5	0	0	0	0	0	0	0	24	2	3	0	1	0	30	19	6	1	0	0	0	26	6	0	2	0	0	0	8	0	0	0	0	0	0	0	69
11:45	2	1	0	0	0	0	3	0	0	0	0	0	0	0	37	2	1	0	1	0	41	19	2	0	0	0	0	21	2	1	0	0	0	0	3	0	2	0	1	0	0	3	71
1 Hr	11	2	0	0	0	0	13	0	0	0	0	0	0	0	105	7	8	0	2	1	123	61	16	4	1	1	0	83	17	1	4	1	0	0	23	1	2	0	1	0	0	4	246
12:00	4	1	1	0	0	0	6	0	0	0	0	0	0	0	36	1	0	0	0	0	37	26	4	2	2	0	0	34	4	0	0	1	0	0	5	3	0	0	0	0	0	3	85
12:15	5	1	0	0	0	0	6	0	0	0	0	0	0	0	27	8	2	1	0	0	38	19	3	0	2	0	0	24	7	3	2	2	0	0	14	0	0	0	0	0	0	0	82
12:30	3	1	0	0	0	0	4	0	0	0	0	0	0	0	28	3	0	0	1	0	32	21	5	1	0	0	0	27	6	0	3	0	0	0	9	1	0	0	0	0	0	1	73
12:45	5	0	0	0	0	0	5	0	0	0	0	0	0	0	22	2	2	1	0	0	27	25	6	0	0	0	0	31	3	0	1	0	0	0	4	1	0	0	0	0	0	1	68
1 Hr	17	3	1	0	0	0	21	0	0	0	0	0	0	0	113	14	4	2	1	0	134	91	18	3	4	0	0	116	20	3	6	3	0	0	32	5	0	0	0	0	0	5	308
13:00	2	1	0	0	0	0	3	0	0	0	0	0	0	0	41	3	2	0	0	0	46	21	1	3	2	0	0	27	4	0	2	1	0	0	7	0	0	1	1	0	0	2	85
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	6	2	0	0	0	52	18	5	3	0	0	0	26	5	3	2	0	0	0	10	0	0	1	0	0	0	1	89
13:30	0	1	1	0	0	0	2	0	0	0	0	0	0	0	31	5	4	0	1	0	41	23	6	2	0	0	0	31	9	0	2	0	0	0	11	1	0	0	0	0	0	1	86
13:45	0	6	1	0	0	0	7	0	0	0	0	0	0	0	36	5	2	1	0	0	44	27	9	3	0	0	0	39	14	4	2	1	0	0	21	3	0	0	0	0	0	3	114
1 Hr	2	8	2	0	0	0	12	0	0	0	0	0	0	0	152	19	10	1	1	0	183	89	21	11	2	0	0	123	32	7	8	2	0	0	49	4	0	2	1	0	0	7	374
14:00	0	1	0	0	0	0	1	0	0	0	0	0	0	0	44	1	0	0	0	0	45	19	4	0	1	0	0	24	3	1	0	0	0	0	4	1	0	0	0	0	0	1	75
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	4	0	0	0	1	44	32	3	1	0	3	1	40	3	2	0	2	0	0	7	0	0	0	0	0	0	0	91
14:30	4	0	0	0	0	0	4	0	0	0	0	0	0	0	28	0	5	0	1	0	34	26	6	4	0	0	0	36	8	1	0	1	0	0	10	0	2	0	0	0	0	2	86
14:45	3	1	0	0	0	0	4	0	0	0	0	0	0	0	31	6	0	0	0	0	37	30	4	0	0	2	0	36	12	0	1	3	0	0	16	0	0	0	0	0	0	0	93
1 Hr	7	2	0	0	0	0	9	0	0	0	0	0	0	0	142	11	5	0	1	1	160	107	17	5	1	5	1	136	26	4	1	6	0	0	37	1	2	0	0	0	0	3	345
15:00	3	1	0	0	0	0	4	0	0	0	0	0	0	0	40	3	1	0	0	0	44	22	7	0	0	1	0	30	8	2	1	0	0	0	11	0	0	0	0	0	0	0	89
15:15	3	2	0	0	0	0	5	0	0	0	0	0	0	0	28	4	1	0	1	0	34	21	5	0	0	0	0	26	4	1	0	0	0	0	5	0	0	0	0	0	0	0	70
15:30	3	1	0	0	0	0	4	0	0	0	0	0	0	0	29	1	1	0	1	0	32	36	3	1	0	0	0	40	3	0	1	0	0	0	4	3	0	0	0	0	0	3	83
15:45	4	0	0	0	0	0	4	0	0	0	0	0	0	0	36	5	2	0	1	0	44	24	4	0	0	0	0	28	12	2	2	2	0	0	18	0	1	0	0	0	0	1	95
1 Hr	13	4	0	0	0	0	17	0	0	0	0	0	0	0	133	13	5	0	3	0	154	103	19	1	0	1	0	124	27	5	4	2	0	0	38	3	1	0	0	0	0	4	337
16:00	2	0	0	0	0	0	2	0	0	0	0	0	0	0	32	2	3	0	5	0	42	37	7	0	0	0	0	44	14	4	2	2	0	0	22	0	0	0	0	0	0	0	110
16:15	4	1	0	0	0	0	5	0	0	0	0	0	0	0	36	2	0	0	0	0	38	33	4	0	0	0	0	37	16	0	2	1	0	0	19	2	0	0	0	0	0	2	101
16:30	6	0	0	0	0	0	6	0	0	0	0	0	0	0	45	4	0	0	1	0	50	38	8	2	0	0	0	48	25	4	0	2	0	0	31	3	0	0	0	0	0	3	138
16:45	2	1	0	0	0	0	3	0	0	0	0	0	0	0	37	5	0	0	0	1	43	40	12	1	0	0	2	55	30	7	0	1	0	0	38	0	0	0	0	0	0	0	139
1 Hr	14	2	0	0	0	0	16	0	0	0	0	0	0	0	150	13	3	0	6	1	173	148	31	3	0	0	2	184	85	15	4	6	0	0	110	5	0	0	0	0	0	5	488
17:00	5	1	0	0	0	0	6	0	0	0	0	0	0	0	36	5	1	0	0	0	42	44	8	1	0	0	0	53	26	1	1	1	0	0	29	0	0	0	0	0	0	0	130
17:15	5	1	0	0	0	0	6	0	0	0	0	0	0	0	37	5	1	0	0	0	43	45	11	3	1	0	0	60	30	7	0	1	0	0	38	0	0	0	0	0	0	0	147
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	2	2	0	0	0	50	53	6	2	1	0	0	62	28	3	1	1	0	0	33	0	0	2	0	0	0	2	147
17:45	1	1	0	0	0	0	2	0	0	0	0	0	0	0	34	0	1	0	0	0	35	38	5	0	0	0	0	43	17	1	0	0	0	0	18	0	0	0	0	0	0	0	98
1 Hr	11	3	0	0	0	0	14	0	0	0	0	0	0	0	153	12	5	0	0	0	170	180	30	6	2	0	0	218	101	12	2	3	0	0	118	0	0	2	0	0	0	2	522
18:00	3	0	0	0	0	0	3	0	0	0	0	0	0	0	31	3	0	0	0	0	34	27	6	1	0	0	0	34	17	0	0	0	0	0	17	2	0	0	0	0	0	2	90
18:15	1	0	0	0	0	0	1	0	0	0	0	0	0	0	31	1	2	1	0	0	35	41	6	0	0	1	0	48	10	0	0	0	0	0	10	2	0	0	0	0	0	2	96
18:30	1	2	0	0	0	0	3	0	0	0	0	0	0	0	46	1	0	0	0	0	47	36	2	1	0	2	0	41	10	0	0	0	0	0	10	2	0	0	0	0	0	2	103
18:45	1	1	0	0	0	0	2	0	0	0	0	0	0	0	44	2	1	0	0	0	47	48	2	0	0	0	0	50	1	0	0	0	0	0	1	1	0	0	0	0	0	1	101
1 Hr	6	3	0	0	0	0	9	0	0	0	0	0	0	0	152	7	3	1	0	0	163	152	16	2	0	3	0	173	38	0	0	0	0	0	38	7	0	0	0	0	0	7	390
Total	231	40	9	0	0	0	280	0	0	0	0	0	0	0	2125	160	75	4	25	4	2393	1368	254	57	13	17	3	1712	620	101	46	39	2	0	808	36	6	4	2	0	0	48	5241

Entry : Arm C

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Destination : Arm D							Destination : Arm E							Destination : Arm F							Arm Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	34	6	0	0	1	0	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	1	2	0	0	1	18	21	0	0	0	0	0	21	12	0	0	0	0	0	12	92
07:15	30	2	1	0	1	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	1	0	0	0	0	19	29	2	2	0	0	0	33	15	0	0	0	0	0	15	101
07:30	56	5	2	0	2	0	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	4	4	0	0	0	42	43	6	3	0	1	0	53	27	8	0	0	0	0	35	195
07:45	53	3	3	0	2	1	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	4	1	0	0	0	37	47	10	0	0	0	0	57	24	0	0	0	0	0	24	180
1 Hr	173	16	6	0	6	1	202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98	10	7	0	0	1	116	140	18	5	0	1	0	164	78	8	0	0	0	0	86	568
08:00	46	6	4	0	2	0	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	5	2	0	0	0	43	49	9	0	0	1	0	59	27	3	0	0	2	0	32	192
08:15	45	3	3	0	2	0	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	1	0	0	2	0	25	48	7	2	0	0	2	59	27	5	0	0	0	1	33	170
08:30	49	1	0	0	1	0	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	4	2	1	0	1	41	70	5	2	1	0	0	78	24	2	1	0	0	0	27	197

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 2
Date: Thursday 16th October 2014

	Arm A							Arm B							Arm C							Arm D							Arm E							Arm F							
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total
08:45	38	2	2	0	4	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	1	4	0	0	0	30	47	8	1	0	0	0	56	20	6	0	0	0	0	26	158
1 Hr	178	12	9	0	9	0	208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	11	8	1	2	1	139	214	29	5	1	1	2	252	98	16	1	0	2	1	118	717
09:00	29	5	0	0	2	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	0	2	0	0	0	31	50	7	3	0	0	1	61	14	1	3	0	0	0	18	146
09:15	27	1	2	0	2	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	6	0	1	1	0	30	35	8	3	0	0	0	46	12	2	1	0	0	0	15	123
09:30	24	5	0	0	1	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	4	1	0	1	0	37	39	4	0	0	0	0	43	8	2	1	0	0	0	11	121
09:45	27	3	1	0	3	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	9	1	0	0	0	36	33	5	0	0	0	1	39	7	3	1	0	0	0	11	120
1 Hr	107	14	3	0	8	0	132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108	19	4	1	2	0	134	157	24	6	0	0	2	189	41	8	6	0	0	0	55	510
10:00	17	4	1	0	2	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	5	0	0	0	0	36	40	4	2	0	0	0	46	10	3	0	0	0	0	13	119
10:15	22	4	0	0	0	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	4	5	0	1	1	30	32	4	0	1	0	0	37	17	1	0	0	0	0	18	111
10:30	23	4	3	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	1	1	1	0	0	41	34	4	5	1	0	0	44	22	0	2	0	0	0	24	139
10:45	29	1	0	0	1	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	2	3	0	1	0	31	46	5	0	0	0	0	51	17	3	2	0	0	0	22	135
1 Hr	91	13	4	0	3	0	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113	12	9	1	2	1	138	152	17	7	2	0	0	178	66	7	4	0	0	0	77	504
11:00	28	4	4	0	0	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	2	1	0	0	0	33	46	5	4	0	0	0	55	21	3	2	0	0	0	26	150
11:15	28	3	1	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	4	1	0	1	0	42	46	3	2	0	0	1	52	17	1	1	0	0	0	19	145
11:30	19	2	2	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	1	0	0	0	0	41	41	1	0	1	0	0	43	20	0	1	0	0	0	21	128
11:45	24	3	3	0	1	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	3	0	0	0	0	41	42	5	2	0	1	0	50	21	1	1	0	0	0	23	145
1 Hr	99	12	10	0	1	0	122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	144	10	2	0	1	0	157	175	14	8	1	1	1	200	79	5	5	0	0	0	89	568
12:00	32	3	2	1	0	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	2	1	0	0	0	32	50	6	1	0	0	0	57	18	1	1	0	0	0	20	147
12:15	30	1	0	0	0	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	0	0	0	2	0	45	38	1	1	0	0	0	40	19	0	0	0	0	0	19	135
12:30	29	3	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	2	2	0	0	0	36	47	4	2	0	0	0	53	19	1	2	0	0	0	22	143
12:45	24	4	0	0	1	0	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	1	2	0	0	0	26	41	7	3	0	0	0	51	12	0	0	0	0	0	12	118
1 Hr	115	11	2	1	1	0	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	127	5	5	0	2	0	139	176	18	7	0	0	0	201	68	2	3	0	0	0	73	543
13:00	37	7	0	0	0	1	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	5	4	0	0	0	39	52	0	0	0	0	0	52	24	1	2	1	0	0	28	164
13:15	38	3	1	0	0	0	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	5	1	0	1	0	44	49	4	1	0	0	0	54	15	1	1	0	0	0	17	157
13:30	37	2	1	0	1	0	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	3	0	0	0	0	29	36	6	2	0	0	0	44	17	2	2	0	0	0	21	135
13:45	26	3	1	1	1	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	6	1	0	0	0	22	45	8	1	1	0	0	55	18	1	0	0	0	0	19	128
1 Hr	138	15	3	1	2	1	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108	19	6	0	1	0	134	182	18	4	1	0	0	205	74	5	5	1	0	0	85	584
14:00	31	5	1	0	1	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	5	0	0	0	0	30	40	7	1	0	0	1	49	14	1	3	0	1	0	19	136
14:15	42	5	6	0	2	0	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	4	0	0	2	0	42	52	6	2	0	0	0	60	22	2	1	1	0	0	26	183
14:30	64	6	1	1	1	0	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	5	1	0	0	0	39	51	6	1	0	0	2	60	23	2	0	0	0	0	25	197
14:45	54	3	1	0	2	0	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	4	1	0	0	0	40	66	9	1	0	0	0	76	33	2	2	0	0	0	37	213
1 Hr	191	19	9	1	6	0	226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	129	18	2	0	2	0	151	209	28	5	0	0	3	245	92	7	6	1	1	0	107	729
15:00	96	3	2	0	2	0	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	6	0	0	0	1	53	86	2	0	0	0	1	89	32	3	1	0	0	0	36	281
15:15	104	5	2	0	1	1	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	4	0	0	1	0	46	88	5	0	0	0	0	93	52	2	0	0	0	0	54	306
15:30	97	1	2	0	2	0	102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	2	0	0	1	0	34	85	11	1	0	0	0	97	38	7	2	0	0	0	47	280
15:45	98	2	0	0	2	0	102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	1	0	0	0	0	27	98	8	0	0	1	0	107	48	0	0	0	0	0	48	284
1 Hr	395	11	6	0	7	1	420	0	0	0	0	0	0	0	0	0	0	0	0	0	0	144	13	0	0	2	1	160	357	26	1	0	1	1	386	170	12	3	0	0	0	185	1151
16:00	106	1	1	0	1	0	109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	5	1	0	0	0	41	101	3	1	0	1	0	106	51	3	0	0	0	0	54	310
16:15	84	4	0	0	1	0	89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	2	1	0	1	0	47	108	7	1	0	0	0	116	61	0	0	0	0	1	62	314
16:30	95	5	1	0	2	0	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	2	1	0	0	0	27	100	3	1	0	0	0	104	63	8	0	0	0	0	71	305
16:45	94	5	2	0	2	0	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	2	1	0	0	0	39	107	4	0	0	2	1	114	39	3	2	0	0	0	44	300
1 Hr	379	15	4	0	6	0	404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	138	11	4	0	1	0	154	416	17	3	0	3	1	440	214	14	2	0	0	1	231	1229
17:00	93	3	0	0	1	0	97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0	0	0	0	1	37	115	12	2	0	0	2	131	45	3	0	0	0	0	48	313
17:15	79	1	1	0	2	0	83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	4	0	0	1	0	35	92	8	2	0	3	3	108	53	3	0	0	0	0	56	282
17:30	77	6	0	0	1	0	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	2	1	0	0	0	31	101	2	0	0	0	0	103	38	0	0	0	0	0	38	256
17:45	58	1	0	0	3	0	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	1	0	0	3	34	90	2	0	0	0	1	93	29	0	0	0	0	0	29	218
1 Hr	307	11	1	0	7	0	326	0	0	0	0	0	0	0	0	0	0	0	0	0	0	124	6	2	0	1	4	137	398	24	4	0	3	6	435	165	6	0	0	0	0	171	1069
18:00	46	1	1	0	1	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	4	0	0	1	0	36	68	5	0	0	0	0	73	27	2	0	0	0	0	29	187
18:15	45	2	1	0	2	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	4	27	60	3	1	0	1	0	65	21	0	0	0	0	1	22	164
18:30	36	1	0	1	1	0	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	1	0	0	2	0	48	44	3	0	0	0	0	47	22	3	0	0	0	0	25	159
18:45	24	3	0	0	1	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	1	0	0	0	20	41	2	0	0	0	0	43	22	2	0	0	0	0	24	115
1 Hr	151	7	2	1	5	0	166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	118	5	1	0	7	0	131	213	13	1	0	1	0	228	92	7	0	0	0	1	100	625
Total	2324	156	59	4	61	3	2607	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1467	139	50	3	23	8	1690	2789	246	56	5	11	16	3123	1237	97	35	2	3	3	1377	8797

Entry : Arm D

	Arm A							Arm B							Arm C							Arm D							Arm E							Arm F							Arm Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	35	17	2	0	0	0	54	0	0	0	0	0	0	0	19	1	2	0	1	0	23	1	0	0	0	0	0	1	4	3	0	0	0	0	7	4	4	0	0	0	0	8	93
07:15	37	15	1	0	0	1	54	0	0	0	0	0	0	0	42	5	2	0	1	0	50	0	0	0	0	0	0	0	8	1	1	0	0	0	10	14	3	2	0	0	0	19	133
07:30	46	9	0	0	3	1	59	0	0	0	0	0	0	0	30	5	2	0	1	0	38	0	0	0	0	0	0	0	6	2	0	0	0	0	8	8	2	1	0	0	0	11	116
07:45	48	11	2	1	0	0	62	0	0	0	0	0	0	0	61	5	0	0	1	0	67	0	0	0	0	0	0	0	11	4	0	0	0	0	15	8	8	1	0	0	0	17	161
1 Hr	166	52	5	1	3	2	229	0	0	0	0	0	0	0	152	16	6	0	4	0	178	1	0	0	0	0	0	1	29	10	1	0	0	0	40	34	17	4	0	0	0	55	503
08:00	49	8	2	0	0	0	59	0	0	0	0	0	0	0	51	2	0	0	3	0	56	0	0	0	0	0	0	0	15	1	2	0	1	0	19	13	8	1	0	0	0	22	156
08:15	35	3	2	0	0	0	40	0	0	0	0	0	0	0	59	2	1	0	1	2	65	1	0	0	0	0	0	1	18	2	0	0	0	0	20	11	8	1	0	0	0	20	146
08:30	38	4	2	0	1	1	46	0	0	0	0	0	0	0	39	2	1	0	0	0	42	0	0	0	0	0	0	0	10	3	1	0	0	0	14	7	1	1	0	1	1	11	113
08:45	26	3	1	0	1	0	31	0	0	0	0	0	0	0	53	3	0	0	0	0	56	0	0	0	0	0	0	0	13	4	0	0	0	0	17	7	1	0	0	0	0	8	112
1 Hr	148	18	7	0	2	1	176	0	0	0	0	0	0	0	202	9	2	0	4	2	219	1	0	0	0	0	0	1	56	10	3	0	1	0	70	38	18	3	0	1	1	61	527
09:00	15	3	1	0	0	0	19	0	0	0	0	0	0	0	36	1	1	0	0	0	38	0	0	0	0	0	0	0	12	2	0	0	1	0	15	9	2	1	0	0	0	12	84
09:15	20	10	1	2	1	0	34	0	0	0	0	0	0	0	35	4	0	0	0	0	39	0	0	0	0	0	0	0	10	2	0	0	0	0	12	5	3	1	0	0	0	9	94
09:30	24	2	0	0	1	0	27	0	0	0	0	0	0	0	37	1	0	0	0	0	38	0	0	0	0	0	0	0	15	3	1	0	0	0	19	9	1	1	0	0	0	11	95
09:45	25	6	0	1	4	0	36	0	0	0	0	0	0	0	31	6	2	0	0	0	39	0	0	0	0	0	0	0	7	2	0	0	0	0	9	7	1	0	0	0	0	8	92

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 2
Date: Thursday 16th October 2014

1 Hr	84	21	2	3	6	0	116	0	0	0	0	0	0	0	139	12	3	0	0	0	154	0	0	0	0	0	0	0	44	9	1	0	1	0	55	30	7	3	0	0	0	40	365
10:00	17	10	4	0	1	0	32	0	0	0	0	0	0	0	22	2	0	0	0	0	24	0	0	0	0	0	0	0	8	0	0	0	0	0	8	6	2	0	1	0	0	9	73
10:15	12	5	1	1	0	0	19	0	0	0	0	0	0	0	29	1	2	0	0	0	32	0	0	0	0	0	0	0	7	4	0	0	0	0	11	3	1	1	0	0	0	5	67
10:30	14	3	2	0	0	0	19	0	0	0	0	0	0	0	24	4	0	0	0	0	28	0	0	0	0	0	0	0	8	1	0	0	1	0	10	5	3	1	0	0	0	9	66
10:45	13	3	3	0	1	0	20	0	0	0	0	0	0	0	27	2	3	0	0	0	32	0	0	0	0	0	0	0	11	0	0	0	0	0	11	5	1	1	0	0	0	7	70
1 Hr	56	21	10	1	2	0	90	0	0	0	0	0	0	0	102	9	5	0	0	0	116	0	0	0	0	0	0	0	34	5	0	0	1	0	40	19	7	3	1	0	0	30	276
11:00	19	2	0	0	0	0	21	0	0	0	0	0	0	0	23	2	2	0	0	0	27	0	0	0	0	0	0	0	4	1	1	0	1	0	7	4	1	0	0	0	0	5	60
11:15	18	5	2	1	0	0	26	0	0	0	0	0	0	0	41	2	0	0	0	0	43	0	0	0	0	0	0	0	5	5	2	0	0	0	12	6	0	0	0	0	0	6	87
11:30	14	5	2	0	1	0	22	0	0	0	0	0	0	0	26	1	2	0	0	0	29	0	0	0	0	0	0	0	16	1	0	1	0	0	18	5	2	0	0	0	0	7	76
11:45	26	8	2	0	0	1	37	0	0	0	0	0	0	0	28	1	0	0	0	0	29	0	0	0	0	0	0	0	11	1	0	0	0	0	12	8	3	0	0	0	1	12	90
1 Hr	77	20	6	1	1	1	106	0	0	0	0	0	0	0	118	6	4	0	0	0	128	0	0	0	0	0	0	0	36	8	3	1	1	0	49	23	6	0	0	0	1	30	313
12:00	20	3	0	0	0	0	23	0	0	0	0	0	0	0	24	1	3	0	0	0	28	0	0	0	0	0	0	0	6	1	1	0	0	0	8	6	2	0	0	0	0	8	67
12:15	22	7	1	1	0	0	31	0	0	0	0	0	0	0	31	1	1	0	0	0	33	0	0	0	0	0	0	0	12	1	2	0	1	0	16	5	2	0	0	0	0	7	87
12:30	31	4	1	0	0	0	36	0	0	0	0	0	0	0	31	2	1	0	1	0	35	0	0	0	0	0	0	0	8	0	2	1	0	0	11	5	1	0	0	0	0	6	88
12:45	23	3	0	2	0	0	28	0	0	0	0	0	0	0	27	3	3	0	0	0	33	0	0	0	0	0	0	0	8	0	0	0	0	0	8	3	0	0	0	0	0	3	72
1 Hr	96	17	2	3	0	0	118	0	0	0	0	0	0	0	113	7	8	0	1	0	129	0	0	0	0	0	0	0	34	2	5	1	1	0	43	19	5	0	0	0	0	24	314
13:00	26	1	1	1	0	0	29	0	0	0	0	0	0	0	39	6	0	0	0	0	45	0	0	0	0	0	0	0	13	2	0	0	0	0	15	5	4	0	0	0	0	9	98
13:15	21	2	3	0	0	0	26	0	0	0	0	0	0	0	51	2	0	0	0	0	53	0	0	0	0	0	0	0	16	0	0	1	0	0	17	5	2	1	1	0	0	9	105
13:30	18	4	1	0	0	0	23	0	0	0	0	0	0	0	26	2	1	0	0	0	29	0	0	0	0	0	0	0	9	1	0	0	0	0	10	7	0	0	0	0	0	7	69
13:45	22	4	2	1	1	0	30	0	0	0	0	0	0	0	29	1	2	0	0	0	32	0	0	0	0	0	0	0	19	1	1	0	0	0	21	4	1	0	0	0	0	5	88
1 Hr	87	11	7	2	1	0	108	0	0	0	0	0	0	0	145	11	3	0	0	0	159	0	0	0	0	0	0	0	57	4	1	1	0	0	63	21	7	1	1	0	0	30	360
14:00	25	7	2	0	0	0	34	0	0	0	0	0	0	0	29	2	1	0	0	0	32	0	0	0	0	0	0	0	11	1	1	0	1	0	14	5	1	0	0	0	0	6	86
14:15	28	5	0	1	0	0	34	0	0	0	0	0	0	0	40	1	0	0	0	0	41	0	0	0	0	0	0	0	16	1	1	0	0	0	18	6	3	0	0	0	0	9	102
14:30	29	7	1	0	0	0	37	0	0	0	0	0	0	0	36	2	2	0	0	0	40	0	0	0	0	0	0	0	10	2	1	0	1	0	14	11	1	1	0	0	0	13	104
14:45	30	5	3	0	0	0	38	0	0	0	0	0	0	0	38	5	1	0	0	0	44	0	0	0	0	0	0	0	14	0	1	0	1	0	16	11	1	0	0	0	0	12	110
1 Hr	112	24	6	1	0	0	143	0	0	0	0	0	0	0	143	10	4	0	0	0	157	0	0	0	0	0	0	0	51	4	4	0	3	0	62	33	6	1	0	0	0	40	402
15:00	32	1	0	0	0	0	33	0	0	0	0	0	0	0	20	2	0	0	0	1	23	0	0	0	0	0	0	0	24	4	0	0	0	0	28	13	1	1	0	0	0	15	99
15:15	29	9	0	0	0	0	38	0	0	0	0	0	0	0	35	0	1	0	0	0	36	0	0	0	0	0	0	0	19	3	0	0	0	0	22	13	0	1	0	0	0	14	110
15:30	44	8	0	2	3	0	57	0	0	0	0	0	0	0	45	2	0	0	2	0	49	0	0	0	0	0	0	0	16	4	0	0	0	0	20	16	2	0	0	0	0	18	144
15:45	31	4	1	0	0	0	36	0	0	0	0	0	0	0	29	2	0	0	0	0	31	0	0	0	0	0	0	0	29	1	1	0	2	0	33	22	1	1	0	0	0	24	124
1 Hr	136	22	1	2	3	0	164	0	0	0	0	0	0	0	129	6	1	0	2	1	139	0	0	0	0	0	0	0	88	12	1	0	2	0	103	64	4	3	0	0	0	71	477
16:00	42	13	2	0	0	0	57	0	0	0	0	0	0	0	30	1	0	0	0	0	31	0	0	0	0	0	0	0	17	0	0	0	0	0	17	12	1	0	0	0	1	14	119
16:15	44	10	1	0	0	0	55	0	0	0	0	0	0	0	27	5	1	0	0	0	33	0	0	0	0	0	0	0	28	4	0	0	0	0	32	15	1	0	0	0	0	16	136
16:30	58	7	0	1	0	0	66	0	0	0	0	0	0	0	32	3	1	0	0	0	36	0	0	0	0	0	0	0	19	1	0	0	0	0	20	19	4	2	1	0	0	26	148
16:45	42	12	1	0	0	0	55	0	0	0	0	0	0	0	23	4	1	1	0	0	29	0	0	0	0	0	0	0	12	2	0	0	0	0	14	16	4	0	0	0	0	20	118
1 Hr	186	42	4	1	0	0	233	0	0	0	0	0	0	0	112	13	3	1	0	0	129	0	0	0	0	0	0	0	76	7	0	0	0	0	83	62	10	2	1	0	1	76	521
17:00	47	14	0	1	0	0	62	0	0	0	0	0	0	0	34	1	0	0	1	0	36	0	0	0	0	0	0	0	21	4	2	0	0	0	27	15	1	1	0	1	0	18	143
17:15	53	4	1	0	0	0	58	0	0	0	0	0	0	0	25	4	0	0	0	1	30	0	0	0	0	0	0	0	20	0	2	0	0	0	22	18	1	0	0	0	0	19	129
17:30	53	4	1	0	0	0	58	0	0	0	0	0	0	0	19	2	0	0	0	1	22	0	0	0	0	0	0	0	19	1	0	0	0	0	20	15	2	0	0	0	0	17	117
17:45	40	3	0	0	0	0	43	0	0	0	0	0	0	0	33	1	1	0	1	0	36	0	0	0	0	0	0	0	15	3	0	0	0	0	18	19	0	0	0	0	0	19	116
1 Hr	193	25	2	1	0	0	221	0	0	0	0	0	0	0	111	8	1	0	2	2	124	0	0	0	0	0	0	0	75	8	4	0	0	0	87	67	4	1	0	1	0	73	505
18:00	26	4	0	0	0	0	30	0	0	0	0	0	0	0	29	1	0	0	0	0	30	0	0	0	0	0	0	0	18	2	0	0	0	0	20	15	0	2	0	0	0	17	97
18:15	45	5	0	0	0	0	50	0	0	0	0	0	0	0	26	1	0	0	0	0	27	0	0	0	0	0	0	0	16	1	0	0	0	3	20	10	0	0	0	0	0	10	107
18:30	26	7	0	1	0	0	34	0	0	0	0	0	0	0	35	0	1	0	0	0	36	0	0	0	0	0	0	0	11	0	0	0	0	0	11	12	1	0	0	0	0	13	94
18:45	16	0	0	0	0	0	16	0	0	0	0	0	0	0	60	2	1	0	0	0	63	0	0	0	0	0	0	0	12	0	0	0	0	0	12	7	2	1	0	0	0	10	101
1 Hr	113	16	0	1	0	0	130	0	0	0	0	0	0	0	150	4	2	0	0	0	156	0	0	0	0	0	0	0	57	3	0	0	0	3	63	44	3	3	0	0	0	50	399
Total	1454	289	52	17	18	4	1834	0	0	0	0	0	0	0	1616	111	42	1	13	5	1788	2	0	0	0	0	0	2	637	82	23	3	10	3	758	454	94	24	3	2	3	580	4962

Entry : Arm E

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Destination : Arm D							Destination : Arm E							Destination : Arm F							Arm Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	7	1	0	0	0	0	8	0	0	0	0	0	0	0	37	2	0	0	0	0	39	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49
07:15	2	0	0	0	0	0	2	0	0	0	0	0	0	0	55	3	1	0	0	1	60	5	2	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69
07:30	4	1	2	0	0	0	7	0	0	0	0	0	0	0	63	3	2	0	1	1	70	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80
07:45	4	0	1	1	0	0	6	0	0	0	0	0	0	0	78	0	1	0	2	1	82	4	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	1	0	0	1	93
1 Hr	17	2	3	1	0	0	23	0	0	0	0	0	0	0	233	8	4	0	3	3	251	14	2	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	1	0	0	1	291
08:00	3	5	0	0	0	0	8	0	0	0	0	0	0	0	55	1	1	0	0	0	57	4	0	1	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70
08:15	2	0	0	1	0	0	3	0	0	0	0	0	0	0	90	4	1	0	1	0	96	6	0	1	0	0	0	7	0	0	0	0	0	0	0	1	0	0	0	0	0	1	107
08:30	2	1	0	0	0	0	3	0	0	0	0	0	0	0	73	8	1	0	1	2	85	2	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	1	91
08:45	1	1	0	0	0	0	2	0	0	0	0	0	0	0	66	9	1	0	0	2	78	5	1	0	0	0	0	6	0	0	0	0	0	0	0	0	1	0	0	0	0	1	87
1 Hr	8	7	0	1	0	0	16	0	0	0	0	0	0	0	284	22	4	0	2	4	316	17	1	2	0	0	0	20	0	0	0	0	0	0	0	2	1	0	0	0	0	3	355
09:00	3	1	0	0	0	0	4	0	0	0	0	0	0	0	64	5	0	0	0	0	69	2	2	1	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78
09:15	2	1	1	0	0	0	4	0	0	0	0	0	0	0	24	3	1	0	0	2	30	6	1	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41
09:30	1	0	0	0	0	0	1	0	0	0	0	0	0	0	51	5	2	0	0	0	58	5	0	0	0	0	0	5	0	0	1	0	0	0	1	0	1	1	0	0	0	2	67
09:45	3	2	2	1	0	0	8	0	0	0	0	0	0	0	25	2	1	0	0	0	28	1	2	0	0	0	0	3	0	0	0	0	0	0	0	0	1	0	1	0	0	2	41
1 Hr	9	4	3	1	0	0	17	0	0	0	0	0	0	0	164	15	4	0	0	2	185	14	5	1	0	0	0	20	0	0	1	0	0	0	1	0	2	1	1	0	0	4	227
10:00	0	4	0	0	0	0	4	0	0	0	0	0	0	0	30	1	0	0	1	1	33	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40
10:15	2	0	0	0	0	0	2	0	0	0	0	0	0	0	22	5	3	0	0	0	30	7	0	0	0	0	0	7	1	0	0	0	0	0	1	0	0	0	0	0	0	0	40
10:30	4	0	0	0	0	0	4	0	0	0	0	0	0	0	20	5	1	0	0	0	26	3	0	2	0	0	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0	1	36
10:45	3	0	3	5	0	0	11	0	0	0	0	0	0	0	29	8	2	0	0	0	39	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53
1 Hr	9	4	3	5	0	0	21	0	0	0	0	0	0	0	101	19	6	0	1	1	128	16	0	2	0	0	0	18	1	0	0	0	0	0	1	1	0	0	0	0	0	1	169

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 2
Date: Thursday 16th October 2014

| | | |

Sky High
Count On Us

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Project: C0738 Abergelli
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Date: Thursday 16th October 2014

	Arm A							Arm B							Arm C							Arm D							Arm E							Arm F							Dest Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
13:30	50	7	2	0	0	0	59	64	12	9	0	1	0	86	116	13	5	0	1	0	135	60	7	2	0	0	0	69	32	5	2	0	0	0	39	0	0	0	0	0	0	0	388
13:45	47	14	2	0	2	0	65	80	24	8	2	0	0	114	104	18	3	2	1	0	128	74	7	5	1	1	0	88	39	4	4	0	0	0	47	0	0	0	0	0	0	0	442
1 Hr	193	36	7	0	2	0	238	279	55	33	6	1	0	374	502	57	18	3	3	1	584	310	33	12	4	1	0	360	150	14	13	1	0	0	178	0	0	0	0	0	0	0	1734
14:00	59	4	2	0	0	0	65	67	7	0	1	0	0	75	110	18	5	0	2	1	136	70	11	4	0	1	0	86	50	8	1	1	0	1	61	0	0	0	0	0	0	0	423
14:15	40	12	3	0	2	0	57	74	9	1	2	3	2	91	152	17	9	1	4	0	183	90	10	1	1	0	0	102	50	6	2	0	1	0	59	0	0	0	0	0	0	0	492
14:30	35	9	1	1	2	0	48	66	9	9	1	1	0	86	171	19	3	1	1	2	197	86	12	5	0	1	0	104	48	5	2	0	0	0	55	0	0	0	0	0	0	0	490
14:45	63	2	1	0	2	1	69	76	11	1	3	2	0	93	188	18	5	0	2	0	213	93	11	5	0	1	0	110	49	8	1	0	0	0	58	0	0	0	0	0	0	0	543
1 Hr	197	27	7	1	6	1	239	283	36	11	7	6	2	345	621	72	22	2	9	3	729	339	44	15	1	3	0	402	197	27	6	1	1	1	233	0	0	0	0	0	0	0	1948
15:00	37	6	4	0	1	0	48	73	13	2	0	1	0	89	260	14	3	0	2	2	281	89	8	1	0	0	1	99	43	4	0	5	0	0	52	0	0	0	0	0	0	0	569
15:15	65	6	3	0	1	0	75	56	12	1	0	1	0	70	285	16	2	0	2	1	306	96	12	2	0	0	0	110	53	5	0	0	0	2	60	0	0	0	0	0	0	0	621
15:30	84	4	3	1	2	0	94	74	5	3	0	1	0	83	251	21	5	0	3	0	280	121	16	0	2	5	0	144	39	7	1	0	0	2	49	0	0	0	0	0	0	0	650
15:45	61	4	0	0	3	0	68	76	12	4	2	1	0	95	270	11	0	0	3	0	284	111	8	3	0	2	0	124	37	4	5	0	0	0	46	0	0	0	0	0	0	0	617
1 Hr	247	20	10	1	7	0	285	279	42	10	2	4	0	337	1066	62	10	0	10	3	1151	417	44	6	2	7	1	477	172	20	6	5	0	4	207	0	0	0	0	0	0	0	2457
16:00	53	11	0	0	2	0	66	85	13	5	2	5	0	110	293	12	3	0	2	0	310	101	15	2	0	0	1	119	51	6	1	0	1	0	59	0	0	0	0	0	0	0	664
16:15	63	7	2	0	1	0	73	91	7	2	1	0	0	101	296	13	2	0	2	1	314	114	20	2	0	0	0	136	36	4	3	1	0	0	44	0	0	0	0	0	0	0	668
16:30	66	10	0	0	2	1	79	117	16	2	2	1	0	138	282	18	3	0	2	0	305	128	15	3	2	0	0	148	47	6	1	1	0	0	55	0	0	0	0	0	0	0	725
16:45	69	12	1	0	2	0	84	109	25	1	1	0	3	139	276	14	5	0	4	1	300	93	22	2	1	0	0	118	44	6	0	1	0	1	52	0	0	0	0	0	0	0	693
1 Hr	251	40	3	0	7	1	302	402	61	10	6	6	3	488	1147	57	13	0	10	2	1229	436	72	9	3	0	1	521	178	22	5	3	1	1	210	0	0	0	0	0	0	0	2750
17:00	95	16	2	0	2	0	115	111	15	3	1	0	0	130	289	18	2	0	1	3	313	117	20	3	1	2	0	143	62	5	0	0	0	0	67	0	0	0	0	0	0	0	768
17:15	95	13	1	0	1	1	111	117	24	4	2	0	0	147	254	16	3	0	6	3	282	116	9	3	0	0	1	129	58	6	0	2	0	0	66	0	0	0	0	0	0	0	735
17:30	77	10	1	0	1	0	89	127	11	7	2	0	0	147	244	10	1	0	1	0	256	106	9	1	0	0	1	117	52	6	0	0	1	0	59	0	0	0	0	0	0	0	668
17:45	88	10	1	0	2	0	101	90	7	1	0	0	0	98	207	3	1	0	3	4	218	107	7	1	0	1	0	116	38	4	0	0	1	0	43	0	0	0	0	0	0	0	576
1 Hr	355	49	5	0	6	1	416	445	57	15	5	0	0	522	994	47	7	0	11	10	1069	446	45	8	1	3	2	505	210	21	0	2	2	0	235	0	0	0	0	0	0	0	2747
18:00	89	10	3	0	2	0	104	80	9	1	0	0	0	90	172	12	1	0	2	0	187	88	7	2	0	0	0	97	52	3	0	0	1	0	56	0	0	0	0	0	0	0	534
18:15	79	5	2	0	1	0	87	85	7	2	1	1	0	96	149	5	2	0	7	1	164	97	7	0	0	0	3	107	38	1	0	1	0	0	40	0	0	0	0	0	0	0	494
18:30	55	8	1	0	1	0	65	95	5	1	0	2	0	103	147	8	0	1	3	0	159	84	8	1	1	0	0	94	31	0	0	0	0	0	31	0	0	0	0	0	0	0	452
18:45	76	3	0	0	0	0	79	95	5	1	0	0	0	101	106	7	1	0	1	0	115	95	4	2	0	0	0	101	48	0	0	0	0	1	49	0	0	0	0	0	0	0	445
1 Hr	299	26	6	0	4	0	335	355	26	5	1	3	0	390	574	32	4	1	13	1	625	364	26	5	1	0	3	399	169	4	0	1	1	1	176	0	0	0	0	0	0	0	1925
Total	3173	383	104	5	56	11	3732	4380	561	191	58	44	7	5241	7817	638	200	14	98	30	8797	4163	576	141	24	43	15	4962	2244	237	80	28	11	19	2619	0	0	0	0	0	0	0	25351

DESTINATION SUMMARY

	Arm A							Arm B							Arm C							Arm D							Arm E							Arm F							Dest Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	78	24	2	0	1	0	105	0	0	0	0	0	0	0	250	9	2	0	3	0	264	40	5	5	0	0	1	51	37	5	0	1	0	0	43	19	4	0	0	0	0	23	486
07:15	77	18	2	0	1	1	99	0	0	0	0	0	0	0	307	12	9	0	3	1	332	56	10	1	0	0	0	67	49	4	3	0	0	0	56	29	3	2	0	0	0	34	588
07:30	118	17	4	0	5	1	145	0	0	0	0	0	0	0	288	15	7	0	8	3	321	96	21	6	1	1	0	125	71	9	3	0	1	0	84	35	10	1	0	0	0	46	721
07:45	119	16	6	2	2	1	146	0	0	0	0	0	0	0	316	21	9	0	6	1	353	95	16	2	0	2	0	115	78	25	2	1	1	0	107	32	8	1	1	0	0	42	763
1 Hr	392	75	14	2	9	3	495	0	0	0	0	0	0	0	1161	57	27	0	20	5	1270	287	52	14	1	3	1	358	235	43	8	2	2	0	290	115	25	4	1	0	0	145	2558
08:00	120	19	6	0	2	0	147	0	0	0	0	0	0	0	294	15	5	0	5	2	321	110	12	6	1	1	0	130	105	14	3	0	2	0	124	42	11	1	0	2	0	56	778
08:15	100	6	5	1	2	0	114	0	0	0	0	0	0	0	353	13	4	0	3	3	376	72	14	2	0	4	0	92	100	13	4	0	0	2	119	39	13	1	0	0	1	54	755
08:30	117	7	2	0	2	1	129	0	0	0	0	0	0	0	314	20	7	0	5	2	348	80	19	4	1	0	1	105	123	16	4	3	0	0	146	32	4	2	0	1	1	40	768
08:45	81	7	3	0	5	0	96	0	0	0	0	0	0	0	312	27	5	1	3	2	350	77	10	8	0	0	0	95	99	20	3	2	0	0	124	29	8	0	0	0	0	37	702
1 Hr	418	39	16	1	11	1	486	0	0	0	0	0	0	0	1273	75	21	1	16	9	1395	339	55	20	2	5	1	422	427	63	14	5	2	2	513	142	36	4	0	3	2	187	3003
09:00	56	9	2	0	2	0	69	0	0	0	0	0	0	0	243	17	6	0	2	2	270	85	11	4	0	0	0	100	84	13	4	1	1	1	104	25	3	4	0	0	0	32	575
09:15	52	15	4	2	3	0	76	0	0	0	0	0	0	0	152	16	8	0	1	2	179	54	10	3	1	2	0	70	59	10	3	1	1	0	74	19	5	2	0	0	0	26	425
09:30	59	10	1	0	2	0	72	0	0	0	0	0	0	0	162	15	3	0	3	0	183	75	8	3	0	1	0	87	60	11	3	1	0	0	75	17	4	3	0	0	0	24	441
09:45	60	11	4	2	7	0	84	0	0	0	0	0	0	0	113	15	6	0	2	0	136	46	17	3	0	0	0	66	46	12	2	1	0	1	62	15	5	3	1	0	0	24	372
1 Hr	227	45	11	4	14	0	301	0	0	0	0	0	0	0	670	63	23	0	8	4	768	260	46	13	1	3	0	323	249	46	12	4	2	2	315	76	17	12	1	0	0	106	1813
10:00	34	18	6	0	3	0	61	0	0	0	0	0	0	0	105	9	4	0	2	1	121	51	13	4	0	2	0	70	49	4	4	0	0	0	57	17	5	2	1	0	0	25	334
10:15	40	9	1	1	0	0	51	0	0	0	0	0	0	0	102	14	7	0	0	0	123	59	8	7	0	1	1	76	43	11	0	3	0	0	57	21	2	1	0	0	0	24	331
10:30	42	7	5	0	0	0	54	0	0	0	0	0	0	0	107	21	10	0	1	0	139	68	10	5	1	0	0	84	48	8	8	3	1	0	68	28	3	3	0	0	0	34	379
10:45	45	5	8	5	2	0	65	0	0	0	0	0	0	0	105	15	8	0	0	0	128	43	12	4	1	1	0	61	61	6	1	2	0	0	70	24	4	3	0	0	0	31	355
1 Hr	161	39	20	6	5	0	231	0	0	0	0	0	0	0	419	59	29	0	3	1	511	221	43	20	2	4	1	291	201	29	13	8	1	0	252	90	14	9	1	0	0	114	1399
11:00	50	7	4	0	0	0	61	0	0	0	0	0	0	0	111	11	6	0	0	1	129	60	8	4	0	1	0	73	54	6	6	1	1	0	68	25	4	2	0	0	0	31	362
11:15	51	9	3	1	0	0	64	0	0	0	0	0	0	0	108	12	4	0	0	0	124	64	13	3	1	1	0	82	57	8	6	0	0	2	73	24	1	1	1	0	0	27	370
11:30	41	7	7	0	1	0	56	0	0	0	0	0	0	0	105	8	6	1	1	1	122	68	10	1	0	0	0	79	64	3	2	2	0	0	71	28	2	1	1	0	0	32	360
11:45	52	12	7	1	1	1	74	0	0	0	0	0	0	0	132	8	6	0	1	1	148	65	12	0	0	0	0	77	55	7	2	0	1	0	65	30	9	1	1	0	1	42	406
1 Hr	194	35	21	2	2	1	255	0	0	0	0	0	0	0	456	39	22	1	2	3	523	257	43	8	1	2	0	311	230	24	16	3	2	2	277	107	16	5	3	0	1	132	1498
12:00	58	7	4	1	0	0	70	0	0	0	0	0	0	0	117	10	5	1	0	0	133	64	8	3	2	0	1	78	60	7	2	1	0	0	70	27	3	1	0	0	0	31	382
12:15	61	10	1	1	0	0	73	0	0	0	0	0	0	0	104	16	4	1	0	0	125	71	4	1	2	2	0	80	57	6	5	2	1	0	71	27	2	0	0	0	0	29	378
12:30	63	9	3	0	0	0	75	0	0	0	0	0	0	0	140	12	3	0	2	0	157	66	9	3	0	0	0	78	61	4	7	1	0	0	73	25	2	2	0	0	0	29	412
12:45	59	8	1	4	1	0	73	0	0	0	0	0	0	0	107	10	6	1	0	0	124	55	8	2	0	0	0	65	52	7	5	0	0	0	64	19	1	1	0	0	0	21	347
1 Hr	241	34	9	6	1	0	291	0	0	0	0	0	0	0	468	48	18	3	2	0	539	256	29	9	4	2	1	301	230	24	19	4	1	0	278	98	8	4	0	0	0	110	1519
13:00	73	9	1	2	0	1	86	0	0	0	0	0	0	0	143	17	6	0	0	0	166	64	10	7	2	0	0	83	69	2	2	1	0	0	74	30	5	4	2	0	0	41	450
13:15	65	5	5	0	0	0	75	0	0	0	0	0	0	0	153	14	5	0	0	0	172	73	12	5	0	1	0	91	71	7	3	1	0	0	82	27	3	3	1	0	0	34	454
13:30	58	8	3	0	1	0	70	0	0	0	0	0	0	0	119	18	8	0	1	0	146	60	9	3	0	0	0	72	57	7	4	0	0	0	68	28	2	2	0	0	0	32	388
13:45	48	16	8	2	2	0	76	0	0	0	0	0	0	0	133	14	6	1	2	0	156	58	20	4	0	0	0	82	79	13	4	2	0	0	98	26	4	0	0	0	0	30	442
1 Hr	244	38	17	4	3	1	307	0	0	0	0	0	0	0	548	63	25	1	3	0	640	255	51	19	2	1	0	328	276	29	13	4	0	0	322	111	14	9	3	0	0	137	1734
14:00	66	13	3	1	1	0	84	0	0	0	0	0	0	0	158	10	3	0	0	1	172	52	12	0	1	0	0	65	57	9	2	0	1	1	70	23	4	4	0	1	0	32	423
14:15	82	12	8	1	2	0	105	0	0	0	0	0	0	0	140	17	1	0	2	1	161	80	9	1	0	6	1	97	73	9	5	2	0	0	89	31	7	1	1	0	0	40	492
14:30	102	13	2	1	1	0	119	0	0	0	0	0	0	0	128	8	10	0	3	0	149	70	17	5	0	0	0	92	69	9	2	1	1	2	84	37	7	1	1	0	0	46	490

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 2
Date: Thursday 16th October 2014

14:45	91	10	4	0	2	0	107	0	0	0	0	0	0	0	158	16	1	0	2	1	178	82	10	1	0	2	0	95	93	9	3	3	1	0	109	45	5	4	0	0	0	54	543
1 Hr	341	48	17	3	6	0	415	0	0	0	0	0	0	0	584	51	15	0	7	3	660	284	48	7	1	8	1	349	292	36	12	6	3	3	352	136	23	10	2	1	0	172	1948
15:00	140	7	2	5	2	0	156	0	0	0	0	0	0	0	117	10	3	0	1	1	132	76	14	1	0	1	1	93	121	8	2	0	0	1	132	48	6	2	0	0	0	56	569
15:15	150	16	2	0	1	1	170	0	0	0	0	0	0	0	143	12	5	0	2	2	164	84	12	0	0	1	0	97	112	9	0	0	0	0	121	66	2	1	0	0	0	69	621
15:30	149	10	3	2	5	0	169	0	0	0	0	0	0	0	164	11	4	0	5	2	186	90	6	1	1	1	0	99	108	16	2	0	0	0	126	58	10	2	0	0	0	70	650
15:45	138	7	1	0	2	0	148	0	0	0	0	0	0	0	135	13	5	0	2	0	155	69	5	2	0	2	0	78	141	11	3	2	3	0	160	72	3	1	0	0	0	76	617
1 Hr	577	40	8	7	10	1	643	0	0	0	0	0	0	0	559	46	17	0	10	5	637	319	37	4	1	5	1	367	482	44	7	2	3	1	539	244	21	6	0	0	0	271	2457
16:00	171	14	3	0	1	0	189	0	0	0	0	0	0	0	123	10	3	0	7	0	143	85	20	1	0	1	0	107	135	8	3	2	1	0	149	69	5	1	0	0	1	76	664
16:15	140	15	2	1	1	0	159	0	0	0	0	0	0	0	136	13	3	0	1	0	153	94	11	2	0	1	0	108	152	11	3	1	0	0	167	78	1	1	0	0	1	81	668
16:30	172	12	2	2	2	0	190	0	0	0	0	0	0	0	140	17	1	0	3	0	161	95	15	3	0	0	1	114	145	8	1	2	0	0	156	88	13	2	1	0	0	104	725
16:45	151	18	3	1	2	0	175	0	0	0	0	0	0	0	137	22	1	1	1	2	164	94	19	3	0	1	2	119	150	13	0	1	2	1	167	59	7	2	0	0	0	68	693
1 Hr	634	59	10	4	6	0	713	0	0	0	0	0	0	0	536	62	8	1	12	2	621	368	65	9	0	3	3	448	582	40	7	6	3	1	639	294	26	6	1	0	2	329	2750
17:00	176	18	0	1	1	0	196	0	0	0	0	0	0	0	160	19	1	0	3	0	183	104	15	3	0	0	1	123	163	17	5	1	0	2	188	71	5	1	0	1	0	78	768
17:15	155	10	2	1	2	0	170	0	0	0	0	0	0	0	157	18	1	0	1	2	179	107	19	4	2	1	0	133	143	15	4	1	3	3	169	78	6	0	0	0	0	84	735
17:30	145	12	2	0	1	0	160	0	0	0	0	0	0	0	154	11	2	0	2	1	170	94	11	3	1	0	0	109	151	7	1	1	0	0	160	62	5	2	0	0	0	69	668
17:45	109	5	0	0	3	0	117	0	0	0	0	0	0	0	147	10	3	0	4	0	164	92	5	1	0	0	3	101	128	11	0	0	0	1	140	54	0	0	0	0	0	54	576
1 Hr	585	45	4	2	7	0	643	0	0	0	0	0	0	0	618	58	7	0	10	3	696	397	50	11	3	1	4	466	585	50	10	3	3	6	657	265	16	3	0	1	0	285	2747
18:00	91	5	1	0	1	0	98	0	0	0	0	0	0	0	148	13	1	0	3	0	165	90	14	3	0	1	0	108	107	7	0	0	0	0	114	45	2	2	0	0	0	49	534
18:15	99	7	1	1	2	0	110	0	0	0	0	0	0	0	132	7	3	1	1	0	144	91	7	1	0	5	0	104	89	4	1	0	1	3	98	37	0	0	0	0	1	38	494
18:30	65	10	0	2	1	0	78	0	0	0	0	0	0	0	149	5	2	0	1	0	157	96	7	1	0	4	0	108	66	3	0	0	0	0	69	36	4	0	0	0	0	40	452
18:45	45	4	0	0	1	0	50	0	0	0	0	0	0	0	190	6	2	0	0	1	199	92	3	1	0	0	0	96	57	2	0	0	0	0	59	36	4	1	0	0	0	41	445
1 Hr	300	26	2	3	5	0	336	0	0	0	0	0	0	0	619	31	8	1	5	1	665	369	31	6	0	10	0	416	319	16	1	0	1	3	340	154	10	3	0	0	1	168	1925
Total	4314	523	149	44	79	7	5116	0	0	0	0	0	0	0	7911	652	220	8	98	36	8925	3612	550	140	18	47	13	4380	4108	444	132	47	23	20	4774	1832	226	75	12	5	6	2156	25351

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 3
Date: Thursday 16th October 2014

Entry : Arm A

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Arm Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	0	0	0	0	0	0	0	7	0	0	0	0	1	8	34	4	0	0	0	0	38	46
07:15	0	0	0	0	0	0	0	7	2	0	0	0	0	9	39	4	2	0	0	0	45	54
07:30	0	0	0	0	0	0	0	9	0	1	0	0	0	10	77	11	2	0	0	0	90	100
07:45	0	0	0	0	0	0	0	5	0	0	0	1	0	6	73	9	1	0	1	1	85	91
1 Hr	0	0	0	0	0	0	0	28	2	1	0	1	1	33	223	28	5	0	1	1	258	291
08:00	0	0	0	0	0	0	0	8	1	0	0	0	0	9	68	4	5	0	1	0	78	87
08:15	0	0	0	0	0	0	0	14	0	2	0	0	0	16	66	7	2	0	2	1	78	94
08:30	0	0	0	0	0	0	0	14	0	0	0	1	0	15	79	6	4	1	0	1	91	106
08:45	0	0	0	0	0	0	0	6	3	0	0	0	1	10	44	6	7	0	0	0	57	67
1 Hr	0	0	0	0	0	0	0	42	4	2	0	1	1	50	257	23	18	1	3	2	304	354
09:00	0	0	0	0	0	0	0	21	1	0	0	0	0	22	62	4	2	0	1	1	70	92
09:15	0	0	0	0	0	0	0	13	2	1	0	0	0	16	51	7	2	0	0	0	60	76
09:30	0	0	0	0	0	0	0	5	0	0	0	0	0	5	48	7	1	0	0	0	56	61
09:45	0	0	0	0	0	0	0	3	2	1	0	0	0	6	37	13	1	0	1	0	52	58
1 Hr	0	0	0	0	0	0	0	42	5	2	0	0	0	49	198	31	6	0	2	1	238	287
10:00	0	0	0	0	0	0	0	10	0	0	0	0	0	10	58	10	1	0	0	0	69	79
10:15	1	0	0	0	0	0	1	5	1	0	0	0	1	7	48	5	2	1	0	0	56	64
10:30	1	0	0	0	0	0	1	8	0	1	0	0	0	9	69	7	6	1	0	0	83	93
10:45	0	0	0	0	0	0	0	6	1	0	0	0	0	7	57	7	3	0	1	0	68	75
1 Hr	2	0	0	0	0	0	2	29	2	1	0	0	1	33	232	29	12	2	1	0	276	311
11:00	0	0	0	0	0	0	0	5	2	1	0	0	0	8	74	9	6	0	0	0	89	97
11:15	0	0	0	0	0	0	0	6	0	0	0	0	0	6	70	6	3	0	0	0	79	85
11:30	0	0	0	0	0	0	0	10	0	0	0	0	0	10	63	2	3	0	0	0	68	78
11:45	0	0	0	0	0	0	0	5	0	0	0	0	0	5	68	3	2	0	1	0	74	79
1 Hr	0	0	0	0	0	0	0	26	2	1	0	0	0	29	275	20	14	0	1	0	310	339
12:00	0	0	0	0	0	0	0	8	0	0	0	0	0	8	60	8	4	1	1	0	74	82
12:15	0	0	0	0	0	0	0	12	0	0	0	0	0	12	69	3	1	0	0	0	73	85
12:30	0	0	0	0	0	0	0	2	0	0	0	0	0	2	57	3	4	0	0	0	64	66
12:45	0	0	0	0	0	0	0	7	1	0	0	0	0	8	50	3	3	0	1	0	57	65
1 Hr	0	0	0	0	0	0	0	29	1	0	0	0	0	30	236	17	12	1	2	0	268	298
13:00	0	0	0	0	0	0	0	6	0	0	0	0	0	6	59	6	3	0	0	0	68	74
13:15	0	0	0	0	0	0	0	3	0	1	0	0	1	5	81	6	2	0	0	0	89	94
13:30	0	0	0	0	0	0	0	5	1	0	0	1	0	7	58	8	2	0	0	0	68	75
13:45	0	0	0	0	0	0	0	8	1	0	0	0	0	9	41	7	2	2	1	0	53	62
1 Hr	0	0	0	0	0	0	0	22	2	1	0	1	1	27	239	27	9	2	1	0	278	305
14:00	0	0	0	0	0	0	0	9	2	1	0	0	0	12	47	12	3	0	0	0	62	74
14:15	0	0	0	0	0	0	0	10	0	1	0	0	0	11	64	9	6	0	0	0	79	90

Sky High
Count On Us

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
Site: 3
Date: Thursday 16th October 2014

14:30	0	0	0	0	0	0	0	11	2	0	0	0	0	13	90	12	2	0	0	1	105	118
14:45	0	0	0	0	0	0	0	7	2	0	0	0	0	9	87	7	3	0	1	0	98	107
1 Hr	0	0	0	0	0	0	0	37	6	2	0	0	0	45	288	40	14	0	1	1	344	389
15:00	0	0	0	0	0	0	0	13	1	1	0	0	0	15	135	8	3	0	0	0	146	161
15:15	0	0	0	0	0	0	0	17	0	0	0	0	0	17	101	5	1	0	0	0	107	124
15:30	0	0	0	0	0	0	0	12	1	0	0	1	0	14	119	6	4	0	0	0	129	143
15:45	0	0	0	0	0	0	0	13	0	0	0	0	0	13	112	4	0	0	1	0	117	130
1 Hr	0	0	0	0	0	0	0	55	2	1	0	1	0	59	467	23	8	0	1	0	499	558
16:00	0	0	0	0	0	0	0	14	0	0	0	1	0	15	172	9	3	0	1	0	185	200
16:15	0	0	0	0	0	0	0	9	2	0	0	0	0	11	140	8	0	0	0	0	148	159
16:30	0	0	0	0	0	0	0	5	1	0	0	1	0	7	112	10	2	0	0	0	124	131
16:45	0	0	0	0	0	0	0	6	0	0	0	0	0	6	89	6	2	0	1	0	98	104
1 Hr	0	0	0	0	0	0	0	34	3	0	0	2	0	39	513	33	7	0	2	0	555	594
17:00	0	0	0	0	0	0	0	8	0	0	0	0	0	8	153	7	0	0	0	3	163	171
17:15	0	0	0	0	0	0	0	12	0	0	0	0	0	12	106	4	0	0	1	0	111	123
17:30	0	0	0	0	0	0	0	1	0	0	0	0	0	1	89	2	1	0	0	0	92	93
17:45	0	0	0	0	0	0	0	9	0	0	0	0	0	9	82	0	1	0	0	0	83	92
1 Hr	0	0	0	0	0	0	0	30	0	0	0	0	0	30	430	13	2	0	1	3	449	479
18:00	0	0	0	0	0	0	0	9	0	0	0	0	0	9	76	5	1	0	1	0	83	92
18:15	0	0	0	0	0	0	0	12	0	0	0	0	0	12	70	1	2	0	4	0	77	89
18:30	0	0	0	0	0	0	0	4	0	0	0	0	0	4	74	2	0	0	2	0	78	82
18:45	0	0	0	0	0	0	0	7	0	0	0	0	0	7	50	3	0	0	0	0	53	60
1 Hr	0	0	0	0	0	0	0	32	0	0	0	0	0	32	270	11	3	0	7	0	291	323
Total	2	0	0	0	0	0	2	406	29	11	0	6	4	456	3628	295	110	6	23	8	4070	4528

Entry : Arm B

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Arm Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	3	0	0	0	0	0	3	0	0	0	0	0	0	0	42	1	1	0	1	0	45	48
07:15	8	1	0	0	0	0	9	0	0	0	0	0	0	0	51	2	1	0	1	0	55	64
07:30	7	0	0	0	0	0	7	0	0	0	0	0	0	0	74	16	7	0	3	0	100	107
07:45	13	0	2	0	1	0	16	0	0	0	0	0	0	0	83	7	3	0	1	0	94	110
1 Hr	31	1	2	0	1	0	35	0	0	0	0	0	0	0	250	26	12	0	6	0	294	329
08:00	11	0	0	0	0	0	11	0	0	0	0	0	0	0	93	14	1	0	4	1	113	124
08:15	26	1	0	0	1	0	28	0	0	0	0	0	0	0	77	12	3	0	2	2	96	124
08:30	19	0	1	0	0	0	20	0	0	0	0	0	0	0	99	6	1	1	2	0	109	129
08:45	16	0	0	0	0	0	16	0	0	0	0	0	0	0	82	19	2	0	3	0	106	122
1 Hr	72	1	1	0	1	0	75	0	0	0	0	0	0	0	351	51	7	1	11	3	424	499
09:00	7	0	0	0	0	0	7	0	0	0	0	0	0	0	64	5	4	0	1	0	74	81

Sky High
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Client: Parsons Brinckerhoff
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09:15	6	0	2	0	0	0	8	0	0	0	0	0	0	0	45	11	4	1	3	0	64	72
09:30	5	1	0	0	0	0	6	0	0	0	0	0	0	0	52	7	1	0	2	0	62	68
09:45	5	2	1	0	0	0	8	0	0	0	0	0	0	0	57	12	2	0	2	1	74	82
1 Hr	23	3	3	0	0	0	29	0	0	0	0	0	0	0	218	35	11	1	8	1	274	303
10:00	3	0	0	0	2	0	5	0	0	0	0	0	0	0	38	6	1	0	2	0	47	52
10:15	6	0	0	0	0	0	6	0	0	0	0	0	0	0	45	7	3	0	1	1	57	63
10:30	8	0	1	0	0	0	9	0	0	0	0	0	0	0	45	7	4	1	0	1	58	67
10:45	5	0	0	0	0	0	5	1	0	0	0	0	0	1	60	3	2	0	1	0	66	72
1 Hr	22	0	1	0	2	0	25	1	0	0	0	0	0	1	188	23	10	1	4	2	228	254
11:00	8	1	1	0	0	0	10	0	0	0	0	0	0	0	53	6	6	0	0	0	65	75
11:15	7	0	1	0	0	0	8	0	0	0	0	0	0	0	57	3	1	0	1	1	63	71
11:30	8	2	1	0	0	0	11	0	0	0	0	0	0	0	57	3	0	1	0	0	61	72
11:45	6	0	2	0	2	0	10	0	0	0	0	0	0	0	55	8	4	0	1	0	68	78
1 Hr	29	3	5	0	2	0	39	0	0	0	0	0	0	0	222	20	11	1	2	1	257	296
12:00	5	0	0	0	0	0	5	0	0	0	0	0	0	0	67	4	1	0	0	1	73	78
12:15	9	0	0	0	0	0	9	0	0	0	0	0	0	0	64	0	0	0	2	0	66	75
12:30	8	0	0	0	0	0	8	0	0	0	0	0	0	0	71	3	2	0	0	0	76	84
12:45	11	1	0	0	0	1	13	0	0	0	0	0	0	0	48	9	2	0	0	0	59	72
1 Hr	33	1	0	0	0	1	35	0	0	0	0	0	0	0	250	16	5	0	2	1	274	309
13:00	6	1	1	0	0	0	8	0	0	0	0	0	0	0	84	5	3	1	0	1	94	102
13:15	3	1	1	0	0	0	5	0	0	0	0	0	0	0	63	5	3	0	1	0	72	77
13:30	7	2	0	0	0	0	9	0	0	0	0	0	0	0	56	5	3	0	1	0	65	74
13:45	13	0	0	0	0	0	13	0	0	0	0	0	0	0	66	10	1	0	0	0	77	90
1 Hr	29	4	2	0	0	0	35	0	0	0	0	0	0	0	269	25	10	1	2	1	308	343
14:00	18	4	1	0	0	0	23	0	0	0	0	0	0	0	62	5	2	0	2	1	72	95
14:15	3	1	0	0	1	0	5	0	0	0	0	0	0	0	94	5	1	1	4	0	105	110
14:30	14	3	0	0	0	0	17	0	0	0	0	0	0	0	85	9	1	1	1	0	97	114
14:45	22	1	0	0	0	0	23	0	0	0	0	0	0	0	104	7	2	0	1	1	115	138
1 Hr	57	9	1	0	1	0	68	0	0	0	0	0	0	0	345	26	6	2	8	2	389	457
15:00	14	0	0	0	0	0	14	0	0	0	0	0	0	0	128	4	0	0	2	2	136	150
15:15	7	0	0	0	0	0	7	0	0	0	0	0	0	0	178	9	1	0	2	0	190	197
15:30	11	0	0	0	0	0	11	1	0	0	0	0	0	1	136	8	1	0	3	0	148	160
15:45	10	0	0	0	0	0	10	1	0	0	0	0	0	1	161	7	0	0	2	0	170	181
1 Hr	42	0	0	0	0	0	42	2	0	0	0	0	0	2	603	28	2	0	9	2	644	688
16:00	2	0	1	0	0	0	3	0	0	0	0	0	0	0	114	3	1	0	1	2	121	124
16:15	5	0	0	0	1	0	6	1	0	0	0	0	0	1	157	3	1	0	2	0	163	170
16:30	7	1	0	0	1	0	9	0	0	0	0	0	0	0	170	8	1	0	2	0	181	190
16:45	12	1	0	0	0	0	13	0	0	0	0	0	0	0	184	9	2	0	3	1	199	212
1 Hr	26	2	1	0	2	0	31	1	0	0	0	0	0	1	625	23	5	0	8	3	664	696
17:00	6	0	0	0	0	0	6	0	0	0	0	0	0	0	137	18	3	0	1	0	159	165
17:15	5	1	0	0	0	0	6	0	0	0	0	0	0	0	145	10	3	0	5	3	166	172

Client: Parsons Brinckerhoff
Project: C0738 Abergelli
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	Destination : Arm A							Destination : Arm B							Destination : Arm C							Arm Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
17:30	16	0	0	0	0	0	16	0	0	0	0	0	0	0	146	9	0	0	1	0	156	172
17:45	10	2	0	0	0	0	12	0	0	0	0	0	0	0	123	3	0	0	3	4	133	145
1 Hr	37	3	0	0	0	0	40	0	0	0	0	0	0	0	551	40	6	0	10	7	614	654
18:00	5	0	0	0	0	0	5	0	0	0	0	0	0	0	89	5	0	0	1	0	95	100
18:15	16	1	0	0	1	0	18	0	0	0	0	0	0	0	75	4	0	0	3	1	83	101
18:30	11	2	0	0	0	0	13	0	0	0	0	0	0	0	73	4	0	1	1	0	79	92
18:45	10	0	0	0	0	0	10	0	0	0	0	0	0	0	57	3	1	0	1	1	63	73
1 Hr	42	3	0	0	1	0	46	0	0	0	0	0	0	0	294	16	1	1	6	2	320	366
Total	443	30	16	0	10	1	500	4	0	0	0	0	0	4	4166	329	86	8	76	25	4690	5194

Entry : Arm C

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Arm Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	54	0	0	0	1	0	55	186	4	1	0	1	0	192	0	0	0	0	0	0	0	247
07:15	107	6	4	0	2	2	121	197	4	5	0	0	0	206	0	0	0	0	0	0	0	327
07:30	116	9	3	0	2	0	130	169	6	3	0	5	1	184	0	0	0	0	0	0	0	314
07:45	202	13	2	0	2	0	219	117	10	6	0	5	1	139	0	0	0	0	0	0	0	358
1 Hr	479	28	9	0	7	2	525	669	24	15	0	11	2	721	0	0	0	0	0	0	0	1246
08:00	151	7	5	0	2	0	165	138	7	2	0	2	2	151	0	0	0	0	0	0	0	316
08:15	208	5	3	0	1	2	219	144	8	1	0	3	1	157	0	0	0	0	0	0	0	376
08:30	179	10	1	0	0	1	191	129	10	4	0	4	5	152	0	0	0	0	0	0	0	343
08:45	158	11	2	0	1	0	172	147	14	3	1	2	2	169	0	0	0	0	0	0	0	341
1 Hr	696	33	11	0	4	3	747	558	39	10	1	11	10	629	0	0	0	0	0	0	0	1376
09:00	102	12	4	0	0	0	118	129	9	3	0	2	2	145	0	0	0	0	0	0	0	263
09:15	88	8	1	0	0	0	97	58	8	7	0	1	2	76	0	0	0	0	0	0	0	173
09:30	80	6	1	0	1	0	88	67	8	2	0	2	0	79	0	0	0	0	0	0	0	167
09:45	54	9	2	0	0	0	65	54	7	3	0	2	0	66	0	0	0	0	0	0	0	131
1 Hr	324	35	8	0	1	0	368	308	32	15	0	7	4	366	0	0	0	0	0	0	0	734
10:00	60	9	4	0	0	0	73	45	1	0	0	1	1	48	0	0	0	0	0	0	0	121
10:15	52	8	4	0	0	0	64	49	4	4	0	0	0	57	0	0	0	0	0	0	0	121
10:30	68	9	5	0	1	0	83	37	8	5	0	0	0	50	0	0	0	0	0	0	0	133
10:45	57	7	5	0	0	0	69	46	10	2	0	0	0	58	0	0	0	0	0	0	0	127
1 Hr	237	33	18	0	1	0	289	177	23	11	0	1	1	213	0	0	0	0	0	0	0	502
11:00	42	7	5	0	0	0	54	58	4	1	1	0	1	65	0	0	0	0	0	0	0	119
11:15	57	7	1	0	0	0	65	51	3	3	0	0	0	57	0	0	0	0	0	0	0	122
11:30	62	4	3	1	1	0	71	40	3	3	0	0	0	46	0	0	0	0	0	0	0	117
11:45	64	2	2	0	0	0	68	61	6	2	0	1	1	71	0	0	0	0	0	0	0	139
1 Hr	225	20	11	1	1	0	258	210	16	9	1	1	2	239	0	0	0	0	0	0	0	497
12:00	43	5	3	0	0	0	51	71	4	1	1	0	0	77	1	0	0	0	0	0	1	129

Sky High
Count On Us

Client: Parsons Brinckerhoff
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12:15	55	6	3	1	0	0	65	46	10	1	0	0	0	57	0	0	0	0	0	0	0	122
12:30	89	2	2	0	1	0	94	47	6	1	0	1	0	55	0	0	0	0	0	0	0	149
12:45	71	4	3	0	0	0	78	32	5	3	2	0	0	42	0	0	0	0	0	0	0	120
1 Hr	258	17	11	1	1	0	288	196	25	6	3	1	0	231	1	0	0	0	0	0	1	520
13:00	88	12	2	0	0	0	102	51	4	3	0	0	0	58	0	0	0	0	0	0	0	160
13:15	98	8	2	0	1	0	109	57	4	1	0	0	1	63	0	0	0	0	0	0	0	172
13:30	78	11	6	0	1	0	96	45	8	2	0	0	0	55	0	0	0	0	0	0	0	151
13:45	83	10	6	0	0	0	99	44	7	0	1	2	1	55	0	0	0	0	0	0	0	154
1 Hr	347	41	16	0	2	0	406	197	23	6	1	2	2	231	0	0	0	0	0	0	0	637
14:00	89	3	0	0	0	0	92	70	5	2	0	0	1	78	0	0	0	0	0	0	0	170
14:15	74	7	1	0	0	0	82	55	9	0	0	2	1	67	0	0	0	0	0	0	0	149
14:30	85	3	8	0	1	0	97	40	3	1	0	1	0	45	0	0	0	0	0	0	0	142
14:45	89	12	2	0	0	1	104	64	2	0	0	2	0	68	0	0	0	0	0	0	0	172
1 Hr	337	25	11	0	1	1	375	229	19	3	0	5	2	258	0	0	0	0	0	0	0	633
15:00	63	4	1	0	0	0	68	52	4	2	0	1	1	60	0	0	0	0	0	0	0	128
15:15	58	2	2	0	0	0	62	81	6	3	0	2	1	93	0	0	0	0	0	0	0	155
15:30	66	2	3	0	3	0	74	92	10	2	0	2	2	108	0	0	0	0	0	0	0	182
15:45	74	4	1	0	1	0	80	57	4	4	0	1	0	66	0	0	0	0	0	0	0	146
1 Hr	261	12	7	0	4	0	284	282	24	11	0	6	4	327	0	0	0	0	0	0	0	611
16:00	66	3	1	0	0	0	70	54	8	2	0	8	0	72	0	0	0	0	0	0	0	142
16:15	64	7	1	0	0	0	72	64	6	1	0	1	0	72	0	0	0	0	0	0	0	144
16:30	78	9	1	0	1	0	89	58	7	0	0	2	0	67	0	0	0	0	0	0	0	156
16:45	55	9	1	1	0	0	66	73	8	1	0	1	2	85	1	0	0	0	0	0	1	152
1 Hr	263	28	4	1	1	0	297	249	29	4	0	12	2	296	1	0	0	0	0	0	1	594
17:00	74	7	1	0	1	0	83	80	8	0	0	2	0	90	0	0	0	0	0	0	0	173
17:15	61	5	0	0	0	1	67	89	12	0	0	1	0	102	0	0	0	0	0	0	0	169
17:30	76	3	3	0	1	1	84	77	7	0	0	1	0	85	0	0	0	0	0	0	0	169
17:45	84	3	2	0	1	0	90	61	5	1	0	2	1	70	0	0	0	0	0	0	0	160
1 Hr	295	18	6	0	3	2	324	307	32	1	0	6	1	347	0	0	0	0	0	0	0	671
18:00	73	4	1	0	1	0	79	73	7	0	0	1	0	81	0	0	0	0	0	0	0	160
18:15	76	1	2	0	0	0	79	56	5	2	0	1	0	64	0	0	0	0	0	0	0	143
18:30	99	1	2	0	0	0	102	47	3	0	0	1	0	51	0	0	0	0	0	0	0	153
18:45	139	4	1	0	0	0	144	46	3	1	0	0	0	50	0	0	0	0	0	0	0	194
1 Hr	387	10	6	0	1	0	404	222	18	3	0	3	0	246	0	0	0	0	0	0	0	650
Total	4109	300	118	3	27	8	4565	3604	304	94	6	66	30	4104	2	0	0	0	0	0	2	8671

ORIGIN SUMMARY

Origin :	Arm A						Origin :	Arm B						Origin :	Arm C						Origin Totals
Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	

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07:00	41	4	0	0	0	1	46	45	1	1	0	1	0	48	240	4	1	0	2	0	247	341
07:15	46	6	2	0	0	0	54	59	3	1	0	1	0	64	304	10	9	0	2	2	327	445
07:30	86	11	3	0	0	0	100	81	16	7	0	3	0	107	285	15	6	0	7	1	314	521
07:45	78	9	1	0	2	1	91	96	7	5	0	2	0	110	319	23	8	0	7	1	358	559
1 Hr	251	30	6	0	2	2	291	281	27	14	0	7	0	329	1148	52	24	0	18	4	1246	1866
08:00	76	5	5	0	1	0	87	104	14	1	0	4	1	124	289	14	7	0	4	2	316	527
08:15	80	7	4	0	2	1	94	103	13	3	0	3	2	124	352	13	4	0	4	3	376	594
08:30	93	6	4	1	1	1	106	118	6	2	1	2	0	129	308	20	5	0	4	6	343	578
08:45	50	9	7	0	0	1	67	98	19	2	0	3	0	122	305	25	5	1	3	2	341	530
1 Hr	299	27	20	1	4	3	354	423	52	8	1	12	3	499	1254	72	21	1	15	13	1376	2229
09:00	83	5	2	0	1	1	92	71	5	4	0	1	0	81	231	21	7	0	2	2	263	436
09:15	64	9	3	0	0	0	76	51	11	6	1	3	0	72	146	16	8	0	1	2	173	321
09:30	53	7	1	0	0	0	61	57	8	1	0	2	0	68	147	14	3	0	3	0	167	296
09:45	40	15	2	0	1	0	58	62	14	3	0	2	1	82	108	16	5	0	2	0	131	271
1 Hr	240	36	8	0	2	1	287	241	38	14	1	8	1	303	632	67	23	0	8	4	734	1324
10:00	68	10	1	0	0	0	79	41	6	1	0	4	0	52	105	10	4	0	1	1	121	252
10:15	54	6	2	1	0	1	64	51	7	3	0	1	1	63	101	12	8	0	0	0	121	248
10:30	78	7	7	1	0	0	93	53	7	5	1	0	1	67	105	17	10	0	1	0	133	293
10:45	63	8	3	0	1	0	75	66	3	2	0	1	0	72	103	17	7	0	0	0	127	274
1 Hr	263	31	13	2	1	1	311	211	23	11	1	6	2	254	414	56	29	0	2	1	502	1067
11:00	79	11	7	0	0	0	97	61	7	7	0	0	0	75	100	11	6	1	0	1	119	291
11:15	76	6	3	0	0	0	85	64	3	2	0	1	1	71	108	10	4	0	0	0	122	278
11:30	73	2	3	0	0	0	78	65	5	1	1	0	0	72	102	7	6	1	1	0	117	267
11:45	73	3	2	0	1	0	79	61	8	6	0	3	0	78	125	8	4	0	1	1	139	296
1 Hr	301	22	15	0	1	0	339	251	23	16	1	4	1	296	435	36	20	2	2	2	497	1132
12:00	68	8	4	1	1	0	82	72	4	1	0	0	1	78	115	9	4	1	0	0	129	289
12:15	81	3	1	0	0	0	85	73	0	0	0	2	0	75	101	16	4	1	0	0	122	282
12:30	59	3	4	0	0	0	66	79	3	2	0	0	0	84	136	8	3	0	2	0	149	299
12:45	57	4	3	0	1	0	65	59	10	2	0	0	1	72	103	9	6	2	0	0	120	257
1 Hr	265	18	12	1	2	0	298	283	17	5	0	2	2	309	455	42	17	4	2	0	520	1127
13:00	65	6	3	0	0	0	74	90	6	4	1	0	1	102	139	16	5	0	0	0	160	336
13:15	84	6	3	0	0	1	94	66	6	4	0	1	0	77	155	12	3	0	1	1	172	343
13:30	63	9	2	0	1	0	75	63	7	3	0	1	0	74	123	19	8	0	1	0	151	300
13:45	49	8	2	2	1	0	62	79	10	1	0	0	0	90	127	17	6	1	2	1	154	306
1 Hr	261	29	10	2	2	1	305	298	29	12	1	2	1	343	544	64	22	1	4	2	637	1285
14:00	56	14	4	0	0	0	74	80	9	3	0	2	1	95	159	8	2	0	0	1	170	339
14:15	74	9	7	0	0	0	90	97	6	1	1	5	0	110	129	16	1	0	2	1	149	349
14:30	101	14	2	0	0	1	118	99	12	1	1	1	0	114	125	6	9	0	2	0	142	374
14:45	94	9	3	0	1	0	107	126	8	2	0	1	1	138	153	14	2	0	2	1	172	417
1 Hr	325	46	16	0	1	1	389	402	35	7	2	9	2	457	566	44	14	0	6	3	633	1479
15:00	148	9	4	0	0	0	161	142	4	0	0	2	2	150	115	8	3	0	1	1	128	439

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15:15	118	5	1	0	0	0	124	185	9	1	0	2	0	197	139	8	5	0	2	1	155	476
15:30	131	7	4	0	1	0	143	148	8	1	0	3	0	160	158	12	5	0	5	2	182	485
15:45	125	4	0	0	1	0	130	172	7	0	0	2	0	181	131	8	5	0	2	0	146	457
1 Hr	522	25	9	0	2	0	558	647	28	2	0	9	2	688	543	36	18	0	10	4	611	1857
16:00	186	9	3	0	2	0	200	116	3	2	0	1	2	124	120	11	3	0	8	0	142	466
16:15	149	10	0	0	0	0	159	163	3	1	0	3	0	170	128	13	2	0	1	0	144	473
16:30	117	11	2	0	1	0	131	177	9	1	0	3	0	190	136	16	1	0	3	0	156	477
16:45	95	6	2	0	1	0	104	196	10	2	0	3	1	212	129	17	2	1	1	2	152	468
1 Hr	547	36	7	0	4	0	594	652	25	6	0	10	3	696	513	57	8	1	13	2	594	1884
17:00	161	7	0	0	0	3	171	143	18	3	0	1	0	165	154	15	1	0	3	0	173	509
17:15	118	4	0	0	1	0	123	150	11	3	0	5	3	172	150	17	0	0	1	1	169	464
17:30	90	2	1	0	0	0	93	162	9	0	0	1	0	172	153	10	3	0	2	1	169	434
17:45	91	0	1	0	0	0	92	133	5	0	0	3	4	145	145	8	3	0	3	1	160	397
1 Hr	460	13	2	0	1	3	479	588	43	6	0	10	7	654	602	50	7	0	9	3	671	1804
18:00	85	5	1	0	1	0	92	94	5	0	0	1	0	100	146	11	1	0	2	0	160	352
18:15	82	1	2	0	4	0	89	91	5	0	0	4	1	101	132	6	4	0	1	0	143	333
18:30	78	2	0	0	2	0	82	84	6	0	1	1	0	92	146	4	2	0	1	0	153	327
18:45	57	3	0	0	0	0	60	67	3	1	0	1	1	73	185	7	2	0	0	0	194	327
1 Hr	302	11	3	0	7	0	323	336	19	1	1	7	2	366	609	28	9	0	4	0	650	1339
Total	4036	324	121	6	29	12	4528	4613	359	102	8	86	26	5194	7715	604	212	9	93	38	8671	18393

DESTINATION SUMMARY

	Destination : Arm A							Destination : Arm B							Destination : Arm C							Dest Totals
	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	Car	Lgv	Ogv1	Ogv2	Psv	Mc	Total	
07:00	57	0	0	0	1	0	58	193	4	1	0	1	1	200	76	5	1	0	1	0	83	341
07:15	115	7	4	0	2	2	130	204	6	5	0	0	0	215	90	6	3	0	1	0	100	445
07:30	123	9	3	0	2	0	137	178	6	4	0	5	1	194	151	27	9	0	3	0	190	521
07:45	215	13	4	0	3	0	235	122	10	6	0	6	1	145	156	16	4	0	2	1	179	559
1 Hr	510	29	11	0	8	2	560	697	26	16	0	12	3	754	473	54	17	0	7	1	552	1866
08:00	162	7	5	0	2	0	176	146	8	2	0	2	2	160	161	18	6	0	5	1	191	527
08:15	234	6	3	0	2	2	247	158	8	3	0	3	1	173	143	19	5	0	4	3	174	594
08:30	198	10	2	0	0	1	211	143	10	4	0	5	5	167	178	12	5	2	2	1	200	578
08:45	174	11	2	0	1	0	188	153	17	3	1	2	3	179	126	25	9	0	3	0	163	530
1 Hr	768	34	12	0	5	3	822	600	43	12	1	12	11	679	608	74	25	2	14	5	728	2229
09:00	109	12	4	0	0	0	125	150	10	3	0	2	2	167	126	9	6	0	2	1	144	436
09:15	94	8	3	0	0	0	105	71	10	8	0	1	2	92	96	18	6	1	3	0	124	321
09:30	85	7	1	0	1	0	94	72	8	2	0	2	0	84	100	14	2	0	2	0	118	296
09:45	59	11	3	0	0	0	73	57	9	4	0	2	0	72	94	25	3	0	3	1	126	271
1 Hr	347	38	11	0	1	0	397	350	37	17	0	7	4	415	416	66	17	1	10	2	512	1324

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10:00	63	9	4	0	2	0	78	55	1	0	0	1	1	58	96	16	2	0	2	0	116	252
10:15	59	8	4	0	0	0	71	54	5	4	0	0	1	64	93	12	5	1	1	1	113	248
10:30	77	9	6	0	1	0	93	45	8	6	0	0	0	59	114	14	10	2	0	1	141	293
10:45	62	7	5	0	0	0	74	53	11	2	0	0	0	66	117	10	5	0	2	0	134	274
1 Hr	261	33	19	0	3	0	316	207	25	12	0	1	2	247	420	52	22	3	5	2	504	1067
11:00	50	8	6	0	0	0	64	63	6	2	1	0	1	73	127	15	12	0	0	0	154	291
11:15	64	7	2	0	0	0	73	57	3	3	0	0	0	63	127	9	4	0	1	1	142	278
11:30	70	6	4	1	1	0	82	50	3	3	0	0	0	56	120	5	3	1	0	0	129	267
11:45	70	2	4	0	2	0	78	66	6	2	0	1	1	76	123	11	6	0	2	0	142	296
1 Hr	254	23	16	1	3	0	297	236	18	10	1	1	2	268	497	40	25	1	3	1	567	1132
12:00	48	5	3	0	0	0	56	79	4	1	1	0	0	85	128	12	5	1	1	1	148	289
12:15	64	6	3	1	0	0	74	58	10	1	0	0	0	69	133	3	1	0	2	0	139	282
12:30	97	2	2	0	1	0	102	49	6	1	0	1	0	57	128	6	6	0	0	0	140	299
12:45	82	5	3	0	0	1	91	39	6	3	2	0	0	50	98	12	5	0	1	0	116	257
1 Hr	291	18	11	1	1	1	323	225	26	6	3	1	0	261	487	33	17	1	4	1	543	1127
13:00	94	13	3	0	0	0	110	57	4	3	0	0	0	64	143	11	6	1	0	1	162	336
13:15	101	9	3	0	1	0	114	60	4	2	0	0	2	68	144	11	5	0	1	0	161	343
13:30	85	13	6	0	1	0	105	50	9	2	0	1	0	62	114	13	5	0	1	0	133	300
13:45	96	10	6	0	0	0	112	52	8	0	1	2	1	64	107	17	3	2	1	0	130	306
1 Hr	376	45	18	0	2	0	441	219	25	7	1	3	3	258	508	52	19	3	3	1	586	1285
14:00	107	7	1	0	0	0	115	79	7	3	0	0	1	90	109	17	5	0	2	1	134	339
14:15	77	8	1	0	1	0	87	65	9	1	0	2	1	78	158	14	7	1	4	0	184	349
14:30	99	6	8	0	1	0	114	51	5	1	0	1	0	58	175	21	3	1	1	1	202	374
14:45	111	13	2	0	0	1	127	71	4	0	0	2	0	77	191	14	5	0	2	1	213	417
1 Hr	394	34	12	0	2	1	443	266	25	5	0	5	2	303	633	66	20	2	9	3	733	1479
15:00	77	4	1	0	0	0	82	65	5	3	0	1	1	75	263	12	3	0	2	2	282	439
15:15	65	2	2	0	0	0	69	98	6	3	0	2	1	110	279	14	2	0	2	0	297	476
15:30	77	2	3	0	3	0	85	105	11	2	0	3	2	123	255	14	5	0	3	0	277	485
15:45	84	4	1	0	1	0	90	71	4	4	0	1	0	80	273	11	0	0	3	0	287	457
1 Hr	303	12	7	0	4	0	326	339	26	12	0	7	4	388	1070	51	10	0	10	2	1143	1857
16:00	68	3	2	0	0	0	73	68	8	2	0	9	0	87	286	12	4	0	2	2	306	466
16:15	69	7	1	0	1	0	78	74	8	1	0	1	0	84	297	11	1	0	2	0	311	473
16:30	85	10	1	0	2	0	98	63	8	0	0	3	0	74	282	18	3	0	2	0	305	477
16:45	67	10	1	1	0	0	79	79	8	1	0	1	2	91	274	15	4	0	4	1	298	468
1 Hr	289	30	5	1	3	0	328	284	32	4	0	14	2	336	1139	56	12	0	10	3	1220	1884
17:00	80	7	1	0	1	0	89	88	8	0	0	2	0	98	290	25	3	0	1	3	322	509
17:15	66	6	0	0	0	1	73	101	12	0	0	1	0	114	251	14	3	0	6	3	277	464
17:30	92	3	3	0	1	1	100	78	7	0	0	1	0	86	235	11	1	0	1	0	248	434
17:45	94	5	2	0	1	0	102	70	5	1	0	2	1	79	205	3	1	0	3	4	216	397
1 Hr	332	21	6	0	3	2	364	337	32	1	0	6	1	377	981	53	8	0	11	10	1063	1804
18:00	78	4	1	0	1	0	84	82	7	0	0	1	0	90	165	10	1	0	2	0	178	352

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18:15	92	2	2	0	1	0	97	68	5	2	0	1	0	76	145	5	2	0	7	1	160	333
18:30	110	3	2	0	0	0	115	51	3	0	0	1	0	55	147	6	0	1	3	0	157	327
18:45	149	4	1	0	0	0	154	53	3	1	0	0	0	57	107	6	1	0	1	1	116	327
1 Hr	429	13	6	0	2	0	450	254	18	3	0	3	0	278	564	27	4	1	13	2	611	1339
Total	4554	330	134	3	37	9	5067	4014	333	105	6	72	34	4564	7796	624	196	14	99	33	8762	18393

Appendix 7.2

Capacity Assessment Output Report

Junctions 9

ARCADY 9 - Roundabout Module

Version: 9.0.2.5947
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Filename: Network Model.j9
Path: F:\$Development Planning\Abergelli Power Station, Swansea\Modelling
Report generation date: 30/11/2017 12:31:58

»2017 Base, AM Peak Hour
»2017 Base, PM Peak Hour
»2022 Do Minimum, AM Peak Hour
»2022 Do Minimum, PM Peak Hour
»2022 Do Something, AM Peak Hour
»2022 Do Something, PM Peak Hour
»2022 Do Something + Cumulative Development, AM Peak Hour
»2022 Do Something + Cumulative Development, PM Peak Hour

Summary of junction performance

	AM Peak Hour				PM Peak Hour			
	Queue (Veh)	Delay (s)	RFC	LOS	Queue (Veh)	Delay (s)	RFC	LOS
	[Lane Simulation] - 2017 Base							
Junction 1 - Arm A	1.3	34.12		D	0.3	5.43		A
Junction 1 - Arm C	0.5	3.10		A	0.7	3.87		A
Junction 1 - Arm D	110.7	813.95		F	0.6	6.04		A
Junction 2 - Arm A	22.1	174.69		F	0.5	3.37		A
Junction 2 - Arm B	208.0	878.20		F	1.0	5.81		A
Junction 2 - Arm C	1.6	6.82		A	4.9	12.90		B
Junction 2 - Arm D	35.5	182.47		F	1.3	7.83		A
Junction 2 - Arm E	58.5	638.48		F	0.3	5.54		A
Junction 3 - Arm A	5.6	45.08		E	23.5	130.04		F
Junction 3 - Arm B	2.3	16.59		C	74.4	359.91		F
Junction 3 - Arm C	16.6	52.87		F	2.9	13.37		B
	[Lane Simulation] - 2022 Do Minimum							
Junction 1 - Arm A	1.6	35.48		E	0.3	5.67		A
Junction 1 - Arm C	0.5	3.12		A	0.9	3.92		A
Junction 1 - Arm D	158.1	1026.88		F	0.7	6.41		A
Junction 2 - Arm A	22.1	176.37		F	0.5	3.38		A
Junction 2 - Arm B	261.6	1038.45		F	1.1	6.33		A
Junction 2 - Arm C	1.8	7.40		A	4.8	13.66		B
Junction 2 - Arm D	59.0	297.89		F	1.6	8.86		A
Junction 2 - Arm E	84.2	874.71		F	0.4	5.71		A
Junction 3 - Arm A	7.3	54.91		F	44.1	229.30		F
Junction 3 - Arm B	3.2	19.39		C	110.3	548.72		F
Junction 3 - Arm C	16.6	52.76		F	3.6	14.40		B
	[Lane Simulation] - 2022 Do Something							
Junction 1 - Arm A	1.8	39.27		E	0.5	6.40		A
Junction 1 - Arm C	0.6	3.16		A	0.9	3.95		A
Junction 1 - Arm D	150.0	954.24		F	0.8	6.37		A
Junction 2 - Arm A	21.9	170.25		F	0.5	3.53		A
Junction 2 - Arm B	255.6	997.37		F	1.3	6.81		A
Junction 2 - Arm C	2.2	8.17		A	5.2	14.41		B
Junction 2 - Arm D	70.5	378.35		F	1.8	9.22		A
Junction 2 - Arm E	89.5	919.66		F	0.5	5.89		A
Junction 3 - Arm A	9.3	67.07		F	45.3	235.07		F
Junction 3 - Arm B	4.0	23.34		C	111.5	557.18		F
Junction 3 - Arm C	16.5	52.54		F	3.7	15.05		C
	[Lane Simulation] - 2022 Do Something + Cumulative Development							
Junction 1 - Arm A	4.0	60.44		F	0.8	7.39		A
Junction 1 - Arm C	0.8	3.29		A	1.1	4.27		A
Junction 1 - Arm D	196.2	1098.13		F	0.8	7.21		A
Junction 2 - Arm A	21.9	160.46		F	0.7	3.71		A
Junction 2 - Arm B	289.6	1106.92		F	2.2	9.49		A
Junction 2 - Arm C	2.2	8.59		A	6.6	18.83		C
Junction 2 - Arm D	139.1	703.20		F	2.9	13.06		B
Junction 2 - Arm E	102.2	1013.28		F	0.4	6.40		A
Junction 3 - Arm A	8.9	65.30		F	55.0	304.44		F
Junction 3 - Arm B	4.1	23.49		C	115.0	580.23		F
Junction 3 - Arm C	16.6	52.43		F	4.2	15.98		C

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Arm and junction delays are averages for all movements, including movements with zero delay.

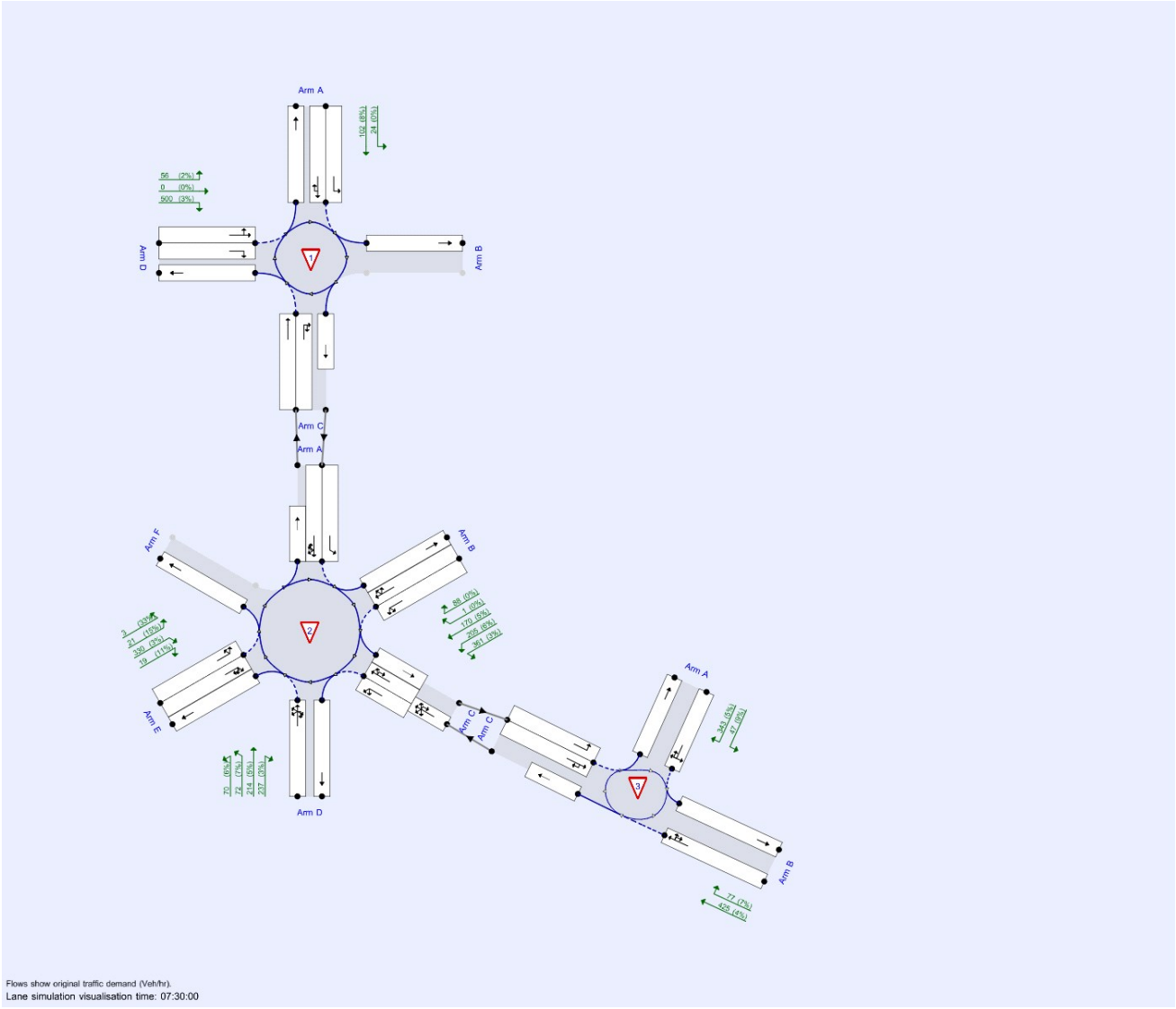
File summary

File Description

Title	M4 Junction 46 and A48/Pant Lasau Road Mini-Roundabout Network
Location	Swansea, Wales
Site number	
Date	30/11/2017
Version	
Status	
Identifier	
Client	Stag Energy
Jobnumber	60542910
Enumerator	EU\Matthew.Davies
Description	Geometric parameters for approach road half-width and entry width have been measured on-site. All other measurements are based on OS mapping.

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	Veh	Veh	perHour	s	-Min	perMin



The junction diagram reflects the last run of Junctions.

Analysis Options

Mini-roundabout model	Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
JUNCTIONS 9	5.75				0.85	36.00	20.00

Lane Simulation options

Stop criteria (%)	Stop criteria time (s)	Stop criteria number of trials	Random seed	Results refresh speed (s)	Individual vehicle animation number of trials	Use crossings quick response	Last run random seed	Last run number of trials	Last run time taken (s)
1.00	100000	100000	-1	3	1	✓	1238323674	486	251.32

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2017 Base	AM Peak Hour	ONE HOUR	07:30	09:00	15	✓
D2	2017 Base	PM Peak Hour	ONE HOUR	16:15	17:45	15	✓
D3	2022 Do Minimum	AM Peak Hour	ONE HOUR	07:30	09:00	15	✓
D4	2022 Do Minimum	PM Peak Hour	ONE HOUR	16:15	17:45	15	✓
D5	2022 Do Something	AM Peak Hour	ONE HOUR	07:30	09:00	15	✓
D6	2022 Do Something	PM Peak Hour	ONE HOUR	16:15	17:45	15	✓
D7	2022 Do Something + Cumulative Development	AM Peak Hour	ONE HOUR	07:30	09:00	15	✓
D8	2022 Do Something + Cumulative Development	PM Peak Hour	ONE HOUR	16:15	17:45	15	✓

Analysis Set Details

ID	Use Lane Simulation	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	✓	100.000	100.000

2017 Base, AM Peak Hour

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Last Run	Lane Simulation	Junction 1 - Arm D - Lane Simulation	Arm D: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm A - Lane Simulation	Arm A: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm B - Lane Simulation	Arm B: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm E - Lane Simulation	Arm E: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 3 - Arm C - Lane Simulation	Arm C: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Warning	Mini-roundabout	Junction 3	Mini-roundabout appears to have unbalanced flows and may behave like a priority junction; treat results with caution. See User Guide for details.[Arms B and C have 83% of the total flow for the roundabout for one or more time segments]
Warning	Linked junction	Junction 1 - Arm C	Linked arm: Junction 1 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 2 - Arm A	Linked arm: Junction 2 Arm A has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 3 - Arm C	Linked arm: Junction 3 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Large Roundabout	Junction 1 - Arm C - Large roundabout data	Large Roundabout Circulating Flow is zero for one or more arms.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	M4 J46 Northern Dumbell Roundabout	Large Roundabout	A, B, C, D	367.03	F
2	M4 J46 Southern Dumbell Roundabout	Large Roundabout	A, B, C, D, E, F	379.00	F
3	A48/Pant Lasau Road Mini-Roundabout	Mini-roundabout	A, B, C	42.78	E

Junction Network Options

Driving side	Lighting	Road surface	In London
Left	Normal/unknown	Normal/unknown	

Arms

Arms

Junction	Arm	Name	Description
1	A	B4489	
	B	M4 EB On-Slip	
	C	A48 Internal	
	D	M4 EB Off-Slip	
2	A	A48 Internal	
	B	M4 WB Off-Slip	
	C	A48 Southeast	
	D	B4489 South	
	E	A48 Southwest	
	F	M4 WB On-Slip	
3	A	Pant Lasau Road	
	B	A48 Southeast	
	C	A48 Northwest	

Roundabout Geometry

Junction	Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	A	7.30	7.30	0.0	20.0	60.0	43.0	
	B							✓
	C	7.30	7.30	0.0	38.0	60.0	0.0	
	D	7.30	7.30	0.0	30.0	60.0	49.0	
2	A	6.90	9.85	10.0	19.0	97.0	46.0	
	B	7.45	7.45	0.0	27.0	97.0	32.0	
	C	4.00	8.35	15.0	40.0	97.0	31.0	
	D	3.85	6.05	10.5	19.0	97.0	45.0	
	E	6.45	8.10	5.0	20.0	97.0	38.0	
	F							✓

Mini Roundabout Geometry

Junction	Arm	Approach road half-width (m)	Minimum approach road half-width (m)	Entry width (m)	Effective flare length (m)	Distance to next arm (m)	Entry corner kerb line distance (m)	Gradient over 50m (%)	Kerbed central island
3	A	5.00	3.20	7.80	4.0	11.00	8.00	0.0	✓
	B	4.50	3.50	4.70	1.0	17.00	18.00	0.0	✓
	C	6.30	6.30	7.50	3.0	12.00	9.00	0.0	✓

Large Roundabout Data

Junction	Arm	Circulating flow (PCU/hr)	Entry-to-exit separation (m)
1	A	868	20.00
	B	603	33.00
	C	0	50.00
	D	546	12.00
2	A	586	41.00
	B	1193	41.00
	C	576	26.00
	D	883	22.00
	E	965	22.00
	F	902	21.00

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Junction	Arm	Final slope	Final intercept (PCU/hr)
1	A	1.114	2737
	B		
	C	1.558	3256
	D	1.185	2819
2	A	1.029	3048
	B	0.896	2775
	C	0.938	2614
	D	0.736	2095
	E	0.896	2735
	F		
3	A	0.525	819
	B	0.619	1069
	C	0.626	1384

The slope and intercept shown above include any corrections and adjustments.

Lane Simulation: Arm options

Junction	Arm	Lane capacity source	Traffic Considering Secondary Lanes (%)
1	A	Evenly split	10.00
	B	Evenly split	10.00
	C	Evenly split	10.00
	D	Evenly split	10.00
2	A	Evenly split	10.00
	B	Evenly split	10.00
	C	Evenly split	10.00
	D	Evenly split	10.00
	E	Evenly split	10.00
	F	Evenly split	10.00
3	A	Evenly split	10.00
	B	Evenly split	10.00
	C	Evenly split	10.00

Lanes

Junction	Arm	Lane level	Lane	Destination arms	Has limited storage	Storage (PCU)	Minimum capacity (PCU/hr)	Maximum capacity (PCU/hr)
1	A	1 [Give-way line]	1	B		Infinity	0	99999
			2	A, C		Infinity	0	99999
	C	1 [Give-way line]	1	A	✓	21.00	0	99999
			2	B, C	✓	21.00	0	99999
	D	1 [Give-way line]	1	A, B		Infinity	0	99999
			2	C		Infinity	0	99999
2	A	1 [Give-way line]	1	C	✓	23.00	0	99999
			2	A, D, E, F	✓	23.00	0	99999
	B	1 [Give-way line]	1	C, D		Infinity	0	99999
			2	A, E, F		Infinity	0	99999
	C	1 [Give-way line]	1	D, E	✓	3.00	0	99999
			2	A, C, F	✓	3.00	0	99999
		2	1	(A, C, D, E, F)	✓	10.00		
	D	1 [Give-way line]	1	A, C, D, E, F		Infinity	0	99999
	E	1 [Give-way line]	1	A, F		Infinity	0	99999
			2	C, D, E		Infinity	0	99999
3	A	1 [Give-way line]	1	A, B, C		Infinity	0	99999
	B	1 [Give-way line]	1	A, B, C		Infinity	0	99999
	C	1 [Give-way line]	1	A	✓	13.00	0	99999
			2	B, C	✓	13.00	0	99999

Entry Lane slope and intercept

Junction	Arm	Lane level	Lane	Final slope	Final intercept (PCU/hr)
1	A	1 [Give-way line]	1	0.557	1368
			2	0.557	1368
	C	1 [Give-way line]	1	0.779	1628
			2	0.779	1628
	D	1 [Give-way line]	1	0.592	1409
			2	0.592	1409
2	A	1 [Give-way line]	1	0.514	1524
			2	0.514	1524
	B	1 [Give-way line]	1	0.448	1388
			2	0.448	1388
	C	1 [Give-way line]	1	0.469	1307
			2	0.469	1307
	D	1 [Give-way line]	1	0.736	2095
	E	1 [Give-way line]	1	0.448	1367
			2	0.448	1367
3	A	1 [Give-way line]	1	0.525	819
	B	1 [Give-way line]	1	0.619	1069
	C	1 [Give-way line]	1	0.313	692
			2	0.313	692

Lane Movements

Junction	Arm	Lane Level	Lane	Destination arm			
				A	B	C	D
1	A	1 [Give-way line]	1		✓		
			2	✓		✓	
	C	1 [Give-way line]	1	✓			
			2		✓	✓	
	D	1 [Give-way line]	1	✓	✓		
			2			✓	

Lane Movements

Junction	Arm	Lane Level	Lane	Destination arm					
				A	B	C	D	E	F
2	A	1 [Give-way line]	1			✓			
			2	✓			✓	✓	✓
	B	1 [Give-way line]	1			✓	✓		
			2	✓				✓	✓
	C	1 [Give-way line]	1				✓	✓	
			2	✓		✓			✓
		2	1	✓		✓	✓	✓	✓
	D	1 [Give-way line]	1	✓		✓	✓	✓	✓
	E	1 [Give-way line]	1	✓					✓
			2			✓	✓	✓	

Lane Movements

Junction	Arm	Lane Level	Lane	Destination arm		
				A	B	C
3	A	1 [Give-way line]	1	✓	✓	✓
	B	1 [Give-way line]	1	✓	✓	✓
	C	1 [Give-way line]	1	✓		
			2		✓	✓

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2017 Base	AM Peak Hour	ONE HOUR	07:30	09:00	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Linked Arm Data

Junction	Arm	Feeding Junction	Feeding Arm	Link Type	Flow source	Uniform flow (Veh/hr)	Flow multiplier (%)	Internal storage space (PCU)
1	C	2	A	Queue limited	Normal	0	100.00	21.00
2	A	1	C	Queue limited	Normal	0	100.00	23.00
	C	3	C	Queue limited	Normal	0	100.00	13.00
3	C	2	C	Queue limited	Normal	0	100.00	13.00

Demand overview (Traffic)

Junction	Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1	A		ONE HOUR	✓	126	100.000
	B					
	C	✓				
	D		ONE HOUR	✓	556	100.000
2	A	✓				
	B		ONE HOUR	✓	825	100.000
	C	✓				
	D		ONE HOUR	✓	593	100.000
	E		ONE HOUR	✓	373	100.000
	F					
3	A		ONE HOUR	✓	390	100.000
	B		ONE HOUR	✓	502	100.000
	C	✓				

Origin-Destination Data

Junction 1

Demand (Veh/hr)

		To			
		A	B	C	D
From	A	0	24	102	0
	B	0	0	0	0
	C	178	367	0	0
	D	56	0	500	0

Junction 2

Demand (Veh/hr)

		To					
		A	B	C	D	E	F
From	A	0	0	514	80	10	2
	B	88	0	361	205	170	1
	C	231	0	0	151	261	120
	D	214	0	237	0	70	72
	E	21	0	330	19	0	3
	F	0	0	0	0	0	0

Junction 3

Demand (Veh/hr)

From \ To	A	B	C
A	0	47	343
B	77	0	425
C	819	618	0

Vehicle Mix

Junction 1

Heavy Vehicle Percentages

From \ To	A	B	C	D
A	0	0	8	0
B	0	0	0	0
C	5	5	0	0
D	2	0	3	0

Junction 2

Heavy Vehicle Percentages

From \ To	A	B	C	D	E	F
A	0	0	4	3	10	0
B	0	0	3	6	5	0
C	8	0	0	5	2	3
D	5	0	3	0	6	7
E	15	0	3	11	0	33
F	0	0	0	0	0	0

Junction 3

Heavy Vehicle Percentages

From \ To	A	B	C
A	0	9	5
B	7	0	4
C	2	5	0

Results

Results Summary for whole modelled period

Junction	Arm	Max delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
1	A	34.12	1.3	D	116	174
	B					
	C	3.10	0.5	A	507	760
	D	813.95	110.7	F	511	766
2	A	174.69	22.1	F	474	711
	B	878.20	208.0	F	760	1139
	C	6.82	1.6	A	704	1056
	D	182.47	35.5	F	542	813
	E	638.48	58.5	F	342	512
	F					
3	A	45.08	5.6	E	358	537
	B	16.59	2.3	C	461	691
	C	52.87	16.6	F	1126	1689

2017 Base, PM Peak Hour

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Last Run	Lane Simulation	Junction 3 - Arm B - Lane Simulation	Arm B: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Warning	Linked junction	Junction 1 - Arm C	Linked arm: Junction 1 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 2 - Arm A	Linked arm: Junction 2 Arm A has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 3 - Arm C	Linked arm: Junction 3 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Large Roundabout	Junction 1 - Arm C - Large roundabout data	Large Roundabout Circulating Flow is zero for one or more arms.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	M4 J46 Northern Dumbell Roundabout	Large Roundabout	A, B, C, D	4.68	A
2	M4 J46 Southern Dumbell Roundabout	Large Roundabout	A, B, C, D, E, F	8.77	A
3	A48/Pant Lasau Road Mini-Roundabout	Mini-roundabout	A, B, C	177.12	F

Junction Network Options

Driving side	Lighting	Road surface	In London
Left	Normal/unknown	Normal/unknown	

Arms

Arms

[same as above]

Roundabout Geometry

[same as above]

Mini Roundabout Geometry

[same as above]

Large Roundabout Data

Junction	Arm	Circulating flow (PCU/hr)	Entry-to-exit separation (m)
1	A	1027	20.00
	B	400	33.00
	C	0	50.00
	D	768	12.00
2	A	290	41.00
	B	692	41.00
	C	555	26.00
	D	1290	22.00
	E	1143	22.00
	F	855	21.00

Slope / Intercept / Capacity
[same as above]

Lane Simulation: Arm options
[same as above]

Lanes
[same as above]

Entry Lane slope and intercept
[same as above]

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2017 Base	PM Peak Hour	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Linked Arm Data

Junction	Arm	Feeding Junction	Feeding Arm	Link Type	Flow source	Uniform flow (Veh/hr)	Flow multiplier (%)	Internal storage space (PCU)
1	C	2	A	Queue limited	Normal	0	100.00	21.00
2	A	1	C	Queue limited	Normal	0	100.00	23.00
	C	3	C	Queue limited	Normal	0	100.00	13.00
3	C	2	C	Queue limited	Normal	0	100.00	13.00

Demand overview (Traffic)

Junction	Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1	A		ONE HOUR	✓	167	100.000
	B					
	C	✓				
	D		ONE HOUR	✓	320	100.000
2	A	✓				
	B		ONE HOUR	✓	573	100.000
	C	✓				
	D		ONE HOUR	✓	556	100.000
	E		ONE HOUR	✓	192	100.000
	F					
3	A		ONE HOUR	✓	547	100.000
	B		ONE HOUR	✓	763	100.000
	C	✓				

Origin-Destination Data

Demand (Veh/hr)

Junction 1

		To			
		A	B	C	D
From	A	0	76	91	0
	B	0	0	0	0
	C	50	718	0	0
	D	11	0	309	0

Junction 2

Demand (Veh/hr)

		To					
		A	B	C	D	E	F
From	A	0	0	261	114	4	23
	B	22	0	184	223	141	3
	C	399	0	0	143	472	226
	D	249	0	135	0	86	86
	E	30	0	129	26	0	7
	F	0	0	0	0	0	0

Junction 3

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	34	513
	B	35	0	728
	C	315	355	0

Vehicle Mix

Junction 1

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	7	0
	B	0	0	0	0
	C	17	2	0	0
	D	0	0	2	0

Junction 2

Heavy Vehicle Percentages

		To					
		A	B	C	D	E	F
From	A	0	0	2	5	0	0
	B	0	0	2	4	4	0
	C	3	0	0	2	2	1
	D	2	0	3	0	5	6
	E	14	0	0	4	0	0
	F	0	0	0	0	0	0

Junction 3

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	3	1
	B	3	0	3
	C	2	2	0

Results

Results Summary for whole modelled period

Junction	Arm	Max delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
1	A	5.43	0.3	A	155	233
	B					
	C	3.87	0.7	A	639	958
	D	6.04	0.6	A	295	443
2	A	3.37	0.5	A	371	556
	B	5.81	1.0	A	525	788
	C	12.90	4.9	B	1123	1684
	D	7.83	1.3	A	513	769
	E	5.54	0.3	A	176	264
	F					
3	A	130.04	23.5	F	502	752
	B	359.91	74.4	F	705	1057
	C	13.37	2.9	B	652	977

2022 Do Minimum, AM Peak Hour

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Last Run	Lane Simulation	Junction 1 - Arm D - Lane Simulation	Arm D: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm A - Lane Simulation	Arm A: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm B - Lane Simulation	Arm B: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm D - Lane Simulation	Arm D: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm E - Lane Simulation	Arm E: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 3 - Arm C - Lane Simulation	Arm C: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Warning	Mini-roundabout	Junction 3	Mini-roundabout appears to have unbalanced flows and may behave like a priority junction; treat results with caution. See User Guide for details.[Arms B and C have 83% of the total flow for the roundabout for one or more time segments]
Warning	Linked junction	Junction 1 - Arm C	Linked arm: Junction 1 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 2 - Arm A	Linked arm: Junction 2 Arm A has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 3 - Arm C	Linked arm: Junction 3 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Large Roundabout	Junction 1 - Arm C - Large roundabout data	Large Roundabout Circulating Flow is zero for one or more arms.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	M4 J46 Northern Dumbell Roundabout	Large Roundabout	A, B, C, D	462.87	F
2	M4 J46 Southern Dumbell Roundabout	Large Roundabout	A, B, C, D, E, F	476.81	F
3	A48/Pant Lasau Road Mini-Roundabout	Mini-roundabout	A, B, C	45.02	E

Junction Network Options

Driving side	Lighting	Road surface	In London
Left	Normal/unknown	Normal/unknown	

Arms

Arms

[same as above]

Roundabout Geometry

[same as above]

Mini Roundabout Geometry

[same as above]

Large Roundabout Data

Junction	Arm	Circulating flow (PCU/hr)	Entry-to-exit separation (m)
1	A	921	20.00
	B	639	33.00
	C	0	50.00
	D	579	12.00
2	A	622	41.00
	B	1265	41.00
	C	611	26.00
	D	937	22.00
	E	1023	22.00
	F	957	21.00

Slope / Intercept / Capacity

[same as above]

Lane Simulation: Arm options

[same as above]

Lanes

[same as above]

Entry Lane slope and intercept

[same as above]

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2022 Do Minimum	AM Peak Hour	ONE HOUR	07:30	09:00	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Linked Arm Data

Junction	Arm	Feeding Junction	Feeding Arm	Link Type	Flow source	Uniform flow (Veh/hr)	Flow multiplier (%)	Internal storage space (PCU)
1	C	2	A	Queue limited	Normal	0	100.00	21.00
2	A	1	C	Queue limited	Normal	0	100.00	23.00
	C	3	C	Queue limited	Normal	0	100.00	13.00
3	C	2	C	Queue limited	Normal	0	100.00	13.00

Demand overview (Traffic)

Junction	Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1	A		ONE HOUR	✓	133	100.000
	B					
	C	✓				
	D		ONE HOUR	✓	590	100.000
2	A	✓				
	B		ONE HOUR	✓	876	100.000
	C	✓				
	D		ONE HOUR	✓	630	100.000
	E		ONE HOUR	✓	395	100.000
	F					
3	A		ONE HOUR	✓	413	100.000
	B		ONE HOUR	✓	533	100.000
	C	✓				

Origin-Destination Data

Junction 1

Demand (Veh/hr)

		To			
		A	B	C	D
From	A	0	25	108	0
	B	0	0	0	0
	C	189	390	0	0
	D	59	0	531	0

Junction 2

Demand (Veh/hr)

		To					
		A	B	C	D	E	F
From	A	0	0	545	85	11	2
	B	93	0	383	218	181	1
	C	245	0	0	160	277	127
	D	227	0	252	0	74	77
	E	22	0	350	20	0	3
	F	0	0	0	0	0	0

Junction 3

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	50	363
	B	82	0	451
	C	869	656	0

Vehicle Mix

Junction 1

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	8	0
	B	0	0	0	0
	C	5	5	0	0
	D	2	0	3	0

Junction 2

Heavy Vehicle Percentages

		To					
		A	B	C	D	E	F
From	A	0	0	4	3	10	0
	B	0	0	3	6	5	0
	C	8	0	0	5	2	3
	D	5	0	3	0	6	7
	E	15	0	3	11	0	33
	F	0	0	0	0	0	0

Junction 3

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	9	5
	B	7	0	4
	C	2	5	0

Results

Results Summary for whole modelled period

Junction	Arm	Max delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
1	A	35.48	1.6	E	122	184
	B					
	C	3.12	0.5	A	532	798
	D	1026.88	158.1	F	539	808
2	A	176.37	22.1	F	470	704
	B	1038.45	261.6	F	805	1207
	C	7.40	1.8	A	741	1112
	D	297.89	59.0	F	577	866
	E	874.71	84.2	F	360	540
	F					
3	A	54.91	7.3	F	378	567
	B	19.39	3.2	C	485	728
	C	52.76	16.6	F	1130	1695

2022 Do Minimum, PM Peak Hour

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Last Run	Lane Simulation	Junction 3 - Arm B - Lane Simulation	Arm B: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Warning	Linked junction	Junction 1 - Arm C	Linked arm: Junction 1 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 2 - Arm A	Linked arm: Junction 2 Arm A has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 3 - Arm C	Linked arm: Junction 3 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Large Roundabout	Junction 1 - Arm C - Large roundabout data	Large Roundabout Circulating Flow is zero for one or more arms.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	M4 J46 Northern Dumbell Roundabout	Large Roundabout	A, B, C, D	4.85	A
2	M4 J46 Southern Dumbell Roundabout	Large Roundabout	A, B, C, D, E, F	9.34	A
3	A48/Pant Lasau Road Mini-Roundabout	Mini-roundabout	A, B, C	275.70	F

Junction Network Options

Driving side	Lighting	Road surface	In London
Left	Normal/unknown	Normal/unknown	

Arms

Arms

[same as above]

Roundabout Geometry

[same as above]

Mini Roundabout Geometry

[same as above]

Large Roundabout Data

Junction	Arm	Circulating flow (PCU/hr)	Entry-to-exit separation (m)
1	A	1088	20.00
	B	424	33.00
	C	0	50.00
	D	813	12.00
2	A	308	41.00
	B	733	41.00
	C	588	26.00
	D	1366	22.00
	E	1210	22.00
	F	905	21.00

Slope / Intercept / Capacity
[same as above]

Lane Simulation: Arm options
[same as above]

Lanes
[same as above]

Entry Lane slope and intercept
[same as above]

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D4	2022 Do Minimum	PM Peak Hour	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Linked Arm Data

Junction	Arm	Feeding Junction	Feeding Arm	Link Type	Flow source	Uniform flow (Veh/hr)	Flow multiplier (%)	Internal storage space (PCU)
1	C	2	A	Queue limited	Normal	0	100.00	21.00
2	A	1	C	Queue limited	Normal	0	100.00	23.00
	C	3	C	Queue limited	Normal	0	100.00	13.00
3	C	2	C	Queue limited	Normal	0	100.00	13.00

Demand overview (Traffic)

Junction	Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1	A		ONE HOUR	✓	177	100.000
	B					
	C	✓				
	D		ONE HOUR	✓	339	100.000
2	A	✓				
	B		ONE HOUR	✓	606	100.000
	C	✓				
	D		ONE HOUR	✓	589	100.000
	E		ONE HOUR	✓	204	100.000
	F					
3	A		ONE HOUR	✓	579	100.000
	B		ONE HOUR	✓	809	100.000
	C	✓				

Origin-Destination Data

Demand (Veh/hr)

Junction 1

		To			
		A	B	C	D
From	A	0	81	96	0
	B	0	0	0	0
	C	53	761	0	0
	D	12	0	327	0

Junction 2

Demand (Veh/hr)

		To					
		A	B	C	D	E	F
From	A	0	0	277	120	4	24
	B	23	0	195	236	149	3
	C	422	0	0	151	500	240
	D	264	0	143	0	91	91
	E	32	0	137	27	0	8
	F	0	0	0	0	0	0

Junction 3

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	36	543
	B	37	0	772
	C	334	376	0

Vehicle Mix

Junction 1

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	7	0
	B	0	0	0	0
	C	17	2	0	0
	D	0	0	2	0

Junction 2

Heavy Vehicle Percentages

		To					
		A	B	C	D	E	F
From	A	0	0	2	5	0	0
	B	0	0	2	4	4	0
	C	3	0	0	2	2	1
	D	2	0	3	0	5	6
	E	14	0	0	4	0	0
	F	0	0	0	0	0	0

Junction 3

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	3	1
	B	3	0	3
	C	2	2	0

Results

Results Summary for whole modelled period

Junction	Arm	Max delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
1	A	5.67	0.3	A	164	247
	B					
	C	3.92	0.9	A	662	993
	D	6.41	0.7	A	312	469
2	A	3.38	0.5	A	390	585
	B	6.33	1.1	A	554	831
	C	13.66	4.8	B	1152	1727
	D	8.86	1.6	A	540	811
	E	5.71	0.4	A	190	284
	F					
3	A	229.30	44.1	F	531	796
	B	548.72	110.3	F	742	1113
	C	14.40	3.6	B	689	1033

2022 Do Something, AM Peak Hour

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Last Run	Lane Simulation	Junction 1 - Arm D - Lane Simulation	Arm D: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm A - Lane Simulation	Arm A: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm B - Lane Simulation	Arm B: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm D - Lane Simulation	Arm D: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm E - Lane Simulation	Arm E: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 3 - Arm C - Lane Simulation	Arm C: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Warning	Mini-roundabout	Junction 3	Mini-roundabout appears to have unbalanced flows and may behave like a priority junction; treat results with caution. See User Guide for details.[Arms B and C have 82% of the total flow for the roundabout for one or more time segments]
Warning	Linked junction	Junction 1 - Arm C	Linked arm: Junction 1 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 2 - Arm A	Linked arm: Junction 2 Arm A has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 3 - Arm C	Linked arm: Junction 3 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Large Roundabout	Junction 1 - Arm C - Large roundabout data	Large Roundabout Circulating Flow is zero for one or more arms.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	M4 J46 Northern Dumbell Roundabout	Large Roundabout	A, B, C, D	415.48	F
2	M4 J46 Southern Dumbell Roundabout	Large Roundabout	A, B, C, D, E, F	484.17	F
3	A48/Pant Lasau Road Mini-Roundabout	Mini-roundabout	A, B, C	48.13	E

Junction Network Options

Driving side	Lighting	Road surface	In London
Left	Normal/unknown	Normal/unknown	

Arms

Arms
[same as above]

Roundabout Geometry
[same as above]

Mini Roundabout Geometry
[same as above]

Large Roundabout Data

Junction	Arm	Circulating flow (PCU/hr)	Entry-to-exit separation (m)
1	A	921	20.00
	B	647	33.00
	C	0	50.00
	D	635	12.00
2	A	622	41.00
	B	1273	41.00
	C	633	26.00
	D	980	22.00
	E	1085	22.00
	F	1012	21.00

Slope / Intercept / Capacity
[same as above]

Lane Simulation: Arm options
[same as above]

Lanes
[same as above]

Entry Lane slope and intercept
[same as above]

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D5	2022 Do Something	AM Peak Hour	ONE HOUR	07:30	09:00	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Linked Arm Data

Junction	Arm	Feeding Junction	Feeding Arm	Link Type	Flow source	Uniform flow (Veh/hr)	Flow multiplier (%)	Internal storage space (PCU)
1	C	2	A	Queue limited	Normal	0	100.00	21.00
2	A	1	C	Queue limited	Normal	0	100.00	23.00
	C	3	C	Queue limited	Normal	0	100.00	13.00
3	C	2	C	Queue limited	Normal	0	100.00	13.00

Demand overview (Traffic)

Junction	Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1	A		ONE HOUR	✓	149	100.000
	B					
	C	✓				
	D		ONE HOUR	✓	613	100.000
2	A	✓				
	B		ONE HOUR	✓	891	100.000
	C	✓				
	D		ONE HOUR	✓	648	100.000
	E		ONE HOUR	✓	397	100.000
	F					
3	A		ONE HOUR	✓	422	100.000
	B		ONE HOUR	✓	544	100.000
	C	✓				

Origin-Destination Data

Junction 1

Demand (Veh/hr)

		To			
		A	B	C	D
From	A	0	33	116	0
	B	0	0	0	0
	C	245	390	0	0
	D	82	0	531	0

Junction 2

Demand (Veh/hr)

		To					
		A	B	C	D	E	F
From	A	0	0	545	85	11	10
	B	108	0	383	218	181	1
	C	265	0	0	160	277	127
	D	245	0	252	0	74	77
	E	24	0	350	20	0	3
	F	0	0	0	0	0	0

Junction 3

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	50	372
	B	82	0	462
	C	869	656	0

Vehicle Mix

Junction 1

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	23	14	0
	B	0	0	0	0
	C	7	5	0	0
	D	11	0	3	0

Junction 2

Heavy Vehicle Percentages

		To					
		A	B	C	D	E	F
From	A	0	0	4	3	10	77
	B	7	0	3	6	5	0
	C	7	0	0	5	2	3
	D	4	0	3	0	6	7
	E	14	0	3	11	0	33
	F	0	0	0	0	0	0

Junction 3

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	9	5
	B	7	0	4
	C	2	5	0

Results

Results Summary for whole modelled period

Junction	Arm	Max delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
1	A	39.27	1.8	E	136	205
	B					
	C	3.16	0.6	A	585	877
	D	954.24	150.0	F	559	839
2	A	170.25	21.9	F	485	727
	B	997.37	255.6	F	818	1227
	C	8.17	2.2	A	765	1147
	D	378.35	70.5	F	596	894
	E	919.66	89.5	F	364	547
	F					
3	A	67.07	9.3	F	388	582
	B	23.34	4.0	C	498	747
	C	52.54	16.5	F	1129	1693

2022 Do Something, PM Peak Hour

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Last Run	Lane Simulation	Junction 3 - Arm B - Lane Simulation	Arm B: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Warning	Linked junction	Junction 1 - Arm C	Linked arm: Junction 1 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 2 - Arm A	Linked arm: Junction 2 Arm A has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 3 - Arm C	Linked arm: Junction 3 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Large Roundabout	Junction 1 - Arm C - Large roundabout data	Large Roundabout Circulating Flow is zero for one or more arms.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	M4 J46 Northern Dumbell Roundabout	Large Roundabout	A, B, C, D	5.06	A
2	M4 J46 Southern Dumbell Roundabout	Large Roundabout	A, B, C, D, E, F	9.74	A
3	A48/Pant Lasau Road Mini-Roundabout	Mini-roundabout	A, B, C	278.15	F

Junction Network Options

Driving side	Lighting	Road surface	In London
Left	Normal/unknown	Normal/unknown	

Arms

Arms

[same as above]

Roundabout Geometry

[same as above]

Mini Roundabout Geometry

[same as above]

Large Roundabout Data

Junction	Arm	Circulating flow (PCU/hr)	Entry-to-exit separation (m)
1	A	1088	20.00
	B	465	33.00
	C	0	50.00
	D	821	12.00
2	A	308	41.00
	B	775	41.00
	C	615	26.00
	D	1383	22.00
	E	1227	22.00
	F	913	21.00

Slope / Intercept / Capacity
[same as above]

Lane Simulation: Arm options
[same as above]

Lanes
[same as above]

Entry Lane slope and intercept
[same as above]

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D6	2022 Do Something	PM Peak Hour	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Linked Arm Data

Junction	Arm	Feeding Junction	Feeding Arm	Link Type	Flow source	Uniform flow (Veh/hr)	Flow multiplier (%)	Internal storage space (PCU)
1	C	2	A	Queue limited	Normal	0	100.00	21.00
2	A	1	C	Queue limited	Normal	0	100.00	23.00
	C	3	C	Queue limited	Normal	0	100.00	13.00
3	C	2	C	Queue limited	Normal	0	100.00	13.00

Demand overview (Traffic)

Junction	Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1	A		ONE HOUR	✓	255	100.000
	B					
	C	✓				
	D		ONE HOUR	✓	347	100.000
2	A	✓				
	B		ONE HOUR	✓	613	100.000
	C	✓				
	D		ONE HOUR	✓	589	100.000
	E		ONE HOUR	✓	204	100.000
	F					
3	A		ONE HOUR	✓	579	100.000
	B		ONE HOUR	✓	809	100.000
	C	✓				

Origin-Destination Data

Demand (Veh/hr)

Junction 1

		To			
		A	B	C	D
From	A	0	117	138	0
	B	0	0	0	0
	C	60	761	0	0
	D	20	0	327	0

Junction 2

Demand (Veh/hr)

		To					
		A	B	C	D	E	F
From	A	0	0	299	130	5	34
	B	30	0	195	236	149	3
	C	422	0	0	151	500	240
	D	264	0	143	0	91	91
	E	32	0	137	27	0	8
	F	0	0	0	0	0	0

Junction 3

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	36	543
	B	37	0	772
	C	344	388	0

Vehicle Mix

Junction 1

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	6	10	0
	B	0	0	0	0
	C	27	2	0	0
	D	38	0	2	0

Junction 2

Heavy Vehicle Percentages

		To					
		A	B	C	D	E	F
From	A	0	0	2	4	0	22
	B	25	0	2	4	4	0
	C	3	0	0	2	2	1
	D	2	0	3	0	5	6
	E	14	0	0	4	0	0
	F	0	0	0	0	0	0

Junction 3

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	3	1
	B	3	0	3
	C	2	2	0

Results

Results Summary for whole modelled period

Junction	Arm	Max delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
1	A	6.40	0.5	A	235	352
	B					
	C	3.95	0.9	A	667	1001
	D	6.37	0.8	A	316	475
2	A	3.53	0.5	A	426	639
	B	6.81	1.3	A	563	844
	C	14.41	5.2	B	1152	1729
	D	9.22	1.8	A	541	811
	E	5.89	0.5	A	187	280
	F					
3	A	235.07	45.3	F	531	797
	B	557.18	111.5	F	741	1111
	C	15.05	3.7	C	707	1061

2022 Do Something + Cumulative Development, AM Peak Hour

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Last Run	Lane Simulation	Junction 1 - Arm D - Lane Simulation	Arm D: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm A - Lane Simulation	Arm A: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm B - Lane Simulation	Arm B: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm D - Lane Simulation	Arm D: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 2 - Arm E - Lane Simulation	Arm E: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 3 - Arm C - Lane Simulation	Arm C: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Warning	Mini-roundabout	Junction 3	Mini-roundabout appears to have unbalanced flows and may behave like a priority junction; treat results with caution. See User Guide for details.[Arms B and C have 83% of the total flow for the roundabout for one or more time segments]
Warning	Linked junction	Junction 1 - Arm C	Linked arm: Junction 1 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 2 - Arm A	Linked arm: Junction 2 Arm A has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 3 - Arm C	Linked arm: Junction 3 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Large Roundabout	Junction 1 - Arm C - Large roundabout data	Large Roundabout Circulating Flow is zero for one or more arms.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	M4 J46 Northern Dumbell Roundabout	Large Roundabout	A, B, C, D	447.64	F
2	M4 J46 Southern Dumbell Roundabout	Large Roundabout	A, B, C, D, E, F	595.35	F
3	A48/Pant Lasau Road Mini-Roundabout	Mini-roundabout	A, B, C	47.71	E

Junction Network Options

Driving side	Lighting	Road surface	In London
Left	Normal/unknown	Normal/unknown	

Arms

Arms
[same as above]

Roundabout Geometry
[same as above]

Mini Roundabout Geometry
[same as above]

Large Roundabout Data

Junction	Arm	Circulating flow (PCU/hr)	Entry-to-exit separation (m)
1	A	1024	20.00
	B	709	33.00
	C	0	50.00
	D	749	12.00
2	A	657	41.00
	B	1370	41.00
	C	705	26.00
	D	996	22.00
	E	1232	22.00
	F	1142	21.00

Slope / Intercept / Capacity
[same as above]

Lane Simulation: Arm options
[same as above]

Lanes
[same as above]

Entry Lane slope and intercept
[same as above]

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D7	2022 Do Something + Cumulative Development	AM Peak Hour	ONE HOUR	07:30	09:00	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Linked Arm Data

Junction	Arm	Feeding Junction	Feeding Arm	Link Type	Flow source	Uniform flow (Veh/hr)	Flow multiplier (%)	Internal storage space (PCU)
1	C	2	A	Queue limited	Normal	0	100.00	21.00
2	A	1	C	Queue limited	Normal	0	100.00	23.00
	C	3	C	Queue limited	Normal	0	100.00	13.00
3	C	2	C	Queue limited	Normal	0	100.00	13.00

Demand overview (Traffic)

Junction	Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1	A		ONE HOUR	✓	214	100.000
	B					
	C	✓				
	D		ONE HOUR	✓	632	100.000
2	A	✓				
	B		ONE HOUR	✓	939	100.000
	C	✓				
	D		ONE HOUR	✓	789	100.000
	E		ONE HOUR	✓	412	100.000
	F					
3	A		ONE HOUR	✓	428	100.000
	B		ONE HOUR	✓	552	100.000
	C	✓				

Origin-Destination Data

Junction 1

Demand (Veh/hr)

		To			
		A	B	C	D
From	A	0	47	167	0
	B	0	0	0	0
	C	268	481	0	0
	D	90	0	542	0

Junction 2

Demand (Veh/hr)

		To					
		A	B	C	D	E	F
From	A	0	0	588	104	12	10
	B	116	0	383	258	181	1
	C	273	0	0	166	277	127
	D	344	0	272	0	83	90
	E	24	0	362	23	0	3
	F	0	0	0	0	0	0

Junction 3

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	50	378
	B	82	0	470
	C	912	688	0

Vehicle Mix

Junction 1

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	20	10	0
	B	0	0	0	0
	C	7	4	0	0
	D	10	0	4	0

Junction 2

Heavy Vehicle Percentages

		To					
		A	B	C	D	E	F
From	A	0	0	4	4	9	76
	B	9	0	3	5	5	0
	C	7	0	0	5	2	3
	D	4	0	3	0	5	8
	E	13	0	2	9	0	33
	F	0	0	0	0	0	0

Junction 3

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	9	5
	B	7	0	4
	C	2	4	0

Results

Results Summary for whole modelled period

Junction	Arm	Max delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
1	A	60.44	4.0	F	196	293
	B					
	C	3.29	0.8	A	666	999
	D	1098.13	196.2	F	579	868
2	A	160.46	21.9	F	508	762
	B	1106.92	289.6	F	858	1287
	C	8.59	2.2	A	775	1162
	D	703.20	139.1	F	724	1086
	E	1013.28	102.2	F	379	569
	F					
3	A	65.30	8.9	F	393	589
	B	23.49	4.1	C	505	758
	C	52.43	16.6	F	1134	1701

2022 Do Something + Cumulative Development, PM Peak Hour

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Lane Simulation	A1 - [Lane Simulation]	This analysis set uses Lane Simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.
Last Run	Lane Simulation	Junction 3 - Arm A - Lane Simulation	Arm A: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Last Run	Lane Simulation	Junction 3 - Arm B - Lane Simulation	Arm B: Queue at end of modelled period is greater than 10 PCU. Delay is likely to have been underestimated.
Warning	Linked junction	Junction 1 - Arm C	Linked arm: Junction 1 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 2 - Arm A	Linked arm: Junction 2 Arm A has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Linked junction	Junction 3 - Arm C	Linked arm: Junction 3 Arm C has more than one lane at its upstream end. It is recommended that the upstream lane level for a linked arm should have only one lane (if necessary add a dummy lane level to do this)
Warning	Large Roundabout	Junction 1 - Arm C - Large roundabout data	Large Roundabout Circulating Flow is zero for one or more arms.

Junction Network

Junctions

Junction	Name	Junction Type	Arm order	Junction Delay (s)	Junction LOS
1	M4 J46 Northern Dumbell Roundabout	Large Roundabout	A, B, C, D	5.69	A
2	M4 J46 Southern Dumbell Roundabout	Large Roundabout	A, B, C, D, E, F	12.55	B
3	A48/Pant Lasau Road Mini-Roundabout	Mini-roundabout	A, B, C	300.73	F

Junction Network Options

Driving side	Lighting	Road surface	In London
Left	Normal/unknown	Normal/unknown	

Arms

Arms

[same as above]

Roundabout Geometry

[same as above]

Mini Roundabout Geometry

[same as above]

Large Roundabout Data

Junction	Arm	Circulating flow (PCU/hr)	Entry-to-exit separation (m)
1	A	1185	20.00
	B	515	33.00
	C	0	50.00
	D	903	12.00
2	A	335	41.00
	B	852	41.00
	C	770	26.00
	D	1410	22.00
	E	1348	22.00
	F	1006	21.00

Slope / Intercept / Capacity

[same as above]

Lane Simulation: Arm options

[same as above]

Lanes

[same as above]

Entry Lane slope and intercept

[same as above]

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D8	2022 Do Something + Cumulative Development	PM Peak Hour	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Linked Arm Data

Junction	Arm	Feeding Junction	Feeding Arm	Link Type	Flow source	Uniform flow (Veh/hr)	Flow multiplier (%)	Internal storage space (PCU)
1	C	2	A	Queue limited	Normal	0	100.00	21.00
2	A	1	C	Queue limited	Normal	0	100.00	23.00
	C	3	C	Queue limited	Normal	0	100.00	13.00
3	C	2	C	Queue limited	Normal	0	100.00	13.00

Demand overview (Traffic)

Junction	Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1	A		ONE HOUR	✓	319	100.000
	B					
	C	✓				
	D		ONE HOUR	✓	364	100.000
2	A	✓				
	B		ONE HOUR	✓	728	100.000
	C	✓				
	D		ONE HOUR	✓	713	100.000
	E		ONE HOUR	✓	215	100.000
	F					
3	A		ONE HOUR	✓	579	100.000
	B		ONE HOUR	✓	809	100.000
	C	✓				

Origin-Destination Data

Junction 1

Demand (Veh/hr)

		To			
		A	B	C	D
From	A	0	148	171	0
	B	0	0	0	0
	C	62	841	0	0
	D	20	0	344	0

Junction 2

Demand (Veh/hr)

		To					
		A	B	C	D	E	F
From	A	0	0	319	155	5	38
	B	32	0	195	349	149	3
	C	422	0	0	176	520	240
	D	344	0	159	0	102	108
	E	32	0	137	38	0	8
	F	0	0	0	0	0	0

Junction 3

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	36	543
	B	37	0	772
	C	344	388	0

Vehicle Mix

Junction 1

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	7	8	0
	B	0	0	0	0
	C	29	2	0	0
	D	38	0	2	0

Junction 2

Heavy Vehicle Percentages

		To					
		A	B	C	D	E	F
From	A	0	0	2	4	0	21
	B	29	0	2	3	4	0
	C	3	0	0	2	2	1
	D	2	0	3	0	4	6
	E	14	0	0	3	0	0
	F	0	0	0	0	0	0

Junction 3

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	3	1
	B	3	0	3
	C	2	2	0

Results

Results Summary for whole modelled period

Junction	Arm	Max delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
1	A	7.39	0.8	A	293	440
	B					
	C	4.27	1.1	A	726	1089
	D	7.21	0.8	A	333	500
2	A	3.71	0.7	A	473	709
	B	9.49	2.2	A	662	994
	C	18.83	6.6	C	1145	1717
	D	13.06	2.9	B	651	977
	E	6.40	0.4	A	196	294
	F					
3	A	304.44	55.0	F	532	798
	B	580.23	115.0	F	741	1111
	C	15.98	4.2	C	742	1112