The Abergelli Power Gas Fired Generating Station Order

6.2 Environmental Statement Appendices - Volume G Water

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The Infrastructure Planning
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Appendix 9.1

Flood Consequence Assessment

Abergelli Power Project

Flood Consequence Assessment

Abergelli Power Limited

May 2018

Quality information

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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.

11. References

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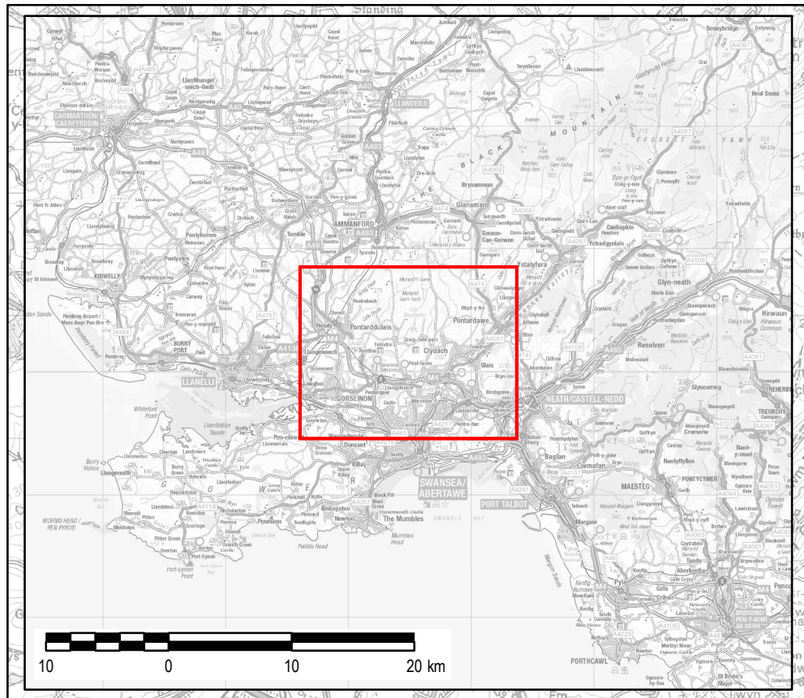
Appendix A – Project Site

A.1 Location Plan



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www.aecom.com

Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

Project Site boundary

Copyright:

AECOM Internal Project No:

60542910

Drawing Title:

APPENDIX A
LOCATION PLAN

Scale at A3: 1:50,000

Drawing No:			Rev:
FIGURE A1			001
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GM	NW	CA	02/05/18

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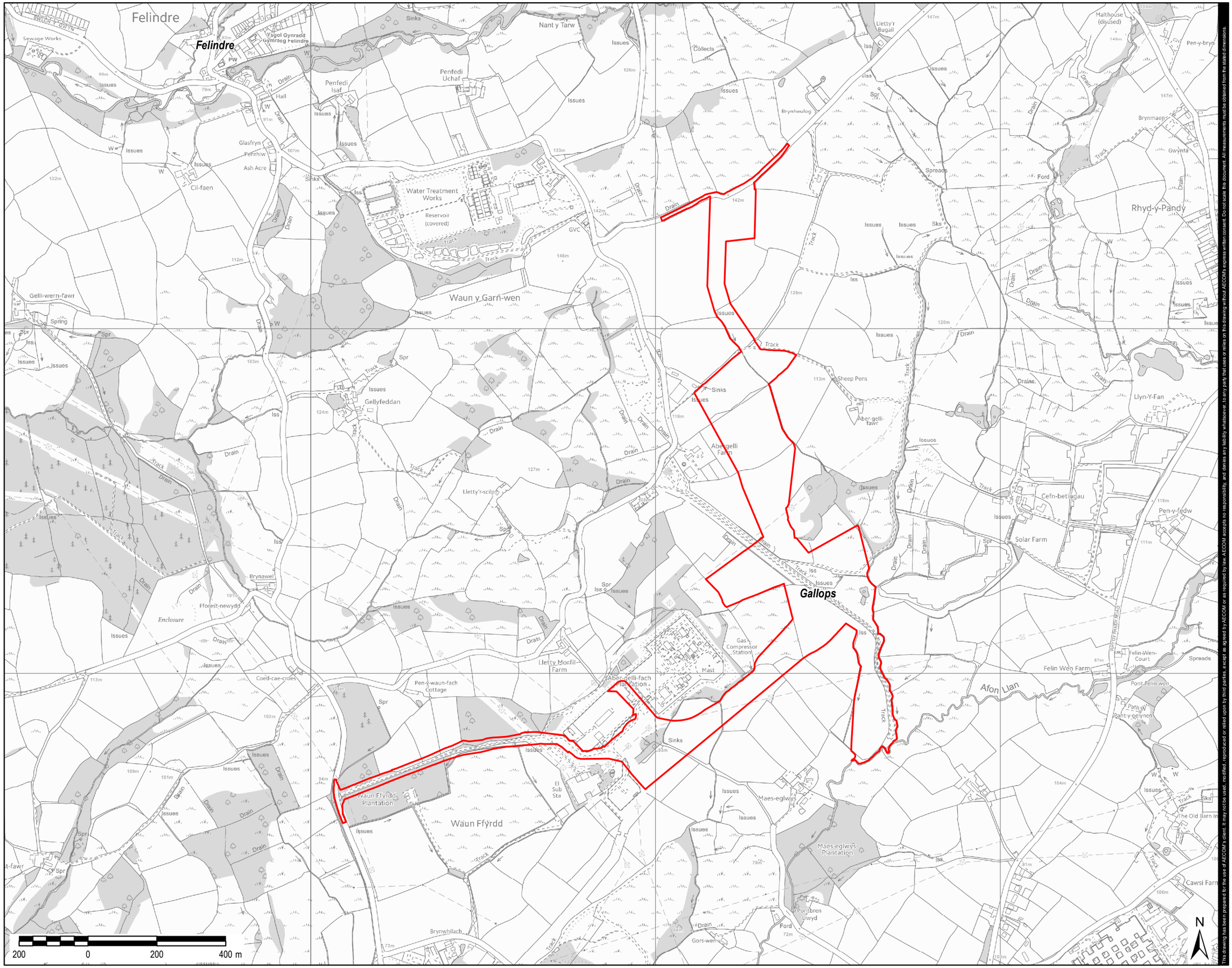
A.2 Project Site



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Client:

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A Drax Group company

LEGEND

Project Site boundary

AECOM Internal Project No:

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Drawing Title:

APPENDIX A
PROJECT SITE

Scale at A3: 1:10,000

Drawing No:			Rev:
FIGURE A2			001
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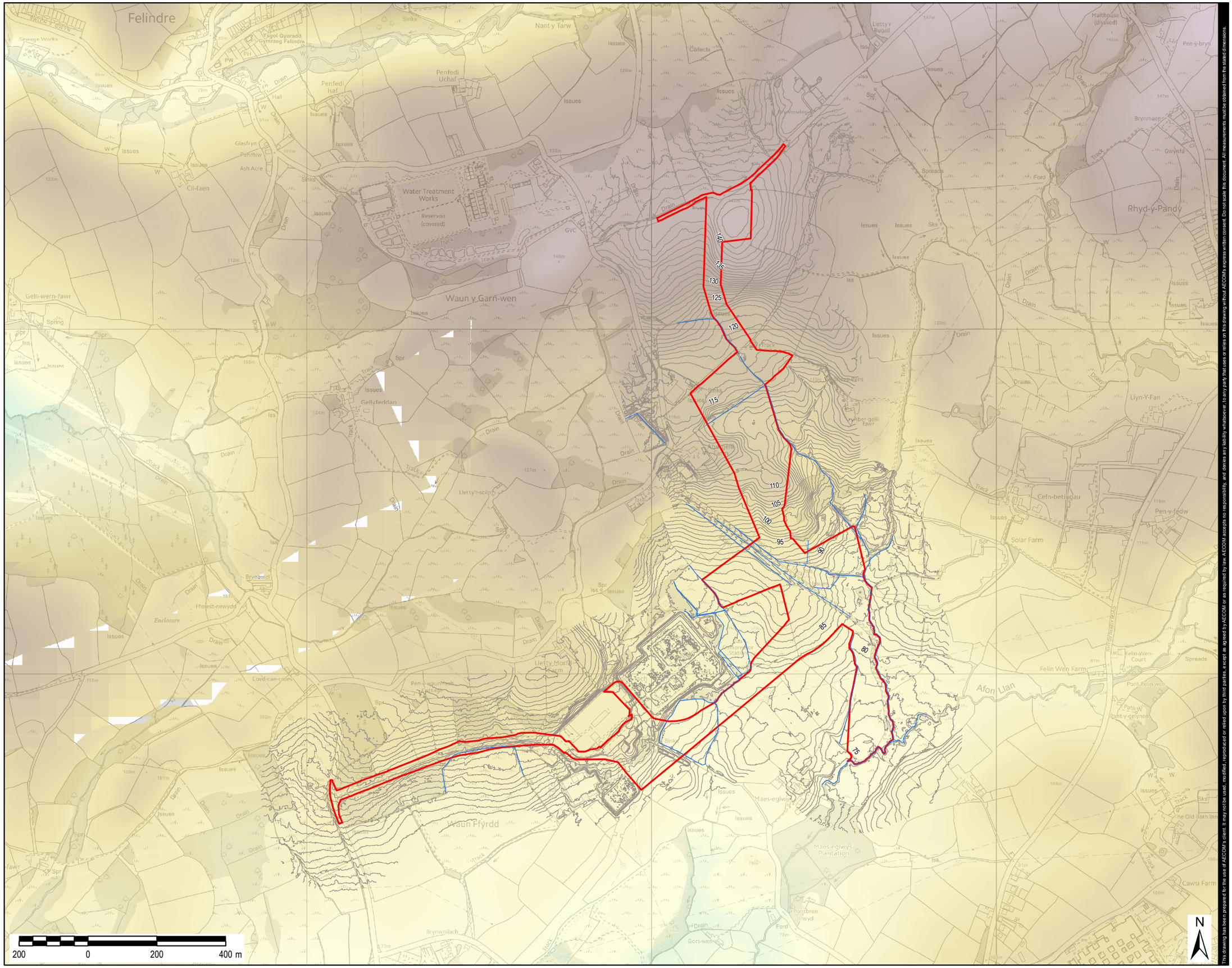
GM	NW	CA	02/05/18

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

AECOM Internal Project No:

60542910

Drawing Title:

APPENDIX B
EXISTING SITE LEVELS

Scale at A3: 1:10,000

Drawing No:			Rev:
FIGURE B1			001
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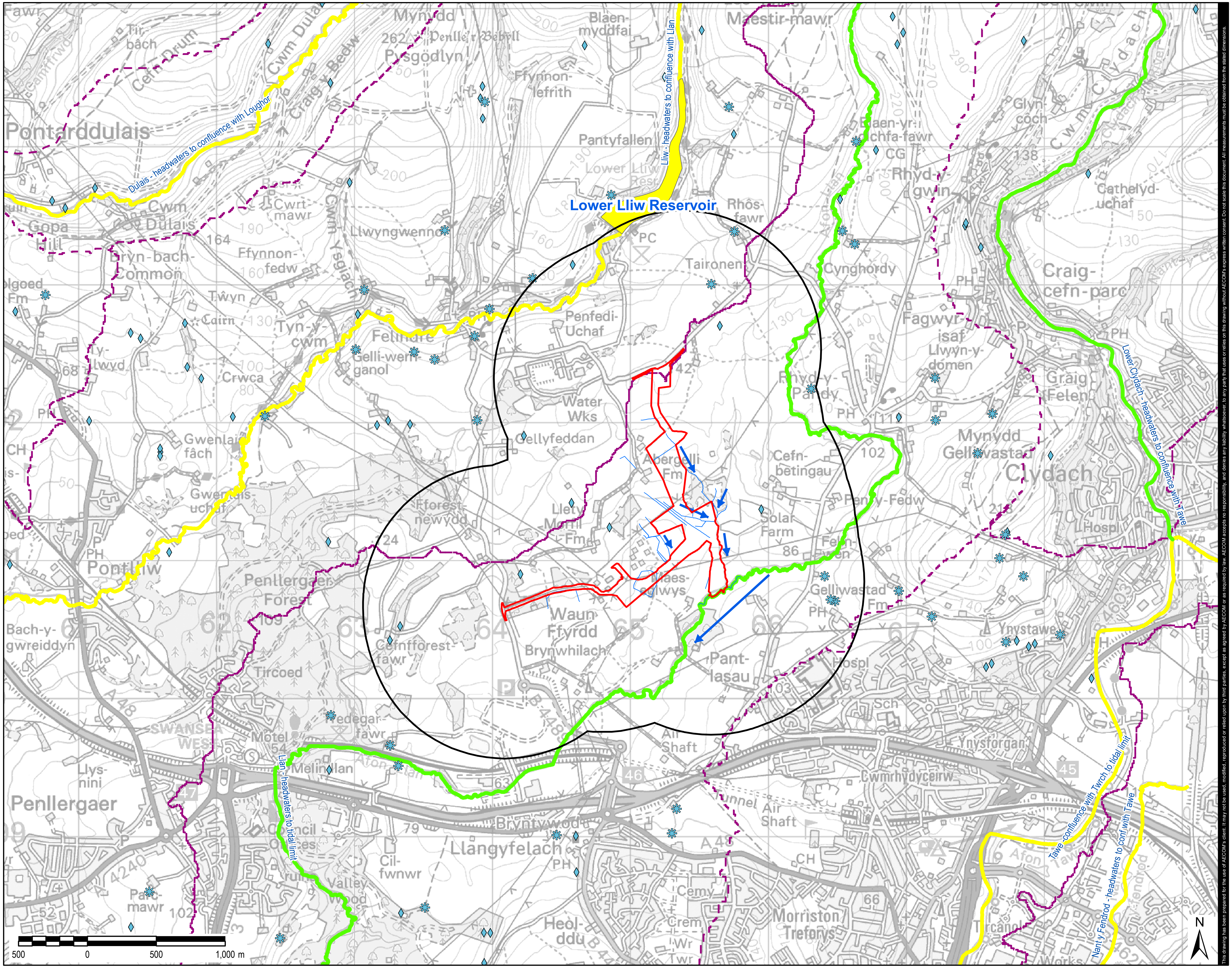
B.2 Surface Water Bodies



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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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AECOM Internal Project No:

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Drawing Title:

APPENDIX B
SURFACEWATER BODIES

Scale at A3: 1:25,000

Drawing No:			Rev:
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B.3 Local Watercourses

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ABERGELLI POWER PROJECT

Client:

Abergelli power
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

AECOM Internal Project No:

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Drawing Title:

APPENDIX B
LOCAL WATERCOURSES

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE B3			005
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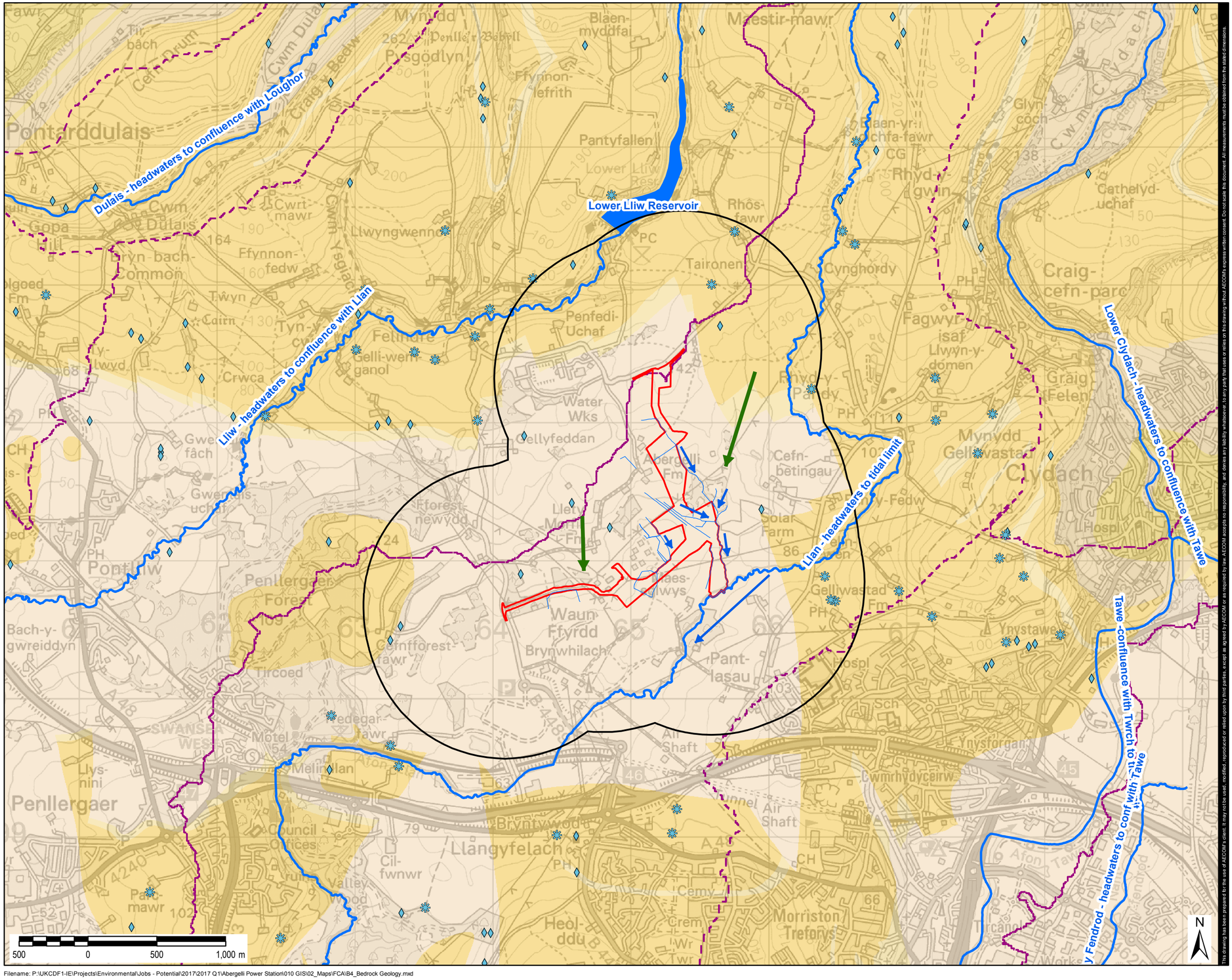
B.4 Bedrock Geology



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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
- 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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AECOM Internal Project No:

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Drawing Title:

APPENDIX B
BEDROCK GEOLOGY

Scale at A3: 1:25,000

Drawing No:			Rev:
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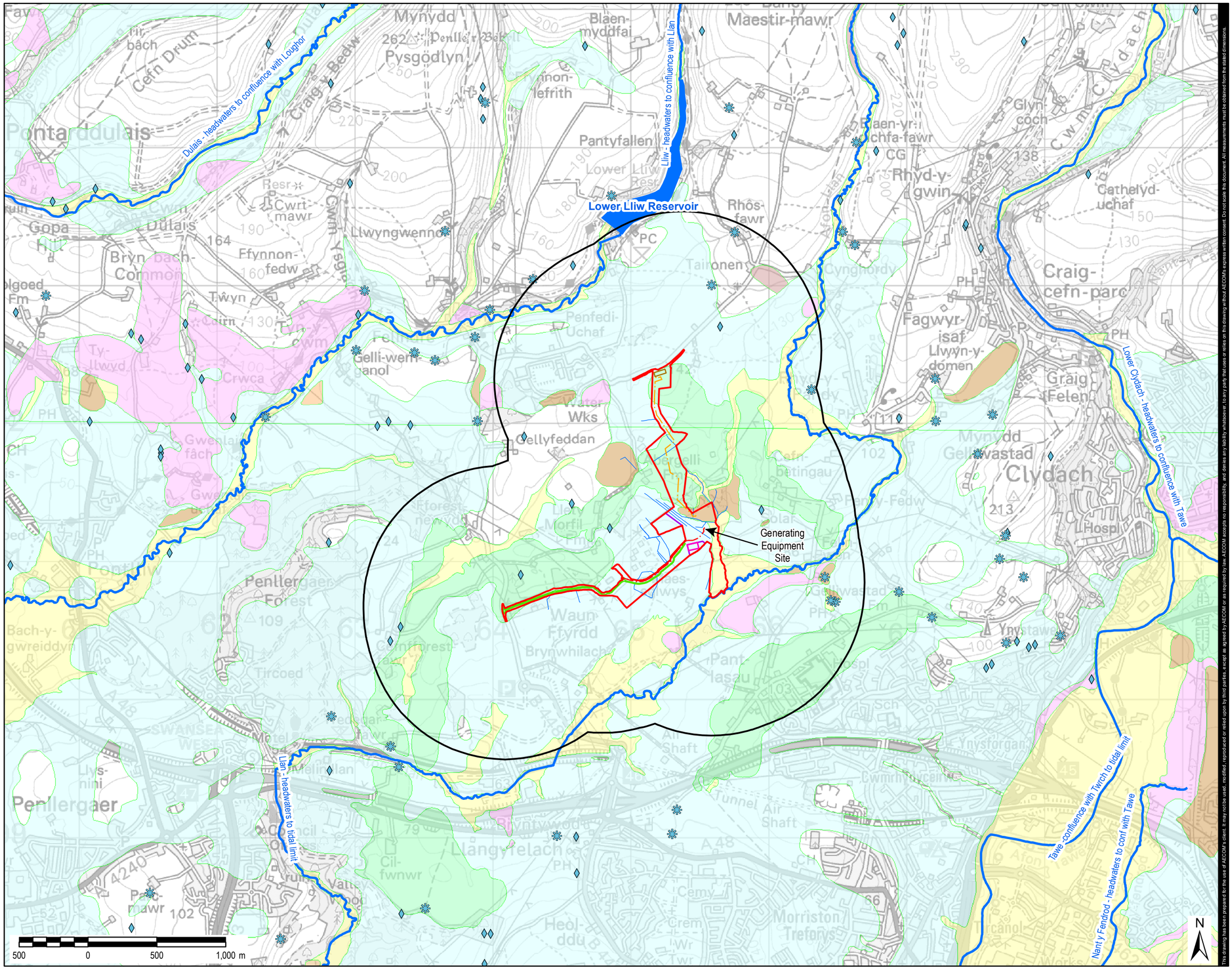
JN	GM	CA	02/05/18

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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60542910

Drawing Title:

APPENDIX B
SUPERFICIAL GEOLOGY

Scale at A3: 1:25,000

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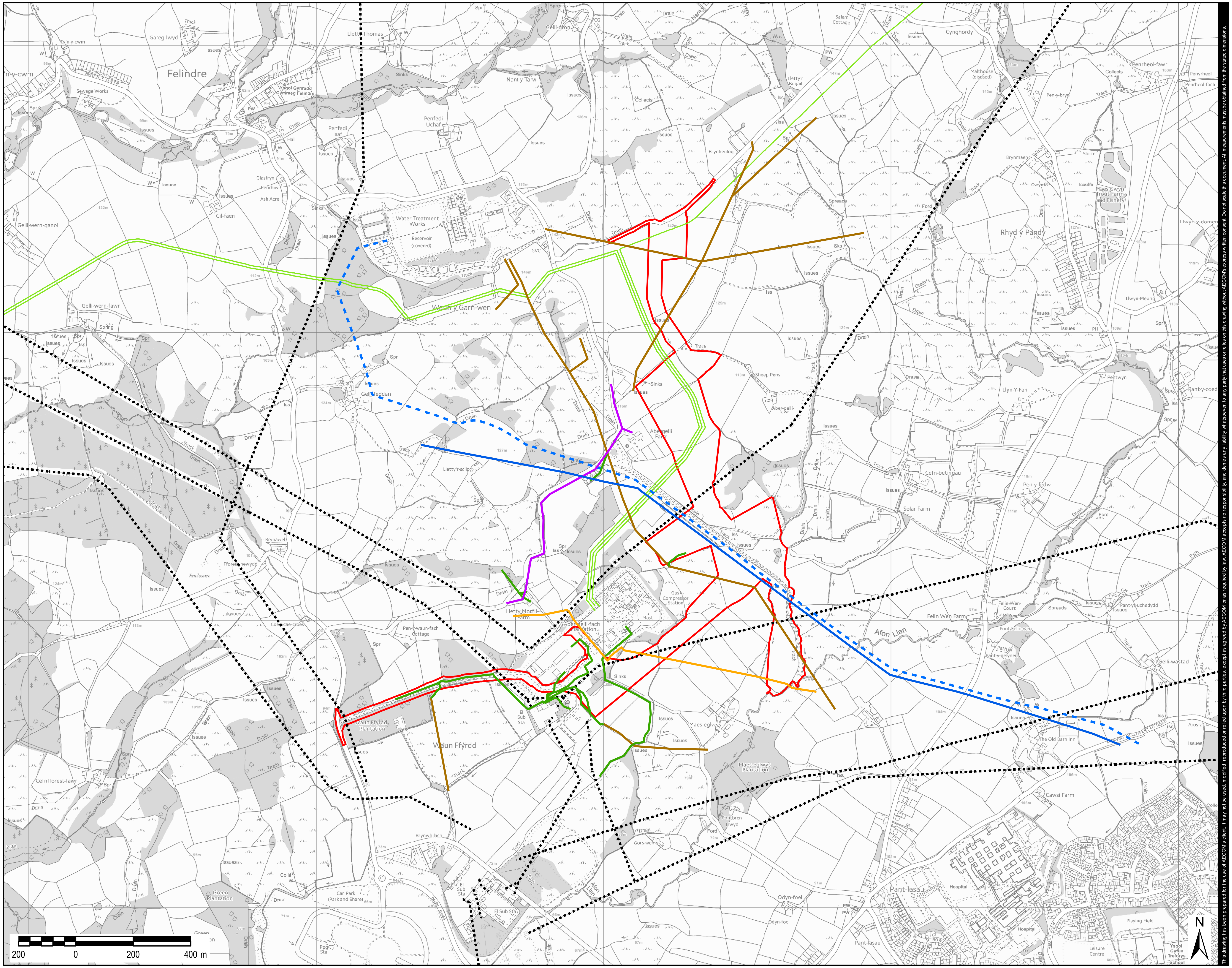
B.6 Utilities



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Project Site boundary
- Wales and West Utilities Limited (Underground Gas Lines)
- British Telecommunications plc (Overhead Telecommunications Lines)
- Western Power Distribution (South Wales) plc (Underground Electricity Distribution Lines)
- Western Power Distribution (South Wales) plc (Overhead Electricity Distribution Lines)
- Water Main
- National Gas Transmission System
- National Electricity Transmission (Overhead Electricity Transmission Lines)
- Oil Pipeline

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APPENDIX B
EXISTING UTILITIES PLAN

Scale at A3: 1:12,000

Drawing No:			Rev:
FIGURE B6			001
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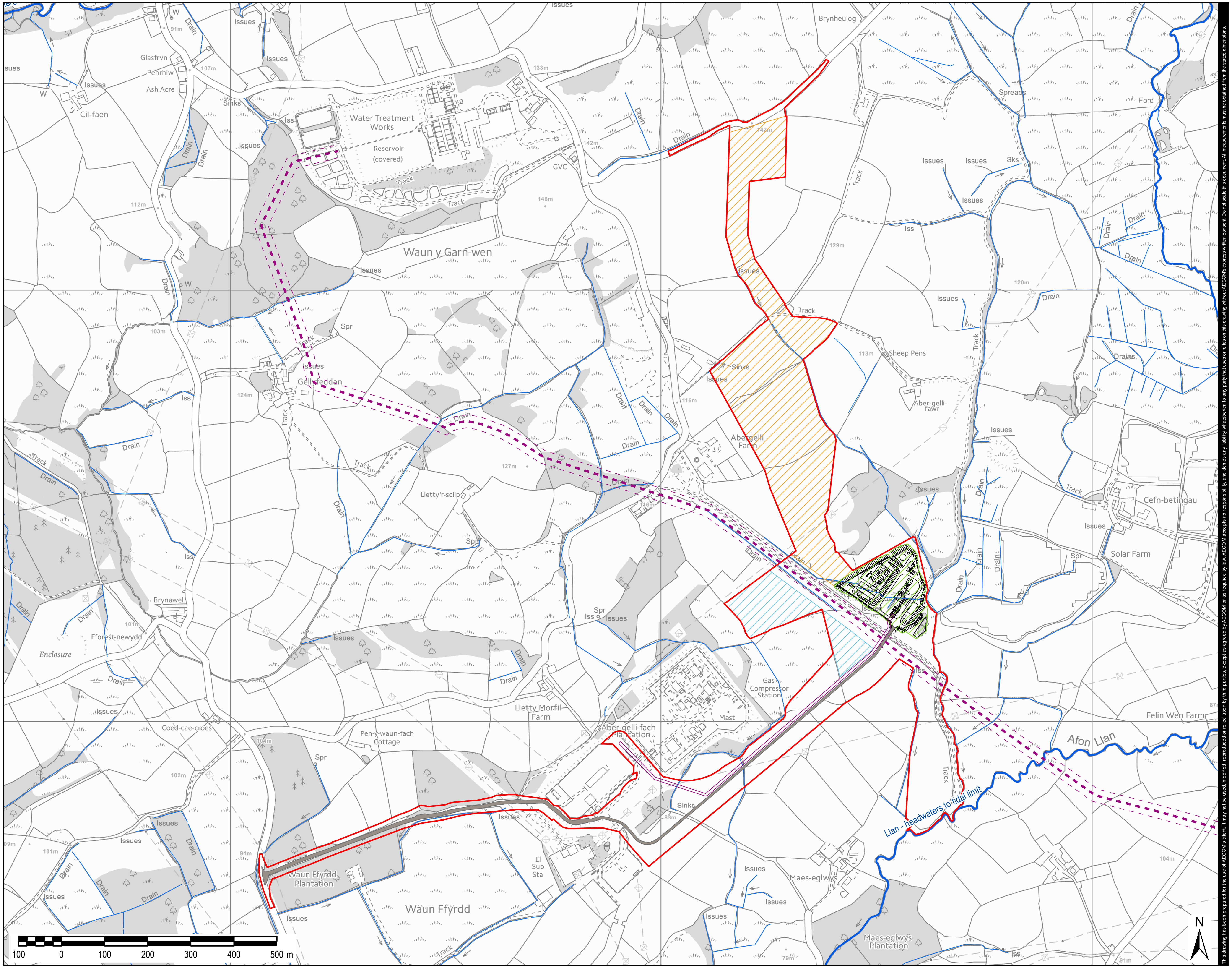
Appendix C – Project

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
- Generating Equipment Site
- Access Track
- Laydown Area
- Watercourses
- Generating Equipment SIte
- Water Main

AECOM Internal Project No:

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Drawing Title:

APPENDIX C
SITE LAYOUT PLAN

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE C1			005
Drawn:	Chk'd:	App'd:	Date:
GM	CC	CA	02/05/18

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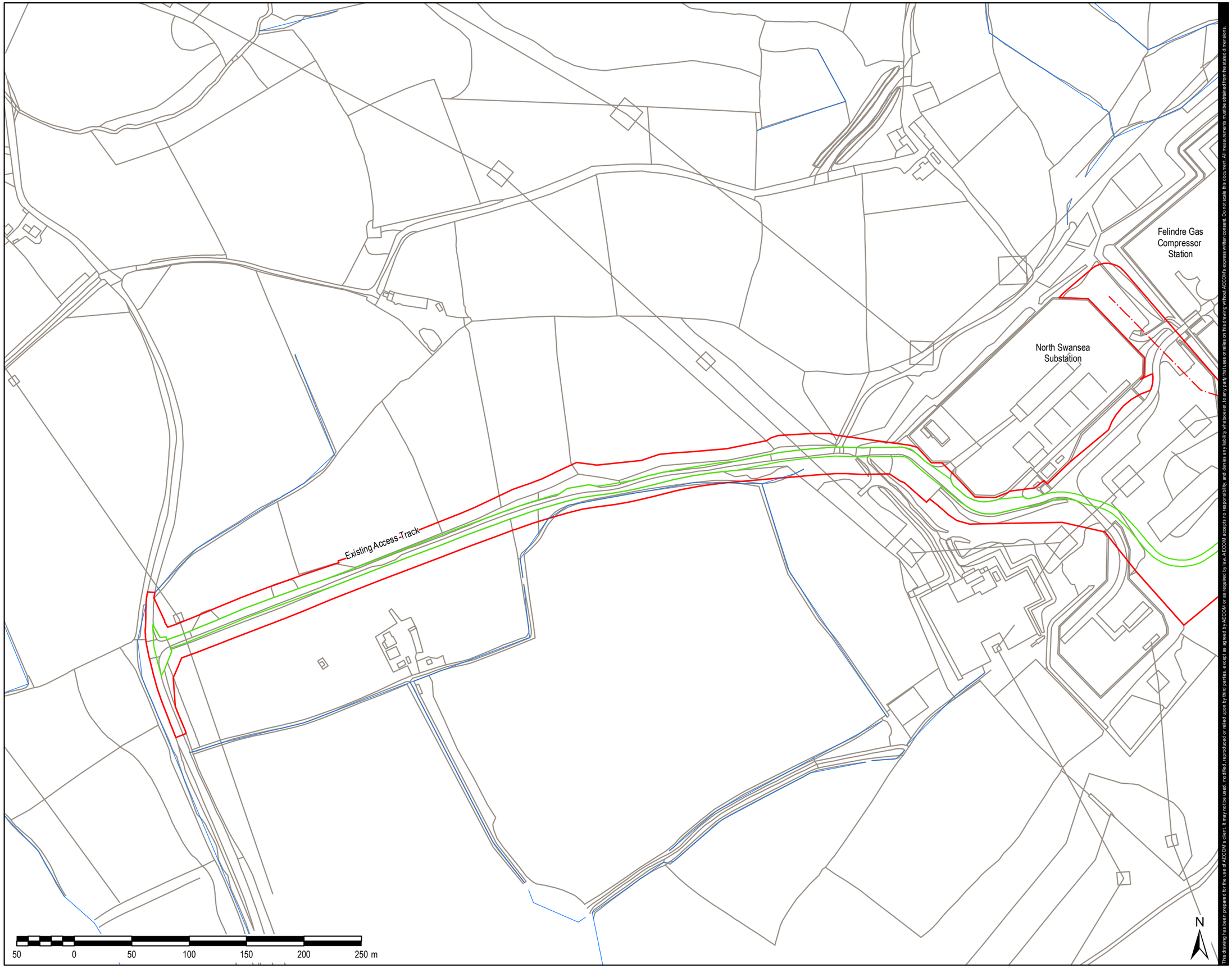
C.2 Works Plan



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Project Site Boundary
- Access Road
- Electrical Connection (400kV Cable)
- Watercourses

AECOM Internal Project No:

60542910

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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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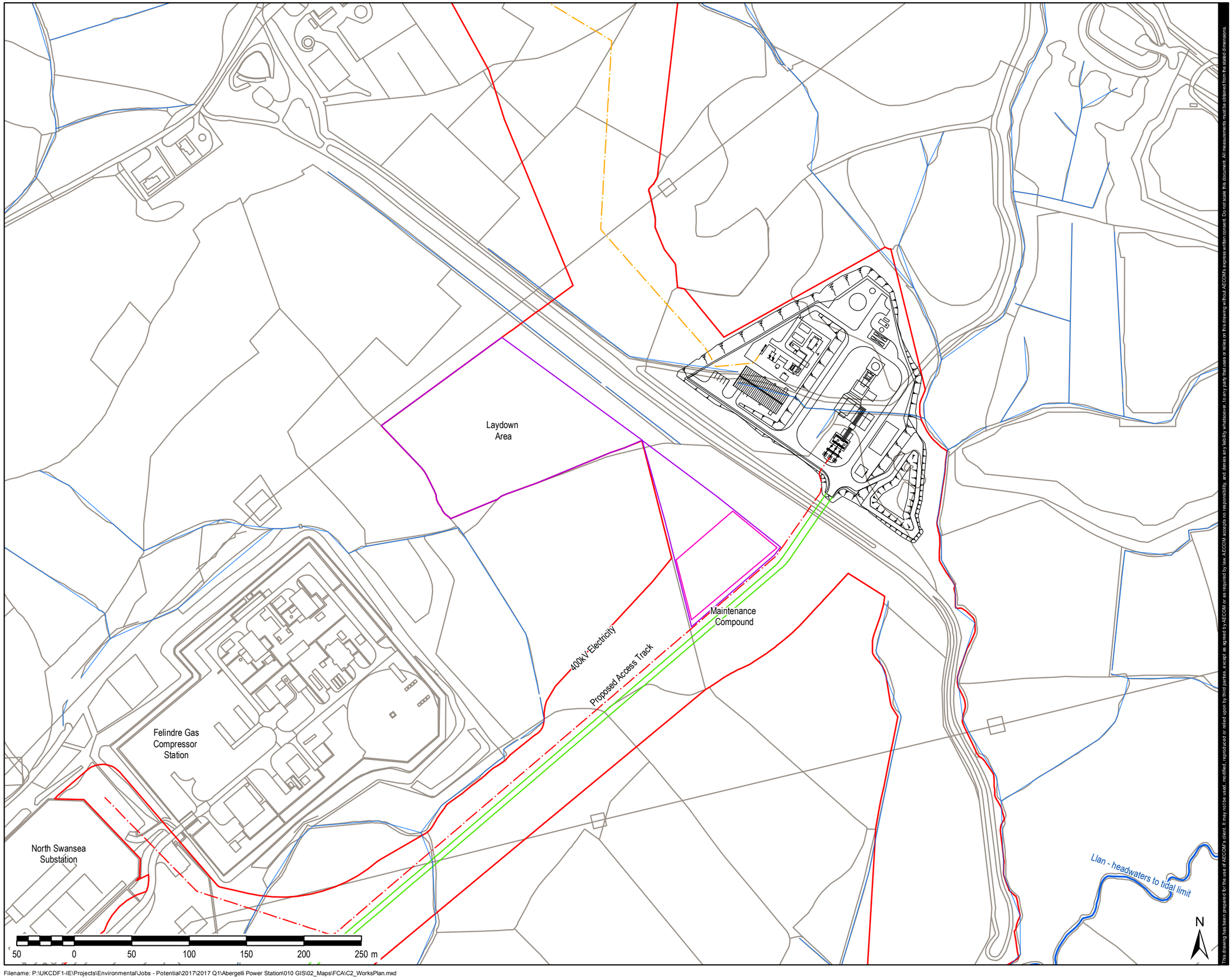

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Project Title:

ABERGELLI POWER PROJECT

Client:

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A Drax Group company

LEGEND

- Project Site Boundary
- Generating Equipment SIte
- Access Road
- Electrical Connection (400kV Cable)
- Gas Connection
- Laydown Area
- Maintenance Compound
- Watercourses

AECOM Internal Project No:

60542910

Drawing Title:

APPENDIX C
WORKS PLANS KEY PLAN AND WORKS SHEET 2 OF 3

Scale at A3: 1:3,000

Drawing No:	Rev:
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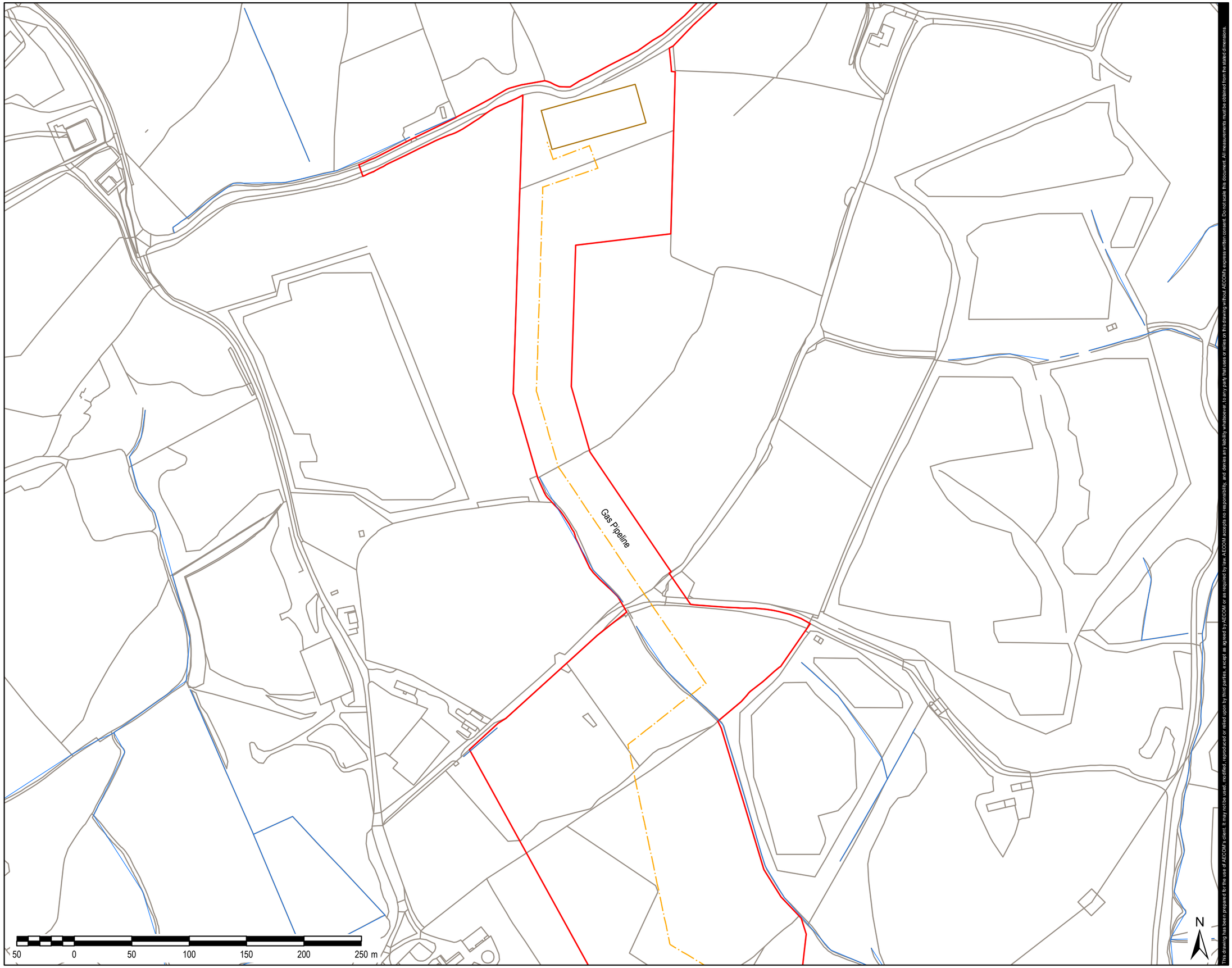

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Project Title:

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Client:

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A Drax Group company

LEGEND

- Project Site Boundary
- Above Ground Installation
- Gas Connection
- Watercourses

AECOM Internal Project No:

60542910

Drawing Title:

APPENDIX C
WORKS PLANS KEY PLAN AND WORKS SHEET 3 OF 3

Scale at A3: 1:3,000

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GM	CC	CA	02/05/18	

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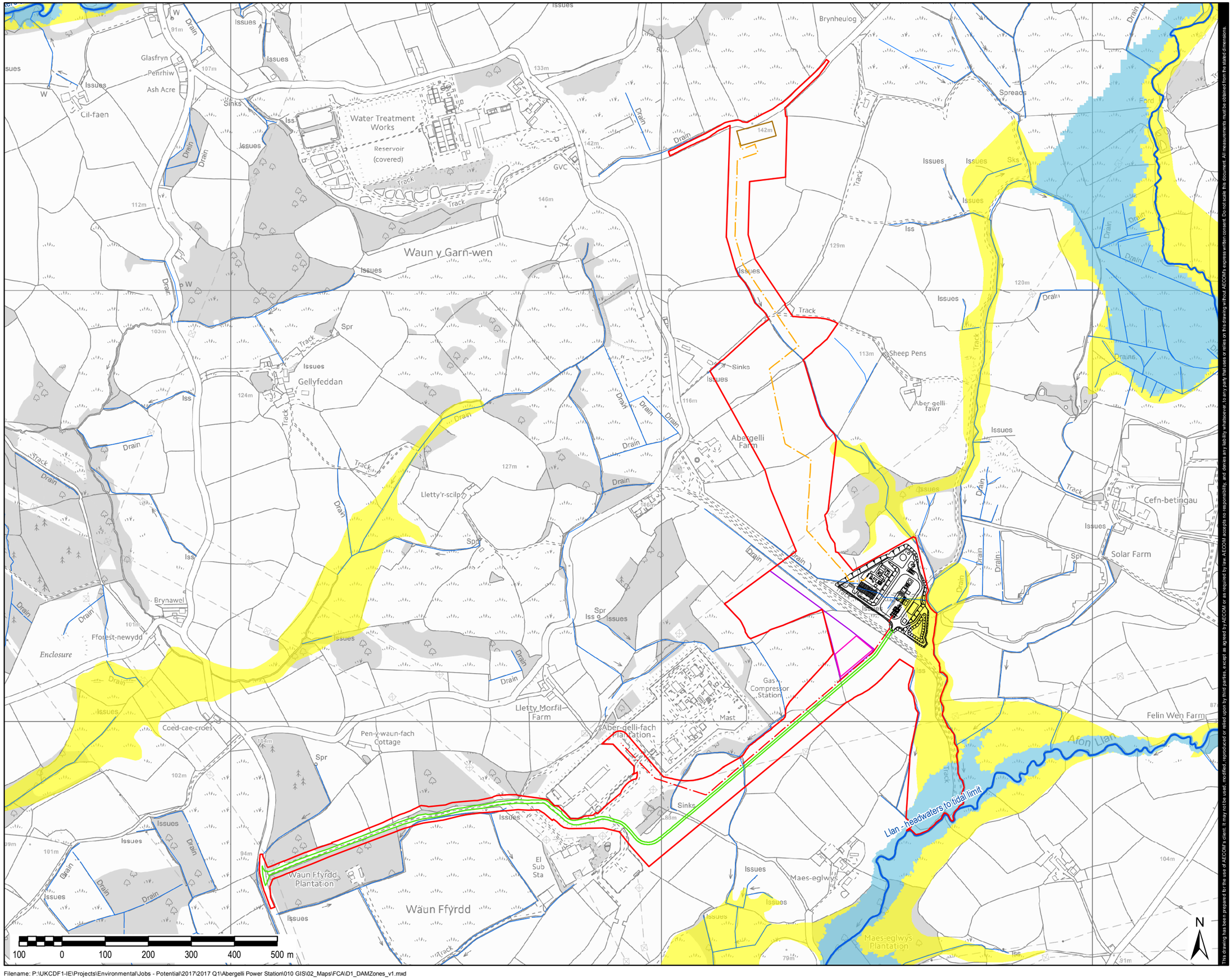
Appendix D – NRW Data

D.1 DAM Zones



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Project Title:

ABERGELLI POWER PROJECT

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
- 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

AECOM Internal Project No:

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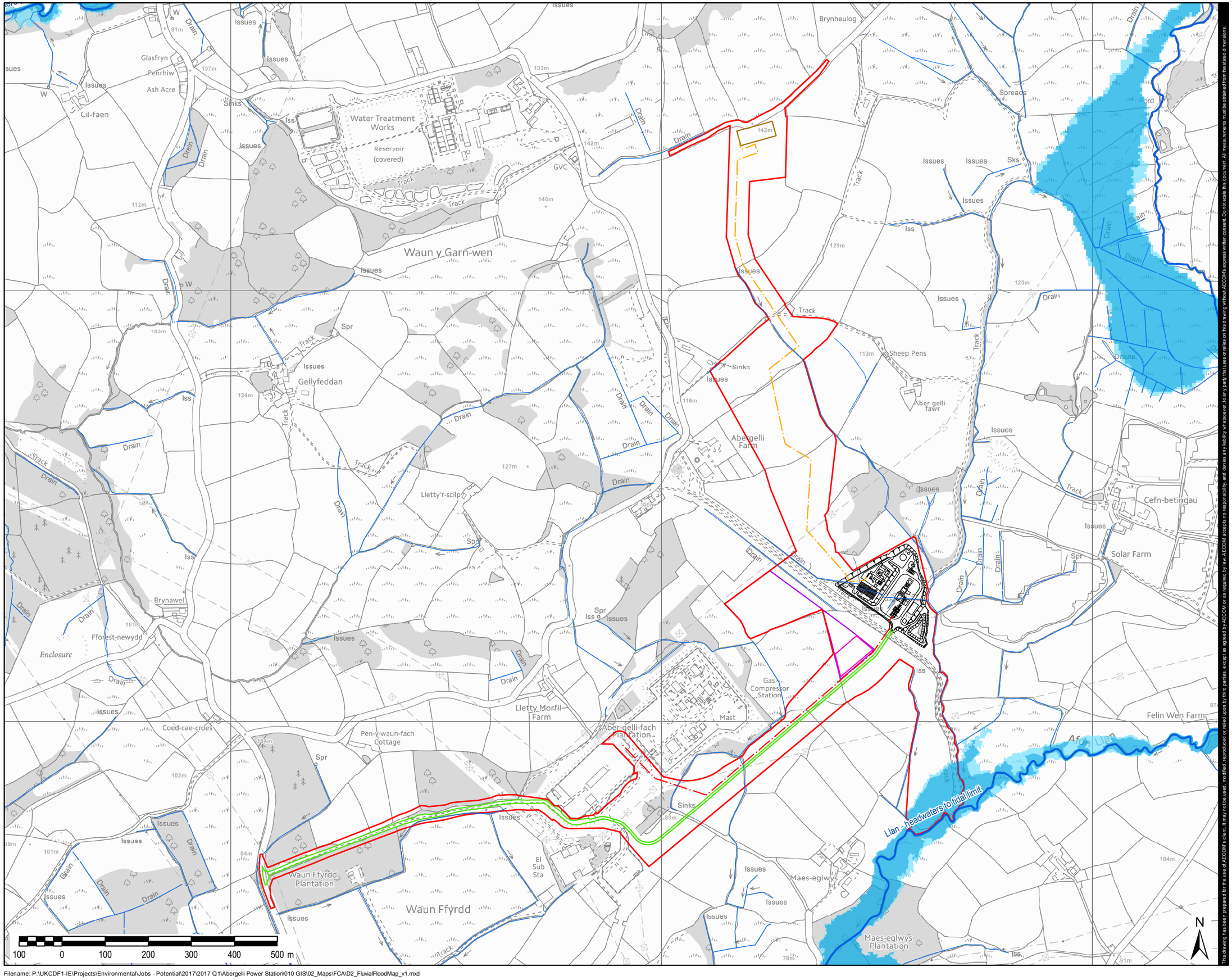
Drawing Title:

APPENDIX D
DEVELOPMENT ADVICE ZONES

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE D1			005
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CC	CA	02/05/18

D.2 Fluvial Flood Map



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Project Title:

ABERGELLI POWER PROJECT

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

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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AECOM Internal Project No:

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Drawing Title:

APPENDIX D
FLUVIAL FLOOD MAP

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE D2			005
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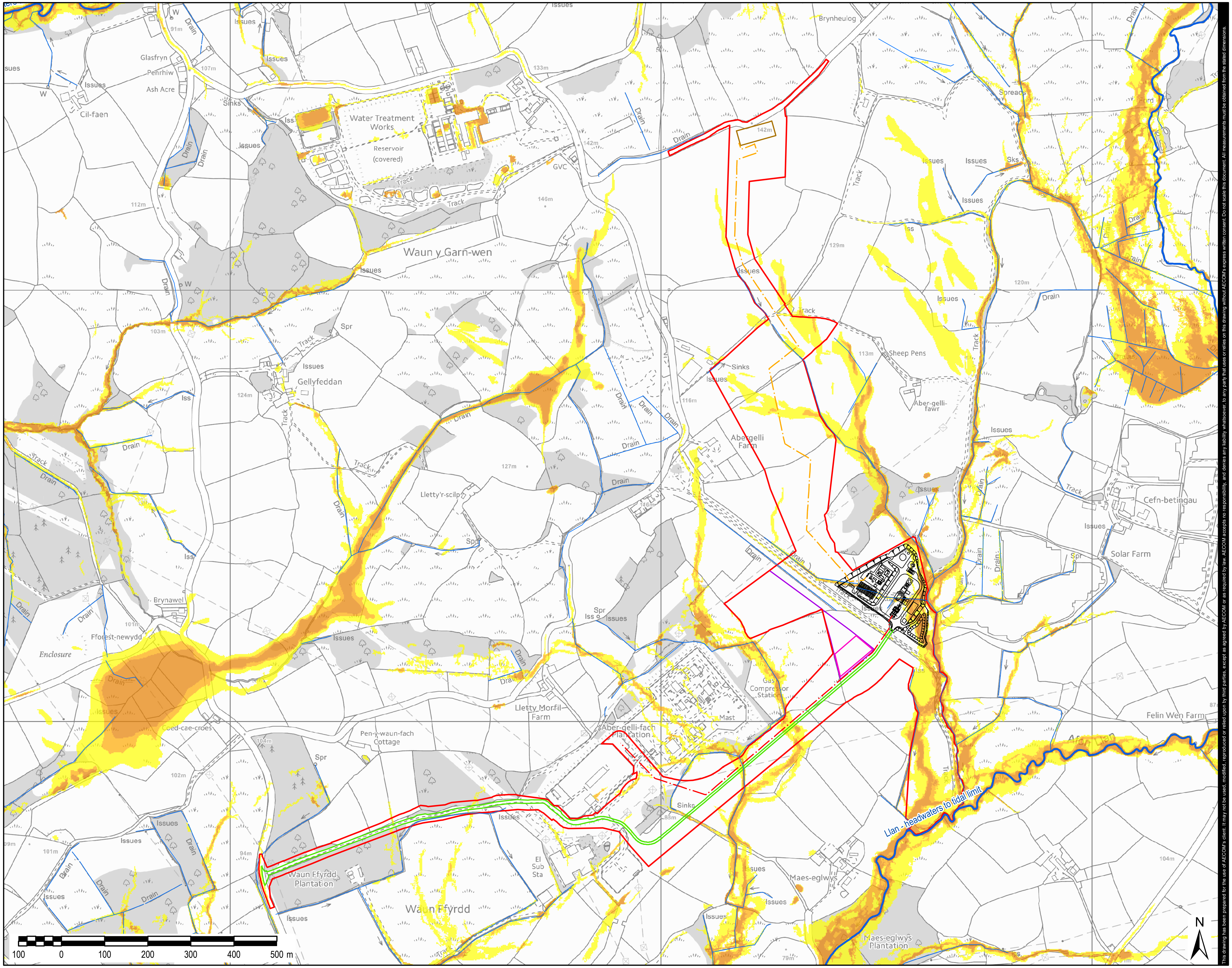
GM	CC	CA	02/05/18

Filename: P:\UKCDF1-IE\Projects\Environmental\Jobs - Potential\2017\2017 Q1\Abergelli Power Station\010 GIS\02_Maps\FCA\D2_FluvialFloodMap_v1.mxd

D.3 Flood Map



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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Project Site Boundary
- 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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60542910

Drawing Title:

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.

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QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
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Date	January 2015	February 2015	March 2015	October 2017
Prepared by	Richard Smith	Richard Smith	Richard Smith	Chris Moore
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Signature				
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APPENDICES

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)

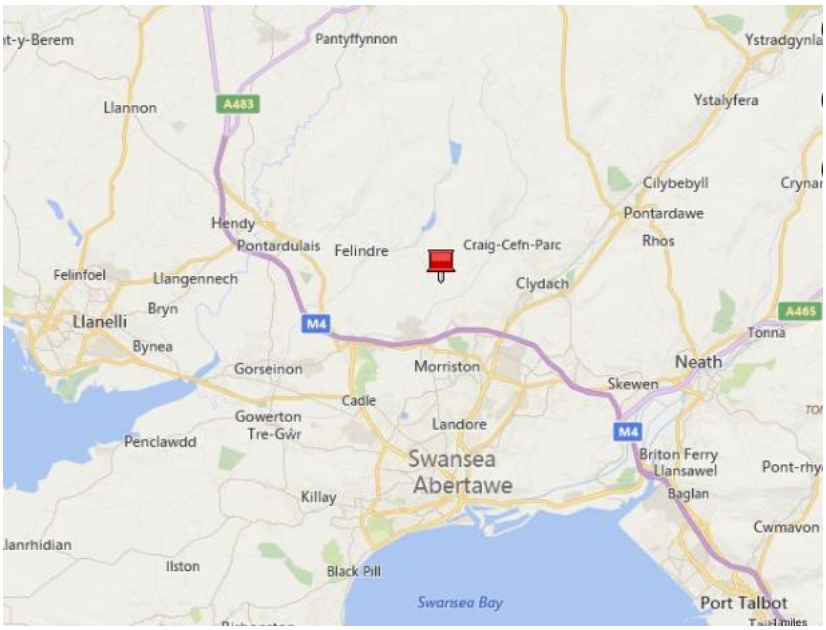

Figure 2.2-2 Site Location (2)

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.

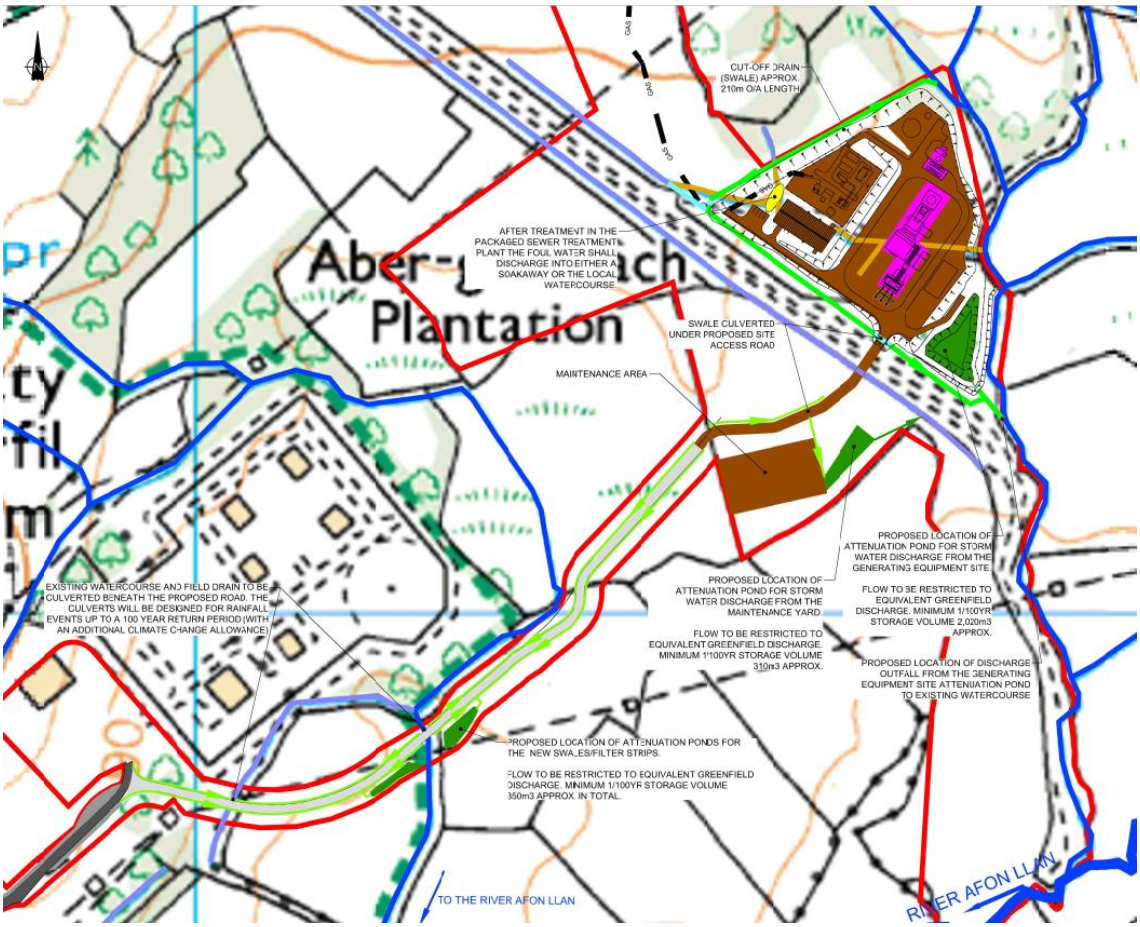

Figure 2-4 Plan showing nearby drains and watercourse to the site (Central section)

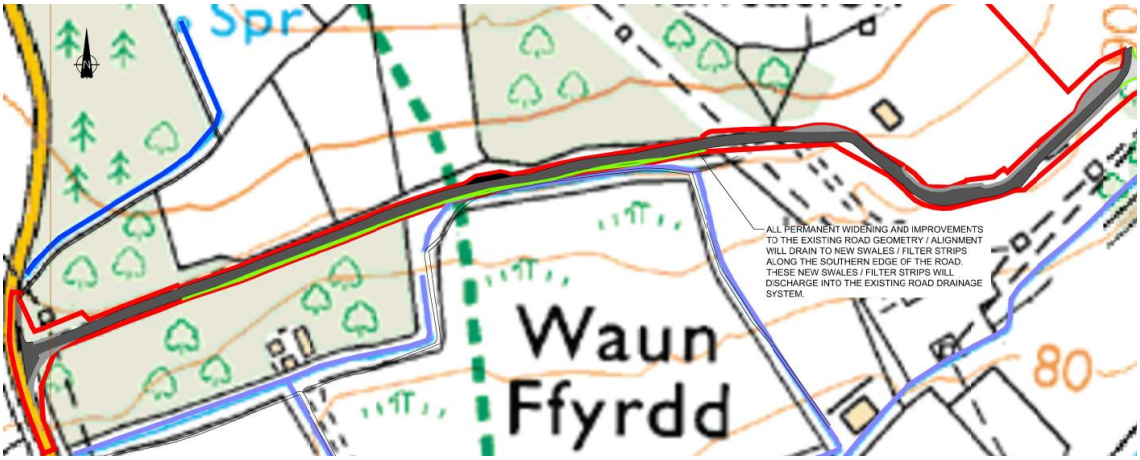

Figure 2-5 Plan showing nearby drains and watercourse to the site (West section)

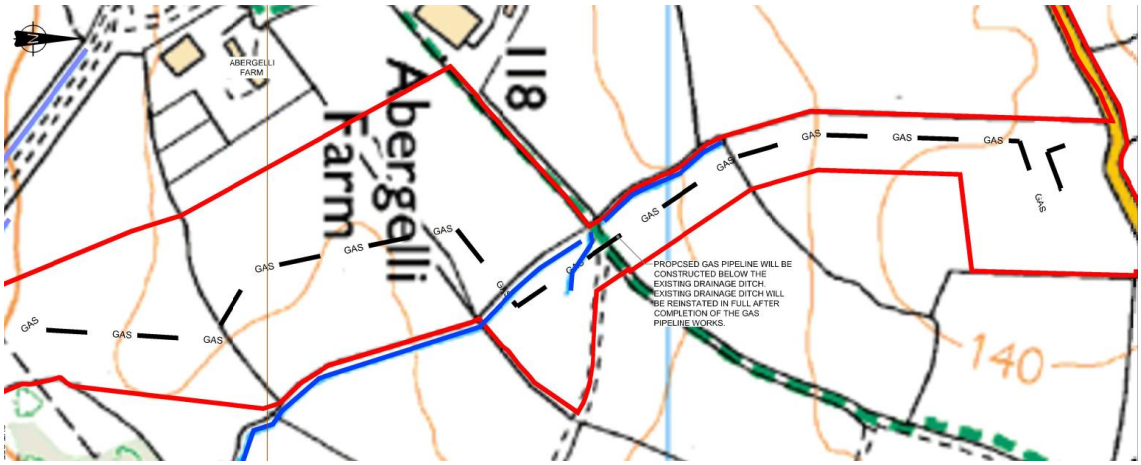

Figure 2-6 Plan showing nearby drains and watercourse to the site (North section)

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

ATTENUATION POND (2020m^3 MIN CAPACITY; 2.0m DEEP APPROX.)

FPL +84.000m AOD

PLANNING BOUNDARY

CULVERT

POND OUTFALL LOCATION

EXISTING WATERCOURSE

GENERATING SITE SURFACE WATER OUTFALL

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 9.2

Water Framework Directive (WFD) Assessment

Water Framework Directive (WFD) Screening Assessment

Abergelli Power Project

Abergelli Power Ltd.

Project Reference: Abergelli WFD

60542910

10 May 2018

Quality information

Prepared by	Checked by	Approved by
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Revision History

Revision	Revision date	Details	Authorized	Name	Position
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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.

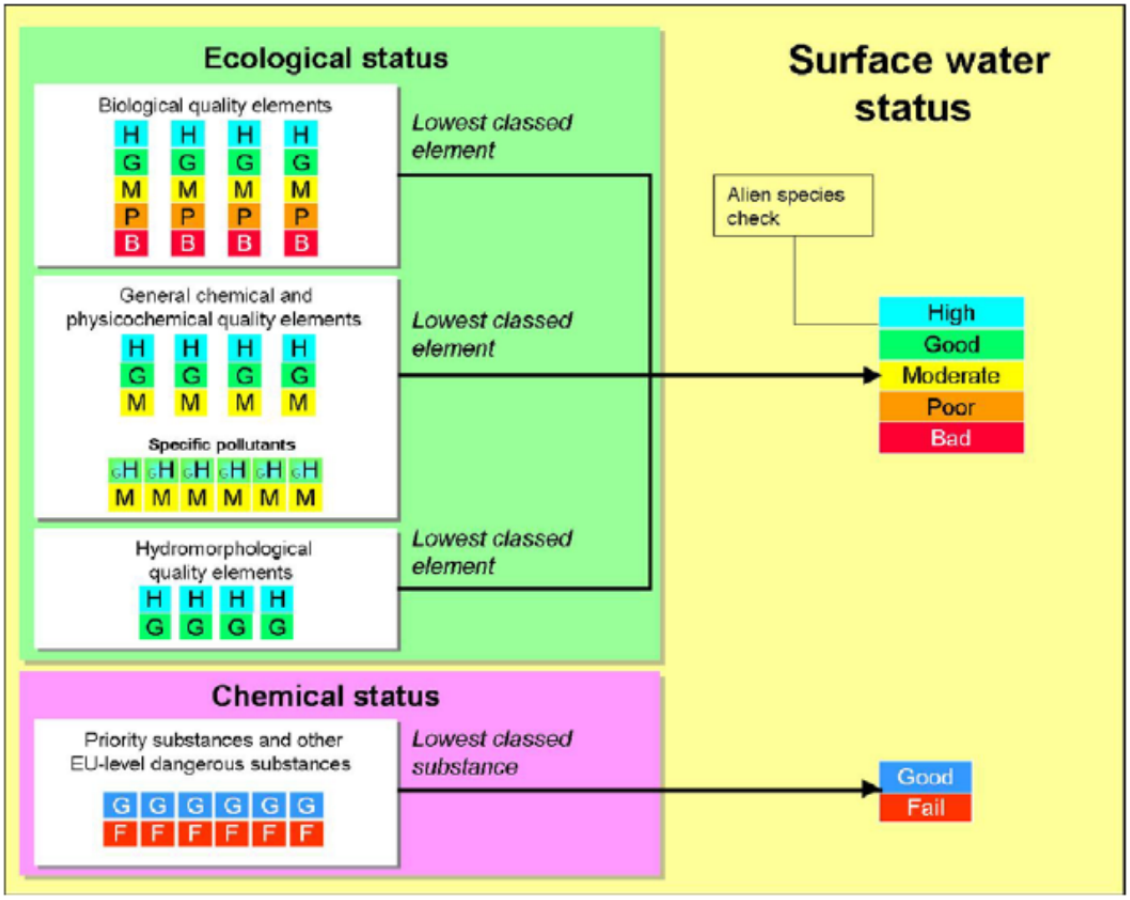

Figure 3-1. WFD classification elements for surface water body status (Environment Agency, 2015)

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.

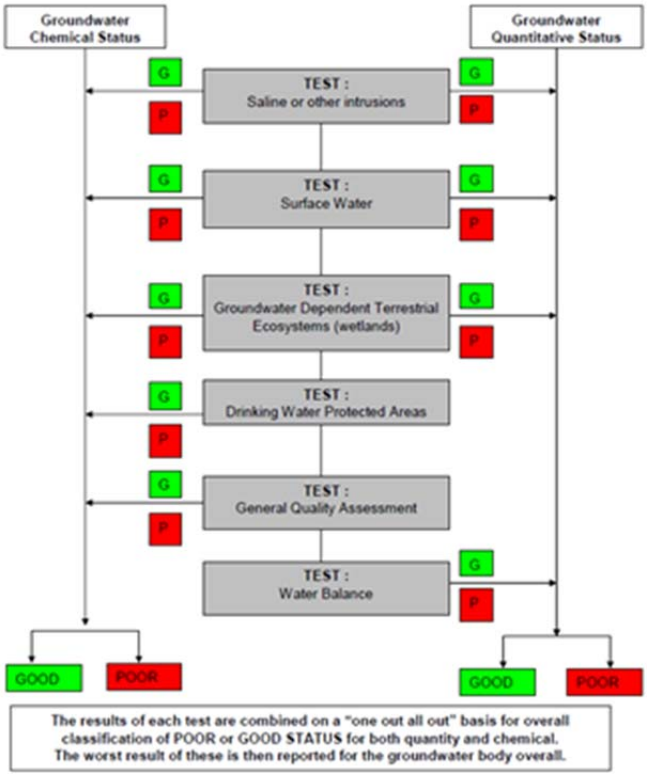

Figure 3-2. WFD Classification Elements for Groundwater Body Status (Environment Agency, 2015)

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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Natural Resource Wales, December 2015. Western Wales River Basin District River Basin Management Plan.

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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

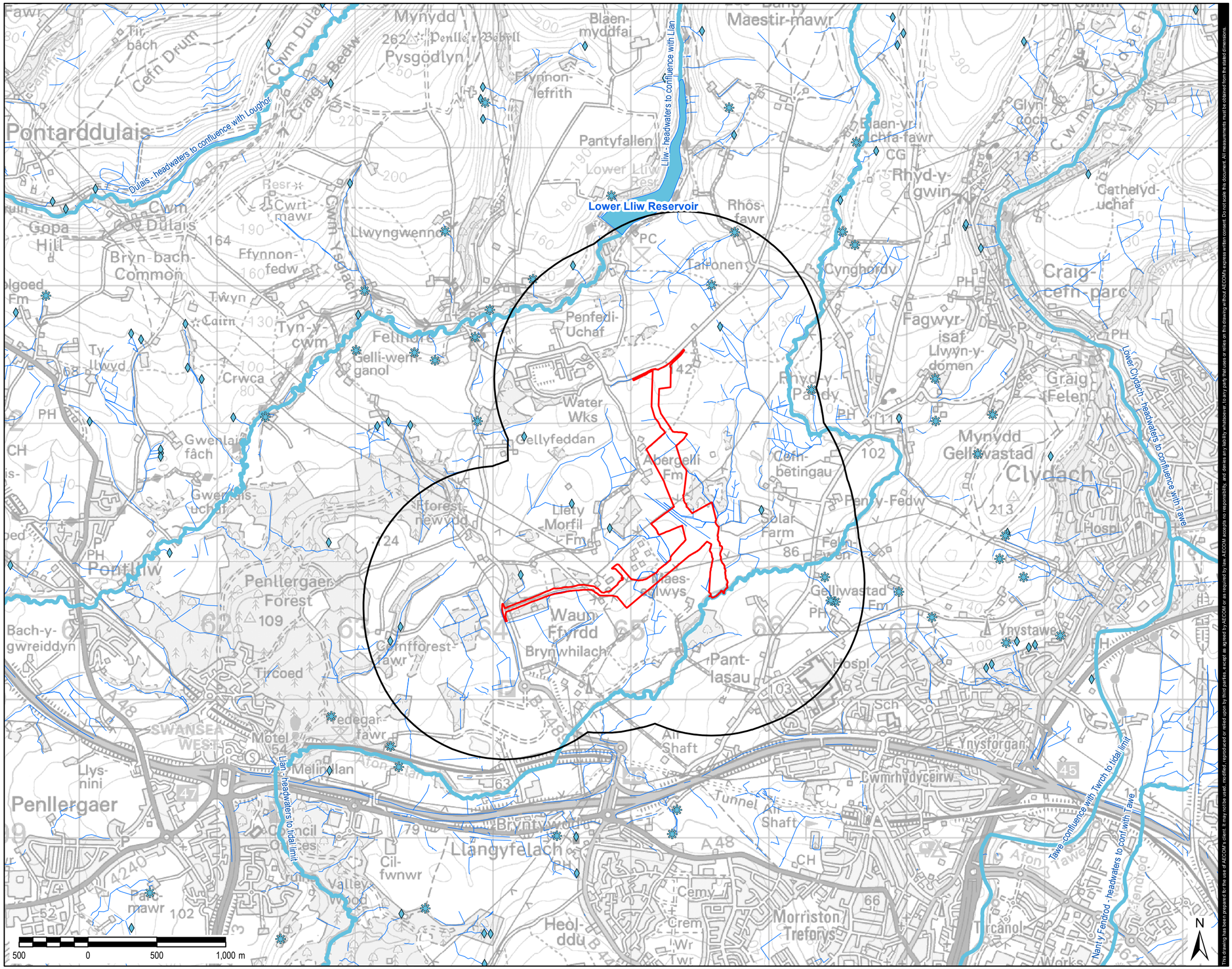
	River	Scheme Elements	Abergelli Power Station - Power Generation Plant including temporary construction compound, access road and new gas and electric connections							Overall impact	Further WFD Assessment or Mitigation (to retain or promote good status)
	GB110059032070	Phase (Construction / Operation)	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

AECOM Internal Project No:

60542910

Drawing Title:

SITE LOCATION

Scale at A3: 1:25,000

Drawing No:			Rev:
FIGURE 1.1			001
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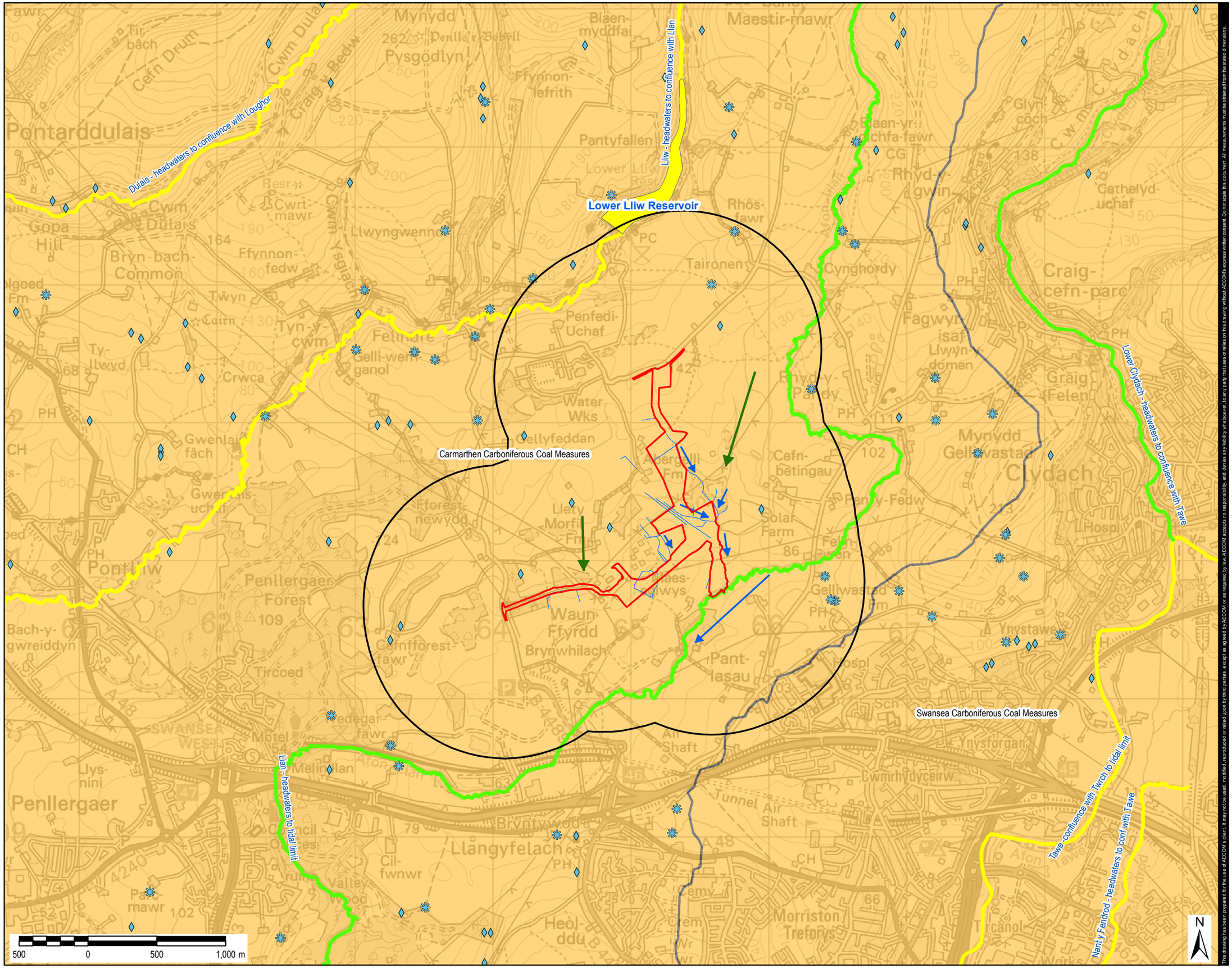

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Project Title:

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

AECOM Internal Project No:

60542910

Drawing Title:

WFD WATER BODIES

Scale at A3: 1:25,000

Drawing No:			Rev:
FIGURE 2.1			001
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JN	GM	CA	09/05/18

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